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AI for Good-Innovate for Impact

Final Report

2024

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Foreword

In an age of rapid technological progress, artificial intelligence (AI) is a crucial tool for meaningful global progress in areas such as climate action, health, and disaster response.

ITU's commitment to realizing this potential is embodied by our standardization and capacity-building work and our leadership of AI for Good, the United Nations' primary platform for collaboration to ensure that AI advances the UN Sustainable Development Goals (SDGs)

AI's great potential to act as a force for good is demonstrated by the promising AI use cases outlined by this report. Our open call for AI use cases relevant to the SDGs generated 219 submissions from 38 countries.

We have also welcomed 14 scholars from around the world to our AI Scholar Programme, selected from 118 applications from 38 countries, who are now working on refining the use cases in this report.

These use cases predominantly highlight AI's relevance to SDGs 3 (Good Health and Wellbeing), 9 (Industry, Innovation, and Infrastructure), 10 (Reduced Inequalities), 11 (Sustainable Cities and Communities), and 13 (Climate Action).

Careful consideration of AI's ethical and societal implications is vital. We must ensure that AI is developed and deployed responsibly, with fairness, transparency, and inclusivity. The use cases included in this report show potential to help uphold these values.

I thank all contributors to this report as well as China's Ministry of Industry and Information Technology for its strong support throughout this project.

Seizo Onoe
Director
ITU Telecommunication Standardization Bureau

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Final Report for Innovate for Impact

1. Introduction

The AI industry is driving a technological revolution, impacting the global economy and society. AI transforms healthcare with diagnoses, finance with analytics, retail with recommendations, and manufacturing with automation. It also enhances transportation safety and aids environmental conservation. However, experts caution about the widening digital divide and the perpetuation of biases.

To tackle these issues, ITU's AI for Good platform facilitates the sharing of AI applications and expertise worldwide. In February 2024, we issued two open calls simultaneously: a call for AI use cases, and a call for AI scholars. The calls can be accessed on the AI for Good website here.

2. Project introduction and selection process

2.1 AI use cases

Equal access to AI and its benefits requires careful and collaborative considerations on capacity building. Bringing together scholars and experts from around the world to discuss and analyse AI enabled use cases impacting sustainable development goals (SDG) is a unique step in knowledge sharing and technology awareness. These scholars collectively analysed use cases which in turn were submitted from various corners of the world. This creates not only a collection of AI use cases impacting SDGs, but also provides a vibrant platform for regional viewpoints to be accounted and global standards and solutions to be built, using mentoring and handholding by use case authors and experts.

Thus, the main outcomes for this report are:

- Bridging the knowledge gap and promote experience sharing on AI applications, especially related to SDGs.
- Analysing requirements for AI applications, along with regional customization and release a curated list of AI empowered vertical industry and other categories of use cases which will align with SDGs.
- Fostering collaboration, networking and mentoring among participants, including policy makers, academia, industry, and civil society, etc.

The collaborative editing and review of these use cases and analysis by scholars and use case authors from around the world presents a unique opportunity for scalable capacity building in the area of AI applications impacting SDGs.

2.1.1 Use case selection

Within the deadline for the call for use cases, we received 219 submissions from 38 countries. For evaluation of the use cases, a set of criteria was established encompassing clarity and completeness, justification, alignment with AI for Good objectives, and evaluation against

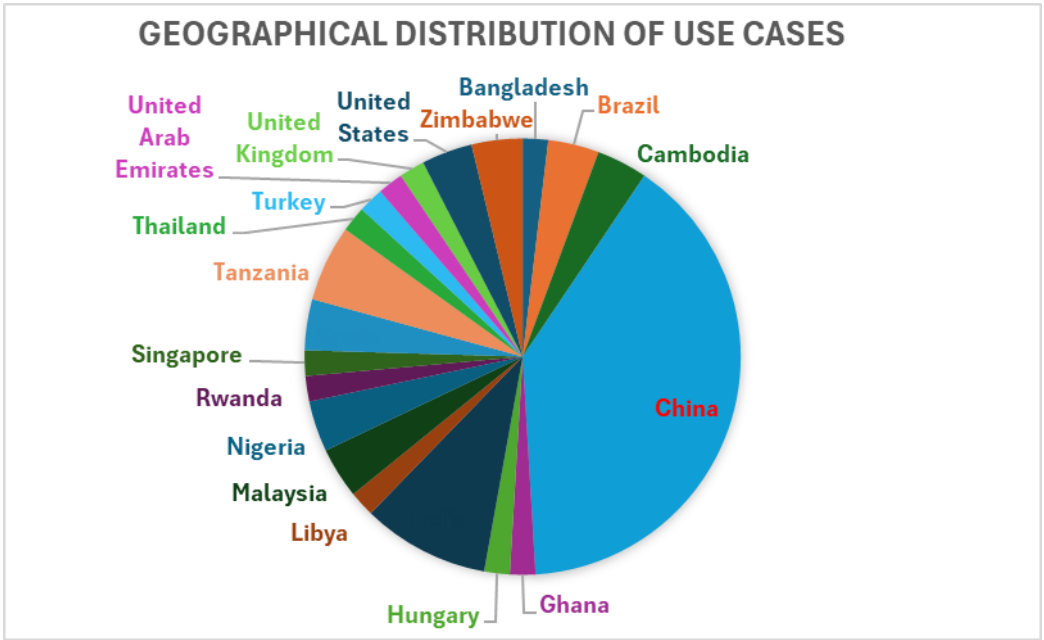
specific metrics, each with an assigned percentage. With the joint efforts made by AI for Good team of ITU Telecommunication Standardization Bureau (ITU TSB) and the scholars and authors of the use cases, 53 selected use cases are released in this final report.

2.1.2 Geographical distribution

The 53 use cases came from 19 countries, including Bangladesh, Brazil, Cambodia, China, Ghana, India, Singapore, Nigeria, Tanzania, Rwanda, UAE, Spain, Hungary, United Kingdom, and United States. And 10 use cases won the awards in 10 categories including:

- Best Innovative AI Solution Award
- Best Environmental Impact Award
- Best Digital Transformation award
- Best SDG Impact Award
- Best Industry Impact award
- Best AI for Humanity Award
- Best AI-driven Social Impact Award
- Best Innovate for Impact Award
- Best Inclusivity Impact Award
- Best Accessibility Award

Figure 1: Geographical distribution of use cases



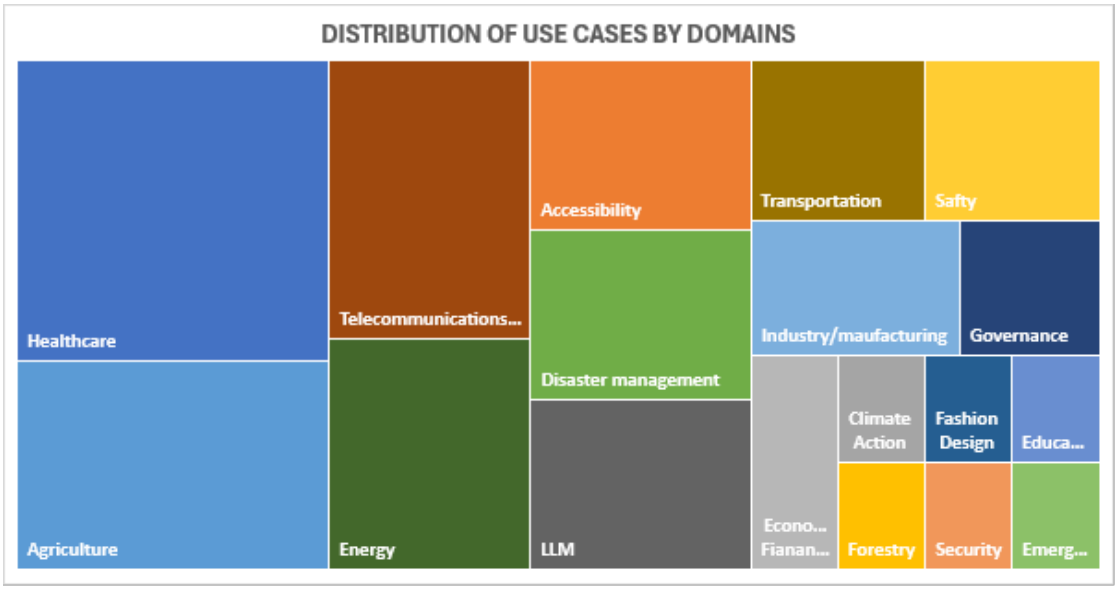
2.1.43 Distribution of use cases by domains

Healthcare emerges as the most prominent domain, underscoring the critical role of AI in revolutionizing healthcare delivery, diagnosis, and treatment. Other significant domains include agriculture, energy, telecommunications (6G), and governance, each with multiple use cases, indicating the broad applicability of AI across sectors. Domains such as fashion, language, safety monitoring, security, and biometrics represent niche applications of AI, showcasing

innovation and specialization within specific industries. The distribution across domains reflects a comprehensive approach to addressing various societal, economic, and environmental challenges through AI-driven solutions.

The use cases cover a wide range of domains, indicating the versatility and adaptability of AI technologies in addressing different challenges. Participation from multiple countries demonstrates the global relevance of AI and its potential to drive innovation and development across borders. Sectors like healthcare, agriculture, and energy stand out for their significant contributions, highlighting the transformative impact of AI in key areas of societal importance. Domains such as 6G, fashion, and safety monitoring represent emerging trends in AI application.

Figure 2: Distribution of use cases by domains



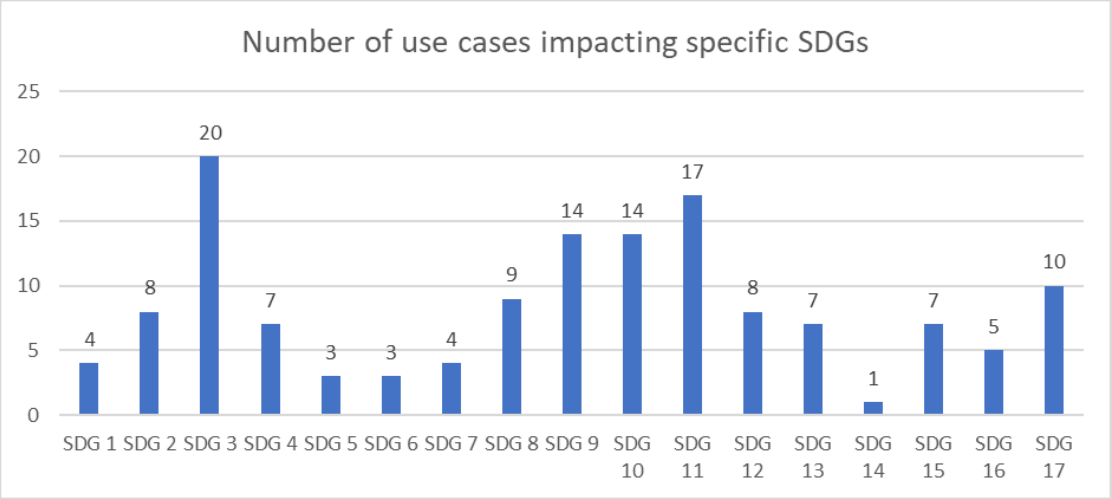
2.1.4 Distribution of use cases by SDGs

Across all use cases, there is a trend of aligning initiatives with multiple Sustainable Development Goals (SDGs), indicating a holistic and multidimensional approach. Among the SDGs addressed, SDGs 3 (Good Health and Well-being), 9 (Industry, Innovation and Infrastructure), 10 (Reduced Inequalities), SDG 11 (Sustainable cities and communities), and SDG 13 (Climate Action) emerge as the top five most commonly targeted goals.

The emphasis on addressing multiple SDGs underscores the interconnected nature of global challenges and the need for comprehensive solutions. Projects are strategically designed to not only tackle specific issues but also contribute to broader sustainability objectives, fostering synergies between different development priorities.

By integrating efforts across these key SDGs, initiatives strive to create positive impacts that extend beyond individual sectors or communities, fostering inclusive and sustainable development pathways. This integrated approach reflects a commitment to addressing complex global challenges and advancing progress towards the overarching goals of the 2030 Agenda for Sustainable Development.

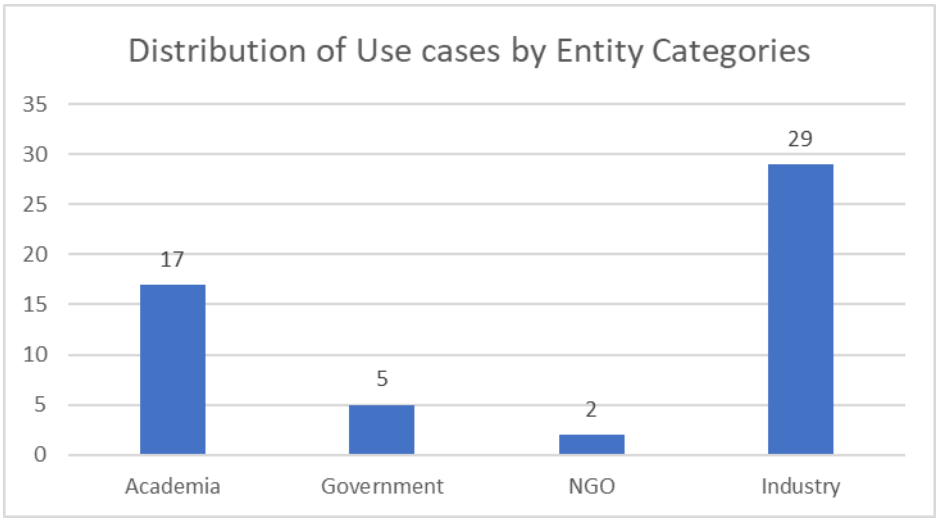
Figure 3: Number of use cases impacting specific SDGs



2.1. Entities who submitted AI use cases

Entities include Academia, Government, NGO (Non-Governmental Organization), and Industry. This indicates a multi-stakeholder approach to AI development and implementation, involving collaboration between academic institutions, government agencies, NGOs, and industry players. Industry appears to be the most common entity type involved in AI initiatives, followed by Academia, Government, and NGO. This suggests that commercial stakeholders play a significant role in driving AI innovation, with academic and governmental institutions also contributing significantly to research, policy development, and implementation of AI technologies.

Figure 4: Distribution of use cases by entity categories



2.2 Scholars Selection

Within the deadline for the Call for AI4G Scholars, we received 118 scholar applications from 35 countries. We aimed for identifying top candidates who embody a diverse range of qualities and commitments. The selection criteria were academic qualifications, interests and dedication

to SDGs, collaboration and partnership, communication skills, and a recommendation letter. We selected 14 scholars from academia, universities, and AI companies (see Table <1>) who were invited to participate in the AI for Good Global Summit 30-31 May and AI for Good Innovate for Impact in July. 2 scholars win the awards including:

- Best AI for Good Scholar Award
- Best Industry Scholar Award

Table 1: Fourteen AI scholars were selected

	Name	Country
1	Ms Talia Kusmirek	USA
2	Mr Ayaz Fayaz Oglu Karimov	Azerbaijan
3	Ms Florence Upendo Rashidi	Tanzania
4	Mr Emmanuel Kifalu Mkina	Tanzania
5	Mr Hu Zhengkun	China
6	Ms Afrah Hussein	Ethiopia
7	Mr Asrat Mulatu Beyene	Ethiopia
8	Mr Prudhvi Krishna Pavuluri	India
9	Mr Emmanuel Othniel Eggah	Nigeria
10	Mr Innocent Nzimenyera	Rwanda
11	Ms Xu Shan	China
12	Mr He Bo	China
13	Mr Emmanuel Aaron	Nigeria
14	Ms Shadia Y. M. Baroud	Palestine[1]

3. Learnings and conclusion

3.1 Generalized / Derived learnings from the use cases

Based on the description provided, here are some generalized or derived learnings from the use cases:

- **Cross-Sector Impact**: The use cases showcased the impact of AI applications, highlighting how AI technologies transcend industry boundaries to address various challenges and opportunities across healthcare, finance, manufacturing, transportation, environmental monitoring, and more.
- **Acceleration of SDGs**: Many of the selected use cases demonstrated how AI can accelerate the achievement of Sustainable Development Goals (SDGs) by addressing key

[1] RESOLUTION 99 (REV. DUBAI, 2018) Status of Palestine in ITU

societal and environmental issues. This underscores the potential of AI to drive positive social impact and contribute to global development agendas.

- **Diverse Geographic Representation**: The use cases exhibited geographic representation, with submissions from 38 countries spanning both developed and developing countries. This underscores the global relevance and applicability of AI solutions in addressing local and global challenges.
- **Collaborative Approach**: The selection process involved collaboration between project team members and external stakeholders, such as scholars and authors, demonstrating the importance of a collaborative approach in curating impactful use cases and fostering knowledge exchange.
- **Standards based and Criteria-based Evaluation**: The use cases were evaluated based on predefined criteria, including clarity, alignment with SDGs, potential for AI acceleration, future scalability, and adherence to ITU scope and standards. This systematic evaluation approach ensured the selection of high-quality use cases aligned with project objectives.
- **Digital Divide Considerations**: While AI holds immense potential for driving innovation and progress, there were considerations regarding the digital divide and disparities in access to technology. Efforts were made to ensure equitable access to AI technologies and promote inclusive growth and opportunity for all.

The use cases provided valuable insights into the diverse applications of AI across sectors and regions, highlighting its transformative potential and the importance of inclusive and collaborative approaches to AI development and deployment.

3.2 Future work:

- Scholar Engagement and Capacity Building:
  - The selected scholars will play a crucial role in promoting the use cases and engaging in discussions at the Innovation for Impact Workshop during the AI for Good Global Summit and AI for Good Innovate for Impact in 2024 and beyond.
  - Continued engagement with scholars and onboarding new scholar engagements will involve capacity building initiatives, such as future workshops, to enhance their skills and expertise in AI for sustainable development.
- Integration with AI for Good Platform:
  - The use case collection will be integrated into the AI for Good platform, providing global visibility and accessibility to stakeholders interested in leveraging AI for advancing sustainable development goals.
  - Collaboration with other stakeholders will ensure the seamless integration of the use cases into existing platforms and initiatives focused on AI for good.
- Dissemination and Awareness Campaigns:
  - The project team will conduct targeted dissemination and awareness campaigns to promote the use cases among relevant stakeholders, including policymakers, researchers, industry leaders, and civil society organizations.
  - Strategies such as webinars, social media outreach, and participation in conferences and events will be employed to raise awareness about the transformative potential of AI in addressing global challenges and advancing sustainable development agendas.
- Impact Assessment and Evaluation:
  - The impact of the use cases on advancing sustainable development goals will be assessed through qualitative and quantitative evaluation methods, including case studies, user surveys, and performance metrics.

  - Feedback from end-users and stakeholders will be collected to measure the effectiveness and scalability of AI solutions in addressing real-world challenges and driving positive impact.

- Collaborative Research, Innovation and Standards:
  - The project team will foster collaboration and knowledge exchange among stakeholders through collaborative research projects, joint publications, and innovation challenges focused on AI for sustainable development.
  - Partnerships with academic institutions, research organizations, and industry partners will be strengthened to facilitate interdisciplinary research and innovation in AI applications for addressing global challenges using standard based solutions.
- Long-Term planning and scaling of efforts:
  - The project team will develop a long-term plan to ensure the continued maintenance and scalability of the use case collection beyond the initial release. This will include reaching out to more parts of the world, expanding our Scholar network and network of experts.

Appendix A: Interim collection of Innovate for impact use cases

Use Case – 1: Neak Pean HealthTech - Khmer Telemedicine Chatbot

Country: Cambodia

Organization: Cambodia Academy of Digital Technology

Contact person: Panharith In, Panharith.in@cadt.edu.kh

Soklay Heng, Soklay.heng@cadt.edu.kh

Phuymeily Chou, Phuymeily.chou@student.cadt.edu.kh

1.1. Use case summary table

Domain	Healthcare (earmark)
The problem to be addressed	Access to medical care, inefficient management of waiting times, and long queues.
Key aspects of the solution	Speech-speech local language Chatbot, medical records, pre-health assessment, summary report generation, doctor dashboard, mobile-based solution.
Technology keywords	Chatbot, NLP, health
Data availability	Private
Metadata (type of data)	Audio speech data (history recording in audio and later converted to text).
Model Training and fine-tuning	ASR (speech engine), chatbot (sentenceBERT for finetuning), for accent handling.
Testbeds or pilot deployments	https://hal.science/hal-03865538/ https://misti.gov.kh/public/file/20220630165657948 3.pdf

1.2. Use case description

1.2.1 Description

According to the Cambodia's HelathTech Roadmap (MISTI, 2022), Cambodia faces a shortage of healthcare professionals leading to patients long waiting for health preliminary assessment. Meta report 2018 shows that 50% of all voice messages are from Cambodia as Khmer language is a complex script and hard to type. Neak Pean HealthTech is the Khmer telemedicine chatbot that integrates advanced technologies like natural language processing (NLP) and Khmer automatic speech recognition (ASR) to facilitate efficient communication between patients and healthcare providers. By allowing patients to report symptoms through voice-to-voice chatbot, keyword detection, summary report generation, schedule appointments, medical record storing, and access medical advice in Khmer, we aim to reduce the waiting time for preliminary assessment.

Use case status: The use case is part of a larger research project

UN Goals

- **SDG 3**: Good Health and Well-being
- **SDG 9:** Industry, Innovation and Infrastructure
- **SDG 10:** Reduced Inequality,
- **SDG 17:** Partnerships to achieve the Goal

Justify UN Goals selection: SDG 3: Good Health and Well-being - Neak Pean platform directly contributes to this goal by improving healthcare accessibility and quality in Cambodia. By enabling remote symptom reporting, efficient appointment scheduling, and access to medical advice in Khmer, the platform will empower individuals to take proactive steps towards better health outcomes. This aligns with the SDG 3 target of ensuring universal access to quality healthcare services.

SDG 9: Industry, Innovation, and Infrastructure - Neak Pean HealthTech epitomizes the spirit of innovation and technological advancement in healthcare. By leveraging AI technology and developing telemedicine infrastructure, we enhance the efficiency and effectiveness of healthcare delivery. The platform fosters innovation ecosystems, driving economic growth and job creation in the healthcare and technology sectors.

SDG 10: Reduced Inequality - The unequal distribution of healthcare resources is a pervasive challenge in Cambodia, with rural and underserved communities often facing limited access to medical care. Regardless of geographical location or socioeconomic status, Neak Pean HealthTech can bridge the gap to empower individuals to access timely medical services, thereby reducing inequalities in healthcare access and outcomes.

SDG 17: Partnerships for the Goals - Achieving sustainable development requires collaboration and partnerships across sectors. Neak Pean HealthTech actively fosters partnerships with public hospitals, healthcare providers, government agencies, and international organizations to scale its impact and reach. Through strategic collaborations, Neak Pean HealthTech leverages collective expertise and resources to address complex healthcare challenges and drive positive change in Cambodia's healthcare landscape.

Partner name: Ministry of Post and Telecommunications

1.2.2 Future work

Data collection, Model development, Others

Elaborate proposal: If provided with scholarships and additional resources, Neak Pean HealthTech aims to bring the platform to new heights through comprehensive data collection, computing power upgrade, and advanced model development.

Firstly, the team focuses on enhancing data collection efforts to enrich the AI algorithms. By collecting a diverse range of patient data, including symptoms, medical history, to name a few, the model can be trained to better understand and interpret Khmer speech patterns and healthcare terms. This data-driven approach will enable the team to refine keyword detection algorithms, improve accuracy and efficiency of symptom identification and summary report generation.

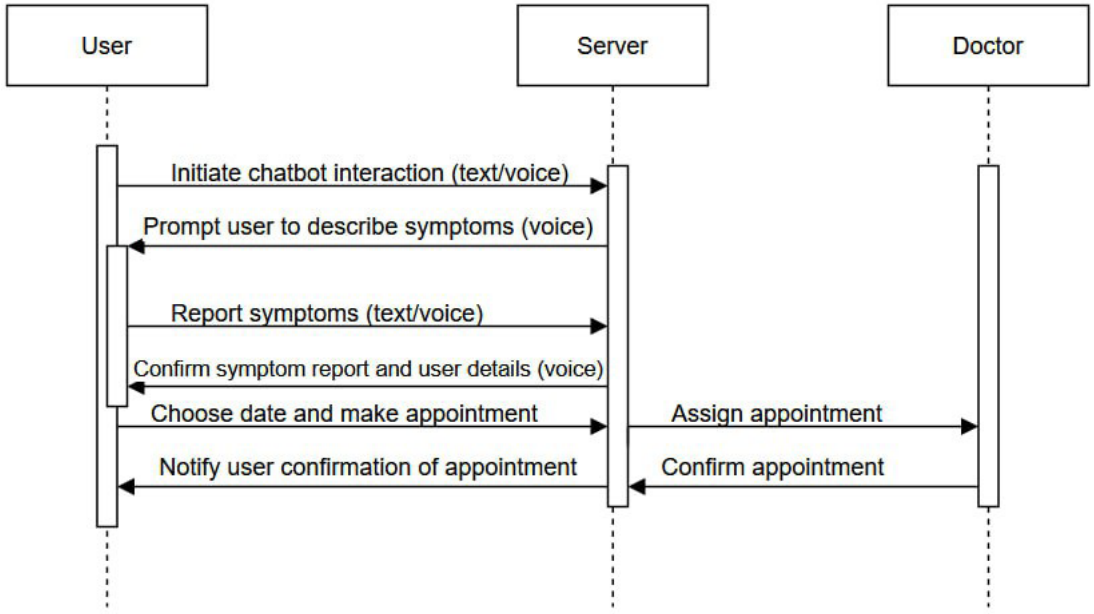
Upgrading the computing power or GPU infrastructure is crucial to support the computational demands for training the model. As currently the computing Capacity that the Cambodia Academy of Digital Technology (CADT) has is still limited. So this upgrading investment can accelerate model training and inference processes, enabling faster response times and scalability.

To enhance the performance of the model, the team would invest in more advanced model development. This includes fine-tuning our NLP, ASR, and Khmer Chatbot models to better handle complex Khmer language structures and dialects, as well as incorporating real-time feedback mechanisms to continuously improve model accuracy and adaptability.

1.3. Use case requirements

- **REQ-01:** It is critical that speech-speech Chatbots which provide access to pre-health assessment, based on a mobile based solution, are available in local languages.
- **REQ-02:** It is critical that a Khmer telemedicine chatbot integrates NLP and Khmer automatic speech recognition (ASR) to facilitate efficient communication between patients and healthcare providers.
- **REQ-03:** It is a chatbot that allows patients to report symptoms remotely through voice or text in Khmer, which is critical given the complex script of the Khmer language and the prevalent use of voice input among Cambodians.
- **REQ-04:** It is critical that the platform employs keyword detection algorithms to extract essential information from patient inputs and automatically generates comprehensive summary reports for healthcare providers.
- **REQ-05:** It is critical that patients can schedule appointments seamlessly through the platform, which facilitates efficient communication and coordination between patients and healthcare providers.
- **REQ-06:** It is critical that the accessibility of medical records and advice in the Khmer language empowers patients, enabling them to make informed decisions about their health and well-being, thereby enhancing patient outcomes.

1.4. Sequence diagram



1.5. References

[1] https://hal.science/hal-03865538/

[2] https://misti.gov.kh/public/file/20220630165657948 3.pdf

Use Case – 2: Machine Translations for Khmer Braille

Country: Cambodia

Organization: Cambodia Academy of Digital Technology

Contact person: Ly Rottana rottana.ly@cadt.edu.kh

2.1. Use case summary table

Domain	Accessibility (visually impaired)
The problem to be addressed	Lack of educational material for visually impaired people. Errors in braille translation software for Khmer language, cost of proprietary solutions. Difficulties for customization in formulas or equations for math, physics, and chemistry.
Key aspects of the solution	Braille – Khmer, open source, specific fine tuning such as mathematical formulas.
Technology keywords	Accessibility, Khmer, braille, open source.
Data availability	Private
Metadata (type of data)	Text data in Khmer and Braille.
Model Training and fine-tuning	A statistical model with an accuracy of 85% (general text).
Testbeds or pilot deployments	Statistical vs Neural Machine Translations for Khmer Braille [1] https://github.com/liblouis/braille-specs/tree/master/khmer

2.2. Use case description

2.2.1 Description

The purpose of this use case is to help facilitate the communication between people who are visually and sight impaired with others in Khmer Language. People with visual impairment are among the vulnerable groups in our society, as they do not have the ability to freely see the world as vision impaired people do [2].

While in most developed countries vulnerable groups can enjoy the same rights as others, in developing nations like Cambodia, this group of people still requires further support for better access and quality of life. Despite the availability of commercial Braille translation software options, such as the Duxbury Braille Translator software, the comparatively high cost

in Cambodia means that only one computer at the National Institute of Special Education (NISE) in Phnom Penh is equipped with a license, thereby limiting accessibility for visually impaired individuals [3], [4].

Therefore, our research team, in collaboration with NISE and Krousar Thmey Organization (an organization helping disadvantaged children in Cambodia), would like to develop a machine translation system for Khmer Braille which is publicly available and free access to the community and for the education for Deaf or Blind.

Repository Link: Repository

Use case status: The use case is part of a larger research project

UN Goals:

- **SDG 4:** Quality Education
- **SDG 10:** Reduced Inequality

Justify UN Goals selection: Our goal is to help reduce the gap between people who are visually and sight impaired with others in Cambodia. We would like to develop a machine translation system for Khmer Braille for this community so they can easily communicate with other people and enjoy the same rights as others in the society if possible. Furthermore, we would like to apply this system particularly for the education for Deaf or Blind people so the disadvantaged children are able to enjoy the rights of education like others. We expect that this system will help facilitator educators and boost the learning outcomes of the children in the field of special education.

Partner name: National Institute for Special Education, Ministry of Education, Youth and Sport

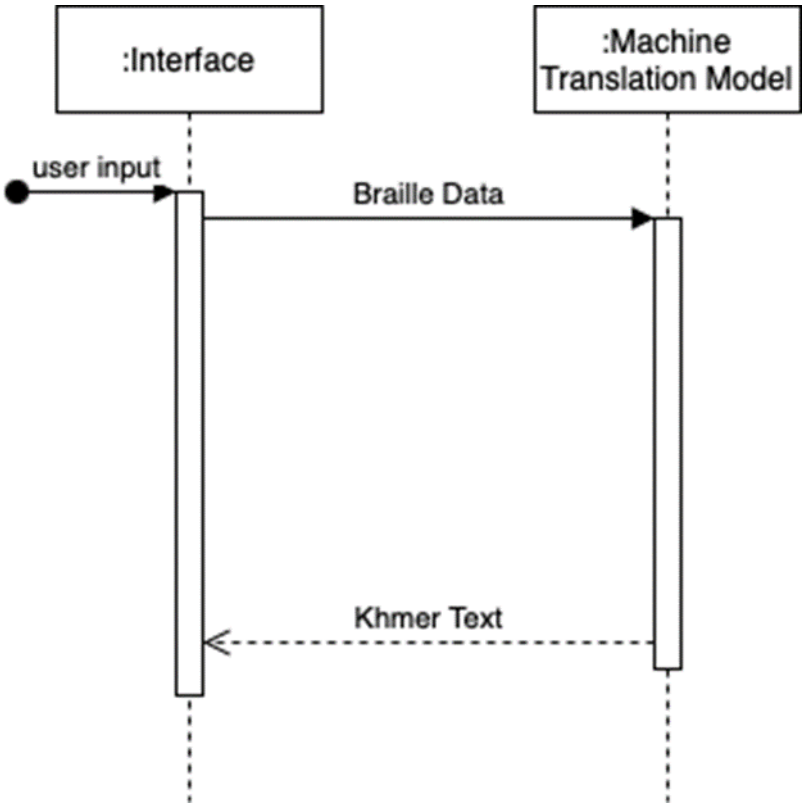
2.2.2 Future work

Model development, Standards development related to the use case Elaborate proposal: As of today, we are able to build a baseline system for a machine translation system for Khmer Braille (general context). If we are given scholarships and resources, we will further develop the machine translation model particularity for education, for example a system that is compatible with Math and Physic formulas so it will help facilitate teachers and instructors in their teaching activities. In addition, we would like to build a mobile application and/or web application that is freely accessible to the public as well so everyone can use it, which is very beneficial to the people within this community.

2.3. Use case requirements

- **REQ-01**: It is critical that MTKB enables the communication between sight impaired people and others.
- **REQ-02:** It is critical that MTKB is open source and accessible by everyone.
- **REQ-03:** It is critical that MTKB facilitates the teaching of instructors and the learning of students, particularly in primary school and high school.

2.4. Sequence diagram



2.5. References

[1] Yann, K., Veng, P., Thu, Y.K, Ly, R.: Statistical vs Neural Machine Translations for Khmer Braille. In: The 13th Conference on Information Technology and Its Applications (2024).

[2] Thu, Y.K., Chea, V., Finch, A.M., Utiyama, M., Sumita, E.: A large-scale study of statistical machine translation methods for khmer language. In: Pacific Asia Conference on Language, Information and Computation (2015), https://api.semanticscholar.org/CorpusID:13622925

[3] Chea, V., Thu, Y.K., Ding, C., Utiyama, M., Finch, A.M., Sumita, E.: Khmer word segmentation using conditional random fields (2015), https://api.semanticscholar.org/CorpusID:49269483

[4] Krousar Thmey Organization: Khmer Braille Book For Blind People (2021), https://github.com/liblouis/braille-specs/blob/master/khmer/Khmer.Braille.Signs.pdf

Use Case – 3: AI-supported Green Growth Simulation Tool for Assessing SDG Co-benefits

Country: Hungary

Organization: Global Green Growth Institute

Contact person: Dr. Lilibeth Acosta, lilibeth.acosta@gggi.org

3.1. Use case summary table

Domain	Climate Action
The Problem to be addressed	• Challenge in accurately quantifying the co-benefits arising from climate mitigation and adaptation measures within national strategic plans. • Limited understanding of how these measures contribute to achieving specific Sustainable Development Goal (SDG) targets relevant to green growth. • Insufficient methodologies to assess SDG co-benefits in social inclusion and gender. • Decision-makers need a robust online platform for informed policy development and to assess the country's performance in achieving the SDGs in 2030 and beyond.
Key aspects of the solution	• The Green Growth Simulation (GGSim) Tool offers scenario analysis for evaluating SDG co-benefits in national strategic plans like NAPs, NDCs, and LEDs. • It includes systems dynamics models for energy and transport, agriculture, forestry, other land use (AFOLU), water, waste, and pollution. • Its AI-based network analysis aims to implement structural equation modeling (SEM) for social inclusion and gender-related SDGs that lack models and data. • GGSim uses machine-learning approaches to validate the robustness of SDG co-benefits from integrated system dynamics and network models.
Technology keywords	Green Growth Index, Green Growth Simulation Tool, Systems Dynamics Models, AI-based Network Analysis, Structural Equation Modeling, Shapley Values, Scenario Analysis
Data availability	National and international public data (UNSTAT, FAO, World Bank) https://hungary-simtool.herokuapp.com/SimulationDashBoard/downloads
Metadata (type of data)	structured and unstructured data
Model Training and fine-tuning	• Basinhopping and L-BFGS-B for model parameter optimization • Grid Search (gridsearchCV) for hyperparameter tuning.
Case Studies	Hungary, Burkina Faso, Ethiopia LT-LEDS, and Senegal and St. Lucia NAP-related policies (i.e. SDG 3, 6, 7, 12, 13, and 15).

(continued)

Domain	Climate Action
Testbeds or pilot deployments	https://greengrowthindex.gggi.org/?page_id=3126

3.2. Use case description

3.2.1 Description

The Global Green Growth Institute (GGGI) [1] is actively engaged in addressing the challenge of accurately quantifying the co-benefits arising from climate mitigation and adaptation measures within national strategic plans. This challenge is compounded by a limited understanding of how these measures contribute to achieving specific Sustainable Development Goal (SDG) targets. To tackle these complexities, GGGI has developed the Green Growth Simulation (GGSim) Tool [2] that is linked to the Green Growth Index, measuring a country's performance in achieving the SDGs [3].

Previous GGSim applications covered SDG indicators such as energy intensity (SDG 7.3.1), share of renewables in the total final energy consumption (SDG 7.2.1), installed renewable energy capacity per capita (SDG 7.b.1 and 12.a.1), food loss and waste index (SDG 12.3.1.a and b), share of forest area to total land area (SDG 15.1.1), above-ground biomass in forest (SDG 15.2.1), water use efficiency (SDG 6.4.1), level of water stress (SDG 6.4.2), treated wastewater (SDG 6.3.1), CO_2 and non-CO2 emissions ((SDG 13.3.2), etc.

Tool Overview: The GGSim Tool includes systems dynamics models for energy and transport, agriculture, forestry, other land use (AFOLU), water, waste, and pollution, aiming to comprehensively analyze the complex dynamics of climate action initiatives. However, to enhance its capability further, GGGI is in the process of integrating social inclusion and gender models into the tool. This scenario-based analysis platform integrates AI-based network analysis for assessing SDG co-benefits in national strategic plans such as National Adaptation Plans (NAPs), Nationally Determined Contributions (NDCs), and Low Emissions Development Strategies (LEDS).

Collaborative Efforts: The collaborative effort between GGGI and Professor Janos Abonyi's team at the University of Pannonia, Hungary [4], has developed a national green growth simulation tool for Hungary [5]. This tool facilitates the assessment of SDG co-benefits stemming from selected policy interventions outlined in the Hungary National Clean Development Strategy (NCDS). The systems covered by the tool include energy, land, water, and waste sectors. The collaboration resulted in the pilot application of machine learning to implement and validate network analysis for water use efficiency (SDG 6.4.1) and level of water stress (SDG 6.4.2).

Building upon this work, the collaboration aims to enrich the GGSim Tool further by integrating AI-supported network analysis with existing systems dynamics models. This enhancement will enable a more comprehensive evaluation of SDG co-benefits, particularly in the realm of social inclusion and gender, which are crucial for promoting equitable and sustainable development. The SDG indicators include, for example, the proportion of population using safely managed drinking water services (SDG 6.1.1), proportion of population using (a) safely

managed sanitation services (SDG 6.2.1), proportion of population with access to electricity (SDG 7.1.1), gender ratio of an account at a bank or other financial institution (SDG 8.10.2), etc.

Assessment of SDG Co-benefits: The GGSim is linked to GGGI's Green Growth Index, which measures a country's performance in achieving SDG targets in four dimensions – efficient and sustainable resource use, natural capital protection, green economic opportunities, and social inclusion. Through this link, the GGSim Tool facilitates the assessment of SDG co-benefits across multiple dimensions, including disease burden due to inadequate sanitation, water use efficiency, renewable energy adoption, food loss and waste reduction, greenhouse gas emissions, land degradation, and forest conservation. These assessments are vital for measuring SDG progress related to poverty alleviation (Goal 1), zero hunger (Goal 2), good health and well-being (Goal 3), gender equality (Goal 5), clean water and sanitation (Goal 6), affordable and clean energy (Goal 7), reduced inequality (Goal 10), sustainable cities and communities (Goal 11), responsible consumption and production (Goal 12), climate action (Goal 13), and life on land (Goal 15).

By integrating the systems dynamics models with AI-based network analysis, more SDG indicators can be covered in Goals 3, 6, 7, 12, 13, and 15. Moreover, this integration enables the inclusion of social inclusion indicators that may currently lack data or models within the GGSim. Improving GGSim's current version will thus allow the assessment of co-benefits in Goals 1, 2, 3, 5, and 10, contributing to a more holistic evaluation of sustainable development progress.

Repository Link

UN Goals:

- **SDG 6:** Clean Water and Sanitation
- **SDG 7:** Affordable and Clean Energy
- **SDG 11:** Sustainable Cities and Communities
- **SDG12:** Responsible Consumption and Production

Justify UN Goals selection: Considering the goals mentioned in the context, the selection of these UN Goals appears to be the most accurate representation of the initiatives outlined. They cover various aspects of sustainable development, including climate action, gender equality, clean energy, sustainable cities, responsible consumption, and reduced inequalities.

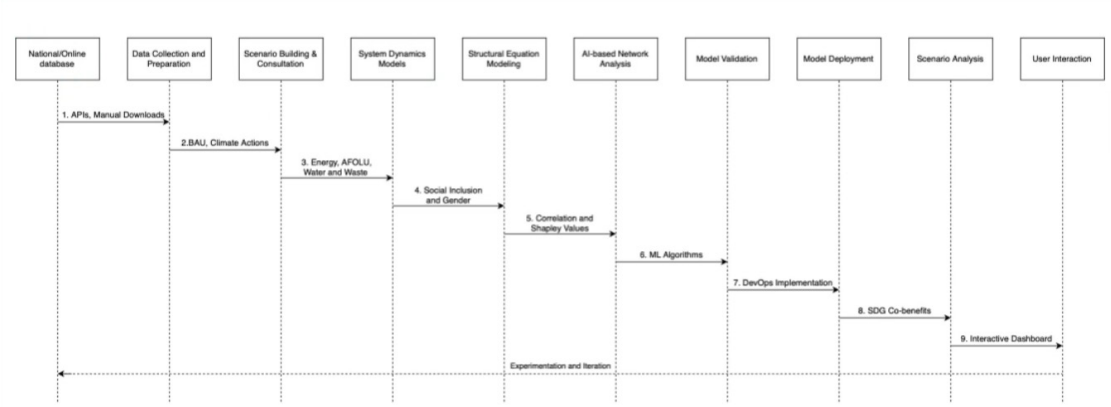
3.2.2 Future Work

Future work on the GGSim Tool will focus on continuing data collection, proof of concept development, model refinement, and establishing reference tools and simulation environments. Additionally, opportunities to collaborate with ITU Innovation for Impact [6] will be explored to enhance research on AI-based solutions that can further improve the tool's capabilities and applications. These efforts will create an improved online platform accessible to policymakers, researchers, and stakeholders worldwide. Ultimately, the goal is to empower decision-makers with robust insights for informed policy development and sustainable development planning, thereby accelerating progress towards achieving the SDGs and fostering inclusive green growth.

3.3. Use case requirements

- **REQ-01:** It is critical that a scenario-based analysis tool, which integrates AI-based network analysis, is provided for assessing SDG co-benefits in national strategic plans.
- **REQ-02:** It is crucial to apply network analysis as a collection of integrated techniques for depicting relationships among SDG-relevant variables and analyzing the social impacts of these connections.
- **REQ-03:** It is critical that the Machine Learning model used to estimate the SDG value for the period 2020-2050 from relevant data be validated by experts.

3.4. Sequence diagram



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[5] Green Growth Simulation (GGSim) Tool for Hungary. Available online: https://hungary-simtool.herokuapp.com/

[6] ITU Innovation for Impact.Available online: https://aiforgood.itu.int/innovate-for-impact/

Use Case – 4: NET-PEAT-ZERO: Networked ASEAN Peatland Forest for Net-Zero

Country: Malaysia

Organization: Universiti Putra Malaysia (UPM)

Contact person: Aduwati Sali aduwati@upm.edu.my

4.1. Use case summary table

Domain	Forestry
Problem to be addressed	Decision-making by forest rangers, firefighters and the local community on potential peatland forest fire could trigger transboundary haze in the ASEAN region. The early warning system is influenced by varied factors such as climate conditions, soil temperature, soil humidity and ground-water level. The problems include water level in the peatland soil, water management, machinery, environmental sustainability, forest rangers, fire-fighters and local community's training and education, market access, and government policies.
Key aspects of the solution	Unifying the data of various agencies and using machine learning models to predict the best plans, policies, and strategies to increase crop productivity and economic growth.
Technology keywords	IoT, Open data, mobile apps, AI/ML and geospatial analysis.
Data availability	Private
Metadata (type of data)	Text data
Model Training and fine-tuning	kNN
Testbeds or pilot deployments	https://doi.org/10.3390/fire6070272 https://doi.org/10.3390/f14071472 https://hal-emse.ccsd.cnrs.fr/emse-03346490

4.2. Use case description

4.2.1 Description

The tropical area has a large area of peatland, which is an important ecosystem that is regarded as home by millions of people, plants and animals. However, the dried-up and degraded

peatland becomes extremely easy to burn, and in case of fire, it will further release transboundary haze. In order to protect the peatland, an improved tropical peatland fire weather index (FWI) system is proposed by combining the ground water level (GWL) with the drought code (DC). LoRa based IoT system for peatland management and detection was deployed in Raja Musa Forest Reserve (RMFR) in Kuala Selangor, Malaysia. Then, feasibility of data collection by the IoT system was verified by comparing the correlation between the data obtained by the IoT system and the data from Malaysian Meteorological Department (METMalaysia).

An improved model was proposed to apply the ground water level (GWL) for Fire Weather Index (FWI) formulation in Fire Danger Rating System (FDRS). Specifically, Drought Code (DC) is formulated using GWL, instead of temperature and rain in the existing model. From the GWL aggregated from the IoT system, the parameter is predicted using machine learning based on a neural network. The results show that the Drought Code (DC), Duff Moisture Code (DMC) and Fire Weather Index (FWI) alternatively calculated from GWL profiled from the IoT system has high correlation with the data released by METMAlaysia. This shows that DC can be calculated using predicted GWL as well as other Fire Danger Rating System (FDRS) indices. The Machine Learning prediction is essential for tropical peatland Fire Danger Rating System (FDRS). The IoT system can be enhanced by including CO2 sensors to measure carbon emission from the peatland soil and from human activities in the area. In turn, the innovation can be used to help predict and reduce the fire risk of tropical peatland, which could lead to transboundary haze in the region [1], [2], [3], [4].

UN Goals:

- **SDG 9:** Industry, Innovation and Infrastructure,
- **SDG15:** Life on Land

Justify UN Goals selection: The project use Machine Learning (ML) to predict Fire Danger Rating System (FDRS) indices such as Drought Code (DC), Duff Moisture Code (DMC) and Fire Weather Index (FWI) using Ground Water Level (GWL) obtained from the IoT system deployed at Raja Musa Forest Reserve (RMFR). The project has received local and regional awards especially in managing transboundary haze in ASEAN region. We would like to extend the project by measuring carbon emission from the peatland forest and how net-zero can be achieved by managing the peatland better, both using IoT technology and through community-based management.

Partner name: Selangor Forest Department Partner

4.2.2 Future work

Proof of concept development, Create new variations/extensions to the same use case, Standards development related to the use case.

Elaborate proposal: There are about 25 million hectares of peat swamp forest in Southeast Asia. To date, poor monitoring and lack of sustainable peatland forest management have led to rapid forest degradation. This is a major threat not only to biodiversity ecosystems, but also to humans, especially from transboundary fog caused by forest fires. From the research so far, we have learned that observations centered on the Underground water level and Ground surface level are important for CO2 emission, disaster prevention (especially fires), and climate change. However, the system and structure for solving the importance of this observation data and problem solving are not in place.

For this challenge, this project applies an IoT-based peatland forest management and monitoring system to use the products of private companies as social practice and proposes a POC to implement the research results into society. The candidate sites are Kuala Selangor and Sarawak in Malaysia. Our IoT system collects sensor data in real time and stores it in an integrated cloud server where all members can access and analyze the data.

In this POC, we aim to introduce machine learning technology for data evaluation and evaluate effective data utilization such as CO2 Emission evaluation and ASEAN FDRS.

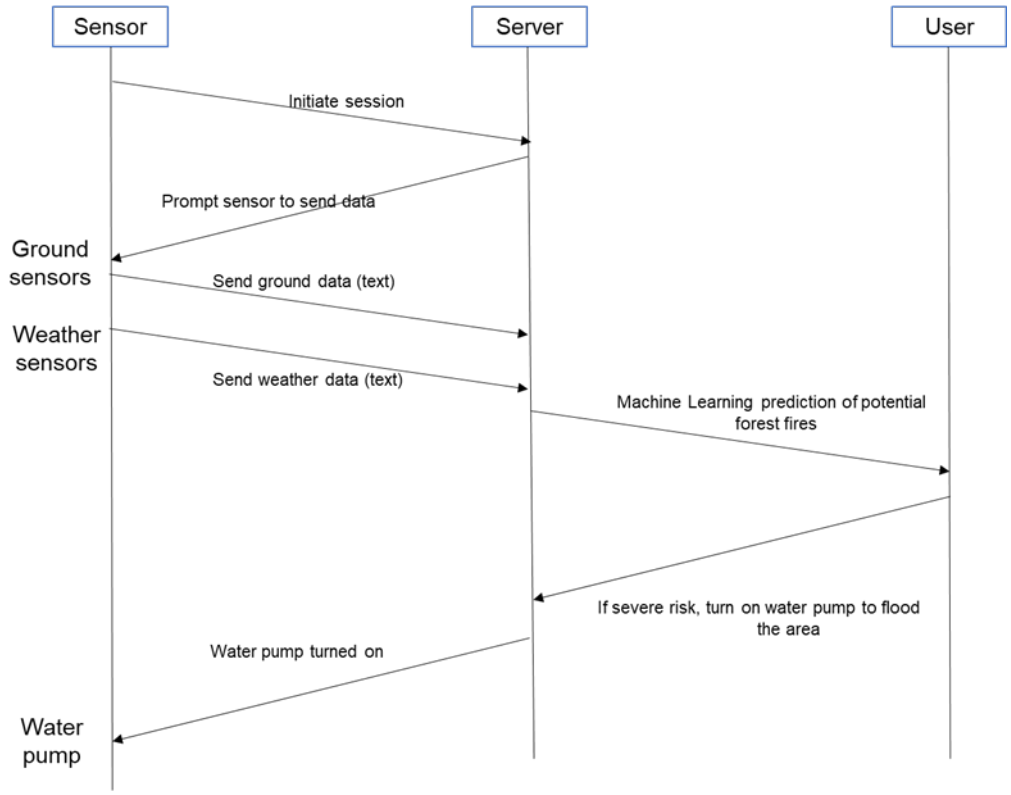
The novelty of this project is aiming for a platform that accelerates the possibility of horizontal collaboration centered on data, and the possibility of not only warning systems for local communities, but also climate change initiatives such as CO2 Emission. This POC will be evaluated by participating stakeholders such as Selangor Forestry Department (JPNS), Meteorological Department (METMalaysia) and Global Environment Centre (GEC).

4.3. Use case requirements

ITU-T Supplement Y.71 ITU-T Y.3000 series – Use Cases for Peatland Management Systems

- **REQ-01:** It is critical that the system must integrate Ground Water Level (GWL) with the Drought Code (DC) to calculate the Fire Weather Index (FWI), using GWL instead of traditional temperature and rainfall metrics.
- **REQ-02:** It is critical that the LoRa-based IoT system must be deployed for continuous monitoring and management of peatland conditions at Raja Musa Forest Reserve (RMFR) in Kuala Selangor, Malaysia.
- **REQ-03:** It is critical that the system must ensure robust data collection capabilities and the feasibility of the collected data must be verified by comparing it with data from the Malaysian Meteorological Department (METMalaysia) to establish high correlation and accuracy.
- **REQ-04:** It is critical that the machine learning model using neural networks must be implemented to predict GWL from the IoT system data and use these predictions to compute Fire Danger Rating System (FDRS) indices such as DC, DMC, and FWI.
- **REQ-05:** It is critical that the IoT system should be enhanced by incorporating CO2 sensors to measure carbon emissions from peatland soil and from human activities, which aids in environmental monitoring and management.
- **REQ-06:** It is critical that the enhanced FWI system must be applied to effectively predict and reduce the fire risk in tropical peatlands, thereby aiding in the prevention of transboundary haze in the region.

4.4. Sequence diagram



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Background Video

Use Case – 5: AI-based Chatbot for Farmers

Country: India

Organization: Development monitoring and evaluation office (DMEO), NITI Aayog

Contact person: Dr. Tejal Agarwal tejal.agarwal1994@gmail.com

5.1. Use case summary table

Domain	Agriculture
Problem to be addressed	Decision making by farmers is influenced by varied factors such as climate conditions; soil fertility; crop breeding; water management; seed quality, pesticides, fertilizers, and machinery; environmental sustainability; farmer's training and education; market access, and government policies.
Key solution	Unifying the data of various agencies and using machine learning models to predict the best plans, policies, and strategies to increase crop productivity and economic growth.
Technology keywords	AI, open data, mobile apps, ML and geospatial analysis.
Data availability	Public(The data is open source and it is available on https://agmarknet.gov.in/PriceAndArrivals/CommodityDailyStateWise.aspx, https://data.telangana.gov.in/search/?page=2&sort-order=asc&theme=Agriculture)
Metadata (type of data)	Text data (Time/date, district, mandal, market, crop, arrival, crop yield,-model, number of houses, number of people, electricity load, rain(mm), latitude, longitude.)
Model Training and fine tuning	Machine learning algorithms to process and analyze, natural language processing (NLP) algorithms to extract insights from textual data.
Testbeds or pilot deploy-ments	Government agencies to identify pilot sites, integration with existing agricultural systems through feedback mechanisms and performance metrics.

5.2. Use case description

5.2.1 Description

Revolutionizing the agriculture sector by unifying multiple government agency's data using Artificial intelligence models.

In India, ~59% of the total workforce is engaged in the agriculture sector, contributing ~23% to GDP, according to a survey conducted by the Food and Agriculture Organization of the United

Nations [1]. The Indian agriculture sector is expected to support the food security of more than 1.5 billion people by 2030 [4]. However, the productivity of agriculture and its allied sectors is influenced by numerous factors, including climate conditions; soil fertility; crop breeding; water management; seed quality, pesticides, fertilizers, and machinery; environmental sustainability; farmer's training and education; market access, and government policies. Unfortunately, many of these factors are managed using traditional methods and practices till now, which often limit farmer's livelihoods and grain productivity.

Several studies also suggest that intensive irrigation, fertilization can destroy the soil components and nutrients, causing an increase in soil erosion which results in the reduction of the crop yield [5]. Thus, there is a need for a transformation of the agriculture sector. The state-of-the-art technologies of today combined with government policies can help various stakeholders to make informed decisions to achieve the sustainable development goals of the United Nations.

In this direction, only recently, AI-driven technologies have entered the Indian agriculture sector which assists farmers with precise information on farming techniques, agricultural water management, soil health management and logistics, etc. According to the World Economic Forum, the pilot study of agriculture-related AI technology on 7000 farmers in the Khammam district of Telangana (India) showed promising results, where the net income of the farmers using the AI technology had been doubled ($800 per acre) from the average income in 6 months. To significantly improve the livelihoods of Indian farmers, the adoption of these technologies must occur on a large scale. The integration of artificial intelligence and other modern technologies has the potential to revolutionize Indian agriculture, driving increased productivity, sustainability, and economic growth across the sector.

However, the central bottleneck in this direction is the disaggregated data provided by various agencies, e.g.:

(a) Indian Agricultural Statistics Research Institute (IASRI) provides data and analysis on Indian agriculture, aiding in crop production, land use, and farmer demographics.

(b) Indian Institute of Soil Science (IISS) conducts research on soil fertility, and soil testing services, enhancing soil health and crop productivity.

(c) National Bureau of Soil Survey and Land Use Planning assesses soil resources and provides land management recommendations, supporting sustainable agriculture.

(d) Indian Meteorological Department (IMD) offers weather forecasts and climate data, such as rainfall patterns and temperature fluctuations, which are crucial for crop growth. IMD's GKMS (Gramin Krishi Mausam Sewa) scheme provides weather forecasts at district and block levels, aiding farmers in decision-making and planning using Weather Based Agro Advisory Services [3]. The Advisories are prepared by AMFUs (Around 130 Agromet Field Units) and DAMUs (199 District Agromet Units), and disseminated through apps, social media, and awareness programs [3].

(e) Indian Space Research Organisation (ISRO) and Bhuvan monitors land use and crop health through satellite imagery and geospatial data, assisting in crop monitoring and yield estimation.

(f) Ministry of Agriculture and Farmers Welfare formulates policies and programs to promote agricultural development and ensure food security.

(g) Agmarknet (Agricultural Marketing Information Network) collects and disseminates market information on agricultural commodities such as crop prices, market trends, and trade statistics to support farmers, traders, and policymakers. Government initiatives like the Kisan Suvidha App and eNAM (National Agriculture Market) facilitate access to agricultural information and online trading platforms, improving market access and reducing transaction costs for farmers. Open Government Data (OGD) Platform India

aims to promote data sharing and enable access to the exchange of data between government agencies, research institutions, and other stakeholders to support evidence-based policymaking and development initiatives.

UN Goals:

- **SDG 2:** Zero Hunger
- **SDG 9:** Industry, Innovation, and Infrastructure.
- **SDG 13:** Climate Action
- **SDG 15:** Life on Land

Justify UN Goals selection:

1. Data Integration: By unifying data from multiple government agencies such as IASRI, IISS, IMD, ISRO, and others, AI models can provide comprehensive insights into various aspects of agriculture, including crop production, soil health, weather patterns, and market trends. This integrated data approach enables evidence-based decision-making and supports initiatives aimed at achieving Zero Hunger and promoting sustainable agriculture.
2. Precision Agriculture: AI-driven technologies offer farmers precise information and recommendations tailored to their specific needs and conditions. This precision agriculture approach increases resource efficiency, minimizes environmental impact, and contributes to achieving Sustainable Development Goals (SDGs) related to climate action and sustainable land use.
3. Policy Formulation: By leveraging AI-driven insights, government agencies can formulate more effective policies and programs to promote agricultural development, ensure food security, and address key challenges in the sector. This policy alignment contributes to achieving SDGs related to Zero Hunger, Industry, Innovation, and Infrastructure, and Climate Action.
4. Capacity Building: AI technologies can also facilitate capacity building initiatives by providing training and education to farmers on modern agricultural practices, technology adoption, and climate-smart farming techniques. This capacity building enhances resilience, promotes sustainable livelihoods, and supports the achievement of SDGs related to Zero Hunger and Life on Land.

5.2.2 Future work

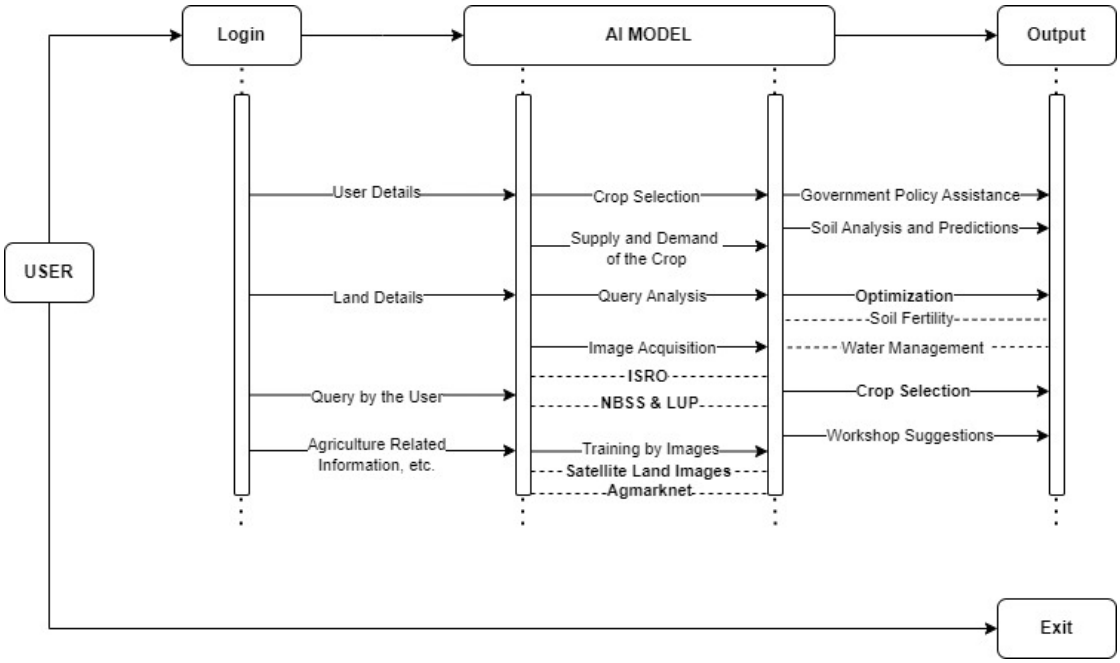
However, the current digital platform does not optimize the data between multiple government agencies. Unifying the data of various agencies and using machine learning models to predict the best plans, policies, and strategies using data will help relevant stakeholders make informed decisions and implement effective interventions for sustainable agriculture and development.

We propose to use an AI-based strategic model to enable decision-making based on comprehensive government data related to agriculture, including crop production, land use, water use, market prices, weather patterns, and government schemes to enable farmers to make informed decisions by leveraging the existing data.

5.3. Use case requirements

- **REQ-01:** Data Integration and Standardization - Required data from various sources mentioned above in the references.
- **REQ-02:** Machine Learning Models - predictive analytics, analyzing historical data to forecast crop yields.
- **REQ-03:** User Friendly Interface - To interact with the AI driven decision support system

5.4. Sequence diagram



5.5. References

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Use Case – 6: Using AI to Reduce the 6G Standards Barrier for African Aontributors

Country: Nigeria

Organization: Federal University of Technology, Minna

Contact person: Prof. James Agajo james.agajo@futminna.edu.ng

Emmanuel Othniel Eggah, emmanueleggah@gmail.com

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Victor Chukwuebuka Onah, onahvictorc@gmail.com

6.1. Use case summary table

Domain	LLM for 6G
Problem to be addressed	Addressing the standards gap between developed and emerging nations in Africa, especially in 6G.
Key aspects of the solution	Text to Text Chatbot that predict the new use cases and its architectures, classify material, including multimedia material from ITU into context specific useful classes which can be easily consumed, generate captions in regional languages and provide answers to queries from students and scholars.
Technology keywords	6G, standards gaps, LLM
Data availability	Public (The data is open source and it is available on hugging face Link to dataset
Metadata (type of data)	Text data (Fields:background-text, prompt -text.response -text, Response_correction)
Model Training and fine tuning	Argilla Space for Dataset annotation, Mistral Model for fine tuning
Testbeds or pilot deployments	https://github.com/CrashingGuru/FGAN-Build-a-thon/tree/main/Notebooks2023

6.2. Use case description

6.2.1 Description

Currently, there exists a standard gap between developed and developing nations, especially in emerging technologies such as 6G. Due to several factors such as resource scarcity and other priorities, emerging nations in Africa find it difficult to bridge the standards gap. A strong research background is needed to produce standards based essential innovations and contributions which can create global solutions while being customized for regional needs. In many cases, this background requires time and effort to set up. Due to the knowledge gap that exists between different regions, it takes longer time for converting innovations from research labs such as WINEST into deployment. Also, contributors from emerging regions such as Africa find it difficult to attend, track and create contributions which are impactful technically especially on leading technologies such as 6G.

ITU has several initiatives such as bridging the standards gap (BSG) and ML5G initiatives which tries to bring the experts closer to such emerging regions. ITU already rolled out open source initiatives such as ITU FG AN Build-a-thon which created reference implementations supported by WINEST. ITU AI4Good Summit, and ML5G Discovery series of webinars and the ML5G Challenge initiatives provides platform and opportunities, including technical videos and webinars available free of cost. ITU provides computers including GPUs free of cost. WINEST team, led by Prof. Agajo has already made international presentations in July 2023 in Geneva during ITU workshop Using AI as an enabler for standards and innovation, we are able to predict the new use cases and its architectures, classify material, including multimedia material from ITU into context specific useful classes which can be easily consumed, generate captions in regional languages and provide answers to queries from students and scholars. Using a co-pilot like chatbot trained on ITU materials, we are able to easily create scenarios, experimentation setup using open source, utilizing the already trained models, but fine-tuning based on our needs in 6G. AI based and graph based knowledge bases (demonstrated by WINEST during ITU FG AN Build-a-thon in 2023 and during ITU workshop on 19 Jan 2024), allows us to create regionally curated knowledge bases based on ITU materials.

Repository Link here.

UN Goals:

- **SDG 9:** Industry, Innovation and Infrastructure,
- **SDG 17**: Partnerships to achieve the Goal

Justify UN Goals selection: The proposed use case aligns closely with UN SDG 9 and 17.

Our proposed use case aims to:

1. Address the standards gap between developed and emerging nations, especially in 6G, thereby creating an innovative ecosystem in Africa (and beyond), which lowers the overall cost for connectivity and interoperability for future networks.
2. Create a strong research mindshare. This creates regional standards based essential innovations and contributions customized to regional needs, at the same time leading the global standards. This requires strong partnership based on the open datasets and tools put in place as described above.
3. Balance the AI awareness and expertise in Africa (and around the world), thereby addressing the inequality and accessibility of innovations.

4. Reduce lead time for innovations from research labs such as WINEST which in turn creates a strong research mentality, which is essential for industrial and wireless infrastructure.

Using our proposal, contributors from emerging regions such as Africa are able to create impactful and collaborative contributions to ITU and other standards bodies.

Partner name: Nigerian Communications Commission

Background papers and/or references: Source Code

6.2.2 Future work

Data collection, Proof of concept development, Model development, Setup reference tools, notebooks and simulation environment Elaborate proposal: Building upon our extensive work within the ITU ML5G initiative and the insightful presentations made during the ITU workshop in Geneva in July 2023, we, the WINEST team, led by Prof. Agajo, propose an innovative project that uses AI to foster collaboration and reduce 6G standards barrier for African contributors. If we are given the scholarships and resources:

1. We would continue our effort in the open source dataset in ITU Build-a-thon – we have been actively developing on this dataset as presented in the most recent ITU FGAN Build-a-Thon workshop on 19 Jan 2024
2. We would continue our efforts in annotating and creating the HF dataset and reference tools are available from dataset link and source code link.
3. We would also continue our collaboration with NCC (Nigerian Communications Commission) and other regional standards bodies such as ITU SG13 RG AFR.

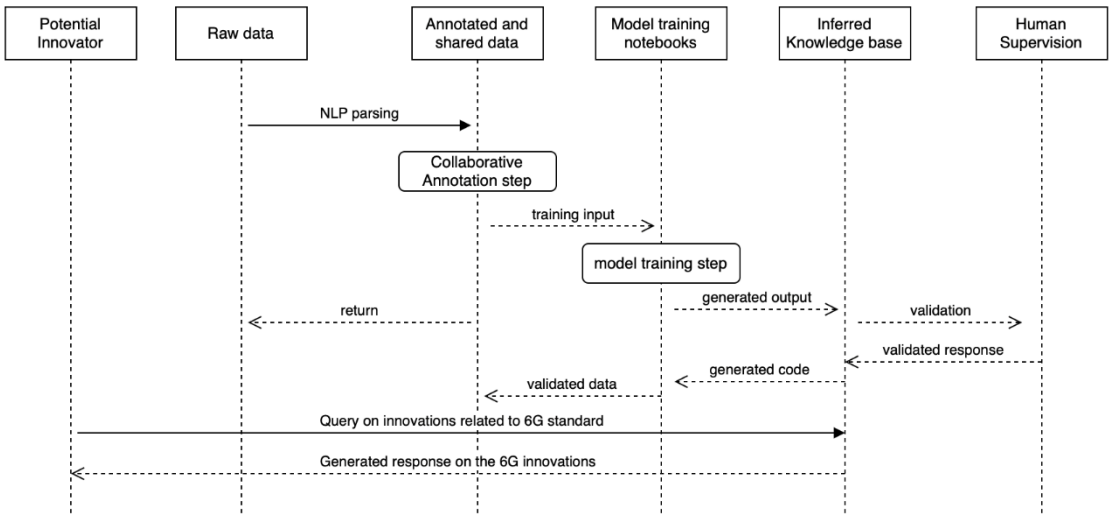
WINEST team would continue with the above effort led by Prof. Agajo who has already made international presentations in July 2023 in Geneva during ITU workshop. Our students such Ms. Yemisi and Mr. Blessed have already been featured in ITU perspectives videos which can be found here.

6.3. Use case requirements

This section describes the requirements for each entity on using AI to reduce the 6G standard barrier for African contributors use case.

- **REQ-01:** It is required to perform NLP parsing on the Raw data
- **REQ-02:** It is required to annotate the data as a step to preparing the data for fine turning/ training
- **REQ-03:** It is recommended to use validated responses for the fine turning
- **REQ-04:** The Potential innovator require the inferred knowledge to generate responses on 6G innovation

6.4. Sequence diagram



Use Case – 7: Smart UAV Networks for Efficient Disaster Response

Country: Turkey

Organization: Istanbul Technical University

Contact person: Dr. Nazim Kemal Ure, ure@itu.edu.tr

7.1. Use case summary table

Domain	Disaster Response
Problem to be addressed	To solve delays, resource limitations, and logistical challenges during disaster response.
Key aspects of the solution	Combo of drones, object detection and satellite based coordination for rescue operations. Drone-2-drone or drone-base station communication. Adhoc network design.
Technology keywords	Multi-agent, collaborative intelligent solution.
Data availability	Video and still images, satellite images to determine the location and network location.
Metadata (type of data)	Video and Images
Testbeds or pilot deployments	sim2real

7.2. Use case description

7.2.1 Description

The proposed use case aims to harness the advancements in reinforcement learning (RL) to enhance the deployment, route selection, and coordination of unmanned aerial vehicles (UAVs) in disaster scenarios, especially for scenarios that require immediate response such as earthquakes and floods. Traditional disaster response efforts are often hampered by delays, resource limitations, and logistical challenges. To overcome these obstacles, the use case develops a coordinated UAV network designed to autonomously perform essential tasks within disaster-stricken areas. Utilizing RL algorithms, UAVs can learn and adjust their operations (including route navigation, returning to charging stations, and data detection and transmission) based on feedback from the environment. In particular, the project integrates several state of the art RL approaches, such as multiagent learning (for achieving efficient cooperation among UAVs), sim2real transfer (for leveraging simulated data) and curriculum learning (for achieving smoother learning curve from simple to complex scenarios). This combination of approaches allows for the optimization of task distribution and resource management in real time, while ensuring generalization across a rich variety of disaster scenarios.

The network, equipped with sensors, cameras, communication systems, and payload delivery mechanisms, collaborates to carry out a range of tasks such as reconnaissance, damage assessment, communication relay, and aid distribution. Through advanced data collection and mapping algorithms, the UAV network achieves real-time situational awareness, facilitating informed decision-making by the response teams. Each UAV maintains a connection to ground stations, either through direct links or an ad-hoc network, ensuring seamless coordination and data exchange.

The use case's goal is to enhance the efficiency of response efforts, increase resilience, and accelerate recovery in communities affected by disasters. By offering a scalable, adaptable, and sustainable solution, the use case represents a significant step forward in disaster response technology.

UN Goals:

- **SDG 3:** Good Health and Well-being,
- **SDG 11:** Sustainable Cities and Communities,
- **SDG 15:** Life on Land

Justify UN Goals selection: The use case enhances the efficiency of the disaster response system and directly mitigates loss of life and damage to city infrastructure.

Partner name: Turkcell

7.2.2 Future work

Model development, Setup reference tools, notebooks and simulation environment

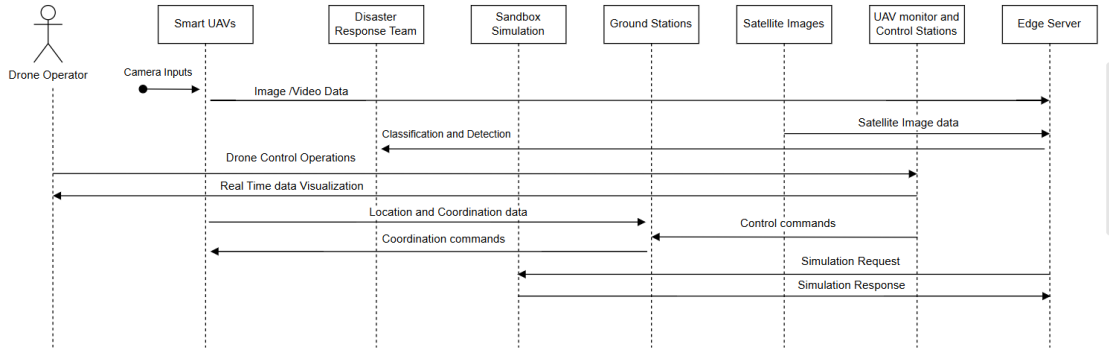
Elaborate proposal: If the scholarship is awarded, we will utilize the funds to recruit PhD students dedicated to developing a disaster scenario simulator and designing reinforcement learning (RL) algorithms for multi-UAV systems to enhance disaster response times. The outcomes of this work will include an open-source simulator and an environment for algorithm design, alongside numerical results for the developed algorithms.

7.3. Use case requirements

- **REQ-01:** It's critical that drones have the capability to operate autonomously and collaboratively.
- **REQ-02:** It's critical that drones should be able to communicate with each other and with base stations in real-time.
- **REQ-03:** It's critical to implement advanced object detection algorithms to identify damaged infrastructure and locate survivors.
- **REQ-04:** It's critical that drones process and analyze data locally to minimize latency.
- **REQ-05:** It's critical to seamlessly integrate data from multiple sources, including drone cameras and satellite images.
- **REQ-06:** It's critical that the system provides a user-friendly interface for disaster response teams to monitor and control drone operations.
- **REQ-07:** It's critical that the system displays real-time data and analytics for informed decision-making.
- **REQ-08:** It's critical that the system optimize drone operations to maximize battery life without compromising area coverage.

- **REQ-10:** It's critical that the system implement efficient power management strategies to extend operational time.

7.4. Sequence diagram



Use Case – 8: Developing an Artificial Intelligence (AI) - Powered System for Enhancing Transparency and Accountability in Public Procurement and Project Monitoring in Tanzania

Country: Tanzania

Organization: The Prevention and Combating of Corruption Bureau

Contact person: Dr Michael Mollel, msamwelmollel@gmail.com, michael.mollel@pccb.go.tz

8.1. Use case summary table

Domain	Corruption prevention and combating with LLMs
Problem to be Addressed	Lack of transparency and accountability in public procurement and project monitoring processes.
Key Aspects of the Solution	Deployment of an AI-powered system to monitor procurement processes and project execution, providing real-time analytics and reporting to ensure compliance and detect irregularities.
Technology keywords	Natural Language Processing (NLP), Large Language Models (LLMs), Text Classification, Anomaly Detection, Multimodal Analysis, AI, Data Analytics, Transparency, Anti-corruption.
Data Availability	Data from public procurement and project records are free and accessible, 3000 cases from 2010 (private for recent cases, public for cases older than 10 years).
GPU	Not available, but using from collaboration
Metadata (Type of Data)	Text data (tender documents, evaluation reports, corruption cases, laws, and regulations)
Pipeline	Inference: 1. Text Generation: helping investigator by generation using generative AI. 2. Classification: corruption/no, 3. Other: many downstream tasks.
Model Training and Fine Tuning	Machine learning models trained on historical procurement data and outcomes to predict and identify patterns indicating potential fraud or mismanagement. The method involves Unsupervised pre-training on the dataset, followed by supervised fine-tuning for specific tasks.
Testbeds or Pilot Deployments	To be determined.

8.2. Use case description

8.2.1 Description

Public procurement and project follow-up are critical processes for sustainable development and are often plagued by corruption, fraud, and lack of transparency. This is primarily true for Developing countries, including Tanzania. This use case uses artificial intelligence (AI) and machine learning (ML) technologies to enhance transparency and accountability throughout the tendering and project implementation stages and develop the Generative AI tool to assist the Investigator in their daily work. This proactive approach empowers the Prevention and Combating of Corruption Bureau (PCCB) and other stakeholders to combat corruption effectively, ensuring transparency and accountability in the tendering process and project follow-up.

Current solutions, primarily based on traditional legal and audit mechanisms, struggle to contend with the scale and complexity of corrupt practices. These limitations have motivated the project, which introduces an AI and ML-based approach to predict and detect patterns indicative of corruption.

The proposed AI system, a powerful tool, is expected to process procurement data, including tender documents, evaluations, and corruption cases, to detect irregularities and assign a corruption probability percentage (Natural language classification task). Offering an anticipatory tool empowers PCCB and other stakeholders—judiciary and public procurement regulator authority (PPRA)—to take preventative action against corrupt activities, thereby enhancing transparency and ensuring compliance throughout the procurement lifecycle. This system is designed to augment efforts, making combating and preventing corruption more effective and impactful.

While the AI-based method promises more proactive and efficient response to corruption, its reliance on high-quality, large-volume data may pose a challenge. Additionally, the effectiveness of the AI system hinges on continuous training and updates to stay current with evolving regulations and corrupt practices.

The benefits of this AI approach are manifold, including the potential for real-time corruption detection, automated document analysis, and improved resource allocation for investigative efforts. Conversely, the approach may encounter drawbacks, such as substantial initial data curation, possible biases within AI models, and the requirement for ongoing technical expertise to manage and update AI systems.

Ultimately, the project seeks to provide a robust, scalable solution to a chronic problem, with implications for broader adoption across other nations facing similar challenges in public procurement.

UN Goals:

- **SDG 9:** Industry, Innovation and Infrastructure,
- **SDG 11:** Sustainable Cities and Communities,
- **SDG 16:** Peace and Justice Strong Institutions

Justify UN Goals selection:

1. SDG 9 (Industry, Innovation, and Infrastructure): The AI-based system supports building resilient infrastructure by ensuring integrity in the procurement process, which is crucial for developing quality, reliable, and sustainable infrastructure.
2. SDG 11 (Sustainable Cities and Communities): Enhancing the tendering process contributes to the development of sustainable cities through accountable and transparent governance, which can lead to the efficient creation of public services and infrastructure.
3. SDG 16 (Peace, Justice, and Strong Institutions): By combating corruption and enhancing transparency, the AI initiative contributes significantly to building effective, accountable, and inclusive institutions at all levels, which is at the core of Goal 16.

AI aids in achieving these SDGs by providing a sophisticated tool to analyze vast amounts of tender-related data, identify patterns indicative of corruption, and provide actionable intelligence. This capability ensures that resources are allocated efficiently and fairly, thus fostering innovation (SDG 9) and aiding in developing sustainable infrastructure and communities (SDG 11). Moreover, promoting a corruption-free environment reinforces the institutions' integrity and credibility, which are crucial for maintaining peace and justice (SDG 16). AI speeds up the detection process and provides a non-biased system that can be continuously improved, scaling up the impact of anti-corruption efforts to drive sustainable development in Tanzania.

Partner name: University of Dar es Salaam

Partner name: University of Dodoma

8.2.2 Future work

Standards development related to the use case, Others Elaborate proposal: This project aims to develop an AI-powered system to combat corruption and promote transparency in Tanzania's public procurement process and project implementation cycle. The proposed methodology outlines a comprehensive approach leveraging state-of-the-art natural language processing (NLP) and large language model (LLM) techniques.

The core components of this use case include:

1. Data Collection: Gather a comprehensive dataset from various sources, including the Prevention and Combating of Corruption Bureau (PCCB), district councils, Tanzania courts, tax authorities, and public procurement regulatory bodies. The dataset will encompass tender documents, evaluation reports, corruption cases, laws, and regulations related to procurement.
2. Unsupervised Training and Data Preprocessing: Utilize NLP techniques and LLMs to preprocess and analyze the collected data. This includes the preprocessing stage, which removes duplicate text and irrelevant data elements, as well as personal or organizational information, and then unsupervised pre-training (foundation model development) of LLMs on the dataset to gain a general understanding of the procurement domain.
3. Supervised Fine-tuning: Fine-tune the pre-trained LLM using supervised learning techniques for specific tasks such as sentiment analysis, named entity recognition, text classification, anomaly detection in tender documents, and text generation. The goal is to develop models capable of different downstream tasks, such as analyzing tender documents, identifying irregularities, providing a corruption probability percentage, and text generation.
4. Document Analysis and Corruption Detection: Deploy the fine-tuned model to analyze tender documents and identify potential fraud, corruption risks, and irregularities. The

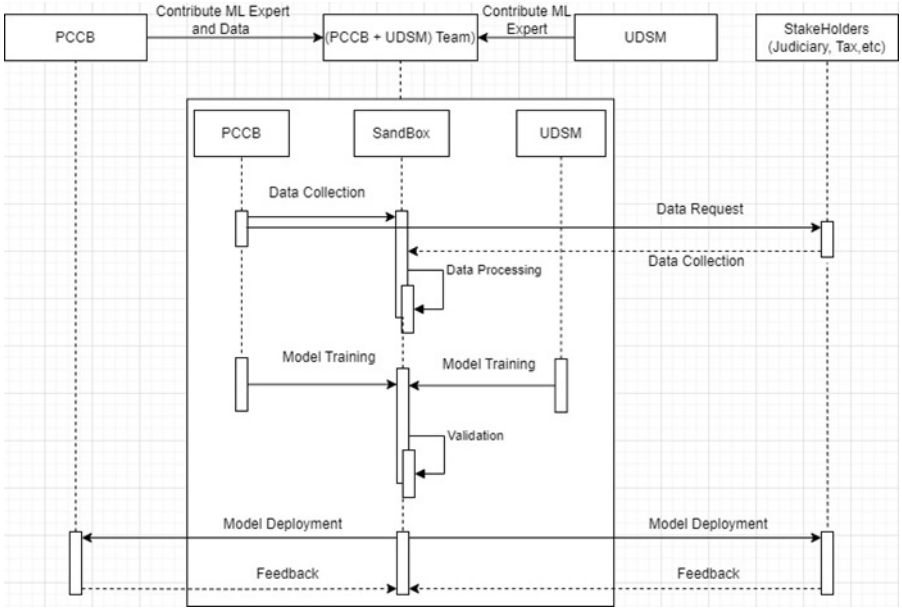
model will leverage its understanding of the procurement domain, laws, and regulations to provide detailed corruption probability reports.

5. Project Follow-up and Monitoring: Extend the AI-powered solution to the project follow-up stage by enabling stakeholders to upload relevant documents, such as contracts, implementation reports, and payment records. The system will analyze these documents to ensure compliance, identify potential issues, and track project progress. This progression into the project's subsequent phase involves adopting a multi-modal approach to refine the system's capabilities for a more nuanced and sophisticated analysis.
6. Decision Support and Intervention: The AI system's corruption probability reports and project monitoring insights will empower the PCCB and other stakeholders to make informed decisions, intervene proactively to prevent corruption, and ensure transparency throughout the tendering and project implementation phases.

8.3. Use case requirements

- **REQ-01:** It's critical that the system implements an AI-powered system capable of monitoring procurement processes and project execution in real time and providing real-time analytics and reporting.
- **REQ-02:** It's critical that the system utilize NLP techniques to analyze text data from tender documents, evaluation reports, and corruption cases.
- **REQ-03:** It's critical that the system implements text classification to detect potential corruption cases and develop algorithms to detect anomalies and irregularities in procurement data.
- **REQ-04:** It's critical that the system use multimodal analysis to integrate various data types for comprehensive insights and ensure accessibility to public procurement data and project records.
- **REQ-05:** It's critical that the system train models using historical data to predict and identify patterns of fraud or mismanagement and fine-tune models with supervised learning for specific tasks related to anti-corruption.
- **REQ-06:** It's critical that the system provides a user-friendly interface for investigators to access and analyze data. Also, it enables real-time reporting and visualization of analytics.

8.4. Sequence diagram



8.5. References

[1] Aarvik, P. (2019). Artificial Intelligence–a promising anti-corruption tool in development settings. U4Anti-Corruption Resource Centre.

[2] Adobor, H., & Yawson, R. (2022). The promise of artificial intelligence in combating public corruption in the emerging economies: A conceptual framework. Science and Public Policy.

Use Case – 9: U-Ask

Country: United Arab Emirates

Organization: Telecommunications And Digital Government Regulatory Authority, info@tdra.gov.ae

Contact person: Mohammed alkhamis, mohammed.alkhamis@tdra.gov.ae

9.1. Use case summary table

Domain	Digital Government
The problem to be addressed	Inefficient Access to Digital Government Information and Services, due to the current distribution of information and services across multiple channels leading to scattered resources, making it difficult and time-consuming for users to efficiently search and access the necessary digital government information and services.
Key aspects of the solution	Multilingual support of over 30 languages, location management, Voice Command, Predictions and Recommendations capability.
Technology keywords	Generative AI, ChatGPT, LLM
Data availability	Public
Metadata (type of data)	U.AE and all UAE government portals content and other government public sources.
Model Training and fine-tuning	ChatGPT
Testbeds or pilot deployments	https://ask.u.ae/

9.2. Use case description

9.2.1 Description

The U-Ask platform is an advanced Generative AI-powered solution that enhances how users interact with the government. It makes it easier for people to access comprehensive government information by Interacting with a virtual agent capable of sourcing information from different government sources. The old-fashioned way of doing this was visiting multiple websites owned by various ministries which turned out to be frustrating as well as time-consuming. This has been successfully sorted out by taking advantage of modern and sophisticated Generative AI techniques, in particular (ChatGPT). U-Ask provides personalized real time responses tailored to each users' needs for an engaging experience. While there might be errors generated by AI, U-Ask continuously learns from user feedback to enhance accuracy. Moreover, the platform

boosts client satisfaction through response times and optimized resource management strategies. Its flexibility allows it to effectively tackle issues within the government sector. In summary, U-Ask showcases how generative AI can revolutionize interactions between citizens and their government while improving service delivery.

Repository Link: here.

UN Goals:

- **GOAL 9:** Industry, Innovation and Infrastructure,
- **GOAL 11:** Sustainable Cities and Communities,
- **GOAL 16:** Peace and Justice Strong Institutions

Justify UN Goals selection: The implementation of U-Ask supports some of the key Sustainable Development Goals (SDGs), specifically SDG 9: Industry, Innovation and Infrastructure. The development of an advanced AI-powered solution called U-Ask is a contribution towards technological progress in the government sector. U-ASK efficiency and effectiveness are enhanced in service delivery leading to improved quality of government infrastructure. Furthermore, use of Generative AI enables meaningful and personalized responses to user inquiries. This has the effect of not only enhancing user experience but also increases access to information which is consistent with the inclusive and sustainable industrialization as well as innovation aspects stated under SDG 9. Furthermore, U-Ask is committed to fostering Sustainable Cities and Communities by empowering efficient knowledge-sharing systems, promoting inclusivity, and supporting informed decision-making, thereby contributing to the realization of SDG 11. Equally important, U-Ask's impact extends to SDG 16: Peace, Justice and Strong Institutions. Through transparent and accessible government services that it offers, U-Ask enhances accountability and strengthens institutional frameworks. Trust and confidence in government institutions are built through better access to information and services for citizenships. Consequently, through its advanced AI capabilities, U-Ask helps improve the efficiency of government operations while driving innovation that contributes to promoting transparency thereby supporting the attainment of these SDGs via its implantation process.

Partner name: various UAE government organizations

Partner URL: Telecommunications And Digital Government Regulatory Authority, Ministry of Education, Ministry of Health and Prevention, Ministry of Community Development, Ministry of Climate Change and Environment, Ministry of Human Resources and Emiratisation, Ministry of Justice, Ministry of Finance, Ministry of Cabinet Affairs.

9.2.2 Future work

Proof of concept development, create new variations/extensions to the same use case, Standards development related to the use case, Others Elaborate proposal: If provided with scholarships and resources, our future work on the U-Ask use case would contain a number of key initiatives. Initially, we would attempt to create best industry practices and guidelines for AI-driven government service platforms. This aims at ensuring the ethical usage of such emerging technologies and enabling data security interoperability and user privacy in similar platforms thus fostering trust among users. Furthermore, due to the exponential evolution of generative AI, we are always navigating the updates and advancements. Also, we would examine new functionalities to further enhance U-Ask's capabilities, such as the upcoming WhatsApp integration as an omni channel to the current U-Ask web version. This integration

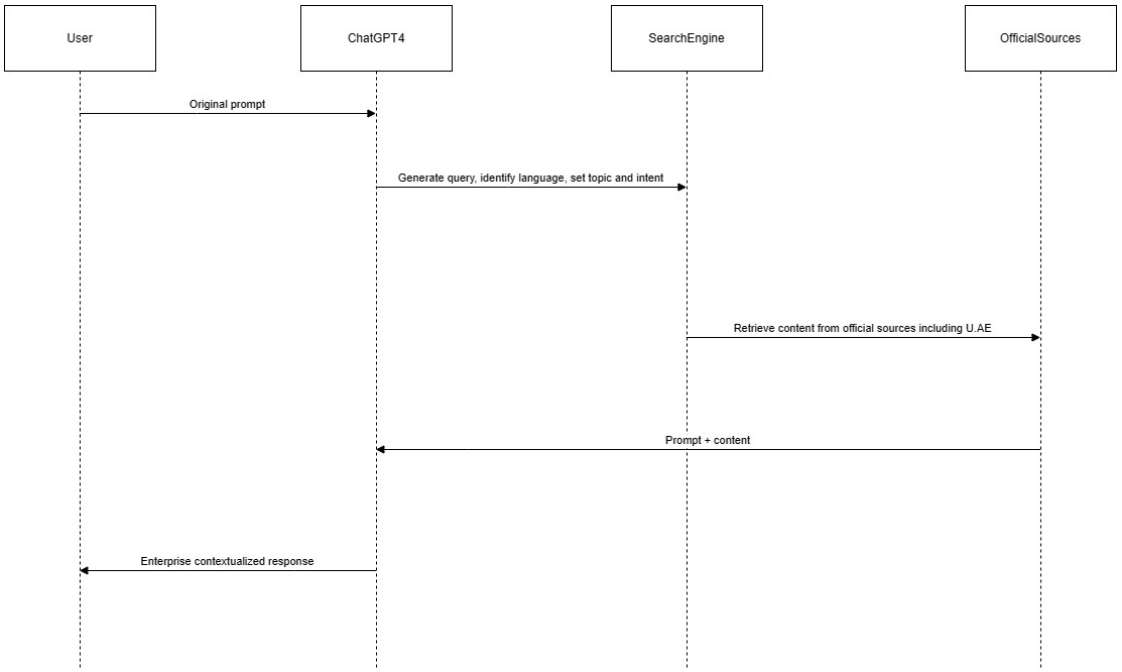
reflects our strategy to enable users to interact at their most convenient channel to increase accessibility and enhance user engagement. Additionally, we might add more sources of data, test new means of attracting users, and develop additional modifications and add-ons for U-Ask to address a wider range of government services and user preferences.

We recently implemented version 1.8 of GPT4-Turbo 128K on U-Ask, which showed our commitment to continuous improvement. The latest version uses GPT4-Turbo 128K's strengths to give more verbose and elaborate responses thereby improving user experience. Notably, we are the first to utilize GPT4-Turbo 128K in our industry. Our proactive approach ensures that we remain one step ahead in the evolving field of technology advancement, and aligns with our strategic objective of strengthening U-Ask's role as an industry leader.

9.3. Use case requirements

- **REQ-01:** It is critical that U-Ask offers centralized access to all U.A. E information, services, and external sources, including other UAE official government portals. This ensures users can find everything they need in one place, improving efficiency and user satisfaction.
- **REQ-02:** It is critical that U-Ask personalizes information and services based on the user's specific location. Through intent analysis, U-Ask can also provide Google location responses if the user is searching for a particular place, enhancing relevance and user experience.
- **REQ-03:** It is critical that U-Ask supports voice commands, allowing users to interact with the chatbot using their voice for added convenience and accessibility.
- **REQ-04:** U-Ask promotes inclusivity by understanding and responding in more than 30 languages, catering to a diverse user base and ensuring broad accessibility.
- **REQ-05:** It is critical that U-Ask employs advanced predictive and recommendation algorithms to anticipate user needs and suggest next actions. This feature makes it easier for users to find relevant information and services, providing a seamless and comprehensive experience.
- **REQ-06:** It is critical that U-Ask ensures precise control, clarity, and consistency in addressing sensitive topics. Equipped with tools to navigate any conversation with confidence, it maintains a high standard of communication.
- **REQ-07:** It is critical that U-Ask is developing the capability to respond using information from external offline sources, further expanding its informational reach and reliability.

9.4. Sequence diagram



Use Case – 10: Easing Operations using ML/AI solution for 6G and beyond Network Orchestration and Secure Network Operations

Country: India

Organization: Tata Elxsi

Contact person: Priyadarshini, Priyadarshini@tataelxsi.co.in

Ramesh Ramanathan, Ramerama@tataelxsi.co.in

Jayaprakash G, Jayaprakash.G@tataelxsi.co.in

10.1. Use case summary table

Domain	Telecommunications
The problem to be addressed	• The sophisticated orchestration engines require technical know-how and are labour-intensive. • Repeatedly modeling standard configurations is time-consuming. • Manual calculations for capacity and cost forecasting can lead to errors and resource overprovisioning. • Traditional security measures are inadequate against diverse attacks.
Key aspects of the solution	• Autonomous network operations simplify deployment and configuration using NLP and ML/AI. • A digital twin projects resource utilization for optimized infrastructure management. • Extended reality (XR) enhances observability and interaction through responsive visualization. • AI-driven security detects and mitigates threats with continuous monitoring and automated policy enforcement.
Technology keywords	NLP, ML, AI, Digital Twin, Extended Reality (XR), Network Functions (NFs), Kubernetes, Anomaly Detection, Security Policies
Data availability	Not publicly available; internal data used for model training and validation.
Metadata (Type of data)	Network configurations, historical deployment data, traffic patterns, security incidents, resource utilization stats.
Model Training and fine-tuning	historical network data and deployment records to train ML models; continuous fine-tuning based on new
Testbeds or Pilot deployments	Development of proof of concept and potential for future testbeds or pilot deployments to validate solutions.

10.2. Use case description

10.2.1. Description

Introduction: Conventional network operations in the telecommunications industry are fraught with complexity, inefficiency, human error, and security vulnerabilities. They require significant expertise and are labor–and time-intensive, making them prone to errors and vulnerable to security attacks. As networks evolve towards 6G and beyond, there is a pressing need for more efficient, reliable, and secure network orchestration and operations.

Solution Overview: This use case proposes an advanced solution that leverages cutting-edge technologies such as Natural Language Processing (NLP), Machine Learning (ML), Artificial Intelligence (AI), Digital Twins, and Extended Reality (XR) to revolutionize network operations and orchestration.

Autonomous Network Operations: The solution simplifies the deployment and configuration of network functions (NFs) by utilizing NLP and ML/AI. Operators can input commands in natural language, transcending language barriers and reducing the need for specialized technical knowledge.

Digital Twin for Resource Management: A digital twin of the Kubernetes cluster projects resource utilization, helping operators manage infrastructure efficiently. This reduces the need for overprovisioning, thereby saving costs and minimizing carbon emissions.

Extended Reality (XR) for Observability: XR provides responsive and interactive observability, allowing operators to visualize and interact with network configurations and projected traffic. This enhances decision-making and troubleshooting capabilities.

AI-Driven Security Measures: The solution continuously monitors network traffic for anomalies using ML algorithms. AI modules enforce appropriate security policies in real time, and simulated attacks on the digital twin help identify and fix vulnerabilities.

UN Goals:

- The solution aligns with UN **SDG 11**: Sustainable Cities and Communities by addressing several key areas:
- **Efficient Resource Utilization:** AI-driven predictive analytics optimize network resource usage, reducing unnecessary overprovisioning and operational costs.
- **Environmental Impact:** Improved efficiency in resource utilization directly translates to lower carbon emissions, supporting environmental sustainability.
- **Operational Resilience:** Enhancing network security and efficiency ensures the reliable operation of critical communications infrastructure, which is vital for sustainable urban environments.

10.2.2. Future work

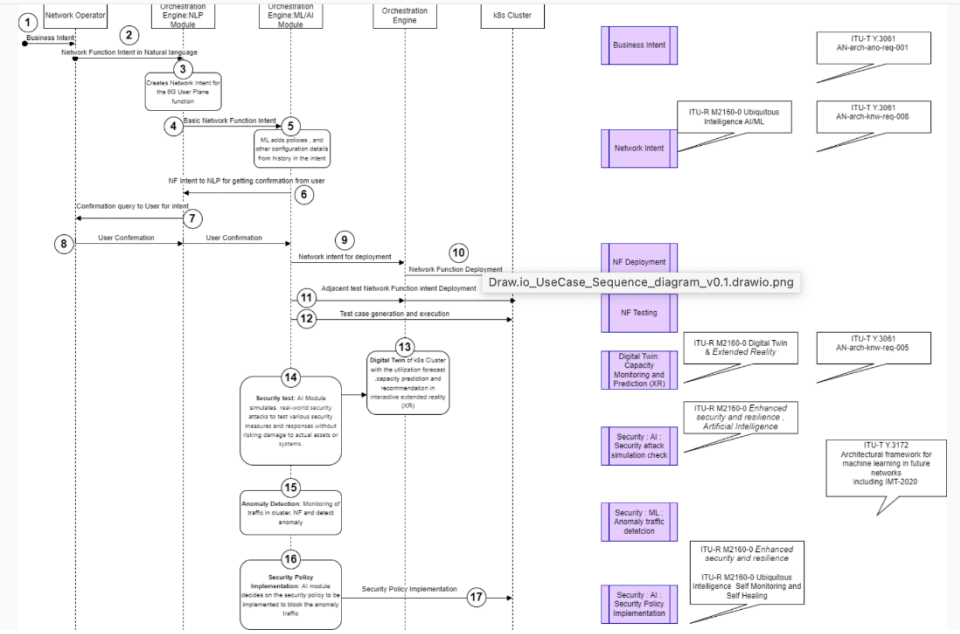
In the next phases, the focus will be on developing a robust proof of concept that integrates NLP, ML/AI, Digital Twin, and XR technologies to demonstrate the feasibility of the solution. Simultaneously, efforts will be made to contribute to industry standards, collaborating with standardization bodies like the International Telecommunication Union (ITU). Pilot deployments in real-world environments will follow, allowing testing of scalability, reliability, and performance. Subsequently, outcomes will be documented through case studies, fostering partnerships

with technology vendors, operators, and research institutions to enhance development and deployment processes. Continuous improvement will be prioritized to adapt to evolving technology and network environments, while contributing insights to ITU specifications will ensure global alignment and readiness for the challenges of 6G and beyond.

10.3. Use case requirements

- **REQ-01:** It is critical that the solution enables autonomous network operations through NLP and ML/AI to simplify deployment and configuration tasks.
- **REQ-02:** It is critical that the solution incorporates a Digital Twin for efficient resource management, projecting resource utilization to optimize infrastructure usage.
- **REQ-03:** It is critical that the solution provides XR capabilities for responsive observability, allowing operators to visualize and interact with network configurations and projected traffic..
- **REQ-04:** It is critical that the solution includes AI-driven security measures for continuous monitoring of network traffic and automated enforcement of security policies.

10.4. Sequence diagram



Use Case – 11: Libras Project

Country: Brazil

Organization: Lenovo

Contact person: Hildebrando Lima, hlima1@lenovo.com

11.1. Use case summary table

Domain	Accessibility
Problem to be addressed	Communication with the hearing impaired
Key aspects of the solution	Sign language (Libras) to text (Brazilian language), (text to sign language) using avatars
Technology keywords	Classifier Model Digital Avatar
Data availability	Private
Metadata (type of data)	Articulation points, Movements, Vectors
Model Training and fine tuning	Classifier
Testbeds or pilot deployments	PC support using sign language, via Lenovo portal

11.2. Use case description

11.2.1. Description

Introduction: Communication barriers for the hearing-impaired pose significant challenges in daily interactions, hindering their ability to engage effectively with others. Sign language serves as a primary means of communication for individuals using Libras (Brazilian Sign Language), but the lack of widespread understanding can lead to misunderstandings and isolation. This use case addresses these challenges by leveraging AI-driven technology to facilitate seamless communication between individuals using sign language and those using spoken language.

Solution Overview: The solution focuses on developing a robust translation tool that translates sign language (Libras) into Brazilian text and audio, and vice versa, using digital avatars[2]. Using a classifier model and digital avatars, the solution accurately captures and translates sign language gestures into written and spoken language, bridging the communication gap between the hearing impaired and the broader community. Access to private data, including vectors from individuals using Libras, enables the training and fine-tuning of the classifier model to ensure accurate translation. GPU resources are utilized for efficient processing, while metadata such as articulation points and movements enhance translation accuracy. Pilot deployments, including PC support via the Lenovo portal, validate the solution's effectiveness in real-world scenarios.

Repository Link:Repository

Partners: Collaborative Efforts: Collaboration with CESAR [2], a research and development organization, enhances the solution's development and deployment. Partnering with CESAR provides access to expertise and resources necessary for refining the solution and addressing specific challenges associated with communication barriers for the hearing impaired.

UN Goals: This use case aligns with several UN Sustainable Development Goals (SDGs) to create a more inclusive and equitable society:

- **SDG 3:** Good Health and Well-being: By providing a reliable translation tool, individuals with hearing impairments can access healthcare services more effectively, ensuring better diagnosis and treatment.
- **SDG 4:** Quality Education: Integration of the solution into the education system facilitates learning for individuals using sign language and accelerates the learning curve for those unfamiliar with Libras, promoting inclusive education.
- **SDG 8:** Decent Work and Economic Growth: The solution fosters inclusivity in the workforce by providing communication tools for individuals with hearing impairments, promoting economic growth through expanded opportunities for employment.
- **SDG 9:** Industry, Innovation and Infrastructure: Innovative solutions like the sign language translation tool contribute to advancing technology and infrastructure, enabling more accessible communication for marginalized communities.
- **SDG 10:** Reduced Inequality: By breaking down communication barriers, the solution reduces inequality for individuals with hearing impairments, fostering social inclusion and participation.
- **SDG 12:** Responsible Consumption and Production: Access to accurate communication tools empowers individuals to make informed decisions about products and services, promoting responsible consumption and production practices.

11.2.2. Future work

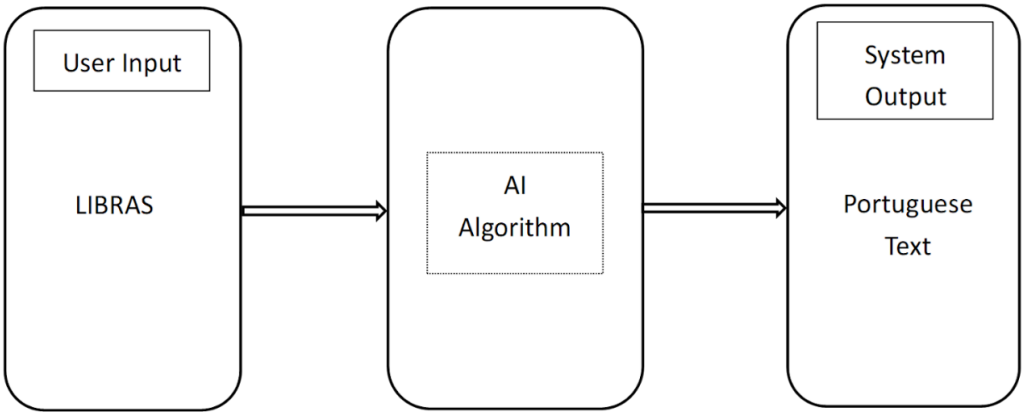
Proof of concept development, Model development, Create new variations/extensions to the same use case Elaborate proposal: as the goal is to expand the solution for a global application and proficient translators on different languages to do accuracy checks of the AI engine, we should partner with other R&D organizations across the world to allow other sign language standards to be developed, and also learn together how to improve our own solution to make it better and better to the Deaf community I do not wish to receive any additional invitations to AI for Good sessions in the future.

11.3. Use case requirements

- **REQ-01:** It is critical that the solution enables seamless translation from sign language (Libras) to Brazilian text and audio, and vice versa, using avatars.
- **REQ-02:** It is critical that the solution utilizes a classifier model and digital avatars to facilitate accurate translation and communication.
- **REQ-03:** It is critical that the solution has access to private data, including vectors from individuals using Libras, with approximately 23K hours of data.
- **REQ-04:** It is critical that the solution utilizes GPU resources for efficient processing of data and model training.
- **REQ-05:** It is critical that the solution incorporates metadata such as articulation points, movements, and vectors to enhance the accuracy of translation.

- **REQ-06:** It is critical that the solution undergoes rigorous model training and fine-tuning to optimize translation accuracy.
- **REQ-07:** It is critical that the solution supports pilot deployments, including PC support for sign language communication via the Lenovo portal.
- **REQ-08:** It is critical that the solution contributes to metrics, KPIs, and measurements to evaluate its performance and effectiveness in facilitating communication with the hearing impaired.

11.4. Sequence diagram



11.5. References

[1] Lenovo. (n.d.). AI-Powered Sign Language Translation Solution for the Hearing Impaired. Retrieved from https://news.lenovo.com/ai-powered-sign-language-translation-solution-hearing

[2] CESAR. (n.d.). CESAR - Innovation for a Better World. Retrieved from https://www.cesar.org.br/web/english

Use Case – 12: Democratizing Large Language Models for Southeast Asian Languages: SeaLLMs Help to Achieve Inclusive Development for Underrepresented Communities in Digital World

Country: China

Organization: Alibaba Damo (Hangzhou) Technology Co., Ltd.

Contact person: Yi Chen, elaine.cy@alibaba-inc.com

12.1. Use case summary table

Domain	LLMs in SEA languages
The problem to be addressed	Performance bias for non-latin languages.
Key aspects of the solution	Efficient vocabulary/token usage (SeaLLMs-v1). Strong performance in low-resource languages. Safe content creation
Technology keywords	LLMs for SEA languages.
Data availability	https://huggingface.co/datasets/SeaLLMs/Sea-bench
Metadata (type of data)	Text
Model Training and fine-tuning	Pre-training data is in free text and trained with next token prediction; Fine-tuning data is in QA pair or multiturn dialog format.
Testbeds or pilot deployments	Tech Memo: https://github.com/DAMO-NLP-SG/SeaLLMs Technical Report: https://arxiv.org/pdf/2312.00738.pdf Huggingface DEMO: https://huggingface.co/spaces/SeaLLMs/SeaLLM-7B-v2.5

12.2. Use case description

12.2.1 Description

The project introduces SeaLLMs, a suite of specialized language models optimized for Southeast Asian languages. These languages often lack substantial language technology support, leading to a stark performance gap in existing large language model (LLM) applications. SeaLLMs are built upon the existing English-centered models and enhanced through continued pre-training with an optionally extended vocabulary set, specialized instruction tuning, and alignment tuning to better capture the nuances of regional languages. This approach allows SeaLLMs to respect and reflect local cultural norms, customs, stylistic preferences, and legal considerations, demonstrating superior performance across a broad spectrum of linguistic

tasks and assistant-style instruction-following capabilities compared to open-source models and outperforming some mainstream commercial models in non-Latin languages such as Thai, Khmer, Lao, and Burmese by significant margins.

Compared to existing solutions, which often have strong linguistic bias in high-resource languages such as English, SeaLLMs is designed to eliminate barriers to accessing cutting-edge AI technologies for non-English-speaking communities, thereby reducing the risk of cultural homogenization and preserving linguistic diversity. SeaLLMs offer several benefits, including improved performance in language understanding and generation tasks for Southeast Asian languages, respect for local norms and legal stipulations, and cost-effective operation due to efficient tokenization of non-Latin scripts. However, we also acknowledge potential drawbacks, such as the complexity and resource intensity of developing and maintaining such specialized AI models, and the ongoing challenge of balancing model performance across a diverse set of languages without sacrificing the quality of service in high-resource languages**.**

Use case Status: The use case is part of a larger research project

Data is publicly available: Yes

Data is privately available: Yes

Repository Link Data repository link

UN Goals:

- **SDG 9**: Industry, Innovation, and Infrastructure
- **SDG 10**: Reduced Inequalities
- **SDG 17**: Partnerships for the Goals

The SeaLLMs project contributes to advancing Sustainable Development Goals (SDGs) 9, 10, and 17 by fostering innovation, reducing inequality, and encouraging global partnerships.

For Goal 9 (Industry, Innovation, and Infrastructure), SeaLLMs epitomize innovation in natural language processing by developing language models tailored to Southeast Asian languages. This innovation enhances digital infrastructure in the region, enabling more inclusive access to information and technology, and spurring growth in industries reliant on AI and language technologies.

In relation to Goal 10 (Reduce Inequalities), SeaLLMs directly address linguistic inequalities by providing high-quality AI capabilities in languages that are typically underrepresented in digital spaces. By improving AI accessibility and performance for these languages, SeaLLMs help reduce the digital divide, allowing for more equitable participation in the global digital economy, and ensuring that technological advancements benefit a wider and more diverse population.

Regarding Goal 17 (Partnerships for the Goals), the development and implementation of SeaLLMs likely involve collaboration between multiple stakeholders, including academic institutions, technology companies, and possibly government entities across Southeast Asia. This collaborative effort not only exemplifies the spirit of partnership but also ensures that the benefits of AI and language model advancements are shared widely, contributing to the collective pursuit of the SDGs.

Through these contributions, the SeaLLMs use case illustrates a concrete application of AI technology that aligns with and advances the objectives of the specified SDGs, demonstrating the potential of targeted technological innovations to address global challenges.

Future work: If you are given scholarships and resources, what would you propose as future work on this use case.

- Data collection
- Model development
- Create new variations/extensions to the same use case

12.2.2. Future work

Elaborate proposal:

Given scholarships and resources, the future work on the SeaLLMs use case could expand across several key areas:

- Data Collection: Enhanced data collection efforts are essential to further improve the SeaLLMs models. Collecting a more diverse set of high-quality, culturally relevant datasets across more Southeast Asian languages would help to fine-tune the models for better accuracy and nuanced understanding.
- Model Development: With additional resources, we could explore the development of more advanced models or specialized versions of SeaLLMs. This could involve language-specific models, including more low-resource languages, and scaling the model sizes.
- Create New Variations/Extensions to the Same Use Case: Investigating new variations or extensions of SeaLLMs could involve exploring multilingual or cross-lingual capabilities that extend beyond Southeast Asian languages, potentially creating a global language model that respects regional linguistic idiosyncrasies while facilitating cross-cultural communication.

12.3. Use case requirements

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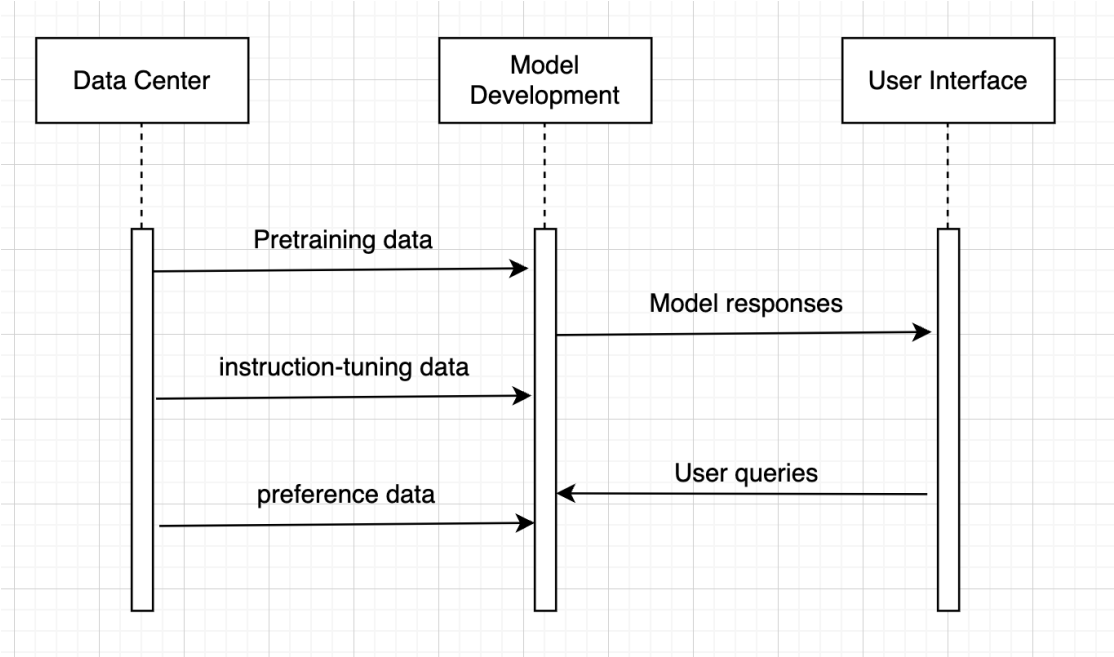
- **SEA-UC02-DESC-001:** It is critical that the SeaLLMs model or chatbot built upon the model can only be interacted via text format, instead of other modalities such as speech or image.
- **SEA-UC02-DESC-002:** SeaLLMs was developed to provide strong language processing and generation capability for local Southeast Asian languages and thus, it may not provide strong service for other languages.
- **SEA-UC02-DESC-003:** It is critical that the usage of SeaLLMs must comply with all local regulations and guidelines related to digital services, data handling, and language use within Southeast Asian countries.
- **SEA-UC02-DESC-004:** It is critical that the users of SeaLLMs need to have basic knowledge and skills of prompting large language models.

12.4. Sequence diagram



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Use case –13: Intelligent Automobile Integrated Safety and Secure Service Platform

Country: China

Organization: Chongqing Changan Automobile

Contact person: Dr. Yonggang Luo, luoyg3@changan.com.cn

13.1. Use case summary table

Domain	Transportation
The Problem to be addressed	Enhance the safety and security level of autonomous driving, reduce traffic accidents, ensure the safety of life, and increase the degree of traffic automation.
Key aspects of the solution	Integrated perception-decision closed-loop simulation testing platform, achieving closed-loop testing in all scenarios through generative and reinforcement methods.
Technology keywords	Autonomous driving, simulation, perception-decision safety, federated learning, data barrier
Data availability	Partially available.
Metadata (type of data)	POI (point of interest) data; Object detection data; BEV images data; Adversarial patches data; trajectory data
Pipeline	Data collection and pre-processing; scenario generation; inference; evaluation; Feedback loop for continuous improvement
Case Studies	Analysis of safety of perception-decision system through predictive simulations.
Testbeds or pilot deployments	Virtual simulations in controlled environments; Real-vehicle adversarial attack Tests; Real-world pilot projects in selected traffic scenarios; Ablation comparison test.
Metrics, KPIs, measurements	Reduction in accident rates; Adversarial efficiency compared to natural data; Data utilization rate; Perception attack success rate.
GPU	Internal GPUs.
Network requirements, architecture components	4g/5g network for collaborative training/testing, cloud service, autonomous driving simulator
Role of Trainings, standards	Developed the platform based on IEEE SA P3129, P3187, CSAE standards and discussed related technical topics with experts in workshops (e.g DIAVT 2024)
Pre-standard research	Benchmarks on advanced autonomous driving simulation and testing algorithms & tools; Benchmarks on cross domain federated learning;

13.2. Use case description

13.2.1 Description

Closed-Loop test the safety of autonomous system with generative and adversarial methods in various scenarios (e.g. different environments and traffic conditions.)

On the aspect of life safety: Through closed-loop data and natural adversarial scene generation, adversarial sample attacks, and defense reinforcement techniques, the platform can enhance the safety and reliability of intelligent driving systems in dealing with complex environments and threats such as attacks, effectively ensuring the safety of drivers and passengers.

On the aspect of traffic automation: The platform, through its safety simulation capabilities and data sharing capabilities, aids in the secure implementation of intelligent driving systems, promoting the development of intelligent transportation systems, improving road traffic efficiency, and fostering sustainable urban development.

On the aspect of industrial development: The platform facilitates the sharing of intelligent vehicle data and models among enterprises, breaking down data barriers, collectively enhancing the performance and safety of intelligent driving systems. This transformation in production relations promotes the circulation of data production factors and drives the development of industrial systems.

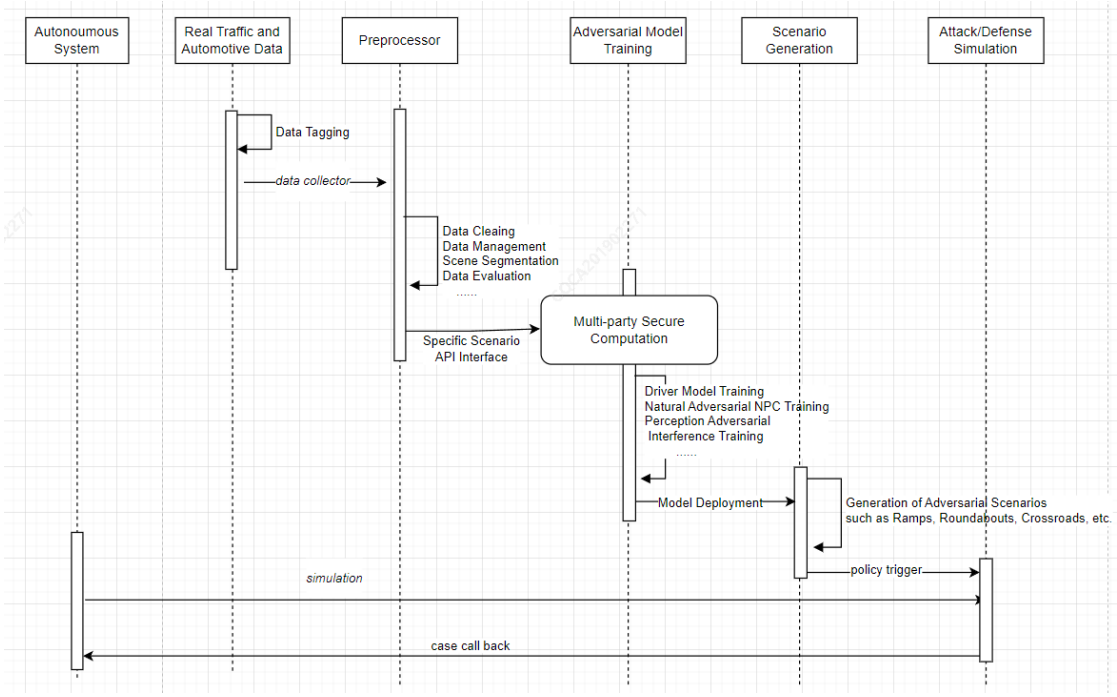
13.2.2 Future Work:

Enhance capability of generating natural adversarial driving scenarios in perception & decision tasks; Develop federated learning based sharing solutions for autonomous driving verification scenarios across enterprises; Establish global standards on the assessment of autonomous driving service quality; Collaborate with global experts; Global promotion and operation, hosting or organizing related international conferences, forums, events, international youth AI safety education, and training.

13.3. Use case requirements

- **UC15-REQ01:** Test the performance of autonomous vehicles in different environment and traffic conditions. Support for a wide range of environmental simulations (e.g. urban, highway, rural, adverse weather), and simulating various traffic scenarios (e.g. intersections, ramps, lane-changing, pedestrian crossing), integration of multiple sensors (e.g. radar, LIDAR, camera) for realistic perception emulation. Closed-loop simulation to test behaviour-based vehicles from sensor inputs to control outputs.
- **UC15-REQ02**: Develop and integrate advanced adversarial attack algorithms to improve scenario control policies ensuring compatibility with popular adversarial methods.
- **UC15-REQ03**: Generate comprehensive reports, including analytics for model performance and evaluation, automated reporting tools to track model performance metrics (e.g. accuracy, precision and recall), visualizing capability for analyzing model behavior and decision-making processes, with customizable options to include specific metrics and charts.
- **UC15-REQ04**: Continuously refine and enhance the performance of the autonomous vehicle models. Support for iterative developing and rapid prototyping. Analyzing simulation results and identifying area for improvement. Integration with version contro systems to manage model iterations and updates. Support for parallel testing of multiple model versions to compare performance.

13.4. Sequence diagram



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Use Case – 14: Innovative Practices of Cloud Networking Enabled by Network Large Model

Country: China

Organization: CHINA TELECOM

Contact person: LYU Tiantian, lvtt@chinatelecom.cn

14.1. Use case summary table

Domain	5G/6G
Problem to be addressed	The current manual assistance is unable to meet the challenges of operation and maintenance. It is necessary to start from the requirements of the operator's network, including user service requirements such as Accurate business recommendations, Network operation and maintenance requirements such as Network fault frequency, slow response, use large models to build an architecture that adapts to the complex cloud-network operations of the future, to meet the high-order evolution of self-intelligence requirements..
Key aspects of the solution	The Qi Ming network large model will employ the advanced structure and algorithm to handle the complexities. It will also integrate network knowledge, business, and operational data through large-scale pre-training, fine-tuning, and optimization.
Technology keywords	Network large model and AI agent technology
Data availability	Private data: we use some sensitive words from https://github.com/jkiss/sensitive-words, but do some processing in the combination with telecom data features.
Metadata (type of data)	China Telecom's massive network data and knowledge corpora. Text data, Logs, alarms, and configurations
Network Large Model Characteristics	Professional intent identification, ubiquitous generation, logical orchestration, collaborative scheduling, predictive analytics
Testbeds or pilot deployments	Inside China Telecom

14.2. Use case description

14.2.1 Description

In the era of Large Language Models led by ChatGPT, Large Network O&M Models have become a focus of industry attention [1]. Leveraging its natural advantages in networks, data, and technology, China Telecom developed the "Qi Ming" Network Large Model (hereinafter referred to as Qi Ming), marking a breakthrough for Chinese technology companies.

Qi Ming integrates network knowledge, business, and operational data through large-scale pre-training, fine-tuning, and optimization. It excels in understanding networks and operations, meeting cloud-network operation needs intelligently.

Advantages include advanced structures and algorithms, leveraging China Telecom's vast network data for comprehensive training, and offering various capabilities such as intelligent network operation management. China Telecom pioneers network mega-model AI agent technology, driving processes from solution generation to self-learning optimization.

In specific applications, Qi Ming has excelled in fault localization, audit efficiency improvement, and home broadband fault handling, enhancing operational efficiency and service quality. It offers Model as a Service (MaaS), deploying mega-model services via cloud computing for rapid integration without deep model understanding.

Looking ahead, Qi Ming is expected to further enhance cloud-network operations and empower industries with continuous technological progress.

Repository Link: Data is private and not public

Partners: Huawei.

UN GOALS:

- **SDG 9:** Industry, Innovation, and Infrastructure

The "Qi Ming" Network Large Model of China Telecom has significantly enhanced the quality and sustainability of communication infrastructure through its intelligent application, thereby promoting the achievement of United Nations Sustainable Development Goal 9. Its efficient training and precise tuning capabilities make cloud-network operations more intelligent and efficient, increasing resource utilization efficiency and reducing operating costs. Additionally, it adapts to various scenarios, solving problems in complex business scenarios, and driving innovation and development in the communication industry.

The "Qi Ming" Network Large Model relies on China Telecom's massive network data and knowledge corpora for training and optimization. It acquires telecom domain expertise and characteristic data, enabling features such as intelligent scheduling, rule understanding, and decision-making. Additionally, it incorporates multiple model toolchains and model capability algorithm features, pioneering network mega-model AI agent technology in the industry. This technology achieves full-process driving from solution generation to task decomposition, logical arrangement, perception analysis, automatic execution, and self-learning optimization, thereby contributing to the advancement of scientific research and technological capabilities.

The "Qi Ming" Network Large Model aims to lay a solid foundation for achieving United Nations Sustainable Development Goal 9 by improving infrastructure quality, promoting sustainable industrialization, and strengthening scientific research and technological capabilities.

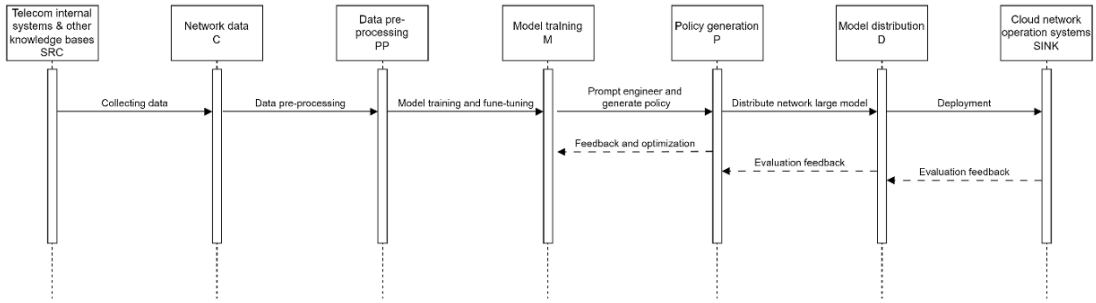
14.2.2. Future work

The "Qi Ming" Network Large Model of China Telecom has achieved significant results in the industry and plans to expand further. To this end, China Telecom is collaborating with Huawei to establish the "Future AI Agent" Innovation Collaboration Center, aiming to promote the formulation of relevant standards and apply for multiple challenges internationally and within China. Currently, Qi Ming ranks second in the 2023 Large Language Model Vitality Ranking (by CIWEEK.com, Deben Consulting (Beijing) Co., Ltd and Institute of Quantitative & Technical Economics, Chinese Academy of Social Sciences) [2], laying a solid foundation for its future development. Going forward, China Telecom will build upon this achievement by actively introducing new partners, gradually expanding the alliance, and jointly promoting the formulation of standards, award applications, and industry evaluations. This collective effort aims to drive the continuous development and innovation of the network mega-model industry, to co-create and co-build an ecosystem for network large models.

14.3. Use case requirements

- **ICN-NLM-UC01-REQ-001:** It must utilize Network Large Models (NLMs) to automate the detection and resolution of network faults and performance deterioration, reducing manual intervention and response times.
- **ICN-NLM-UC01-REQ-002:** It must provide accurate business recommendations by analyzing user service requirements and network operational data using Network Large Models (NLMs).
- **ICN-NLM-UC01-REQ-003:** It must continuously evolve and modify or adapt its architecture to satisfy the evolving requirements of self-intelligence in cloud-network operations using Network Large Models (NLMs).

14.4. Sequence diagram



Note: The sequence diagram refers to [ITU-T M.3080] and [ITU-T Y.3172].

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Use Case – 15: Generative AI-Driven Fashion Design: Digital Fashion Interpretation of "Exquisite Wonderland" Blue & White Porcelain

Country: China

Organization: Beijing Institute of Fashion Technology

Contact person: Xizi Yu, 149988494@qq.com

15.1. Use case summary table

Domain	Fashion Design
Problem to be addressed	To enhance design efficiency by minimizing the reliance on physical prototypes, significantly reducing material waste and carbon footprint during the design process.
Key aspects of the solution	Digital, design refinement with greater precision, tailor to diverse cultural preferences, Midjourney
Technology keywords	generation, CLO3D, CLO4D, 3d modelling software, Midjourney
Data availability	Synthetic https://pan.baidu.com/s/1SnUkJkvzg8T4DRE6B1S8Ug?pwd=b79c
Metadata (type of data)	File information, resolution, image dimensions, exif data, material information (modelling), geometric data (modelling), render setting (modelling), history and versioning (modelling), variation from user prompt (midjourney), scale (midjourney), zoom (midjourney), remix from user prompt (midjourney).
Model Training and fine tuning	Images have been generated with Midjourney's pre-trained LLM models, which have been adjusted according to user input to provide customizability.
Testbeds or pilot deployments	Midjourney

15.2. Use case description

15.2.1. Description

Introduction: The "Exquisite Wonderland" AI fashion collection, spearheaded by the Beijing Institute of Fashion Technology's College of Fashion Arts and Engineering, aims to revolutionize fashion design processes. By leveraging cutting-edge technologies, the initiative seeks to

enhance design efficiency, reduce material waste, and promote sustainable practices in the fashion industry.

Solution Overview: The key aspect of the solution lies in the complete digitalization of the design process, enabling refinement with precision and customization to cater to diverse cultural preferences. Using advanced technologies such as generation, CLO3D, CLO4D, and Midjourney, the initiative streamlines the design phase and minimizes reliance on physical prototypes. By integrating AI algorithms, the time required for design conceptualization to market readiness is significantly reduced, fostering rapid innovation and product iteration.

Partners: Collaborative Efforts: The collaboration involves interdisciplinary efforts within the Beijing Institute of Fashion Technology and potential partnerships with fashion brands, technology providers, and sustainable producers. By pooling resources and expertise, the initiative aims to drive industry-wide innovation and adoption of sustainable practices.

UN Goals:

- **SDG 9:** Industry, Innovation, and Infrastructure
- **SDG12:** Responsible Consumption and Production

Through digitalization and AI-driven design processes, the project contributes to industrial modernization and fosters responsible consumption and production patterns, ultimately advancing towards a more sustainable fashion industry.

15.2.2. Future work

With potential prize money and resources, our future endeavors will concentrate on developing new offerings and extensions for the "Exquisite Wonderland" series. The strategic outline includes:

Product Development and Expansion: We aim to innovate by integrating blue and white porcelain motifs into our designs, thereby diversifying our range to include a broader variety of apparel and accessories. Leveraging AI, we plan to refine our designs with greater precision and introduce elements tailored to diverse cultural preferences, offering bespoke solutions for our global clientele. This approach will also be applied across various commercial brands to embed innovation within their workflows.

Technological Advancements: Our focus will be on enhancing our AI algorithms and workflows, including the development of specialized models to improve pattern recognition and generation capabilities. We will also pioneer new tools and methodologies to ensure the accurate depiction of intricate designs across varied materials.

Market Expansion: We propose the creation of an online platform featuring a virtual try-on function, showcasing our collection and enabling users to experience our garments in a virtual setting. This platform is envisioned to facilitate a more interactive and customized shopping journey.

Sustainability Initiatives: A thorough evaluation of our supply chain will be conducted to align all operations with sustainability benchmarks. Collaborations with local producers will explore the viability of renewable energy sources and eco-friendly materials in our production processes.

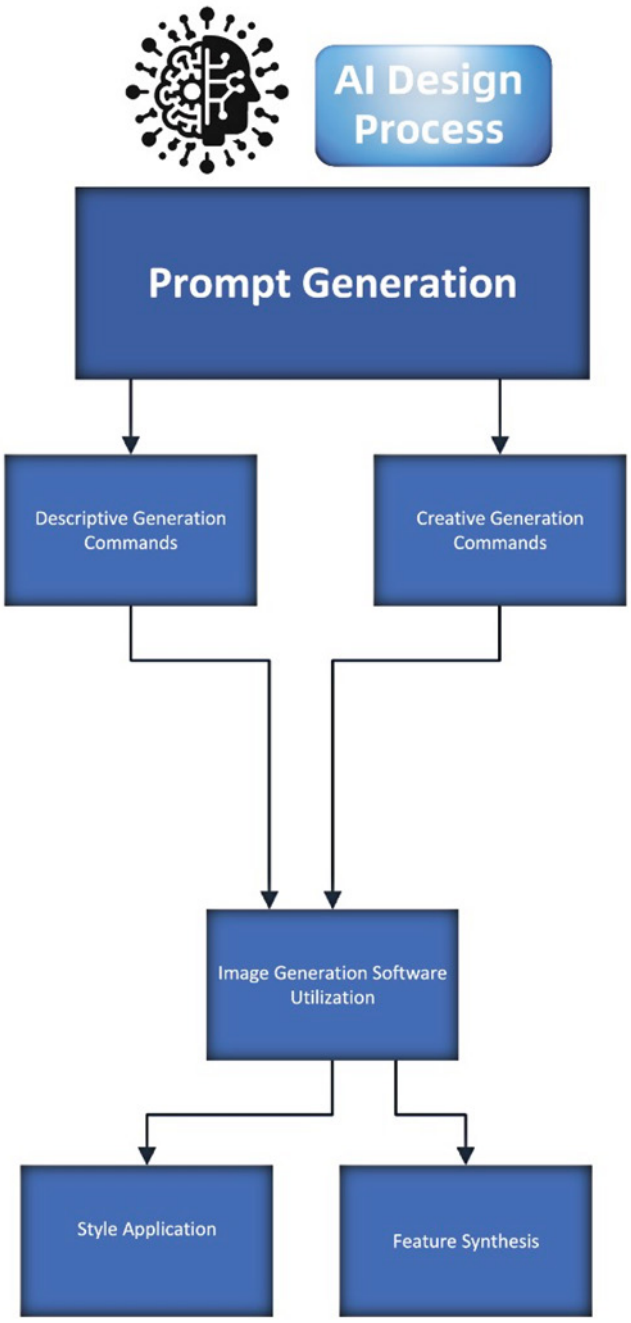
Cultural Engagement and Education: Through seminars and exhibitions, we intend to foster a dialogue with the public, raising awareness about the significance of digital fashion and sustainable manufacturing.

Strategic Collaborations: By partnering with fashion entities, designers, and technology providers, we aim to drive the industry towards a digital and sustainable future.

15.3. Use case requirements

- **REQ-001:** Digital design tools must enable seamless exchange of design knowledge and data between different components of the design process.
- **REQ-002:** AI algorithms should significantly reduce the time required in the design phase to expedite the transition from conceptualization to market readiness.
- **REQ-003:** Sustainability considerations must be integrated into the design process, with tools and practices that support sustainable material choices and minimize environmental impact.
- **REQ-004:** AI models should allow for user input to provide the ability of customization in the image generation process.

15.4. Sequence diagram



Use Case – 16: Fusion of nanosecond pulses and artificial intelligence: precision medicine innovation in the field of tumor ablation

Country: China

Organization: Hangzhou Ruidi Biological Technology Co., Ltd.

Contact person: Xinhua Chen (Cindy Chen), xinhua_chen@zju.edu.cn

16.1. Use case summary table

Domain	Health
The Problem to be addressed	• Reducing damage to surrounding cells during tumor treatment • Optimizing treatment effects and reducing postoperative complications • Decreasing mortality and treatment costs
Key aspects of the solution	• Use of nanosecond pulse technology for precise tumor ablation • Integration of Artificial Intelligence (AI) for optimized treatment planning and intraoperative navigation • Targeted tumor management and precise positioning, facilitated by preoperative image planning and intraoperative navigation.
Technology keywords	Nanosecond pulse technology, AI for planning and navigation, Positioning, Image processing, Deep Learning
Data availability	No Combination of public research and patient data
Metadata (type of data)	Image (Pre-operative and treatment), Real-time monitoring data
Model Training and fine-tuning	• Image processing techniques for training • Ongoing AI model optimization
Case Studies	None
Testbeds or pilot deployments	The research and testing phase is still ongoing.

16.2. Use case description

16.2.1. Description

Introduction: Tumor ablation, a critical aspect of cancer treatment , often faces challenges in achieving precision while minimizing collateral damage to healthy tissues. To address these

challenges, a groundbreaking approach integrating nanosecond pulse technology with artificial intelligence (AI) has emerged. This innovative fusion aims to revolutionize tumor ablation procedures, optimize treatment outcomes, and reduce postoperative complications.

Solution Overview: The solution combines nanosecond pulse technology, which delivers precise electrical pulses to destroy tumor cells, with advanced AI algorithms. This integration enhances preoperative image planning and intraoperative navigation, allowing for targeted tumor management and real-time monitoring. By leveraging AI's capabilities, surgeons can optimize treatment planning and execution, improving accuracy and effectiveness in tumor ablation procedures.

Partners: Zhejiang University collaborates with R-ablation to advance this pioneering approach to tumor ablation. Through this partnership, expertise from academic and industry sectors contributes to developing and implementing this innovative solution.

UN Goals: Fusing nanosecond pulse technology with AI directly contributes to SDG 3: Good Health and Well-being. By enhancing tumor ablation procedures, this solution reduces mortality rates, decreases treatment costs, and minimizes disease burden. Furthermore, improving treatment accessibility and reducing disparities aligns with the broader agenda of promoting health equity and well-being for all.

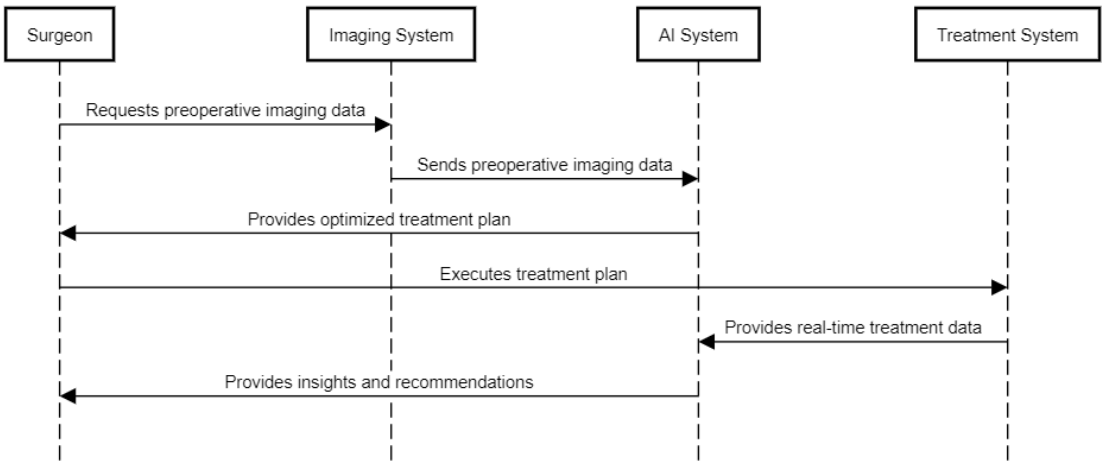
16.2.2. Future work

Future work will focus on further optimizing preoperative image planning and intraoperative navigation through advanced AI techniques. Expanding clinical trials and reducing technology costs will enhance the solution's accessibility and effectiveness. These efforts aim to accelerate progress towards achieving the Sustainable Development Goals, particularly Goal 3, by ensuring equitable access to high-quality healthcare services.

16.3. Use case requirements

- **REQ-01:** Precision Tumor Ablation
- **REQ-02:** Optimized Treatment Planning
- **REQ-03:** Real-time Monitoring and Analysis

16.4. Sequence diagram



16.5. References

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Use Case – 17: Infervision AI International Hospital

Country: China

Organization: Infervision

Contact person: Huang Chao, hchao@infervision.com

17.1. Use case summary table

Domain	Healthcare
The problem to be addressed	• Limited medical resources for high-quality healthcare services. In China, despite the dramatic development of healthcare services, the large Chinese population still poses a great pressure on the available medical resources. Compared with the rising demand for health-care services, the growth rate of the number of practicing physicians remains relatively low, resulting in longer wait times, reduced access to specialized care, and overall inefficiency in delivering optimal health-care. • Doctor-centric traditional In-hospital services. The conventional health-care model is heavily doctor-centric, meaning the quality of medical services relies largely on the competence of individual practitioners. This dependency can lead to variability in care quality, frequent misdi-agnoses, and missed diagnoses, compromising patient safety and treatment outcomes. • Dispersed and geographically restricted medical resources. Medi-cal resources are often concentrated within hospital premises, limiting access for those in rural areas or in emergency situations. This geographic restriction prevents many citizens from receiving high-quality medical services, exacerbating healthcare disparities, and hindering timely medical interventions.
Key aspects of the solution	Based on the medical large language model from super-computing center, AI hospital integrates top-tier medical resources globally to estab-lish multiple AI specialized centers. These centers are supplemented by AI mobile clinics for health examinations and screenings, creating an AI-em-powered medical service network that encompasses mobile primary screening and triage, precise diagnosis and treatment, and intelligent patient management.
Technology keywords	AI medical supercomputing center. Medical large language model. AI-based medical services. Digital hospital management. Medical big data analysis. 5G+AI Tele-medicine.
Data availability	Private data
Metadata (type of data)	Medical images, Pathology results, Text-based clinical documents, Clinical notes and reports, Genomic and genetic testing data, hospital perfor-mance status, etc.

(continued)

Domain	Healthcare
Model Training and fine-tuning	The AI models powering the AI Hospital undergo rigorous training and fine-tuning using vast datasets of patient records, medical images, and genomic information. Transformer-based models are employed for tasks such as image analysis, sequential data processing, and natural language processing within the AI Medical Supercomputing Center. These models leverage the center's computational power for continuous refinement, enhancing diagnostic precision and treatment efficacy.
Testbeds or pilot deployments	Infervision's AI systems have been deployed in more than 1,000 hospitals across 25 countries. The AI hospital, as well as cloud-based AI solutions and AI mobile medical service, has been validated by several government entities and medical institutions.

17.2. Use case description

17.2.1. Description

Designed as a state-of-the-art facility, the 4-layered AI Hospital integrates globally advanced AI and medical expertise from China's renowned healthcare institutions, focusing on providing exceptional patient care and handling complex medical cases efficiently.

The foundational layer is the AI Brain, driven by the AI Medical Supercomputing Center. This center is a hub for collecting and processing vast amounts of medical data, including patient records, imaging, and genomic information. The center's real-time data analysis capabilities support immediate clinical decision-making, optimizing patient care. Additionally, the center develops Large Language Models specifically for the medical field, continuously learning to remain at the forefront of medical technology. The center also supports scientific research, offering the computational power needed for complex simulations and analyses, accelerating medical innovations.

The second layer comprises multiple AI Specialized Centers, including AI Lung Health Management Center, AI Medical Imaging Center, AI Tumer Center, AI Wellness center, etc, each dedicated to specific diseases. These centers use specialized AI tools for targeted and effective medical interventions, providing personalized care plans that improve outcomes and healthcare efficiency.

The third layer, the AI Health Cloud, is a sophisticated cloud-based platform connecting and coordinating healthcare services. It ensures that District Hospitals, Community Health Centers, and Primary Health Centers are well-coordinated, data-informed, and quality-controlled.

The outermost layer extends the hospital's services beyond its physical building. AI Mobile Clinics provide specialized medical services directly to patients, ensuring timely interventions in remote areas. Equipped with mobile medical devices and AI systems, these clinics offer effective treatment and borderless healthcare services, expanding the reach of AI Hospital.

UN Goals: SDGs

- **SDG 3:** Good Health and Well-Being
- **SDG 8:** Good Health and Well-Being

- **SDG 9:** Industry, Innovation, and Infrastructure
- **SDG 10:** Reduced Inequalities

SDG 3 – Good Health and Well-Being. The AI Hospital, equipped with state-of-the-art AI technology and facilities, will significantly enhance the quality of healthcare services. Innovative approaches such as AI-driven diagnostics, personalized treatment plans, and advanced surgical techniques will lead to more accurate diagnoses and effective treatments, thereby improving patient outcomes. The advanced healthcare infrastructure ensures higher standards of care, reducing disease burden and promoting overall well-being.

SDG 8 – Good Health and Well-Being. The construction and operation of the AI Hospital will create numerous jobs, spanning from medical professionals to administrative and support staff. This will contribute significantly to local employment and skills development, fostering economic stability and growth. The hospital's presence will stimulate the local economy, providing a sustainable source of income and professional development opportunities for the community.

SDG 9 – Industry, Innovation, and Infrastructure. As a hub of medical innovation, the AI Hospital will drive technological advancements in healthcare and related sectors such as biotechnology, medical devices, and information technology. This environment of innovation will spur further economic growth, positioning the region as a leader in healthcare technology and infrastructure. The hospital will serve as a catalyst for cutting-edge research and development, fostering an ecosystem of continuous improvement and industrial progress.

SDG 10 – Reduced Inequalities. By introducing a high-tech healthcare facility, the AI Hospital will expand healthcare accessibility, particularly in specialized medical fields. This expansion is crucial in areas where such advanced healthcare services are currently limited, ensuring that more people can receive the care they need. The hospital will help bridge the gap in healthcare disparities, providing equitable access to top-tier medical services and improving health outcomes for underserved populations.

Partners: AI Hospital has established a comprehensive ecosystem, encompassing a network of globally recognized medical and healthcare resources. This includes prestigious institutions like Peking University People's Hospital, China-Japan Friendship Hospital, and the Chinese Academy of Medical Sciences' Cancer Hospital from China, alongside renowned U.S. entities such as Wake Radiology, Sanford Health, Jefferson University Health, and Harvard Medical School. The network extends to Japan's Doctor Net and CVIC, Europe's Diagnose Me, and other notable organizations. Additionally, partnerships with major industrial companies like Huawei, AstraZeneca, Johnson & Johnson, MSD, Boehringer Ingelheim, Pfizer, GE Healthcare, Sinopharm, Taikang, and China Life further enhance AI hospital’s ecosystem.

17.2.2 Future work

Future work on the AI hospital will focus on data collection, model refinement, Standards development, AI-based devices deployment and create new variations/extensions to the same use case.

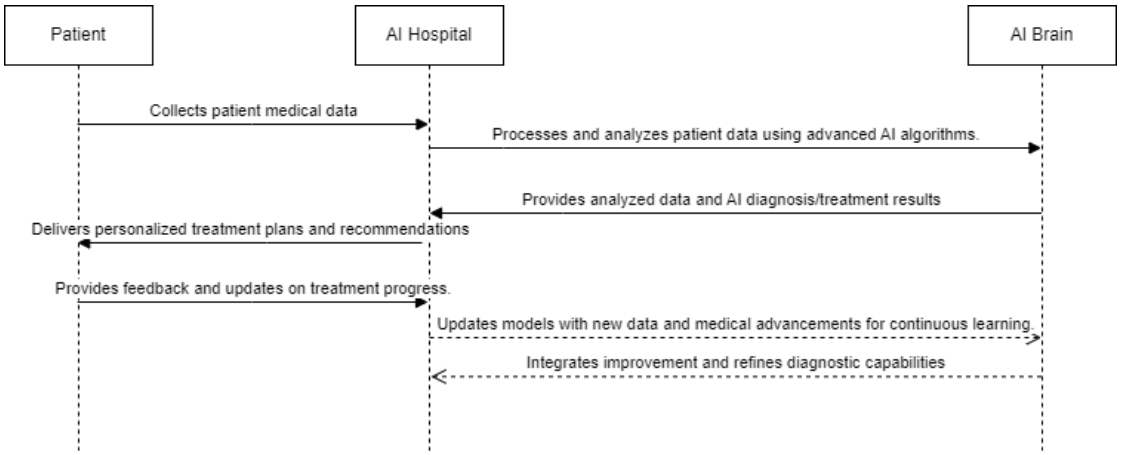
1. Establish goals: Choose a hospital to carry out AI transformation, and determine the construction goals to improve diagnostic accuracy, improve treatment effects, and improve patient satisfaction, etc.

2. Determine staffing: Identify the number and skill sets of medical professionals and IT personnel needed based on the AI Hospital's requirements.
3. Artificial Intelligence Deployment: Based on the construction of the AI Medical Supercomputing Center, integrate the AI system with multiple clinical and administrative departments, deploying corresponding AI modules.
4. Data collection and analysis: Collect high-quality data, clean and organize the data so that the artificial intelligence system can learn from it and improve its performance.
5. Continuous improvement: Constantly pay attention to new technologies and trends in the direction of artificial intelligence, and timely update and adjust strategies and plans.

17.3. Use case requirements

- **REQ-001:** Must facilitate seamless integration of patient data across various medical services, such as appointment scheduling, triage, diagnosis, and surgery assistance.
- **REQ-002:** Management systems must support digital management capabilities.
- **REQ-003:** AI should efficiently organize training/test data and analysis of research data.
- **REQ-004:** Automation features of AI should streamline basic tasks to reduce labor cost and operational efficiency of hospital(s).

17.4. Sequence diagram



17.5. References

[1] Link of database

[2] Link of GLOBAL DRUG FACILITY (GDF) page 39.

Use case –18: AI enabled Power efficient Macro Radio Unit

Country: India

Organization: HFCL Limited

Contact person: Sonali, sonali@hfcl.com

18.1. Use case summary table

Domain	Energy Efficient
Problem to be addressed	Inefficient resource allocation and energy wastage in telecommunications infrastructure.
Key solution	AI based deactivation of RU. (granularity at RF Chain level and at frame level)
Technology keywords	Resource allocation, telecommunications, 5G NR, Radio Unit, 6G, Energy Efficiency.
Data availability	Open traffic data (Traffic Data | Mapbox)
Metadata (type of data)	Time series data on network activity (cpu usage), radio unit occupancy (cpu utilization at BS)
Model Training and fine tuning	Based on the traffic density on working days vs weekends and also between the different time slots of a day, i.e., office hours (peak hours) vs late evening time.
Testbeds or pilot deployments	Experimentation. With optimized design, energy efficiency can increase by 50 % for heavy network load conditions and the number can scale upto 80 % with low load conditions.
Metrics, KPIs, measurements	CPU utilization, energy spent in tackling a particular load amount and Radio Unit utilization factor.
Role of Trainings, standards	Integration to RU products, and standards.
Open Source	Commercial Utilization

18.2. Use case description

18.2.1. Description

The use case involves the deployment of 5G base stations and Customer Premises Equipment (CPE), focusing on assessing network efficiency and resource allocation through key performance indicators (KPIs) like CPU utilization. CPU utilization of the base station serves as an indicator of its operational workload. It tells us the amount of data sent which then tells us the CPU

occupancy, and is evaluated by buffer occupancy in the MAC layer. As the traffic increases, CPU occupancy increases. Will that increase be linear? Well, that's another research problem. Understanding the CPU utilization enables us to assess Radio Unit (RU) occupancy levels and allocate Physical Resource Blocks (PRBs) effectively. One example of this can be, suppose there is gNB from where the data being sent to two UEs, UE1 and UE2, hence the total occupancy level will be given by physical resource block required for the data transmission.

The study aims to leverage time-series data analysis techniques to optimize network resource utilization, despite challenges posed by learning data and network utilization seasonality. It seeks to determine if certain Radio Frequency (RF) chain links within 8T8R macro-Radio units can be deactivated during low network demand without compromising service quality. However, the time-series analysis of data presents challenges due to the presence of learning data and network utilization seasonality. The dataset encompasses varying levels of network activity over working days and weekends, necessitating a comprehensive analysis to discern patterns and trends. Energy efficiency is highlighted, with an AI-based traffic prediction system proposed to optimize power transmission, potentially increasing energy efficiency to at least 50%. Key aspects include continuous CPU utilization monitoring, time-series data analysis, understanding seasonal variations, developing optimization strategies, and evaluating performance. Addressing these challenges aims to optimize network resource allocation, enhancing the overall performance and reliability of 5G base station deployments.

To illustrate the importance of energy efficiency, consider the power requirements of an open RAN-based MACRO RU. Each RF chain typically demands 46 dBm, equivalent to 40 Watts of power. With 8 RF chains, the total power requirement reaches 320 Watts. However, this figure only represents a fraction of the actual power consumption, as additional processing units like antenna gain, power amplifiers, digital processing units, and beamforming logic significantly contribute to the total power consumption. In a holistic view of the end-to-end solution, the total power demand escalates to 1200 Watts.

This scenario yields an energy efficiency of merely 25%, indicating substantial wastage of power. To address this inefficiency, leveraging an AI-based traffic prediction system becomes imperative. Such a system can intelligently predict traffic patterns and optimize power transmission accordingly, leading to a potential increase in energy efficiency to at least 50%. This improvement underscores the critical role of AI-driven solutions in enhancing energy efficiency and minimizing wastage in telecommunications infrastructure.

To address this problem, the following key aspects need to be considered:

1. **CPU Utilization Monitoring**: Continuous monitoring of base station CPU utilization to assess operational workload and RU occupancy levels accurately.
2. **Time-Series Data Analysis**: Analyzing historical data to identify patterns and trends in network utilization over working days and weekends.
3. **Seasonal Variations**: Understanding the impact of network utilization seasonality on resource allocation decisions, considering fluctuations in demand throughout the week.
4. **Optimization Strategies**: Developing algorithms and models to determine the optimal configuration of RF chain links based on observed network utilization patterns.
5. **Performance Evaluation**: Evaluating the effectiveness of optimization strategies in terms of network efficiency, resource utilization, and service quality metrics.

Overall, addressing these challenges will enable us to optimize network resource allocation and improve the efficiency of 5G base station deployments, ultimately enhancing the overall performance and reliability of the network infrastructure.

Repository link : Repository

UN Goals:

- **SDG 9**: Industry, Innovation and Infrastructure
- **SDG 11**: Sustainable Cities and Communities.

Justify UN Goals selection: The emphasis on energy efficiency in macro radio units (RUs) aligns with UN Sustainable Development Goals 9 (Industry, Innovation, and Infrastructure) and 11 (Sustainable Cities and Communities).

Industry: Efficient energy utilization in macro RUs aligns with the industry's objective of optimizing operational costs and resource allocation. By reducing power consumption, telecom operators can enhance profitability while ensuring sustainability and compliance with regulatory standards. Moreover, energy-efficient RUs enable operators to extend connectivity to underserved areas, fostering economic development and social inclusion.

Innovation: Innovation in macro-RU energy efficiency drives technological advancements and fosters the development of smarter, more sustainable solutions. Emerging technologies such as Artificial Intelligence (AI) and machine learning enable operators to optimize power usage dynamically, adapting to changing network conditions and traffic patterns. This innovation not only enhances network performance but also contributes to environmental sustainability, paving the way for a more resilient and efficient telecommunications infrastructure.

Infrastructure: Energy-efficient macro-RUs form the backbone of robust and resilient telecommunications infrastructure. By minimizing energy consumption, operators can deploy network infrastructure in remote or energy-constrained areas, expanding connectivity and bridging the digital divide. Additionally, optimized energy usage ensures the reliability and stability of the telecommunications network, enabling uninterrupted service delivery and enhancing overall infrastructure resilience.

18.2.2. Future work

In future developments, we aim to focus on standardizing the components involved in our use case, particularly the Programmable Baseband, Low Noise Amplifier (LNA) and PA Inputs, PHY Connections, Mod/Demod Processing, Multicore Processor, Communication Interfaces, Data Consolidation, and AI Prediction Model. Standardization ensures interoperability and compatibility across different systems, facilitating seamless integration and deployment of AI-driven optimization solutions in 5G networks. This standardization effort will streamline the development process, improve scalability, and promote industry-wide adoption of energy-efficient and resource-optimized network architectures.

Standards development related to the use case Elaborate proposal: We first give the description of the blocks used in attached XML diagram Programmable Baseband:

Programmable baseband refers to baseband processors or units that can be reconfigured or programmed for various signal processing tasks. Unlike fixed-function processors, programmable baseband offers flexibility to support multiple communication standards

and adapt to changing network conditions. It allows for customization of signal processing algorithms and improves resource efficiency by consolidating functions onto a single platform. Programmable baseband is essential for applications like Software-Defined Radio (SDR), cognitive radio, and Network Function Virtualization (NFV), enabling dynamic spectrum access, intelligent spectrum management, and virtualization of network functions.

For this use case programmable baseband will actually be responsible for providing the training data of CPU occupancy to the AI prediction model.

LNA and PA Inputs: A low noise amplifier (LNA) is a critical component in communication systems, amplifying weak signals while minimizing added noise, thus improving receiver sensitivity. Conversely, a power amplifier (PA) boosts signal power to transmit data over long distances, ensuring robust communication performance in wireless networks.

These building blocks are important as these are the part of multiple RF transmission chains which carry the raw data transmitted or received by the antennas. Also, we are configuring these blocks based on the prediction data received by the AI model PHY Connections: Each LNA and PA unit is connected to the Programmable Baseband through physical connections, represented as PHY connections. These connections facilitate the transmission of signals from the antennas to the baseband processing unit.

Mod/Demod Processing: The received signals undergo modulation/demodulation (Mod/Demod) processing within the Programmable Baseband. Modulation converts digital data into analog signals suitable for transmission, while demodulation performs the reverse process. They are an essential part of the RF chain and are controlled by our AI prediction model which informs processors about their requirements based on the traffic prediction Processed Signals: After modulation/demodulation processing, the signals are prepared for further processing and transmission to other components.

Multicore Processor: A multicore processor is a CPU (central processing unit) design that integrates multiple processing cores onto a single chip. This architecture allows for parallel processing of tasks, improving overall system performance and efficiency by enabling simultaneous execution of multiple instructions and tasks.

Data Reception: The Multicore Processor component receives the processed data from the Programmable Baseband. This data includes the signals that have been modulated/demodulated.

Communication Interfaces: The Multicore Processor utilizes various communication interfaces, such as PCIe (Peripheral Component Interconnect Express), for data communication. These interfaces enable communication with other components within the system.

Data Consolidation: Data from different sources, including the baseband processing unit and the AI prediction model, are consolidated within the Multicore Processor. This consolidation likely involves aggregating and synchronizing data for further processing or transmission.

AI Prediction Model:

Prediction Generation: The AI Prediction Model component is responsible for generating predictions using artificial intelligence algorithms. These predictions could be related to optimizing radio link configurations or enhancing network performance based on learned patterns or predictive analytics.

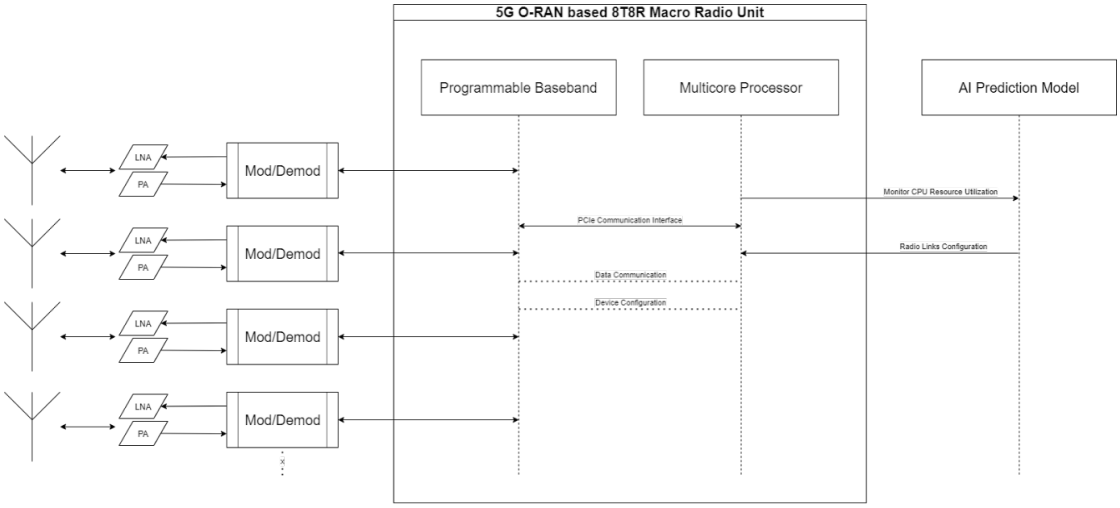
Data Interaction: The AI Prediction Model interacts with the Multicore Processor to exchange data. This interaction likely involves providing input data for prediction generation and receiving output predictions for further processing or action.

Radio Link Configuration: The predictions generated by the AI Prediction Model are utilized for radio link configuration. This configuration may involve adjusting parameters such as modulation schemes, transmission power levels, or antenna beamforming to optimize the performance of the radio links within the network.

18.3. Use case requirements

- **UC18-REQ01:** Continuous CPU Utilization Monitoring - operational workload and Radio Unit (RU) occupancy levels.
- **UC18-REQ02:** Data Analysis - Time series data, historical data, patterns
- **UC18-REQ03:** Use of statistical algorithms
- **UC18-REQ04:** Documentations to train the data
- **UC18-REQ05:** Programmable baseband is required
- **UC18-REQ6:** Day to day telecom operations

18.4. Sequence diagram



18.5. References

[1] https://www.sciencedirect.com/science/article/pii/S2405959522000996

[2] https://networkblog.global.fujitsu.com/2023/02/22/ai-enabled-computing-for-o-ran-increase s-utilization-reduces-power-consumption-and-cost/

[3] https://ieeexplore.ieee.org/document/8663985

Use case –19: Supporting families of missing persons of Derna Flooding using AI chatbot

Country: Libya

Organization: Leapchat AI

Contact person: Kusai Fteita, Kusai@leapchat.ai

19.1. Use case summary table

Domain	Natural Disaster handling
Problem to be addressed	Assisting families in finding missing loved ones following the Derna Flooding in Libya through an AI chatbot platform.
Key aspects of the solution	Integration of a database with an AI chatbot, Incorporation of local data such as names and locations, Facilitation of communication and coordination in crisis situations, Deployment of an AI chatbot accessible via WhatsApp, Enablement of users to submit information about missing individuals and Provision for updating the status of missing individuals.
Technology keywords	Text to data conversion algorithms, image to data conversion (paper record) Generative AI (Gen AI) models, Database as a repository for storing and managing information, communication channel (WhatsApp), K-means clustering for location clustering, Geopandas for geospatial data analysis.
Data availability	Private, with a goal to make it public(Life time 2 month)
Metadata (type of data)	Image (Paper records), Converted data (names and locations), WhatsApp numbers and Geographical metadata such as location coordinates for spatial analysis
Model Training and fine tuning	Gen AI models, K-mean clustering.
Testbeds or pilot deployments	Derna-AI-chatbot: https://leapchat.ai/humanitarian-ai-chatbot Communication channel powerd by chatbot Whatsapp:+218915269476 link

19.2. Use case description

19.2.1 Description

The project introduce an AI-Chatbot Assistance for Locating Missing Individuals during Derna Flooding Crisis. This use case entails the collaboration between an AI chatbot platform, operating a corporate social responsibility (CSR) program, and Libyan non-governmental organizations (NGOs) to provide support to individuals affected by the Derna Flooding crisis

in Libya. The primary objective is to assist families in locating missing loved ones who were separated or lost during the flooding disaster. The collaboration focuses on aiding families in locating missing individuals through the use of the AI chatbot as a tool and Communication Channel via WhatsApp. The families of missing people basically reach AI using local phone number through whatsapp as a communication channel - the platform allows people add any information like name, est age, aree and region of person missing also it allow people to add status updates like the status of missing individuals, indicating whether the missing person has been found, is still missing, or has been declared unknown. The AI chatbot facilitates the delivery of messages, updates, and inquiries related to missing persons, ensuring effective communication and coordination during the crisis.

Outcome: The AI chatbot's intervention results in the successful delivery of 1000 messages within one week to over 250 users.

Use case Status: The use case is part of a larger product development

UN Goals:

- **SDG 3:** Good Health and Well-being
- **SDG 13:** Climate Action
- **SDG 16:** Peace and Justice Strong Institutions
- **SDG 17:** Partnerships to achieve the Goal

Goal relation description:

- SDG3 - Good Health and Well-being: Natural disasters like the Derna flooding can lead to various health challenges, including injuries, waterborne diseases, and mental health issues. By assisting in locating missing persons and facilitating communication during the crisis, it contributes to promoting good health and well-being by ensuring timely access to medical assistance and support services for affected individuals and families.
- SDG13 - Climate Action: The Derna flooding, attributed to heavy rains from storm Daniel, is a consequence of climate change and extreme weather events. By assisting in disaster response and recovery efforts, it contributes to mitigating the impacts of climate change (e.g., flooding) and promoting resilience in affected communities.
- SDG16 - Peace and Justice Strong Institutions: by promoting partnerships and strengthening institutions involved in disaster response, it ensuring access to justice for those affected by natural disasters.
- SDG17 - Partnerships to achieve the Goal: The collaboration with Libyan NGOs demonstrates the importance of partnerships in addressing complex challenges such as disaster response and recovery. It fosters synergies and collective action towards achieving sustainable development goals.

Partner name: Tech Impact Partner

19.2.2. Future work:

Data collection, Model development Elaborate proposal: We would like to focus on building a scalable model of AI that can be used for humanitarian purpose and connected to partners

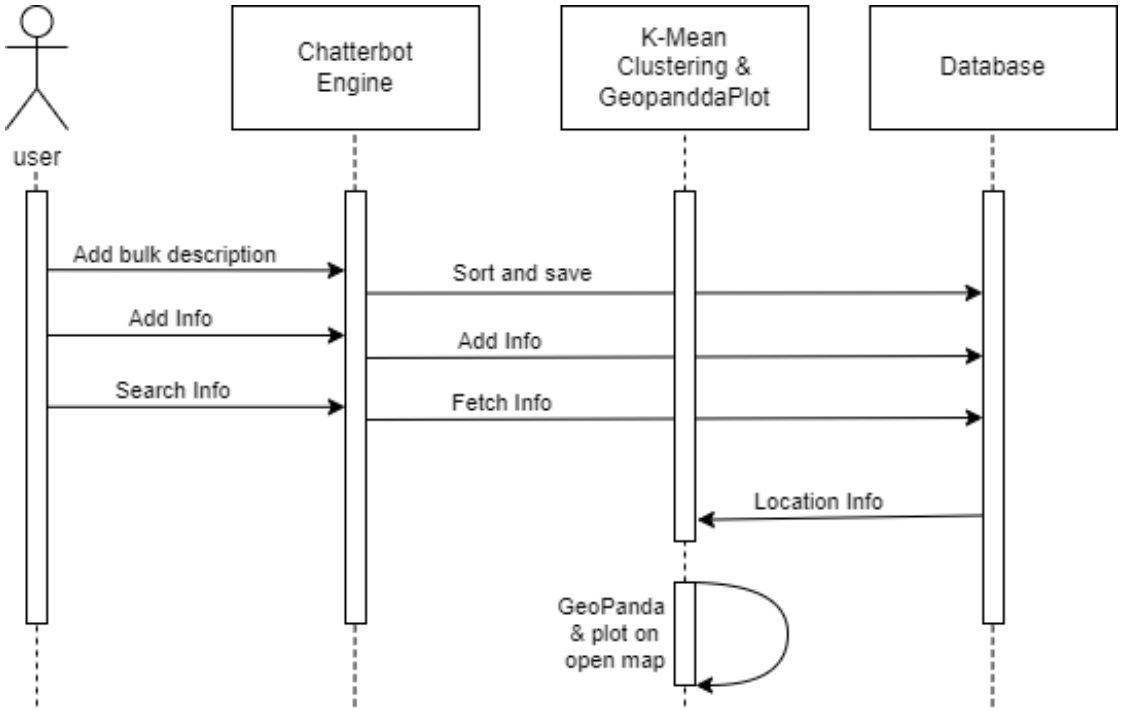
19.3. Use case requirements

- **LC-AI-UC19-REQ-001:** The LC-AI-chatbot must be accessible via widely used communication platforms like Whatsapp and must facilitate the delivery of messages,

updates, and inquiries related to missing persons, ensuring effective communication and coordination during the crisis.

- **LC-AI-UC19-REQ-002:** The LC-AI-chatbot must allow users to add any information like name, estimated age, area, and region of the missing person, and to add status updates about the missing individuals.
- **LC-AI-UC19-REQ-003:** The LC-AI-chatbot must be capable of delivering a large number of messages within a short period of time to a large number of users, and must be scalable and adaptable to handle varying levels of demand and complexity of queries.
- **LC-AI-UC19-REQ-004:** The LC-AI-chatbot must be designed with a focus on user privacy and data security, ensuring that sensitive information is handled responsibly.
- **LC-AI-UC19-REQ-005:** TheLC-AI-chatbot must utilize Geopandas for geospatial data analysis to handle location-based information effectively.

19.4. Sequence diagram



19.5. References

Derna AI Chatbot (CSR)

Use case – 20: A repository of digital tools to empower the modern farmer

Country: Nigeria

Organization: FarmX

Contact person: Olufemi Victor Tolulope, femiosinkolu@gmail.com

20.1. Use case summary table

Domain	Agriculture and Farming
Problem to be addressed	Crop disease,Climate change, etc
Key aspects of the solution	A repository of digital tools for farmers, which includes: Crop disease detection, recommendation system, market place, local languages translation and community for farmers
Technology keywords	Crop Disease detection, pest detection Recommendation (crop) IoT for farmers (local sensors) Local language support (google translate based, not custom translation) Wiki for information. Backend (TF), frontend technologies
Data availability	Opensource data is used. Curated datasets (open)
Metadata (type of data)	Images (plant) - input from farmers via images captured. Sensed data (atmos pressure , humidity, moisture, wind sensors, wifi enabled, ESP based board).
Model Training and fine tuning	Classification Recommendation NLP GenAI (Gemini AI) RAG based approach – using internet search.
Testbeds or pilot deployments	https://github.com/Cognexus-Labs/FarmX

20.2. Use case description

20.2.1 Description

In Sub-Saharan Africa (SSA), agriculture is often viewed as the 'poor man's job,' characterized by low productivity and inadequate returns.

Smallholder farmers contribute to more than 80% of the total food production in SSA, yet they face numerous challenges, including limited access to funding, machinery, and quality inputs. These barriers restrict their ability to enhance productivity and increase yields, ultimately hindering their economic prospects, and contributing to high levels of poverty and hunger in the region.

Existing solutions have been closed and too generic, hence not being able to capture the precise needs of SSA farmers. Our solution is open-source & tailored to the specific needs of smallholder farmers in Sub-Saharan Africa. The mobile app incorporates crop disease detection technology and goes one step further to provide recommendations for effective cures.

The app is adapted to include multiple local languages via AI which ensures accessibility for farmers with diverse linguistic backgrounds. It also provides personalized crop recommendations based on local soil and climate conditions to optimize yield potential.

Furthermore, it includes a marketplace feature that connects farmers directly with buyers, thus mitigating market instability and price volatility concerns.

We also have IoT (Internet of Things) technology which enables precision agriculture, enhancing resource efficiency and productivity. Lastly, the app incorporates a wiki-style platform dedicated to regenerative farming practices, fostering knowledge-sharing and community-building among farmers.

The solution aims to empower smallholder farmers in SSA, addressing their most pressing challenges and driving sustainable agricultural development.

Repository link : https://github.com/Cognexus-Labs/FarmX

UN Goals:

- **SDG 2:** Zero Hunger
- **SDG 12:** Responsible Consumption and Production
- **SDG 13:** Climate Action

Justify UN Goals selection: For our solution, we have selected Sustainable Development Goals 2 and 12, which focus on Zero Hunger and Sustainable Production and Consumption, respectively. However, solving these goals strongly enables us to contribute to Goal 13.

For SDG 02, we are focused on Target 2.1, Target 2.3, and Target 2.4, while for SDG 12, we streamline down to Target 12.2 and Target 12.3.

Our inspiration for selecting these goals comes from the fact that food loss and waste is a major contributor to hunger and malnutrition, particularly in Sub-Saharan Africa where we are based. We believe that by providing farmers with A.I. tools, we can help to reduce food loss and waste, which will ultimately help to alleviate hunger and malnutrition in the region.

In addition to addressing SDG 2, our solution is also aligned with SDG 12, which aims to promote sustainable production and consumption patterns. By reducing food loss and waste, we can conserve natural resources and reduce the carbon footprint associated with food production. We recognized that many farmers in Africa struggle with pest and disease management and that it is a major contributor to food loss.

We believe that our solution has the potential to make a significant impact on food security and sustainable development in Africa, while also contributing to global efforts to address climate change.

20.2.2. Future work

Scholarships and resources would catalyze our efforts to democratize access to agricultural technology, promote sustainable farming practices, and empower smallholder farmers to thrive in an ever-changing agricultural landscape. Firstly, if we get funds, it would provide essential financial support for sustaining the servers and infrastructure necessary for open-sourcing our technology. The resources would ensure that our solution remains accessible and beneficial to smallholder farmers in Sub-Saharan Africa and beyond.

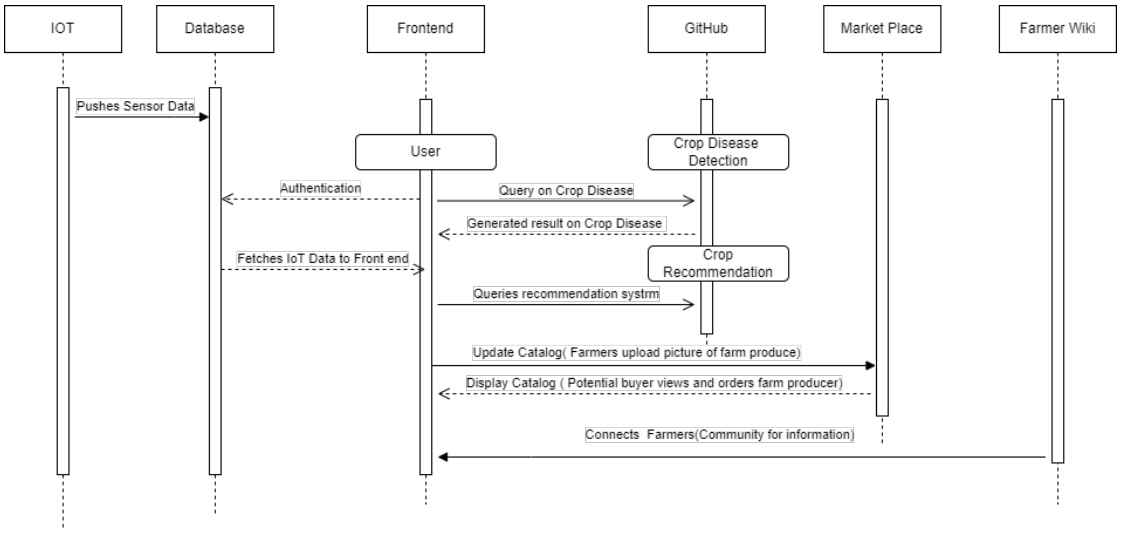
Given resources would also facilitate ongoing research and development efforts, allowing us to continually innovate and refine our solution to meet the evolving needs of farmers better and address emerging challenges in agriculture. Additionally, we want to expand our community engagement initiatives, including training and capacity-building programs focused on modern agricultural practices and regenerative farming techniques. These programs would empower farmers with the knowledge and skills they need to enhance their productivity and resilience.

20.3. Use case requirements

This section describes the requirements for each entity on the Repository of tools to empower modern Framers.

- **ARDTEMFUC20 REQ-001:** It is required to establish a communication with cloud where the data is collected via sensor stored in Database.
- **ARDTEMFUC20 REQ-002:** It is required to establish a transfer protocol from the ESP module to the firebase.
- **ARDTEMFUC20REQ-003:** It is recommended to support various image sizes, brightness and file type when the model is being queried by the farmer
- **ARDTEMFUC20 REQ-004: It** is recommended to provide a user-friendly interface for the user to interact with the backend of the application
- **ARDTEMFUC20 REQ-005:** It is required for users to register
- **ARDTEMFUC20 REQ-006:** It is required for users with account to authenticate from the database

20.4. Sequence diagram



Use case – 21: AI for accessible and sustainable virtual worlds (for education) (user needs and preferences)

Country: Spain

Organization : Universitat Autonoma de Barcelona.

Contact person: Estella Oncins (estella.oncins@uab.cat)

Anna Matamala (anna.matamala@uab.cat)

Pilar Orero (pilar.orero@uab.cat)

Sarah McDonagh (sarahanne.mcdonagh@uab.cat)

21.1. Use case summary table

Domain	Education
The Problem to be addressed	• Lack of cross-platform interoperability when transitioning between different metaverses. • Absence of consideration for user needs in AI-based education.
Key aspects of the solution	• Integration of AI within the metaverse environment. • Mapping various user interactions and providing guidelines to address anxiety and mental health within educational systems. • Enhancing interaction between communication agents in educational systems through AI technologies.
Technology keywords	Educational systems in virtual worlds; User centric approach (user needs and preferences); Metaverse; AI-based Blockchain solutions in 2D, 3D, immersive environments
Data availability	• Assessing the availability of relevant data for mapping workflows within educational contexts. • Evaluating the accessibility of data regarding the use of AI, along with understanding associated barriers and benefits. • Examining the availability of platform-specific scenarios that prioritize user interaction.
Metadata (type of data)	Textual data, Numerical data, Categorical data, Image data and Video data
Model Training and fine-tuning	• Using reinforcement learning algorithms for optimizing AI models in the metaverse. • Employing neural networks to fine-tune models for better communication in educational systems.
Case Studies	None

(continued)

Domain	Education
Testbeds or pilot deployments	• Collaborating closely with the European Disability Forum to ensure inclusivity. • Consistently testing guidelines within university environments to validate their effectiveness.

21.2. Use case description

21.2.1 Description

The use case titled "AI for accessible and sustainable virtual worlds (for education)" is an initiative led by the TransMedia Catalonia research group at Universitat Autonoma de Barcelona [1]. The aim is to leverage AI technologies to enhance accessibility, inclusivity, and sustainability in virtual educational environments. The project addresses the growing importance of virtual worlds in education and the need to ensure that these environments are accessible to all users, regardless of their needs and preferences.

Solution Overview:

The project focuses on integrating AI-based solutions into virtual educational environments to address accessibility gaps and foster personalized learning experiences [2]. By leveraging state-of-the-art AI technologies, the initiative aims to create immersive educational experiences that cater to diverse user needs and preferences. These solutions include speech-to-text and text-to-speech tools, personalized teaching scenarios, and real-time communication aids.

Assessment of SDG Co-benefits:

The initiative aligns with several UN Sustainable Development Goals (SDGs), including :

- **SDG 4:** Quality Education
- **SDG 5:** Gender Equality
- **SDG 10:** Reduced Inequality
- **SDG 11:** Sustainable Cities and Communities; Goal 12: Responsible Consumption and Production
- **SDG 13:** Climate Action

The project contributes to these goals by promoting inclusive and equitable education, ensuring gender equality representation, reducing inequalities, fostering sustainable communities, promoting responsible consumption and production practices, and addressing climate change.

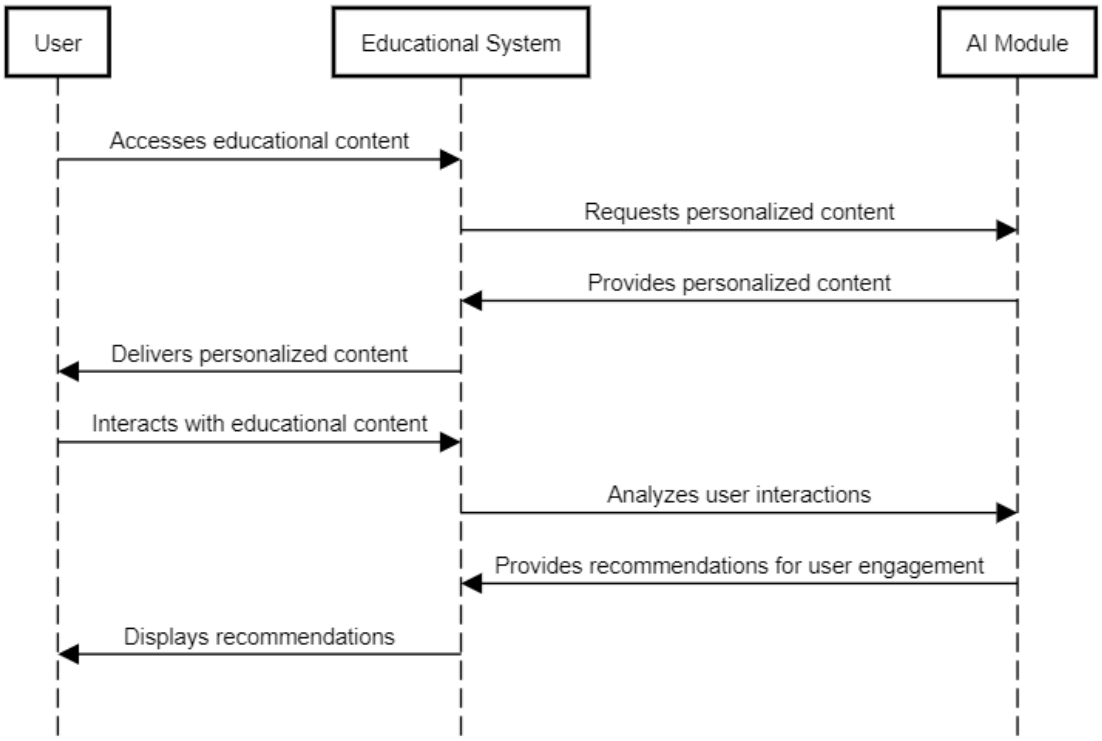
21.2.2 Future Work

Future work on the project will focus on proof-of-concept development, creating new variations/extensions to the same use case, and standards development related to AI-based solutions for accessible and sustainable virtual worlds. The project aims to map state-of-the-art AI-based solutions, explore different educational contexts, and develop guidelines for designing inclusive and sustainable virtual environments.

21.3. Use case requirements

- **REQ-Q1**: Cross-Platform Interoperability
- **REQ-Q2:** User-Centric Design
- **REQ-Q3:** Integration of AI

21.4. Sequence diagram



21.5. References

[1] Universitat Autonoma de Barcelona. (n.d.). Retrieved from link

[2] ResearchGate. (n.d.). Virtual Worlds for Learning in Metaverse: A Narrative Review. Retrieved from link

Use case – 22: AI-Rapid TB Diagnosis

Country: Tanzania

Organization: Sengerema Health Institute

Contact person: Gideon Ngerageza, nadsoncarliva@gmail.com

Ndabuye Gideon, sndabuye@gmail.com

22.1. Use case summary table

Domain	Health
Problem to be addressed	Enhanced early TB diagnosis using AI from microscopic images of sputum samples, significantly reduces diagnostic turnaround time and the start of treatment.
Key aspects of the solution	Image segmentation, Image classification, Microscopic images of sputum samples
Technology keywords	Image segmentation, image classification.
Data availability	Public data: Available here for piloting Private data: requires requests to hospitals
Metadata (type of data)	Images – microscopic images (currently) In future – Clinical data (fever, sweating, weight trend, etc) for multi-modality
Model Training and fine tuning	Training – U-Net or Mask R-CNN for segmentation, these have proven to be best architectures for segmentation, accompanied by image augmentation Fine tuning – Segment Anything Model (SAM) can be finetuned to build a good start.
Testbeds or pilot deployments	Automated detection of tuberculosis in Ziehl-Neelsen-stained sputum smears using two one-class classifiers Link A sputum smear microscopy image database for automatic bacilli detection in conventional microscopy. Database for around 1320 images. Link

22.2. Use case description

22.2.1 Description

Tuberculosis (TB) remains a significant global health threat, with millions of cases reported annually [1]. Diagnosing active TB relies heavily on culturing Mycobacterium tuberculosis

(MTB) from patient samples [2], a process that can take weeks [3]. This delay hinders timely treatment initiation and increases the risk of transmission.

The current gold standard for TB diagnosis, culturing MTB especially in developing countries, suffers from several limitations. It is time-consuming, labour-intensive, and requires specialized facilities. Additionally, some strains of MTB grow slowly [4], further extending the diagnostic window. This delay translates to prolonged patient suffering, increased healthcare costs, and the potential for further transmission within the community. More importantly, in most developing countries, no modern method is used, therefore leading to severe outcomes like damaged lungs.

There is a faster alternative called sputum smear microscopy that uses Ziehl-Neelsen (ZN) staining to identify acid-fast bacilli (AFB) characteristic of MTB. However, it has low sensitivity [5], particularly in patients with low bacterial loads; therefore, it is not always reliable, especially if the sickness is in its early stages. Additionally, differentiating MTB from other acid-fast bacilli can be challenging for less experienced technicians. This signifies a need for a better approach to diagnosis.

We propose the use of multiple deep learning techniques (image segmentation and classification with state-of-the-art architectures) to analyze microscopic images of patient samples stained for MTB. AI has mostly been used to diagnose TB through the classification of conventional radiography images [6]. This approach has shown a good change, but since it depends on visible lung damage, there is usually a delay in realising the infection.

A combination of trained model architectures could potentially identify MTB bacilli with high accuracy and speed, significantly reducing diagnostic turnaround time, therefore bringing the following benefits.

- Faster treatment initiation will allow for early diagnosis and prompt treatment, minimizing patient complications, worsening, and transmission risks.
- Building this will lead to improved resource allocation, if we don't depend on culturing, this frees up resources for other critical laboratory procedures.
- AI powered diagnosis could be deployed in resource-limited settings lacking specialized facilities for culturing. This is more important in developing countries, where most health centers lack specialized facilities.

The possibility of drawbacks is more centered on the quality and size of the data to be used in building the model, this mostly affects the model's accuracy. Additionally, integrating AI into clinical workflows requires careful validation and regulatory approval.

UN Goals:

SDG 3: Good Health and Well-being

Justify UN Goals selection: Tuberculosis remains a significant barrier to achieving SDG 3, particularly target 3.3. It states that "end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases" and the targets linked to the end TB strategy are two, one is to detect 100% of new sputum smear-positive TB cases, cure at least 85% of these cases, and eliminate TB as a public health problem (<1 case per million population) by 2050. Therefore, this proposed solution directly faces SDG 3 and particularly 3.3, as explained. Faster diagnosis through AI leads to quicker initiation of treatment, improving patient outcomes, and reducing the risk of

complications and death. Aligning with SDG 3.3's focus on ending the TB epidemic. Also, early treatment minimizes the duration of infectiousness, thereby curbing the spread of TB within communities. This directly supports SDG 3.3's goal of controlling communicable diseases.

Finally, AI-based diagnosis has the potential to be deployed in resource-limited settings, expanding access to accurate TB diagnosis in regions with limited healthcare infrastructure. Matching with SDG 3.8's focus on achieving universal health coverage.

22.2.2 Future work

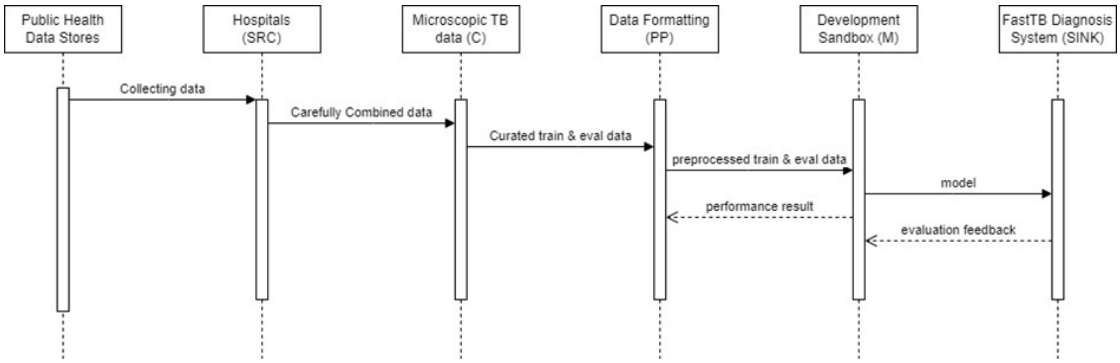
1. **Data Collection:** Collaborate with microbiology labs to establish standardized protocols for capturing high-quality microscopic images of patient samples. This should ensure consistency in the data used to train the AI model. Partner with research institutions and public health organizations worldwide to create a comprehensive dataset encompassing diverse geographical regions, patient demographics, and MTB strains to strengthen the models' generalizability.
2. **Proof of Concept Development:** Evaluate different AI architectures specifically designed for medical image analysis. Optimize hyperparameters and training procedures to maximize the model's accuracy and efficiency. Employ eXplainable AI (XAI) techniques like LIME (Local Interpretable Model-agnostic Explanations) to understand the model's reasoning behind its diagnoses. This fosters trust and transparency among healthcare professionals.
3. **Creating Use Case Variations :** Expand the AI model's capabilities to not only identify MTB but also predict its susceptibility to different anti-tuberculosis drugs. This allows for early tailoring of treatment regimens for optimal effectiveness. Explore the potential of the AI model to identify other respiratory pathogens present within the same microscopic images. This could enhance the overall diagnostic capabilities of the tool.

Develop an AI assistant that analyzes ZN-stained sputum smear microscopy images in real-time, highlighting potential MTB bacilli to aid less experienced technicians, this is to enhance the current alternative to culturing the mycobacterium.

22.3. Use case requirements

- **AIRTBD-UC01-REQ-001**: It must accurately analyze microscopic pictures of MTB-stained sputum samples in order to detect TB infection quickly and reliably.
- **AIRTBD-UC01-REQ-002:** It must demonstrate high sensitivity and specificity in differentiating MTB from other acid-fast bacilli, ensuring trustworthy diagnostic results across diverse patient groups.
- **AIRTBD-UC01-REQ-003:** It must be deployable in resource-limited settings, especially developing nations, in order to effectively address the global TB burden.
- **AIRTBD-UC01-REQ-004:** It requires thorough validation and regulatory certification to assure its safety, efficacy, and conformity with medical standards and regulations.

22.4. Sequence diagram



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Use Case – 23: Generative AI based Video Analytics for Improving Worker Safety

Country: Singapore

Organization: Okyasoft Pte Ltd

Contact person: Asankhaya Sharma, asankhaya@securade.ai

23.1. Use case summary table

Domain	Safety monitoring
Problem to be addressed	Lead time and effort needed to create models for safety monitoring for enterprises (logistics and manufacture)
Key aspects of the solution	Fine tuned models for Video analytics at the edge with real time monitoring (learnt from visual prompting and images from existing cctv cam)
Technology keywords	Zero shot object detection Visual prompting
Data availability	private data
Metadata (type of data)	Video from existing cctc cam
Model Training and fine tuning	0 shot, Conventional model is finetuned with data generated from gen AI model (like distillation)
Testbeds or pilot deployments	Feature in the WSHAsia Magazine: link Vestar Iron Case Study: link SDTA-Lenovo-Securade.ai partnership: link

23.2. Use case description

23.2.1 Description

Securade.ai's innovative Generative AI-based Video Analytics platform is revolutionizing the field of worker safety in high-risk industries such as construction, manufacturing, and logistics. Traditional safety monitoring systems fall short due to static rules, delayed real-time alerts, and a lack of customization, often leading to inadequate workplace safety. The advent of generative AI has introduced a paradigm shift, enabling the transformation of conventional CCTV cameras into intelligent safety monitors. These AI-enhanced systems can provide real-time alerts for safety violations, ensuring a proactive approach to accident prevention and enhancing the overall safety culture within workplaces.

Existing solutions often require extensive data collection, labeling, and model training, which is both time-consuming and resource-intensive. In contrast, Securade.ai utilizes a generative AI approach to streamline this process, allowing for faster, more cost-effective deployment and easier customization to meet specific safety requirements. This method significantly reduces the need for manual data annotation by employing zero-shot object detection and visual prompting techniques, thereby speeding up the implementation process from weeks to just days or even hours.

The benefits of adopting this AI-based approach include a substantial increase in safety compliance and productivity, with companies reporting an average of 500% ROI within the first year of deployment and an 80% reduction in safety violations. However, it's important to acknowledge potential limitations, such as the initial learning curve associated with adopting new technology and the necessity of integrating these systems with existing safety protocols and infrastructure.

Furthermore, the scalability and flexibility of Securade.ai's platform support a wide range of use cases, from PPE compliance and proximity estimation to zone management and behavior monitoring, making it a versatile tool for enhancing workplace safety. Future work will focus on further refining AI models, expanding the range of detectable safety violations, and enhancing the user interface to make it even more intuitive. The goal is not only to maintain the alignment with ITU's standards but also to contribute to the evolution of these standards by setting new benchmarks for safety and efficiency in high-risk industries.

Use case status: The use case is part of a larger product development

UN Goals:

- **SDG 3:** Good Health and Well-being,
- **SDG 8:** Decent Work and Economic Growth,
- **SDG 9:** Industry, Innovation and Infrastructure

Justify UN Goals selection: The Generative AI-based Video Analytics for Improving Worker Safety directly contributes to three key Sustainable Development Goals (SDGs):

- SDG3 - Good Health and Well-being: By enhancing worker safety through real-time monitoring and alerting systems, the AI solution directly contributes to reducing workplace accidents and injuries, thereby promoting good health and well-being among workers. Implementing such technologies ensures safer working environments, crucial for preserving life and preventing health issues related to occupational hazards.
- SDG8 - Decent Work and Economic Growth: Safety is a fundamental aspect of decent work. The AI platform's ability to prevent accidents enhances workplace safety, which is intrinsic to creating decent and safe working conditions. This not only aids in achieving economic growth by reducing downtime and healthcare costs associated with workplace injuries but also improves productivity and worker satisfaction.
- SDG 9 - Industry, Innovation, and Infrastructure: The adoption of innovative AI technologies in creating safer workplaces embodies the spirit of SDG 9. By integrating generative AI into existing CCTV infrastructure for safety monitoring, the solution promotes industrial innovation. Moreover, it contributes to building resilient infrastructure by ensuring workplaces are equipped with advanced safety measures, paving the way for sustainable industrialization.

Partner name: Vestar Iron Works Pte Ltd Partner

23.2.2 Future work

Data collection, Model development, Create new variations/extensions to the same use case, Standards development related to the use case, Setup reference tools, notebooks and simulation environment Elaborate proposal: A pivotal aspect of future work will be the commitment to open-sourcing the technology, a move designed to democratize access to cutting-edge safety solutions and catalyze innovation within the community.

Key components of the future work:

1. Technology and Platform Open-Sourcing: The decision to open-source the platform marks a paradigm shift in making advanced safety technologies accessible to a broader range of users, particularly benefiting small to medium enterprises (SMEs) and industries in developing regions. By removing financial barriers, we aim to empower all organizations to prioritize worker safety and foster a culture of innovation and collaboration.

Open-sourcing will include:

- Releasing the core AI model training and inference framework.
- Providing comprehensive documentation and community support to encourage contributions and adaptations.
- Establishing a vibrant developer ecosystem for continuous improvement and customization of safety solutions.

2. Enhanced AI Capabilities: Continuous research and development efforts will focus on improving the accuracy and efficiency of the AI models, incorporating advancements in zero-shot learning, and exploring new methodologies in AI to adapt to diverse workplace environments.

Future enhancements include:

- Developing more robust models capable of operating in varying lighting and weather conditions.
- Implementing adaptive learning algorithms that evolve based on new data, ensuring the system remains effective as workplace layouts and conditions change.

3. Integration and Scalability: Expanding the platform's integration capabilities with various industrial systems and IoT devices to offer a more comprehensive safety monitoring solution.

This includes:

- Enhancing compatibility with different camera and sensor technologies.
- Building APIs for easy integration with existing enterprise systems, such as HR and EHS management platforms.

4. Community Engagement and Support: Establishing a support framework for users and developers that includes:

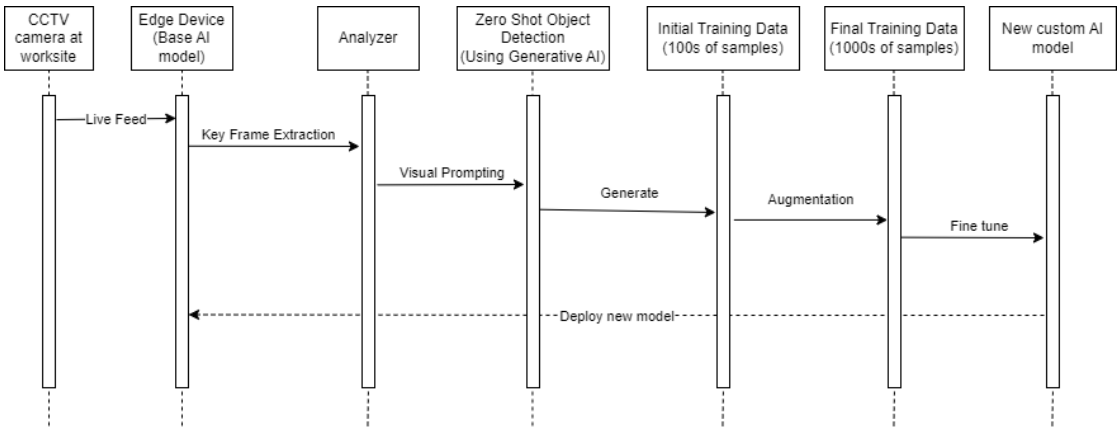
- Training programs and workshops to facilitate the adoption of the technology.
- A dedicated support forum for sharing best practices, troubleshooting, and collaborative problem-solving.

23.3. Use case requirements

ITU-T Supplement Y.71 ITU-T Y.3000 series – Use Cases for Safety Monitoring

- **GAI-VA-SM-UC23-REQ-001:** The GAI-VA-SM system must be capable of operating within the domain of safety monitoring, specifically focusing on improving worker safety in high-risk industries like manufacturing. The system should be designed to handle a high volume of video data and process it in real-time.
- **GAIVASM-UC23- REQ-002:** The system must be capable of addressing the significant lead time and effort required to create models for safety monitoring in enterprises. It should leverage advanced machine learning techniques to automate and expedite the model creation process.
- **GAIVASM-UC23-REQ-003**: The system should utilize fine-tuned models for video analytics at the edge with real-time monitoring. These models should be trained using visual prompting and images from existing CCTV cameras. The system should also be capable of handling a variety of video formats and resolutions.
- **GAIVASM-UC23-REQ-004:** The system should employ zero-shot object detection and visual prompting techniques. It should be capable of identifying safety violations even in scenarios that it has not been explicitly trained on.
- **GAIVASM-UC23-REQ-005:** The system should be designed to be tested in dedicated testbed environments resembling real-world industrial settings and be capable of being deployed in pilot projects in real-world manufacturing, construction, and logistics environments. The system should also be robust enough to handle varying lighting conditions and different camera angles.

23.4. Sequential diagram



23.5. References

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Use Case – 24: AI-PROTECT-IMEC: AI-powered Protection & Resilience Optimization for IMEC

Country: Thailand

Organization: Asian Disaster Preparedness Center (ADPC)

Contact Person : Dr. Mona Chhabra Anand, monachhabra.anand@adpc.net

Kilian Murphy, kilian.murphy@adpc.net

24.1. Use Case summary table

Domain	Industry, Innovation, and Infrastructure
Problem to be addressed	1. The IMEC corridor faces diverse disaster risks due to complex geography. 2. Users need to prepare well for traversing this challenging terrain safely. 3. Investors adhere to necessary infrastructure codes and standards. 4. Freight transporters must plan for disaster and climate risks along the corridor.
Key solution	1. Real Time risk data 2. Intelligent increase with frequent uses 3. Scenario based planning 4. Mobile applications and Portal View
Technology keywords	Evaluation metrics, Real time risk
Data availability	Public data gathered from different stakeholders along the IMEC corridor
Metadata (type of data)	1. Satellite Imagery 2. Early warning data
Model Training and fine tuning	1. Impact based forecast 2. Generate advisories 3. Specific to the IMEC corridor
Testbeds or pilot deployments	1. PoC is in plan 2. Different stages (over 1 year period)

24.2. Use case description

24.2.1 Description:

The India-Middle East-Europe Economic Corridor (IMEC) was announced during India's presidency of the G20 in 2023 as a planned corridor to bolster economic development by fostering connectivity from India to Europe through the United Arab Emirates, Saudi Arabia,

Jordan, Israel and Greece. According to media reports, the Corridor will provide a reliable and cost-effective cross-border ship-to-rail transit network to supplement existing maritime routes.

The Corridor stretching from India to Europe through the Middle East, is marked by a complex interplay of geographical and socio-economic factors, resulting in diverse disaster risks. While investors and promoters of the trade corridor are already likely using the necessary infrastructure codes and standards to withstand these risks, users of the trade corridor such as freight transporters will need to prepare well for traversing this complex geography safely. This requires an AI-based Disaster Risk Management Tool that would enable business entities using the corridor to plan their business processes and prepare for disaster and climate risks.

The proposed tool, AI-PROTECT-IMEC, would offer users of the IMEC trade corridor to access real-time risk data and undertake proactive steps to manage risk. Likewise, this tool would also enable the host national and sub-national governments to manage trade and traffic flows with little disruption and damage due to disasters and extreme climate events. Leveraging AI algorithms, satellite imagery and locally available risk data, this tool would provide informed decision-making support, to enhance disaster resilience and sustainable development across the IMEC region.

Intended Use and Problem Statement: AI-PROTECT-IMEC will be utilized to assess and mitigate disaster risks, such as earthquakes, floods, landslides, cyclones and industrial accidents, along the IMEC corridor. The tool addresses the lack of a comprehensive and real-time risk assessment tailored to the users of the trade corridor at risk sue to IMEC region's unique geographical and socio-economic characteristics. Existing solutions often lack granularity, timeliness, or integration across multiple risk factors and governance structures, hindering effective disaster preparedness and response efforts.

Limitations of Existing Solutions: Current methods for disaster risk assessment often rely on manual data collection and analysis, leading to delays in decision-making and limited coverage of risk factors. Traditional approaches may struggle to handle the vast amount of data required for comprehensive risk informed decision making across diverse contexts. Furthermore, existing solutions may lack the predictive capabilities necessary for proactive risk management and mitigation.

Benefits and Drawbacks of AI-Based Approach: AI-PROTECT-IMEC offers automated data processing, real-time monitoring, and predictive analytics, enabling more accurate and timely risk assessment. AI algorithms can identify complex patterns or correlations that may not be apparent through manual methods. However, challenges such as data privacy concerns, algorithm bias, and the need for specialized expertise in AI implementation must be addressed. Nevertheless, the potential benefits of using AI for disaster risk mapping in the IMEC corridor outweigh the drawbacks, offering a valuable tool for enhancing resilience and sustainable development across the region. Integrating AI-PROTECT-IMEC into the planning and design processes of IMEC would mainstream disaster risk considerations, ensuring that infrastructure and development projects are built to withstand potential hazards.

Repository url: N/A

UN Goals:

- **SDG 8:** Decent Work and Economic Growth
- **SDG 9:** Industry, Innovation and Infrastructure

- **SDG11:** Sustainable Cities and Communities
- **SDG13:** Climate Action,
- **SDG17:** Partnerships to achieve the Goal

Justify UN Goals selection: The choice of AI in AI-PROTECT-IMEC significantly contributes to achieving several Sustainable Development Goals (SDGs) within the context of IMEC bolstering economic development by fostering connectivity and economic integration between Asia, the Arabian Gulf, and Europe. Firstly, by facilitating more accurate risk assessment and mitigation strategies, the tool supports Goal 8: Decent Work and Economic Growth. It safeguards economic activities and livelihoods along the IMEC corridor, ensuring the uninterrupted flow of trade and commerce between regions. This fosters economic growth, creates job opportunities, and promotes sustainable livelihoods, especially in sectors crucial for IMEC's economic integration, such as transportation, logistics, and manufacturing.

Secondly, AI-PROTECT-IMEC aligns with Goal 9: Industry, Innovation and Infrastructure. The integration of AI technology into disaster risk management practices fosters innovation and advances infrastructure development. By enhancing the resilience of critical infrastructure networks, such as transportation routes and communication systems, the tool ensures uninterrupted connectivity and facilitates seamless economic integration across the IMEC region.

Additionally, AI-PROTECT-IMEC contributes to Goal 17: Partnerships to achieve the Goal. By fostering collaboration between governments, organizations, and communities to enhance disaster resilience and sustainable development across the IMEC region, the tool promotes collective action and partnership. These partnerships are essential for strengthening regional cooperation, fostering cross-border collaboration, and leveraging collective resources to address shared challenges, ultimately contributing to the sustainable development and economic prosperity of the IMEC region.

Partner name: Federation of Indian Chambers of Commerce & Industry

24.2.2 Future work:

Proof of concept development, Create new variations/extensions to the same use case, Setup reference tools, notebooks and simulation environment Elaborate proposal: AI-PROTECT-IMEC, proposed by the iPrepare Business facility at the Asian Disaster Preparedness Center (ADPC), encompasses critical components to assist business entities as users of IMEC to manage disaster and climate risks to their business processes along the India-Middle East-Europe Economic Corridor (IMEC). To develop this idea further, a proof of concept development stage is essential. During this phase, a small-scale version of the AI-PROTECT-IMEC tool would be developed and tested for feasibility and functionality. The prototype would integrate AI algorithms, freely available space data, as well as locally relevant climate and disaster data to provide real time information and advisories to IMEC users to undertake proactive risk management actions.

Additionally, creating new variations or extensions to the use case would involve expanding the functionalities of AI-PROTECT-IMEC beyond its initial scope. This could include incorporating additional risk factors, enhancing predictive analytics capabilities, or integrating feedback mechanisms for continuous improvement. By iterating on the initial concept and incorporating

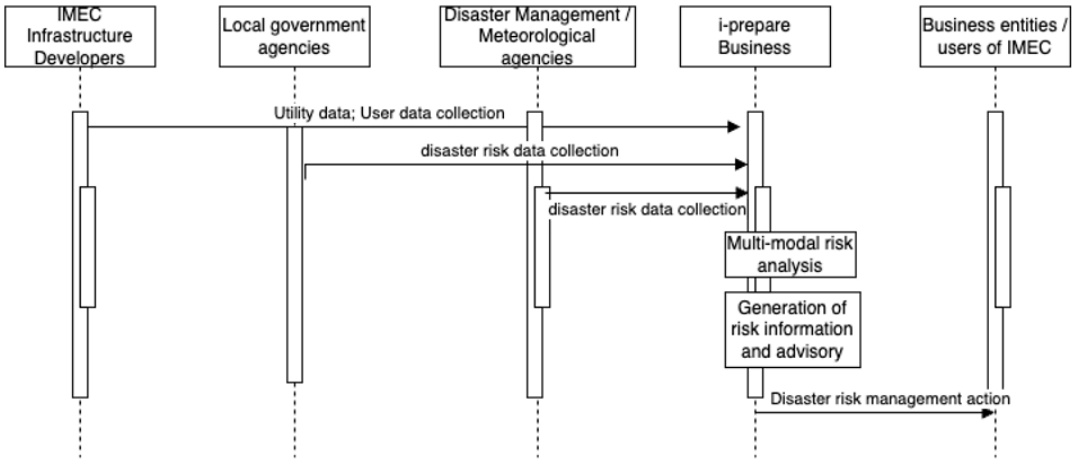
user feedback, the tool can evolve to better meet the specific needs of other stakeholders along the IMEC corridor.

Fostering collaboration between IMEC infrastructure developers, local government agencies/ disaster management agencies, and business entities/users of IMEC is paramount. Setting up reference tools, information portals, mobile applications, and a simulation environment will be instrumental in facilitating this collaboration. This involves creating multi-stakeholder coordination platforms where stakeholders can work together to assess disaster risks, plan mitigation strategies, and optimize infrastructure development. Moreover, establishing a user-friendly interface and providing comprehensive and continued training are essential for ensuring that stakeholders from diverse backgrounds can effectively utilize the tool to make informed decisions and collectively mitigate disaster risks along the IMEC corridor.

24.3. Use case requirements

- **UC24-REQ01:** Real-time Risk Assessment - gathering real time data - data including (earthquakes, floods, landslides, cyclones, and industrial accidents).
- **UC24-REQ02:** Predictive Analytics - AI algorithms needed to predict potential disaster events.
- **UC24-REQ03:** User Accessibility and Interface - interface that allows stakeholders, including businesses, government agencies, and communities, to easily access and interpret risk data.
- **UC24-REQ04**: Cross Border Collaboration

24.4. Sequence diagram



24.5. References

[1] FACT SHEET: World Leaders Launch a Landmark India-Middle East-Europe Economic Corridor

Use Case – 25: Enhancing SME Online Business through An Automatic Recommendation Powered by LLM and Knowledge Graph

Country: China

Organization: Ant Group CO., Ltd.

Contact person: Guanchen LIN, guanchen.lgc@antgroup.com

25.1. Use case summary table

Domain	Business, economy
The Problem to be addressed	• Accelerate SMEs' ability to quickly find their customers under limited resources. • Ease the competitive relationship between SMEs (e.g., mini-program merchants) and large internet platforms. • Assist SMEs in implementing recommendation systems at a low cost to drive their revenue growth.
Key aspects of the solution	• Structured knowledge representation: Ant Personalization Engine (APE) utilizes advanced NLP technologies including LLMs to create a universal knowledge graph, generates diverse entities from texts and logs, and establishes complex entity relationships using Entity-bert methods. • Multi-source heterogeneous knowledge understanding: APE develops a multi-dimensional cold-start recommendation strategy using graph neural networks and knowledge transfer learning to address data sparsity and sample knowledge deficiency in long-tail scenes and private-domain scenarios, inspired by zero-shot and few-shot recommendation tasks in machine learning. • Cross-modal knowledge mining: APE establishes internal standards for content creation, explores generative techniques including stable diffusion (SD) model, LoRA, ControlNet, Roop, and iteratively enhances AIGC quality. • Machine Learning Operations (MLOps) Automation: APE provides SMEs with the capabilities for automated data integration, automated model training and deployment, as well as automated search and recommendation.
Technology keywords	NLP, LLMs, Knowledge Graph, Cold-start Recommendations, AIGC, MLOps
Data availability	Private in Alipay
Metadata (type of data)	Structured and unstructured data

(continued)

Domain	Business, economy
Model Training and fine-tuning	• Main training process: The proposed method utilizes a multi-interest and entity-oriented pre-training architecture designed to learn generalized knowledge across various granularities. This architecture benefits from the inclusion of structural information in the entity graph, setting the stage for effective knowledge transfer. • Main fine-tuning process: After the pre-training phase over source domains, prototype learning is integrated. This involves the use of a contrastive prototype learning module and a prototype enhanced attention mechanism. These components work together to improve the representations of users and items by leveraging adaptive knowledge utilization.
Case Studies	China (i.e. SDG 8,10).
Testbeds or pilot deployments	APE is deployed on Alipay Mini Program Cloud: link APE is published in the publicly available paper PEACE: link

25.2. Use case description

25.2.1 Description:

Amidst the surge in e-commerce, accelerated by the COVID-19 pandemic, SMEs are increasingly turning to online platforms like mini-programs to maintain operations. However, they encounter stiff competition from larger companies in reaching their desired customers. Ant Personalization Engine (APE), an autonomous machine learning system, is thus proposed, empowering small and medium-sized enterprises (SMEs) to connect with their target customers more effectively, despite resource constraints.

APE aims to mitigate this inequality by providing SMEs with a personalized recommendation engine that leverages large models, knowledge graph technology and AI-generated content to enhance user engagement and drive business growth. APE delivers precise personalized recommendations tailored specifically for SME-owned mini-programs. Additionally, integration of AI-generated content enhances user experience, while multi-dimensional cold-start technology ensures rapid engagement with new users, driving increased visibility and traffic. Moreover, MLops automation streamlines operations, reducing manual intervention and cutting operational costs.

The engine's personalized recommendation accuracy is currently being enhanced, while further expansion across industry sectors and mini programs is in progress.

Across the world, SMEs play a vital role, contributing substantially to tax revenue, GDP, technological innovation, and urban employment. They serve as the backbone of national economic and social development, playing a crucial role in expanding employment opportunities and improving living standards for people worldwide.

This case study is intricately linked to United Nations Sustainable Development Goal 8(**Decent Work and Economic Growth**) and Goal 10(**Reduced Inequalities**). Goal 8, which focuses on promoting sustained, inclusive, and sustainable economic growth, emphasizes the importance

of creating decent work opportunities and fostering productivity. By employing artificial intelligence technologies to enhance the digital operations of small and medium-sized enterprises (SMEs), this initiative directly contributes to Goal 8. It enables SMEs to improve their operational efficiency, expand their market reach, and generate more sustainable revenue streams, thereby promoting economic growth and creating more jobs, particularly in the digital sector.

Furthermore, Goal 10 aims to reduce inequality within and among countries by fostering social, economic, and political inclusion for all individuals. Through the adoption of intelligent and digital technologies, this case study addresses the digital divide that often marginalizes traditional SMEs. By providing these businesses with the tools and resources to compete in the digital economy, it helps reduce economic disparities and promote equal opportunities for all stakeholders. This inclusive approach aligns with Goal 10's objectives of reducing inequality and ensuring that economic growth benefits everyone, regardless of their background or status.

UN Goals:

- **SDG 8:** Decent Work and Economic Growth
- **SDG 10**: Reduced Inequalities

25.2.2 Future work:

Firstly, the awarded resources will be allocated to support the ongoing development, platform construction, and promotion of the APE artificial intelligence model. These resources will be utilized to enhance the quality of training data, refine the model through continuous fine-tuning, and bolster the technical capabilities of the large models and knowledge graphs used for personalized recommendations. This will result in improved precision and broader coverage of personalized recommendations for small and medium-sized enterprises (SMEs) across various industries through mini programs.

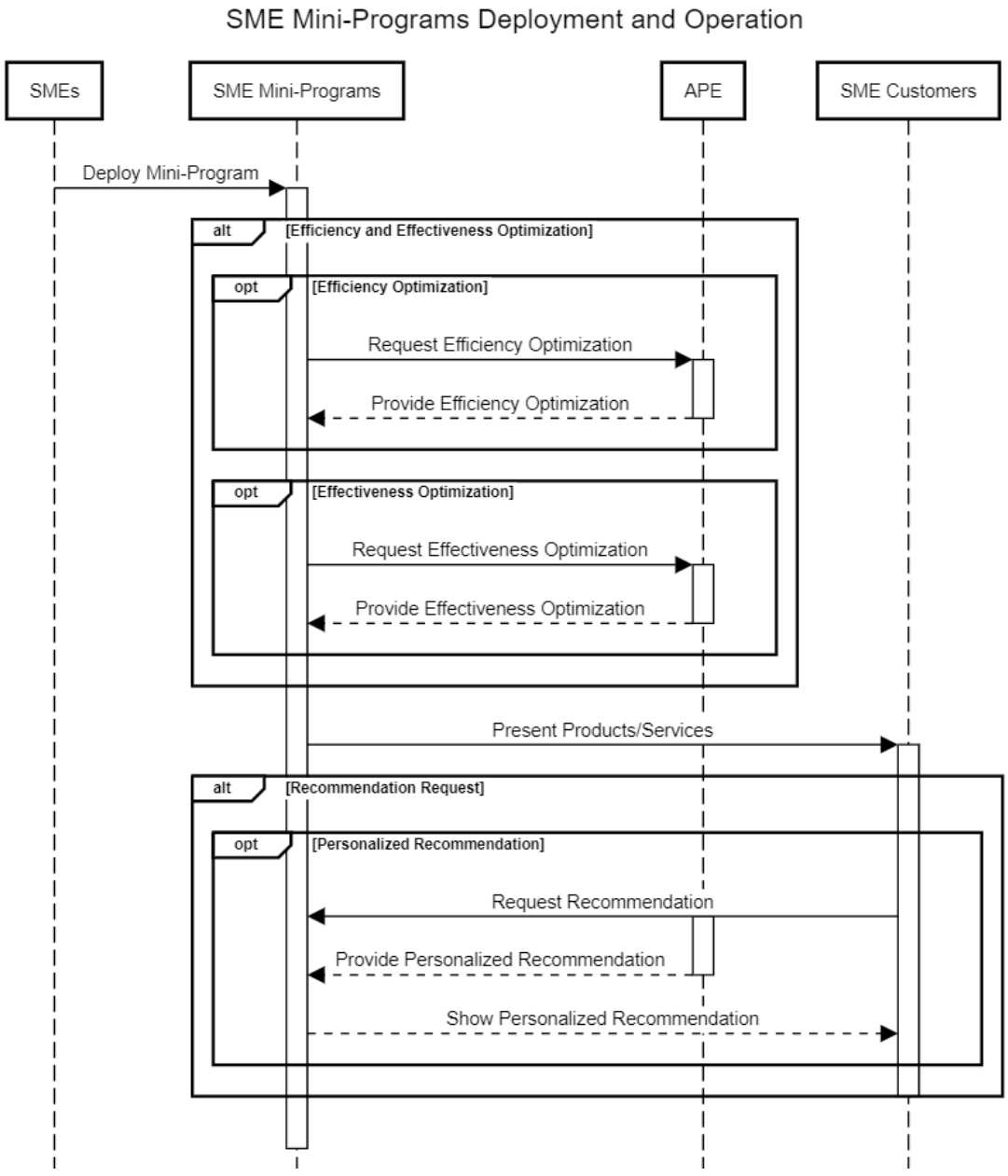
Secondly, the resources will be directed towards strengthening collaboration with the International Telecommunication Union (ITU) and contributing to the formulation of relevant ITU standards. By sharing the practical experiences and expertise gained from APE, efforts will be made to disseminate this knowledge to more countries and industries in need. This will enhance the accessibility and productivity of technology, thereby contributing to economic development. Utilizing APE-related standards as tools, further exploration will be conducted into viable pathways for the governance of AI technology and its application in various service domains. This initiative aims to ensure that inclusive artificial intelligence technology is not only safer and more reliable but also better supports the goals of technological inclusivity, equality among organizations of different scales, fairness, and economic development.

25.3. Use case requirements

- **REQ-01**: It is crucial to establish standardized data transmission protocols with mini-program merchants, aiding them in more effectively unlocking the potential value of their data.
- **REQ-02:** It is crucial that data sequences derived from users' historical interactions within the platform are leveraged for the pretraining of models. This strategy is key to effectively mitigating the cold start issue prevalent in recommendation systems.
- **REQ-03**: It is crucial that a fusion solution based on the privacy-secure co-creation zone is deployed, enabling the legal and compliant acquisition and use of data from the platform

and third-party users within the recommendation process. This approach ensures that scenario personalization effects are maximized while meeting compliance requirements.

25.4. Sequence diagram



25.5. References

[1] Small and medium-sized enterprises.Available online: link

[2] Alipay Mini Program Cloud.Available online: link

[3] PEACE: Prototype lEarning Augmented transferable framework for Cross-domain Recommendation. Available online: link

Use Case – 26: Multimodal Bio-verification and Anti-counterfeiting Platform

Country: China

Organization: Mashang Consumer Finance Co., Ltd. (MSCF)

Contact person: Weihong Deng, Yufeng Xie, yufeng.xie@msxf.com

26.1. Use case summary table

Domain	Security and Biometrics
The problem to be addressed	Identify people and detect the fake face by using multimodal features such as images, video, voice, and ultrasound. Protect us from fraud and false identity information
Key aspects of the solution	Using the AI models to identify real and fake faces, it makes comprehensive use of video, image, voiceprint, ultrasound, and other features to ensure the security of identification.
Technology keywords	Biometrics, Computer vision, multimodal fusion, Anti-Counterfeiting, Privacy and Data Protection.
Data availability	Facial images, video, voice, and ultrasound. Parts of our data were licensed to be made public, which we will make public to promote research in this area.
Metadata (type of data)	Image, Video, Biometric personal data, template format, voice frequency metadata
Model Training and fine-tuning	We use BP algorithm to train our anti-counterfeiting model which is based on transformer architecture. The data used for training were collected by ourselves and purchased from data companies. All data were licensed to be taken by subjects and used for model training.
Testbeds or pilot deployments	The platform is deployed as a part of the financial services system of our company, which used to ensure the security of financial transactions

26.2. Use case description

26.2.1 Description

The multi-modal biometric verification and anti-counterfeiting platform (MmBvAcP), with its three-tier defense design system, is an exceptionally forward-thinking and innovative technological solution that plays a crucial role in ensuring security, enhancing efficiency, and improving user experience.

To begin with, the platform integrates multi-modal biometric verification technology, combining biometric feature recognition with various modes such as facial recognition and voice

recognition, significantly enhancing recognition accuracy and security. This comprehensive utilization of different biometric features not only increases system complexity and reduces the likelihood of counterfeiting but also makes the user verification process more convenient and rapid.

Furthermore, the platform employs a three-tier defense-in-depth design system, indicating higher reliability in ensuring security. The first defense layer typically refers to physical security measures such as hardware security and network security, ensuring the basic stability and security of the system. The second defense layer operates at the software level, including techniques such as data encryption and identity authentication, further enhancing system security. The third defense layer pertains to behavioral security measures such as anomaly detection and real-time monitoring, enabling timely detection and response to potential security threats. This multi-layered defense system enables the platform to address various security challenges effectively, safeguarding the security of user information and data.

Moreover, the application scope of the multi-modal biometric verification and anti-counterfeiting platform is extensive, applicable not only to personal identity verification but also to various sectors such as finance, healthcare, and government affairs, providing secure and reliable solutions across industries. This not only enhances the security level of enterprises and organizations but also delivers a more convenient and secure user experience, driving the development and progress of the digital society.

In conclusion, the multi-modal biometric verification and anti-counterfeiting platform, compliant with regulations such as the EU's General Data Protection Regulation and the Personal Information Protection Law of the People's Republic of China, utilizing a three-tier defense design system, represents an innovative technology with immense potential and value. It not only enhances security and efficiency but also positively impacts the development of various industries and user experiences.

Use case status: The use case is part of a larger product development

UN Goals:

- **SDG 9:** Industry, Innovation, and Infrastructure
- **SDG 16:** Peace, Justice, and Strong Institutions

Justify UN Goals selection: The choice of Sustainable Development Goals (SDGs) by the multi-modal biometric verification and anti-counterfeiting platform stems from its positive impact on fostering economic sustainability. The core objective of the platform is to reduce instances of non-compliance. This initiative directly supports SDG 16: building peaceful, inclusive, and just societies. By applying anti-counterfeiting technology, the platform effectively safeguards intellectual property rights and the legitimate interests of goods, fostering fair competition and economic growth. Moreover, it contributes to building trust and transparency, enhancing the predictability of the business environment, thereby furthering the achievement of SDGs.

Furthermore, the platform's utilization of artificial intelligence (AI) plays a pivotal role in achieving both SDG 16 and SDG 9: Industry, Innovation, and Infrastructure. AI technologies empower the platform to implement cutting-edge algorithms for seamless biometric recognition, ensuring swift and accurate identity verification processes. This technological advancement optimizes operational efficiency and augments the platform's capabilities in safeguarding user identities.

Moreover, it reduces the time-consuming process of user authentication, which can improve the user experience and enhance user satisfaction.

Thus, through the strategic integration of AI-driven solutions, the platform contributes significantly to realizing SDGs 16 and 9 by promoting social justice, economic sustainability, innovation, and infrastructure development.

26.2.2 Future work:

- Data collection
- Model development
- Standards development related to the use case

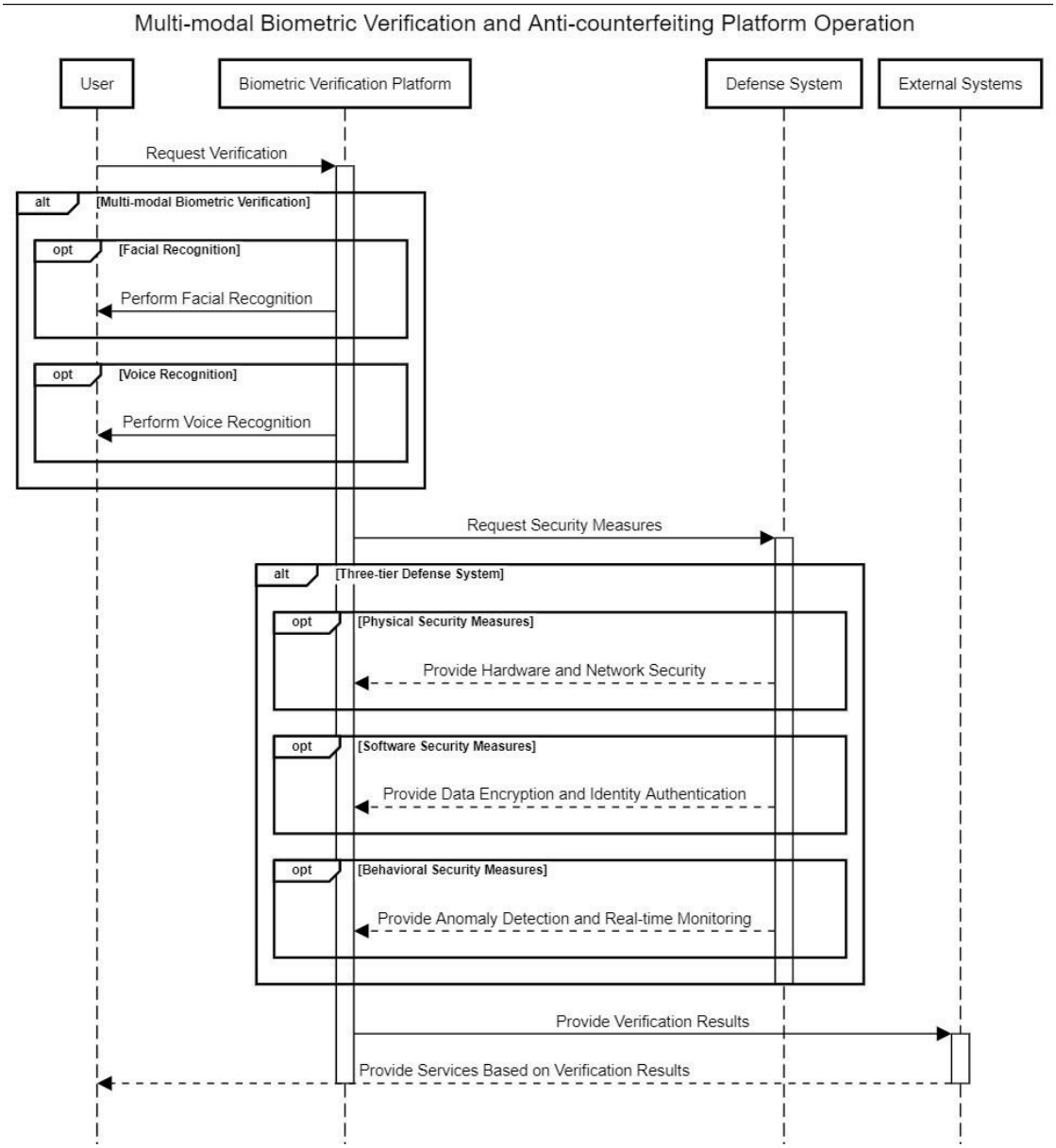
Elaborate proposal:

In the future, the multi-modal biometric verification and anti-counterfeiting platform will continue to strive for innovation and improvement to meet the growing market demands and user expectations. Firstly, we will further optimize verification algorithms to enhance recognition accuracy and speed, addressing complex and evolving security challenges. Secondly, we will expand the platform's application areas across various industries such as finance, healthcare, and logistics, providing AI solutions to a broader range of users. Additionally, we will strengthen collaborations with industry partners to advance the development and application of relevant technology collaboratively. Most importantly, we will uphold the principles of sustainable development, striving to promote social justice, economic prosperity, and environmental protection, contributing to building a better future.

26.3. Use case requirements

ITU-T Supplement ITU-T X.1000 series–Use Cases for biometrics and secure authentication technologies for digital financial services

26.4. Sequence diagram



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Use Case – 27: Metro Intelligent Customer Service Center Case

Country: China

Organization: Guangzhou GRG Intelligent Technology Solution Co., Ltd.

Contact person: ShuShen, Cheng, chengshushen@grgbanking.com

27.1. Use case summary table

Domain	Rail Transit Domain
Problem being addressed	Excavate and enrich the corpus data in the rail transit industry, construct a Large Language Model of Rail Transit Domain and continuously optimize it, study the integration of Large Language Model technology with existing small models to avoid AI hallucination issues in the public service field, and deploy the large model in a lightweight manner.
Key aspects of the solution	Processing of multi-source heterogeneous data, fine-tuning of large models, text classification and retrieval, integration of large models with industry knowledge graphs.
Technology keywords	Large Language Models, Fine-tuning, Lightweight, Knowledge Graphs.
Data availability	The data source is non-public and primarily consists of industry-specific data, including both structured and semi-structured data, such as documents from metro operating entities regarding regulations, fare parameters, and route stations, as well as records of conversations between passengers and staff.
Metadata(type of data)	The core algorithms of this project are focused in the field of NLP (Natural Language Processing), hence the training data is predominantly textual, although it also involves voice data. However, ultimately, the voice data is transformed into text data through ASR (Automatic Speech Recognition) algorithms for NLP model training and optimization.
Model training and finetuning	Instructions Tuning, LoRA Tuning.
Testbed and pilot deployment	URL: https://aimetro.grgbanking.com/guangzhou-qa/#/chat The testbed is primarily aimed at passengers of the Guangzhou Metro, with the scope of knowledge encompassing issues related to passengers' travel, such as route navigation, inquiries about facilities within the station, fare inquiries, and metro ticketing rules. At present, this environment only supports the Chinese language. Please ask questions in Chinese.

27.2. Use case description

27.2.1 Description

The expected use of the Metro Intelligent Customer Service Center case is to achieve intelligent technology services and open ticketing functions, providing passengers with a convenient travel experience and meeting the people's aspirations for a better life.

The intelligent customer service system aims to generate text, parse semantics, and answer user voice inquiries. In Metro Intelligent Customer Service products, users often raise various questions and needs, involving ticketing, routes, stations, and other aspects. Due to the diverse ways in which users express themselves, there may be situations such as word ambiguity and semantic ambiguity. Therefore, we have developed an intelligent customer service system that can quickly determine the main intentions of users, covering metro knowledge, route planning, ticket price inquiries, first and last bus time inquiries, station facilities inquiries, line transfer inquiries, and other issues, thereby reducing the workload of metro staff in receiving passenger inquiries. The intelligent customer service system combines advanced technologies such as natural language processing, machine learning, and deep learning, with strong semantic understanding capabilities. Its design and optimization have undergone multiple experiments and iterations, improving accuracy and stability, and providing reliable technical support for metro intelligent customer service products. Through the application of this algorithm, we believe that it can improve the user experience of the metro intelligent customer service system and achieve more intelligent and efficient services.

Use case Status: The use case is part of a larger product development

Is it publicly available?: No

Is it privately available?: Yes

UN Goals:

SDG 9: Industry, Innovation, and Infrastructure .The case of Metro Intelligent Customer Service Center is of great significance in terms of industry, innovation, and sustainable development goals of infrastructure. Firstly, it promotes the innovative development of the smart transportation industry, promotes digital transformation, and promotes the construction of smart cities. Secondly, it has improved the application level of informatization and integration of key equipment functions in rail transit, and enhanced the service efficiency of the transportation industry. In addition, the intelligent customer service system greatly reduces operating costs, effectively saves server resources and energy consumption, and is conducive to improving system efficiency and sustainable development.

Applying for this case will help achieve sustainable development goals. The intelligent customer service system improves customer satisfaction, supports data-driven decision-making, and promotes industrial innovation and development. In addition, this case integrates existing infrastructure, reduces human resources and energy consumption, enhances the level of intelligent urban services, lays the foundation for the construction of smart cities, and helps achieve sustainable development goals.

27.2.2 Future work:

Create new variations/extensions to the same use case

If the Metro Intelligent Customer Service Center case receives bonuses and resource support, the intelligent customer service system will focus on the following aspects in its future work plan to improve user experience and service efficiency.

Firstly, we will use the intelligent customer service system as the foundation to empower on-site equipment at the station and provide proactive services for passengers.

Secondly, the system will combine generative large language models and multimodal technology to provide passengers with more intelligent and diverse voice inquiry services.

Then, the system realizes cross channel integration, supports multiple channels such as App, applet, official account, and establishes online and offline full scene intelligent customer service.

Finally, we will take remote customer service assistance as the main focus, strengthen automated process processing, improve service efficiency, reduce on-site manual customer service intervention, and gradually achieve unmanned stations.

In terms of technological research and development, we will continue to learn and improve, continuously optimize algorithm models through data analysis and user feedback, adapt to multiple languages and cultures, customize personalized solutions, and explore applications in more scenarios.

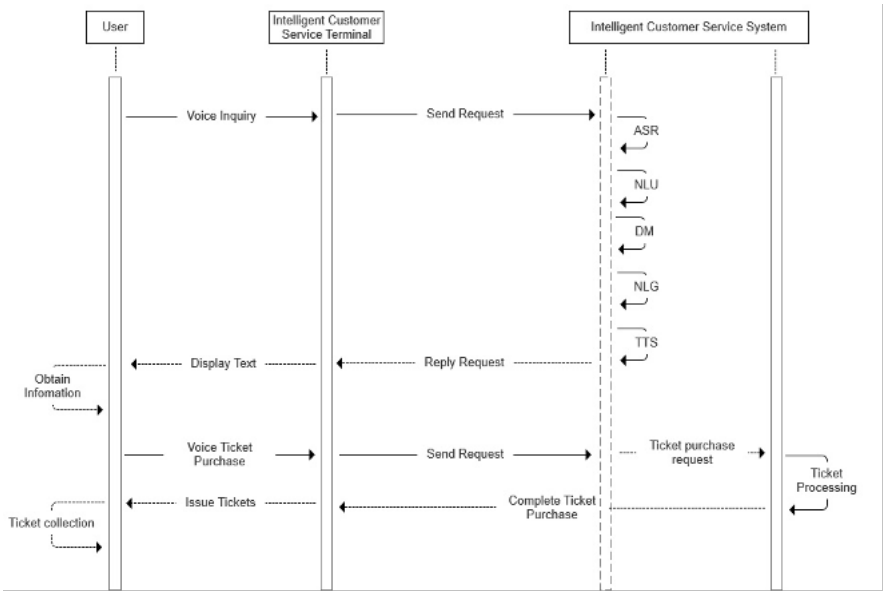
Through the implementation of the above plan, the intelligent customer service system will develop towards intelligence, emotion, personalization, and universality, in order to provide a better customer service experience and promote the sustainable development of the transportation industry.

27.3. Use case requirements

- **UC36-REQ-01:** Domain - Rail Transit Domain.
- **UC36-REQ-02:** Problem being addressed: excavate and enrich the corpus data in the rail transit industry, construct a Large Language Model of Rail Transit Domain and continuously optimize it, study the integration of Large Language Model technology with existing small models to avoid AI hallucination issues in the public service field, deploy the large model in a lightweight manner.
- **UC36-REQ-03:** Key solution - processing of multi-source heterogeneous data, fine-tuning of large models, text classification and retrieval, integration of large models with industry knowledge graphs.
- **UC36-REQ-04:** Technology keywords - Large Language Models, Fine-tuning, Lightweight, Knowledge Graphs.
- **UC36-REQ-05:** Data available - private data.
- **UC36-REQ-06:** GPU - Nvidia A100 graphics cards.
- **UC36-REQ-07:** Metadata - The core algorithms of this project are focused in the field of NLP (Natural Language Processing), hence the training data is predominantly textual, although it also involves voice data. However, ultimately, the voice data is transformed into text data through ASR (Automatic Speech Recognition) algorithms for NLP model training and optimization.

- **UC36-REQ-08:** Pipeline - Source of data (domain data) -> Collection mechanism -> Data preprocessing -> Model training-> Supervised Learning (expert supervision) -> Fine Tuning-> Distribution mechanisms.
- **UC36-REQ-09:** Model - A variety of algorithmic models, including the Transformer-based Bert and the current mainstream large language models, ensuring the accuracy of the output results through the strategic integration of multiple models.
- **UC36-REQ-10:** Model training and finetuning - Instructions Tuning, LoRA Tuning.
- **UC36-REQ-11:** Case studies - This case study has been launched and is operational in both new line projects and retrofit projects of the Guangzhou Metro and Shenzhen Metro.
- **UC36-REQ-12**: Testbeds/Experimentation/pilots/simulations/validations/tests - Model unit testing, integrated testing of the overall solution.
- **UC36-REQ-13:** Metrics, KPIs, measurements - Accuracy rate of question and answer within the scope of domain knowledge.
- **UC36-REQ-14:** Use case scenarios and Requirements - Passenger ticket purchasing scenarios in rail transit travel, scenarios where passengers consult with station staff, etc.
- **UC36-REQ-15:** Role of Trainings, standards - Enhance the generalization ability and application effectiveness of general large models in specific domains and downstream tasks.
- **UC36-REQ-16:** Role of open source - Accelerate model iteration, enhance the foundational capabilities of the model.

27.4. Sequence diagram



Use Case – 28: Digital Application of Technical Standards for China Southern Power Grid

Country: China

Organization: Electric Power Research Institute of China Southern Power Grid Company

Contact person: Lin Zhengping, linzp@csg.cn

28.1. Use case summary table

Domain	Power grid standards
Problem to be addressed	Questions answering on power grid standards Comprehension
Key aspects of the solution	Provides Standards as data, Standards as service, Standard generation and authoring tools. Query & A
Technology keywords	Semantic retrieval Standard comprehension Standard understanding Knowledge graph
Data availability	Standards are published step-by-step and currently it is Private data. Is there a plan to publish the standards as open data? (already published the standards in 5 provinces in China, can be used by public to generate new models, In Chinese language)
Metadata (type of data)	textual data, Some images + formulae and tables.
Model Training and fine tuning	Transformer models Q&A robots.
Testbeds or pilot deployments	Lin Zhengping, Tu Liang, Huang Junkai, et al. Design and Application of Digital Power Grid Standard Information System Based on Knowledge Graph [J]. Journal of Central South University for Nationalities (Natural Science Edition), 2023,42 (03): 394-401. DOI: 10.20056/j.cnki ZNMDZK.20230315.

28.2. Use case description

28.2.1 Description

The technical standard data of China Southern Power Grid has numerous sources and a large amount of data. How to efficiently leverage the value of standard data has become a major challenge in the digital transformation of standards. As the "Central Research Institute" of China Southern Power Grid Corporation, China Southern Power Grid Research Institute aims at major strategic needs in the industry, applies industry-leading artificial intelligence technology, independently designs and comprehensively coordinates, upgrades the entire lifecycle process of "management, inspection, use, and compilation" of power technology standards, builds the first digital application platform for technology standards in the energy field, realizes intelligent retrieval, intelligent Q&A, intelligent writing, and intelligent recommendation of standard documents, efficiently promotes the digital transformation of China Southern Power Grid technology standards throughout the entire process, and creates a benchmark case for the digital transformation of power industry standards. The advantage lies in providing comprehensive digital solutions, building a systematic standard knowledge base, and providing intelligent services. The application of large models not only improves the efficiency of reviewing standards by more than 50%, but also assists employees in writing standard outlines and main texts, increasing the efficiency of standard writing by more than twice; The shortcomings lie in the need to further ensure data security and compliance.

UN Goals:

- **SDG 9:** Industry, Innovation, and Infrastructure
- **SDG 11:** Sustainable Cities and Communities

Justify UN Goals Selection: Through digital transformation and intelligent standardization work, the application case aims to "reshape standardized business with digitization, improve standardized management and service capabilities", digitize and network information such as equipment standard experience, and construct a new type of standard model that is readable and understandable for digital power grid equipment, achieving efficient circulation and interactive integration of standard knowledge within the enterprise. Based on real-time data collection, monitoring, and status perception of the physical power grid, and relying on standard digital platforms to provide intelligent services such as digital standard generation, design compliance review, and operation ticket auxiliary generation, a digital twin of the power grid is constructed from a standard digital perspective, greatly improving the level of physical power grid management, promoting industrial innovation and infrastructure construction, providing more intelligent and efficient infrastructure and services for cities, and promoting the realization of sustainable development of cities.

28.2.2. Future work

- Model development
- Create new variations/extensions to the same use case
- Standards development related to the use case

If we receive bonuses and resource support, our future work plan will be more fulfilling. We will deepen the intelligent application of its technical standards by adopting the latest artificial intelligence technology to optimize functions such as intelligent retrieval, question answering,

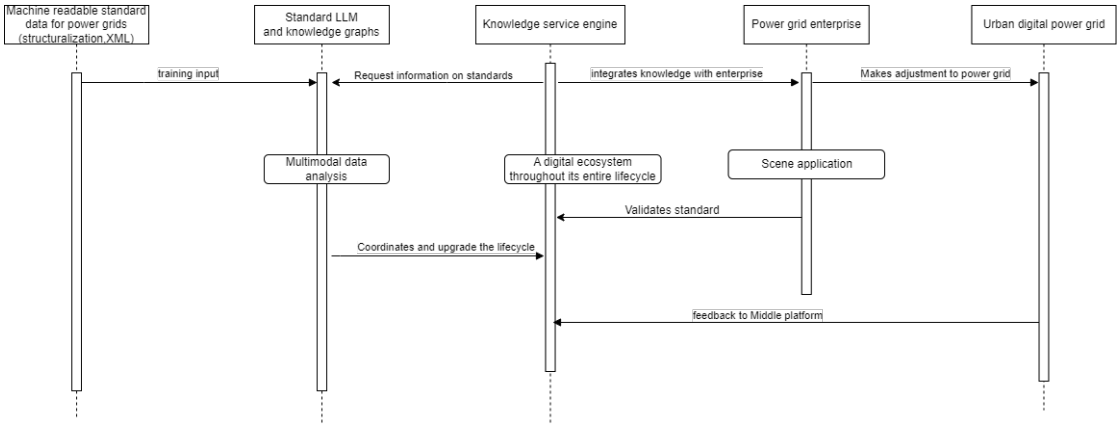
writing, and recommendation, in order to improve system accuracy and response speed. At the same time, the plan is to continuously update and expand the standard knowledge base to ensure that users can access the most comprehensive and cutting-edge standard information. In ensuring data security and compliance, we will increase investment in data encryption technology and improve the data compliance management system to ensure the security, reliability, and legality of data processing activities. In addition, the plan is to share its experience and achievements in digital transformation of technical standards through seminars, workshops, and other forms, to promote industry exchange and cooperation. At the same time, establish a continuous improvement mechanism, regularly adjust and optimize platform functions to continuously meet user needs and industry development needs, support high-quality development and intelligent enhancement of the power energy business, further strengthen its leadership position in the field of digital transformation of power industry standards, and make greater contributions to achieving sustainable development goals._

28.3. Use case requirements

This section describes the requirements for each entity on the Repository of tools to empower modern Framers.

- **DATSCSPGUC28 REQ-001:** It is required to train standard big model and knowledge graph with machine readable standard data
- **DATSCSPGUC28 REQ-002:** The model and knowledge graph requires a platform where enterprise can ask question on power grid standard
- **DATSCSPGUC28 REQ-003:** Standard middle platform requires the multimodal analysis to coordinate and upgrade the life cycle which involves management ,inspection, use, and compilation" of power technology standards
- **DATSCSPGUC28 REQ-004:** The enterprise requires the standard big model and knowledge graph to generate responses on power grid standards
- **DATSCSPGUC28 REQ-005:** The Power grid enterprise validates the generated response before implement standards using Scene application
- **DATSCSPGUC28 REQ-006:** Power grid enterprise requires the Standard middle platform to integrate generated responses on standard with Power grid enterprise
- **DATSCSPGUC28 REQ-007:** Urban power grid requires the power grid enterprise to make necessary adjustment base on validated standard

28.4. Sequence diagram



28.5. References

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Use Case – 29: AI-based Video Analysis System to Intelligently Protect the Lives of Miners

Country: China

Organization Name: Shenzhen Corerain Technologies Co.Ltd.

Contact: Dai Jie, jie.dai@corerain.com

29.1. Use case summary table

Domain	Mining, Protecting Lives
Problem to be addressed	Protect lives of miners and safety of mining equipment
Key aspects of the solution	• Streaming accelerator for AI • Safety surveillance and monitoring system • Edge computing device + algorithms for monitoring the safety of miners and mining equipment • Hardware, algorithm, platform and service layers
Technology keywords	Edge Computing, Surveillance and Monitoring for Mining, AI Streaming Accelerator
Data availability	Both publicly and privately available data
Metadata (type of data)	Video streaming input
Model Training and fine tuning	Anomaly detection, Diffusion for generation of new samples, CNN, detection, classification and segmentation.
Test beds or pilot deployments	• Baijigou coal mine • 100,000 alarms with 95% accuracy

29.2. Use case description

29.2.1 Description

According to statistics from Global Energy Monitor (GEM)[1], there are nearly 3 million miners worldwide. However, the working environment in mining areas is exceptionally complex with frequent occurrences of major production accidents. With the development of the Internet of Things (IoTs), most mining areas have deployed cameras, sensors, and other devices to monitor the safety of production. Due to limitations such as manpower, distance, and operating environments, these solutions are unable to timely detect and intervene during unsafe behaviors

of personnel, risky conditions of equipment, and environmental safety factors. As a result, the safety of millions of miners' lives and property is at risk.

In order to improve the efficiency of safety management in mining areas, protect the lives of miners, and safety of equipment, Corerain Technology has collaborated with Ningxia Coal to propose an integrated AI based video analysis system using AI-based streaming accelerator technology. The system consists of three layers: computing power, algorithms, and platform. The computing power layer utilizes the globally leading Custom AI Streaming Accelerator (CAISA)[2] chip to create a high-performance, cost-effective, and low-latency AI computing infrastructure. The algorithm layer deploys over ten high-precision custom algorithms tailored to actual mining operation scenarios, including blockages in coal conveyor belts, instances of smoke and fire in surface substations, and unauthorized entry into hazardous areas. The platform layer builds a visual "cockpit" to achieve intelligent analysis and early warning in mining areas 24/7.

After the deployment of this system in the Baijigou Coal Mine of Ningxia Coal, the mine area has achieved second-level warning of safety risks. Within six months, it has triggered more than 100,000 alarms in total, with an average measured accuracy of over 95%. This has significantly reduced potential accidental risks in coal mine production, achieved zero accidents in the mine area, and improved the safety of miners' lives and possible damages to property.

UN Goals:

- **SDG 8:** Decent Work and Economic Growth
- **SDG 9:** Industry, Innovation, and Infrastructure
- **SDG 12:** Responsible Consumption and Production

This case will effectively contribute to the achievement of multiple Sustainable Development Goals (SDGs), including:

1. SDG 8 - Decent Work and Economic Growth: The AI video analysis system created in this case can achieve real-time AI monitoring and early warning in various complex, special, and extreme working environments, providing frontline workers with a safer, more convenient, and stable working environment, thus safeguarding workers' lives and property.
2. SDG 9 - Industry, Innovation, and Infrastructure: Energy and information technology are crucial for infrastructure industries to achieve sustainable development in various countries and regions. This case innovatively applies emerging technologies such as artificial intelligence and the Internet of Things (IoT), effectively improving industrial production and resource utilization efficiency, helping traditional industries transform and upgrade, and providing significant impetus for global economic growth.
3. SDG 12 - Responsible Consumption and Production: The CAISA chip used in this case achieves a performance that is up to 4.12 times higher while costing only one-third of similar international products. This significantly reduces the deployment costs of artificial intelligence and accelerates the industrial digitization process. Replicating and promoting this case in other fields will effectively reduce the economic, environmental, and social costs of future global development.

29.2.2. Future work

- Create new variations/extensions to the same use case
- Standards development related to the use case

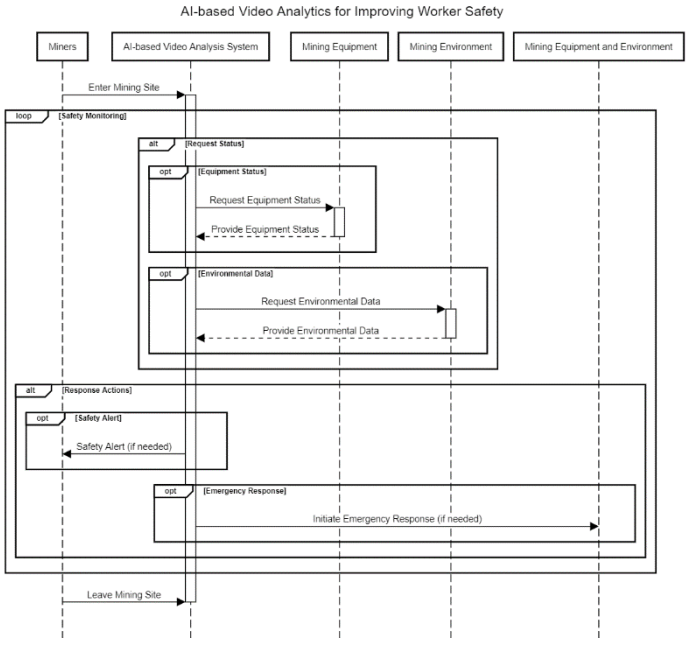
Leveraging the performance and cost advantages brought by the innovative architecture of reconfigurable data flow, Kunyun Technology has launched a series of computing power products and solutions that have supported partners in more than 20 industries, including petrochemicals, mining, electricity, smart city, transportation, and agriculture, in implementing thousands of digital projects.

In the future, Corerain Technology will collaborate with partners across various industries to create industry benchmark cases based on past high-quality project practices. This initiative aims to provide industry-related guidelines and standards, offering decision-making references for enterprises embarking on the journey of digital transformation, and accelerating the global implementation of artificial intelligence. Simultaneously, Corerain Technology will continue to iterate on related artificial intelligence products and solutions, enabling advanced technology to penetrate deeply into various scenarios of social production. This will fully unleash the social and economic value of artificial intelligence, gradually benefiting all humanity.

29.3. Use case requirements

- ITU-T SG16 - F.OHSP-req "Requirements and framework of occupational health service platform" (New): Output draft (Rennes, 15-26 April 2024)
- IEEE P2840 - IEEE Draft Standard for Responsible AI Licensing
- P2976 - Standard for XAI - eXplainable Artificial Intelligence - for Achieving Clarity and Interoperability of AI Systems Design
- P3110 - Standard for Computer Vision (CV) - Technical Requirements for Algorithms Application Programming Interfaces (APIs) of Deep Learning Framework
- IEEE 7010-2020 - IEEE Recommended Practice for Assessing the Impact of Autonomous and Intelligent Systems on Human Well-Being
- P7010.1 - Recommended Practice for Environmental Social Governance (ESG) and Social Development Goal (SDG) Action Implementation and Advancing Corporate Social Responsibility

29.4. Sequence diagram



Link

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Use Case – 30: Financial Model Empowered AI Digital Employee Bridge "Digital Divide"

Country: China

Organization: SenseTime

Contact Person: Zhengkun HU, huzhengkun@sensetime.com

30.1. Use case summary table

Domain	Financial services
Problem to be addressed	Compassionate communication banking Services for Ageing population Accessibility of digital financial services to elderly Intelligent financial services
Key aspects of the solution	Financial Knowledge Base, Large Language Model(LLM), Hyper-realistic Digital Human
Technology keywords	Vision, NLP, LLM, banking, digital Human
Data availability	Private data
Metadata (type of data)	Video/images, audio, text
Model Training and fine tuning	Voice processing, NLP Generative AI (video and text), TTS (text to sound), STA (speech to Animation)
Case Studies	link
Testbeds or pilot deployments	Having completed the knowledge base training of 2,000 Q&A data and 100,000 corpus data, with a 20% improvement in response accuracy in the second phase compared to the first phase Bank of Shanghai Mobile App link Shanghai bank Puxi HQ link Metaverse bank link

30.2. Use case description

30.2.1 Description

Based on SenseTime's "SenseChat" language model and "SenseAvatar" digital human video generation technology, SenseTime, in collaboration with the Bank of Shanghai, has developed two digital employees, "Hai Xiaozhi" and "Hai Xiaohui". These digital employees provide

professional interactive services such as business consulting, business guidance, product recommendations, cultural promotion, and customer investment education to users. It aimed at helping or assist elderly customers to handle mobile services, solve the problem that elderly customers do not know or dare to use mobile banking, and help elderly customer groups bridge the "digital divide". The system uses a large language model enriches the financial knowledge base, effectively identifies questions and answers accurately; innovatively proposes the architectural concept of "device-side rendering + cloud push streaming" to optimize the allocation of computing resources; adopts "AI digital employees" instead of "search boxes" access all mobile banking services.

Data Source: Private

UN GOAL:

- **GOAL 9:** Industry, Innovation, and Infrastructure
- **GOAL 10:** Reduced Inequalities

Justify UN Goals seletion:

- SDG 9 - Industry, Innovation, and Infrastructure:
    - in terms of industry: increasing the penetration rate of financial services; promoting financial inclusion; and enhancing customer experience, which are crucial to the long-term development and branding of banks.
    - in terms of innovation: Promote financial technology innovation, stimulate new business models, promote cross-industry cooperation, and promote technological exchanges and innovative cooperation between different fields.
    - Infrastructure: To support the operation of digital employees, banks need to strengthen digital infrastructure. The strengthening of these infrastructures is beneficial to the digital transformation of the entire society.
- SDG 10 – Reduced Inequalities: The digital employees created by SenseTime for the Bank of Shanghai not only improve the efficiency and quality of banking services, but also make positive contributions to achieving sustainable development goals in terms of promoting industrial upgrading, stimulating innovation vitality and strengthening infrastructure construction.

Name of partner: Bank of Shanghai

30.2.2 Future work

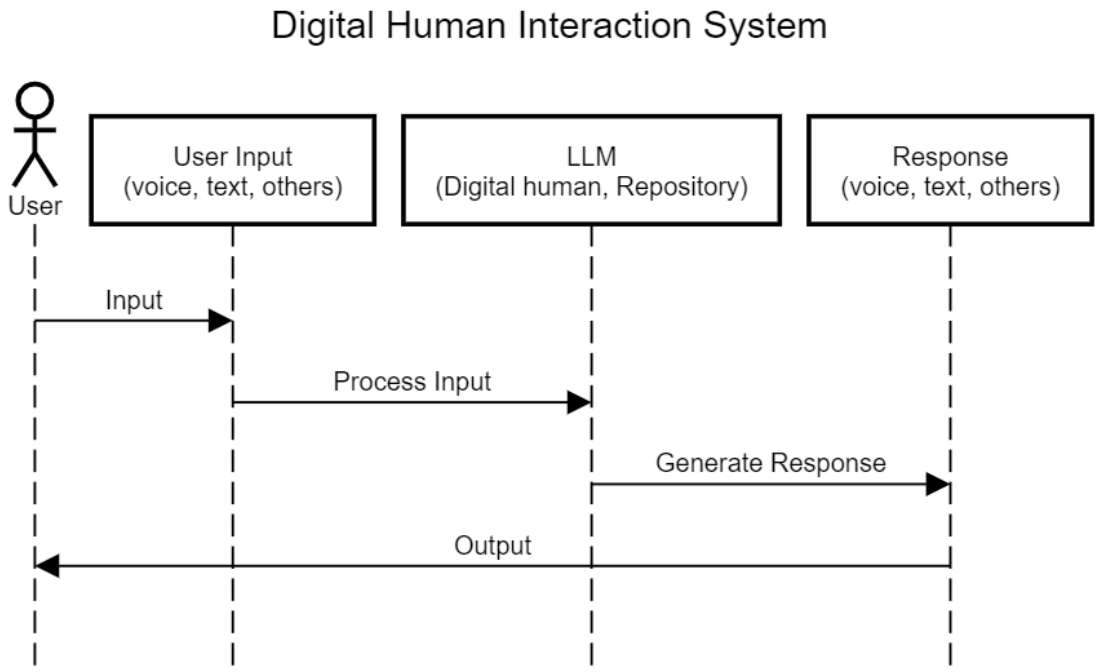
In the future, SenseTime is committed to expanding its reach and impact, particularly in underserved areas and among vulnerable populations such as small and micro businesses and the elderly. Leveraging the power of artificial intelligence, SenseTime aims to develop more advanced “brains”, more engaging “voices”, and more distinctive “behaviors” for Hai Xiaozhi and Hai Xiaohui. These enhancements will equip these digital employees with greater capabilities, enabling them to provide more effective and efficient services.

30.3. Use case requirements

ITU-T Supplement Y.71 ITU-T Y.3000 series – Use Cases for Financial Technology

- **BS-AIDE-UC30-REQ-001:** It is critical that speech-speech Bank of Shanghai AI Digital Employees, which provide access to financial services and guidance, are available in local languages.
- **BS-AIDE-UC30-REQ-002:** It is critical that a Bank of Shanghai AI digital employee integrates NLP and local language automatic speech recognition (ASR) to facilitate efficient communication between customers and the bank.
- **BS-AIDE-UC30-REQ-003:** It is critical that Bank of Shanghai AI digital employees allow customers to report their queries and needs remotely through voice or text in the local language, which is critical given the complexity of the local language script and the prevalent use of voice input among the elderly population.
- **BS-AIDE-UC30-REQ-004:** It is critical that the platform employs keyword detection algorithms to extract essential information from customer inputs and automatically generates comprehensive summary reports for the bank.

30.4. Sequence diagram



Use Case – 31: Smart City Energy Grid Infrastructure based on Big Data of Lithium Batteries

Country: China

Organization: Hanghzou Yugu Technology CO., LTD

Contact person: Zhao Li, lizhao@yugu.net.cn

31.1. Use case summary table

Domain	Smart Energy Service
Problem to be addressed	Eco friendly energy management Battery Range Anxiety Inconvenient Battery Charging Public Casualty Reduce invalid mileage Reduce Carbon Emission
Key aspects of the solution	Battery swap as a service (BaaS) LBS (Location based Service) BMS (Battery Management System) AIoT Resource Allocation and Scheduling App Battery Range Estimation Battery Anomaly Detection
Technology keywords	AIoT (Artificial Intelligence of Things), Big Data
Data availability	
Metadata (type of data)	Rider pattern Sensor data (Temperature, Acceleration, GPS, smoke, power, etc,.)
Model Training and fine tuning	SEB (sharing E-Bike) Transformer, GNN, Transformer, Graph Neural Network
Testbeds or pilot deployments	Demo link Paper or reference • Efficient and Sustainable Battery-Swap Service: A Green AIoT Solution for City E-Bike Riders link • Transformer-based Graph Neural Networks for Battery Range Prediction in AIoT Battery-Swap Services link • Anomaly Detection in Battery Charging Systems: A Deep Sequence Model Approach link • Real-time E-bike Route Planning with Battery Range Prediction link

31.2. Use case description

31.2.1 Description

The new infrastructure of smart city energy networks based on big data of lithium batteries utilizes AIoT (Artificial Intelligence of Things) technology to achieve functions such as active battery balancing, efficient battery endurance, energy consumption management, fault diagnosis, and fault-tolerant control, ensuring battery safety and endurance. Building a city-wide battery swapping network changes the consumption mode of instant delivery through technological innovation, realizing a mode of swap instead of charge, thereby improving energy supply efficiency by separating vehicle and battery. It addresses the sustainable development issues of safety, efficiency, and environmental friendliness in the social consumption and service sectors of new energy low-speed vehicles, promoting the intelligence and digitization of the entire industry and significantly enhancing social and economic benefits, providing innovative solutions for smart energy consumption for 35 million low-speed vehicles in China.

However, the current new infrastructure system of smart city energy networks may face some challenges. For example, establishing, maintaining, and popularizing extensive battery swapping networks require substantial financial investment and policy support. At the same time, it is also necessary to establish a unified battery swapping standard system to promote the healthy, orderly, and sustainable development of the industry.

The widespread distribution of electric bicycle battery swapping networks enables urban electric bicycle users to find stations for battery swapping within a few kilometers, ensuring access to clean and affordable electricity and reducing the cost of charging and purchasing batteries by approximately 3000 yuan per person. The primary users of the battery swapping network are urban delivery riders. Our data shows that the battery swapping network increases the daily delivery volume of riders by approximately 40%, reducing ineffective mileage spent on charging routes by about 6 km per person per day. This promotes sustainable digital economic growth and can annually reduce carbon emissions from ineffective mileage by nearly 6000 tons. The battery swapping network not only contributes to achieving urban dual carbon reduction goals and shared prosperity for delivery riders but also facilitates convenient battery swapping for the vast urban mobile population of electric vehicle users, eliminating power loss and safety hazards associated with charging. This establishes a safe, disaster-resistant, and sustainable smart city.

Use case status: The use case is part of a larger research project

UN Goals:

- **SDG 7:** Affordable and Clean Energy
- **SDG 8:** Decent Work and Economic Growth
- **SDG 11:** Sustainable Cities and Communities

31.2.2 Future work

Model development, Create new variations/extensions to the same use case, Standards development related to the use case. Utilize funding support to accelerate the construction speed of battery swapping stations, expanding network coverage to include major urban areas, transportation hubs, commercial centers, and residential communities, enabling more users to

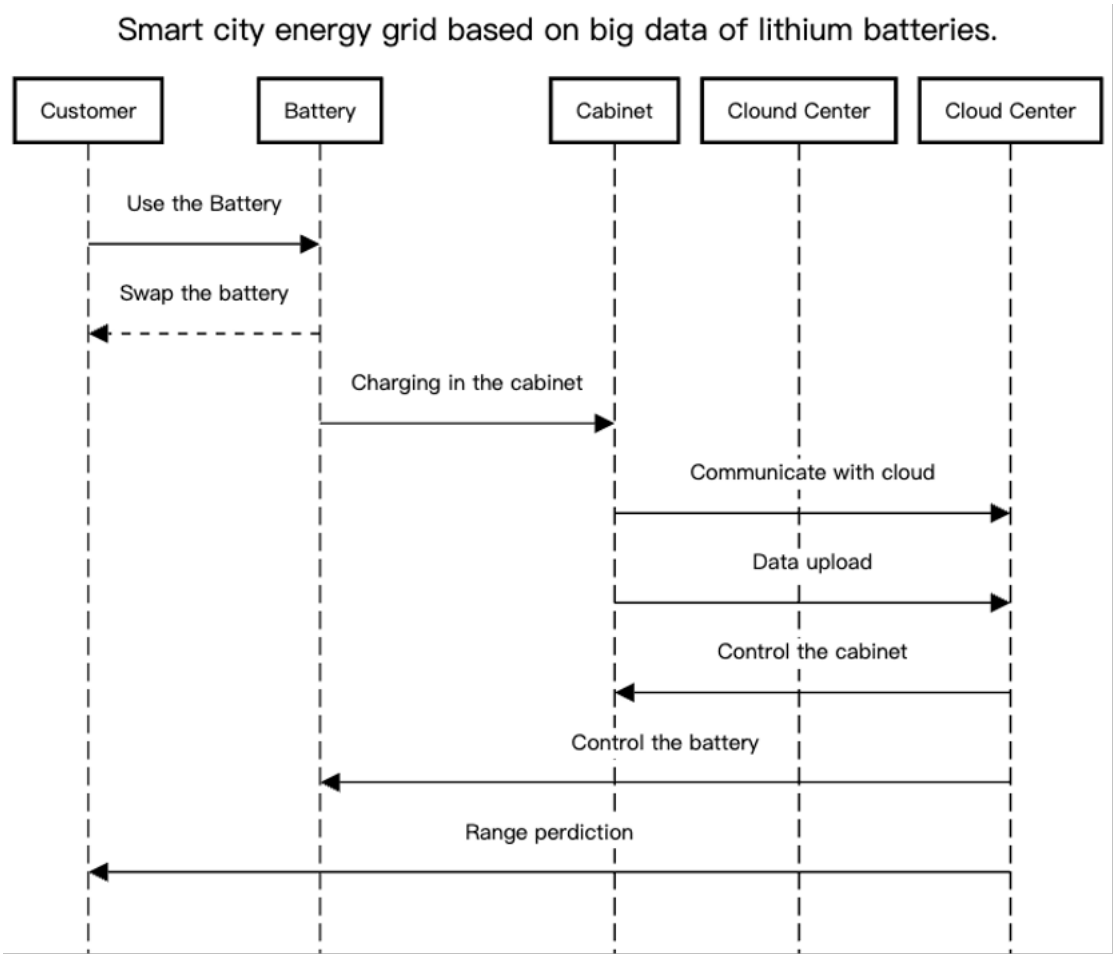
enjoy convenient charging services. Allocate funds for technological research and innovation to continuously improve the performance and functionality of the battery swapping system. This can involve further optimizing the design of charging and swapping equipment to enhance safety, stability, and durability. Additionally, invest in research on advanced technologies such as IoT, big data analytics, and artificial intelligence to enhance the intelligence level of the system and user experience. Market promotion and advertising: Increase efforts in marketing and promoting battery swapping projects to enhance awareness and acceptance among urban electric vehicle users, replacing home charging with battery swapping to reduce energy consumption and safety hazards. Collaboration and expansion: Actively seek cooperation with government departments, transportation enterprises, and shared mobility platforms to jointly promote the popularization and adoption of electric transportation and facilitate the development of electric mobility.

31.3. Use case requirement

ITU-T Supplement Y.71 ITU-T Y.3000 series – Use Cases for Energy Saving for Energy Service Technology

- **SC-EG-UC31-REQ-001:** It is critical that a smart city energy grid infrastructure based on big data of lithium batteries utilizes AIoT (Artificial Intelligence of Things) technology to achieve functions such as active battery balancing, efficient battery endurance, energy consumption management, fault diagnosis, and fault-tolerant control, ensuring battery safety and endurance.
- **SC-EG-UC31-REQ-002:** It is critical that the system builds a city-wide battery swapping network that changes the consumption mode of instant delivery through technological innovation, realizing a mode of swap instead of charge, thereby improving energy supply efficiency by separating vehicle and battery.
- **SC-EG-UC31-REQ-003:** It is critical that the system addresses the sustainable development issues of safety, efficiency, and environmental friendliness in the social consumption and service sectors of new energy low-speed vehicles, promoting the intelligence and digitization of the entire industry and significantly enhancing social and economic benefits.
- **SC-EG-UC31-REQ-004:** It is critical that the system provides innovative solutions for smart energy consumption for 35 million low-speed vehicles in China.
- **SC-EG-UC31-REQ-005:** It is critical that the system faces challenges such as establishing, maintaining, and popularizing extensive battery swapping networks which require substantial financial investment and policy support. At the same time, it is also necessary to establish a unified battery swapping standard system to promote the healthy, orderly, and sustainable development of the industry.

31.4. Sequence diagram



31.5. Reference

- Efficient and Sustainable Battery-Swap Service: A Green AIoT Solution for City E-Bike Riders link
- Transformer-based Graph Neural Networks for Battery Range Prediction in AIoT Battery-Swap Services link
- Anomaly Detection in Battery Charging Systems: A Deep Sequence Model Approach link
- Real-time E-bike Route Planning with Battery Range Prediction link

Use case – 32: Yuanjing Large Model (Medical)

Country: China

Organization: China Unicom

Contact person: Dong Li, lid530@chinaunicom.cn

Haoran Wu, wuhr15@chinaunicom.cn

32.1. Use case summary table

Domain	Health, medical
The problem to be addressed	Patient medical selection Pre-diagnosis Interpretation of medical reports Medical research assistance
Key aspects of the solution	Data governance Intelligent Patient medical guidance Online intelligent consultation Medical research assistance
Technology keywords	Large models Comprehension generation
Data availability	Private data,
Metadata (type of data)	Natural language text, test results, multi-modal reports, patient queries (chat and video)
Model Training and fine-tuning	Pretrain with Medical data SFT, P-tuning
Testbeds or pilot deployments	pilot deployments case in a hospital in Guangdong Province

32.2. Use case description

32.2.1 Description

Yuanjing Large Model (Medical) is committed to comprehensively empowering various application scenarios in the medical and health field, targeting scenarios such as patient medical selection and pre diagnosis information collection before seeking medical treatment,

and constructing intelligent service processes for the pre diagnosis process; Targeting medical research, building clinical research data governance capabilities and clinical research indicator systems, providing data retrieval services, data processing services, intelligent indicator development services, and research output assistance to support clinical research scenarios for doctors; Develop the ability to interpret health reports for health examination scenarios. Build an intelligent service loop centered around clinical testing, including pre examination, in examination, and post examination, to provide higher quality and flexible AI medical services for intelligent healthcare.

The current plan utilizes the understanding and generation capabilities of large models, which can help doctors and patients quickly understand the condition, assist in health assessment, department recommendations, and so on. Compared to the past, using information databases for retrieval or deep learning model solutions is faster, more convenient, and more user-friendly. However, the current large model still has the problem of "hallucinations", which can only be auxiliary and cannot be used for decision-making.

GPU: Ascend910B

Use case status: The use case is part of a larger research project

UN Goals:

- **SDG 3:** Good Health and Well-being

SDG3 - Good Health and Well-being: Yuanjing Large Model (Medical) is an industry model specifically trained for the medical industry. It can provide patients with functions such as medical selection, pre diagnosis information collection, and pre consultation before seeking medical treatment, provide department recommendation services during medical treatment, and provide health report interpretation services after medical treatment to help patients seek medical treatment more conveniently and flexibly. At the same time, it can provide clinical research data retrieval and processing services for doctors, as well as auxiliary services such as research output and paper analysis for medical research, helping doctors better engage in medical and scientific research work.

32.2.2 Future work

Create new variations/extensions to the same use case

Elaborate proposal:

- Completed in the first half of 2024: recommended departments for medical treatment, recommended hospitals, natural language retrieval for medical research assistants, analysis of test results, interpretation of multimodal reports, pre - and post medical inquiries from patients. And coordinate with local hospitals for initial implementation.
- Completed in the second half of 2024: pre consultation health assessment, medical research assistant scientific research data analysis and statistics, paper analysis, assisted paper writing, automatic output of general inspection reports, drug inquiry, drug knowledge Q&A, medication guidelines, personalized follow-up, health assessment and other services. Further promote the application scope

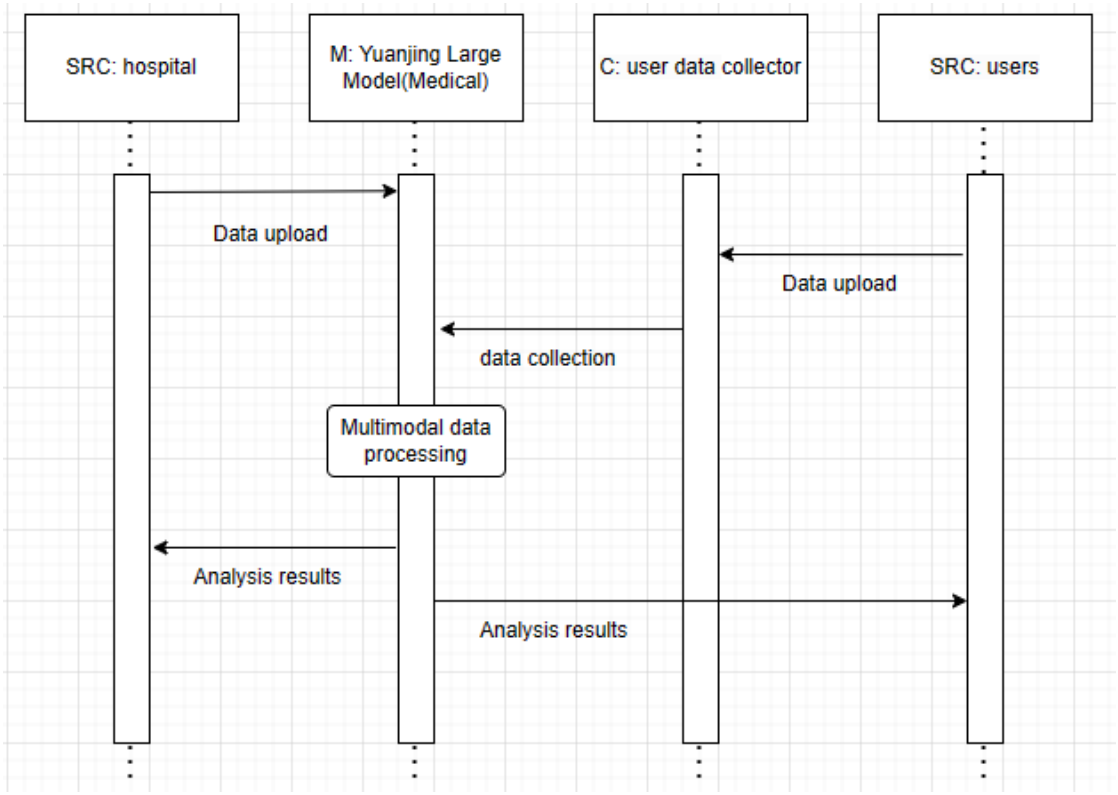
In the future, we will further iterate our product capabilities based on market and medical patient needs, and promote them to more hospitals.

32.3. Use case requirements

ITU-T Supplement Y.71 ITU-T Y.3000 series – Use Cases for AI-Driven Medical Assistance and Clinical Research Support

- **YJ-LM-UC32-REQ-001:** It is critical that YJ-LM are capable of processing and analyzing large amounts of data from various sources, contribute to more accurate diagnoses and treatments, leading to better health outcomes globally.
- **YJ-LM-UC32-REQ-002:** It is crucial that YJ-LM have a user-friendly interface that allows both healthcare professionals and patients to easily interact with it, making healthcare more accessible and reducing health disparities.
- **YJ-LM-UC32-REQ-003:** It is vital that YJ-LM provide support for medical research, such as data retrieval and processing services, accelerating medical advancements and leading to the development of new treatments and therapies.
- **YJ-LM-UC32-REQ-004:** It is imperative that YJ-LM offer a range of healthcare services, such as pre-diagnosis information collection, department recommendations, and health report interpretation, making healthcare more efficient and patient-centric.
- **YJ-LM-UC32-REQ-005:** It is important that YJ-LM continuously learn and improve based on feedback and new data, ensuring that the model stays up-to-date and continues to provide high-quality healthcare services.
- **YJ-LM-UC32-REQ-006:** It is necessary that YJ-LM adhere to all relevant ethical guidelines and regulations, particularly those related to data privacy and security, maintaining trust in AI and its role in healthcare.
- **YJ-LM-UC32-REQ-007:** It is essential that YJ-LM clearly communicates their limitations. They must state if they are not capable of handling a new case or one that is uncertain to the model.

32.4. Sequence diagram



Use case – 33: Embrace the Forest

Country: Brazil

Organization: umgrauemeio

Contact person: Osmar Bambini, osmar.bambini@umgrauemeio.com

33.1. Use case summary table

Domain	Management of wildfires
Problem to be addressed	A holistic, multi-stakeholder approach, adding high-end tools and technologies, respecting local knowledge, and cultural and biological diversity. • Currently the fire management approach is reactive. • Loses time, effort. • Emission reduction from wetland.
Key aspects of the solution	Predictive approach by managing fire, avoiding fire, Prevention, response. In line with local knowledge. Community empowering technologies Early detection is key to extinguishing fires. Used LabVIEW in the past (until 2020) earlier / switched to Python
Technology keywords	NASA, Geographic positioning of communities, Power lines (are shut many times due to wildfire, 30% of the cause is wildfire), this affects the energy utilities availability KPIs. Computer vision (cameras based on python, identify smoke, 20 km range) and satellites. Satellite detection (has limitations, latency between detection and action, satellite have diverse capabilities, coordination of the satellite orbit is not always possible). Satellites can help in fire propagation model. (French collaboration) Post fire analysis.
Data availability	Most of the image data is private. Link Satellite detection data can be shared.
Metadata (type of data)	Streamed videos, detect smoke and light, Satellite images are used only for post-fires, Sensors from satellite which can detect heat (diverse generation of sensor).
Model Training and fine tuning	Anomaly detection for smoke and light. No opensource algorithms.

(continued)

Domain	Management of wildfires
Testbeds or pilot deployments	India, Portugal and Brazil Monitoring currently 17,5 million Hectares Brazilian wetlands 2,5 million hectare Traditional communities from Amazon (tribes) Repository: link References: [1] Embrace the Forest PDF: link [2] Embrace the Forest Available website: link [3] Pantanal Traverse Documentary link [4] umgrauemeio B Corp link [5] Article Pantanal (Naturaleza y Sociedad) link [6] TV News link [7] Images Pantanal Set-up link [8] Sotware Images: link [9] WEF - Uplink Page link

33.2. Use case description

33.2.1 Description

Use case status: The use case is part of a larger product development

Embrace the Forest goal is to address the growing threats of wildland fires to communities, biodiversity, and the environment by empowering forest fire resilience in wildland territories and by activating a holistic, multi-stakeholder approach, adding high-end tools and technologies, respecting local knowledge, and cultural and biological diversity.

UN Goals:

- **SDG 3:** Good Health and Well-being,
- **SDG 6:** Clean Water and Sanitation,
- **SDG 8:** Decent Work and Economic Growth,
- **SDG 13:** Climate Action,
- **SDG 15:** Life on Land

Justify UN SDG Goals selection: The "Embrace the Forest" project is intricately connected to the issue of fire, particularly in the context of forest management and conservation. Fire prevention and control are essential components of the project, as wildfires can have devastating impacts on ecosystems, human health, and economic development. Here's how the project aligns with the Sustainable Development Goals (SDGs) concerning fire:

- SDG 13: Climate Action: Wildfires contribute significantly to carbon emissions, exacerbating climate change. By implementing effective fire management strategies, the "Embrace the Forest" project helps mitigate the impact of fires on the climate, aligning to take urgent action to combat climate change and its impacts.

- SDG 15: Life on Land: Uncontrolled fires can lead to deforestation, loss of biodiversity, and land degradation. The project's focus on sustainable forest management includes measures to prevent and control fires, thereby protecting terrestrial ecosystems and promoting biodiversity.
- SDG 3: Good Health and Well-being: Smoke from wildfires can have severe health impacts, particularly on respiratory and cardiovascular systems. By reducing the incidence and severity of fires, the project contributes to improving air quality and public health.
- SDG 8: Decent Work and Economic Growth: Wildfires can destroy livelihoods, particularly in rural areas where communities depend on forests for their income. The project's fire prevention efforts help safeguard jobs and economic activities related to forestry, agriculture, and tourism.
- SDG 6: Clean Water and Sanitation: Fires can contaminate water sources and disrupt water supply systems. By protecting forests and preventing fires, the project helps ensure the availability and sustainable management of clean water for all.

33.2.2 Future work

Create new variations/extensions to the same use case Elaborate proposal: Expanding the "Embrace the Forest" project to other areas of Brazil and measuring its results is a strategic move that can significantly amplify its impact on sustainable development and environmental conservation. Here's a proposed plan for scaling up the project and establishing a robust framework for monitoring and evaluation:

The expansion strategy involves a comprehensive regional analysis to identify and prioritize areas in Brazil most susceptible to deforestation, wildfires, and biodiversity loss, particularly those with high ecological significance and communities heavily reliant on forest resources. It emphasizes stakeholder engagement, including local communities, government agencies, NGOs, and private sector partners, to build collaborative networks essential for project success and sustainability. The strategy also includes capacity building through training programs on sustainable forest management, fire prevention, and conservation practices. Advanced technologies like remote sensing, GIS mapping, and the Pantera platform are integrated for real-time forest condition monitoring and fire detection. A robust monitoring and evaluation framework is established, encompassing baseline assessments, performance indicators aligned with the SDGs and project objectives, systematic data collection, and impact analysis using statistical and geospatial tools. The framework also incorporates adaptive management for continuous learning and adjustment, and a comprehensive reporting system for transparent communication with stakeholders, funders, and the public. This holistic approach ensures long-term project success and maximizes impact.

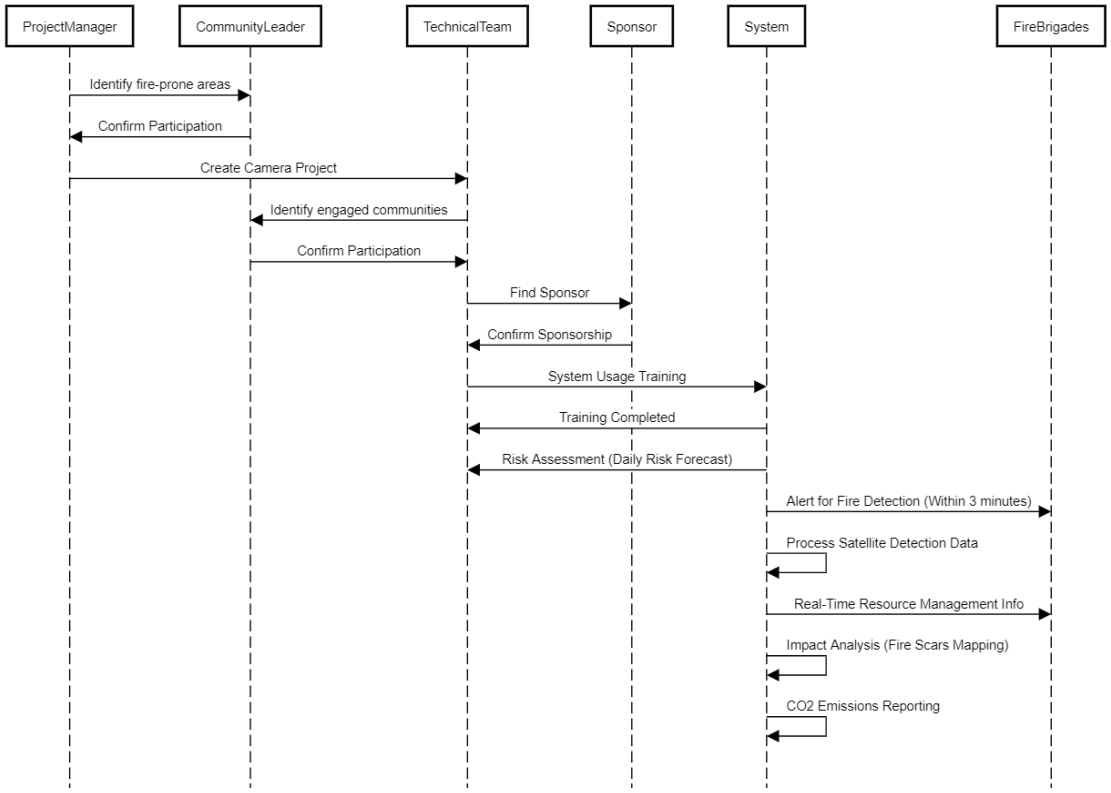
33.3. Use case requirements

ITU-T Supplement Y.71 ITU-T Y.3000 series – Use Cases for Protection wildfire Technology

- **EF-UC33-REQ-001:** It is critical that the Embrace the Forest project addresses the growing threats of wildland fires to communities, biodiversity, and the environment by empowering forest fire resilience in wildland territories and by activating a holistic, multi-stakeholder approach, adding high-end tools and technologies, respecting local knowledge, and cultural and biological diversity.
- **EF-UC33-REQ-002:** It is critical that the project shifts from a reactive fire management approach to a predictive one, managing and avoiding fire through prevention and response measures that are in line with local knowledge.

- **EF-UC33-REQ-003:** It is critical that the project employs community empowering technologies for early detection of fires, as early detection is key to extinguishing fires. This includes the use of computer vision (cameras based on python, identify smoke, 20 km range) and satellites.
- **EF-UC33-REQ-004:** The project must utilize on-premises computers and outdoor infrastructure to manage wildfire risk effectively. It should leverage NASA's geographic positioning data of communities, power lines, and other human infrastructures, such as roads and villages. Additionally, the project must consider the limitations of satellite detection, including latency between detection and action, the diverse capabilities of satellites, and the need for coordination of satellite orbits.
- **EF-UC33-REQ-005:** It is critical that the project uses anomaly detection for smoke and light, and leverages streamed videos, detect smoke and light, Satellite images (used only for post-fires), and Sensors from satellite which can detect heat (diverse generation of sensor) for model training and fine tuning.

33.4. Sequence diagram



33.5. References

[1] Measuring Gross Carbon Dioxide Emissions from Forest Fires in the Abrace o Pantanal Project Area

Use case – 34: Intelligent Solutions for Road Safety through Technology and Engineering -iRASTE

Country: India

Organization: Information Technology, Electronics and Communication Department, Government of Telangana

Contact person: Jayesh Ranjan, secy_itc@telangana.gov.in

34.1. Use case summary table

Domain	Transport safety – reducing road accidents
Problem to be addressed	• Reducing the high number of accidents on Indian roads. • Conventional methods to reduce road accidents are slow, reactive and not scalable.
Key aspects of the solution	• Enhance vehicle safety, avoiding accidents, by equipping vehicles with ADAS devices with built-in AI (to produce alerts). • Algorithm development to predict using AI hotspot grey spots (potential black spots) • Surveys and traffic inspections to optimize road infrastructure so that we can reduce Black spots (as defined by MoRTH) using historical data. • Awareness and emergency response.
Technology keywords	ADAS, AI, grey spot, 4G, cloud.
Data availability	Private data is available Not decided on the timeline to anonymize (bus driver data) and not decided to publish the data.
Metadata (type of data)	Time series data on ADAS alerts tagged with GPS location.
Model Training and fine tuning	Location based prediction algorithms on time series based ADAS alerts. Built-in models in ADAS devices are used commercially off the shelf from Mobil-eye (Intel subsidiary). Cloud based training is used after transporting data using 4G, the ADAS devices are 4G enabled.
Testbeds or pilot deployments	The initiative has already started with 200 buses of TSRTC (Telangana State Road Transport Corporation) equipped with advanced safety technologies and sensors for dynamic risk mapping. Last 9 months data is analyzed ADAS buses have ~30% less accidents when compared to non-ADAS buses in specific routes of the study.

34.2. Use case description

34.2.1 Description

Use case status: The use case is part of a larger research project

In a significant push for road safety, the Telangana government aims to leverage artificial intelligence (AI) with the implementation of iRASTE. This initiative tackles the alarming number of road accidents witnessed in the state, which claimed over 21,000 lives in 2019 alone. While the 2020 lockdown led to a decrease in fatalities (19,000), sustained efforts are crucial to achieving the national goal of halving road accidents by 2030. iRASTE presents a holistic solution, moving beyond just addressing black spots - previously identified as high-accident areas. This AI-powered approach promises to enhance vehicle safety, improve mobility planning, and optimize road infrastructure management. The initiative involves installation of Advanced Driver Assistance System(ADAS) and Collision Avoidance System(CAS) devices on Telangana State Road Transport Corporation(TSRTC) buses on highways(National and State) for an AI based hotspot prediction algorithm which takes input from ADAS devices and maps it in real time to the relevant road infrastructure to predict future accident prone locations (Gray Spots) and also reduce near misses by up to 50%. The system collects and analyzes data to pinpoint grey-spots, enabling the implementation of cost-effective engineering improvements to prevent accidents. Additionally, the categorization of drivers based on the Vienna Test allows for the assessment of CAS device adoption and driver behavior, further contributing to road safety. Moreover, the initiative includes efforts towards driver training, education, and community awareness to promote a culture of safety on the roads.

UN Goals:

- SDG 11: Sustainable Cities and Communities

Justify UN Goals selection: iRASTE's comprehensive approach to road safety in Telangana resonates with the objectives of SDG 11 by promoting sustainable urban development and enhancing safety in human settlements. SDG 11 targets making cities and human settlements safe, inclusive, resilient, and sustainable. iRASTE's focus on using AI to predict accident-prone areas (grey spots) and improve road safety contributes to creating a safer transportation network within Telangana. The initiative's use of data analysis to inform mobility planning can optimize traffic flow and reduce congestion with emphasis on sustainable transport systems that meet the needs of present and future generations. By identifying grey spots and enabling cost-effective road improvements, iRASTE promotes efficient infrastructure management that contributes to SDG 11's goal of building sustainable and resilient infrastructure.

Partner name: International Institute of Information Technology, Intel India, Applied AI Research Centre for Mobility and Healthcare Partner

34.2.2 Future work

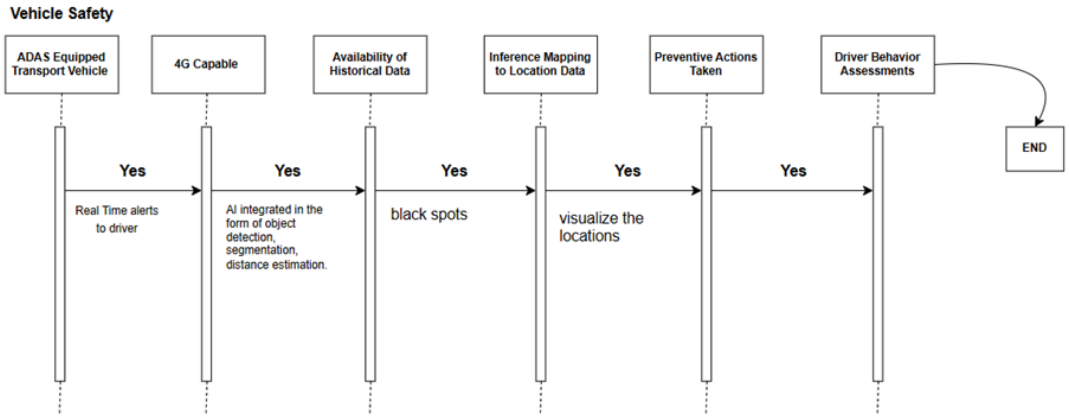
Create new variations/extensions to the same use case Elaborate proposal: iRASTE aims to enhance road safety and reduce accidents by addressing critical areas known as black spots, grey zones, and white zones. Its AI-based risk assessment and solution engineering support the 'Vision Zero' goal, which seeks to eliminate accidents and improve societal well-being. The initiative starts with NMC vehicles equipped with advanced safety technologies and sensors for

dynamic risk mapping. This data will guide infrastructure upgrades and policy decisions. After successful implementation in 3 highway corridors in Telangana, iRASTE's successful model is set to expand to more cities in the next 3-5 years. The objective is to outfit 350 buses, setting a standard for nationwide implementation and reducing India's road fatality rates. Ultimately, iRASTE represents a significant step towards a safer future, showcasing AI's role in public safety and the promise of scalable, life-saving innovations.

34.3. Use case requirements

- **UC44-REQ01:** It is critical that the transport vehicles are equipped with ADAS devices which are network capable.
- **UC44-REQ02:** It is critical that inference from the model is mapped to the location data such as maps to visualize the locations of the grey spots.
- **UC44-REQ03:** It is critical that historical data in form of black spots is available for a period of study.
- **UC44-REQ04:** it is critical that the road owning agency consumes or considers the inference from the models to take preventive actions to reduce accidents.
- **UC44-REQ05:** it is expected that the driver behavior assessment is done by correlating the ADAS alerts per kilometer per driver.

34.4. Sequence diagram



34.5. References

[1] Project iRASTE Telangana

[2] Project iRaste Telangana Youtube:

Use case – 35: Empowering Childhood Nutrition: Enhancing Poultry Product Quality and Availability via Farm Digitalization

Country: Rwanda

Organization: Carnegie Mellon University- Africa

Contact person: Semebia Wurah, swurah@andrew.cmu.edu

Esther Mensah, emensah@andrew.cmu.edu

35.1. Use case summary table

Domain	Food
Problem to be addressed	Availability of quality poultry products for children's development, Nutritional deficiencies, especially in developing countries like Rwanda. There are challenges in poultry farming such as disease outbreaks, heat stress, theft, and predation
Key aspects of the solution	Integrating sensor technology into poultry farming practices Monitoring environmental parameters (temperature, humidity, ammonia gas levels) Capturing and analyzing chicken sounds for early detection of threats and health monitoring Leveraging data-driven predictions and machine learning algorithms Providing alert notifications to farmers for timely interventions
Technology keywords	• Sensor technology • Environmental monitoring • Audio analysis • Machine learning • Predictive modeling • Alert system
Data Availability	Open-source chicken language datasets (GitHub repositories) Kaggle both Private and Public
Metasdata(type of data)	• Temperature data • Humidity data • Ammonia gas content data • Chicken sound recordings
Model training and fine-tuning	Classification for chiken sounds and Prediction model for chicken diseases

(continued)

Domain	Food
Testbeds of pilot deployment	None are available

35.2. Use case description

35.2.1 Description

Use case status:The use case is part of a larger research project

Background Poultry products, including chicken meat and eggs, play a vital role in children's development both before and after birth [1]. Rich in essential nutrients like folic acid and a wide array of other vital nutrients, poultry products are not only widely accessible and relatively affordable but also serve as a crucial source of essential nutrients [1]. Unlike some other food sources, poultry products are generally free from major consumption taboos, making them a versatile and widely accepted dietary option [1].

The nutritional value and affordability of eggs and chicken meat make them indispensable in addressing dietary deficiencies, thereby potentially reducing the incidence of common metabolic diseases associated with inadequate intake of critical dietary minerals, vitamins, and amino acids [1]. Especially in developing countries where food scarcity is a pressing concern, the promotion of poultry farming holds significant promise in addressing nutritional challenges and improving public health.

According to Poultry Africa 2022, a conference and exhibition event about the poultry value chain in Rwanda, the poultry farming sector in Rwanda has experienced substantial growth, with the number of commercial poultry farms increasing significantly in recent years [2]. Despite this growth, poultry farming faces various challenges, including disease outbreaks, and climate-related stressors like heat stress, theft, and predation [3] [4].

To address these challenges and optimize poultry farm management, integrating sensor technology into poultry farming practices presents a promising solution. By strategically placing sensors to monitor key environmental parameters such as temperature, humidity, and ammonia gas levels, as well as capturing chicken sounds, farmers can take proactive actions based on predictions made from the data to protect the health and well-being of their flock. It will also facilitate early detection of potential issues and ensure optimal production outcomes and product quality.

Leveraging technology to enhance poultry farm management, will increase the productivity of poultry farms and also ensure quality farm products.

UN Goals:

- **SDG 2:** Zero Hunger,
- **SDG12:** Responsible Consumption and Production

Justify UN Goals selection: Aligning with SDG 2 (Zero Hunger) and SDG 12 (Responsible Consumption and Production), our submission harnesses AI to bolster food security and sustainable agricultural practices in poultry farming. Through the integration of predictive

modeling, our system forecasts potential disease outbreaks, enabling farmers to take proactive measures to safeguard their flocks' health. By preemptively addressing disease threats, we mitigate risks to food production, thereby contributing to SDG 2's goal of ensuring access to safe, nutritious, and sufficient food for all.

Furthermore, utilizing AI-powered insights enables farmers to improve feed management, ultimately boosting the efficiency of meat and egg production. Through harnessing data on environmental conditions and indicators of poultry health, our system enables farmers to make informed decisions, leading to increased productivity and optimized resource utilization. This approach is in line with SDG 12's objective of promoting sustainable consumption and production patterns by reducing food waste and enhancing resource efficiency in agricultural operations.

By integrating AI into poultry farming practices, our initiative not only addresses immediate nutritional needs but also fosters long-term sustainability, advancing progress towards achieving SDGs 2 and 12. Through collaboration with stakeholders and leveraging digitalization technologies, we aspire to transform poultry farming in Rwanda, promoting food security, sustainable practices, and responsible consumption.

35.2.2. Future work

Data collection, Model development, Create new variations/extensions to the same use case, Standards development related to the use case Elaborate proposal: The sequence diagram illustrates the data flow originating from sensors positioned at nodes within poultry houses. It depicts the intermittent transmission of this data to a database, alongside the triggering of alert SMS (using a GSM module connected to the microcontroller) notifications to farmers in the event of critical conditions. The green blocks in the diagram denote areas earmarked for future development. Our future work will encompass initial system design, prototype testing in collaboration with the Poultry Association Rwanda and the Agriculture and Animal Resources Development Board (RAB), as well as data analysis and model training tailored to the needs of indigenous and exotic poultry farming. We aspire to promote structured poultry farm systems integrated with digitalization technologies, leveraging insights from existing digitalized farms and expertise from governmental agencies, agricultural associations, and health professionals. Through this collaborative effort, we aim to revolutionize poultry farming in Rwanda, enhancing productivity, sustainability, and ultimately, food security. Our goal is to provide healthy poultry products to safeguard the health of children and others who rely on poultry farms.

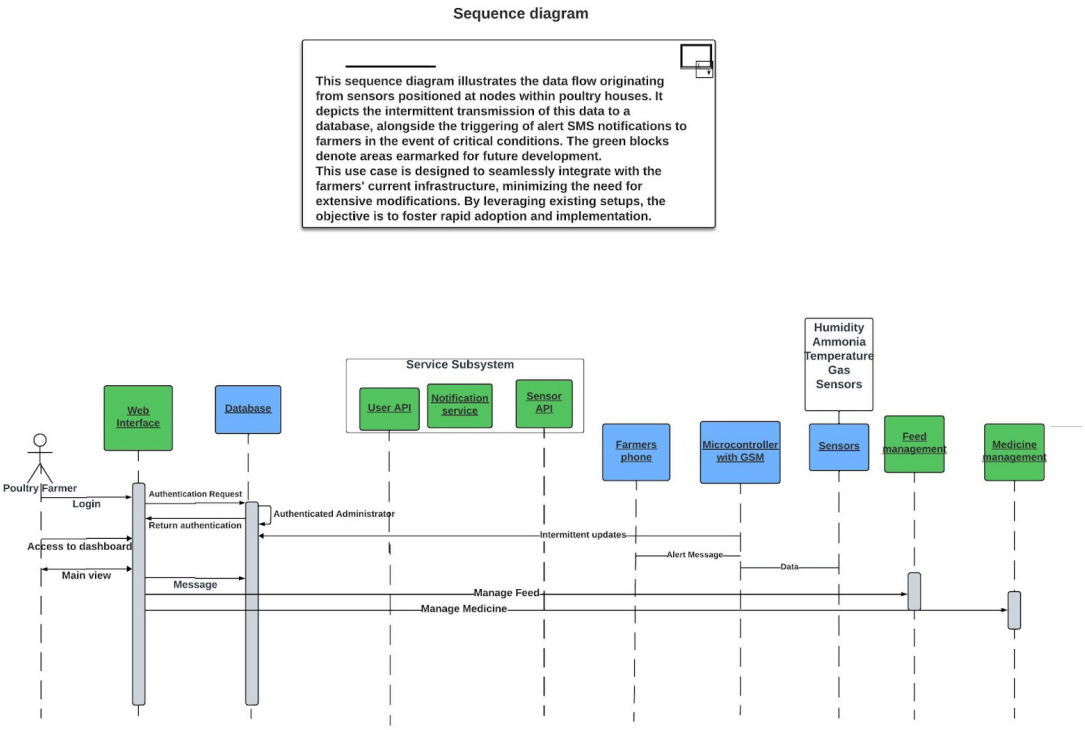
This use case is designed to seamlessly integrate with the farmers' current infrastructure, minimizing the need for extensive modifications. This is important to reduce the cost of implementation for local chicken farmers. By leveraging existing setups, the objective is to foster rapid adoption and implementation.

35.3. Use case requirements

- **ECN-UC35-REQ-001:** It is critical that the Empowering Childhood Nutrition project addresses the availability of quality poultry products for children's development and nutritional deficiencies, especially in developing countries like Rwanda. The project should also address challenges in poultry farming such as disease outbreaks, heat stress, theft, and predation.

- **ECN-UC35-REQ-002:** It is critical that the project integrates sensor technology into poultry farming practices. This includes monitoring environmental parameters (temperature, humidity, ammonia gas levels) and capturing and analyzing chicken sounds for early detection of threats and health monitoring.
- **ECN-UC35-REQ-003:** It is critical that the project leverages data-driven predictions and machine learning algorithms to optimize poultry farm management and increase the productivity of poultry farms.
- **ECN-UC35-REQ-004:** It is critical that the project provides alert notifications to farmers for timely interventions. This includes the use of a GSM module connected to the microcontroller to trigger alert SMS notifications to farmers in the event of critical conditions.
- **ECN-UC35-REQ-005:** It is critical that the project uses open-source chicken language datasets (GitHub repositories), Kaggle, and both private and public data for model training and fine-tuning. This includes temperature data, humidity data, ammonia gas content data, and chicken sound recordings.

35.4. Sequence diagram



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[14] Use Case, India - Sandhiya, R & Mohana, T & Jothi, B & Agarwal, Juhie & Kulshrestha, Nitin & Sandhiya, S. (2024). IoT based Smart Poultry to Produce a Healthy Environment.

Use case – 36: Bidirectional Telecom-to-Grid and Telecom-to-Vehicle Energy Exchange for Net-Zero

Country: United Kingdom

Organization: University of Sussex, IEEE Young Professionals Climate and Sustainability Task Force

Contact person: Ferheen Ayaz, f.ayaz@sussex.ac.uk

36.1. Use case summary table

Domain	Energy management
Problem to be addressed	Achieving net-zero and demand supply balance through telecom by utilizing the backup batteries of 5G base stations (BSs)
Key aspects of the solution	Modeling energy consumption of 5G BSs Analyzing the capability of BSs to supply energy to demanding Electric Vehicles (EVs) and other devices Formulating optimization algorithm for bidirectional energy exchange through Telecom-to-Grid (T2G) and Telecom-to-Vehicle (T2V) exchange
Technology keywords	• Energy management • 5G • Base stations • Electric Vehicles • Telecom-to-Grid • Telecom-to-Vehicle
Data Availability	Open-source datasets of base stations energy consumption (GitHub repositories)
Meta data (type of data)	Temporal data of load and energy consumption of BSs
Model training and fine-tuning	Prediction of load traffic on BSs Analysis of energy consumed according to time
Testbeds of pilot deployment	None are available

36.2. Use case description

36.2.1 Description

Use case status: The use case is part of a larger research project use case description: The shift towards renewable energy resources for environmental sustainability and achieving net-zero has given rise to some challenges like instability and fluctuations in power supply, and massive costs incurring in completely changing the infrastructure of electricity generation. In this scenario, small scale distributed renewable energy sources are one of the low-cost solutions to meet the increasing energy demands in an environment-friendly manner. This Use case proposes the backup battery of Base Stations (BSs) as a distributed energy source to be supplied in case of high demand. It explores the concept that BSs can take part in achieving net-zero through bidirectional energy exchange with gird, i.e., Telecom-to-Grid (T2G) and Electric Vehicles (EVs) i.e., Telecom-to-Vehicle (T2V). Well-established and thoroughly analyzed solutions of bidirectional Vehicle-to-Grid (V2G) energy exchange are in practice but T2G and T2V are amongst relatively emerging approaches. It can be further evaluated with the help of energy-efficient AI approaches. The feasibility of the use case will be investigated with accurate energy consumption modeling of BSs and EVs to forecast their demand and supply, and optimization algorithms to optimally match buyer and seller BSs and EVs. The existing energy consumption and optimization models of 5G BSs are limited. The AI based models produce accurate results but are high power consuming themselves. We aim to work on energy-efficiency of AI based energy consumption and optimization solutions. The solutions to reduce power consumption of AI models such as quantization and Tiny Machine Learning can produce models with low carbon footprints but may trade-off accuracy. This use case aims to achieve optimal accuracy with energy-efficient AI solutions designed to achieve net-zero in an electrified transportation network assisted by telecommunications.

Is it publicly available?: Yes

is it privately available?: No

Repository url: link

UN Goals:

- **SDG 7:** Affordable and Clean Energy,
- **SDG 8:** Decent Work and Economic Growth,
- **SDG 9:** Industry, Innovation and Infrastructure,
- **SDG 11:** Sustainable Cities and Communities

Justify UN Goals selection: Firstly, this use case encourages distributed peer-to-peer energy exchange. EVs and BSs can sell their energy at times of high demand and later charge themselves at reduced off-peak prices. The concept will help in achieving net-zero, specifically when the supply from renewable sources is low and therefore it is aligned with Goal 7 of Affordable and Clean Energy. Secondly, the use case brings a novel concept in telecommunications industry and framework of energy exchange and matches with Goal 9 of Industry, Innovation and Infrastructure. Unique approaches to propose energy-efficient AI solutions will further contribute to innovation. Thirdly, the use case aims to achieve net-zero in EV transportation. The access to energy for EVs will be easier as they can either travel to a charging station or a BS. Less travel will further lead towards environmental sustainability. Therefore, the use

case will ultimately contribute to sustainable cities and communities that is Goal 11. Finally, the affordable energy and an option to earn incentive in exchange of energy will motivate road drivers to opt for EVs. The shift towards EV will potentially result in its market growth. Manufacturing of large number of EVs matches with Goal 8. i.e., Decent Work and Economic growth. The growth in energy market will also be promoted through peer-to-peer direct selling or buying energy without third-party.

36.2.2 Future work

Data collection, Proof of concept development, Model development

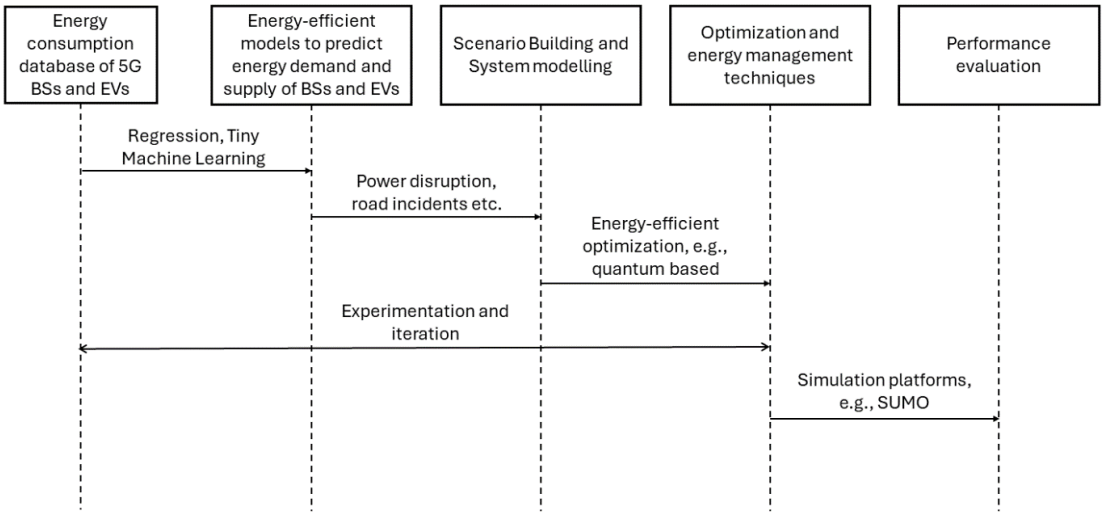
This use case will explore the concept of bidirectional T2G and also Telecom-toVehicle (T2V) energy exchange assisted by Artificial Intelligence (AI). We aim to utilize AI for the following objectives:

- Energy consumption modeling of BSs to evaluate their feasibility in contributing to T2G and T2V energy exchange
- Energy consumption modeling of EVs during their journey to forecast their demands and surplus energy in their batteries
- Optimized energy supply to BSs and EVs while maintaining the net-zero balance

36.3. Use case requirements

- **UC36-REQ-001:** Collection of massive dataset of 5G and 6G BSs, and EVs to model their energy consumption and evaluate the excess energy they can provide from their backup batteries.
- **UC36-REQ-002:** Producing accurate AI models to predict energy usage of EVs and BSs in future times.
- **UC36-REQ-003:** Energy-efficient AI mechanisms with reduced carbon footprints to optimize and manage energy exchange among EVs and BSs.
- **UC36-REQ-004:** Simulation platform to evaluate the feasibility of the proposal.

36.4. Sequence diagram



36.5. References

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[2] P. Yong et al., "Evaluating the Dispatchable Capacity of Base Station Backup Batteries in Distribution Networks," *IEEE Trans. Smart Grid*, vol. 12, no. 5, pp. 3966-3979, Sep. 2021.

Use case – 37: Multilingual Medical Language Models: A Path to Improving Lay Health Worker Effectiveness

Country: United States

Organization: Ethriva

Contact Person: Agasthya Gangavarapu, august@ethriva.a,

Ananya Gangavarapu, ananya@ethriva.com

37.1. Use case summary table

Domain	Healthcare
Problem to be addressed	Access to medical care, inefficient management of waiting times, long queues.
Key aspects of the solution	Local language chatbot, medical records, pre-health assessment, diagnostics, summary report generation, doctor dashboard, mobile based solution.
Technology keywords	Large Language Model (LLM), Machine Translator (MT), API
Data availability	Private
Metadata (type of data)	Medical dialog data, adverse events, clinical notes, medical records
Model Training and fine tuning	Fine-tuned Llama 3 70B model with GQA and quantization. Seamless M4T-Large is finetuned with context and cultural information. NVIDIA NeMo Guardrails is customized to filter out the prompts that are toxic.
Testbeds or pilot deployments	https://arxiv.org/abs/2404.08705

37.2. Use case description

37.2.1. Description

This innovative project introduces a transformative use case targeting the enhancement of healthcare delivery by empowering Community Health Workers (CHWs) in Low- and Middle-Income Countries (LMICs) through the integration of Large Language Models (LLMs) with machine translation technologies. Aimed at addressing the critical shortfall of healthcare workers, the initiative seeks to navigate the complex challenges of linguistic barriers, cultural nuances, and the scarcity of tailored medical dialog datasets, which collectively impede the efficacy of CHWs in remote and underserved regions.

The primary limitation of existing healthcare solutions lies in their lack of customization for the diverse linguistic and cultural landscapes of LMICs. Traditional tools often overlook the necessity for contextually relevant educational and diagnostic resources, thus failing to adequately support CHWs. Such shortcomings contribute to the strain on healthcare systems in LMICs, exacerbating disparities in access to quality healthcare services.

The proposed model presents numerous advantages, notably its capability for swift adaptation to different cultural and linguistic settings, facilitated by its modular design and reliance on open-source components. This not only aids in curtailing operational costs but also ensures the model's scalability and relevance across various regions. By equipping CHWs with accurate, context-sensitive medical information and tools, the model aims to significantly elevate healthcare outcomes in LMICs.

However, the project is not devoid of challenges. One of the main drawbacks is the reliance on machine translation models, which are susceptible to inaccuracies, particularly with complex medical terminologies, potentially leading to error propagation and amplification. This necessitates a rigorous and continuous process of fine-tuning and validation to mitigate errors and enhance the system's reliability and effectiveness.

Despite these challenges, the project marks a crucial advancement in utilizing AI to bolster healthcare provision in LMICs. By bridging the gap between advanced technology and practical healthcare needs, it offers a promising solution to improve the accessibility and quality of healthcare services. The model's emphasis on scalability, adaptability, and cultural sensitivity represents a substantial stride towards diminishing global healthcare disparities, showcasing the potential of AI to address critical health challenges and support the indispensable work of CHWs worldwide.

Is it publicly available?: Yes

is it privately available?: Yes

Repository url: link.

UN Goals:

- **SDG 3:** Good Health and Well-being,
- **SDG 9:** Industry, Innovation and Infrastructure,
- **SDG10:** Reduced Inequality

Justify UN Goals selection: The model introduced in this paper makes a significant contribution toward achieving the United Nations Sustainable Development Goals (UN SDGs), particularly emphasizing Good Health and Well-being (SDG 3), Quality Education (SDG 4), and Reduced Inequalities (SDG 10). By integrating advanced Large Language Models (LLMs) with machine translation technologies, the model specifically addresses the critical shortage of healthcare workers in Low- and Middle-Income Countries (LMICs), directly enhancing the capabilities of Community Health Workers (CHWs). This approach not only overcomes language barriers and cultural sensitivities but also improves the accessibility and quality of healthcare services, ensuring that communities, regardless of their geographical or socio-economic status, have access to essential health care.

Furthermore, the model acts as an educational tool for CHWs, offering personalized and contextually relevant medical knowledge and diagnostic resources. This fosters an environment

of continuous learning and skill enhancement, aligning with the Quality Education goal. The focus on modular design and open-source components reflects an innovative leap towards Industry, Innovation, and Infrastructure (SDG 9), demonstrating a scalable and adaptable solution to healthcare challenges across different linguistic and cultural settings.

By empowering CHWs with the knowledge and tools needed for effective healthcare delivery, the model plays a pivotal role in reducing health disparities and inequalities. It showcases how leveraging AI and technology can facilitate a more equitable distribution of health resources and knowledge, making a significant stride towards realizing the UN's vision for health equity and access worldwide.

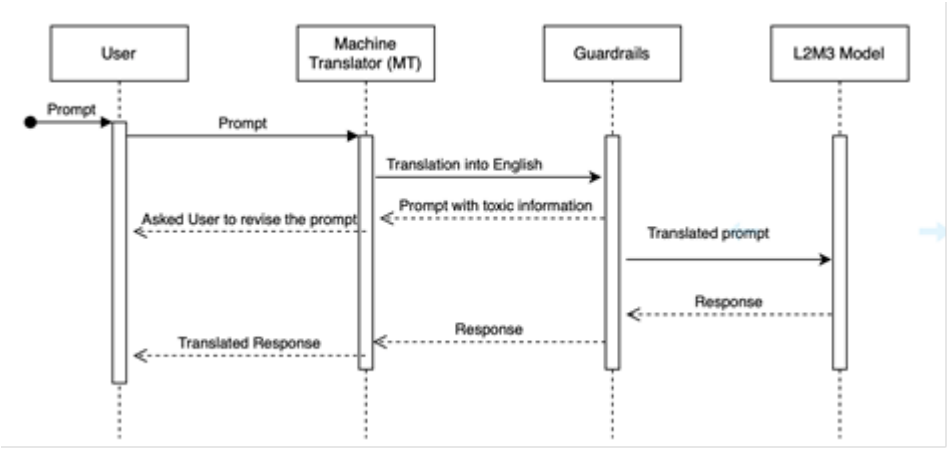
37.2.2. Future work

Model development, Create new variations/extensions to the same use case, Standards development related to the use case, Setup reference tools, notebooks and simulation environment, Others Elaborate proposal: Addressing the imminent shortfall of 10 million health workers by 2030, predominantly in Low- and Middle-Income Countries (LMICs), this paper introduces an innovative approach that harnesses the power of Large Language Models (LLMs) integrated with machine translation models. This solution is engineered to meet the unique needs of Community Health Workers (CHWs), overcoming language barriers, cultural sensitivities, and the limited availability of medical dialog datasets.

I have crafted a model that not only boasts superior translation capabilities but also undergoes rigorous fine-tuning on open-source datasets to ensure medical accuracy and is equipped with comprehensive safety features to counteract the risks of misinformation.

Featuring a modular design, this approach is specifically structured for swift adaptation across various linguistic and cultural contexts, utilizing open-source components to significantly reduce healthcare operational costs. This strategic innovation markedly improves the accessibility and quality of healthcare services by providing CHWs with contextually appropriate medical knowledge and diagnostic tools. This paper highlights the transformative impact of this context-aware LLM, underscoring its crucial role in addressing the global healthcare workforce deficit and propelling forward healthcare outcomes in LMICs

37.3. Sequence diagram



37.4. References

[1] https://ieeexplore.ieee.org/abstract/document/10354650

Use case – 38: AI for Intelligent Steel Manufacturing in Hunan Province, China

Country: China

Organization: Huawei Technologies Co. Ltd, Hunan Valin Xiangtan Iron and Steel Co. Ltd

Contact person: Yizhou Cai, caiyizhou@huawei.com

38.1. Use case summary table

Domain	Steel manufacturing industry
The Problem to be addressed	• Iron and steel are integral to the manufacturing industry and play an important role in the national economy of China and worldwide. • Conventional smelters are labor-intensive, with workers stuck in a high-temperature environment filled with dust and noise. The environment can be unsafe, and harms their health. • Traditional plants have suffered from low efficiency and high employee turnover, and have faced difficulties hiring new people. • For scenarios in which defects are difficult to detect and manual inspection is required, the best approach is a long-term process of photographs plus computing to find the pattern and perform an informed analysis. Traditionally, photography and detection functions are incorporated in manufacturing equipment, but that is costly and relies on dated detection algorithms backed by insufficient computing power. It's also hard to upgrade detection algorithms. • To address these challenges, Xiangtan Iron and Steel collaborated with China Mobile Hunan and Huawei to develop the smart steel smelter, the first 5G+AI smart plant.

(continued)

Domain	Steel manufacturing industry
Key aspects of the solution	• Workers previously used outdated methods to inventory steel bars one at a time which was slow and prone to error. By using the AI-based image detection capability, during the smelting stage, the steel bars can be automatically identified, and the number of steel bars can be quickly calculated, yielding higher levels of accuracy with a shorter turnaround. • During the stage of steel rolling, workers can control the turning and speed of the rolling mill using a trained cloud-based AI model and video data from 5G-connected cameras. This method of rolling is smarter and more efficient, as 1 more steel billet rolled per mill can be produced in an hour, resulting 30,000 more tons rolled every year and annual revenue increased by 100+ million CNY. • With the help of AI data filtering, the Pangu steel model is also designed to pre-train production, safety observation, and decision-making models based on the principle of marking anything not normal as abnormal. These models require only a small number of samples for training and boast a 10% higher accuracy in detecting abnormalities compared to smaller models. An AI-based analysis and automatic detection of abnormality is adopted by the Xiangtan steel, have replaced the manual inspection that workers had to walk around factory floors with over 1000 °C temperature. • With images and videos collected for data training and real-time detection ensure efficient operation and predictive maintenance, minimizing device downtime for O&M reduced by 17% and maintenance costs of annual motor damage rate from 5% to 2%, reallocating workers' time and digital skills to be better used (number of spot check personnel in slabs and bar is reduced by 10 to 4, and O &M status can be checked on their mobile phones). • With the help of AI, Xiangtan Steel's workers have been able to operate more efficiently, and in a much safer environment.
Technology keywords	Smart manufacturing, 5G+AI+Cloud+Industrial Internet, abnormality detection, remote control, safety observation, AI-based image detection, computer vision
Data availability	Data is privately available upon request
Metadata (type of data)	Structured and unstructured data, descriptive data, administrative data
Model Training and fine-tuning	• Predictive model with decision trees, regression and neural networks • Huawei OptVerse AI Solver with Large Network Linear Programming, Convex Continuous QPLIB, Lpopt and MIPLIB2017 for model parameter optimization • Grid Search (gridsearchCV) for hyperparameter tuning.
Case Studies	• https://www.youtube.com/watch?v=KbuVEqj61TA • http://www.csteelnews.com/qypd/gl/202405/t20240506_87708.html
Testbeds or pilot deployments	• https://www.analysysmason.com/contentassets/3f8280c2fe264a029bb5c968046b3a95/analysys_mason_huawei_xisc_5g_may2021_rma18.pdf • http://www.csteelnews.com/qypd/gl/202405/t20240506_87708.html • https://m.cnfin.com/cy-lb/zixun/20240429/4042612_1.ht

38.2. Use case description

38.2.1 Description

Facing a harsh work environment for steel workers and low level of automation, the steel manufacturing industry is in dire need of digital transformation. AI modeling for the industry is vital in supporting steel production in the quest to make it safer, smarter and more efficient.

Intelligent steel manufacturing solutions employed by Xiangtan Steel have deployed an AI training and application platform in this Chinese firm with an annual production capacity of 12 million tons of steel. The platform is based on Huawei's Pangu models, and consists of four foundation models: computer vision (CV), graph neural network (GNN), multimodal, and natural language processing (NLP). For instance,Pangu CV model has undergone pre-training on over 1 billion images and more than 100 terabytes of video data using the unsupervised learning method. It could thus extract and store vast amounts of knowledge within its extensive network, allowing it to represent intricate visual features with ease. Plus, Pangu AI models have superior generalization performance compared to smaller models; when trained for one scenario, it can also be applied to scenarios with a detection accuracy of over 23%, meaning these models can be quickly deployed in other steel mills, with minimal need for repeated training.

The Pangu AI Steel Model enables unsupervised self-learning, covering over 300 sub-scenarios in steel operations. The smart charcoal blending solution consists of the intelligent metallurgical coal/coking coal blending algorithm model and cloud storage and the coal blending system of the customer. The solution summarizes and integrates data such as raw coking coal data, process/working condition data, coke data and operation data. After the data is encrypted and anonymized, it is uploaded to the cloud storage. Based on the mechanism and data, select a model framework, train the model, and deploy and release the trained model in the form of API to provide coke quality prediction, coke blending ratio optimization and other core functions.

UN Goals:

- **SDG 8:** Decent Work and Economic Growth,
- **SDG 9:** Industry, Innovation and Infrastructure

SDG 8 - Decent Work and Economic Growth: the system enhances the working conditions in the iron and steel industry by replacing labor-intensive and unsafe tasks with AI-based technologies. This not only improves the safety and health of the workers but also increases efficiency and productivity, leading to economic growth. The use of AI for inventory and defect detection reduces errors and increases the speed of operations, resulting in more steel billets rolled per hour and a significant increase in annual revenue. Specifically, 1 more steel billet can be rolled per mill every hour, resulting in 30,000 more tons rolled every year and an increase in annual revenue by over 100 million. The reduction in device downtime and maintenance costs also contributes to economic efficiency. In fact, the annual motor damage rate has been reduced from 5% to 2%, and the number of spot check personnel in slabs and bars has been reduced from 10 to 4.

SDG 9 - Industry, Innovation and Infrastructure: the collaboration between Xiangtan Iron and Steel, China Mobile Hunan, and Huawei to develop the first 5G+AI smart plant is a clear example of innovation in industry. The use of AI and 5G technology in the manufacturing

process represents a significant advancement in infrastructure. The system leverages AI for real-time detection and predictive maintenance, ensuring efficient operation of the plant. The reduction in the number of personnel required for checks also shows how digital skills can be better utilized in the industry.

Partner name: Hunan Valin Xiangtan Iron and Steel Co. Ltd

38.2.2 Future work

Future work on the intelligent steel manufacturing equipped with Pangu steel models includes

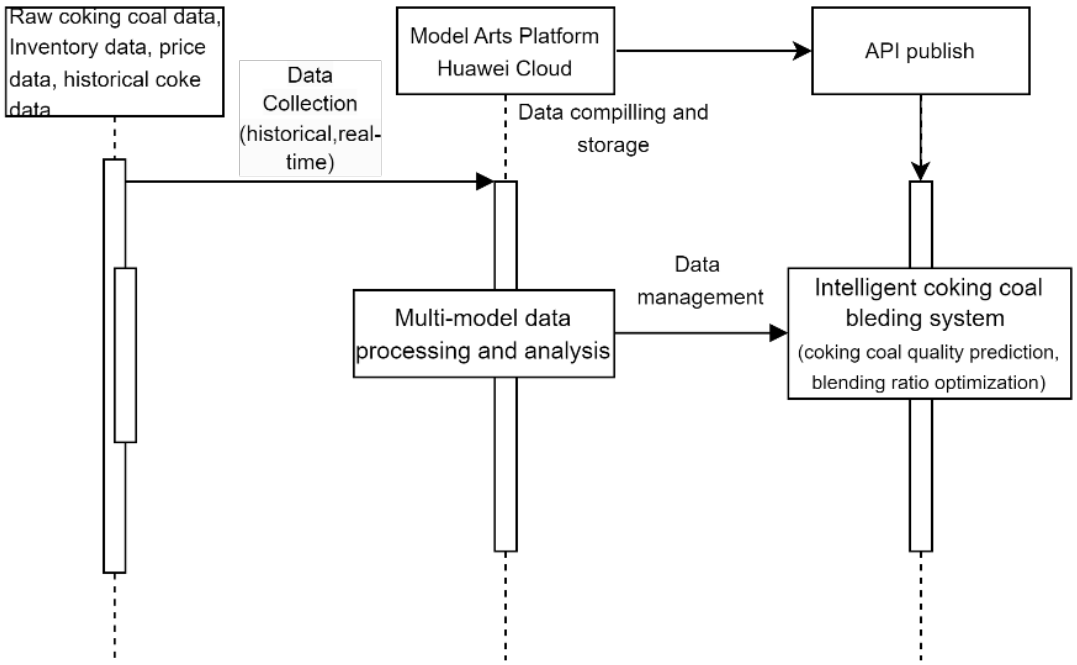
model development that can be used in other business and production scenarios of steel milling, create new variations/extensions to the same use case, develop standards related to the use case in the industry.

Model development, Create new variations/extensions to the same use case, Standards development related to the use case, Setup reference tools, notebooks and simulation environment, Others Elaborate proposal: Model development that can be used in other business and production scenarios of steel milling, create new variations/extensions to the same use case, develop standards related to the use case in the industry.

38.3. Use case requirements

- **AI-ISM-UC38-REQ-001:** It is critical that AI for Intelligent Steel Manufacturing which provide access to smart charcoal blending solutions, based on a platform solution, are available in local languages.
- **AI-ISM-UC38-REQ-002:** It is critical that a Chinese steel manufacturing AI platform, integrates computer vision (CV), graph neural network (GNN), multimodal, and natural language processing (NLP) to facilitate efficient operations in steel manufacturing.
- **AI-ISM-UC38-REQ-003:** It is critical that the AI platform allows operators to report data remotely through voice or text in Chinese, which is critical given the complex script of the Chinese language and the prevalent use of voice input among Chinese.
- **AI-ISM-UC38-REQ-004:** It is critical that the platform employs keyword detection algorithms to extract essential information from operator inputs and automatically generates comprehensive summary reports for steel manufacturers.
- **AI-ISM-UC38-REQ-005:** It is crucial to apply network analysis as a collection of integrated techniques for depicting relationships among SDG-relevant variables and analyzing the social impacts of these connections.
- **AI-ISM-UC38-REQ-006:** It is critical that the Machine Learning, and computer vision models used to estimate the SDG value for the period 2023-2030 from relevant data be validated by experts.

38.4. Sequence diagram



38.5. Reference

[1] The combination of campus 5G, edge and slicing has transformed the business of steelmaker XISC in China

Use case – 39: AI Enabling Travel Model helps search and rescue incidental lost elderly people for the global aging challenge

Country: China

Organization: China Mobile Communications Corporation Co.,Ltd

Contact person: He Rongjian, herongjian@chinamobile.com

Wu Zukang, wuzukang@js.chinamobile.com

39.1. Use case summary table

Domain	Good Health and Well-Being
The Problem to be addressed	• The global population is generally facing the problem of aging, and the number of elderly people living alone is increasing, and they are facing more risks of getting lost. • At present, the country lacks fast and effective tracking means for the lost elderly , and it is difficult to achieve the sustainable development goal of health and safety of elderly people living alone. • Inadequate co-benefit methodologies for assessing the SDGS in terms of good health and well-being of older persons living alone. • The country needs a smart product that can guard the health and safety of elderly people living alone around the clock, so as to achieve the Decade of Healthy Ageing 2021-2030 advocated by the World Health Organization.
Key aspects of the solution	• AI Enabling Jiutian Travel Model can provide real-time location, lost contact search and rescue, and risk prediction to achieve the co-benefits of sustainable development in the World Health Organization's Decade of Healthy Ageing 2021-2030. • AI Enabling Jiutian Travel Model includes a large model of real-time positioning, identification, loss judgment and travel path prediction for elderly people living alone. • AI Enabling Jiutian Travel Model Based on artificial intelligence trajectory analysis of the elderly living alone, to achieve dynamic graph neural network modeling.
Technology keywords	Continuous-time dynamic graph representation learning framework, Hierarchical message passing module
Data availability	Geographic information data https://www.openstreetmap.org
Metadata (type of data)	Structured and unstructured data

(continued)

Domain	Good Health and Well-Being
Model Training and fine-tuning	• A continuous-time dynamic graph representation learning framework is proposed for OD(Origination and Destination) demand forecasting. Different from the previous research, our method maintains continuous time node representations and updated them continuously once a number of transactions are available. As the evolutionary dynamics of stations could be learned in an extremely fine time scale, our method is promising to achieve higher prediction accuracy. • A hierarchical message passing module is proposed to model the spatial interactions of stations. • Extensive experiments have been conducted on two real-world datasets.
Case Studies	The World Health Organization's Decade of Healthy Ageing 2021-2030(SDGS 3, 10, 11).
Testbeds or pilot deployments	The pilot is deployed on China Mobile's internal network.

39.2. Use case description

39.2.1 Description

Introduction:-China Mobile is actively responding to the challenge of co-benefits arising from "working to improve the lives of older people, their families and the communities in which they live" within the National strategic plan advocated by the World Health Organization. To address these complex issues, China Mobile has developed the AI Enabling Jiutian Travel Model, which is associated with good health and well-being and can improve a country's performance in achieving the Sustainable Development Goals.

Overview of the product: AI Enabling Jiutian Travel Model includes a large model of real-time positioning, identity determination, loss judgment and travel path prediction for elderly people living alone, aiming to accurately and quickly monitor the complex location trajectory dynamics of elderly people living alone. This product, based on 5G base station signaling data analysis, integrates AI-based trajectory analysis for elderly people living alone to achieve the co-benefits of sustainable development over the Decade of Healthy Ageing 2021-2030.

Cooperative efforts: China Mobile, in cooperation with the Chinese government, has developed an AI Enabling Jiutian Travel Model, which covers functions such as real-time location, identity determination, loss of contact judgment, travel path prediction, and pilot applications to help family members of elderly people timely grasp the location information and health and safety status of elderly people living alone. On the basis of this work, through cooperation with the government, products and services are extended to more families, so that more elderly people can enjoy health care services. This product will enable the achievement of the SDG co-benefits, particularly in the realm of good health and well-being for older persons living alone, This is essential to promote equitable and sustainable development.

Partner: Zhuhu Town People's Government, Sihong County, Suqian City, Jiangsu Province

UN Goals:

- **SDG 3:** Good health and well-being
- **SDG 10:** Reduced inequalities
- **SDG 11:** Sustainable cities and communities

Assessment of SDG Co-benefits: The AI Enabling Jiutian Travel Model is linked to China Mobile's Geriatrics Health Assessment Index, which measures a country's performance in achieving the Sustainable Development Goals in three areas - physical health, mental health and social health. Through this linkage, AI Enabling Jiutian Travel Model helps to assess the co-benefits of sustainable development from multiple dimensions, including reduced risk of elderly people living alone going missing, enhanced health and safety care, and improved search-and-rescue efficiency. These assessments are critical to measuring progress towards the SDGS in good health and well-being (Goal 3), reducing inequalities (Goal 10), and sustainable cities and communities (Goal 11). By combining a large model of China's mobility with an AI-based trajectory analysis of older people living alone, more SDG indicators can be covered in Goals 10, and 11. Improving the current version of the AI Enabling Jiutian Travel Model will therefore allow the assessment of co-benefits in Goal 3, contributing to a more comprehensive assessment of sustainable development progress.

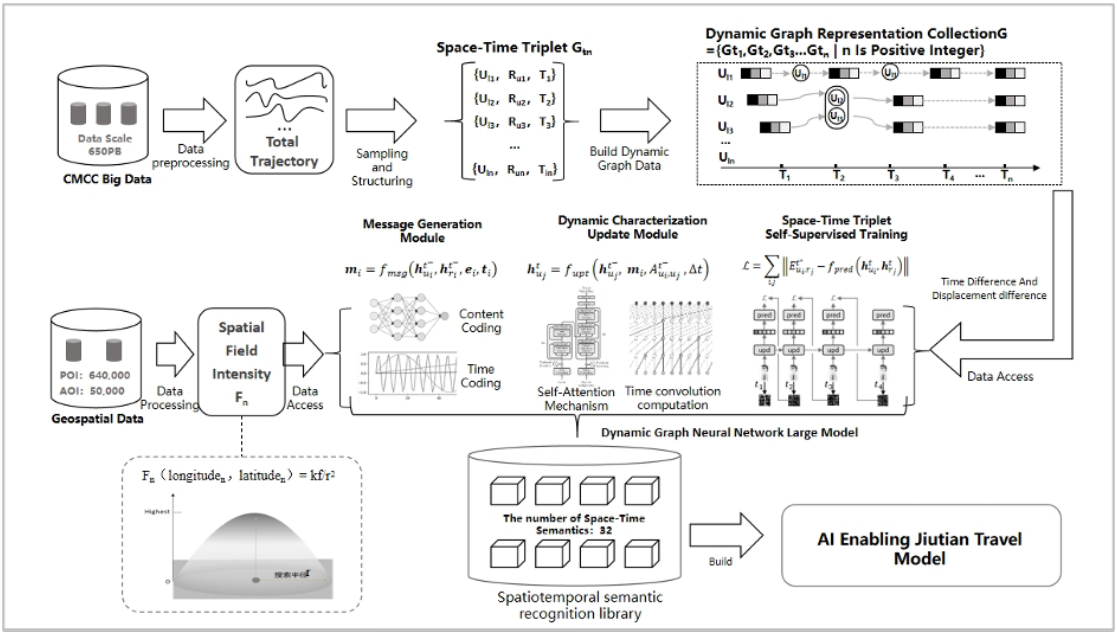
39.2.2 Future Work

Future work on AI Enabling Jiutian Travel Model will focus on continued data collection, model improvement, standardization of service output, and roll-out.Additionally, opportunities to collaborate with ITU Innovation for Impact will be explored to enhance research on AI-based solutions that can further improve the tool's capabilities and applications. These efforts will create an improved product accessible to all people, policymakers, researchers, and stakeholders worldwide. Ultimately, the goal is to empower decision-makers with robust insights for informed policy development and sustainable development planning, thereby accelerating progress towards achieving the SDGs and Improving the health and safety of the elderly.

39.3. Use case requirements

- **REQ-01:** To obtain the travel trajectory data of elderly individuals living alone, China Mobile must obtain the authorization of both the elderly individuals and their families.
- **REQ-02:** The coverage of 5G network base stations will affect the positioning and tracking of authorized elderly individuals.
- **REQ-03:** The product requires more trajectory data from elderly individuals as training samples.

39.4. Sequence diagram



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[2] Towards Better Dynamic Graph Learning: New Architecture and Unified Library. Available online: https://arxiv.org/abs/2303.13047

[3] Community-based Dynamic Graph Learning for Popularity Prediction. Available online: https://dl.acm.org/doi/abs/10.1145/3580305.3599281

Use case – 40: Traffic accidents stop in the virtual world - Use virtual simulation synthesis data to improve intelligent driving AI algorithm and reduce the accident rate in traffic scenarios

Country: China

Organization: GEELY

Contact person: Ms. REN Xian, renxian@geely.com

40.1. Use case summary table

Domain	Transportation
The Problem to be addressed	• The level of autonomous driving at this juncture does not yet align with the completion objective of Level 4 unmanned operation, primarily attributed to the imperative of algorithmic enhancement, and a concomitant deficiency of adequate algorithmic data • Autonomous driving deployments necessitate an abundance of real-world data to facilitate training and testing processes, but the procurement and annotation of this data is inevitably expensive and labor intensive. • The acquired data may exhibit biases, and fail to encompass every conceivable driving scenario. • Autonomous driving systems are bound by the requirement to withstand testing under diverse and complex circumstances, such as harsh weather situations, congested traffic conditions, and ongoing road construction projects. Nevertheless, these specific conditions may not be consistently accessible for real-world testing. • In the dimension of validation and testing, the restrictions of closed testing arenas include a monolithic environmental context, an inability to replicate varying complexities encountered on real-world roads, a deficiency in affirming performance on actual roadways, and an exorbitantly high cost associated with utilising testing equipment and spaces.
Key aspects of the solution	• Utilizes virtually simulated synthetic data to amplify the perceptual capabilities of the autonomous driving system, and also to augment the efficiency of testing and validation processes. • This avant-garde approach plays a pivotal role in elevating the system's performance, safety, and adaptability, while concurrently accelerating the progression of system development and testing. This consequently results in a substantial reduction in costs and risks. • AI generated virtual data generation is helpful to realize the purpose of energy saving and emission reduction, and protect the green earth.
Technology keywords	AI-based Network Analysis, Scenario Analysis, energy saving, emission reduction, Simulated security, Reduce labor costs, protect the green earth, life saving.
Data availability	Will be released soon.

(continued)

Domain	Transportation
Metadata (type of data)	Images and labels with structured standard
Model Training and fine-tuning	• Vehicle vision perception model for parameter optimization • Based on style-transfer method model fine-tuning.
Case Studies	China, MIIT.gov, intelligent connected vehicle test management procedure and industrial development suggestion
Testbeds or pilot deployments	link

40.2. Use case description

40.2.1 Description

Introduction: The level of autonomous driving at this juncture does not yet align with the completion objective of Level 4 unmanned operation, primarily attributed to the imperative of algorithmic enhancement, and a concomitant deficiency of adequate algorithmic data. Autonomous driving deployments necessitate an abundance of real-world data to facilitate training and testing processes, but the procurement and annotation of this data is inevitably expensive and labor intensive.

Furthermore, the acquired data may exhibit biases, and fail to encompass every conceivable driving scenario. Autonomous driving systems are bound by the requirement to withstand testing under diverse and complex circumstances, such as harsh weather situations, congested traffic conditions, and ongoing road construction projects. Nevertheless, these specific conditions may not be consistently accessible for real-world testing.

In the dimension of validation and testing, the restrictions of closed testing arenas include a monolithic environmental context, an inability to replicate varying complexities encountered on real-world roads, a deficiency in affirming performance on actual roadways, and an exorbitantly high cost associated with utilizing testing equipment and spaces. Testing processes undertaken on actual roads are dependent on real road and traffic situations, which mandate considerable investment of manpower and resources, whilst also introducing safety risks.

The case in study utilizes virtually simulated synthetic data to amplify the perceptual capabilities of the autonomous driving system, and also to augment the efficiency of testing and validation processes. This avant-garde approach plays a pivotal role in elevating the system's performance, safety, and adaptability, while concurrently accelerating the progression of system development and testing. This consequently results in a substantial reduction in costs and risks.

Tool Overview: This case is applied to intelligent driving and intelligent transportation scenarios. The virtual simulation platform is used to build scenarios, generate a large number of data under various scenarios, including normal and extreme situations, and simulate various complex driving scenarios, such as bad weather, traffic congestion, road engineering, etc., to generate more diversified data. Helps intelligent driving systems better generalize to previously

unseen scenarios. The virtual simulation platform can quickly generate large-scale data sets of corner cases scenarios based on synthetic data.

At the same time, in order to reduce the accident rate in traffic scenarios, the intelligent driving algorithm is connected to the virtual simulation platform, SIL software is implemented in the loop, algorithm code is run and tested, and continuous iteration and optimization are carried out, so that "traffic accidents stop in the virtual world".

40.2.2 Future work

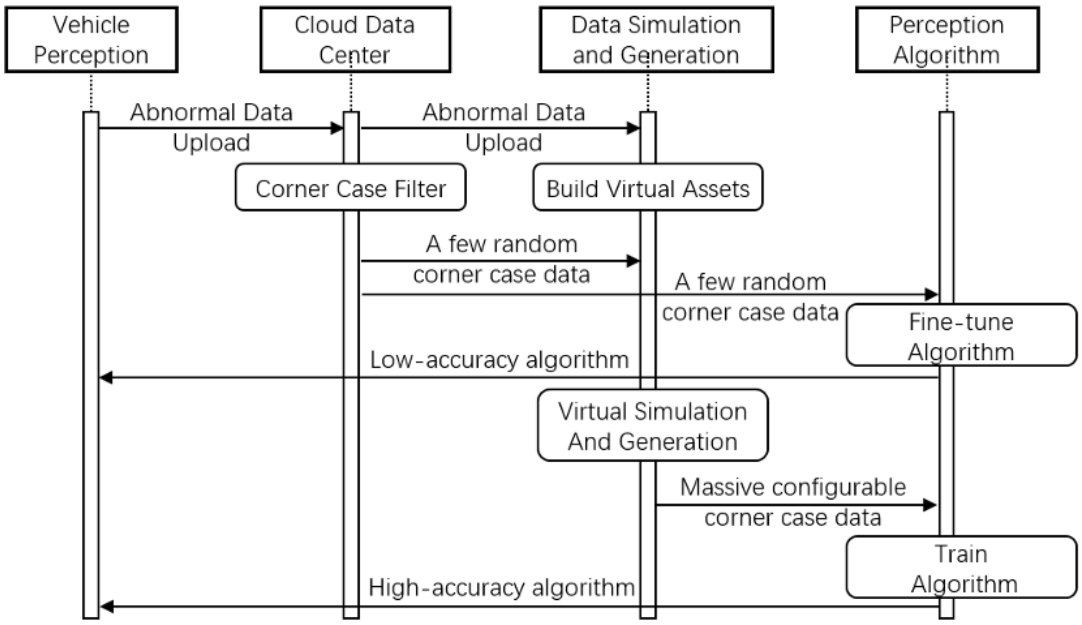
The future work plan is divided into the following points:

1. Conduct big data analysis on the current open source data set, road test data and mass production return data, and dig out the core corner cases in real scenarios;
2. Conduct 3D scene reconstruction and development for core corner cases scenes, edit static and dynamic elements, and realize the generalization of scene contents; Further improve the synthetic data set, including adding synthetic data for different scenarios, weather conditions, road conditions, etc., to ensure data quality and diversity;
3. Based on the real data and synthetic data of intelligent driving, optimize the perception algorithm of intelligent driving system, improve the recognition and understanding ability of various complex scenarios, reduce the probability of misjudgment and missed judgment, evaluate the performance and robustness of the perception algorithm, find potential problems and make improvements;
4. Cooperate with industry, academia and government departments to jointly promote the development and application of intelligent driving perception technology and promote the application of synthetic data in the field of intelligent driving; The corner cases data set is disclosed and the data conversion mode and method are set.

40.3. Use case requirements

- **REQ-01:** Simulation of different weather conditions: The synthetic data can simulate different weather conditions, such as rainy, snowy, foggy, etc., to help the autonomous driving system adapt to driving conditions in various weather conditions.
- **REQ-02:** Simulation of different road conditions: The synthetic data can simulate different road conditions, such as highways, urban roads, rural roads, etc., to help the autonomous driving system adapt to driving conditions in different road environments.
- **REQ-03:** Simulation of traffic situations: Synthetic data can simulate different traffic situations, such as congestion, intersections, pedestrian crossing, etc., to help autonomous driving systems adapt to complex traffic situations.
- **REQ-04:** Simulation of vehicle behavior: Synthetic data can simulate the behavior of other vehicles, such as lane changes, overtaking, parking, etc., to help the autonomous driving system predict the behavior of other vehicles and make corresponding driving decisions.

40.4. Sequence diagram



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Use case – 41: AI for Kidney Disease Prevention

Country: United States

Organization: Columbia University & Carna Health

Contact persons: Eugenio Zuccarelli, Salvatore Viscomi

41.1. Use case summary table

Domain	Healthcare
The problem to be addressed	Chronic kidney disease (CKD) as a growing worldwide healthcare concern.
Key aspects of the solution	Medical records, pre-health assessment, summary report generation
Technology keywords	Machine Learning, Explainable AI, Shapely Additive Explanations (SHAP)
Data availability	Private data available
Metadata (type of data)	Numerical and Tabular patient report data.
Model Training and fine-tuning	Randomforest classification, Decision trees.
Testbeds or pilot deployments	Not available

41.2. Use case description

41.2.1 Description

Chronic kidney disease (CKD) is a growing worldwide healthcare concern. As of 2017 it was estimated it affects almost 700 million people globally, with a prevalence of approximately 10%. Data shows that it is increasing by as much as 5% per year and is expected to be the fifth most common cause of death by 2040. In addition to the human cost of CKD, it also accounts for a disproportionate financial burden to the healthcare system. Although in the USA patients with ESKD make up less than 1% of the total Medicare population, they represent 6% of total Medicare spending, or over $50 billion in 2020 [8, 9], and this cost burden is not unique to the USA. Whilst it is important to diagnose the cause of CKD as it may be treatable or modifiable, it is now more important than ever to diagnose the presence of CKD, as there are new medications which can delay progression to end stage kidney disease (ESKD), a terminal condition unless treated with dialysis or transplantation – collectively described as renal replacement therapy (RRT). The presence of CKD also marks individuals for premature death due to cardiovascular disease and is a major cause of hypertension, which in turn worsens CKD. Prevention of CKD requires screening of high-risk individuals, most notably those with type 2

diabetes or hypertension. Prevention of progression of CKD to ESKD also requires screening as 90% of people with CKD are unaware that they have impaired kidney function, because it is usually asymptomatic until it reaches an advanced stage.

This project aims to develop an AI system that would be able to aggregate all the collected data at patient level, process it through data cleaning and feature engineering, develop and train a model on such data to predict the likelihood of developing CKD or, if already present, the likelihood to get worse next year. Through the use of Explainable AI techniques, e.g. SHAP or Causal SHAP, we will then be able to understand each individual's main risk factors, to then intervene on those people to help them take the right actions to reduce their risk, leading to health and financial improvements.

UN Goals:

- SDG 3: Good Health and Well-being
- SDG 10: Reduced Inequality
- SDG 17: Partnerships to achieve the Goal

Justification of UN Goals selection: SDG 3: Good Health and Well-being: The primary goal of this project is to predict chronic kidney disease (CKD), thereby contributing directly to SDG 3, which focuses on ensuring healthy lives and promoting well-being for all at all ages. By leveraging advanced predictive analytics, the project aims to enable early detection and intervention for CKD, ultimately improving patient outcomes and reducing the burden of disease on individuals and healthcare systems. SDG 10: Reduced Inequality: Chronic Kidney Disease often disproportionately affects certain populations due to inequalities based on ethnicity, gender, and socioeconomic status. Addressing SDG 10, which seeks to reduce inequality within and among countries, this project emphasizes the need for an ethical and bias-free approach in its predictive models. By ensuring that the predictive tools are inclusive and equitable, the project aims to mitigate disparities in CKD diagnosis and treatment, fostering a more just healthcare system. SDG 17: Partnerships for the Goals: The project's collaborative framework aligns with SDG 17, which advocates for strengthening the means of implementation and revitalizing the global partnership for sustainable development. Carna's industry expertise, combined with connections to academic experts, underscores the value of multi-sectoral collaboration. This synergy not only enhances the project's impact but also showcases the potential of partnerships in driving innovative solutions for global health challenges.

Partner name: Carna Health Partner

41.2.2 Future work

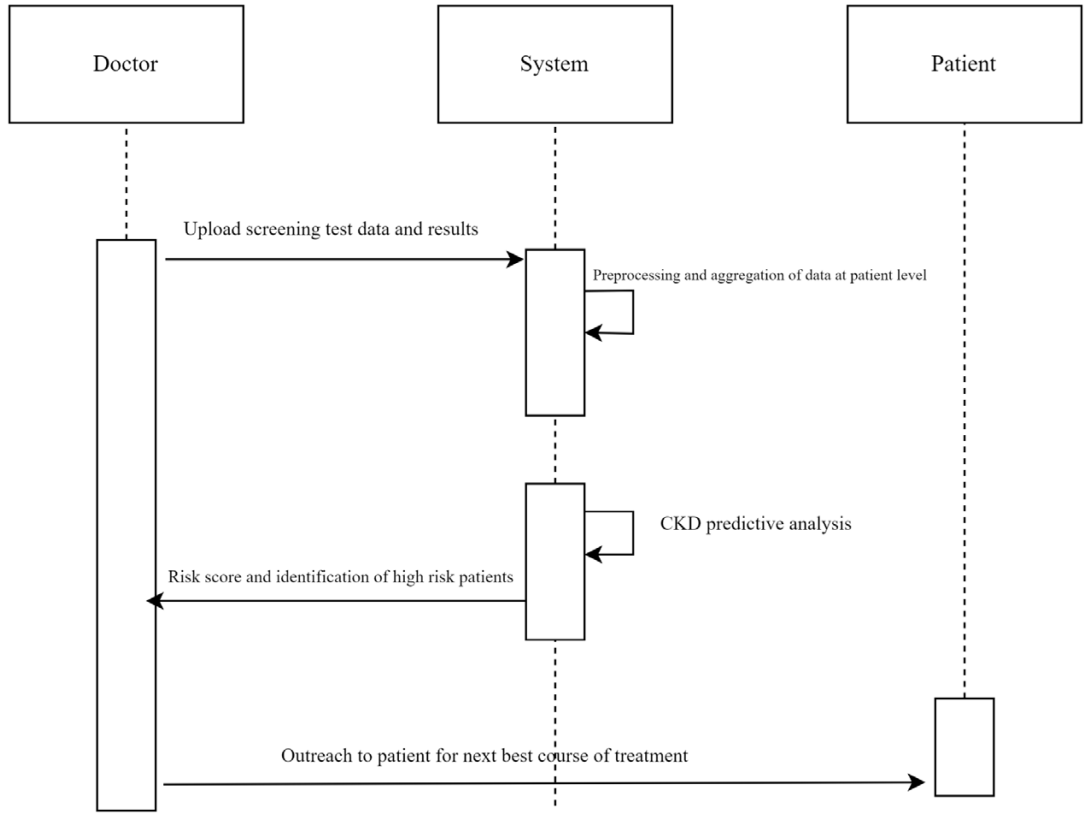
Proof of concept development, Model development, Collection of more data

41.3 Use-case requirements

- **REQ-01:** It is required that there is a comprehensive collection of patient screening data, medical history, medication records and demographic information.
- **REQ-02:** It is critical that there are secure databases for storing patient data and data integration tools to handle diverse data sources.
- **REQ-03:** It is crucial that there is development of a highly accurate machine learning model to make appropriate predictive analysis.

- **REQ-04:** It is critical that there are methods to visualize and communicate individual risk factors for predictive analysis interpretability.

41.4 Sequence Diagram



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[1] Carna Health Partner

[2] US Department of Health and Human Services, Advancing American Kidney Health. 2019.

[3] United States Renal Data System, 2022 USRDS Annual Data Report: Epidemiology of kidney disease in the United States. 2022. Chapter 9: Healthcare Expenditures for Persons with ESRD. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD.

Use case – 42: AI 4 Health – Live Primary Health Care African National Sign Languages Translation tool

Country: Zimbabwe

Organization: Purple Signs Global

Contact person: Dominic Tinashe Tapfuma,

tapfumadominic@gmail.com

+263 773 744 246, +263 292 200 040

42.1. Use case summary table

Domain	Artificial Intelligence in Healthcare
The problem to be addressed	1. Limited access to critical health information and services. 2. Difficulty in effective communication between deaf individuals and service providers. 3. Marginalization of deaf and hard of hearing individuals, hindering their ability to participate fully in society and the economy.
Key aspects of the solution	AI-powered Live Sign Language Translation Multimodal Communication Capabilities
Technology keywords	AI-powered Translation, Text to Speech, Speech to Sign Language, Facial Animation, AI Dubbing, Healthcare Accessibility, RMNCAH (Reproductive, Maternal, Newborn, Child, and Adolescent Health & Nutrition).
Data availability	Private data available
Metadata (type of data)	1. Creating visuals with video 2. Can convert any text to visual. 3. Computer vision to computer generated visuals
Model Training and fine-tuning	Using AutoML, which automatically prepares a dataset for model training, performs a set of trials using open-source libraries such as scikit-learn and XGBoost, and creates a Python notebook with the source code for each trial run so you can review, reproduce, and modify the code. Using hyperparameter tuning for fine tuning the model . Making use of HyperOpt, scikit-learn, MLflow libraries.

(continued)

Domain	Artificial Intelligence in Healthcare
Testbeds or pilot deployments	How Zimbabwean SME Purple Signs are bringing ever more Africans the benefits of affordable, accessible sign language tools – thanks in part to ITU Telecom World - ITU Telecom World

42.2. Use-case description

42.2.1 Description

Mr Dominic Tapfuma Developed a United Nations International Telecommunications Union Award winning AI powered Live Sign Language translation tool applicable in Health , Finance & Tourism for at least 25 African Sign Languages. The technology is registered under the Africa Regional Intellectual Property Office and its interfaces create speech from sign language and vice versa for the 1.5million + Dead / Hard of hearing in Zimbabwe alone. Sign Language hand signals converted to text at 80 words per minute using phonemes and converted to audio.

AI Capabilities are vocal generation from Sign Languages and text; text and voice to sign language mirroring as well as facial animations for communication.

Since 2018, 3500 words in sign language content have been generated for his technology. Using AI dubbing, Dominic Tapfuma' Sign Language translation and cloning products have applications in content creation, gaming, publishing, education and accessibility in health to enable everyone who is either deaf or with a hearing impairment to connect with information and stories that matter in health.

Population Focus: 12% Zimbabwean Population (Persons With Disabilities)

Number: 300 000 to 1,5 Million

Employment Creation: 10 000 New Jobs - Deaf persons in Tourism, Finance, Health, Front Office Jobs Highest Impact Industries: Health, Finance, Tourism Income impact - (Agro-Industry) – Active hiring of Deaf farm Workers (Communication in Sign Language with deaf farm /industry workers).

At an individual level Dominic Tapfuma is an innovative leader who believes in Zimbabwe's potential to disrupt Africa through its leaders approaching business from a global standards standpoint. At a service level he ensures delivery of high quality service for vulnerable populations (Persons With Disabilities), ensuring appropriate support and advice is given, and staff are supported while going above and beyond when needed.

At an organizational level he is an ambassador for our expectations of values and behavior consistent with changing the story for persons with disabilities to live empowered, healthy, wealthy lifestyles while getting ahead and not being left behind. He delivers excellence, achieves ambitions (for himself and others) as seen by his appointment to be a committee member of the International Standards Organisation (ISO) supports people in working together to ensure a good service and everything he does is underpinned by compassionate care for those he works with.

Impact In Zimbabwe's Primary Healthcare (Applicable to 28 Other African National Sign Language Use Cases)

Dominic's leadership had led to development and delivery of disability inclusive communication and access to information on drugs & medicines for hard of hearing/deaf clients which is critical to ensuring access to quality health care services and essential medicines for all. His work has and will continue to lead to improved human resource performance in the health sector (seamless communication with the deaf client/ service provider), improved access to information on essential medicines & commodities in Zimbabwean and Other African Sign Languages, improved access to (Primary, Secondary, Tertiary) quaternary & quinary health care services, Improved inclusive Public Health Surveillance for the deaf population, Disaster Preparedness & Response in Sign Languages, Reduced Morbidity & Mortality due miscommunication with reference to CD's & NCDs, Increased access to information on water sanitation and healthy environment for the deaf as well as improved RMNCAH & N for deaf clients which are the key sign language inclusive health sector outcome areas to be supported by the technologies being championed by Dominic as executive director of Purple Signs Global. If the deaf do not learn the standard health care Sign Language variety for the country and if non-deaf (hearing) members of the medical community have no knowledge of Sign Language, then the deaf will not enjoy any of the rights they are entitled to.

As highlighted in a United Nations ITU report, there are at least 1.5million deaf /hard of hearing Zimbabweans who are and will benefit from the technologies Purple Signs Global has developed. At least 10000 front office workers in health and finance will benefit from seamless communications with deaf clients which will have a positive impact on the bottom line of businesses as more deaf clients take up their services while enjoying a previously fragile customer experience.

UN Goals:

- **SDG 3:** Good Health and Well-being
- **SDG 4:** Quality Education
- **SDG 8:** Decent Work and Economic Growth
- **SDG 17:** Partnerships to achieve the Goal

Justification UN Goals selection: The tool is used in health to allow the deaf to communicate with health care providers and for healthcare providers to communicate with the deaf. This also allows quality education and decent work for the deaf in public health , primary healthcare etc .

Partner: harare institute of public health Partner.

42.2.2 Future work

Data collection, Model development, Create new variations/extensions to the same use case, Standards development related to the use case, Setup reference tools, notebooks and simulation environment.

Elaborate proposal: Extension of AI based African National Sign Translation tool to Health, Banking, Finance, Insurance and Investment industries in Africa. Also expanding beyond national sign languages to regional sign language dialects within each nation's borders for seamless translations. Sign languages have regional and community dialects which must be integrated for best use in Public Healthcare.

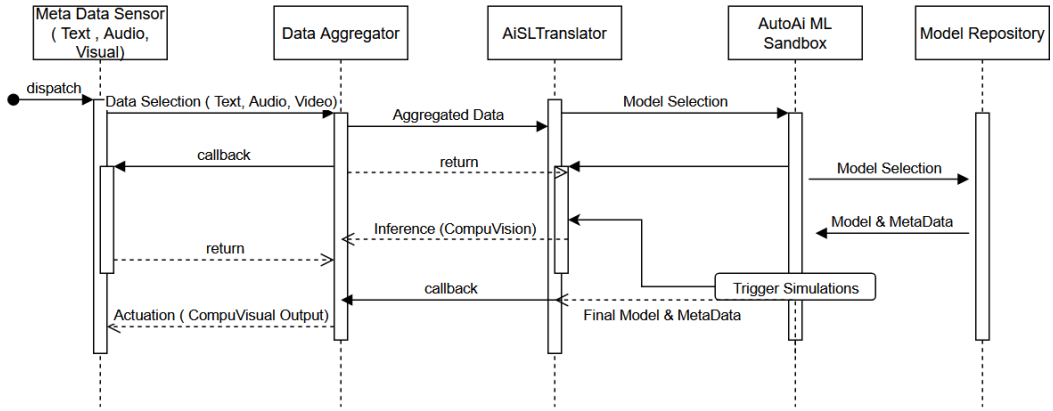
Multi-modal content analysis (visual , audio & text) using computer vision and AI dubbing technology, sign language model training, Public Health (WHO) policy triggers. If given scholarship we would set up a data simulator which reflects the data generation from a variety of sources such as audio, visual and text, including historical records, online existing sign language imagery/ videography in African National sign languages. This would include spatial coverage of public health institutions and new content alerts from telecom providers via the AI platform.

Prediction on policy triggers in Health and impacts on resource allocation in African Sign Languages , including readiness will be demonstrated and published with the simulated data patterns via Public Platforms which can be accessed remotely using multiple Tecomms Service providers with last mile connectivity.

42.3. Use case requirements

- **REQ-01:** Live Sign Language Translation Tool - Develop an AI-powered live sign language translation tool capable of translating between at least 25 African sign languages and spoken/written language in real-time.
- **REQ-02: The application of the use case:** Purple Signs - ITU Telecom World.
- **REQ-03: Content Creation and Dubbing -** Use AI to create and dub content into sign language, making information accessible to the deaf community.

42.4. Sequence Diagram



42.5. References

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[2] Pharmaceutical Society Of Zimbabwe Joint Congress [PSZ] , 2018 (PSZ , 2019)

[3] Zimbabwe Medical Association Annual Scientific Congress Journal , 2019

Use case – 43: Datasets and AI for 3GPP Mission Critical Services (MCX) in emergency

Country: Spain

Organization: Nemergent Solutions

Contact person: Adrian Santiago, adrian.santiago@nemergent-solutions.com

43.1. Use case summary table

Domain	Telecommunications and emergency services
The problem to be addressed	Developing AI/ML-driven solutions for optimizing and managing 5G/6G networks in massive emergency scenarios due to the lack of real-world datasets
Key aspects of the solution	• Implementation of AI/ML mechanisms for network optimization and anomaly detection. • Development of datasets simulating emergency scenarios. • Enhanced network topology and configuration management during disasters.
Technology keywords	• 5G/6G networks • AI/ML • Mission Critical Services (MCX) • Network optimization • Anomaly detection
Data availability	It has not yet been publicly released. Data collection is still pending implementation. The simulation and emulation of large-scale events are necessary. Currently, due to data privacy concerns, the company does not make the data public.
Metadata (type of data)	Numerical values, text data and GPS.
Model Training and fine-tuning	Depends on the final data. May use neural networks, supervised learning.
Testbeds or pilot deployments	https://doi.org/10.1109/ACCESS.2024.3350902

43.2. Use-case description

43.2.1. Description

Traditional critical communications have evolved during the last years towards implementations adapted to new generation broadband networks, starting from LTE to 5G+/6G, following

standard-based, interoperable and cost-efficient objectives. This evolution has been supported and carried out by the 3rd Generation Partnership Project (3GPP), developing standards and requirements for Mission Critical Services (MCX) over the broadband wireless networks, since the Release 13. Targeting multiple services (audio, data and video), their requirements have increased and new scenarios for optimization and AI have arisen. The 3GPP has already identified the relevance of AI/ML in mobile broadband network management and in Release 18 there already exist multiple Work Items focusing AI/ML research for 5G internal and 3th party services, and for Radio Access Networks purposes. This work is still in preliminary stages and it is required to develop solutions based on these theoretical proposals. The lack of datasets for massive emergency scenarios is an issue that must be addressed due to the difficulties related to the access to this kind of deployments or simulations.

Emergency and disaster scenarios datasets will allow MCX services providers and 5G/6G networks managers to implement solutions for optimization and smart management of resources and services in cases which have not been widely analyzed in real-world cases, where disaster characteristics imply massive user communications in restrained conditions (geographical, architectural and wireless). AI/ML mechanisms can be applied to identify anomalies to anticipate errors (vital in disasters for Public Safety) and reorganize the network topology and configuration to adapt properly to each time spot requirements. Dataset shall include radio and service parameters, correctly labeled and for some periods of interest, under emergency and normal work days situations.

UN Goals:

- **SDG 9:** Industry, Innovation and Infrastructure
- **SDG 11:** Sustainable Cities and Communities
- **SDG 17:** Partnerships to achieve the Goal

Justification on UN Goals selection: SDG9: MCX services seek to use common infrastructures for the sake of interoperability and standardization, reducing the impact of isolated network infrastructures and equipment for the environment, promoting resilient networks for extreme scenarios and enhancing research and upgrading industrial technologies. Promoting MCX services over broadband networks (private or commercial) also facilitates developing countries accessing this kind of technology. SDG11: MCX services standards are applied to get safer and resilient transport systems and to reduce the adverse effects of natural disasters. This technology allows governments and institutions to develop national and regional planning thanks to its principle of interoperability, also providing resource optimal management (resource efficiency) thanks to the new broadband network features. Disaster risk reduction can be also improved thanks to resilient and guaranteed communications for first responders in case of disaster scenarios, where every second of delay in communications has a huge impact. SDG17: Standardization provides the opportunity to access to research and technology in a cooperative way and also without the need to invest on preliminary stages in the case of developing countries.

Partner name: University of the Basque Country - UPV/EHU

43.2.3. Future work

A data simulator would be set up to reflect the data generation from a 5G network (encompassing Radio Access Network and 5G Core functions) for massive MCX equipment connected to

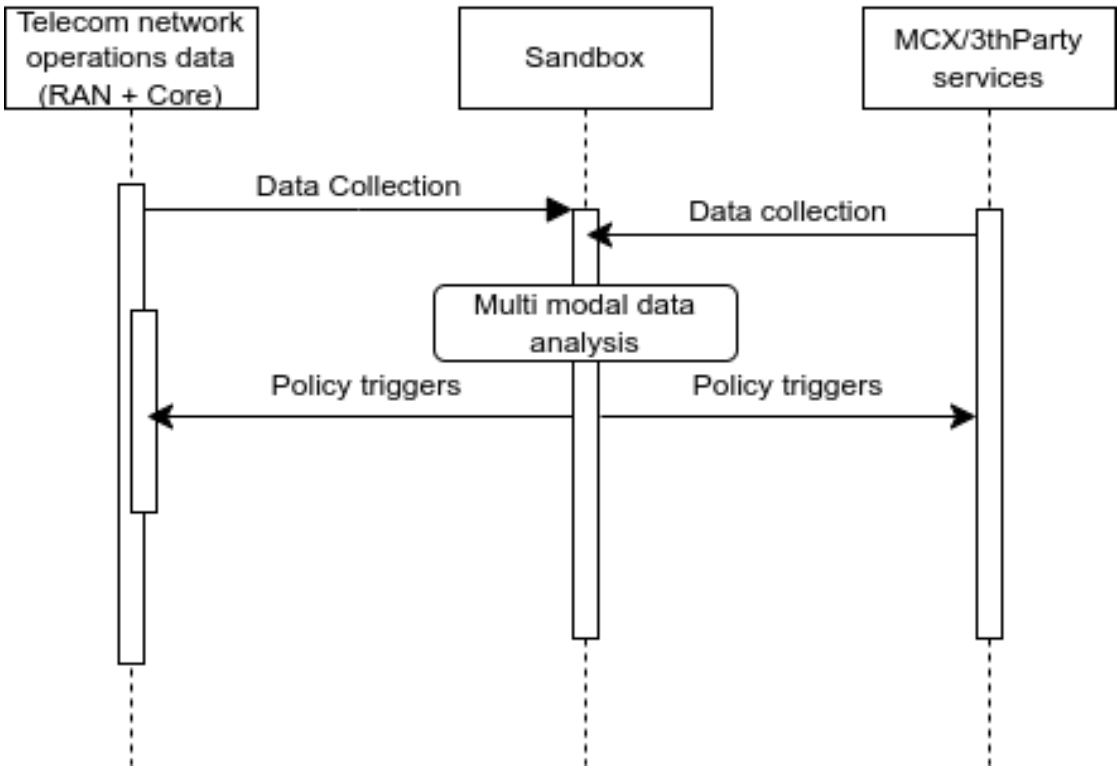
the radio network to simulate location and radio conditions. RAN metrics (such as channel conditions, cells, bands, resources), 5G Core metrics (including network functions location, resources, and configurations), MCX metrics (like users, groups, calls, bytes transmitted/received, codecs), and equipment metrics (such as CPU, disk, memory, and network usage) would be included. Interaction through an interface for real-time/near-real-time metrics retrieval would be facilitated by the environment.

The simulated data would then be analyzed as a time series from a cumulative database and as a Reinforcement Learning agent-environment for optimal policy learning. Adaptation of the 5G network for KPI violations, error detection, or capacity bottlenecks would be pursued. Predictions on KPI violations, error detection, or capacity bottlenecks, along with optimal policy triggers, would be demonstrated and published based on the simulated data patterns.

43.3. Use case requirements

- **REQ-01:** It is critical that the solution/system enables autonomous network operations through ML/AI to simplify deployment and configuration tasks.
- **REQ-02:** It is critical that the solution/system incorporates a Digital Twin for efficient resource management, projecting resource utilization to optimize infrastructure usage.
- **REQ-03:** It is critical that the solution/system provides monitoring, dashboard and dispatch capabilities for responsive observability, allowing operators to visualize and interact with network configurations and projected traffic.
- **REQ-04:** It is critical that the solution/system includes security measures for continuous monitoring of network traffic and automated enforcement of security policies.

43.4. Sequence diagram



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[2] 3GPP, "Feasibility study for Further Advancements for E-UTRA (LTE-Advanced)", document TR 36.912

[3] 3GPP, "Study on New Radio (NR) access technology", document TR 38.912

[4] ITU-R, "Guidelines for evaluation of radio interface technologies for IMT-Advanced", document Report ITU-R M.2135-1

Use case – 44: Intelligent UAV-Assisted Plant Disease Detection in Rock Melon Greenhouses

Country: Malaysia

Organization: Universiti Teknologi Malaysia

Contact person: Norulhusna Ahmad, norulhusna.kl@utm.my, +60192777681

44.1. Use case summary table

Domain	Smart Agriculture
The problem to be addressed	• Decrease crop losses • Inconsistencies in plant disease detection • Decrease human errors
Key aspects of the solution	Plant disease detection
Technology keywords	Image, agriculture, plant detection.
Data availability	Currently Private.
Metadata (type of data)	• NPK sensors • Soil moisture sensors • Drone camera
Model Training and fine-tuning	• Reinforcement learning • Categories of plant diseases • One class detection and five class classification • YOLOv9, IoT, Edge Computing
Testbeds or pilot deployments	http://dx.doi.org/10.14569/IJACSA.2024.01501119

44.2. Use-case description

44.2.1. Description

The Intelligent UAV-Assisted Plant Disease Detection project in Rock Melon Greenhouses, supported by the ASEAN IVO grant on Edge Computing in Agriculture, represents a groundbreaking advancement in agricultural surveillance. By integrating unmanned aerial vehicle (UAV) technology with cutting-edge deep-learning models like You Only Look Once version 9 (YOLOv9), this initiative aims to revolutionize precision agriculture practices. The project's innovative approach involves utilizing UAV imagery to detect diseases in melon leaves, focusing on enhancing agricultural productivity and sustainability. Moreover, an automated and online plant disease detection system based on the YOLOv9 model eliminates the need for farmers to physically inspect the greenhouse, allowing them to allocate their time more efficiently.

Currently, the project features an IoT fertilizer system equipped with NPK, soil moisture, and temperature sensors. Data collected by these sensors are stored in the cloud via mobile apps or websites for convenient monitoring. In scenarios of connectivity challenges, manual control ensures uninterrupted system operation. It is important to note that these two systems operate independently, providing farmers with versatile tools for efficient crop management and disease detection in rock melon greenhouses. This comprehensive approach enhances agricultural surveillance and promotes innovation and sustainability in farming practices, contributing to global development goals and transforming the landscape of precision agriculture.

UN Goals:

- **SDG 2:** Zero Hunger,
- **SDG 9:** Industry, Innovation and Infrastructure,
- **SDG12:** Responsible Consumption and Production,
- **SDG15:** Life on Land

Justification UN Goals selection: SDG 2: Zero Hunger: By utilizing UAV technology and advanced deep-learning models for efficient disease detection in melon leaves, the project enhances agricultural productivity and ensures food security. Timely identification and management of plant diseases can help prevent crop losses, ultimately supporting efforts towards achieving zero hunger. SDG 9: Industry, Innovation, and Infrastructure

Integrating UAV technology, IoT systems, and Reinforcement Learning algorithms in agriculture showcases innovation and technological advancement in the industry. This project not only enhances agricultural surveillance but also promotes the development of sustainable infrastructure and practices in the agricultural sector. SDG 12: Responsible Consumption and Production. Through optimising fertilizer application, improved crop health, and data-driven decision-making enabled by the IoT smart fertilizer system, the project promotes responsible consumption and production patterns. Reducing resource wastage and enhancing efficiency in farming practices contribute to more sustainable agricultural production. SDG 15: Life on Land. The project's focus on plant disease detection in rock melon greenhouses supports the conservation of terrestrial ecosystems and biodiversity. By effectively managing plant diseases through innovative technologies, the project helps maintain the health of agricultural lands and ecosystems, aligning to promote life on land.

44.2.2. Future work

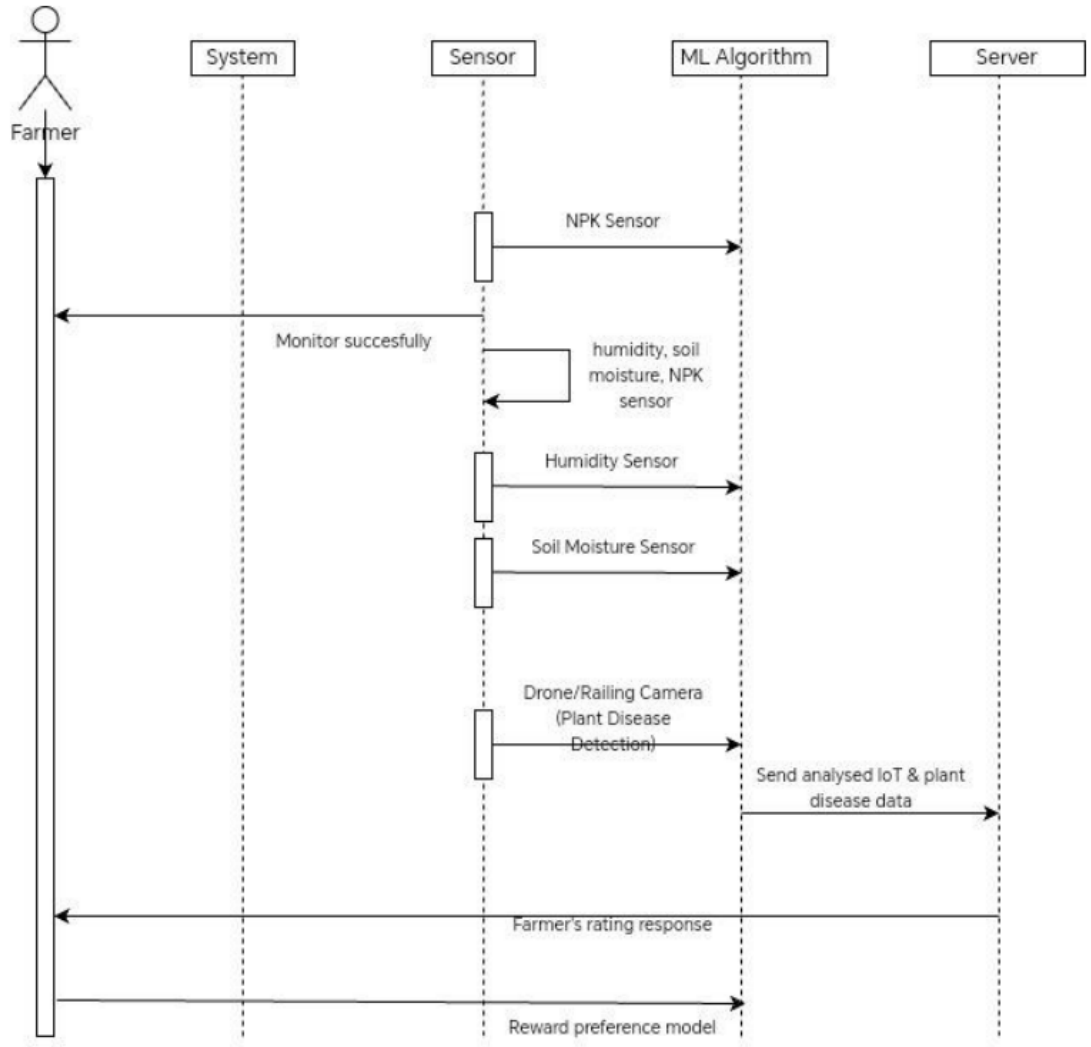
We will integrate an online plant diesease detection with the IoT intelligent fertilizer system to analyze the correlation between data sensor inputs and detected plant diseases. This integration seeks to optimize fertilizer application, improve crop health, and facilitate data-driven decision-making for farmers.

Additionally, Reinforcement Learning algorithms will enhance the system's intelligence by designing effective policies based on environmental interactions and reward processes. This approach will allow the system to learn and adapt based on feedback provided by farmers, ultimately improving the performance of the models.

44.3. Use case requirements

- **REQ-01:** Data Integration and Standardization - It's critical to integrate and standardize data from UAV imagery and IoT sensors (NPK, soil moisture, temperature) to ensure seamless operation and accurate disease detection.
- **REQ-02:** Machine Learning Models - It's critical to implement and utilize advanced machine learning models for predictive analytics and disease detection.
- **REQ-03:** User-Friendly Interface - It's critical to develop a user-friendly interface for farmers and stakeholders to interact with the AI-driven decision support system.
- **REQ-04:** Reliability and Performance - It's critical to ensure the system is reliable and performs efficiently under various conditions.
- **REQ-05:** Security and Privacy - It's critical to ensure the security and privacy of data collected and processed by the system.
- **REQ-06:** Training and Support - It's critical to provide comprehensive training and support to users for effective system utilization.

44.4. Sequence diagram



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Use case – 45: Digital twins for AI based xapps in open RAN for smart agriculture in 5G

Country: India

Organization: OMACS Technocraft Solutions Pvt. Ltd.

Contact person: Dr. V. Udaya Sankar, uday@omacs.in, udayasankar.v@srmap.edu.in

P. N. B. S. Eswar, eswar_panchakarla@srmap.edu.in

P. Prudhvi Krishna, prudhvikrishna_pavuluri@srmap.edu.in

45.1. Use case summary table

Domain	Metaverse, 6G
The problem to be addressed	One of the important problems to be solved in future networks such as 5G and 6G is the opportunities for monetization. To identify such opportunities, operators need to study and experiment with several scenarios and arrive at optimized solutions. This is applicable not only to connectivity solutions but also to vertical applications such as in agriculture and healthcare.
Key aspects of the solution	In this use case, we create digital twins for running Artificial Intelligence integrated xapps in open RAN based architecture in a simulated environment. These would be tested and validated in a Sandbox before deploying them in real world environments.
Technology keywords	AI, Digital Twins, Metaverse, 5G, 6G, OpenRAN, Xapps.
Data availability	Public
Metadata (type of data)	Multimodal data
Model Training and fine-tuning	Models trained on Multi-modal data
Testbeds or pilot deployments	Setup for ORAN xapp deployment: https://github.com/CrashingGuru/FGAN-Build-a-thon/blob/main/Docs/Setup%20for%20ORAN%20xapp%20deployment.pdf

45.2. Use-case description

45.2.1 Description

The use case titled "Digital twins for AI based xapps in open RAN for smart agriculture in 5G" is a study on improving performance and efficiency of 5G and 6G networks. This increases the credibility and confidence of operators in such applications.

Here is a concrete example: A network operator integrates an application for smart agriculture. This is developed in the form of a xApp, integrating AI models for optimal yield prediction. The xApp infers the yield, using the data obtained from the deployed units in the field. This solves an important problem of food security and related SDG.

But before deploying in the field, the operator wants to test this using Sandbox. Here, a digital twin based implementation, where similar data is routed to the digital twin and inference is validated by experts. This technique uses a Sandbox mechanism as explained in **ITU-T Y.3172**.

However, in this use case, two additional techniques are used: Open RAN xApp based implementation and Vertical applications such as smart agriculture are used as SINK and SRC for the **Y.3172** based pipeline.

The project is currently in the research phase, with publicly available data being collected and analyzed to understand the current state of digital twin applications in 5G and identify areas for improvement. The insights gained from this research will guide the development of a proof of concept, demonstrating the feasibility of the proposed applications.

This use case represents a significant step towards realizing the full potential of the future applications such as Metaverse in enhancing 5G communications. It opens a way for operators to credibly monetize the AI applications developed in the labs, by deploying them confidently in the fields, at the same time achieving the SDGs.

In this use case , We are aiming to explore the potential of integrating the digital twins with Open RAN based 5G communications, leveraging the power of Artificial Intelligence (AI).

The first phase of the project involves comprehensive data collection and analysis. We aim to understand the current state of digital twin applications in open RAN 5G and identify areas for improvement. The data used in this project is publicly available, ensuring transparency and reproducibility of the research.

Based on the insights gained from the data analysis, we plan to develop a proof of concept. This will demonstrate the feasibility of the proposed applications of the open RAN in 5G communications. The proof of concept will focus on creating immersive and interactive experiences, such as virtual environments for remote collaboration, enhanced data visualization, and new forms of media and entertainment.

Concurrently, we will also work on building AI models. These models will simulate the proposed solution and predict its impact. AI will also be used to create intelligent virtual agents, analyze data, create dynamic environments, and ensure user security and privacy.

In the long term, we aim to contribute to the development of standards for the application of Metaverse in 5G communications. This will ensure that the Metaverse is accessible, secure, and beneficial for all users.

This proposal represents a significant step towards realizing the full potential of the Metaverse in enhancing 5G communications. It not only pushes the boundaries of what is currently possible in digital communication but also paves the way for a future where distance and physical limitations are no longer barriers to communication.

UN Goals:

- **SDG 2:** Zero Hunger
- **SDG 9:** Industry, Innovation and Infrastructure
- **SDG 11:** Sustainable Cities and Communities

Justification UN Goals selection: SDG 2: by using digital twins and AI for achieving better yields, also increasing the explainability and confidence in AI models for agriculture. SDG 9: Industry, Innovation and Infrastructure: The project aligns with this goal as it involves innovative use of technology (AI and 5G) to potentially transform industries and infrastructure using digital twin technologies. SDG 11: Sustainable Cities and Communities: The application of AI in 5G communications can contribute to creating digital solutions for sustainable urban development.

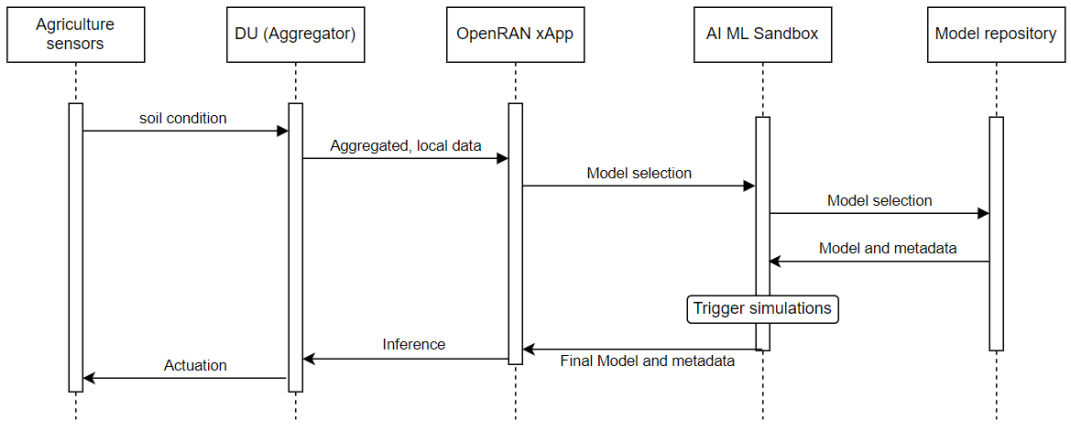
45.2.2 Future work

Proof of concept development, Model development, Create new variations/extensions to the same use case, Standards development related to the use case, Setup reference tools, notebooks and simulation environment Elaborate proposal: This project is already guided and mentored under ITU ML5G initiatives.

45.3. Use case requirements

- **REQ-01:** Data Collection and Analysis - Gathering publicly available data relevant to smart agriculture and digital twin applications. Analyze the current state of digital twin applications in 5G.
- **REQ-02:** Sandbox Testing and Validation - Implement a sandbox environment that mimics the real-world deployment conditions. Using the ITU-T Y.3172 framework to route data to the digital twin for validation.
- **REQ-03:** xApp Development - Developing an xApp integrating AI models for yield prediction in smart agriculture. Ensure the xApp is compatible with Open RAN architecture and 5G network requirements.

45.4. Sequence Diagram



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[3] ITU-T Recommendation Y.3172 : Architectural framework for machine learning in future networks including IMT-2020

[4] ITU-T Recommendation Y.3179 : Architectural framework for machine learning model serving in future networks including IMT-2020

[5] ITU-T Recommendation Y.3181 : Architectural framework for machine learning sandbox in future networks including IMT-2020

[6] ITU Journal on Future and Evolving Technologies, Volume 3 (2022), Issue 2, "Network resource allocation for emergency management based on closed-loop analysis", https://doi.org/10.52953/HVPI8935

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Use case – 46: Improving early detection of neonatal asphyxia with smartphone-based AI technologies

Country: Bangladesh

Organization: Bangladesh Open University

Contact person: Samrat Kumar Dey (samrat.sst@bou.ac.bd, +8801823267937)

46.1. Use case summary table

Domain	healthcare
The problem to be addressed	Development of more robust and reliable AI algorithms for neonatal asphyxia detection on smartphones
Key aspects of the solution	Voice sample analysis to identify asphyxia
Technology keywords	Healthcare, asphyxia, voice, machine learning, deep learning
Data availability	Private right now.
Metadata (type of data)	Audio sample from Mexico. 1049 audio samples. 1s samples.
Model Training and fine-tuning	At the moment, using ML (regression models, ensemble models) May use DL in future (RNN-LSTM type models)
Testbeds or pilot deployments	In 4 different hospitals from 4 different divisions.

46.2 Use-case description

46.2.1 Description

This use case explores leveraging smartphones and artificial intelligence (AI) for early detection of neonatal asphyxia, a critical condition where newborns experience oxygen deprivation during birth. Timely diagnosis is paramount for effective interventions and improved outcomes. However, current methods in resource-constrained settings often rely on subjective assessments or expensive equipment.

Intended Use: This AI-powered solution targets healthcare professionals, particularly midwives and frontline workers, in low- and middle-income countries, where access to specialized

equipment and neonatal intensive care units (NICUs) might be limited. The smartphone app would be readily available for use during routine newborn checkups.

Problem: Neonatal asphyxia can lead to devastating consequences like brain damage, cerebral palsy, and even death. Early detection is crucial for prompt interventions such as oxygen therapy or therapeutic hypothermia, which can significantly improve a newborn's prognosis. However, traditional detection methods have limitations (i) Clinical signs like weak muscle tone or slow breathing can be subjective and depend on the healthcare provider's experience and training, and (ii) Pulse oximeters, the standard tool for measuring blood oxygen levels, might not be readily available in all settings, hindering timely diagnosis.

Benefits of AI Solution: Smartphones are ubiquitous, making this solution readily deployable even in resource-limited settings. This democratizes access to a potentially life-saving tool. AI algorithms can analyze a newborn's cry recordings for subtle changes indicative of asphyxia, offering a more objective and potentially more accurate assessment compared to subjective clinical signs.

Drawbacks of AI Solutions: The accuracy of AI models hinges on the quality and quantity of data used to train them. Continuous improvement and data collection are essential. This solution relies on a functional smartphone and potentially internet access for updates. Addressing these potential barriers is crucial for broader adoption.

Conclusion: Smartphone-based AI for neonatal asphyxia detection has the potential to democratize access to critical care, particularly in low-resource settings. While limitations exist, continuous research and development can refine accuracy, address accessibility concerns, and ultimately improve the lives of newborns worldwide.

UN Goals:

- **SDG 3:** Good Health and Well-being

Justification UN Goals selection: SDG 3: Good Health and Well-being)targets a significant reduction in preventable newborn deaths. Neonatal asphyxia is a major contributor to such deaths. By enabling early detection and intervention, this AI technology can improve survival rates for newborns who experience oxygen deprivation during birth. On the other hand, early detection and treatment of asphyxia can significantly improve the health outcomes of newborns. This directly supports SDG Goal 3's focus on ensuring healthy lives and promoting well-being at all ages. Early intervention can prevent serious health complications like brain damage and cerebral palsy that asphyxia can cause. The use of AI technology in neonatal care represents an innovative approach to improving healthcare. This also aligns with SDG Goal 3's focus on promoting research and development for improved health outcomes. This research paves the way for utilizing new technologies to address critical health challenges. In summary, this use case directly contributes to achieving SDG Goal 3: Good Health and Well-being by focusing on early detection of a significant health risk for newborns, improving overall health outcomes, promoting equitable access to healthcare, and utilizing innovative technology to address a critical health concern.

46.2.2 Future work

Data collection, Model development Elaborate proposal: If the submitted use case has been awarded the scholarship and resources, the future direction of this research work will focus on

data collection from the country's partnered hospital/medical college. The collected data from primary sources will be analyzed, and a deep learning-based AI architecture will be constructed for data training and testing. A detailed description of how the data collection and model development phases will be carried out is provided here.

The data collection phase will contain the following working steps:

1. **Expand data sources:** We will collaborate with hospitals to collect data on a larger and more diverse population of newborns, including data from different ethnicities, gestational ages, and birth complications. This process will also explore collecting data from pre-birth stages (fetal heart rate, maternal health data) to identify potential risk factors.
2. **Simulate data variations**: Further, we will develop methods to simulate variations in crying sounds due to background noise, microphone quality, and different recording environments.

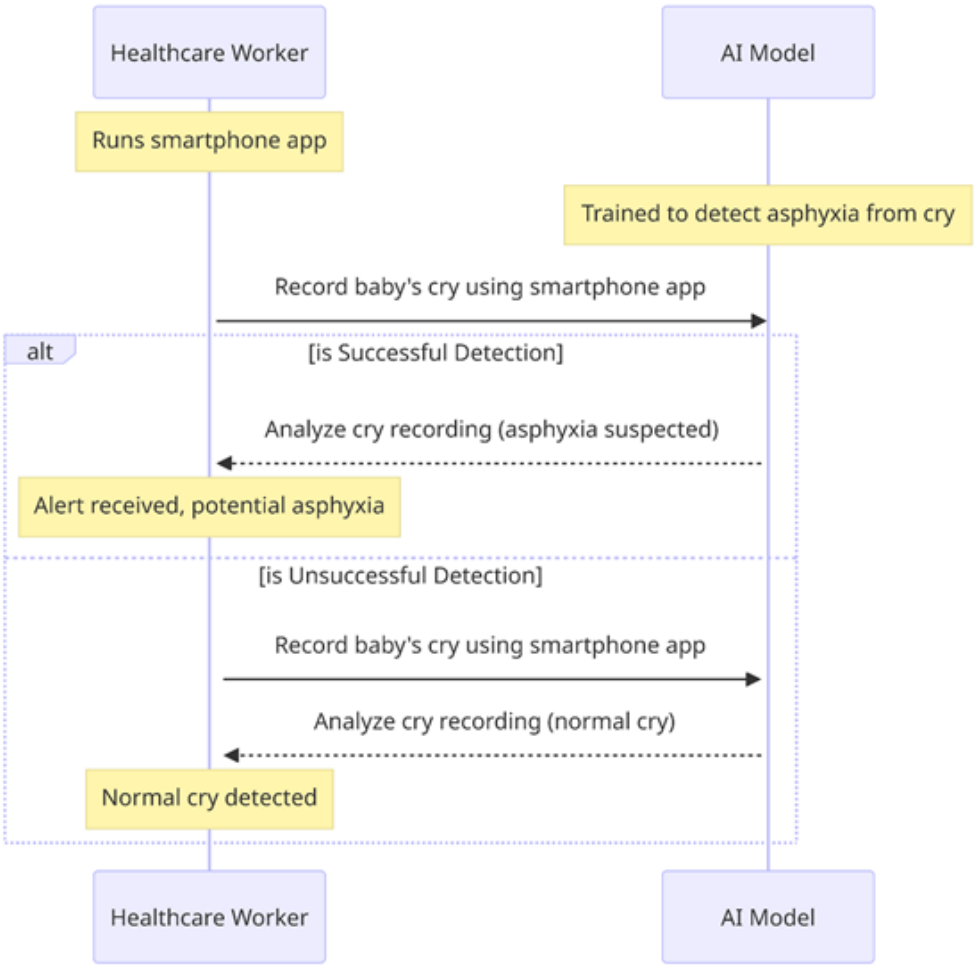
The model development phase will contain the following working steps:

1. **Advanced AI models:** The development phase will try to implement deep learning architectures like convolutional neural networks (CNNs) and recurrent neural networks (RNNs) to analyze and handle sequential data like cry sounds. It will also explore transfer learning by leveraging pre-trained models on similar audio classification tasks. Moreover, for global accessibility, it will explore methods for developing low-cost and low-power solutions that can be used in resource-limited settings. In addition, we will focus on the integration of generative AI (GenAI) model development, depending on the outcome of the initial stage of model development.

46.3 Use case Requirement

- **REQ-01:** It is critical that the solution must provide an AI-powered tool for analyzing newborns' cries via smartphones, accessible in resource-limited settings, and deployable without specialized equipment, ensuring continuous data collection for AI model training with minimal internet dependency.
- **REQ-02:** It is critical that the solution must have a user-friendly interface suitable for healthcare professionals, designed to integrate seamlessly with existing healthcare systems, and address barriers to adoption, such as smartphone functionality and internet access.
- **REQ-03:** It is critical that the solution should support ongoing research and development, be scalable and adaptable to diverse populations, and contribute to the UN Sustainable Development Goal 3 by improving health outcomes for at-risk newborns.

46.4 Sequence Diagram



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[2] Related Website: https://notun-kuri.netlify.app/

[3] GitHub: https://github.com/samratkumardey/AI4Good

Use case – 47: Water conservation using AI-enabled smart irrigation systems in agriculture Use-case

Country: Tanzania

Organization: University of Dodoma

Contact person: Joel Emmanuel Mshana joelmsha4@gmail.com, +255755787327

Adolf Faustine adolffaustine200@gmail.com,+255 711583374/+255629653757

47.1. Use case summary table

Domain	Water conservation and Agriculture
Problem to be addressed	Inefficiency and water wastage associated with traditional irrigation methods in Tanzania and similar regions facing water scarcity.
Key aspects of the solution	• AI-driven smart irrigation systems optimize water usage. • Real-time monitoring and adjustment of irrigation schedules. • Sustainable agriculture practices supported by optimized water usage, minimizing environmental impact.
Technology keywords	Irrigation systems, water conservation, Artificial intelligence, IoT
Data availability	Public data from ministry of agriculture in tanzania and private data
Metadata (type of data)	Numerical such as weather data, Soil data, EX data, plant profile data, etc.
Model Training and fine tuning	Train - LSTM model Fine tuning - the LSTM model can be fine tuned for good start
Testbeds or pilot deployments	Dodoma region, selected for its representative soil types, crop varieties, and climate conditions prevalent in Tanzanian agriculture.

47.2. Use case description

47.2.1. Description

Irrigation has a significant role in food and cash crops production thus has become a global concern in many developing countries like Tanzania. Its importance is based on the current influence of climatic change that has resulted in an increase of drought and change in rainfall pattern [4]. This situation has resulted in high demand for water for irrigation but at global level the water resources are thinning at a shocking rate [3]. Therefore, conservation of water is important for future sustainability. But at the same time, development and sustenance of crops is important for food security and economic stability and hence we need advanced smart irrigation systems that can optimize water use while supporting agricultural productivity.

Existing irrigation solutions, such as pump irrigation, drip irrigation, and surface irrigation, face significant challenges: increasing water scarcity due to climate change and population growth makes efficient water management critical; traditional methods often result in significant water loss due to evaporation, runoff, and inefficient distribution [2]; many systems rely heavily on manual operation or static, timer-based controls that do not adapt to changing environmental conditions or crop needs in real-time[5]; and current systems typically do not integrate real-time feedback from soil moisture levels, weather conditions, or crop health, leading to over-irrigation or under-irrigation [1].

Integrating AI technologies offers promising solutions to these challenges. Advanced AI models, such as fine-tuned LSTM networks, enable predictive analysis of crop status, soil moisture levels, and future water needs using historical data and real-time sensor inputs. By leveraging AI alongside communication networks, real-time insights and expert feedback can be effectively integrated into remote agricultural areas, facilitating adaptive irrigation strategies tailored to local conditions. This approach involves deploying distributed AI systems that refine models based on local weather patterns and soil characteristics, optimizing irrigation practices for enhanced water efficiency. Furthermore, the implementation of sensors and IoT devices enables continuous monitoring of soil conditions and crop health, allowing for dynamic adjustments in irrigation schedules to minimize water wastage and ensure sustainable agricultural productivity. Ultimately, this comprehensive AI-driven approach not only enhances agricultural output but also promotes long-term environmental and economic stability through efficient water management practices.

UN Goals:

- **SDG 2:** Zero Hunger,
- **SDG 6:** Clean Water and Sanitation,
- **SDG 11:** Sustainable Cities and Communities,
- **SDG 12:** Responsible Consumption and Production,
- **SDG 15:** Life on Land,

Justification of UN Goals: SDG 2 (Zero Hunger), Efficient irrigation systems improve agricultural productivity and ensure food security by providing the necessary water resources for crop growth, thereby contributing to the elimination of hunger. SDG 6 (Clean Water and Sanitation), Using our techniques, described in this usecase we can significantly reduce water wastage, ensuring more water is available for drinking and sanitation purposes, directly contributing to the availability of clean water. SDG 11 (Sustainable Cities and Communities), Using our

techniques, described in this usecase, we propose to advance SDG11, whereby in Tanzania the efficient water use in agriculture will support the sustainability of farming communities, which is crucial for maintaining vibrant, sustainable rural areas and ensuring food security. SDG 12 (Responsible Consumption and Production), Smart irrigation systems promote the efficient use of water resources, reducing waste and ensuring sustainable consumption patterns in agriculture. SDG 13 (Climate Action), By optimizing water use and reducing wastage, smart irrigation systems help mitigate the impacts of climate change, such as water scarcity and changing precipitation patterns. They also contribute to resilience in agricultural practices. SDG 15 (Life on Land), Sustainable water management in agriculture supports the health of terrestrial ecosystems, reduces soil degradation, and promotes biodiversity by ensuring that natural water sources are not depleted or polluted.

47.2.2. Future work

Data Collection: Extensive data gathering from various stakeholders and regions. Weather data will be collected from Tanzania meteorological authority (TMA), plant profile data will be collected from the ministry of agriculture and irrigation historical data from the national irrigation commission for theAI model.

Proof of Concept Development: Develop and test initial versions of the smart irrigation systems. The LSTM model has been chosen for its ability to handle time-series data effectively. The model will be fine-tuned using soil moisture, weather, and plant profile data collected from different regions of Tanzania. This fine-tuned model will then be integrated with an IoT system designed to conserve water during irrigation.

Model Development: Create and refine AI models tailored to local conditions. The LSTM model will be fine-tuned with local data from Tanzania. Hyperparameter tuning is crucial to ensure the model performs optimally and delivers the expected results.

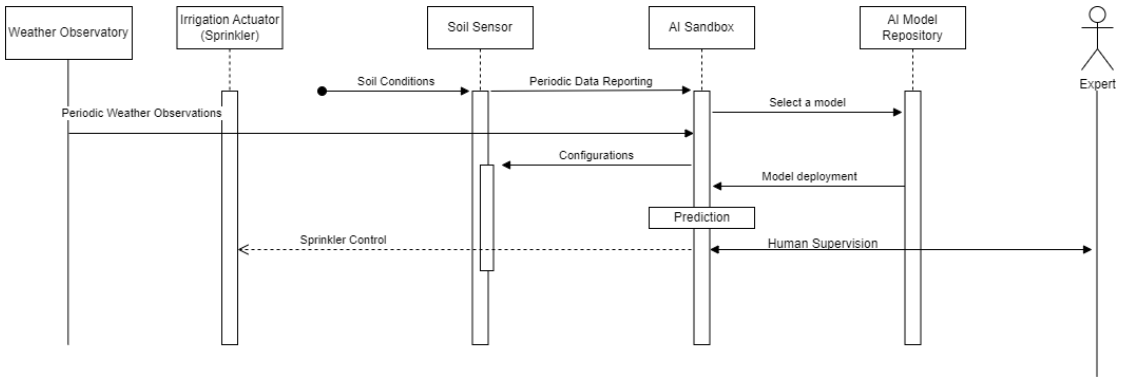
Create Variations/Extensions: Innovate further on the existing use case to develop additional applications.

Reference Tools and Simulation Environment: The programming language that will be used is python and the libraries and framework are TensorFlow, NumPy, Keras , Pandas and scikit-Learn and the IDE are jupyter notebook and PyCham as the software tools. The GPU, and IoT devices are needed as the hardware tools. The simulation environment is Matlab/Simulink and SimPy. GitHub is used as the version control system.

47.3. Use case Requirements

- **WC-AISI-UC01-REQ-001**: It must integrate advanced AI models, that is fine-tuned LSTM networks, for predictive analysis of crop status, soil moisture levels, and future water needs.
- **WC-AISI-UC01-REQ-002**: It must utilize IoT devices and sensors for continuous monitoring of soil conditions, weather patterns, and crop health.
- **WC-AISI-UC01-REQ-003**: It must support adaptive irrigation strategies that adjust in real-time based on local weather patterns, soil characteristics, and crop needs.
- **WC-AISI-UC01-REQ-004**: It must be scalable and adaptable for deployment in remote agricultural areas, integrating with existing communication networks for real-time data transmission and expert feedback.

47.4. Sequence diagram



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Use case – 48: AI boosted Interpretable Renewable Energy Forecasting

Country: China

Organization: Alibaba Damo (Hangzhou) Technology Co., Ltd.

Contact person: Yi Chen, (elaine.cy@alibaba-inc.com, (86) 13605817921)

48.1. Use case summary table

Domain	Sustainable Energy; Power Systems
The problem to be addressed	Deliver interpretable accurate day ahead wind power and rooftop solar power forecasting to mitigate the intermittency and less reliability posed by booming capacity instalment of renewable energy.
Key aspects of the solution	AI-based methods to deliver accurate and interpretable renewable energy forecasting in an Asian city. The forecasting service covers all the wind plants and the rooftop photovoltaics within the area, alongside with an attribution analysis and error analysis.
Technology keywords	CNNs and Conventional Tree-based models with large-scale automatic feature augmentation, XAI
Data availability	Private
Metadata (type of data)	Tabular data, including measured power from wind turbines and solar panels; numerical weather predictions.
Model Training and fine-tuning	• CNN and tree models. • Temporal convolutional architecture, (time series) • Use the standard choices for optimizers. • We use Ray Tune for hyper-parameter tuning.
Testbeds or pilot deployments	• Electricity bureau in Chinese city. • enewable Energy Forecasting System for State Grid Zhejiang Electric Power Co. LTD. , Jiaxing Branch https://doi.org/10.1609/aaai.v37i13.26853 https://arxiv.org/abs/2402.05823

48.2. Use Case Description

48.2.1. Description

The booming capacity instalment of renewable energy such as wind power and photovoltaic power in the past years have posed tremendous challenges to power grid scheduling and

maintenance due to its intermittent nature. Therefore, accurate nowcasting and day-ahead forecasting of the green power is crucial in power dispatch and electricity trading. Traditional methods usually depend on simple regression models and thus suffering low accuracy. Meanwhile, the forecasts were always deemed as black-box outputs to grid operators thus short of interpretability.

In this use case, we applied AI based methods to deliver accurate and interpretable renewable energy forecasting in an Asian city. We adopted convolutional neural networks and conventional tree based models with large scale automatic feature augmentation to produce reliable wind power and solar power forecasts. We used a shapely value based XAI (Explainable AI) method to interpret why the model makes such forecast, via visualizing the contribution from different weather factors.

The forecasting service covers all the wind plants and the rooftop photovoltaics within the area. The interpretable analysis along with the forecasts to enable people understand how the model works._

UN Goals:

- **SDG 7:** Affordable and Clean Energy
- **SDG 9:** Industry, Innovation, and Infrastructure
- **SDG 11:** Sustainable Cities and Communities

Justification UN Goals selection: In this use case, we use AI based models to produce reliable wind power and solar power forecasts, which entails the grid operators to make confident decisions for power dispatchment and real-time electricity balancing. It helps the digestion of the economic green energy to the electric grids inspite of the intermittency challenges, which contributes to SDG 7: Affordable and Clean Energy. In terms of SDG 9: Industry, Innovation, and Infrastructure, our use case has been deployed in grid operation system for about 2 years, which is widely regard as an innovative system in the power systems industry. Last but not least, our work is committed to build a better city with more clean energy, which fits well with SDG 11: Sustainable Cities and Communities.

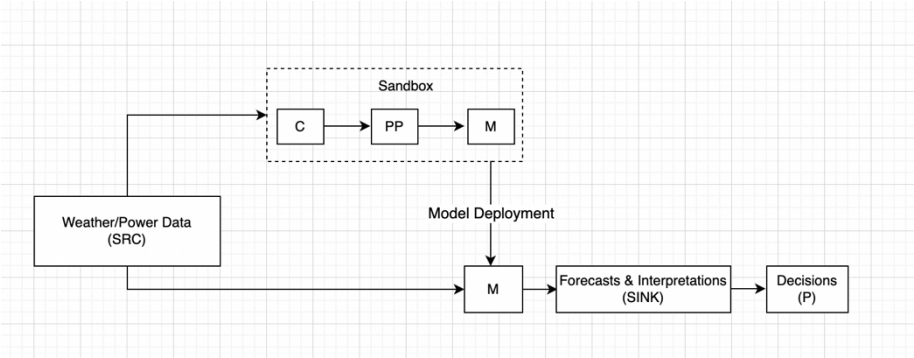
48.2.2. Future work

Given more resources, we would like to elaborate the use case featuring the improvement of forecasting performance under complex weather scenarios such as tropical cyclones, storm and icing. To achieve this goal, we would need more data including the measured weather conditions (e.g. sensor data, satellite images, etc.) at each power plant, historical complex weather period, longer history of measured power, to enrich our model training and pay more attention to those complex scenarios. More advanced machine learning techniques such as Transformer based models may be applied to incorporate the various data modalities.

48.3. Use Case Requirments

- **REQ-01:** It's required to use numerical weather prediction data for day-ahead forecasting.
- **REQ-02:** It's required to use measured power data from renewable power plants, which is always private, for model training.
- **REQ-03:** It's required to use real-time observed weather data for error analysis.
- **REQ-04:** It's recommended to use cloud based data transmission for inner deployment.

48.4. Sequence Diagram



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[2] FusionSF: Fuse Heterogeneous Modalities in a Vector Quantized Framework for Robust Solar Power Forecasting. Available online: https://arxiv.org/abs/2402.05823

Use case – 49: AI-enabled Soil Analysis and Weather Station for Local Farmers

CSIR–INSTI
Institute for Scientific and Technological Information

Country: Ghana

Organization: CSIR - Institute for Scientific and Technological Information

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49.1. Use case summary table

Domain	Agriculture
The problem to be addressed	Inaccurate weather and soil condition predictions for local farmlands due to reliance on national meteorological data that is not specific to local areas. This leads to crop losses and reduced yield for local farmers.
Key aspects of the solution	• Real-time data collection using AI-enabled weather stations and soil analysis sensors. • Monitoring of rainfall intensity, wind intensity and direction, temperature, humidity, pressure, and air quality. • Soil analysis for temperature, humidity, pH, NPK, and conductivity (EC). • Data visualization on dashboards and accessibility through smartphone applications and web browsers. • Predictive modeling for accurate local farm-specific forecasts.
Technology keywords	AI, soil analysis, weather station, real-time data, predictive modeling, IoT, sensors
Data availability	Privately available
Metadata (type of data)	• Environmental data (rainfall, wind, temperature, humidity, pressure, air quality) • Soil data (temperature, humidity, pH, NPK, conductivity)
Model Training and fine-tuning	Using collected data over time to design and refine predictive models for accurate local forecasts.
Testbeds or pilot deployments	https://github.com/ITU-AI-ML-in-5G-Challenge/ITU-2024-GenStorm-Submission-Next-Gen-TinyML-Smart-Weather-Station

49.2. Use case description

49.2.1. Description

Local farmers often rely on weather forecasts provided by national meteorological agencies, which typically offer generalized predictions for wide geographical areas without specific details tailored to local farmlands [1]. This limitation frequently results in local farmers experiencing losses due to inaccurate environmental condition predictions. To address this challenge effectively, there is a critical need for affordable weather stations deployed directly on local farmlands. These stations would enable precise and localized forecasting of environmental conditions essential for optimizing agricultural practices and minimizing risk.

An AI-enabled soil analysis and weather station represents a transformative solution for local farmers, empowering them to monitor crucial soil and weather parameters with unprecedented accuracy and immediacy[1]. Leveraging advanced AI technologies, these weather stations operate without mechanical parts, capturing real-time data on rainfall intensity, wind direction and intensity, temperature, humidity, pressure, and air quality. Simultaneously, they conduct real-time soil analyses to measure temperature, humidity, pH levels, NPK content, and conductivity. The collected data is then visualized through intuitive dashboards accessible via smartphone apps and web browsers. Over time, this data will facilitate the development of predictive models tailored specifically to local farming conditions, ensuring informed decision-making and sustainable agricultural practices.

UN Goals:

- **SDG 1:** No Poverty
- **SDG 13**: Climate Action

Justification of UN Golas: SDG 1 (No Poverty): Local farmers are usually poor because most depend solely on selling their crop yields for money. The accurate predictive capabilities of the AI-enabled soil analysis and weather station will enable farmers to plan the planting and cultivation of their crops to increase yield. SDG 13 (Climate Action): Collecting and analyzing data from various individual farmlands across the country will help visualize the damage climate change has on farmlands and ensure that measures are taken to combat it.

49.2.2. Future work

Our future work includes several important steps: data collection, proof of concept development, model development, and setting up reference tools, notebooks, and a simulation environment.

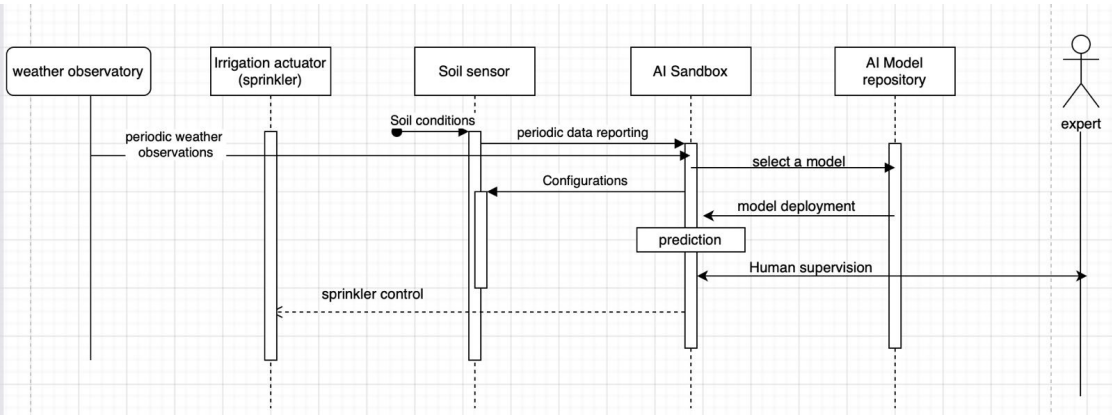
The next steps will involve placing various environmental and soil analysis sensors on individual farmlands to collect data if scholarships and resources are given. This data will be sent wirelessly to a central system for live dashboards and predictive model development. Mobile apps and web servers will be created to test the proof of concept, ensuring that the collected data is accessible and useful for local farmers.

49.2. Use case Requirement

- **REQ-01:** It is critical that the system collects real-time data on environmental conditions and soil parameters from individual farmlands.

- ***Note:*** This requires robust, accurate sensors and reliable wireless data transmission to a central system.
- **REQ-02:** It is critical that the collected data should be visualized on user-friendly dashboards and accessible through smartphone applications and web browsers.
- ***Note:*** The system should provide intuitive and actionable insights to the farmers to aid in decision-making.
- **REQ-03:** It is critical to develop and implement predictive models using the collected data to forecast soil and weather conditions specific to local farms.
- ***Note:*** The models should continuously improve through machine learning techniques and feedback from actual conditions.
- **REQ-04:** It is critical to aggregate data from multiple farms to support policymaking, best farming practices, and resource distribution plans.
- ***Note:*** Ensure data privacy and security while enabling data sharing for broader agricultural benefits.

49.4. Sequence diagram



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[1] Next-Gen tinyML Smart Weather Station Challenge 2024, https://challenge.aiforgood.itu.int/match/matchitem/91.

[2] Next-Gen tinyML Smart Weather Station Challenge 2024 Report, https://github.com/ITU-AI-ML-in-5G-Challenge/ITU-2024-GenStorm-Submission-Next-Gen-TinyML-Smart-Weather-Station/blob/main/Next-Gen-TinyML-Smart-Weather-Station-GenStorm-Report.pdf.

Use case – 50: Using Satellite Imagery and AI for Crop Monitoring Services

Country: Zimbabwe

Organization: abm^parassa IT/Digital Consulting

Contact person: Abel Mautsa abelmautsa@gmail.com, +263713852018

Benhilda Mubaiwa benhildamubaiwa@gmail.com,+263773731535

50.1. Use case Summary Table

Domain	Agriculture
The problem to be addressed	Crop monitoring using satellite image, complemented with drone images. Small scale farmers, and medium to large scale farmers Production is labour intensive. Time investment, human error, timely detection of crop related issues.
Key aspects of the solution	Using Satellite, UAV and scouts imagery to monitor crop for irrigation, plant nutrition, pest/weeds mangement and yield prediction. Farmer connectivity is via mobile data via 3G, 4G, or VSAT links or fiber. But image transmission is via telone.
Technology keywords	Satellite, UAV and Scouts imagery, Field boundary detection, NDRE, MSAVI, NDWI, NDMI, NDVI, Neural Network model.
Data availability	Not available. Current solution is based on the eos Data Analytics [1] (eos data analytics - satellite data analytics provider based in Ukraine) and telone partnership. Need to acquire satellite images, and drones images from farmers.
Metadata (type of data)	Images (satellite or from drones) Sensor data.
Model Training and fine-tuning	The current commercial solution with eosda and telone uses different type of models.
Testbeds or pilot deployments	• https://eos.com/blog/eosda-enters-into-a-strategic-partnership-with-telone/ • https://eos.com/products/high-resolution-images/ • https://eos.com/products/crop-monitoring/

50.2. Use-case Description

50.2.1. Description

Our use case focuses on revolutionising crop monitoring in agriculture by combining satellite imagery and artificial intelligence (AI). Traditional methods of crop monitoring are time-consuming, labour intensive, and prone to human error, limiting farmers' ability to detect and address issues in a timely manner. In leveraging satellite imagery and AI algorithms, we aim to provide farmers with accurate and timely information to optimise their farming enterprises.

The use case addresses the problem of inefficient and inadequacy of crop monitoring methods. Manual observation and sampling techniques are limited in their coverage and can miss crucial information. This leads to reduced yields and economic losses due to undetected crop diseases, nutrient deficiencies, or pest infestations. Our solution aims to overcome these limitations by utilising satellite imagery and AI to provide a comprehensive and bird's eye view of crop fields.

The benefits are significant. Real-time and continuous monitoring of crop health across large farming areas is made possible. This enables farmers to detect early signs of possible challenges and take prompt action. Furthermore, AI algorithms can analyse complex satellite imagery data and extract valuable insights that may not be apparent to the human eye. This empowers farmers to make data-driven decisions regarding irrigation, fertiliser application, and pest control, resulting in improved crop yields and resource management.

However, there are certain drawbacks to consider. The effectiveness of the AI-based approach relies on the availability of high-quality satellite imagery and accurate ground truth data for training the AI models. Limited access to such data, particularly in remote and underdeveloped regions like Zimbabwe, can be a challenge. There are also initial setup and implementation costs associated with acquiring satellite data and developing AI models, which may pose a barrier for some farmers.

In conclusion, our use case aims to address the limitations of existing crop monitoring methods by providing farmers with accurate and timely information. We aim to optimise farming, increase yields, and contribute to sustainable food production. While there are challenges, the potential benefits for farmers and the agricultural industry as a whole make it a promising solution for improving crop monitoring and management.

UN Goals:

- **SDG 1:** No Poverty,
- **SDG 2:** Zero Hunger,
- **SDG 8:** Decent Work and Economic Growth,
- **SDG 9:** Industry, Innovation and Infrastructure,
- **SDG 13:** Climate Action,
- **SDG 14:** Life Below Water,
- **SDG 15:** Life on Land,
- **SDG 17:** Partnerships to achieve the Goal

Justification UN Goals selection: SDG 1 (No Poverty): The use of satellite imagery and AI in crop monitoring enhances agricultural productivity and income opportunities for farmers. By providing timely insights on crop health and management, the technology helps farmers protect their crops from diseases and optimize yields, thereby reducing economic losses and

poverty risks in agricultural communities. SDG 2 (Zero Hunger): The use case improves food security by enabling precise monitoring of crops for diseases, pests, and water stress using satellite and drone imagery. This leads to enhanced agricultural productivity, better resource allocation, and increased access to nutritious food, contributing directly to achieving zero hunger by ensuring sustainable food production and availability. SDG 8 (Decent Work and Economic Growth): By optimizing agricultural practices through advanced crop monitoring technologies, the use case promotes economic growth. It facilitates efficient resource utilization, improved crop yields, and enhanced livelihoods for farmers. This contributes to the creation of decent work and economic opportunities in the agricultural sector. SDG 9 (Industry, Innovation, and Infrastructure): This usecase drives innovation and supports infrastructure development. It fosters technological advancements in precision farming, data-driven decision-making, and sustainable agricultural practices. This promotes inclusive and sustainable industrialization, enhancing agricultural productivity and infrastructure for rural communities. SDG 13 (Climate Action): Crop monitoring contributes to climate action by enabling farmers to adopt climate-resilient agricultural practices. By assessing climate-related risks and optimizing resource management, the technology helps mitigate the impacts of climate change on agriculture. It supports sustainable land use and contributes to climate change adaptation efforts. SDG 15 (Life on Land): Crop monitoring technologies help monitor land use changes, protect ecosystems, and promote sustainable land management practices. By preventing soil degradation and promoting biodiversity conservation, the use case contributes to preserving terrestrial ecosystems and ensuring land sustainability. SDG 17 (Partnerships for the Goals): Collaboration among stakeholders, including governments, organizations, and technology providers, is crucial for the success of crop monitoring initiatives. By facilitating knowledge exchange, capacity building, and sustainable development practices, the use case promotes effective partnerships for achieving shared sustainable development goals globally.

Partner name: TelOne (Pvt) Ltd, the Zimbabwe telecoms parastatal

50.2.2. Future work

Data collection, Proof of concept development, Model development, Create new variations/ extensions to the same use case, Standards development related to the use case, Setup reference tools, notebooks and simulation environment, Others Elaborate proposal: The proposed future work for this use case would focus on the following areas:

1. Data Collection: Further efforts would be directed towards collecting more diverse and comprehensive datasets related to the use case. This would involve expanding the existing data sources and incorporating real-world data to enhance the accuracy and robustness of the AI models.
2. Proof of Concept Development: The next step would involve building a tangible proof of concept based on the use case. This would include refining and optimizing the existing AI algorithms and methodologies to demonstrate their effectiveness in solving the problem at hand.
3. Model Development: The use case would benefit from continuous model development to improve its performance and adaptability. This would involve exploring advanced AI techniques, such as deep learning, reinforcement learning, or transfer learning, to enhance the capabilities of the models. Iterative model development would enable the refinement of predictions, recommendations, or decision-making processes associated with the use case.
4. Creating New Variations/Extensions: To maximise the impact of the use case, it would be essential to explore and create new variations or extensions that address related

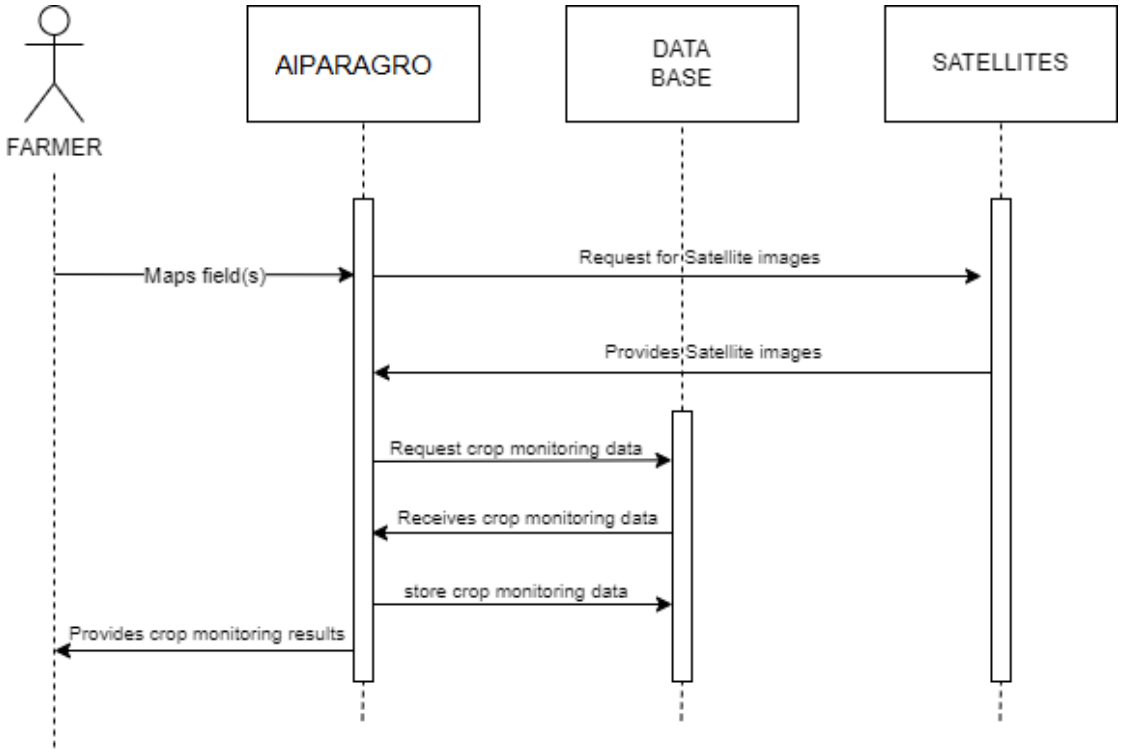
challenges. In expanding the scope of the use case, it would be possible to address a broader range of issues.

5. Standards Development: Collaboration with relevant stakeholders and organizations would be pursued to develop standards and guidelines specific to the use case. This would facilitate interoperability, ethical considerations, and responsible deployment of AI solutions. Establishing standards would ensure the transparency, fairness, and accountability, fostering trust among users and stakeholders.
6. Setup Reference Tools and Simulation Environment: A dedicated effort would be made to develop reference tools, notebooks, and simulation environments that can be utilized by researchers, practitioners, and policymakers. These resources would provide a practical framework for implementing and testing AI solutions in the context of the use case.

50.3. Use case Requirements

- **REQ-01:** It is critical that the Alparagro crop monitoring solution provide farmers with insights relevant to monitor moisture, diseases, pests and weeds, plant nutrition, estimate yields and monitor harvesting.
- **REQ-02:** It is critical that the project integrates satellite technology with UAV and scouts' imagery into the crop monitoring process. This would ensure that satellite imagery is actioned and supplementary imagery is produced through use of drones and scouts on identified hotspots to enhance decision making.
- **REQ-03:** It is critical that the system accepts field data from the farmer, requests and stores satellite imagery data, crop analysis data, and generates relevant crop monitoring results for the farmer.
- **REQ-04:** It is critical that the system continuously ingests the datasets, trains and retrains, integrates into production systems, visualizes model output, monitors model performance, and generates reports and recommendations to farmers and agronomists.

50.4. Sequence Diagram



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[1] Background: EOSDA Enters Into A Strategic Partnership With TelOne

[2] News: https://www.sundaymail.co.zw/new-telone-launches-crop-monitoring-system

[3] Website: https://eos.com/

Use case – 51: A New Mode and Practice of Human-Robot Interaction Operation and Maintenance Based on Network Large Language Model (AI Chat Operations, AIChatOps)

Country: China

Organization: China Telecom Jiangsu Branch

Contact Person: Wenhan Rong
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51.1. Use case summary table

Domain	Telecommunications
The problem to be addressed	Traditional network maintenance lacks real-time scheduling based on intent, relying on manual operations or limited automation.
Key aspects of the solution	Using Large Language Model (LLM) for intent recognition, mobile data query, and execution. Implementing ChatOps for human-robot interaction in network maintenance.
Technology keywords	Large Language Model (LLM), AI Chat Operations, ChatOps, Network Maintenance Automation
Data availability	Data is privately available.
Metadata (type of data)	Textual data, Numerical data, Categorical data, Image data, and Video data
Model Training and fine-tuning	Fine-tuning LLM for task scheduling and parameter completion. Implementing multi-agent systems for execution efficiency.
Testbeds or pilot deployments	Not publicly available

51.2. Use case description

51.2.1. Description

Existing problem: Traditional network maintenance mainly relies on manual operation and equipment inspection or network management systems to carry out specific and inherent automated operations, which cannot realize real-time scheduling based on intent.

Solution: (1) Develop the ability to quickly query and execute data on mobile devices. (2) Based on the intention recognition ability of the Large Language Model LLM , retrieve the most similar automation capabilities and extract the parameters based on the natural language instructions input by the user. (3) Based on the network LLM intelligent agent technology,

realize the full process from scheme generation to task decomposition, logical arrangement, perception analysis, automatic execution and optimization feedback.

Advantages of the solution:

(1) Innovation in human-robot interaction mode: Combining ChatOps with LLM technology, utilizing natural language instruction matching automation capabilities, and using the intent recognition ability of LLM to extract API input parameters, providing frontline maintenance personnel with mobile data quick query and execution capabilities.

(2) Innovation of Function Matching Algorithm: In the initialization stage, a multi to one vector matching relationship is established between natural language samples and several automation capabilities. Users continuously use natural language to call these capabilities, continuously increase training samples through iterative feedback, and optimize the vector matching degree between user input and ChatOps function in real time, achieving dynamic autonomous learning.

(3) The industry's first network LLM intelligent agent technology: The network LLM provides intention decomposition, function and parameter analysis, automatic parameter completion, and real-time orchestration. It forms a dynamic process containing one or more operation and maintenance actions and drives the intelligent agent to complete all operations and maintenance actions. The maintenance and execution results are fed back, iteratively enhancing the intelligent agent's ability.

UN Goals:

- **SDG 9:** Industry, Innovation, and Infrastructure:

Justify UN Goals selection: SDG 9: Industry, Innovation, and Infrastructure: Enhancing infrastructure efficiency and innovation in network maintenance.

Promotion idea: Provide pocket-style digital operation portable toolbox to telecommunications, government, and enterprise customers.

Application effect:

(1) Reducing network maintenance costs: Taking the promotion situation of Jiangsu Telecom in the province as an example, more than 390 robots of various types were registered, with 434 associated API applications. The daily usage exceeded 800 people and exceeded 2000 times, saving about 2000+ hours/day in query, emergency, and work order disposal time in Jiangsu Province.

(2) Improving the efficiency of cloud network operation: The expert knowledge base of network LLM has been constructed for 9 scenarios, based on multi round dialogue, context parameter extraction, automatic parameter correction and completion to assist end-to-end task execution and tool calls, with an average accuracy of over 80%. The real-time orchestration and execution technology of network LLM intelligent agents has covered 8 specialties in Jiangsu Province. The daily real-time orchestration of Jiangsu Telecom's provincial management equipment network exceeds 200 times, reducing the steps of operating equipment or logging into network management queries, saving 20 hours/day of work order processing time, and increasing the work order automation processing rate by 10%.

(3) Serving over a hundred clients with a production capacity, cultivating a development oriented operation and maintenance team of over 800 people. Sustainable provision of convenient and innovative digital self-service channels to the telecommunications, government and enterprise customers.

51.2.2. Future Work

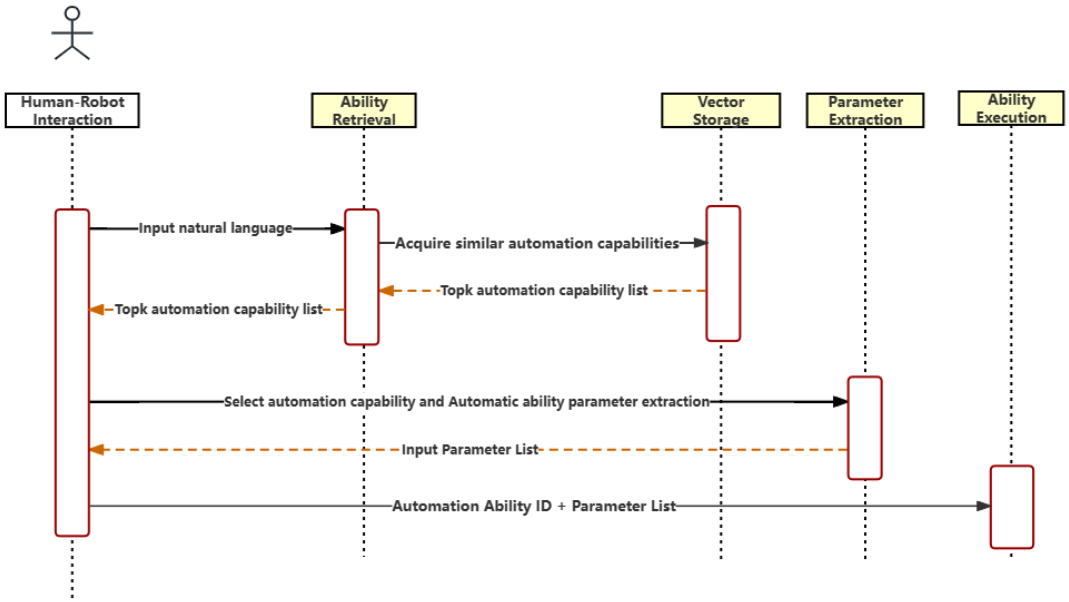
To further enhance this use case, future endeavors include:

- Data Collection: Gathering more comprehensive datasets to refine AI models and enhance operational accuracy.
- Model Development: Evolving the LLM technology to better understand and execute complex network maintenance tasks.
- Extension and Variation: Expanding the application of AIChatOps to new operational scenarios and use cases.
- Standards Development: Establishing industry standards for AI-powered network maintenance practices.

51.3. Use case requirements

- **REQ-Q1:** It is critical to enable real-time intent recognition and scheduling capabilities for network maintenance tasks.
- ***Note:*** Ensure the system can interpret natural language instructions swiftly to initiate and schedule tasks without manual intervention.
- **REQ-Q2:** It is critical to implement mobile-compatible features for querying and executing network tasks via natural language instructions.
- ***Note:*** This functionality empowers frontline personnel with on-the-go access to critical operational data and actions, enhancing operational efficiency and flexibility.
- **REQ-Q3:** It is critical to integrate ChatOps
- ***Note:*** Enhance human-robot interaction by leveraging LLM's intent recognition to match user queries with appropriate automation capabilities, optimizing operational workflows.
- **REQ-Q4:** It is critical to develop a multi-agent system to distribute and execute network maintenance tasks autonomously.
- ***Note:*** This system efficiently handles complex tasks by assigning and coordinating multiple agents.

51.4. Sequence diagram



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[1] ModelScope, "ModelScope swift README," GitHub, 2023. [Online]. Available: https://github.com/modelscope/swift/blob/main/README.md.

[2] LangChain AI, "Agent Supervisor Tutorial," LangChain AI, 2023. [Online]. Available: https://langchain-ai.github.io/langgraph/tutorials/multi_agent/agent_supervisor/.

[3] China National Intellectual Property Administration, "Detailed Document," CNIPA, 2023. [Online]. Available: https://pss-system.cponline.cnipa.gov.cn/documents/detail?prevPageTit=changgui.

Use case – 52: Computer Network Fusion Video Brain

Country: China

Organization: China Mobile Communications Corporation Co., Ltd

Contact person: Zhanmei, Zhang; 13802881237@139.com

52.1. Use case Summary Table

Domain	Industry, Innovation, and Infrastructure
The Problem to be addressed	• Massive video data is mainly monitored through manual viewing, which requires a lot of human resources and cannot monitor video content in real time. • The analysis of massive video data in the central node consumes a lot of network bandwidth resources. • For intelligent video analysis algorithm training, the lack of sample data makes it difficult to improve the accuracy. • Video analysis only through the traditional target detection small model is prone to produce a large number of false positives, requiring a lot of manpower to audit.
Key aspects of the solution	• In order to meet the business expansion needs of massive video access, large models combined with small models will be introduced to complete video analysis: 1. Based on the combination of high reference quantity and strong feature capture ability of large model and high flexibility of small model, it can effectively realize efficient analysis of video. 2. In order to use large models as feature extractors, perform preliminary analysis of videos, infer image events and behaviors, and extract useful feature information from videos, such as color, texture, shape, motion, etc. The feature information extracted from the large model is further analyzed and predicted by using the small target detection model
Technology keywords	Cloud edge collaboration; Large and small model collaboration
Data availability	https://huggingface.co/datasets; https://public.roboflow.com/
Metadata (type of data)	Structured and unstructured data

(continued)

Domain	Industry, Innovation, and Infrastructure
Model Training and fine-tuning	• AIGC technology is proposed for the production of training data of small sample to improve AI recognition ability by using large models to solve problems such as insufficient sample size and data skew in the traditional visual AI training process. • Based on the open-source target detection model, secondary training is carried out to label small targets in images, and the location and category of targets are usually marked with bounding box. The annotation results are saved in VOC or COCO formats.
Case Studies	Computer network fusion video brain
Testbeds or pilot deployments	The pilot is deployed on China Mobile's internal network.

52.2. Use case description

52.2.1 Description

Introduction: Guangdong company innovates to create computer and network integration video intelligence brain, and carries out "artificial intelligence + video" action to promote industrial upgrading and improve the quality of life. The platform sinks the video decoding frame extraction and AI inference service computing power to the city node, realizing the optimal and intelligent scheduling of video analysis computing resources at the provincial side, the city edge side, and the user side, effectively saving 60% of bandwidth resources and increasing the delay by 30%. Moreover, by deploying large models in the cloud, secondary verification of recognition results is carried out to improve the accuracy of video intelligent recognition. At the same time, in terms of data, the introduction of AIGC technology drives the production of training data of small sample AI recognition ability by using large models to solve problems such as insufficient sample size and data skew in the traditional visual AI training process.

The project has landed in urban management and public safety and other fields, building smart transportation, smart city and other business scenarios, to provide more comfortable living conditions for urban residents; As well as industrial manufacturing and food production and other fields, optimize the production process, efficiently supervise the production environment and production quality and other factors, accelerate the industrialization process and improve food safety. Subsequently, it can be extended to all walks of life to provide new quality productivity for the development of the industry.

UN Goals:

- **Goal 3:** Good health and well-being
- **Goal 9:** Industry, Innovation, and Infrastructure
- **Goal 11:** Sustainable cities and communities

Justify UN Goals selection: This project has created a computing network integration of video intelligence, a one-stop video AI product enabling system as the design concept, through "one cloud, two libraries, three centers" as the infrastructure, with "platform and equipment",

"application and algorithm" dual decoupling service combination of distributed cluster, based on cloud edge resource collaboration technology. The video decoding and AI inference service computing power sinks to the city node, reduces the network pressure of the central node and the concurrency and delay of the single node of the AI inference platform, realizes the unified scheduling of video analysis computing power, AI analysis computing power and video resources at the provincial side, the city edge side and the user side, and achieves the purpose of efficient allocation of computing resources. Integrating machine vision capabilities such as video and image OCR, it is oriented to multiple industries, sedimenting industry video AI analysis capability set, and providing atomized AI capability with rapid cross-scene reuse capability for industry video AI enablement scenes. Moreover, relying on multi-modal large model technology and related capabilities of Tuosen, it can identify scenes with high false positive rate of traditional AI capabilities, such as: Fire identification, illegal discharge, etc., the second audit of large models has greatly improved the identification accuracy of such scenes.

The project opened a total of 50,000 + algorithms for intelligent video analysis scenarios, and based on the "video +AI" fusion mode to create universal, high-precision, and rapid scene-oriented AI video standardized products, to achieve the combined reuse of AI capabilities and the standardization of video +AI one-stop overall solution. Vertical industries such as key forest fire prevention, water resources protection, and farmland supervision sites have been applied in scenarios, creating economic benefits of more than 30 million yuan.

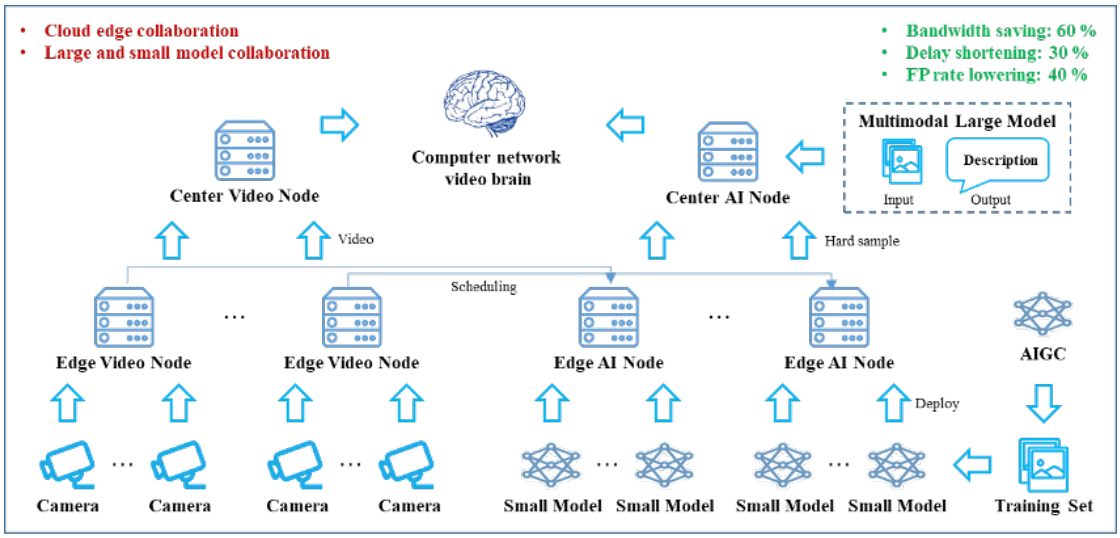
52.2.2 Future Work

In the future, this project will give full play to the natural advantages of China Mobile's "operator connection value", build the MaaS capability of "platform + ecology", realize the end-to-end intelligent video product innovation of "platform +AI+ application + business operation", create a new type of infrastructure capability, integrate different industry scenarios, and empower thousands of industries. Become an important force to promote industrial upgrading and improve the quality of life. For example, integrate into urban management and public safety and other fields, build smart transportation, smart city and other business scenarios, and provide more comfortable living conditions for urban residents; Integrate industrial manufacturing and food production, optimize the production process, efficiently supervise the production environment and production quality and other factors, accelerate the industrialization process and improve food safety.

52.3. Use case Requirements

- **REQ-01:** To obtain the video surveillance data from public areas, China Mobile must obtain the authorization of both the government and administrators.
- **NOTE:** China Mobile can sign an informed consent form with the government and administrators, clearly stating the purpose, scope, and confidentiality measures for the collection of video data.
- **REQ-02:** To obtain the small model and larger model, China Mobile must obtain the open source AI algorithms and conduct secondary training and development.
- **NOTE:** After finding the model on an open source platform or GitHub, download the model file and code directly. Modify the code of the model to fit your data and tasks as required by the project. When using open source models, ensure that the copyright and license agreements for the models are adhered to.

52.4. Sequence diagram



52.5. References

[1] You Only Look Once: Unified, Real-Time Object Detection

[2] The official repo of Qwen-VL (通义千问-VL) chat & pretrained large vision language model proposed by Alibaba Cloud

[3] hugging face dataset

[4] Computer Vision Datasets

Use case – 53: vivo's Technology for All: Bridging the Accessibility Gap

Country: China

Organization: vivo Mobile Communication Co., Ltd.

Contact person: Li Mengzhu, limengzhu.ai@vivo.com

53.1. Use Case Summary Table

Domain	Accessibility
The Problem to be addressed	Smartphone OS-based Information Accessibility Solutions and Public Welfare for People with Disabilities
Key aspects of the solution	vivo AI Lab, founded in 2018, has been committed to building industry-leading AI technologies and providing users with ultimate product experience. Areas of work include Computer Vision, Speech Technology, Natural Language Processing and Machine Learning. We have AI R&D bases in Shenzhen, Beijing, Hangzhou and Nanjing, with a team of over 1,000 AI engineers and dozens of papers published in top AI academic conferences (AAAI, ICLR, ECCV, CVPR, InterSpeech, etc.), as well as hundreds of AI patents granted. 1. vivo Sight: The offline technologies such as Automatic Speech Recognition (ASR), facial recognition, optical character recognition, and multi-target tracking/recognition are integrated with the AI big model's visual multimodal capabilities for image processing, to assist users to "see" the world in personalized scenarios through multiple rounds of Q&A. The environmental description technology can convert recognized images into voice descriptions and broadcast them aloud, thereby augmenting visual comprehension of both on-screen and off-screen environmental information. 2. vivo Score Reading: By utilizing capabilities such as note recognition algorithms, users can customize the reading of music scores according to notes, beats, and measures. This feature aids in the reading and learning of piano scores. 3. vivo Voice/Accessibility Calls: ASR and Speech-to-Text/Text-to-Speech technologies have been applied to aid the fluent face-to-face communication and telephone conversations of hearing-impaired individuals. Additionally, multi-lingual recognition and translation technology have significantly reduced language barriers, allowing effortless communication between different users.

(continued)

Domain	Accessibility
	4. Sound Recognition: Audio event detection, audio labeling, and offline audio recognition help users recognize important sounds around them. When a corresponding sound type is recognized, hearing impaired users will be promptly reminded through vibrations and notifications. 5. Sign Language Translator: The first application in China to implement sign language recognition technology. Sign language recognition utilizes deep learning algorithms to interpret the movements in sign language videos and transform them into text-based information, aiding communication between hearing-impaired and those with normal hearing. Sign language synthesis also creates continuous sign language actions by an AI virtual figure based on text content, which assists the hearing-impaired community in gaining access to and understanding information.
Technology keywords	Automatic Speech Recognition, Facial Recognition, Multi-target Tracking/Recognition, Multi-modal Large Model, Music Note Recognition Technology, Audio Event Detection, Sign Language Recognition Technology, Sign Language Synthesis, Virtual Avatar, Offline Audio Recognition
Data availability	1. National and international public data • laion5B: https://laion.ai/blog/laion-5b/ • Taisu: https://github.com/ksOAn6g5/TaiSu • wukong: https://wukong-dataset.github.io/wukong-dataset/index.html 2. Internal company data 3. Third-party procurement data 4. User-authorized data 5. Generated data
Metadata (type of data)	structured and unstructured data
Model Training and fine-tuning	• Image caption provides a text description of an image • Visual Question Answering combines images and questions to predict answers • Audio-visual speech recognition combines sound and video information to identify speech content
Case Studies	None

53.2. Use Case description

53.2.1 Description

Introduction: Based on the sustainable development vision of "Technology for a Better Future" by vivo, more than 10 accessibility features and products have been launched to meet the needs of relevant groups. Beginning with a humanistic mindset, vivo actively engages in public welfare actions, supporting over 600 impoverished people with disabilities in enhancing their digital literacy, information competency, and employment skills and helping them achieve

barrier-free development. In addition, vivo participates in the customization of multiple accessibility standards and promotes functional accessibility products for the public.

Tool Overview: vivo AI Lab, founded in 2018, has been committed to building industry-leading AI technologies and providing users with ultimate product experience. Areas of work include Computer Vision, Speech Technology, Natural Language Processing and Machine Learning.

We have AI R&D bases in Shenzhen, Beijing, Hangzhou and Nanjing, with a team of over 1,000 AI engineers and dozens of papers published in top AI academic conferences (AAAI, ICLR, ECCV, CVPR, InterSpeech, etc.), as well as hundreds of AI patents granted.

In 2023, vivo made new technological breakthroughs in the areas of hearing and visual impairments. Following core products such as "vivo Voice," "Accessibility Calls," and "Sound Recognition," vivo achieved another breakthrough and introduced the world's first product supporting Chinese sign language recognition–the "Sign Language Translator." This fills the last gap in the four basic technologies for communication for the hearing impaired, further enhancing their communication efficiency.

Concurrently, as technology advances and matures, vivo has introduced two visual aid products for the visually impaired: "vivo Sight" and "vivo Score Reading," and has enhanced the screen reading feature, TalkBack, becoming increasingly popular and recommended among individuals with disabilities.

Collaborative Efforts: vivo, as a globally renowned smartphone brand, boasts 500 million users worldwide (300 million in China) and hundreds of thousands of retail stores. Its accessibility initiative aims to assist users with special needs in better utilizing its products and services. vivo works closely with local disability organizations, NGOs, and government agencies to promote accessibility technology and services, and sponsors events like Accessibility Conferences and Global Accessibility Forums to advocate for technological advancements in this area. Additionally, vivo provides training for hundreds of thousands of sales assistants and customer service representatives, equipping them to offer detailed information and support to users with special requirements.

In product design and R&D, vivo actively collaborates with its users, particularly the 80 million individuals with impairments and 300 million elderly users, collecting their needs and feedback to ensure that their products are accessible and user-friendly. vivo develops and enhances accessibility features, offering solutions for those with hearing and visual impairments.

Additionally, vivo collaborated with advertising companies to produce and share successful cases and user stories highlighting the use of accessible technology and raised public's awareness and understanding of accessibility features through media channels such as social platforms, blogs, videos, and ads. vivo also actively supported and participated in the formulation of policies and standards related to accessibility technology, working with policymakers and standard-setting organizations to steer the industry towards greater inclusivity.

UN Goals:

- **SDG 3 Ensure healthy lives and promote well-being for all at all ages:** By improving the communication and quality of life of people with disabilities, the accessibility project has a positive impact on their physical and mental health, helping to achieve this sustainable development goal.

- **SDG 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all:** Providing accessibility products and services for people with disabilities has addressed their learning and communication barriers, enabling them to access education and learning resources on a more equal basis and promoting educational equity.
- **SDG 8 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all:** Through the implementation of the accessibility project, vivo demonstrates a strong sense of social responsibility while also promoting the development of the accessibility technology and market expansion, providing more job opportunities for people with disabilities and facilitating their integration into society.

53.2.2 Future Work:

1. Data Collection: For the usage scenarios of individuals with disabilities, we aim to expand the training datasets to better meet user needs and develop more targeted solutions. This will further improve model performance.
2. Model Development: We plan to upgrade and iterate the capabilities of our current multimodal large models to enhance their performance, reduce latency, and add real-time conversational abilities, thereby improving the user experience and continuously introducing innovative features. Additionally, we seek collaboration with government agencies, social organizations, enterprises, and developers to build consensus and promote the application of accessible technology, fostering the construction and growth of information accessibility.

The development of vivo's accessibility project is a long-term endeavor that requires ongoing refinement and upgrades. Our goal is to deliver better services and products to individuals with disabilities. To achieve the building and development of information accessibility, we need to support and enhance the innovation and application of accessible technologies. Accessible technology should serve as a bridge that enables more individuals with disabilities to integrate into society, enjoy a fulfilling life, and realize their personal value.

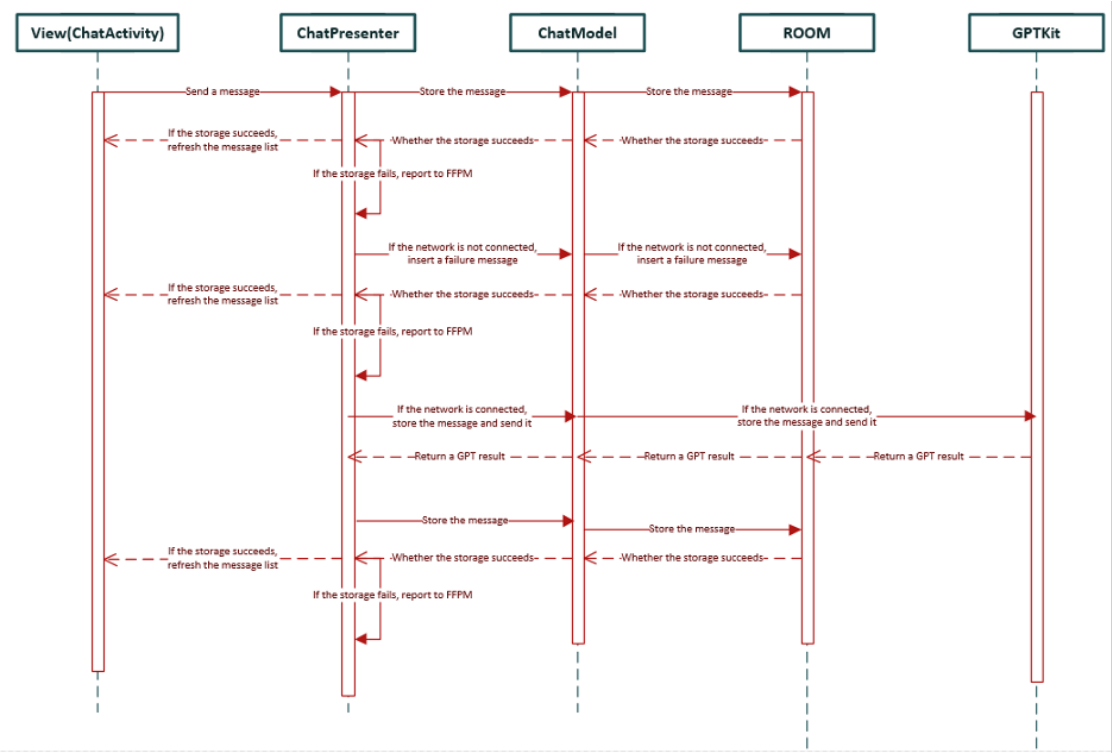
53.3. Use Case Requirements:

- **REQ-01**: Algorithm Capabilities: The multimodal large model uses LLM as its base and adds a visual module to LLM, enabling the model to simultaneously process data from both text and image modalities, which can better handle complex and real-world problems.
- **REQ-02**: Hardware Requirements: Users are required to use vivo smartphones that support accessibility features to ensure that the devices can run high-performance algorithms and handle complex tasks.
- **REQ-03**: User Feedback Collection and Analysis Technology: By collecting user feedback on the accessibility feature via online and offline channels, we use data analysis technology to evaluate these feedbacks and optimize the accessibility feature accordingly. Such an analytical method aids in understanding user needs and behaviors, thus enhancing feature design and boosting user satisfaction.
- **REQ-04:** Social Development Trends and Corporate Responsibility: Given the aging population and the growing demand for accessibility in social, vivo has a responsibility to provide accessible products. This enables AI to permeate all aspects of life through mobile phones, supporting the quality of life for users with visual and hearing impairments.

In order to meet the above use case requirements, vivo's accessibility project combines technology, hardware, requirements, and corporate responsibility to provide high-quality

accessibility services for visually and hearing impaired users, promoting inclusive development in society.

53.4. Sequence Diagram



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