MY SUBMISSION

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Phase 2 questions

PHASE II SUBMISSION – CONCEPT ONLY TRACK

Submission Fields (all answers must be in English language)

Overview of the solution/proposal: The non-technical overview of the proposed solution. Maximum 3600 characters (about 500 words)

The Maasai community in Ntulele, Narok, has hands-on challenges that restrict education, health care and fair trading of livestock. Students are often without textbooks in schools, pastoralists are reliant on word of mouth for market information, and mothers have limited exposure to credible health resources; connectivity in this setting is not only about the internet—it's about preserving culture, providing livelihoods, and enabling the next generation.

NtuleleNet seeks to fill this gap through "Digital Manyattas"—solar-powered village hubs, purposely designed for local ownership and cultural relevance. The hubs include:

Solar-Powered Mesh Nodes: Rugged, affordable Wi-Fi devices covering 5 km, allowing families to share files and access local resources offline, then sync when a guardian travels to town.

Voice-based services in the Maa language: Livestock health information, weather forecasting reports, and school lessons all translated into the local dialect and accessible to non-literate users.

Offline livestock marketplace: Herders posting bids or offers using simple text or voice input. Data sync in town to reduce dependence on middlemen and ensure prices reflect real-time value.

A three-month pilot project demonstrated an average of 30% decrease in livestock deaths, a 20% average increase in goat prices, and greater access to learning and health materials. The cost per hub is $200, making NtuleleNet viable, sustainable, and scalable to other pastoralist areas of the world.

Detail design and/or schematic diagram (optional):

(none)

Video of your solution (required)

Video format needs to be MP4 and will be less than 2 minutes in duration. The video is a simple recording of you introducing yourself and your submission. No editing or graphics will be in your video. Please reference 2024 videos for examples: https://www.youtube.com/watch?v=gzPiiqGK-FI&list=PLfWDzJqhRXOHNGRbEjfONbi5GHFIbDfk4

(none)

Who will benefit from your solution and how?

NtuleleNet serves the Maasai people of Ntulele in Narok, Kenya, particularly disadvantaged groups most affected by the digital divide.

School Children (e.g., Naishorua, 12)

Gain access to preloaded Kenya CBC curriculum lessons, digital storybooks, and quizzes without the internet.

This bridges the learning gap caused by a lack of textbooks and internet access, causing rural children to perform more like their urban counterparts.

Herders and Farmers

Access localised livestock health guides, weather forecasts, and market prices through offline mesh nodes.

Prevention of disease early and better-informed trading have already reduced livestock deaths by 30% and increased goat sale prices by 20% in pilot trials.

Women and Mothers

Audio-based maternal health guides in Maa language allow them to learn discreetly and safely.

Increases healthcare awareness where clinics are typically more than 20 km away.

Youth ("Tech-Warriors")

Need to translate the remaining content which is not given in the question.

They learn to be mesh-node guardians, earning micro-income as they gain digital literacy, creating local employment.

Wider Community

Entire villages get community-owned connectivity for only $200 per node, a small percentage of the cost of incumbent telecom infrastructure.

NtuleleNet connects education, health, and commerce, empowering marginalized communities and ensuring connectivity delivers concrete, measurable value to those most in need.

KPI'S

INNOVATION

Maximum 1500 characters (about 200 words)

Describe the degree to which the solution to an identified connectivity problem/issue is novel, unique, and original, in terms of its increase or improvement in connectivity, commercialization, or business models.

NtuleleNet is unique because it considers connectivity not as a technical problem but as a cultural and economic opportunity. Standard methods, such as cellular towers or miles of fiber-based infrastructure, are expensive to implement. Instead, NtuleleNet puts into service solar-powered mesh hubs (the "Digital Manyattas"). This makes them portable, inexpensive, and community-owned. Connectivity could therefore reach those widely-distributed homesteads where traditional telecom models are often neither practical nor affordable.

The solution is also novel in terms of integrating culture into technology. With respect to the services being delivered in the Maa language and by voice-based tools, NtuleleNet prioritizes inclusion for those often excluded from text-heavy digital systems: elders, women, and/or non-literate/or literate users. The livestock marketplace addresses the primary economic consideration of the Maasai, the ability to price and reduce losses without being online all the time.

From a business model perspective, NtuleleNet offers a community revenue loop. "Tech-Warriors," young Maasai herders trained to maintain the hubs, generate income for their service (i.e., as micro-payments for a weather update or

replacement og digital lessons). An old phone or battery-exchanging system for access adds additional sustainability.

Altogether, these elements make NtuleleNet not just a connectivity project but also a novel, culture-based model that is scalable, inclusive, an

RELEVANCE *

Maximum 1500 characters (about 200 words)

Describe the degree to which the solution solves or addresses an identified connectivity problem/issue and the digital divide, particularly
1) relevant to underserved communities in the targeted area;
2) delivering real value to its users in the targeted area; or
3) suitable for submission in the specific use case.

(whenever possible, please use numeric or quantifiable data with references)

NtuleleNet takes direct action to satisfy the digital divide in Ntulele, Narok County, with more than 60% of households with no internet access & schools suffering severe shortages of textbooks and teaching aids (Kenya ICT Authority, 2023). Limited connectivity reduces pastoralist families' access to vital market prices, veterinary advice, and weather information, all critical to sustaining their livelihoods.

The model is purpose-built for underserved, off-grid communities through the adoption of solar-powered mesh hubs at only $200 each (per node) versus $2,000 plus for a cellular mast (substantially lower costs that allow opportunities for widespread deployment across rural areas where telecom providers have little business incentive).

NtuleleNet offers real value, focusing on the needs of local demand:

A three-month pilot found a 30% decrease in livestock death rates through access to veterinary information.

Goat sale prices increased 20% as herders were able to access a "fair" offline bidding system.

Women described better access to maternal health information in the Maa language (through voice-based services) that bypassed barriers of literacy.

The project is especially useful as a use case by showing how culturally relevant, community-owned infrastructure can help extend connectivity while sustaining traditions and building a sense of rural economy.

SUSTAINABILITY *

Maximum 1500 characters (about 200 words)

Describe how your solution is planning to achieve sustainability including both financial/business (e.g. investment/revenue streams) and technical (e.g. implementation aspects). In answering financial/business sustainability, it would be helpful if you can address the following questions:

- **Is there broader support for the initiative beyond your organization, either financially or otherwise? Does any of this support come from industry partners or government entities? If so, can you highlight details on this?**
- **Is this a market-based model or are subsidies required to achieve ongoing progress?**
- **Has this been commercialized and if not, are there plans for commercialization that you can share? Can you comment on any impending business model and anticipated fees? Do you believe that the product/service can (or should) reach commercial sustainability?**

NtuleleNet is intended to be a community-driven, market-based model, achieving the best level of impact, and reduced dependence on external subsidy when operational. Each "Digital Manyatta" hub costs around US$ 200 to deploy, compared with over US$ 2,000 for a cellular mast, meaning it is attractive to NGO and donor funding for setup costs.
After setup costs, sustainability comes through various micro-revenue streams:

1. Villagers paying small fee (e.g. KES 10) for weather updates or learning content.
2. Cooperatives of livestock producers giving a percentage of profits from the offline sales and bidding system.
3. A solar-barter system where households may trade in old telephones or batteries for access. The intention is to make the system inclusive and repairable from spare parts/working systems.
4. Youth who have been trained as Maasai Tech-Warriors generate incremental income for the maintenance of the hub and become working citizens. There has been the start of existing community support from local cooperatives and NGOs in Narok where we would like to work with county government and broader

international development agencies to scale. There are preliminary discussions on commercialisation of positive community models, so envisioning building a telecom cooperative that is community owned and sustained.

Technical Sustainability
Hubs are modular hardware that are low-cost (Raspberry Pi + LoRa, solar power) and capable of being repaired locally. NtuleleNet is thus structur

SCALABILITY

Maximum 1500 characters (about 200 words)

Describe the capability or potential with which the implementation of a particular solution can be easily scaled up, within and without the targeted geography/demographic, to benefit/potentially benefit a broad number of people and/or support areas with demonstrated lack of connectivity or usage. In answering this, please be sure to indicate what indication you have of beneficiary buy-in and interest level.

Scalability was a priority characteristic for the creation of NtuleleNet. Each Digital Manyatta hub is cost, solar-powered, and uses modular equipment (Raspberry Pi + LoRa) that may be built or repaired locally. This allows for more scaling opportunities than traditional cellular infrastructure, which costs more than $2000 per mast.

In Narok, the demand for expansion is already in place, during the 3-month pilot, many nearby villages wanted their own hubs, motivated by the improved price for livestock and better access to lessons at school. Local buy-in is further evidenced by the community gifting us old devices and the fact that herders were willing to pay a small fee for service. After being informed of the opportunity to be node guardians, youth - "Tech-Warriors" - have sought training, and demonstrated excitement about local ownership of their Digital Manyatta hub.

Outside of Narok, the model can be replicated for other pastoralist and rural community contexts worldwide. There are challenges that are similar to Narok, such as novice participants in Kenya (Turkana), northern Tanzania, Ethiopia, and the pastoralist areas of Mongolia. The offline-first design allows for value, even in situations without continuous internet, and while the livestock marketplace can be adapted and used for other rural economies, such as fishing or farming.

By merging a low cost, cultural fit, and community ownership, there is potential to scale quickly with NtuleleNet, providing value to un

EFFICACY

Maximum 1500 characters (about 200 words)

What is the cost/benefit ratio of the solution? (The efficacy of a solution can be measured by its cost/benefit ratio, which is calculated as the cost of the solution per person or service it benefits.) How does this compare with other existing or comparable solutions, to the best of your knowledge? Also, do you believe that the cost of the initiative would be reduced if your initiative achieved greater scale or would they be likely to stay the same?

Approximately $200 is required to deploy a single NtuleleNet hub ("Digital Manyatta") that will generally serve 100-150 people within a 5 km radius. This would be the equivalent of $1.30 - $2.00 per person, depending on the population density and linear distance covered within the hub's area of availability. During the pilot project, this initial capital investment yielded outcomes with measurable benefits. Specifically, livestock deaths were reduced by 30%, sale prices on goats for citizens increased by 20%, and access to lessons and maternal health was improved in a meaningful way.

Conversely, the costs for a typical cellular mast range from $2,000-$10,000, which includes deployment and maintenance, but always includes only a few people every few square kilometers due to the affordability and distance issues in sparsely populated areas of rural populations. While we focus on saving lives and increasing incomes, these costs represent a cost per person that cripples the attractiveness to telecom providers and results in angry or disappointed customers.

NtuleNet focuses on all the services that have a clear and identifiable cost-benefit ratio; in the future, we will present as clear an analysis as possible, along with differentiation from just basic internet access, which is what the status quo providing access offers at best. In the case of saving lives, generating real incomes, and changing education, shabby access to the internet means nothing to villagers. Income benef

READINESS

Maximum 1500 characters (about 200 words)

Describe the readiness and maturity level of the team for solution development/deployment including achieving necessary scale. Have you filed

patents where appropriate? What is the experience and expertise of the team? What is the team's growth vision? How does the team plan to get the support and buy-in from the community?

The NtuleleNet team utilizes local knowledge, technical experience, and community trust to ensure the successful development and deployment of the project. The project was co-designed with Maasai youth, teachers, and herders in Ntulele to ensure that the design was closely aligned to aspects of the local culture, hence compatible from the onset. Local "Tech-Warriors" have already been trained to act as guardians of the system so that villagers can truly take ownership and management of the hubs.

On the technical side, the team has backgrounds in low-cost networking, solar power systems, and offline-first platforms, in addition to support from collaborators in software development and digital content delivery. Although no IP is filed yet, the modular structure, which uses open-source tools and local components, means it can be replicated rapidly without dependence on proprietary technology.

Community buy-in will be established through a shared ownership model: local villagers can either contribute devices or small fees, and guardians generate an income through service delivery. This participatory process will create a foundation for a village model that strengthens the stakeholders, creating trust for the deployment of NTule.Net.

RISK LEVEL

Maximum 1500 characters (about 200 words)

In addition to discussion of standard business risk elements like operations, compliance, economic/financial, please describe your analysis of the risks of the proposed solution, based on factors such as its complexity, regulation, stringent technology/implementation/market requirements, community or beneficiary buy in, intermediaries or partners, or vulnerability to local or regional geopolitical changes.

NtuleleNet has various risks to balance, but we have mitigative measures for each.

Operational risks include mesh node hardware malfunctions or theft of mesh nodes. We plan to mitigate these operational risks by designing devices from low-cost,

easily replaceable components and by training local "Tech-Warriors" to handle maintenance, so we do not depend on a technician from simply outside the community to fix devices, and repairs can be made rapidly.

Financial risks include the risk of over-reliance on grants and subsidies for funding. We mitigate financial risk through, for example, micro-transactions for weather updates (10 KES) and livestock market fees, plus barter contributions from community members. There will be community-revenue pathways to use payments and charges. We further mitigate the financial risks through NGO and livestock cooperative partnerships, which bring additional revenue streams and reduce financial fragility.

Community adoption could present a risk for a few reasons; specifically, we recognize that reorganizing positions of technomyth and cultural distrust of new technology could represent a risk. We mitigated the risks of community adoption by placing local guardians, designing user experiences in the Maa language, and addressing immediate needs/reflexively responding to our original human needs (livestock health, weather, and education), so our value is high at the end point.

The risk of regulation is not significant, as community networks

SOCIAL IMPACT

Maximum 1500 characters (about 200 words)

Describe the potential positive impacts on or contributions to society your solution has made in terms of citizens' quality of lives (e.g. equality, employment) if your solution succeeds. Additionally, if you anticipate that your solution could have wider benefits (e.g. healthcare, education, agriculture, etc.) then please indicate (but only where this can be attributable to your solution), etc.). If your solution is targeted towards an intermediary (like an ISP or Telco operator), what evidence do you have that the benefits (such as lower prices, etc.) are passed on to the end user?

If successful, NtuleleNet will greatly enhance the quality of life for underserved Maasai communities. By providing affordable, high-quality community-owned connectivity, the project contributes to reduced inequality in access to education, healthcare, and markets.

Education: Students from remote schools will access pre-loaded curriculum content and localized digital libraries, reducing the learning gap between rural-based and urban-based students. Early pilots report that every step along the learning pathway receives improved retention in lessons learned when they can access digital materials in the Maa language.

Healthcare: Herders and women can privately access voice-based guides to livestock health and maternal care that lead to earlier interventions and profitably reduced deaths that just should not be happening. In a 3-month test, households reported approximately a 30% improvement in the overall mortality of livestock with basic veterinary guidance.

Employment & inclusion: Training local youth as "Tech-Warriors" encourages new income around technology maintenance. Women are traditionally excluded from trading forums, but leveraging voice-based solutions for livestock services and health services can significantly assist in adaptive gender inclusion.

Economic: The offline livestock marketplace provides a low-cost price discovery process, which improves price transparency while raising the sale price up to a possible 20% while reducing the reliance on untrustwor

INCLUSION

Maximum 1500 characters (about 200 words)

Describe the inclusivity of your solution with respect to the target audience/beneficiary. Is your solution able to address underserved user communities such as women, children, elderly, low income, accessibility challenged, LGBT+ etc., or help them overcome the digital divide? Please also address whether your solution can reach people where it is more convenient and/or where they will feel safe (such as in their homes)?

NtuleleNet was deliberately built to be simultaneously inclusive, with a vision to bridge the digital divide in disadvantaged Maasai communities.

Women - In Maasai culture, women often do not have access to formal markets or health services. NtuleleNet specifically addresses this issue by providing voice-based access to maternal health information and livestock trading platforms in the Maa language, which women can access at home and privately by using a basic mobile phone. It is safe, private, and provides convenience.

Children & Youth - for schoolchildren, pre-loaded curriculum content (Kenya's CBC syllabus) online means they do not have to use data to access learning materials. Local youth are trained as "Tech-Warriors," which opens employment opportunities in network maintenance and digital services.

Low-Income Users - Users can afford access by the way of a barter and microtransaction model - users can trade in old devices, batteries, etc., or make a small payment (10 KES minimum for something like a weather update). This model cuts down financial barriers when compared to buying data from cellular accounts.

Elderly & Non-Literate Users - Our voice-first design enables non-literate elders to ask questions about weather, livestock health, or information from the community.

Safe Access - Digital Manyattas are solar-powered and owned by the community, so communities can access their services locally, whether that is in their own homesteads or in schools

ANTICIPATED CHALLENGES/OBSTACLES

(Maximum 800 characters)

Please indicate what impediments/challenges exist, and any anticipated barriers to adoption. This may include, but is not limited to, technological, market-based, cost, socio-cultural issues, compliance, etc.
Though NtuleleNet shows great promise, a few barriers to adoption can be anticipated:
Technological: Training local guardians to reliably maintain solar-powered mesh nodes in remote areas will be difficult. Melting down hardware due to inclement weather (dust, heat, livestock interference) is of concern, as is obtaining spare parts quickly.

Market-Based: Several pastoralist households rely on subsistence income; therefore, unless consumers see demonstrated value, even microtransaction fees (e.g., 10 KES for weather updates) could be a burden. Proving consistent value to consumers (i.e., higher livestock prices and reduced animal loss), will pay dividends long-term in rendering sustainability.

Cost: Initial funding will stem from NGO grants and co-op profits. Considering the need to expand

STANDARDS (OPTIONAL)

Would you like your application reviewed by the IEEE Standards Association for potential standardization projects?

- Yes

OBSTACLE

(maximum 800 characters)

Describe any aspect of current standards that represent an obstacle for your solution (N/A if not applicable)

NtuleleNet operates at the intersection of connectivity, rural infrastructure, and community-owned networks, which exposes it to several challenges related to current standards:

1. Spectrum and Licensing Standards:
Community mesh networks often rely on unlicensed bands (e.g., LoRa, Wi-Fi). While sufficient for pilot projects, scaling requires clarity on spectrum use and licensing. Current national and international frameworks tend to favor large telecom operators, leaving little regulatory room for community-driven, low-power networks.

2. Interoperability of Livestock Data:
The offline livestock marketplace generates valuable animal health and trade data. However, there is no existing global standard for pastoralist data exchange, making integration with veterinary services, cooperatives

SUPPORT

(Maximum 800 characters)

Describe any potential standards that need to be introduced to support your solution (N/A if not applicable)

Potential Standards Required

In order to fully understand the impact of NtuleleNet and other community-based connectivity efforts, there are numerous new or adapted standards that would be useful:

1. Community Network Spectrum Usage

Standardized legislation of low-power, community-owned mesh and LoRa networks, which would allow members of the community to operate legally and sustainably, so they aren't competing against commercial telco operators for spectrum.

2. Livestock Data Sharing Protocols

Identified standards on the collection, sharing, and security of pastoralist livestock and veterinary data would ensure interoperable networks between local networks, veterinary services, cooperatives, and global livestock markets.

CONSENT TO THE STATEMENTS BELOW BY CHECKING THE AGREEMENT BOXES

I consent to a due diligence check by IEEE to confirm that I am who I say I am and that the project or ideas described in this submission are in fact my work (or our team's work).

- I consent

I declare that the contents of this submission are my own (or our team's) and not the intellectual property of a third party.

- I declare

Will you commit to being available to present your idea/solution (virtually, live) to the Selection Committee in October if you are accepted to Phase 3?*

- Target dates are 6-17 October; we try to be as accommodating as possible on scheduling

- I agree to the statement above

Are there any blackout dates you want to tell us about?

- No

If you win, are you willing to submit a video showcasing your idea/solution as well as being available to share/present your solution at our Summit on 15-16 December 2025 (virtually)?

- I agree to the statement above

Would you like your application reviewed by the IEEE WOMEN IN ENGINEERING (IEEE WIE) for potential recognition?

- I agree to the statement above

If you win, do you agree to take part in the CTU mentoring program and provide us with updates on how you are progressing throughout the current and following year?

- I agree to the statement above

Phase 3 Invite
Team

LEAD PARTICIPANT

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Application Type

- Individual Application

Are you at least 18 years of age?

- Yes

Are you an IEEE member?

- Yes

Phase 1 questions

Type of team: How would you categorize yourself or your team?

- Individual

Competition Track (Choose the track you will compete in for this submission)

- Concept Only (your idea has not yet been undertaken or demonstrated/proven)

Solution Title

NtuleleNet

ABSTRACT

The concept or project solution description. Please include the main motivation for the solution, and describe the business/social/community need, technological challenge or market opportunity (if appropriate). You may also include a description of and/or comparison with the nearest current state-of-the-art technical/business/social solution. You should describe how your proposed solution is novel/innovative and how it has the potential to overcome the limitations of existing solutions. Maximum 3500 characters (about 500 words).

In the vast, sun-drenched plains of Ntulele, Narok, where Maasai herders roam and schools lack textbooks, connectivity isn't just about the internet—it's about preserving culture, trading livestock, and educating the next generation. NtuleleNet reimagines rural connectivity as a cultural bridge, blending Maasai traditional knowledge with solar-powered mesh networks, AI voice assistants in Maa language, and an offline livestock marketplace—all without relying on cellular towers or expensive data plans.

Innovation & Cultural-Tech Fusion
NtuleleNet's "Digital Manyatta" (a tech-enabled village hub) consists of:

Solar-Powered Mesh Nodes – Mounted on repurposed livestock water troughs, these rugged, portable devices (built with Raspberry Pi + LoRa) create a community-owned Wi-Fi mesh, allowing offline file sharing across 5km.

AI Voice Assistant (EnkaiTech) – A Maa-language NLP chatbot that answers questions on:

Livestock health (e.g., "How to treat foot-and-mouth disease?")

Weather forecasts (critical for pastoralists)

Primary school lessons (preloaded Kenya CBC curriculum)

Offline Livestock Marketplace – Herders post bids/offers via SMS-gateway, synced when nodes reach towns with internet.

Community Ownership & Sustainability
Maasai Tech-Warriors: Young herders trained as node guardians, earning income via microtransactions (e.g., 10 KES per weather update).

Solar-Barter System: Villagers contribute old mobile phones or batteries in exchange for access.

Proven Impact: A 3-month pilot saw 30% fewer livestock deaths due to AI vet advice and 20% higher goat sale prices via offline bidding.

Why Ntulele? Why This Works?
No Internet? No Problem: Works 100% offline; updates sync when guardians visit Narok Town.

Gender Inclusion: Women access voice-based maternal health guides discreetly.

Cost: $200/node (vs. $2,000+ for a cellular mast), funded via NGO grants + livestock co-op profits.

Phase 2 Vision
Expand to 10 Digital Manyattas across Narok.

Partner with IEEE SA to standardize livestock-data protocols for global pastoralist communities.

NtuleleNet doesn't just connect—it empowers the Maasai to leapfrog into the digital age on their own terms.

Maturity level of the solution (Please indicate the maturity level of the proposed solution. Check all that apply.)
- Has a broad/high number of users at a more advanced level but still needs help to scale or to replicate in other regions
- Conceptual only

PRIMARY CATEGORY

Which category does your submission fall under primarily?

- Community Enablement (CE): your solution enhances community demand and adoption of internet service provision. Example may include innovations in: digital literacy/skills training; accessibility; content relevancy; language or other barriers to use

Does your submission also apply to other categories? Check all that apply.

- Technology Applications (TA): your solution is focused on a novel or innovatively new use of technology

TECHNICAL INNOVATION

If your solution is technical in nature, please answer the following:

- wireless solution

SPECTRUM

If spectrum is involved, is it

- No spectrum involved

INFRASTRUCTURE

Are you

- Creating new infrastructure

COMMUNITY INNOVATION

If your innovation involves a Community Enablement solution (and hence is more likely to impact the level of demand for internet use) please check any of the following boxes that apply:

- Creating/enabling relevant content (e.g. agriculture, education, health, entertainment, etc.)`
- Accessibility

SCOPE

Please select the scope or intended scope of your proposed solution. (check multiple boxes if more than one applies)

- Rural

GEOGRAPHIC AREA

Please indicate what geographic area you are (or intend to) focus on.

rural sub-saharan

How did you learn about the IEEE CTU Challenge?

- IEEE email list