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# ACHIEVING SUSTAINED WIRELESS COMMUNICATION IN DIFFICULT TERRAIN, RURALAND REMOTE AREAS BY LOON TECHNOLOGY

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**Abstract:** Broadband link is a solution to ensuring strong profitable progress and improving value of life in different rural areas. Due to low economic growth and population density, communication infrastructure implemented in rural areas around the world lags behind its metropolitan counterparts. In this research, focus on the efforts of providing reliable emergency internet services in the areas struck with calamities like earthquake, Tsunami, War, etc. and also in difficult terrains like mountains, deserts and remote area using minimal infrastructure and cost expenditure. The high cost of erecting up the cell tower, time required to develop the required infrastructure and the other resources like construction & transportation units etc. will be replaced and deployedon the need based location, and easily winded up after successful completion of the objective which can beof duration ranging from few hours to several months. Still for two third of global population, the lack of sufficient infrastructure to deliver Internet services in rural and distant locations is one of the biggest obstacles to providing internet connectivity in these places. Although this objective of sustained wireless communicationcanbe achieved through satellite communication also but considering the long persistent demerits like high cost, long latency, and susceptibility to interference and environmental factors form has prohibited wirelesscommunication to be used a widely accepted and popular method. Our paper is aimed at increasing internet penetration in rural as well as remote areas through by using IP cameras in Google loon**.** Additionally, we dissected and analyzed some commonly raised issues regarding previously developed Google loon technology so that we can overcome those drawbacks.

**Keywords:**
Wireless Communication, IoT, Lora Wan, Residential welfare, digital agriculture, transportation.

## 1. Introduction

Wireless communication is an unguided media based technology in communication network that can be achieved by Loon. Loon is a network of balloons that travel on the edge of space with the goal of connecting people in rural and isolated areas, assisting in filling in coverage gaps, and restoring connectivity after disasters. This technology is based on internet access in various rural and urban locations using various wireless technologies, such as Wi-Fi. The efforts to provide dependable emergency internet services in places affected by calamities like earthquakes, tsunamis, war, etc. as well as in challenging terrains like mountains, deserts, and distant areas with little infrastructure and financial investment are the main emphasis of this study.

In this research paper, we discuss on achievement of wireless communication in rural and remote areas under different difficult terrain. The main focus on different problems earthquake, tsunami war etc. in different remote and rural areas. The 24/7 operation that is border security and surveillance cannot afford downtime or the early warning and threat assessment you need to respond quickly and effectively. Google's Project Loon originally aimed to enable people reconnect to the internet in disaster-affected areas (such as flood-, earthquake-, war-, and remote rural and remote places) by using a network of balloons travelling at the edge of space. Google found the answer to its effort to create an affordable Internet service in an unexpected place: the skies.In order to achieve advanced usage &

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features in the field of sustained surveillance and security in the regions where none are currently available or are only available at a high cost - in terms of life & goods. The structure of sustainable wireless communication with achievement in rural and remote areas is show in figure 1 as:

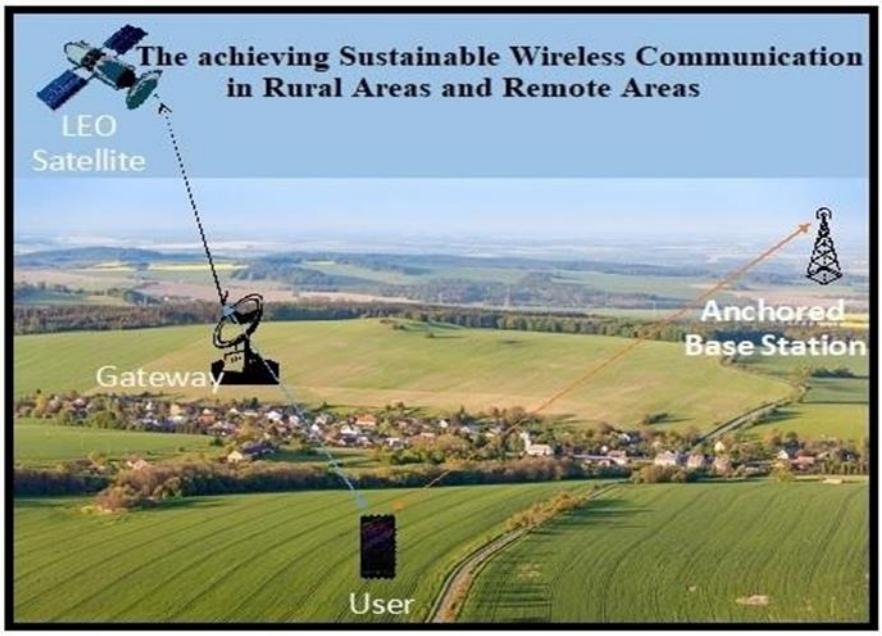


**Fig 1. Wireless communication in rural areas**

Satellite communication generally requires higher upfront costs than other alternatives, as it involves launching and operating satellites, as well as installing and maintaining ground stations and terminals. When difficult problem like tsunami, war, earthquake arise in rural areas then wireless network is a propernetwork for communication show in figure 2 as:

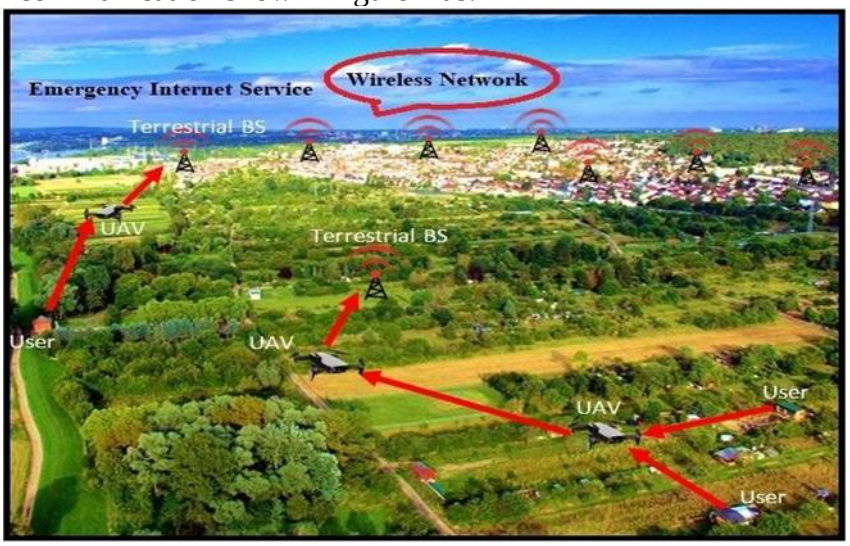


**Fig 2. Emergency internet service in rural areas**

## 2. Literature Review

In this section, discuss the literature review on behalf of this research paper show in table 1 as:

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**Table 1. Literature Review**

| Author's | Research Category | Research Contributions | Research Gaps |
|---|---|---|---|
| Alkhalifah, E. S., & Almalki, F. A. (2023) | UAV based intelligent cellular structure inwireless technology | Proposed the intelligent structure for UAV (unnamed aerial vehicles) based wireless communication technology by using AI for the purpose of highly prediction to wireless adaptable communication without human intervention. [1]. | The limitation of this research is missing theimportant features as connectivity and QOS. |
| Alsharif M. H. et al., (2023) | Survey of Green IoT | Proposed the review on green IOT with focus on four important principles such as energy efficiency of M2M communication, energy efficiency of ecosustainable WSN, energy efficiency of RFID and energy efficiency of microcontroller and IC [2]. | The weak point of this research is eco friendly and sustainable IoT in terms of energy efficiency. |
| Amodu O. A. et al., (2023) | THz – enabled UAV Communications | Proposed the review on UAV based communication and the outcome of this study is THz based UAV communications highly mobile nature in high frequency | The weakness of this research numerous potential use cases in aerial wireless communications. |
| Bhardwaj P. et al.,(2023) | Performance analysis of integrated IoT network | Proposed the implementation of integrated IoT in terms of hybrid. The outcome of this research is integrated IoT is superior then basic IoT [4]. | The fault of this paper is data collection is tuff. |
| Fourati F.et al., (2023) | Urban-rural connectivity in ground networks | Proposed the urban-rural connectivity using terrestrial network with improvingspeusing AI. The outcome of this paper is AI based network is best for improving connectivity [5]. | The weak point of this research is optimal placement and movement of UAV in rural network. |

**3. Research Methodology**

Our primary goal of this research to identify potential extensions of Google's Project Loon and provide

sustained Wireless communication in Rural and Remote Areas. By using IP cameras to provide wireless connectivity, HD, and live streaming footage of the difficult terrains, we may expand Loon's Utilities. It might be used for remote control from any Networked PC in the control centre and 24-hour remote monitoring (with Night vision cameras NGV). Other features can include delivering films and photographs in higher definition to a larger or more specific group (Multi casting). The use of thermal images is very different. In reality, although we refer to them as "cameras," they are truly sensors since they capture images using heat rather than visible light and can detect variations in heat. We can use infrared/thermos graphic cameras to detect infrared radiation. Depending on what you are watching at the time, there are several sources of thermal energy. Some things, such warm-blooded creatures (like humans), machines, and engines, for example, generate heat on their own through mechanical or biological processes. These temperature differences are detected, and they are converted into visual detail.

Nevertheless, motion detecting technology is available. It is the process of identifying changes in the location of an object with relation to its surroundings, or possibly changes in the surroundings themselves. In order to detect motion, software-based motion activated cameras compare pixel changes between subsequent frames. If any people, animals, or even natural disasters (floods, forest fires, etc.) enter the frames, the software will count the difference in pixels and start sending motion warnings.To be used in a variety of harsh terrains, such as deserts, remote lands, mountains, seas, and oceans, we assemble a Camera + Sensor + Transmission/Reception equipment's integrated system where we mount EO/IR sensors on LOON to take advantage of their long-range imaging capabilities and image stabilization. This enables us to recognize targets, follow moving targets, and evaluate risks while operating in challenging environmental conditions. The mechanism should be able to display images even in adverse weather conditions, such as torrential downpours, blizzards, snowfall, smog, heat waves, etc. It also needs EO/IR imaging for target classification that is more precise. EO/IR (Electro-Optical/Infra-Red) systems are imaging systems used by the military or law enforcement that have both visible and infrared sensors. EO/IR systems also give coverage of the visible and infrared spectra in addition to total situational awareness during the day, night, and in low light. To extend the detection range, high-magnification lenses should be utilized, and the system should be capable of maintaining a constant watch over the intended area. It will have the following components:

1. **Command-And-Control Facility (Base center):** There are numerous factors that make it difficult to secure a country's borders, but the size of the region that needs to be efficiently supervised and patrolled is one of them. By connecting with a centralized command and control centre, sector commanders can move their border security resources as the tactical situation necessitates.
2. **LOON - Unmanned Aerial Surveillance:** The ability to locate, follow, and examine moving objects in the air from any location, day or night. High heights, strong winds, rain, snow, and other adverse weather conditions are commonplace for FLIR UAS operations. enlarge your visual field in challenging conditions.
3. **Imagers:** Finding a possible threat is only the first step. Following the detection of an object of interest, its identity and level of threat must be determined. Operators cannot distinguish between false or unnecessary warnings and signals that require interdiction without clear, long-range visual analysis of reported threats on land or in the sea.
4. **Radars:** Intercepting and eliminating a threat require an understanding of its nature. Multiple threats are detected and followed simultaneously by the surveillance radars, which provide precise location, heading, and speed information. Security professionals can monitor and regulate their security zone by covering regions outside the fence line and stopping threats before they can do harm. the division of work among operators, the definition of intervention techniques, and the human organization.

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**Integrated Check Posts (ICP)/ Land Custom Stations (LCS):**
India now has 7 operational Integrated Check Posts (ICPs), and plans are in place to convert more Land Custom Stations (LCS) to ICP, including 7 at borders, bringing the country's total number of border ICP to 14 at a cost of 3,000 crore. Designated Integrated Check Posts (ICP) are ICPs that are designated for both customs and immigration operations. Loon's command center could be either established in the ICPs or LCSs with dedicated 27/7 operating staff involved in aerial vigilance & investigating activities.

## 4. Results

In this section, discuss on the outcomes after analysis to achievements of sustained wireless communication in rural and remote areas. The observation in this study indicates that the study's end findings are that sustained wireless communication using Loon technology is effective in rural areas during various disasters when latency range is increased. The result of this complete research is shown in fig 3 as:

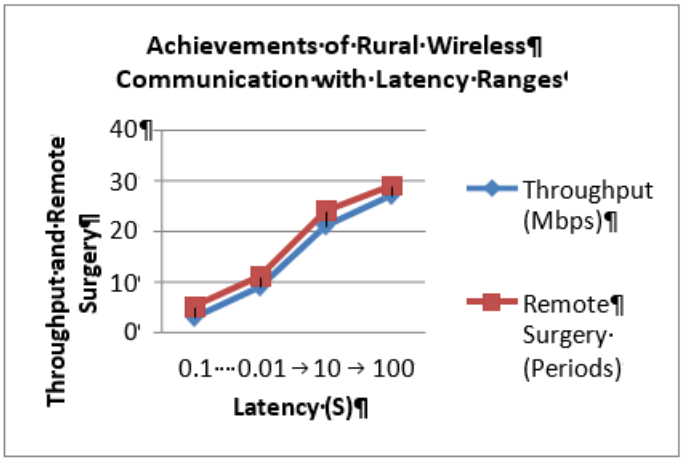


**Fig 3. Result graphs**

## 5. Discussion

There are already a variety of wireless technologies available for various rural communication circumstances. There is a great analogy to be made. Bluetooth works best for short-range, point-to-point communications between personal devices. Wi-Fi dominates short- and medium-range private networks that include adjacent establishments. Back haul can be received by remote areas using fixed wireless. Bluetooth Low Energy and ZigBee are designed for short-range low-energy applications, but LoraWAN and other specific Internet of things (IoT) communication networks, such as SigFox, are meant for low-throughput, long-range low-energy applications. Although their service fees are typically astronomical, cellphone and satellite networks are the main options for Internet in remote areas due to their accessibility. Private wireless networks, such as long-range/mesh Wi-Fi and private 5G, may ultimately be more competitive in particular situations, such as tsunami, earthquake, and conflict. Rural wireless will be crucial, especially for last-mile networks to reach end-user devices and maybe for constructing backhaul at a lower cost in regions with difficult terrain. The quantity of applications is another crucial component that will ensure sustainable rural broadband expansion. Because wireless technology and applications are closely related, developments in rural wireless research may speed the creation of new applications and act as an incubator for the deployment of rural networks.

## 6. Conclusion

The digital partition of wireless communication services is more severe than many understand on behalf of achievement of wireless communication in different rural and remote areas. Wireless in rural areas will be key in bridging this gap. Wireless technology developments will lower the cost and boost the efficiency of rural broadband. In this research paper discuss on achievement of sustainable wireless communication indifferent disaster like tsunami, earthquake and war in rural and remote areas by using loon technology. In this work include review of literature, achievements and application of rural wireless network, requirements of rural wireless network, analysis of achievements of rural wireless communication within latency ranges and challenges for future research directions.

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