

ADVANCED COMMUNICATION USING LoRa (LONG RANGE) FOR NATURAL CALAMITIES

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Abstract—Communication is the key to Disaster management. One of the most important, and oftentimes overlooked, parts of any highly efficient disaster response is effective information exchange between information sources, emergency managers and those impacted by the disaster or emergency event. When a natural disaster occurs one of the major crises is communication. This is mainly because when a disaster occurs all the cellular networks, towers and other contemporary means of network goes down making it impossible to communicate with others. Thus, in this project we propose an alternative solution for communication during disaster which can be achieved using a Long-range radio transceiver module, which can operate without the help of any towers or base stations. The proposed LoRa transceiver model is a standalone device which operates on ISM band of frequency range 902 to 928 MHz, providing a hinderance free good communication and a voice playback module is used to keep us updated with the rescue and relief activities. In the Transmitter section a GPS module is used to find the location of the victim and the values are stored in Latitude and Longitude which can be entered in the google maps to find the exact location where the victim is. In the receiver section the data from the transmitter is stored in cloud and the data from the cloud is used for any web application. We have designed a website so the URL can be used to get the information about the victim.

Key words: Communication, Disaster Management, Long-range transceiver module, web application.

1. INTRODUCTION

An emergency communication system (ECS) is any system (typically computer-based) that is organized for the primary purpose of supporting one-way and two-way communication of emergency information between both individuals and groups of individuals. These

systems are commonly designed to convey information over multiple types of devices, from signal lights to text messaging to live, streaming video, forming a unified communication system intended to optimize communications during emergencies. In this traditional method of wireless communication, towers play a major role. The main purpose of a tower is to facilitate the mobile nodes and other wireless communication devices with signal reception. But during any natural disasters or calamities like earthquakes, floods, etc. these towers go down making it difficult to communicate with others. So to provide a hinderance free communication we go for a Long Range transceiver module which acts as a stand-alone device here.

2. EXISTING SYSTEM

Two-way communication

Two-way communication is a form of transmission in which both parties involved transmit information. Two-way communication has also been referred to as interpersonal communication. Common forms of two-way communication are:

- Amateur radio, CB or FRS radio contacts.
- Chatrooms and instant messaging.
- walkie-talkies
- In-person communication.
- Telephone conversations.

2.1 Amateur Radio

- Amateur radio, also known as ham radio, is the use of radio frequency spectrum for purposes of non-commercial exchange of messages, wireless experimentation, self-training, private radio sport, contesting, and emergency communication.

- It is a professional two-way radio services which plays a major role in public safety situations like disasters, floods, etc.
- It provides a standard connectivity even during worst case scenario and a world-wide connectivity.

Disadvantages

- Ham radio operations can be affected due to weather and terrain conditions as it operates using radio frequency waves.
- Ham radio requires skilled operators.
- The major disadvantage is that we won't be able to call a specific station unless the meeting has been scheduled in advance.
- we need a better antenna and repeaters for the radio to reach out world-wide.

2.2 Walkie-talkies

- A walkie-talkie (more formally known as a handheld transceiver, or HT) is a hand-held, portable, two-way radio transceiver.
- A walkie-talkie is a half-duplex communication device.
- Multiple walkie-talkies use a single radio channel, and only one radio on the channel can transmit at a time, although any number can listen.

Disadvantages

- Their low power results in relatively short range compared with higher power radios
- Their easy availability may result in the channels being congested with multiple users
- Major drawback of this system is the limited range of coverage, it can cover only up to 5 miles. And also, only one person can talk at an instance and it is very easy to "Tap in" and listen to a conversation

2.3 Land Mobile Radio System

- A land mobile radio system (LMRS) is a person-to-person voice communication system consisting of two-way radio transceivers (an audio transmitter and receiver in one unit) which can be stationary (base station units), mobile (installed in vehicles), or portable (handheld walkie-talkies).
- Most systems are half-duplex, with multiple radios sharing a single radio channel, so only

one radio can transmit at a time.

- The transceiver is normally in receiving mode so the user can hear other radios on the channel; when a user wants to talk he presses a push to talk button on his microphone, which turns on his transmitter

Disadvantages

- Limited Coverage Area for Communication
- Governmental Licensing Requirements
- Startup Costs of LMR
- Shorter Battery Life
- Short range of coverage mostly used by military and police officials.

3. PROPOSED SYSTEM

3.1 Introduction

As explained before, Communication is the key for Disaster Management so new and better services are being introduced with newer networks which require more towers. In order to make communication easier the proposed system can be used. In the proposed system a Stand-alone device Lora is used for the long range communication.

3.2 What is LoRa (long Range)?

LoRa (Long Range) is a low-power wide-area network (LPWAN) technology. It is based on spread spectrum modulation techniques derived from chirp spread spectrum (CSS) technology. It was developed by Cycleo of Grenoble, France and acquired by Semtech the founding member of the LoRa Alliance.

3.3 Features of LoRa

LoRa uses license-free sub-gigahertz radio frequency bands like 433 MHz, 868 MHz (Europe), 915 MHz (Australia and North America) and 923 MHz (Asia). LoRa enables long-range transmissions (more than 10 km in rural areas) with low power consumption. The technology covers the physical layer, while other technologies and protocols such as LoRaWAN (Long Range Wide Area Network) cover the upper layers. In January 2018, new LoRa chipsets were announced, with reduced power consumption, increased transmission power, and reduced size compared to older generation. LoRa devices have geolocation capabilities used for trilateration positions of devices via timestamps from gateways. LoRa and LoRaWAN permit long-range connectivity for Internet of Things (IoT) devices in different types of industries.

3.4 Why LoRa?

Unlike other disruptive technologies that can be slow to gain global adoption, Semtech's LoRa Technology is not a promise of a future potential, but is available today all around the globe. With over several hundred known use cases (and growing), and more than 100 million devices deployed on every inhabited continent, Semtech's LoRa devices and the LoRaWAN® protocol are creating a Smart Planet. Industry analyst IHS Market projects that 43% of all LPWAN connections will be based on LoRa by 2023. LoRa Technology is realizing the potential of the Internet of Things (IoT).

3.5 Working

In this project we are proposing an alternate idea for communication during critical times like natural disasters or calamities. This is achieved with the help of a Raspberry Pi 3B+ along and LoRa Transceiver module which together acts as a receiving section(rescue team side). LoRa is a long-range radio transmission module which can transmit signals in the ISM band frequency range from 902Mhz to 928Mhz. The LoRa supports Mesh networking. This LoRa module operates in the ISM band frequency helps in transmitting signals even during disasters up to a radius of 15Km without the help of any base stations or towers.

Thus, this system can act as a standalone device which is reliable and capable of working even during disasters when all other contemporary networks are down. It consumes low power and can transmit to a long range thus making it more advantageous.

In the transmitter section we have an Arduino connected with LoRa transceiver for the transmission and we have a voice playback module connected so as to keep the victim updated with the rescue and relief activities. We have an GPS in order to share the location of the victim to the rescue team. A panic switch is placed so that when the victim presses the panic switch for help the message will be transmitted to the receiver side and the rescue team can provide further help for them.

In receiver section we have a Raspberry pi connected with the LoRa transceiver. The data is received from the transmitter side and the data is stored in cloud and can be further used for any web application. The Rescue Team can reach the victims place after the message has been received from the transmitter side.

3.6 Block diagram

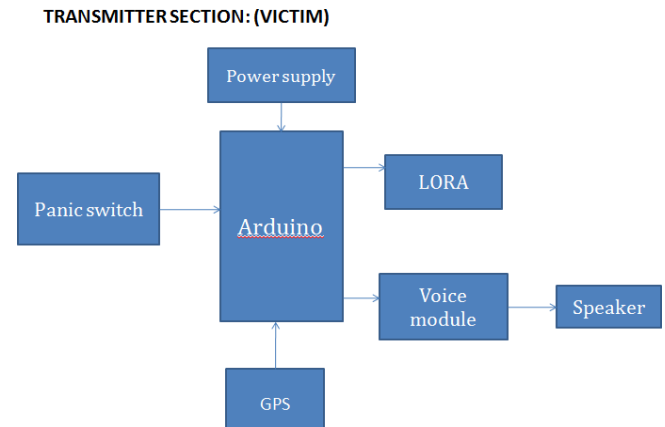


Fig-1: Basic Block Diagram (transmitter section)

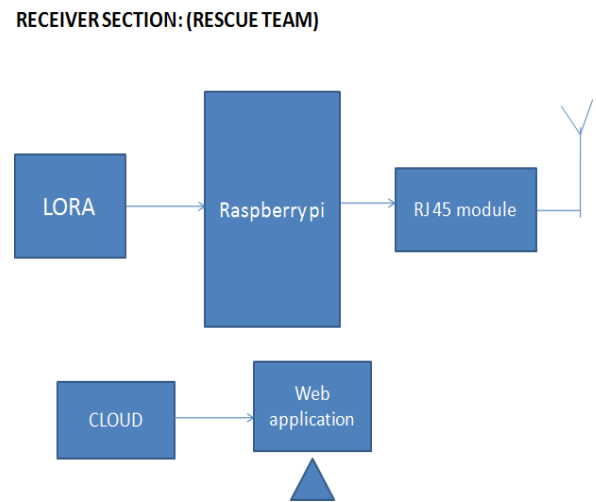


Fig-2: Basic Block Diagram (receiver section)

4. CONCLUSION

As we have discussed Communication is the Key for Disaster Management. When natural disasters occur, they affect the networks of communication, which affects the life of many people. Thus, to avoid such cases we provide an alternate solution using Raspberry pi and LoRa transceiver which is used for advanced communication. We have chosen LoRa as our transceiver module because when compared to other potential transceiver modules LoRa transceiver can work for long ranges and at preferable data rates so they are chosen. We have used the Raspberry pi 3B+ in the gateway side because the gateway is quite complex and need to

handle more complex operations so a Raspberry pi is much preferred than an Arduino. Thus, this device can provide a reliable connectivity to communicate during any emergency situations like natural disasters or calamities.

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