International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 05 | May - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Sos Beacon Using Arduino

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Abstract - In today's world, the need for reliable emergency communication systems has grown significantly, especially for individuals working or traveling in areas with limited or no cellular connectivity. The development of reliable emergency communication systems has become more important in the current world, especially for people operating or traveling to places with little to no cellular coverage. The SOS Beacon which uses an accelerometer, GPS, LoRa, and Arduino works as a practical aid to this problem. The SOS Beacon system automatically identifies emergency situations such as falling or being motionless and autonomously sends critical location information in real-time over vast distances and without the use of mobile networks. This system, by using open-source hardware components that operate on low power, is a useful device that can aid and save lives of hikers, outdoor operators, disaster recovery workers, elderly people, among others. This study investigates the design, functionality, and potential advancements of the SOS Beacon toward modern emergency response infrastructures.

***Key Words*:** Emergency communication, Arduino, LoRa, GPS, Fall detection, Remote alert system.

1.INTRODUCTION

We live in era where mobiles have become our essential service in every emergency situation we dial emergency contacts, emergency service, helplines etc. but what if, there comes a day all the cellular networks are down and people need help. Or there is another situation where we are in rural areas or disaster-prone regions where cellular network is not reachable or damaged. Here comes our project where we can use it in times of our own help. Emergency communication systems have long been hampered by the limitations of their infrastructure. Wherever you are on a mountain trail, in a forest, a desert or in the midst of a natural disaster like an earthquake or flood those limitations can delay rescue efforts with potentially life-or-death consequences. That's where the SOS Beacon system comes in. By combining open-source electronics and low-power wireless technologies, it can overcome those challenges. At its heart is the Arduino Uno, chosen for its simplicity and flexibility. LoRa modules let the system communicate over several kilometers without needing a cellular network. GPS and an accelerometer are also part of the package: the GPS gives you real-time location data, while the accelerometer automatically detects if someone has fallen or lost consciousness. This paper explains the full architecture, functionality and use cases of the system. That means you can see just how it can be used in real-world rescue missions and outdoor safety situations.

2. Body of Paper

The project involves the design, development, and testing of a wireless SOS communication system capable of detecting emergencies and transmitting real-time GPS coordinates over long distances using Arduino and LoRa technology. The approach includes both hardware integration and software programming to create a fully functional transmitter-receiver pair.

1. System Architecture

The system is divided into two main units:

a) Transmitter Unit (User Side):

- Continuously monitors motion using an accelerometer.
- Detects falls or prolonged inactivity (e.g., no movement for 15 minutes).
- Upon no detection, a GPS module (NEO-6M) acquires the user's coordinates (latitude and longitude).
- An optional push button provides the user a short time window to cancel false alarms.
- If not cancelled, the Arduino Uno compiles the GPS data and sends it through an SX1278 LoRa module.
- A buzzer is activated to alert nearby individuals.

b) Receiver Unit (Rescuer Side):

- Built around an Arduino Nano connected to another LoRa module.
- Receives the transmitted GPS data.
- Displays coordinates on a 16x2 I2C LCD.
- Activates a buzzer to notify the rescue team of the incoming alert.

2. Components Used:

- Arduino Uno: Central controller at the transmitter side
- Arduino Nano: Controller at the receiver side
- NEO-6M GPS Module: Acquires real-time location data

- Accelerometer: Detects motion and stillness, used for fall detection
- SX1278 LoRa Module: Enables long-range wireless communication
- Buzzer: Audio alert for nearby users and rescuers
- 16x2 I2C LCD: Displays GPS coordinates at the receiver

3. Programming and Logic

- The Arduino IDE was used to program both the Uno and Nano boards.
- The transmitter code continuously reads accelerometer values to determine inactivity.
- Upon detecting an emergency and validating via the timer logic, GPS coordinates are retrieved and sent through LoRa.
- The receiver listens on the same frequency and extracts and displays the GPS location.
- Error handling and retry logic were also implemented to ensure data reliability.

4. Testing Environment

- Urban field testing verified performance across buildings and roads.
- Open field testing confirmed maximum LoRa range and GPS accuracy.
- The system was tested under different weather and terrain conditions to ensure consistent performance.

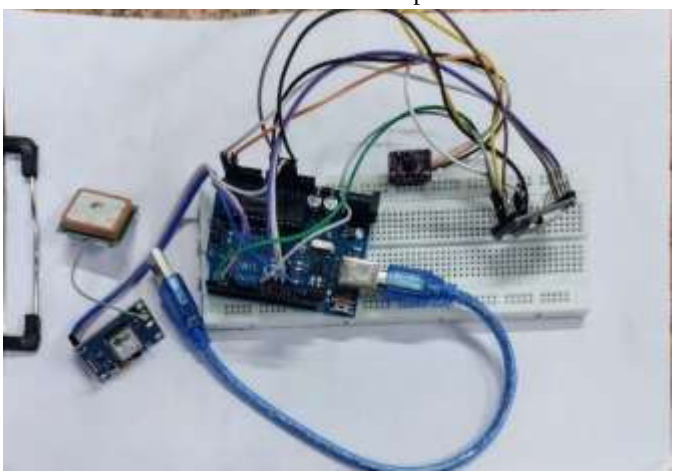

Fig -1: Transmitter

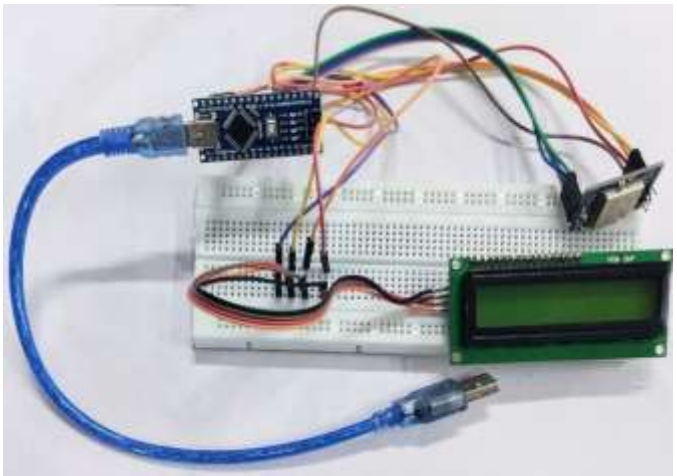

Fig -2: Receiver

Charts

Fig -3: Transmitter Output

Fig -4: Receiver Output

3. CONCLUSIONS

The SOS Beacon proves that life-saving tools don't have to be expensive or complicated. By combining affordable components with smart design, we've created a system that can automatically detect danger and call for help—even when the user can't. Whether you're climbing a mountain, working in the field, or caring for elderly loved one, this device offers a simple and effective layer of safety. With a few improvements, it could become an essential tool in modern emergency response systems.

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