



Life X Lane

Smart Traffic Management for Emergency Services Vehicles

KRS Advanced Project

Team: 4.20

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Abstract

In developing countries like India for example, most of the states still lack a separate lane for Emergency / Red-Light vehicles. As a result, in case of emergencies, these vehicles suffer much delays (even hours in Metropolitan cities) in traffic, resulting in degradation of the condition of the crisis. So the foremost motto of our project is to offer a solution to this critical problem. This paper initially proposes a stand-alone embedded device, easily installable in every car, which will inform them if there is an emergency vehicle in their 2 km radius. It will be an IoT integrated device with Long Range Radio Frequency Transceiver along with GPS, Map Data, and SOS services connected through the Internet to a server for live navigation statistics and route details. LoRa (AI Thinker Ra02 module) will be used along with ESP WROOM 32, in order to establish a communication between all the devices and whenever an emergency vehicle approaches a particular path, all the vehicles in that path will be alerted well before, so that they can make way for it to pass smoothly and swiftly. Besides, the installed devices in normal vehicles can help them turn into emergency vehicles in times of crisis with proper access control. Also, the device will have GPS and SOS options for personal use.

Introduction

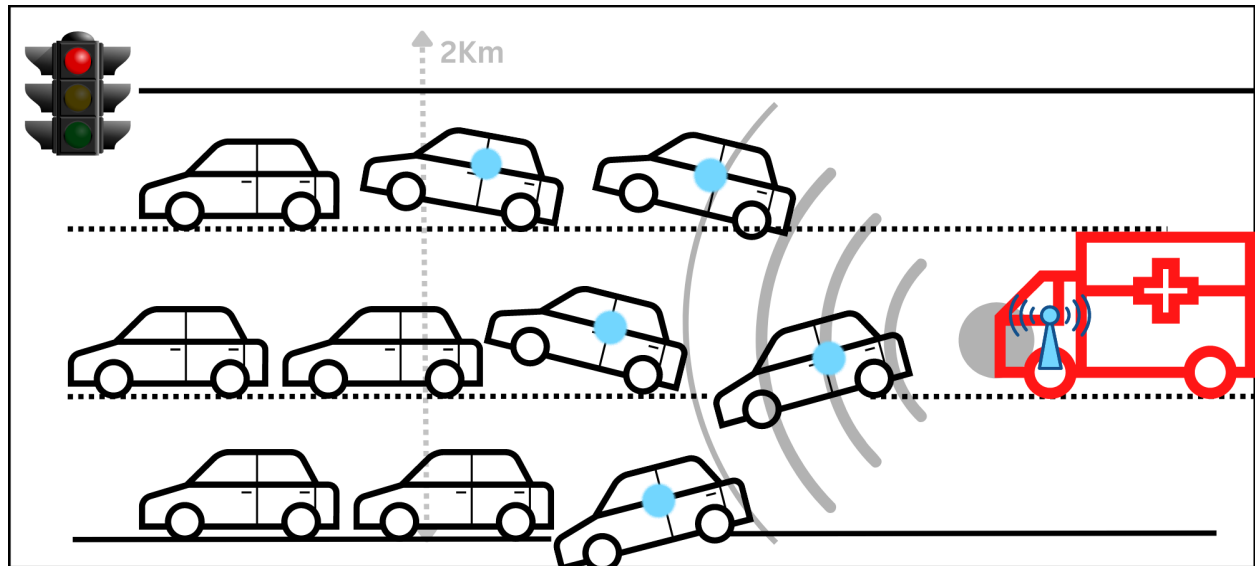
The rapid growth of cities and the resulting increase in traffic congestion have posed a major challenge for emergency vehicles in reaching their destinations in a timely manner. In developing countries such as India, the absence of separate lanes for emergency vehicles often leads to significant delays, putting the lives of patients in danger. According to a study by the World Health Organization, traffic delays in urban areas can reduce the effectiveness of emergency services by up to 40% i.e, 1 in every 10 patients in Mumbai die in an ambulance, stuck in traffic. This highlights the pressing need for a solution that can ensure the smooth passage of emergency vehicles.

To address this issue, our project proposes a standalone embedded device that can be easily installed in every car. The device will use Long Range Radio Frequency (LoRa) technology to communicate with other devices and the Internet, providing GPS, map data, and SOS services. By integrating IoT and live navigation statistics, the device will alert normal vehicles in a close 2Km proximity, well in advance of an approaching emergency vehicle, allowing them to make way for a swift and smooth passage. The goal of this project is to help save precious moments and potentially save lives by providing a clear path for emergency vehicles.

In addition to its primary application in emergency services, this technology has the potential to be integrated into other areas such as road safety, personal security, and fleet management. The

device can also serve as a valuable tool in times of crisis, providing real-time information and emergency services to those in need.

In conclusion, the proposed project has the potential to make a significant impact in the field of emergency services and road safety. By providing a clear path for emergency vehicles, this technology can help save precious moments and potentially save lives.

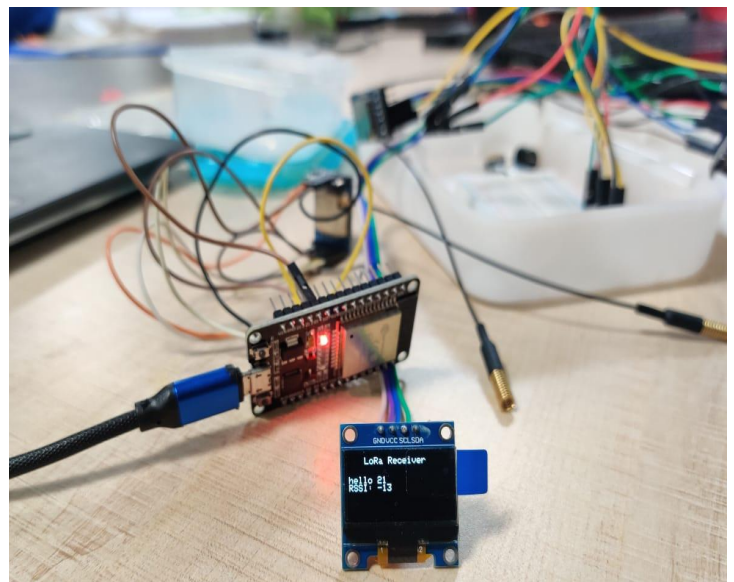
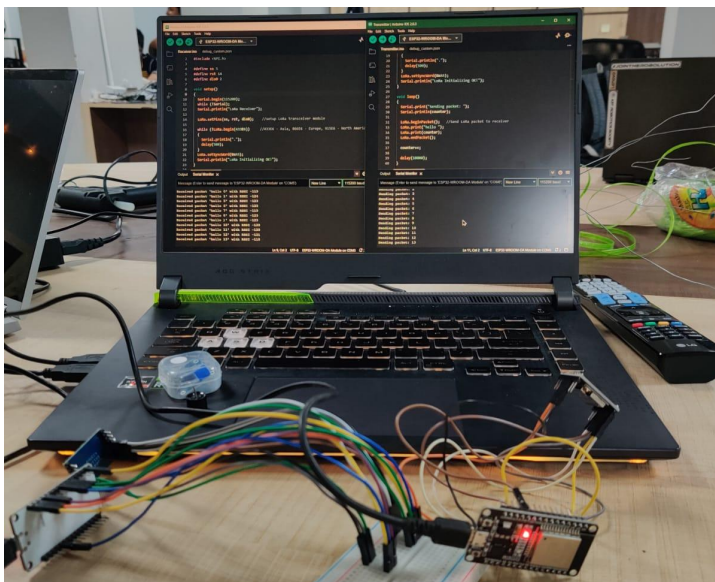
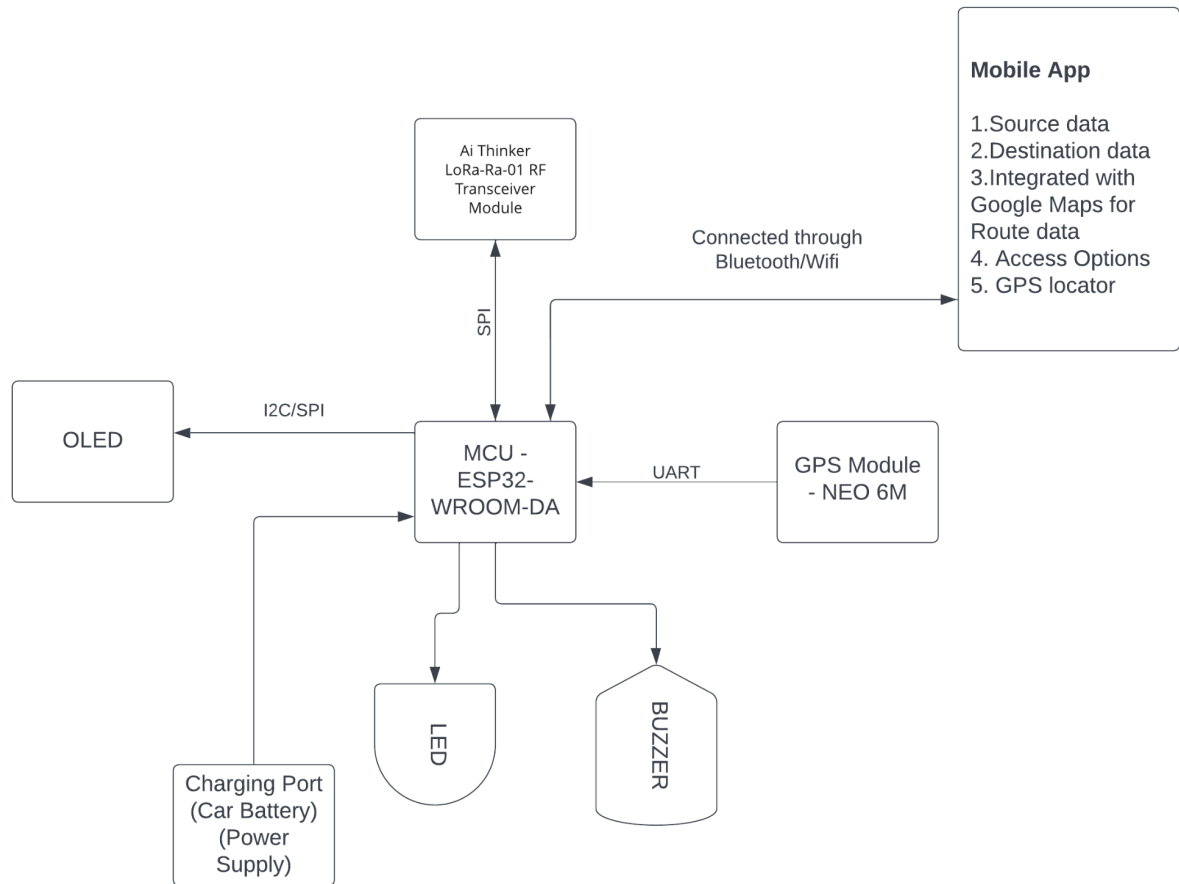


Methodology

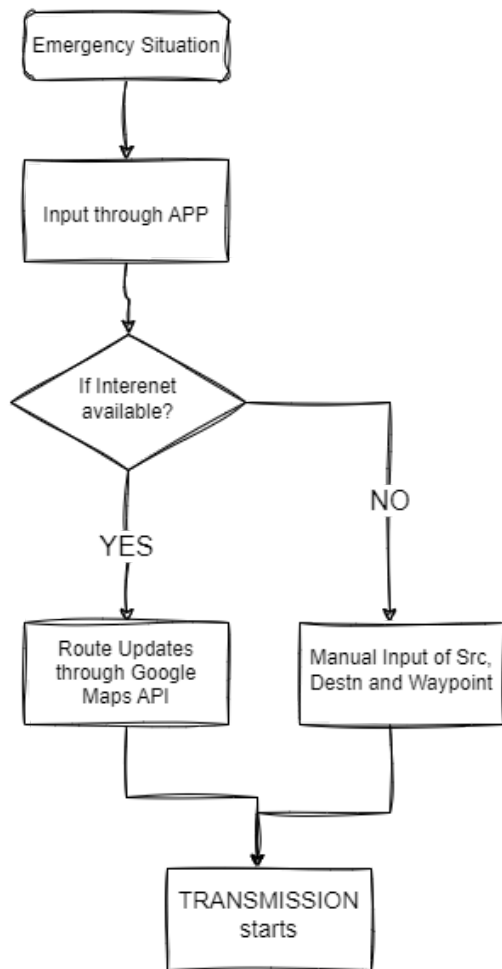
Plan of Action

1. The app accepts two fields Source and Destination, Smartphone is connected with MCU through bluetooth or Wifi.
2. Every updated path of the route is transferred to the MCU for transmission.
3. If there is no network connectivity then the device uses GPS location information and for every change in some location the transmitter transmits the new location
4. The transmission is carried out by the LoRa module which broadcasts the information on a fixed frequency.
5. Every transceiver receives the source and destination data and then consecutive updated route data.
6. The OLED module displays the kind of emergency and the route details.
7. The LED and Buzzer gives an audio and visual alert to the user if the OLED gets unnoticed.
8. The system is powered by the car battery terminal so it gets switched ON every time the car is turned ON.

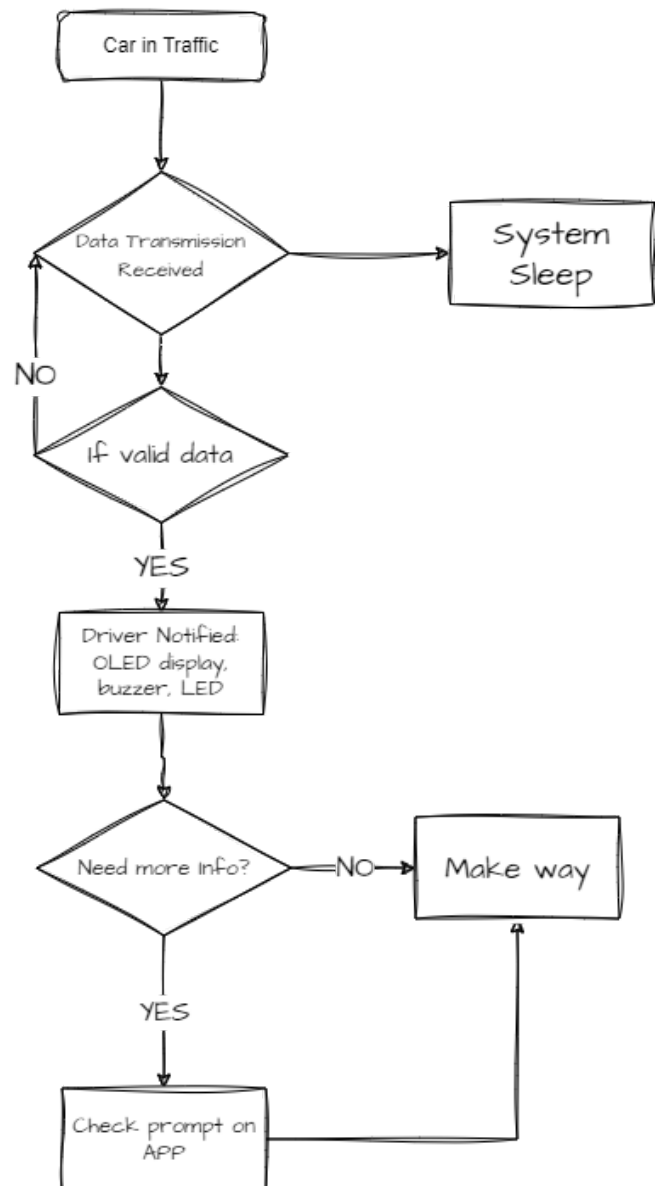
9. The whole system is a stand alone device which helps in reducing problems with the car's ECU.



TRANSMITTER



RECEIVER





Expected Outcome

The goal of this project is to help emergency vehicles reach their destinations more quickly in developing countries like India. The project involves the use of a special device that can be installed in cars to alert drivers when an emergency vehicle is nearby. This will allow normal vehicles to move out of the way, creating a clear path for the emergency vehicle to reach its destination faster. The hope is that this device will save precious time in emergency situations and potentially save lives by ensuring that emergency vehicles can reach their destinations as quickly as possible. The expected outcome is a safer and more efficient road system for everyone, especially in times of emergency.

Advantages & Disadvantages

Pros

Improved Response Time: The project aims to provide clear passage for emergency vehicles to reach their destination on time, thus saving precious moments in case of emergencies and reducing response time.

GPS Tracking: The devices installed in emergency vehicles and normal cars will have GPS tracking, which will help in live navigation and route details.

Turn Normal Cars into Emergency Vehicles: In times of crisis, normal cars can be turned into emergency vehicles with proper access control, thus increasing the number of vehicles available to respond to emergencies.

Personal Safety: The devices installed in normal cars will also have an SOS option, which can be used in case the car is in danger or any other problem. The device will provide coordinates, location, route, and track, making it easier for the authorities to reach the location.

Efficient Communication: The project uses Long Range Radio Frequency technology to establish communication between all the devices, thus making the process of notification and alerting more efficient and quicker.

Cons

Cost: The cost of installing the device in every car can be high, especially in a country like India where a large number of people still use old cars.

Technical Knowledge: Installing the device requires technical knowledge and expertise, which may be a challenge for some people.

Government Support: The success of the project heavily depends on the support from the government, which may not be possible in some cases.

Maintenance: The devices installed in the cars will need regular maintenance and updates, which can be a challenge for some people.

Privacy Concerns: The GPS tracking and the SOS option may raise privacy concerns, which will need to be addressed by the authorities.

Summarizing Key Points

1. Help emergency vehicles by clearing their path
2. Emergency vehicles will transmit signals and their routes and current location
3. Cars falling on that route will receive the signal via notification, in a 2km radius
4. App provided for further details about the location, route and info on the emergency vehicle
5. Only app will provide source and destination details
6. Normal cars can be turned into emergency vehicles by access control
7. One time DL and Aadhar verification
8. Also be used as an SOS device(with coordinates and location, route, track) in case car is in danger or problem
9. Live GPS tracking
10. Rating on app as of how much of an emergency(OPTIONAL)



Budget Requirements

SL. No.	COMPONENT	COST(₹)
1	MCU(BT & Wifi integrated) - ESP32-WROOM-32	~ ₹380
2	LoRa module - AI thinker Ra-02 SX-1278 LoRa Module	~ ₹430
3	PCB - Custom	~ ₹400
4	OLED Module - 1.3 Inch 128x64 SPI OLED	~ ₹410
5	Passive Buzzer - 5V Piezo	~ ₹40
6	LED - 5V	~ ₹5
7	Power Source - Car Battery / Inbuilt Socket	-
8	Wires	~ ₹40
9	GPS - neo 6m	~ ₹270
10	Google Maps API - Dynamic maps(0-100K users)	7USD ~ ₹560 (per 1000)
11	Access Control - Authenticator API	~ ₹1500 (per 1000)
12	Firebase and Cloud Services(AWS)	30USD ~ ₹2400 (per month)
	TOTAL	~ ₹6450 (approx.)