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Evaluation and Implementation of Traffic Clearance for Emergency Applications

Akula Naveen[1], Anna Sai Samanvith[2], Dheeraj G[3], Girish V[4], Ramya R[5]
Students, Department of ECE[1,2,3,4]
Assistant Professor, Department of ECE[5]
Vemana Institute of Technology, Bengaluru, India

Abstract: *In this project, the ESP8266 microcontroller and LEDs are utilized to create a system that effectively controls traffic flow during emergency situations. Two modules, an emergency vehicle module, and a traffic module, communicate with a server. The server receives signals from the emergency vehicle and triggers the corresponding traffic lights to turn green and yellow in the direction of the vehicle. Simultaneously, the traffic lights in other directions turn red and yellow, providing a clear path for the emergency vehicle. To enhance safety and awareness, a mobile application is developed. Users between the emergency vehicle and the traffic signal can install the app, which alerts them of the approaching vehicle. Real-time updates, sound alerts, and vibrations are provided to ensure the public is aware and can take appropriate actions. An additional app is designed for the emergency vehicle driver, allowing manual control over traffic signals when they are positioned too closely together. This ensures the vehicle can navigate intersections without hindrance. By combining the server, mobile apps, and ESP8266 microcontroller, this project offers a comprehensive solution to improve emergency vehicle navigation in urban areas. It optimizes traffic flow, enhances public safety, and provides additional control for emergency vehicle drivers. The goal is to provide an efficient and accessible solution that can be implemented in various urban settings.*

Keywords: Wi-Fi, smart traffic signals, cloud server, traffic signal sever , digital compass

I. INTRODUCTION

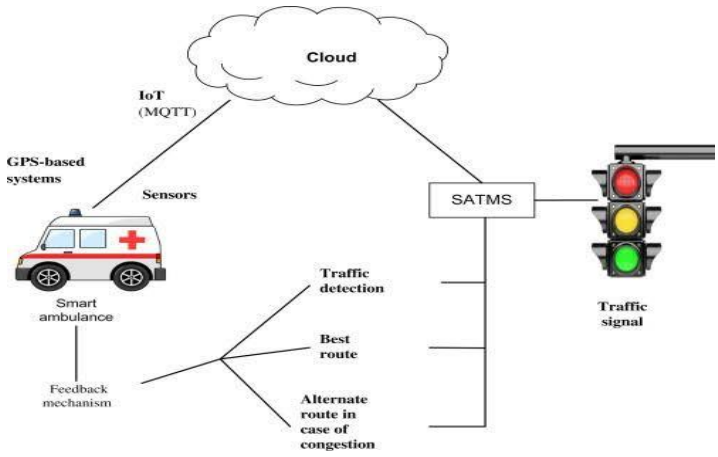

Fig 1 : Signals controlling from cloud server.

Cities became the identity for heavy traffic congestion and have appreciable economic development when compared to the development in rural areas. People in rural regions migrate towards urban areas for improving their standard of living. Cities have higher population density and the people living in urban areas enjoy more facilities than those living in rural areas. Time is the most crucial element in today's life. People like to spend more time in their work place rather than wasting time by commuting on road. Everyone needs to reach their destination within a short duration of time. But most of them actually don't start early to reach their destination earlier. In hurry, the commuters do not

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follow the traffic rules and regulations. Here we developed a smart traffic system with RF transmitter and receiver with ESP8266 modulo where all the components, modulo, traffic signals and traffic signal over the cloud server.

1.1 Model of Traffic Management System

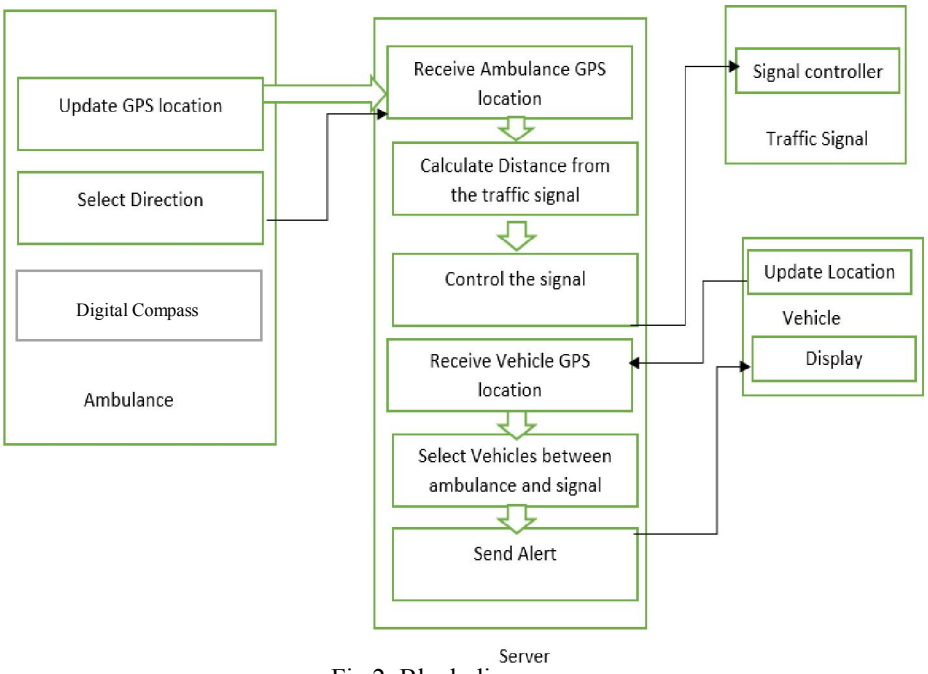

Fig 2 :Block diagram

Figure 2 shows the block diagram of a traffic management system, In this system we are integrating the emergency vehicles and traffic signals with an ESP module, which is connected to a central server that controls the signals. When an ambulance or other emergency vehicle turns on the module, the system immediately begins sending the vehicle's GPS coordinates and direction to the server. The server then calculates the nearest traffic signal and takes control of it, turning it green in the direction of the ambulance and red for other signals in the junction. Along with this even the orange signal will be lit on to notify the emergency situation As soon as the emergency vehicle passes through the intersection, the signal returns to its normal working mode, allowing traffic to resume. To further enhance safety, the system also includes an app that sends notifications to vehicles ahead of the ambulance, alerting them to the approaching emergency vehicle and allowing them to make way

1.2 Application Software

TRAFFIC_APP

The icon of this app is shown below figure 3.

Figure 3: Traffic App

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This application has to be installed in the device which is present in the emergency vehicle.
When the app is turned on, the current location of the emergency vehicle is sent to the server.
NOTE: - [1] Permission for the location must be granted.
[2] Both the server and the application must be connected to the same IP Address.
After receiving the current location of the emergency vehicle, the server looks for the nearest traffic signal.
And the distance between the vehicle and the traffic signal is calculated by the server and it arranges the signals in ascending order.
When the vehicle is in the 500-meter range from the signal, the server takes control of that particular signal.

TRAFFIC USER APP

The icon of this app is shown below figure 4.

Figure 4: Traffic user App

This mobile application serves the general public by providing timely notifications about the presence of emergency vehicles in their vicinity. Its primary objective is to ensure that users are informed of the emergency vehicle's presence and can promptly make way for it. To fulfill this purpose effectively, the application requires certain permissions, including access to data and GPS.

The app utilizes GPS permissions to accurately determine the user's location and transmit this information to the server. This enables the server to gather relevant data and provide precise details regarding the emergency vehicle's location and direction. By leveraging this data, the application can generate real-time alerts that effectively notify users about the presence of the emergency vehicle near them.

When an emergency vehicle is detected nearby, the application triggers an alert message, ensuring that users receive immediate visual information about the approaching emergency vehicle. Additionally, to enhance the user's awareness, the app also employs vibrating notifications, ensuring that users are alerted even if they are in a situation where visual cues might be missed. Furthermore, the application utilizes a distinctive buzzer sound that is easily distinguishable, enabling users to recognize the urgency and take appropriate action promptly. By combining the functionalities of data and GPS permissions, along with alert messages, vibration notifications, and a distinctive buzzer sound, this application aims to provide a comprehensive and effective solution for intimating the public about emergency vehicles. Through these features, users can be promptly informed, increasing overall road safety and enabling emergency services to reach their destinations efficiently.

II. RESULT AND DISCUSSION

In our innovative system, traffic signals are intelligently managed to prioritize the passage of emergency vehicles as shown in figure 5. When an emergency vehicle approaches a traffic signal junction, our system dynamically adjusts the signals to turn green and yellow in its direction as shown in the above figure 5, while simultaneously signaling other drivers with red and yellow lights as shown in figure 5, indicating the presence of an emergency situation. Once the emergency vehicle safely passes through the junction, the signals smoothly transition back to their normal working flow, ensuring less disruption to the regular traffic pattern.

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To enhance the efficiency of emergency vehicle movement, we have developed the Traffic_User_App, which plays a crucial role in notifying vehicles in front of the emergency vehicle to make way. Through real-time alerts, the app communicates with cars, trucks, and heavy vehicles, ensuring they are aware of the approaching emergency vehicle and can clear the path promptly. This proactive approach not only facilitates the smooth flow of emergency vehicles but also contributes to overall road safety and response times during critical situations

Figure 5: Result obtained

Obtained output:

- Efficient implementation of traffic management system for emergency vehicles.
- By using the application created for users, the user can obtain the information of the emergency vehicles surrounding them.
- Traffic signal is controlled automatically by the server based on the ambulance direction and distance.
- Emergency vehicles driver can select the direction from the upcoming traffic signal.

III. CONCLUSION

In conclusion, the project successfully develops and implements a system that effectively manages traffic flow during emergency situations using the ESP8266 microcontroller and LEDs. By employing two modules, an emergency vehicle module, and a traffic module, in conjunction with a server, the system ensures seamless communication and coordination. The server receives signals from the emergency vehicle, triggering the corresponding traffic lights to prioritize the vehicle's passage by turning them green and yellow. Simultaneously, the lights in other directions turn red and yellow, creating a clear path for the emergency vehicle.

To further enhance safety and awareness, a mobile application is introduced, allowing users located between the emergency vehicle and the traffic signal to receive real-time alerts. The app utilizes sound alerts, vibrations, and timely

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updates to ensure the public is well-informed and can take appropriate actions. Additionally, an app is designed specifically for the emergency vehicle driver, enabling manual control over traffic signals when they are closely positioned. This feature ensures the smooth navigation of intersections without any hindrance.

By integrating the server, mobile apps, and ESP8266 microcontroller, the project presents a comprehensive solution that significantly improves emergency vehicle navigation in urban areas. Its implementation optimizes traffic flow, enhances public safety, and provides additional control for emergency vehicle drivers. The ultimate goal of this project is to offer an efficient and accessible solution that can be tailored and implemented in various urban settings, benefiting both emergency responders and the general public alike

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