IoT-Based Ambulance Navigation to Nearby Hospitals with Auto Green Signal

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Objective:

The overarching objective of our IoT-based project is to revolutionize emergency medical services by seamlessly integrating cutting-edge technology into ambulance navigation systems. Our focus extends beyond mere transportation; we aim to optimize response times, enhance patient care, and create a safer urban environment.

Enhancing Ambulance Navigation:

Ambulances play a critical role in emergency medical services. However, navigating through congested city streets can be challenging, especially during peak hours or when faced with unexpected roadblocks. By integrating GPS modules into ambulances, we enable real-time tracking. These high-precision modules continuously transmit location updates to a central server, ensuring accurate navigation. It considers factors such as traffic congestion, road closures, and optimal routes to hospitals.

Database of Nearby Hospitals

We maintain an extensive database of nearby hospitals, including their geographical coordinates. This database serves as the foundation for our proximity calculations. Hospitals are ranked based on their distance from the ambulance's current location.

Communication Infrastructure

Ambulances transmit real-time location data via cellular networks to the central server. This communication link ensures seamless coordination. The central server processes incoming data, calculates proximity, and manages communication with traffic signal control units. Our communication protocols adhere to industry standards, ensuring reliability and security.

Traffic Signal Control Units

Strategically placed at intersections, these intelligent units monitor traffic flow. When an ambulance approaches an intersection, the system dynamically adjusts traffic lights. Green signals are activated in the ambulance's path, creating a clear corridor. The goal is to minimize delays and facilitate smooth movement for emergency vehicles.

Basic Working:

The **IoT-Based Ambulance Navigation to Nearby Hospitals with Auto Green Signal Activation** project addresses the critical challenge of ambulance delays due to traffic congestion. It integrates advanced IoT technologies to streamline ambulance navigation and control traffic lights dynamically. This system leverages **Raspberry Pi** for traffic light control model and **OpenCV** to detect ambulances. Additionally, a **GPS module** combined with **NodeMCU ESP8266** is utilized to capture and transmit live location data. Upon detecting an ambulance, the system automatically activates a green signal at traffic intersections, represented by a green LED in the prototype, allowing ambulances to pass through efficiently.

Key Technologies Used:

- Raspberry Pi and OpenCV: Detect ambulances using real-time image processing.
- GPS and NodeMCU ESP8266: Track the ambulance's location and send data to the central server.
- Automatic Traffic Signal Control: Raspberry Pi triggers green signals to prioritize ambulance movement.

Model Training:

In this project, a real-time ambulance detection system was developed using YOLOv5 and PyTorch, trained on over 4,000 images and integrated with OpenCV for accurate detection in live traffic. YOLOv5's speed and precision ensure quick identification of ambulances in dynamic environments, while PyTorch enhances model accuracy. The system performs reliably under various conditions, enabling automatic traffic light control to reduce ambulance delays. Real-time object reduction techniques further improve detection efficiency, making the system a key component of IoT-based emergency response solutions.

Automated Ambulance Detection:

This project employs a camera for real-time ambulance detection, automatically activating green traffic signals. The system communicates via SSH protocol with a Raspberry Pi, ensuring efficient signal control. By detecting ambulances and clearing their path, the solution optimizes emergency response times. Seamless

communication between components enhances traffic management, allowing ambulances to navigate congested areas swiftly and safely.

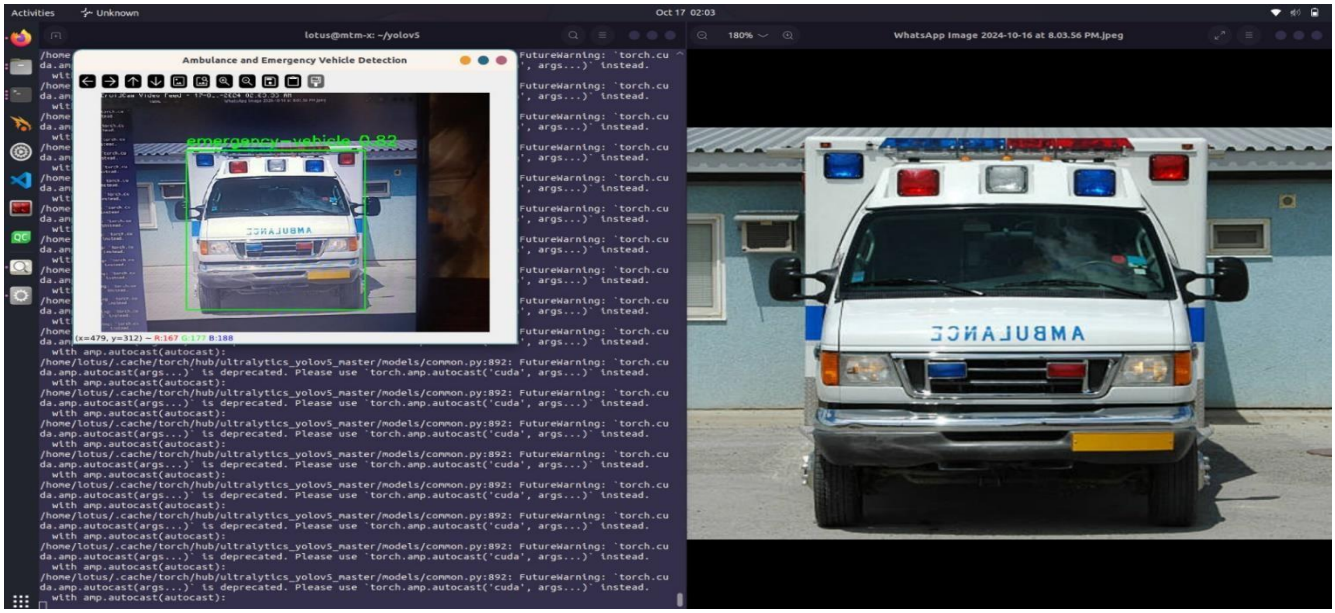
GPS Module:

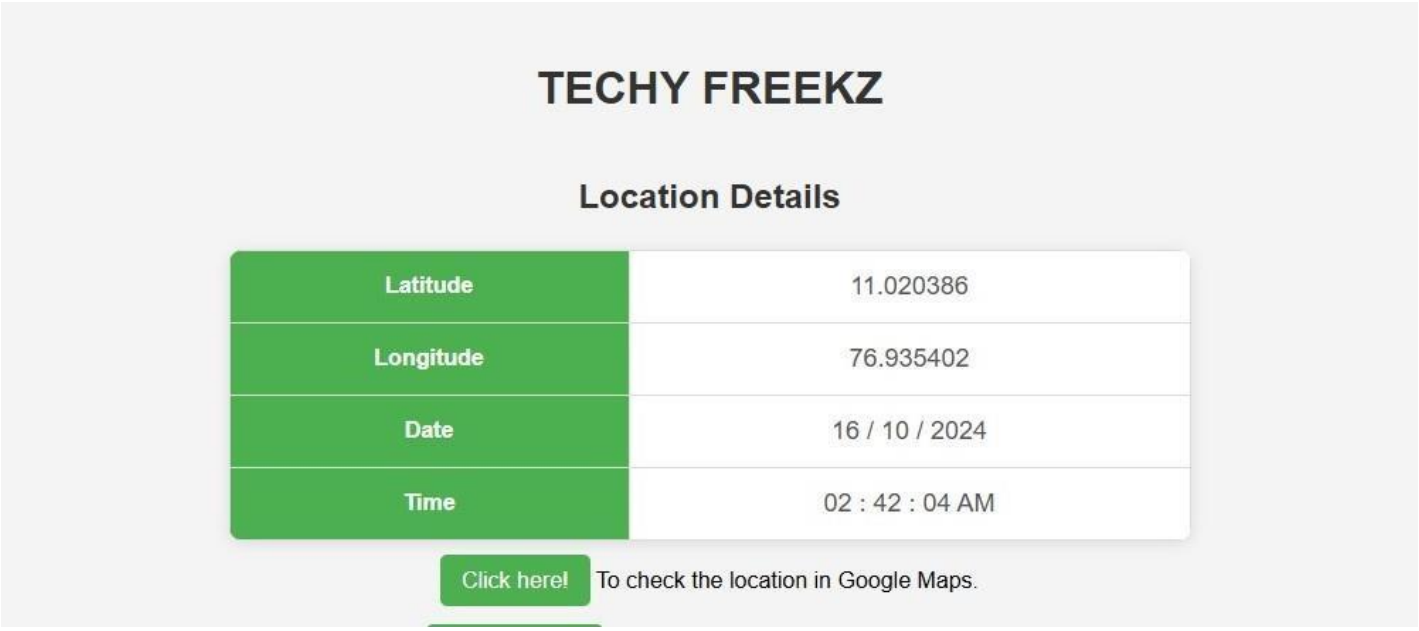
In this project, a GPS module is integrated with the ESP8266 to capture Realtime latitude and longitude coordinates of an ambulance. The location data is then transmitted wirelessly and displayed on a web interface for real-time monitoring. This setup allows for accurate tracking of ambulance movements, ensuring quick navigation to the nearest hospital. The system enhances emergency response efficiency by providing precise location updates accessible through a user-friendly website.

Github:

mtm-x/Ambulance-detection-and-navigation (github.com)

Output:





Advantages:

- Dynamic Traffic Signal Automation: The system ensures green signals in the ambulance's path, clearing the route for quick navigation.
- Real-Time Location Tracking: GPS and communication modules send constant updates to ensure the best route to the nearest hospital.
- Scalability and Adaptability: This system can be expanded for use with other emergency vehicles, making it an integral part of smart city infrastructures.

Conclusion:

In conclusion, the IoT-Based Ambulance Navigation with Auto Green SignalActivation project effectively combines advanced technologies such as Raspberry Pi, OpenCV, YOLOv5, and GPS to create a robust system for real-time ambulance detection and navigation. By integrating ESP8266 for live location tracking and automating traffic signal control using SSH protocols, the system enhances emergency response times by providing a clear path for ambulances through congested urban areas. This innovative approach significantly reduces delays, ensures faster access to healthcare facilities, and contributes to improved public safety. The project offers a scalable, adaptable solution that can be expanded to include other emergency services, making it a vital tool for smart city infrastructure.