

# RF based Automatic Traffic Route Clearance System for Emergency Vehicle

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## Abstract-

Traditional time-based traffic management systems are often inadequate for addressing the complexities of modern urban traffic, resulting in delays for emergency service vehicles such as ambulances and fire services.

This project proposes a wireless communication-based approach to alleviate ambulance congestion in urban areas, presenting an innovative traffic clearance system that is easily deployable and cost-effective.

Keywords— Arduino, ESP 32 Microcontroller, Solar panel, GPS, RFID Sensor.

## I. INTRODUCTION

Congestion at traffic light area gives challenge in many countries. The increasing numbers of vehicles not only has a large environmental impact, but also result in loss of lives and time on the road. Besides, there will be huge losses in terms of productivity where it will affect the ability of cities to compete globally. This situation demands a better approach to handle the situation especially for emergency vehicle like ambulance. There is a need to have a system that can control the traffic light signal at junction in case of emergency.

## II. PROBLEM STATEMENT

“Inefficient routing and delayed responses of emergency vehicles, such as ambulances, pose a critical challenge in urban areas, leading to increased morbidity and mortality rates. Current tracking systems rely on GPS technology, which can be unreliable in urban canyons and areas with high-rise buildings. This project aims to develop an RF-based ambulance tracking system that provides real-time, accurate location information, enabling efficient routing and reducing response times for emergency vehicles.”

## III – METHODOLOGY

Based on our problem statement, we have created a prototype to implement a RF based automatic ambulance tracking system for emergency vehicle considering all aspects of assembling the hardware components, including Arduino microcontroller, ESP 32 microcontroller, Solar panel. The methodology of an RF-based ambulance tracking system for emergency vehicles typically involves several key components and processes. Firstly, RFID tags are installed on each ambulance, containing unique identifiers. These tags are read by RFID readers strategically placed along ambulance routes, such as at ambulance stations, intersections, and hospitals. Secondly, the RFID readers communicate with a central server using wireless technology, such as Wi-Fi or cellular networks, to transmit the data collected from the tags. Thirdly, the central server processes this data, including the location, speed, and status of each ambulance, in real-time. Overall, the methodology of an RF-based ambulance tracking system involves the use of RFID technology, wireless communication, data processing, and integration with other systems to provide real-time tracking and monitoring of emergency vehicles, improving response times and efficiency in emergency situations. mapping and routing software to provide real-time updates. User Interface: Develop a user interface for emergency service providers to track the location of ambulances, view traffic conditions, and optimize routes.

## IV. COMPONENTS USED

### A. ARDUINO UNO

In an RF-based ambulance tracking system utilizing Arduino, the Arduino functions play a crucial role in ensuring accurate and reliable transmission of location and status information. Firstly, the system would involve setting up the RF transmitter module to establish communication with the receiver network. This would include configuring the transmission frequency, power levels, and data encoding schemes to optimize signal integrity and range.

Overall, the Arduino functions in an RF-based ambulance tracking system are essential for establishing reliable communication, processing data, and ensuring efficient

operation of the tracking system to improve emergency response times and outcomes.

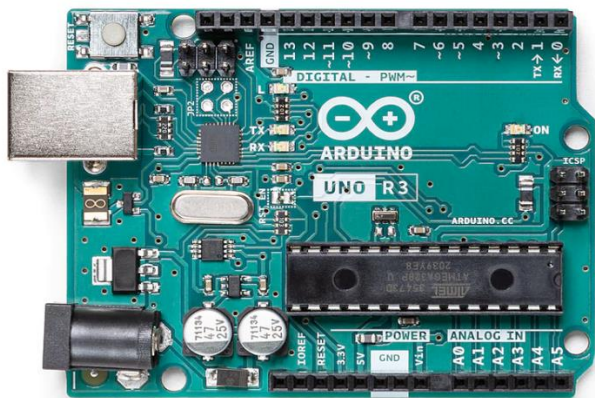


Figure 1: ARDUINO UNO

#### B. ESP 32 Microcontroller

In an RF-based ambulance tracking system utilizing the ESP32 microcontroller, the ESP32 functions play a pivotal role in enabling robust and efficient communication and tracking capabilities. Firstly, the ESP32 would be configured to utilize its built-in WiFi or Bluetooth capabilities for communication. WiFi can be particularly useful for transmitting data over longer distances or through obstacles, while Bluetooth can be used for short-range communication with other devices.

Overall, the ESP32's advanced communication and processing capabilities make it an ideal choice for an RF-based ambulance tracking system, enabling real-time tracking and monitoring of emergency vehicles to improve response times and outcomes.

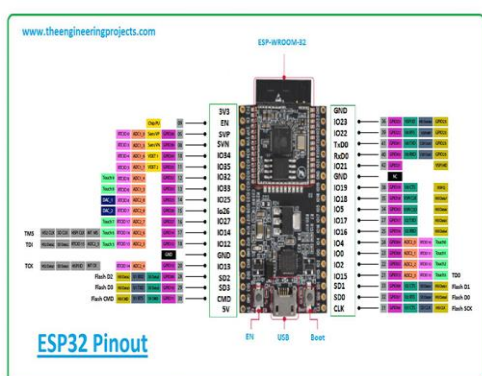


Fig 2: ESP 32 Microcontroller

#### C. IOT

Incorporating IoT (Internet of Things) technology into an RF-based ambulance tracking system enhances its capabilities and effectiveness. By integrating IoT devices, such as sensors and

communication modules, the system can gather and transmit a wealth of real-time data beyond just location information.

Overall, integrating IoT into an RF-based ambulance tracking system enhances its ability to provide timely and efficient emergency medical services, ultimately saving lives.



Figure 3: IOT

#### D. GPS

In an RF-based ambulance tracking system, integrating GPS (Global Positioning System) technology is essential for accurately tracking the location of emergency vehicles in real-time. GPS allows for precise positioning of ambulances, enabling efficient routing and reducing response times during emergencies.

Overall, GPS plays a critical role in RF-based ambulance tracking systems, providing accurate location information that is essential for improving emergency response times and saving lives.



Figure 4 :GPS

#### E. RFID Sensor

RFID sensor-based ambulance tracking systems utilize RFID technology to monitor and manage the movement of emergency vehicles. Each ambulance is equipped with an RFID tag that emits a unique identifier. RFID readers positioned at various locations, such as ambulance stations and hospitals, detect these tags and transmit the information to a central server. This server processes the data, enabling real-time tracking of ambulances' locations, speeds, and directions.

Dispatchers and responders can access this information through a user-friendly interface, aiding in route optimization and response time reduction. Integration with other systems further enhances efficiency, making RFID sensor-based ambulance tracking systems a valuable tool in emergency medical services management.

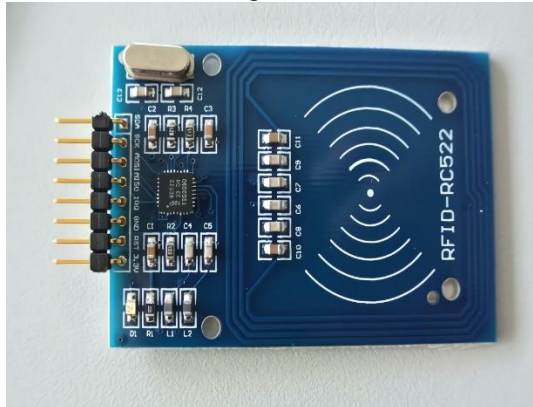


Figure 5: RFID Sensor

#### F. Solar Panel

Integrating solar panels into RFID-based ambulance tracking systems for emergency vehicles can enhance their sustainability and reliability. Solar panels can be used to power RFID readers, communication devices, and other components of the tracking system, reducing reliance on traditional power sources and minimizing environmental impact. By harnessing solar energy, these systems can operate autonomously in remote or off-grid areas, ensuring continuous tracking and monitoring of ambulances. Additionally, the use of solar panels can lower operating costs and improve the overall efficiency of the tracking system. Overall, incorporating solar panels into RFID-based ambulance tracking systems can increase their resilience, reduce their carbon footprint, and enhance their effectiveness in emergency response scenarios.



Figure 6: Solar Panel

#### V. Block Diagram

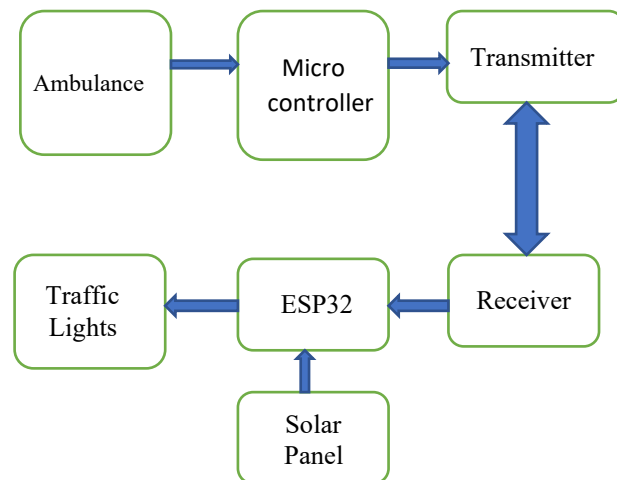


Figure 9: Block Diagram

#### VI. ACKNOWLEDGMENT

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#### CONCLUSION

In conclusion, developing an RF-based ambulance tracking system using Arduino or ESP32 microcontrollers offers a viable solution to improve emergency response efficiency. By integrating GPS modules, RF transmitters/receivers, and data processing capabilities, these systems can provide real-time location and status updates of ambulances, enabling quicker and more effective routing. Arduino and ESP32 microcontrollers offer versatile platforms for implementing such systems, with Arduino being more suitable for simpler applications and ESP32 providing advanced features like WiFi and Bluetooth connectivity. Both platforms can be used to develop robust and reliable tracking systems, with the choice depending on the specific requirements of the project.

## References

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