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# Smart Traffic Management System For Emergency Vehicles Using Rfid

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***Abstract*** - The initiative intends to address the difficulties that emergency vehicles, such as ambulances, experience when navigating through traffic. In this paper, we look at the smart traffic management project, in which the growing amount of vehicles on the road has an impact on emergency services ability to respond rapidly. The biggest issue highlighted is traffic signal delays, which compel rescue vehicles to wait at junctions. The method offered is known as the "Smart Traffic Management System Using RFID for Emergency Vehicles." RFID technology is used in this system, which is a method of communication that uses radio waves to track and identify objects. RFID is employed in this project to permit prioritised passage for emergency vehicles. Using RFID technology, the device activates lights along the ambulance's planned path. This move alerts surrounding traffic to the presence of the emergency vehicle and grants it priority passage. As a result of the reduced congestion, the Emergency vehicles may reach its destination more rapidly. Additionally, GPS integration of technology has been highlighted as an aspect of a traffic management strategy. To summarise, this project fulfils a societal need by enhancing transportation flow and prioritising the transit of emergency vehicles. RFID and potentially GPS technology contribute to the planned traffic control system's efficiency. The major goal is to prioritise the protection of individual and their belongings in increasing areas by minimising emergency service response times.

*Keywords*—Traffic Management System, RFID, GPS

## 1. INTRODUCTION

Technology has greatly improved and opened up possibilities for handling emergency situations in busy urban areas. One of the ongoing challenges for emergency services is navigating through heavy traffic. To combat this obstacle, a new method has been developed to optimize ambulance routes and expedite travel through traffic using Radio Frequency Identification (RFID) technology. This strategy targets problem areas for high number of accidents and extended emergency response times, such as busy roads and intersections. Rapid response vehicles, or ambulances, utilize cutting-edge RFID technology to expedite their journeys.

The RFID system based on microcontrollers, as suggested in reference [1], seeks to minimize ambulance delays resulting from traffic jams. When an ambulance arrives, this system uses RFID technology to communicate with traffic signals and prioritize emergency vehicles' transit through busy junctions. The goal of this integrated strategy is to speed up emergency response times and improve urban traffic management in general. The text proposes an enhancement to the RFID traffic light system for ambulances. Instead of simply switching the light to green, it would turn blue for the ambulance while making all other signals red. This clearer distinction would potentially reduce confusion amongst other drivers. The system could be further improved by incorporating GPS navigation and real-time traffic data

to predict congestion and adjust traffic light timing accordingly [2]. The review in [3] explores the pressing issue of traffic control, which frequently causes delays in emergency response times. It talks about using the A* method to determine the shortest path.

The [4] research highlights the crucial "Golden Hour" in traffic accidents and emphasizes the significance of lowering death rates by promptly transporting critically ill patients to hospitals with the necessary resources. In order to expedite ambulance transportation and determine the best routes for better patient outcomes, it suggests an autonomous ambulance management system. This review [6] discusses the urgent need for quick ambulance response times in life-threatening situations, emphasizing the difficulties caused by traffic jams and drivers' ignorance of active emergency routes. It also suggests a smart ambulance system that prioritizes emergency routes in an effort to improve patient transportation times and ambulance infrastructure, with preliminary findings suggesting areas for improvement.

The increasing number of people means that traffic bottlenecks and delays are happening more often by the hour. When it comes to emergencies, this has had major adverse consequences. Actually, ambulance delays account for thirty percent of road deaths in traffic accidents and twenty percent of mortality involving emergency patients [7]. In order to ultimately replace barcodes in supply chains, radio frequency identification tags were initially created. The microchip, antenna, case, and battery (for active tags only) are the components of RFID transponders, or tags [8]. Utilizing Ultrahigh frequency (UHF) radio frequency identification (RFID), this paper presents a novel real-time vehicle localization scheme in GPS-less environments [9]. A sophisticated traffic management system that makes use of Big Data principles. It calculates the shortest path using the Enhanced Dijkstra's algorithm and handles traffic-related difficulties with the Enhanced time forecasting method. Compared to current systems, Apache Spark, a more sophisticated version of Hadoop, has the potential to significantly improve control efficiency by lowering traffic levels through improved map reduce capabilities [10]. With a focus on emergency vehicle detection and its application in autonomous vehicles and traffic signal controllers, this review examines the use of object detection and instance segmentation in Intelligent Transportation Systems [11].

An innovative method that makes use of infrared sensor technology to optimize traffic signal timing based on vehicle density readings in order to reduce vehicle congestion and wait times. The system also incorporates radio frequency transmitter and receiver technology, which allows ambulances to pass through instantly by switching the signal from green to blue as soon as they arrive. This reduces delays and may even save lives [12].

This study suggests a unique RFID-GPS technique based on the AODV Routing Protocol algorithm within a hybrid VANET (Vehicular Ad hoc network) setup. Route creation and emergency signal control are made possible by the decentralized Ad hoc system, which enables efficient communication between cars and Roadside Units (RSUs) [13]. The literature currently in publication provides few options for allocating priority to emergency vehicles in traffic congestion. a solution based on RFID to close this gap. The system recognizes incoming emergency vehicles and modifies traffic light sequences to create a clear way by merging RFID tags on emergency vehicles with readers at traffic signals [14]. This project proposes the design of Emergency RFID Traffic Light Systems, which use Ultra High-Frequency RFID readers to detect and prioritize emergency vehicles and make it easier for them to pass through traffic lights in response to the difficulties encountered by emergency vehicles in crowded areas [15].

It also makes it easier for emergency vehicles to get through traffic by using RF Transmitter and Receiver technology to trigger blue signals in conjunction with green lights, which reduces delays and may even save lives in situations where there are already traffic jams [16-17]. It is critical to address the issues of traffic congestion and emergency vehicle access in nations like India that are experiencing significant population growth [18]. In order to improve overall traffic safety and efficiency at intersections, a smart traffic management system that uses GPS and RFID technology for emergency vehicles and dynamically modifies traffic light sequences upon receiving RF signals from these vehicles can relieve congestion and allow for smoother passage [19-20].

A single line smart traffic management system integrating RFID and GPS for emergency vehicles, It utilizes a collaborative vehicle-road scheduling approach with real-time route planning and cooperative traffic signal control to optimize EV accessibility amidst heavy congestion, enhancing response times and critical services while improving overall safety [21]. A smart traffic management system that incorporates GPS and RFID technology for emergency vehicles uses a proactive approach to route planning and schedules traffic clear-outs. Using a novel strategy, the smart traffic control system that integrates GPS and RFID for emergency vehicles [24].

## 2. PROPOSED SYSTEM

The originality of our integrated traffic management system, which at first integrates RFID and GPS technology, is highlighted in our project. In this project ambulance acts as emergency vehicle. In addition, we have a blue light that ensures dual message alarm to everyone, which will aid in its operation. We make certain that our solution includes novel features and functionalities that are not available in existing systems, hence separating it from previous art. By satisfying the novelty criteria, we demonstrate that our initiative adds a novel and innovative perspective to the subject of traffic management, establishing the groundwork for our system.

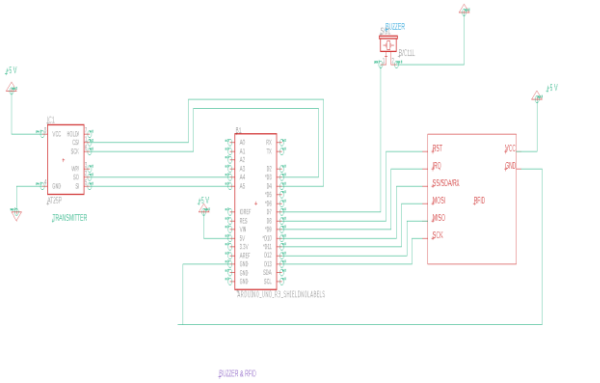

Fig 1. Buzzer & RFID

The Fig. 1 shows how an Arduino Uno is connected to transmitter and RFID Receiver. Transmitter connected with wires, sharing power (ground and 5V) and for data sharing CS, SCK, SO, SI are connected to D4, D3, A4, A5 respectively. RFID receiver is connected via RST, IRQ, SS, MOSI, MISO, SCK throughout D8 to D13. Buzzer is connected to D7.

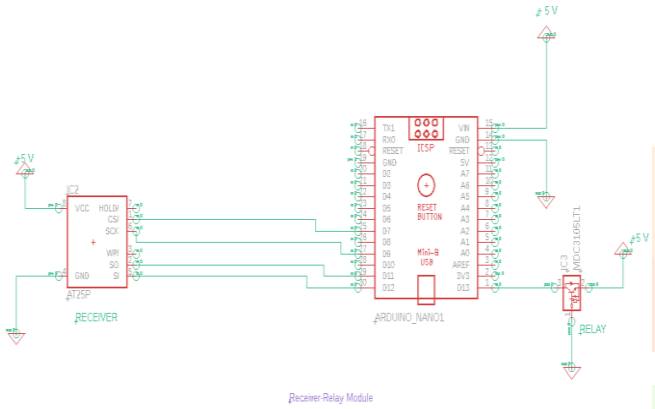

Fig 2. Receiver-Relay Module

The Fig. 2 shows connections between Arduino Nano, Relay Module, and Receiver where the receiver is connected via pin CS, SCK, SO, and SI to D7, D9, D11, and D12 of Arduino pins respectively. Relay Module is connected to D13 of Arduino Nano.

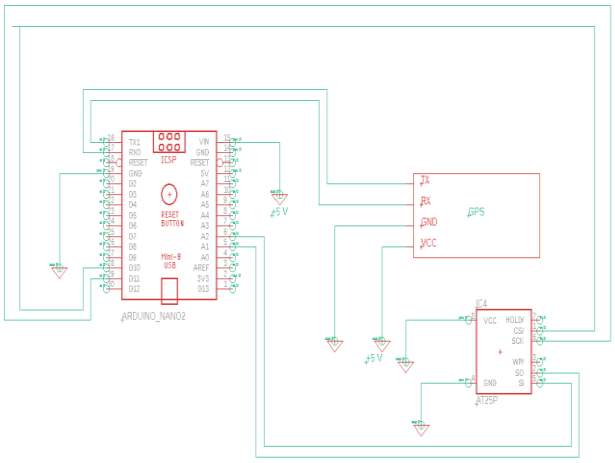

Fig 3. GPS Module

The Fig. 3 depicts the connection between an Arduino Nano and a GPS module. A GPS module enables Arduino Nano to access earth location as longitude and latitude. Through wire connections, they exchange data (RX/TX) and power (ground and 5V). Arduino can send and receive data over the GPS network with this simple configuration.

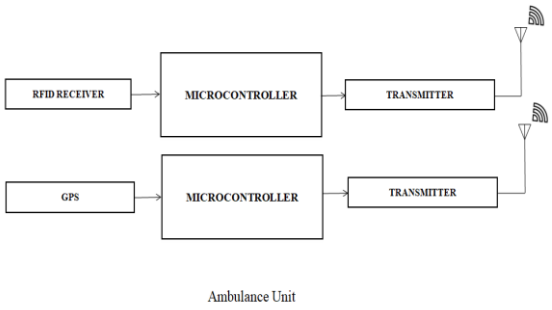


Fig 4. Ambulance Unit

In smart traffic management using RFID, an extension of the ambulance could be an RFID reader. This will communicate with road signs and potentially allow ambulance management to identify ambulances and change traffic signs along the road to move through the intersection faster.

Here is an idea on how to control the ambulance smartly. Traffic management using RFID could work:

- The RFID reader of an ambulance approaching an intersection will read RFID Tag which is on a pole at the roadside.
- The reader will send the ambulance ID to the traffic control center via Transmitter.
- Traffic management will determine the location of the ambulance and ensure that it passes through the intersection quickly.

According to the information in the Fig. 5, the traffic control unit can work in smart traffic control using RFID: The RFID reader at ambulance reaches the intersection and the RFID tag on the roadside sends the identity of the ambulance via the transmitter to the receiver at traffic control unit.

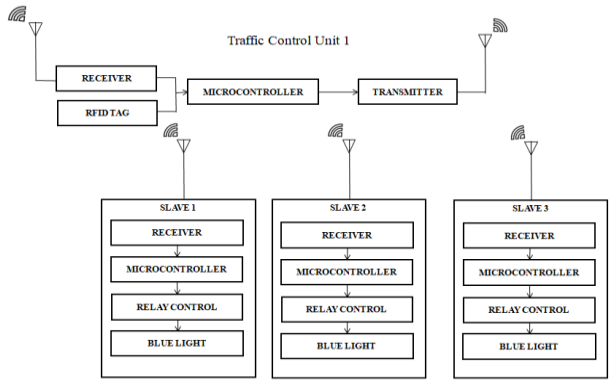


Fig 5. Traffic Control Unit

The microcontroller in the vehicle takes the identity of the ambulance and uses a program to determine how to change the traffic lights to make the ambulance move faster through the intersection. The microcontroller sends a signal from the transmitter to the traffic light to change its colour. When Ambulance passes nearby RFID tag then it transmits its location and ambulance id to traffic control unit 1 receivers. Traffic control unit 1 transmitter on pole transmits the data to turn on blue lights on roadside at slave 1, 2 and 3.

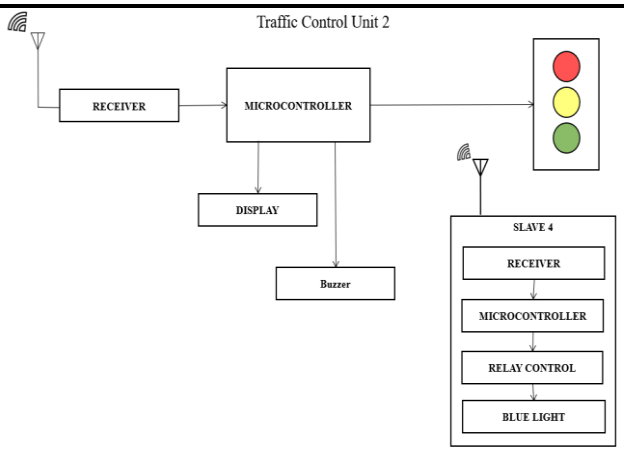


Fig 6. Traffic Control Unit 2

The microcontroller at slave 4 receives the signal from the ambulance transmitter and uses a program to determine how long each colored light should appear. After this the microcontroller sends signals to the relay control unit which turns the relevant lights on and off as per the program shown in fig.6.

## 3. INDUSTRIAL APPLICATIONS

With its many advantages that redefine transportation efficiency, safety, and sustainability, a smart traffic management system signals the beginning of a transformative era in urban mobility. This system reduces traffic congestion and shortens travel times for both products and commuters by utilizing innovative technologies including intelligent traffic signal coordination and real-time RFID data integration. Additionally, it is essential in lowering emergency vehicle emissions, which promotes a healthier and cleaner urban environment. The ability of this system to prioritize emergency vehicles, allowing for their quick passage through traffic, is one of its most important aspects. exact tracking systems allow for more exact navigation, which increases road user and emergency responder safety. This reduces the possibility of accidents, speeds up emergency response times, and enhances general security for the public. Nevertheless, effective traffic management has a wider-ranging effect than just increased safety and comfort. It helps to significantly reduce fuel consumption and greenhouse gas emissions by improving traffic flow and cutting down on idling times at intersections, which promotes a more sustainable urban landscape. Modern the technology's incorporation into transportation infrastructure signals a paradigm shift toward cities that are smarter and more productive. Fundamentally, a smart traffic management system is a cornerstone of contemporary urban development, providing a multitude of advantages that transform our understanding of and experience with urban environments. Its revolutionary applications highlight its crucial role in forming the cities of the future, from making daily journeys easier to promoting environmental sustainability and improving public safety.

## 4. RESULTS AND DISCUSSION

The primary goal of the proposed Smart Traffic Management System for Emergency Vehicles, which uses RFID, is to address the challenges the emergency vehicles, such as ambulances, when driving through traffic. The system attempts to prioritize the flow of emergency vehicles, ensuring access for those in need of quick medical care. The major purpose is to shorten the time it takes for patients to reach critical medical facilities by making it easier to transport those who need immediate medical care. The use of RFID technology is crucial to this system, as it improves coordination with aspects of the transportation network.

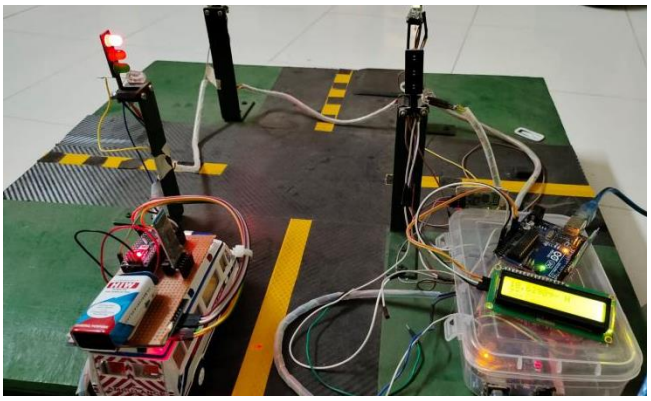

Fig 7. Top view of prototype

The RFID tag embedded at the road or on poles anonymously detect the presence of emergency vehicles in each lane approaching the road square. These will constantly feed real-time data of emergency vehicle (fig. 8a) on each incoming lane to a traffic control unit 2 and give them priority by changing the light sequence to blue to allow them to pass through quickly.

This will also display “the ambulance is coming” the content will be updated remotely (fig. 8b), using transmitter and receiver. GPS is used to provide up-to-date information about the ambulance with buzzer notification.

When the emergency vehicle approaches, the system responds immediately to it. The traffic signal turns to blue light that will allow all traffic in that lane to evacuate immediately to provide a clear path for emergency vehicles.

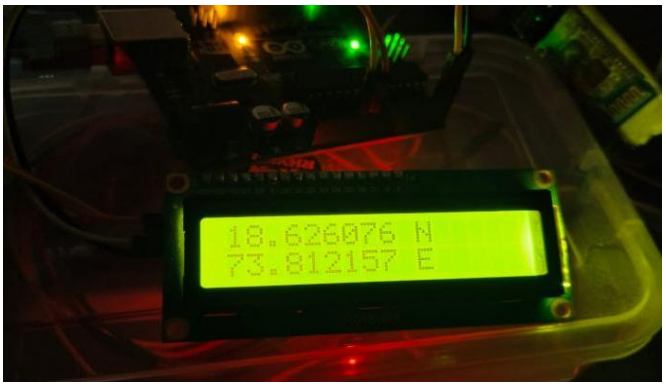


Fig 8 a. Current Location of Ambulance


Fig 8 b. Notification of Ambulance

## 5. CONCLUSIONS AND FUTURE WORKS

The proposed project seeks to completely transform traffic control by implementing an innovative traffic management system that utilizes radio-frequency identification (RFID) technology. The main objective of this system is to prioritize the smooth flow of emergency vehicles, ensuring uninterrupted passage for individuals in urgent need of immediate assistance. In the scenario of medical emergency, by expediting the transfer process for patients requiring urgent medical care, this system aims to decrease the time it takes for critically ill patients to reach vital medical facilities. The integration of RFID technology serves as the cornerstone of this advanced system, enabling improved coordination with various components of the transportation network. Through its proactive approach, this system effectively minimizes time-delay for emergency vehicles. With its advanced RFID technology, the traffic management system proactively responds to shifting traffic patterns, promoting efficient use of transportation infrastructure and prioritizing emergency vehicles. This revolutionary system not only expedites the movement of these vital vehicles but also transforms the overall effectiveness of traffic management in crucial moments. Through its streamlined traffic flow, prompt patient transfers and emergency cases, it plays a crucial role in providing essential and timely care for those facing urgent situation.

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