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Traffic Light Priority Control for Emergency Vehicals

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Abstract: Traffic Light Priority for Emergency Vehicles constitutes a system designed to grant precedence to emergency vehicles at traffic signals, effectively manipulating the traffic lights in their favor. The primary objective is to curtail response times for emergency services and enhance the safety of both responders and the general public. This research endeavors to delve into the practical implementation of traffic light priority for emergency vehicles, encompassing an analysis of the advantages, challenges, and potential remedies associated with this technological solution. Furthermore, the study will scrutinize the influence of traffic light prioritization on overall traffic flow and the efficiency of emergency response systems. Conclusively, the paper will deliberate on prospective developments in this technology, exploring its capacity to advance emergency services on a global scale.

I. INTRODUCTION

In emergency situations, time is of the essence, and the efficiency of emergency services can be a crucial factor in determining outcomes. Emergency responders often encounter challenges in swiftly navigating through traffic to reach their destinations. Traffic congestion and signal delays can significantly impede response times, potentially affecting the outcome of critical situations. To address this issue, Traffic Light Priority for Emergency Vehicles has been conceptualized as a solution. This system is designed to grant priority to emergency vehicles at traffic signals, allowing them to override the standard traffic light sequence. When activated, the system facilitates the safe and expedited passage of emergency vehicles through intersections. This paper delves into the implementation of Traffic Light Priority for Emergency Vehicles, exploring its benefits, challenges, and potential solutions. The impact of this technology on traffic flow and the overall efficiency of emergency response systems is examined. Additionally, the discussion extends to the potential future developments of this technology and its capacity to enhance emergency services on a global scale.In urban environments, emergency vehicles such as ambulances, fire trucks, and police cars often encounter delays due to traffic congestion, posing life-threatening risks in critical scenarios. The objective of this project is to develop an intelligent traffic light system that facilitates the swift and secure movement of emergency vehicles through traffic.

II. RELATED WORKS

Vashishtha, S., Aggarwal[2] proposed a Traffic Light Priority for Emergency Vehicles is a system that allows emergency vehicles to have priority at traffic signals by controlling the traffic lights in their favor.

This system aims to reduce emergency service response times and improve the safety of both emergency responders and the public.

Similarly, Javed, A., Khan, R. U. A., & Mughal, H. A.[3] Traffic light priority for emergency vehicles is a system design to help overcome this challenges by providing a way for emergency vehicles to have priority at Traffic signal

III. LITERATURE SURVEY

A comprehensive examination of the literature related to traffic light priority control for emergency vehicles utilizing Arduino technology involves an in-depth review of existing research and projects in this domain. The primary focus centers on Arduino-based systems, methodologies employed, and findings related to emergency vehicle signal prioritization, alongside an exploration of pertinent traffic management technologies. The system in question aims to enhance the efficiency and safety of emergency vehicle travel, particularly for ambulances and fire trucks. It operates by leveraging technology, particularly Arduino-based systems, to manipulate traffic lights along the emergency vehicle's route. This manipulation may involve granting a green light or adjusting the timing of signals at intersections, facilitating smoother passage and minimizing delays caused by traffic.

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The overarching goal of this literature review is to investigate the current state of knowledge and advancements in the field. It includes an examination of various research studies and implemented solutions that contribute to the optimization of the traffic light priority control system for emergency vehicles. By scrutinizing existing methodologies and outcomes, the review seeks to identify key findings and potential areas for improvement, ultimately aiming to enhance the overall efficiency and effectiveness of the system. This research project is driven by the imperative to save crucial time and potentially lives by mitigating delays induced by traffic, thus underscoring the significance of ongoing efforts to refine and innovate in this domain.

IV. DESCRIPTION OF COMPONENTS

A. RF Transmitter And Receiver

1) HT12E Encoder

The HT12E encoder and HT12D decoder constitute a user-friendly pairing for encoding and decoding data with simple data and address selection capabilities. Both the transmitter (encoder) and receiver (decoder) include switches that facilitate the convenient adjustment of address settings. Additionally, there are female headers provided for the Amplitude Shift Keying (ASK) RF module on both the encoder and decoder units. These components collectively offer a straightforward and adaptable solution for encoding and decoding data, with the added flexibility of address customization through user-friendly switches. The inclusion of female headers ensures easy integration with the ASK RF module on both the transmitting and receiving ends.

2) HT12D Decoder

The HT12D decoder IC is versatile and supports compatibility with diverse remote control systems, accommodating various address code formats such as 8-bit, 4-bit, and 2-bit configurations. This IC possesses the capability to decode information spanning up to 12 bits, rendering it well-suited for a broad spectrum of applications. Its flexibility and decoding capacity make it applicable in a wide range of scenarios, contributing to its adaptability in different electronic control systems.

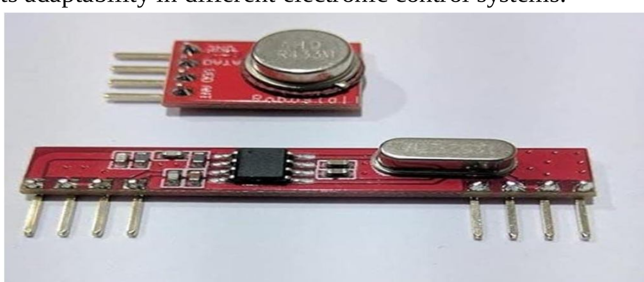

Figure- RF Transmitter & Receiver

3) Atmega328 Microcontroller

The ATmega328 is a single-chip microcontroller created by Atmel in the mega AVR family (later Microchip Technology acquired Atmel in 2016). It has a modified Harvard architecture 8-bit RISC processor core Atmega328 is an Advanced Virtual RISC (AVR) microcontroller. It supports 8-bit data processing. ATmega-328/328P has 32KB internal flash memory. ATmega328/328P has 1KB Electrically Erasable Programmable Read-Only Memory (EEPROM). This property shows if the electric supply supplied to the micro-controller is removed, even then it can store the data and can provide results after providing it with the electric supply. Moreover, ATmega-328 has 2KB Static Random Access Memory (SRAM). ATmega328/328P is a 28-Pin AVR Microcontroller, manufactured by Microchip, follows RISC Architecture and has a flash-type program memory of 32KB.

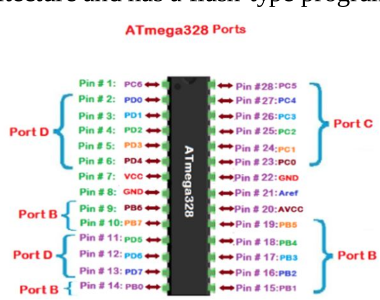

Figure- Atmega328 Microcontro

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*4) LCD 16*2 Display*

A 16x2 LCD indicates that it has the capacity to showcase 16 characters across each of its 2 lines. Each character is presented within a 5x7 pixel matrix on the LCD. This alphanumeric dot matrix display, being 16 characters wide and 2 lines tall, has the capability to exhibit a total of 224 distinct characters and symbols. In essence, it allows for the presentation of a variety of information and symbols using a grid of 5x7 pixels for each character.

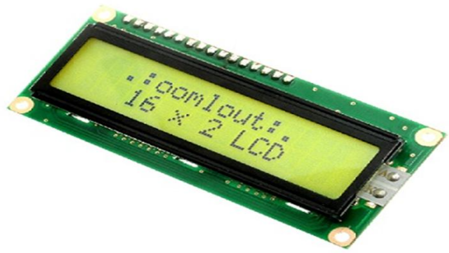


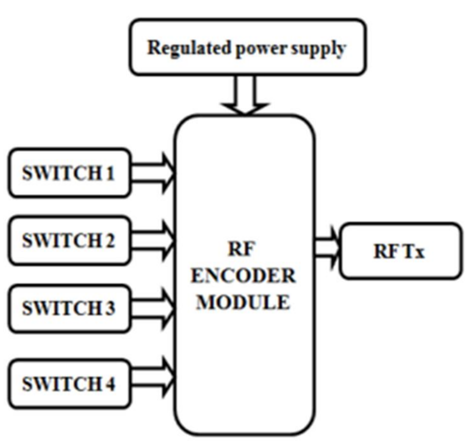
Figure-LCD 16*2 Display

5) Battery

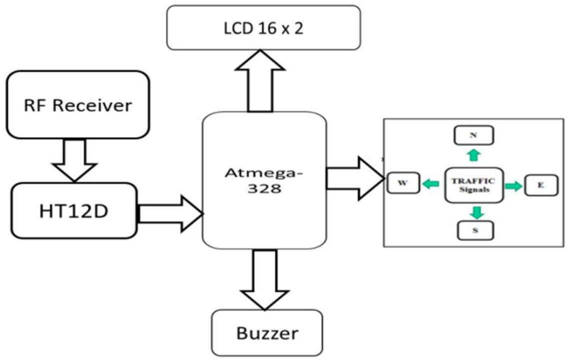
There is need of two Zinc Carbon batteries (refer to figure no.5) which are used to supply the DC power of 9 Volts to the circuits. Out the 2, One is used to provide power to the transmitter circuit i.e Arduino Uno, nRF2401L and MUPU6050. Second battery is used to provide the power to the receiver circuit i.e Arduino UNO, nRF2401L and motor driver.

Figure-Battery

V. BLOCK DIAGRAM



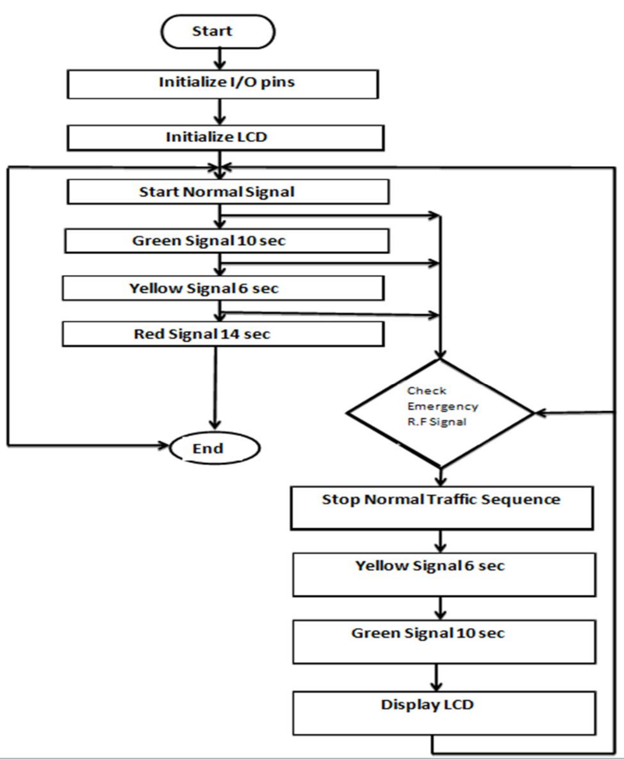
Transmitter Block Diagram



Receiver Block Diagram
Figure- Block Diagram

VI. METHODOLOGY

Step 1 :- Start
Step 2 :- Initialize I/O pins
Step 3 :- Initialize LCD else step 14
Step 4:- Start normal signaling else step 8
Step 5 :- Green signal 10 sec else step 8
Step 6 :- Yellow signal 6 sec else step 8
Step 7 :- Red signal 14 sec else step 8
Step 8 :- Check emergency R.F.signal else step 4
Step 9 :- Stop normal traffic sequence
Step 10 :- Yellow signal 6 sec
Step 11 :- Green signal 10 sec
Step 12:- Display LCD else 8
Step 13:- End



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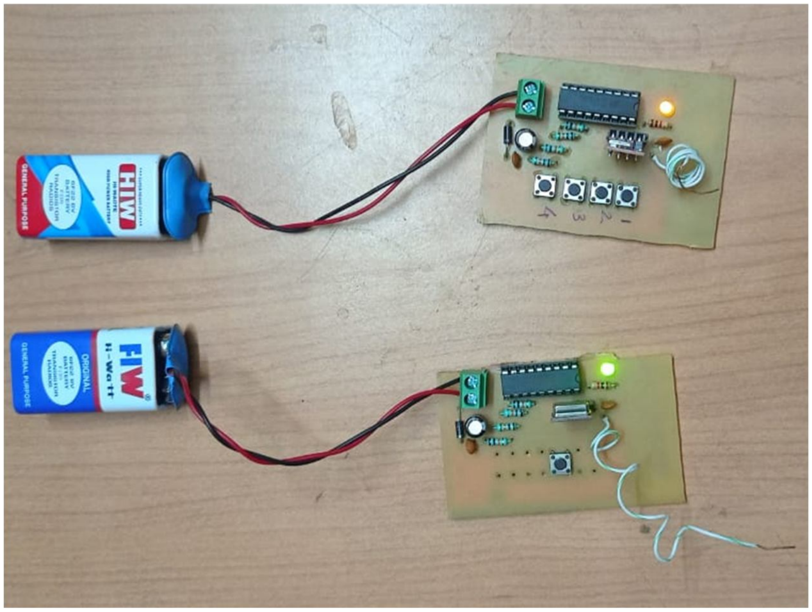
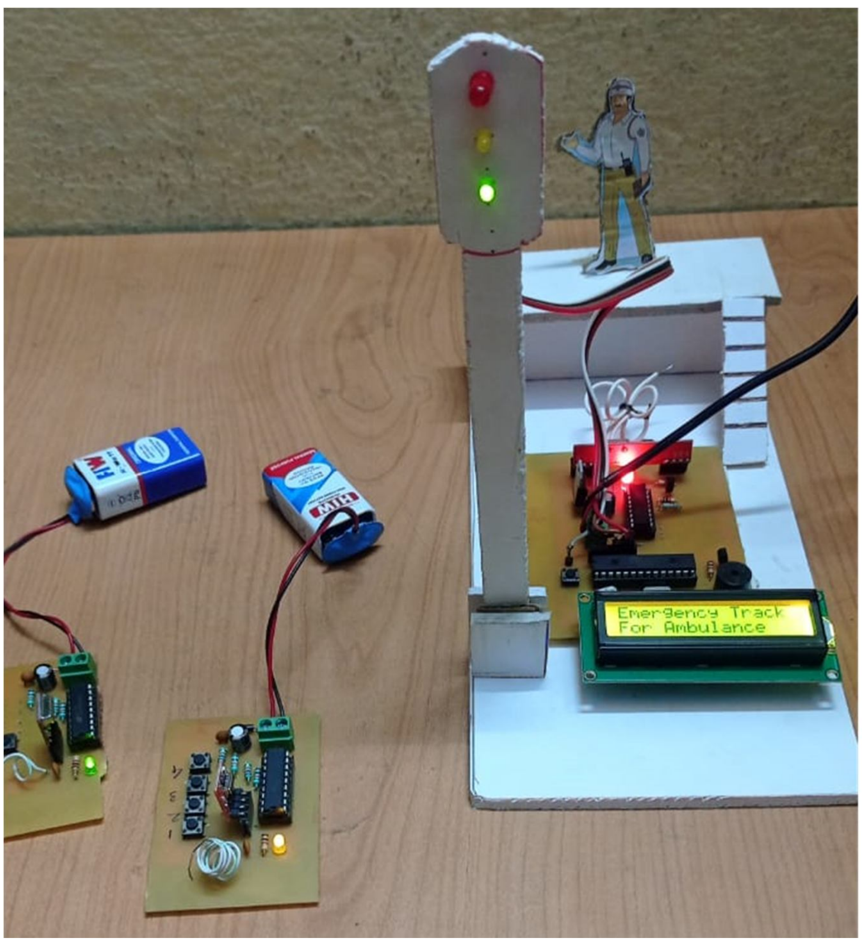
VII. PRACTICAL IMAGES

A. Transmit Part



B. Receiving Part



VIII. CONCLUSION

In this project, the implementation of traffic light priority control for emergency vehicles underscores notable advantages, including decreased response times, heightened safety for emergency responders, and enhanced overall efficiency in emergency services. The conclusion accentuates the pivotal role of seamless coordination, integration of advanced technologies, and public awareness as crucial factors for ensuring the successful implementation of this system while minimizing disruptions to normal traffic patterns.

IX. FUTURE SCOPE

1) In the future, we use Advances in technology, such as AI, IoT, and vehicle-to-infrastructure communication, can enhance the efficiency and effectiveness of prioritizing emergency vehicles.
2) Integration with autonomous vehicles and smart city infrastructure could further optimize traffic flow and response times, potentially saving more lives and reducing congestion.
3) Additionally, ensuring robust cybersecurity measures will be crucial to safeguarding these systems against potential threats.

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