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INTEGRATED TRAFFIC CONTROL SYSTEM FOR EMERGENCY VEHICLES

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Abstract- The utilization of emergency vehicles has grown tremendously across the globe. It is primarily regulated in cities. In cities the traffic is heavy, which causes life-threatening delays. In order to have an appropriate solution to control the traffic to accelerate the emergency vehicle, an automated traffic solution based on RF (radio frequency) modules that provide smooth communication and coordination between the traffic light and the ambulance. It provides greater priority to the emergency vehicles such as ambulances and fire engines. Radio frequency minimizes the maintenance cost and detection time. Incorporation of radio frequency modules opens doors for future advancement in traffic management. Utilization of this computerized traffic system provides huge potential to revolutionize emergency response, to possess road safety, and to save lives in our ever-increasing urban landscape. Emergency vehicles can be utilized for VIPs so that political individuals get meetings very quickly.

1. INTRODUCTION

Traffic congestion is a problem growing beyond its limits all around the globe, as the rate of population growth and usage of cars, which grows proportionally, will also be enhanced with no improvement in road infrastructure. As a result, every traffic intersection will have a possibility of high buildup of vehicles, and during rush hours, it leads to excessive congestion versus regular hours. Because of these situations, which create complexities for the f low of emergency vehicles in busy hours, it raise of putting people who are in need of emergency vehicles into critical stages. So, to erase this issue, various technologies are researched and examined for the purpose of tracking emergency vehicles and managing traffic flow, bringing in the green corridor technique. The green corridor technique can be applied with various techniques such as radar technology, as these technologies would carry greater maintenance and installation complexities, etc. Therefore, in this paper we proposed a model for installing a green corridor with the help of radio frequency technology. This technology is obtained by communication through RF modules. An RF transmitter is mounted on the emergency vehicle, and an RF receiver will be installed closer to the signaling system.

1.1 EXISTING SYSTEM:

The current traffic management system uses fixed traffic lights that do not favor emergency vehicles, resulting in traffic congestion during emergency situations. Emergency vehicles are not communicated to traffic light systems, and also, during peak hours, manpower is slow or inefficient

1.2 PROPOSED SYSTEM:

The suggested system provides intelligent traffic control which identifies emergency vehicles automatically and responds by manipulating traffic signals to provide preference to them so that traffic will be cleared very quickly compared to manual efforts. Manual traffic management is not needed.

2.PROJECT DESCRIPTION

Methodology describes the way radio frequency (RF) communication and embedded system technologies give priority to emergency vehicles at road junctions. The methodology is developed to sense incoming emergency vehicles and manage traffic lights in a way that gives them a free route. The system has two main units: Emergency Vehicle Unit—It is mounted on emergency vehicles (ambulances, fire engines, etc.). Traffic Signal Unit—It is fitted at traffic intersections, interfaced with the traffic light control system. Both units exchange data through RF modules, allowing real-time, wireless identification and response. Emergency Vehicle Unit: An RF transmitter module is placed in the emergency vehicle, and the transmitter broadcasts a distinct signal periodically (e.g., vehicle ID and status). A microcontroller (e.g., an Arduino or Raspberry Pi Pico) manages the RF transmitter and makes sure to continuously broadcast the signal while the siren is running. Traffic Signal Unit: At every traffic intersection, there shall be an RF receiver module to identify signals which recognize the radio frequency signals emitted by emergency vehicles; the receiver, which is linked to a microcontroller or Raspberry Pi, then processes the signal. When a valid emergency signal is received: The system reverses the regular traffic cycle and goes green

as soon as possible for the lane of the path of the emergency vehicle and red for the alternate path. When a traffic signal unit is out of signal from an emergency vehicle, it becomes a regular traffic cycle.

2.1 Block diagrams:

Fig.1 Block Diagram of Transmitter

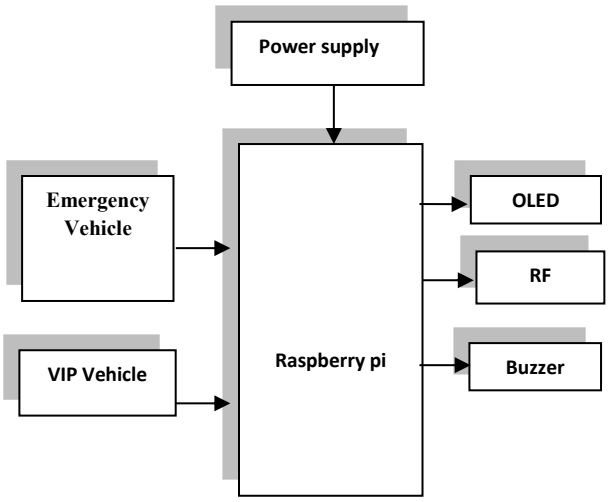
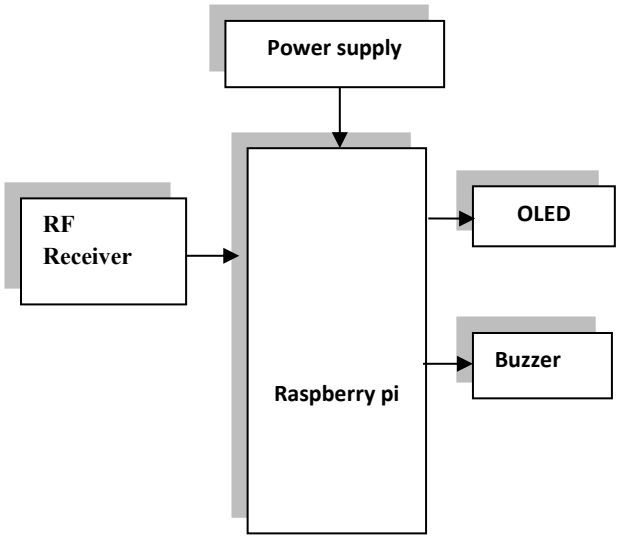


Fig.2 Block Diagram of Recevier



3 HARDWARE DETAILS

Microcontroller: It is low-cost and high-performance microcontroller board that is based on the RP2040 chip and is suitable for embedded systems. A single Pico is employed in the Emergency Vehicle Unit to drive the RF transmitter and another Pico is employed in the Traffic Signal Unit to interface the RF receiver and drive traffic light signals. RF Module – 433 MHz (Tx and Rx Pair): Low-range wireless RF module for communication via Amplitude Shift Keying (ASK).

OLED (Organic Light Emitting Diode): OLED is a flat light emitting technology, produced by sandwiching a series of organic thin films between two conductors. On applying electrical current, an intense light is produced. OLEDs are emissive displays that never need a backlight and therefore are thinner and more power-efficient than LCD displays.

Buzzer: A buzzer or beeper is an alerting device, typically electronic, normally applied to automobiles, domestic appliances like a microwave oven, or television game shows. It typically consists of several switches or sensors wired to a control unit that decides whether and which button was activated or a set time has passed, and typically lights up a light on the corresponding button or control panel, and issues a warning in the form of a steady or intermittent buzzing or beeping noise.

Power Supply: Power supply has a key function in powering the Raspberry Pi Pico, RF modules, and LEDs or traffic light components. The voltage needed is 3.3V (regulated) or 5V input through USB.

RF Transmitter: An RF Transmitter is a wireless communications system that transmit signals from the emergency vehicle to the traffic signal unit. It sends encoded information, like an emergency ID, using Radio Frequency (usually 433 MHz) over short ranges. In the project, the RF transmitter is interfaced with the Raspberry Pi Pico in the emergency vehicle and transmits a signal when a switch or siren is pressed.

RF Receiver: RF Receiver Module (433 MHz) is interfaced in the Traffic Signal Unit for receiving signals transmitted by emergency vehicles

SOFTWARE DETAILS Arduino Software IDE: It has a text editor to enter code, a message area, a text console, a toolbar of buttons for standard operations and a set of menus. . It is linked to the Arduino and Genuino hardware for loading software and communicating with them. Embedded C: Embedded C is applied to code the main firmware executed on microcontrollers such as Arduino pic. Embedded C code is developed to communicate with RF Module.

4.Applications:

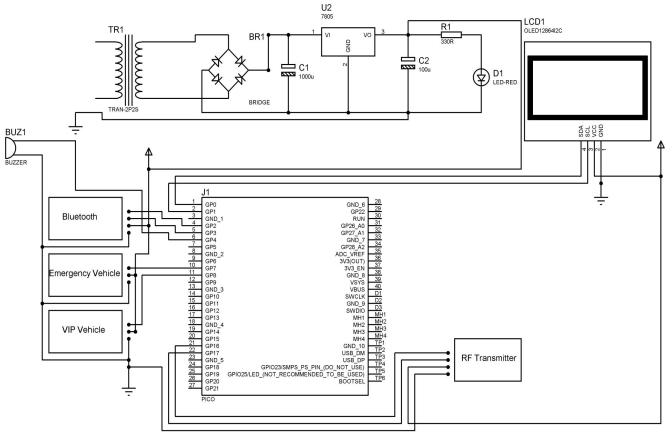
• Prioritizes ambulances, fire engines, and police cars at traffic lights in cities. It connects to centralized traffic control networks for real-time monitoring.

• Ensures prompt arrival of ambulances at hospitals, particularly important in cities with heavy traffic. • Aids life-saving treatments by reducing delays in patient transfer.

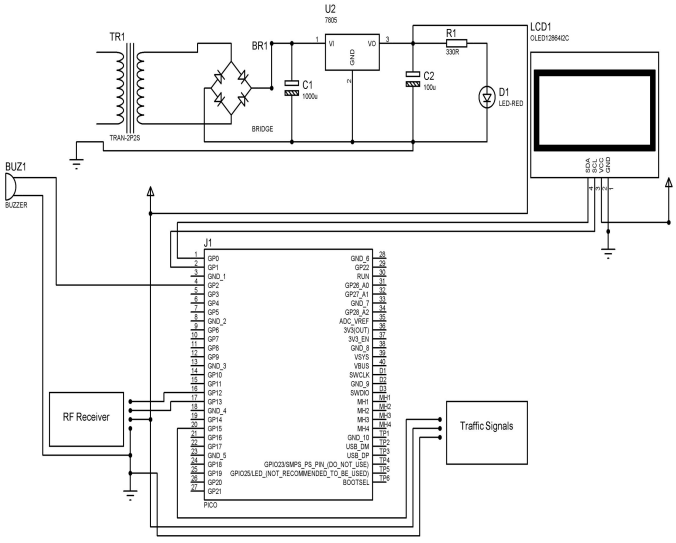
• It prioritizes VIP or defense convoys in urban and strategic corridors. •It is economical in cost in comparison to other.

5. SIMULATION AND DESIGN

RF TRANSMITTER:



RF RECEIVER:



6. CONCLUSION

The paper has the project" Integrated Traffic Control System for Emergency Vehicle Using RF Technology has been successfully designed and tested. We have implemented Radio Frequency Technology and developed with integration of all hardware components. This project, in particular, deals with a vital problem encountered in city traffic. Empowering emergency vehicles with RF transmitters and setting up RF receivers at main traffic intersections linked to Raspberry Pi Pico microcontrollers, the system can detect the approach of an incoming emergency vehicle in real time.

7. REFERENCES

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