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Intelligent Traffic Signal Control using RF Technology for Emergency Vehicles

S. Deekshitha, T. Sri Ganesh, S. N M Vamsi Kumar, Sk. Moulali

Abstract*: The transportation system in our nation has been greatly impacted by the problem of traffic congestion. This leads to a number of complications or problems, especially when there are emergencies in the heavily trafficked lanes at traffic lights. To address these challenges, a traffic light management system is built in. Based on an RFID module, this system was designed to operate when it received a signal from an emergency vehicle. The Programmable Arduino nano micro controller was used to regulate the LEDs used in the traffic signals. The system's use of LEDs makes it easier for emergency vehicles to manoeuvre through traffic. As a result, the project's analysis and implementation of the traffic signal control system for emergency vehicles were successful.

***Keywords*: RFID, LED, Arduino Nano, Traffic Light Management System.**

I. INTRODUCTION

In present days, traffic is expanding all through the world, for the most part in metropolitan regions. As the quantity of street Clients increment continually, an intelligent control of traffic will turn into a vital innovation in the future. Blockage in rush hour traffic has become a difficult issue. Numerous vehicles are long time waiting at the signal because of this there will be additional time consumption for the human and that will be a lot of issue for the people who go to their work and some to the business works. In existing system of controlling the traffic is not according to the density of vehicles and it is not decreasing the effect of traffic in metropolitan regions. The traffic lights are arranged recently fixed exclusively for some specific time, after that time interval the sign will be naturally different to another sign. This makes the opposite side paths delay for long time. In certain spots even traffic signals didn't work as expected. In the proposed system or frame work by utilizing the Arduino Nano Micro-controller, the vehicle density is estimated and appropriately the traffic will be decreased.

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*Correspondence Author(s)
S. Deekshitha*, Department of Electrical and Electronics Engineering, Sri Vasavi Engineering College, Tadepalligudem (A.P), India. Email: deekshithas37@gmail.com, ORCID ID: https://orcid.org/0009-0002-5890-729X
T. Sri Ganesh, Department of Electrical and Electronics Engineering, Sri Vasavi Engineering College, Tadepalligudem (A.P), India. Email: ganeshtirumala2611@gmail.com, ORCID ID: https://orcid.org/0009-0008-7478-8191
S. N M Vamsi Kumar, Department of Electrical and Electronics Engineering, Sri Vasavi Engineering College, Tadepalligudem (A.P), India. Email: suravarapuvamsi800@gmail.com, ORCID ID: https://orcid.org/0009-0006-7590-9499
SK. Moulali*, Assistant Professor, Department of Electrical and Electronics Engineering, Sri Vasavi Engineering College, Tadepalligudem (A.P), India. Email: itsmoulali212@gmail.com, https://orcid.org/0000-0003-2796-3723

II. LITERATURE SURVEY

For vehicles of emergency, RF module has been is it used detecting an emergency vehicle and taking action instantly impossible the light is turned on green for the side with minimum traffic congestion case if the congestion stay high one explicit side, then the other side will be delayed for sign in again emergency vehicle green signal will be given and it travels without traffic issue As it will be in Plain view the ambulance driver should update their journey path to get clearance in congestion what is an not effective method[1-2] hence this project makes automation which gives green signal for the emergency vehicle..

III. PROBLEM DESCRIPTION

In general the light changes to green with specific time delay. The green light will be given even there is no vehicle on the particular lane and it delays for the vehicles on other sides in case of arrival of emergency vehicle on the other side they have to wait till the signal turns green for their side.

IV. EXISTING SYSTEM

In the existing system shown below in fig.1, it is difficult to clear traffic for ambulance. In previous system they used only IR sensors to clear traffic. Depends on density traffic green signal will on. If no density means signal will change for every 1 min by default.
Disadvantages: In this method, there are few disadvantages like the camera which is totally immobile.
In this Technique there may be a chance of occurrence over speed concept results inaccidents by Emergency vehicles.

Figure.1: Existing Mode

V. PROPOSED MODEL

Here we proposed a new system which is more useful to clear traffic for ambulance. To decrease the clog and undesirable time delay in traffic, a high-level framework is required. One such cutting edge innovation is traffic Control for emergency vehicle using RC522 module. Whenever an emergency vehicle arrives the driver in the vehicle has to swipe the RFID card and it transfers signal to the controller used here will activate the Green LED corresponding to that direction and make other side signals to Red indicating emergency vehicle is arriving. [3]

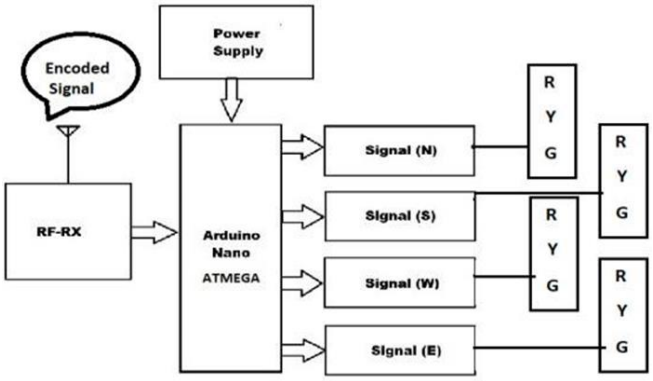

Figure 2: Traffic control unit

Applications: devices can be implanted in emergency vehicles like

- Ambulances
- Fire Tankers
- VIP Vehicles
- Convoys etc.

Steps to Design PCB:

- Create the Schematic
- Create a Blank PCB Layout
- Schematic Capture: Linking to Your PCB
- Designing Your PCB Stack up
- Defining Design Rules and DFM Requirements
- Place Components
- Insert Drill Holes
- Route Traces

Software requirements:

- Arduino IDE software
- Easy EDA PCB design

VI. ACTIVE TAGS & PASSIVE TAGS

The active tags will be used for short-range applications and have very low prices. A reader, an active tag, and an antenna make up an active RFID tag system. An active RFID tag has its own power supply, which is typically an integrated long-life battery. This enables the tag to transmit the data continuously and uninterruptedly, regardless of whether it is in the field of action of a reader. In contrast to passive RFID tags, which only contain an antenna and a microchip without any internal power supply.

Applications: Tracking vehicles, Auto Manufacturing, Mining, Construction, Asset Tracking.

Passive Tags Onboard transceiver battery must be replaced longer range frequency is 433 MHZ to 915 MHZ these tags are working at high temperature an extreme moisture the cost of the passive taxes very high these tags are used in identification purpose of any object.

Applications: Inventory Tracking, Supply Chain Tracking, Race Timing, Manufacturing, Electronic Tolling, , Asset Tracking. The following figure is the physical appearance of active tags and passive tags.

Figure. 3: RFID tags

A. Rc522 RFID Module:

The 13.56MHz RFID module RC522 is dependent on NXP Semiconductors' MFRC522 controller. The module typically ships with an RFID [10] card and key fob and can support I2C, SPI, and UART. It is typically used in applications for person or item identification, such as attendance systems [4]. The RC522 module should only be used with communication lines of 3.3V because it has a voltage operating range of 2.5Volts to 3.3Volts. As a result, it is often powered by 3.3V. However, since this module's communication ports are 5V tolerant, it may also be used with microcontrollers of 5V for example Arduino, without the need for any additional hardware. SPI, IIC, and UART communication are all supported by this module, however SPI is typically utilised because it is the fastest with a maximum data rate of 10Mbps. Since in an application, the reader module will frequently be waiting for the tag to approach, In battery-operated applications, the Reader can be put into power-saving mode in order to conserve energy. The IRQ pin on this module can be used to achieve this. The module will only use 10uA of current at the lowest during power-down mode.

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Figure. 4: RC522 Sensor

Pin No.	Pin Name	Description
1	Vcc	Usually 3.3V is used to power the module.
2	RST	Reset pin: used to turn off or restart the module
3	Ground	Connected to Ground of system
4	IRQ	Wakes the module up via the interrupt pin when a device enters range.
5	MISO/SCL/Tx	MISO pin when used for SPI communication, acts as SCL for I2c and Tx for UART.
6	MOSI	Pins for SPI communication are master out and slave in.
7	SCK	Used to supply a clock source is the serial clock pin.
8	SS/SDA/Rx	Carries out the functions of Serial input (SS) for SPI communication, SDA for IIC, and Rx for UART.

B. RFID Reader

Radio identification reader is a physical device which is used to connect the data from the RFID tag, the radio waves are used to transfer them from the tag. In order to read data from an RFID tag, the RFID reader must be near the RFID tag, which must be between 0 and 300 feet away. it has three types they has fixed mobile and handle units the type of RFID used based on the environment and application. [5-6]

Figure. 5: RFID tag reading Emergency Vehicle

C. Arduino Nano

The transmitter/receiver (Tx/Rx) pair used in this RF communication system operates at 434 MHz. The transmitter module receives serial input and uses RF to send these signals. The receiver module, which is installed far from the source of transmission, receives the broadcast signals. The technology enables transmission and reception, or one-way communication, between two nodes. Four channel encoder/decoder ICs have been utilized in conjunction with the RF module. The encoder changes the remote switches' parallel inputs into a collection of serial signals. Through RF, these signals are transmitted in serial to the reception site. The serial format is decoded by the decoder after the RF receiver and the original signals are obtained as outputs. The outputs observed on the respective LEDs.

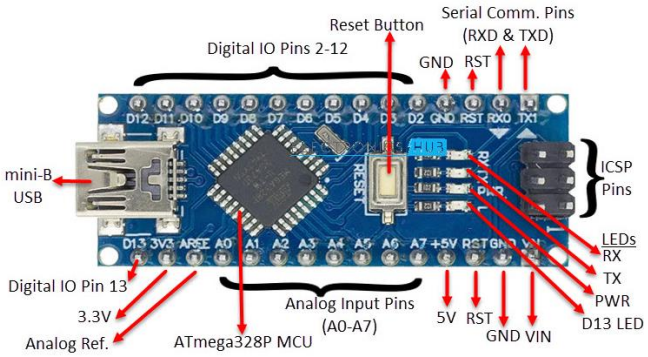
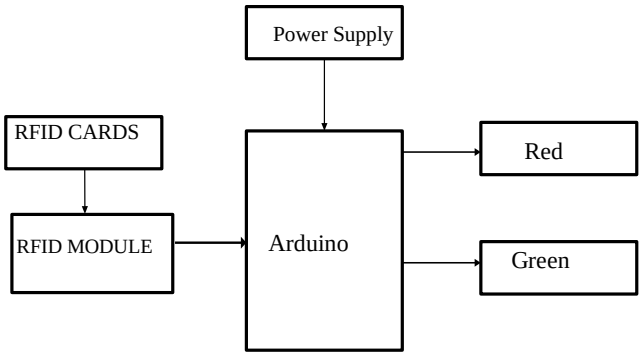
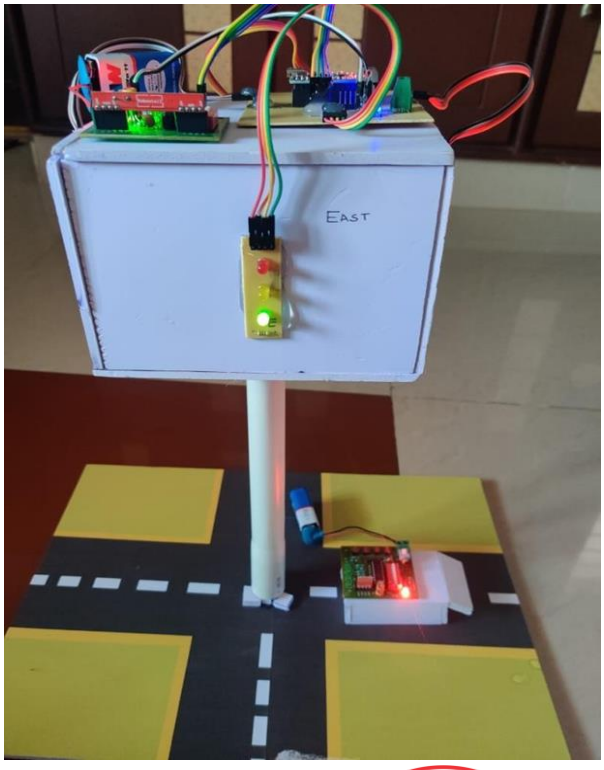


Figure. 6: Arduino Nano Microcontroller

D. Block Diagram





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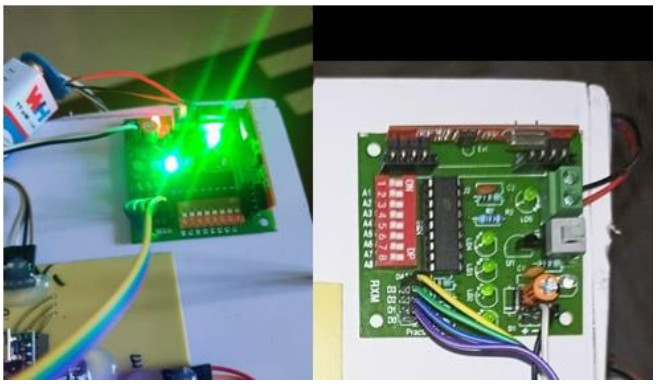

Figure. 7: Results of proposed model

E. Light-Emitting Diode (LED)

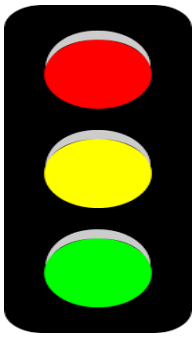

Figure. 8: LED Traffic Light

When current flows through a semiconductor light source like an LED, it emits light. In that semiconductor, energy is released in the form of photons by recombining electrons and electron holes. It will signal when a vehicle is ready to move, stopped, or both. The standard traffic light colours are horizontally or vertically ordered red, yellow, and green. Despite being globally standardised, there are differences in traffic light legislation and sequences at the national and municipal levels. On Parliament Square in London, the technique was first used in December 1868 to lessen the need for police personnel to regulate traffic. Since then, traffic light technology has progressed and intersection capacity has increased thanks to electricity and computerised control. The technique is also used to handle pedestrian traffic, variable lane control (such as on tidal flow systems or smart highways), and level crossings on railroads. [9]

VII. CONCLUSION

This paper reports the development and testing of the "intelligent traffic control system for emergency vehicle using rf technology" project. to identify emergency cars in our implementation, we used radio frequency technology. all of the hardware components were integrated throughout development. every module's existence has been carefully considered, and its placement has contributed to the unit's optimal performance. second, the project has been implemented effectively thanks to advancing technology and very sophisticated ics. we developed an arduino-based traffic congestion control system with automatic signal clearing for emergency vehicles utilising the arduino mega, rc522 module in response to traffic congestion in urban areas. The method offers more versatility in managing the traffic. The effectiveness of an automatic traffic signal control system is that it lessens time lost to traffic-related delays in metropolitan areas.

DECLARATION

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Conflicts of Interest/ Competing Interests	No conflicts of interest to the best of our knowledge.
Ethical Approval and Consent to Participate	No, the article does not require ethical approval and consent to participate with evidence.
Availability of Data and Material/ Data Access Statement	Not relevant.
Authors Contributions	All authors have equal participation in this article.

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AUTHORS PROFILE

S. Deekshitha is an Undergraduate Student of Electrical and Electronics Engineering at Sri Vasavi Engineering College, Tadepalligudem, West Godavari Dist, Andhra Pradesh. Her work focuses specifically on power electronic controllers, IOT projects, and Electric Vehicles.

T. Sri Ganesh is an Undergraduate Student of Electrical and Electronics Engineering at Sri Vasavi Engineering College, Tadepalligudem, West Godavari Dist, Andhra Pradesh. His work focuses specifically on power electronic controllers, IOT projects and Electric Vehicles.

S. N. M Vamsi Kumar is an Undergraduate Student of Electrical and Electronics Engineering at Sri Vasavi Engineering College, Tadepalligudem, West Godavari Dist, Andhra Pradesh. His work focuses specifically on power electronic controllers, IOT and Electric Vehicles.

Sk. Moulali He is working as Assistant Professor in KLEF, Vaddeswaram, Guntur, Andhra Pradesh, India. He has received M. Tech degrees from Vignan U niversity Guntur. He published 10 scopus and 10 international journal papers (non-scopus). This author has overall 10 years teaching experience and guided more than 27 innovative projects as a part of his academic work. His research interests are power electronics, power electronics and drives, power systems.