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Traffic Congestion Detection Using Active RFID Under Thingspeak in Smart Cities

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Abstract: ***Most urban regions have significant challenges due to road traffic. Solving this problem is crucial given the daily increase in automobile traffic. No automated method that controls traffic based on recognized levels of congestion is offered by studies on the use of currently available, widely utilised technologies for traffic congestion and detection control. In light of the rate at which traffic is increasing in metropolitan areas, the purpose of this article is to suggest an efficient plan for managing traffic on the roads that is totally automated and error-proof. In this study, we analyse the most popular and extensively used methods for traffic monitoring and congestion control, along with its shortcomings, and we also provide an alternate model for the same that makes use of RFID technology.***
Keywords: Traffic Congestion, RFID, Thingspeak.

I. INTRODUCTION

Traffic congestion refers to a condition where there are too many vehicles on the road at the same time, causing traffic to slow down or come to a complete standstill. This can lead to longer travel times, wasted fuel, increased air pollution, and frustration for drivers.

All vast and developing urban areas face a challenge from road traffic congestion. Slower speeds, longer travel times, and more backed-up traffic are all signs of traffic congestion on road networks. Today, there are a constantly increasing number of cars. Unfortunately, it is impossible to build road infrastructure at the same rate. This causes the traffic to become more congested. Researchers from all over the world are investigating various technologies to identify traffic congestion and improve the effectiveness of flow control. Many different technologies are being utilised to identify traffic congestion. Today, there are an increasing number of cars. The same ratio cannot be used to increase road infrastructure, though. Traffic congestion grows as a result of this. Several technologies are being investigated by researchers throughout the world to detect traffic congestion and improve the effectiveness of congestion management. Application of Radio Frequency Identification, an emerging technology [5], for autonomous congestion detection is still largely unexplored. RFID technology may be used to detect and count vehicles efficiently. In an existing system, we have ultrasonic sensors and led. If the ultrasonic sensor detects then that time the green led will glow and if the road is empty then the red led will glow so that can easily clear the traffic.

II. RELATED WORKS

This paper [2] presents the results of by measuring traffic density using sensors, intelligent autonomous traffic lights can switch on and off. In practically every nation in the world, traffic light regulation is one of the major technical risks of metropolitan areas. This is a result of the quickly rising car population. A system must combine existing

technology with artificial intelligence to think for itself in order to decrease time and complexity. The traffic signal will be able depending on traffic, to switch from red to green intensity thanks to this recently developed project. In this study, the development and use of a sensor-based traffic light system with dynamic control, which reduces the average trip waiting time, are the main topics (ATWT). It consists of IR sensors, Low Power integrated controllers, comparators, and storage. Mohammed, Shahab Uddin, Md. Abu Taleb, Ayon Kumar Das. This research describes a model for a traffic signal control system that employs real-time area-based traffic density estimation via image processing. The primary contribution of this research is the creation of a novel method for detecting traffic density based on the area of vehicle edges in order to reduce traffic congestion. The intelligent traffic control system will use specialised algorithms, morphology, and photos taken with cameras to detect traffic density.

In order to increase the effectiveness of traffic flow on urban roadways, this paper [1] explains the design and execution of a traffic-based autonomous traffic signal system. The significance of converting the current traffic signal timing lengths to timing lengths that vary according on the volume of traffic in the avenues is discussed, along with how the proposed smart traffic light system will assist in continuously updating these times of automatic way. In order to do this, a PIR sensor-based Internet of Things (IoT) system based on the Raspberry Pi platform will be developed, with the design for implementing camera-related functionalities being laid out with an eye towards expandability.

III. METHODOLOGY

In this project we are using ultrasonic sensor which is interfaced with Arduino controller. By using ultrasonic sensors, we can detect the vehicles based on the vehicle count the led's will ON (Red or Green) and based on the count the green LED will glow at particular side. The traffic lights will work based on the vehicle count, wherever the vehicle count is high that will become high priority then it will check other highest vehicle count. Here we are representing the RFID tags as emergency vehicles whenever emergency vehicle come the green LED will glow which side is vehicle coming at that side it will ON in other sides Red led will ON. These data will be continuously uploaded to the server through NodeMCU. For NodeMCU we need to connect mobile hotspot. We need to change hotspot credentials like User name and Password as per code. Once the credentials changed Then NodeMCU will automatically connect to the Hotspot. Earlier based on time the signals will operated because of it time will be killed at heavy vehicles side. To reduce the time, we are implementing the density-based traffic lights, based on the density signals will be operated [3].

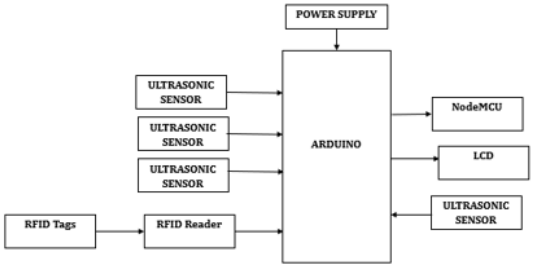
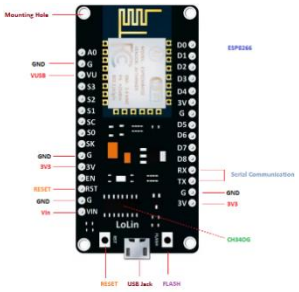


Figure: Block Diagram of System Design

The Arduino Mega 2560 is an ATmega2560-based microcontroller board (datasheet). It has 16 analogue inputs, 4 hardware serial ports, a 16 MHz crystal oscillator, 54 digital input/output pins, 14 of which can be used as PWM outputs, a USB port, a power jack, an ICSP header, and a reset button. It also has a 16 MHz crystal oscillator and a 16 MHz crystal oscillator. Everything needed to support the microcontroller is included; all you need to do to get started is plug in an AC-to-DC adapter, battery, or use it to power a computer via USB.

In order to determine an object's location, size, or proximity, a device known as an ultrasonic sensor employs ultrasonic waves. It operates by releasing a high-frequency sound wave, often in the 20–40 kHz range, and then timing how long it takes for the wave to return after striking an item. Based on how long the sound wave took to return to the sensor, the sensor determines the distance to the object. An ultrasonic sensor emits ultrasonic waves into the air to detect reflected waves from an object. Many different devices use ultrasonic sensors, including automatic door openers, intrusion alarm systems, and backup sensors for automobiles.

Often used with microcontroller and microprocessor platforms like Arduino, ARM, PIC, Raspberry Pi, etc. is the HC-SR04 distance sensor. The following advice is universal since it must be complied with regardless of the kind of computing equipment being utilised.



When creating your own IoT device with a few lines of Lua code, NodeMCU, an open-source firmware and development kit, is essential.

There are several GPIO pins on the board that can be used to generate PWM, I2C, SPI, and UART serial communications as well as link the board to other peripherals. Because to the integration of a programming platform and Wi-Fi connectivity, it enables developers to quickly and simply design Internet of Things (IoT) devices..

RC522 RFID Module

The MFRC522 controller from NXP Semiconductors is the foundation of the 13.56MHz RFID module known as the RC522. The module typically comes with an RFID card and key fob and can support I2C, SPI, and UART. It is frequently used in applications for person/object identification, such as attendance systems.

A transponder or tag attached to the item that has to be identified, also known as radio frequency identification [4], and a transceiver, also known as an interrogator or reader, are the two primary elements of an RFID system. A reader is made comprised of a radio frequency module and an antenna that generates a high frequency electromagnetic field. However, the tag is frequently a passive device, which means it has no batteries. Instead, it has a microchip for information processing and storage, as well as an antenna for signal reception and transmission.

A tag is positioned close to a Reader in order to read the data encoded on it (does not need to be within direct line-of-sight of the reader). An electromagnetic field produced by a reader causes electrons to flow through the antenna of a tag and power the chip as a result.

Advantages and Applications

Advantages

- Low cost
- Efficient
- Wireless communication
- Portable
- Reduces man power
- Can monitor the status of the slots via IOT

Applications

- Traffic signals
- Industries etc.

IV. RESULTS AND DISCUSSIONS

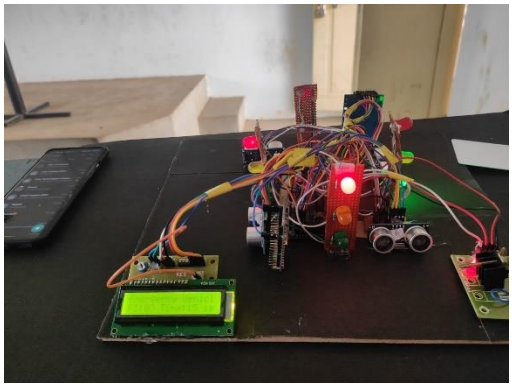


Figure 1: Hardware kit

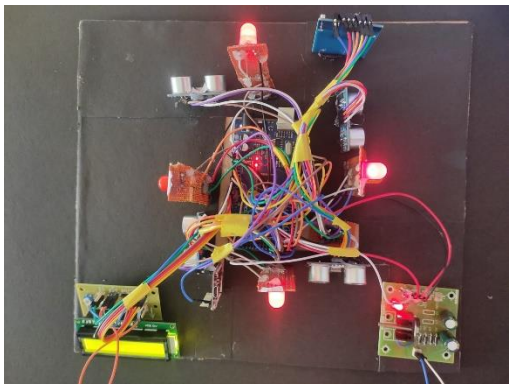


Figure 2: Top view of kit when the kit is turn on

Above figures are total kit and top view of kit which shows how the components arranged.

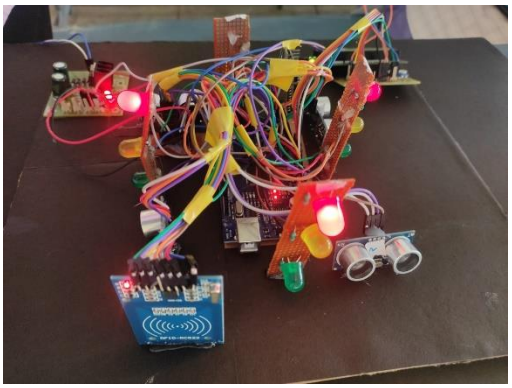


Figure 3: In the above image we are showing the RFID reader and ultra sonic sensor for detection the traffic density

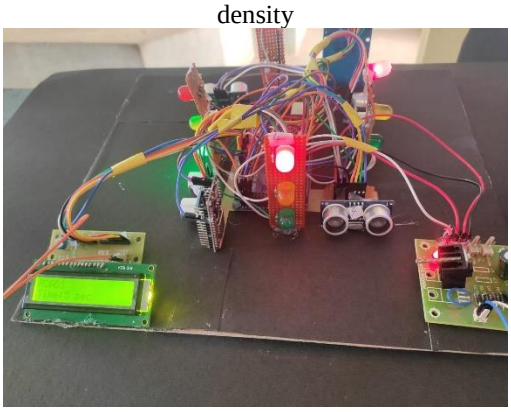


Figure 4: Kit turned on and traffic density are reading by ultra sonic sensor.

After Reading ultra sonic sensor data from four roads and displaying the traffic density in LCD display.

Figure 5: LCD Display indicating Heavy vehicles.

As per conditions in code which is written in Arduino are compared with the number of vehicles and then gives green light to highest density road then simultaneously red light to other roads. After giving signal to one road next highest density road signal will be activated to green light for time fixed which is showing in LCD 15 seconds and simultaneously to all 4 roads.

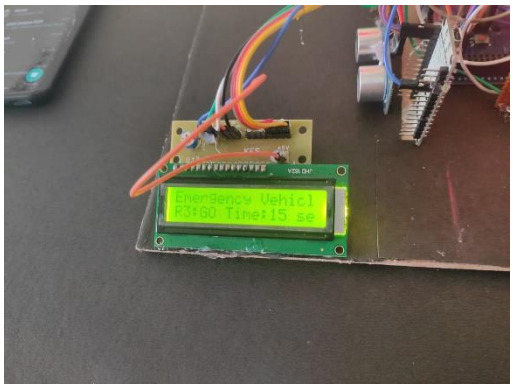


Figure 6: LCD display indicating emergency vehicles.

If emergency vehicle or heavy vehicle is on any road we will read RFID card and allows that vehicles irrespective of density.

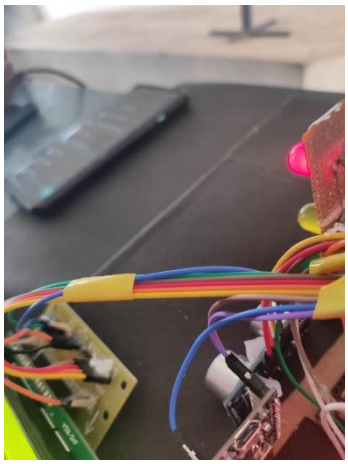


Figure 7: NodeMCU connection for uploading values to thingspeak

Figure 8: Distribution of traffic congestion-Thingspeak system

V. CONCLUSION

We have developed a strategy for setting up a traffic-control system. Our system is built on the idea that automobiles can be tracked using RFID technology and Ultrasonic sensors, and that the data gathered from those sensors can then be used to monitor and manage traffic. The benefits of our method are discussed in the paper with clarity. Despite the fact that there are numerous methods for managing traffic that are currently in use and numerous others that are being developed, this area of study will always be relevant because of the continuous rise in the number of cars on the road and the unpredictability of events that can cause traffic.

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