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IoT Based Traffic Management System Prioritizing Emergency Vehicles

Kumar Anurag, Santanu Agarwal,
Ramansh Taluja, Prashant Kumar Dewangan,
Students, Dept. of CSE,
BMS Institute of Technology and Management,
Bengaluru, Karnataka, India

Dr. Manoj H M.
Assistant Professor,
Dept. of CSE,
BMS Institute of Technology and Management,
Bengaluru, Karnataka, India

***Abstract* – In today's world, one of the many problems that people living in urban communities face on a daily basis is the problem of gridlock on roads. As a result of this many people lose their precious time sitting idle in long exhausting traffic jams. Congestion is a condition that occasionally leads to traffic accidents. Emergency vehicles such as ambulances, fire brigades, police cars also lose significant time and hence are unable to reach the crisis spot on time, which in turn results in loss of innocent lives. We propose a method in this study to address challenges caused by traffic congestion, some of which are stated above. An IoT based automated traffic signal monitoring and controller system is proposed which also allows manual overriding of signals over the internet. This concept will minimize traffic congestion while simultaneously providing emergency vehicles with Green Corridors. It will help to prevent the loss of time and human lives to a considerable extent.**

I. INTRODUCTION

Growing population is leading to an alarming rise in the number of vehicles on roads. This eventually results in increased congestions on roads.

The issues mentioned above have the potential to cause significant harm to people's lives. Road congestion not only wastes time of commuters but also causes delay in the urgent assistance from emergency vehicles such as ambulances. According to one study, "about 65-70 percent of deaths may have been avoided if emergency responders responded fast."

Thus a new system is proposed in this paper which is responsible to automatically control the traffic signaling based on the current congestion scenarios on the road. This technology will help commuters and emergency vehicles save time and get to their destinations on time by reducing wasted time. The IoT enabled system makes it possible to allow free passage to emergency vehicles as and when required. This system monitors traffic light densities and communicates the information to the controllers using Arduino-based circuitry. It also gives controllers the option of overriding any signal and turning it green if a critical vehicle is stalled in the bottleneck while all other signals remain red. The signal is not altered if an emergency vehicle is not in the vicinity of the traffic lights.

Previous approaches to traffic congestion management were ineffective and unable to maintain proper traffic control in such situations. The method proposed in this paper is capable of managing the traffic efficiently without causing any delays.

II. LITERATURE REVIEW

The advantages and disadvantages of previous traffic management systems and our proposed system is shown below in the table.

Table 1: Advantages and Disadvantages of previous systems

Technology	Advantages	Disadvantages
Manual traffic control system	1. Easily implemented 2. Errors are less due to human intervention	1. Time expensive. 2. Crossing accidents are a risk. 3. Emergency vehicles stuck very often.
Automatic traffic light system	1. It takes less time to use than the manual way. 2. It can automate traffic management according to vehicle congestion.	1. Fixed timings at signals may delay the traffic 2. Vehicles in emergency situations are unable to communicate properly.
Traffic Management using Wireless Technologies	1. It saves you time. 2. Allows faster passage to emergency vehicles 3. On the road, there are less disputes.	1. To ensure that this system operates at optimal efficiency, all traffic signals must be smart.

III. PROPOSED SYSTEM

Here we present automated traffic signal monitoring based on IoT as well as a control system that automates the full working of the traffic signal system and also allows manual override over the internet. The system controls the density of traffic signals using an Arduino-based circuit system and sends the data to the controllers via the Internet. We used IoTGecko to develop an online GUI based system for traffic congestion management. The system displays current densities and thus helps to control the traffic situation on the roads. The controller can rewrite each light and turn it green when ambulances or other high-priority vehicles pass by, while the other signals remain red. It has a traffic signal monitoring and control system that can be remotely

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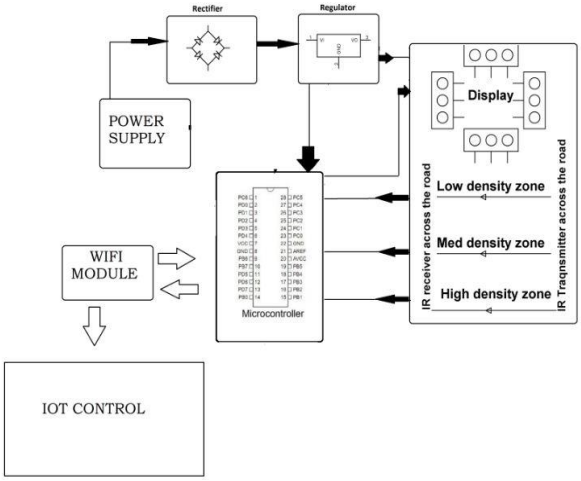
controlled via the internet from anywhere with the possibility of manual overriding.

Below is the block diagram of our proposed traffic management system using IoT.

Figure 1: Block Diagram

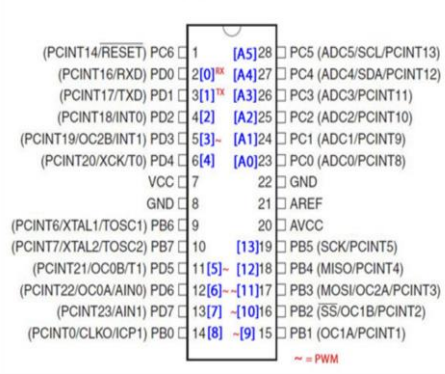


Design Specifications:

A) Hardware requirements :

- Atmega 328 Microcontroller : It's an 8-bit microcontroller with good performance and low power consumption, which uses advanced RISC architecture. Many instructions are executed in a single clock cycle with oscillations upto 20MHz.

Figure 2: ATmega 328 Microcontroller



- WiFi Module : The ESP8266 WiFi Module is a self-contained SOC with an inbuilt TCP/IP protocol stack that can provide access to your WiFi network to any microcontroller. The ESP8266 can either host an application or offload all Wi-Fi networking functionality to a separate application processor.
- IR LED & Sensors : The IR LED, also known as the IR transmitter, is a special purpose LED that emits infrared rays with a wavelength of 760 nm. They are frequently referred to as sensors, coupled with IR receivers.

B) Software requirements :

- Arduino IDE : Arduino is a prototype platform built on open source hardware and software that is simple to use. Arduino boards may read inputs such as light from a sensor, a finger on a button, or a tweet, and then convert them to outputs by generating a signal. Then arduino programming language and arduino software (IDE) for processing. The Arduino IDE supports the languages C and C++ using special rules to organize code. The Arduino IDE supplies a software library called Wiring from the Wiring project, which provides many common input and output procedures.

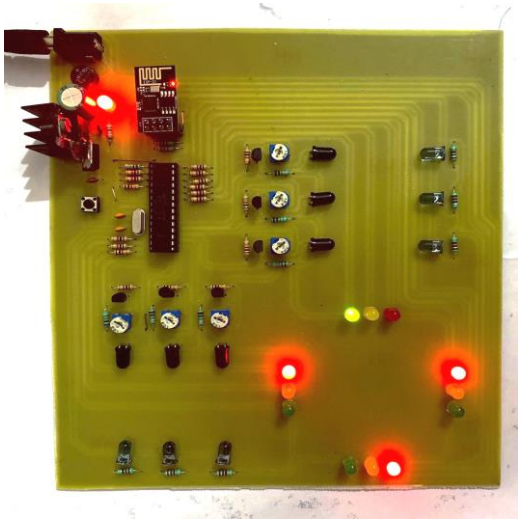
IV. IMPLEMENTATION

The following hardwares are used to implement our suggested system:

1. Atmega 328 microcontroller
2. Wifi module
3. Photodiodes
4. IR LED
5. Green, Yellow & Red LEDs
6. Resistors
7. Capacitors

The project setup is shown in the figures below.

Figure 3: Setup of proposed system



This project based on IoT prioritizes emergency vehicles by changing the traffic signal to green. The system can be controlled manually to prioritize lanes with emergency vehicles. The proposed system is also simulated on IoT Gecko for better visualization of the scenario, as shown below.

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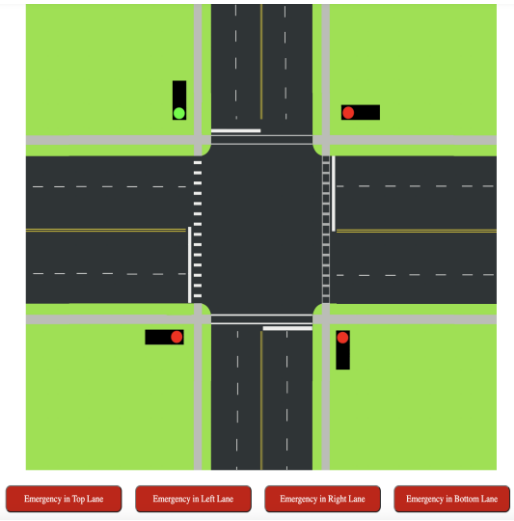
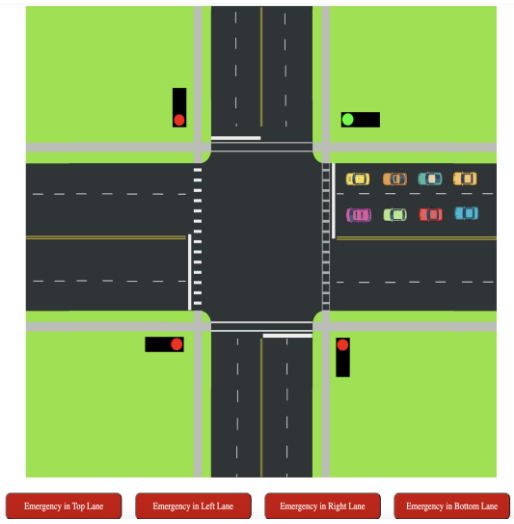
Figure 4: Simulation of the setup



This project manages the traffic system based on the density of vehicles on a particular lane. IR leds and photodiodes, which are arranged at preset distances apart on each lane, transmit and sense the density. The traffic lights are then manipulated systematically with different time delays for different densities. The densities are measured at three levels -

1. Low density - 15 seconds
2. Medium density - 45 seconds
3. High density - 1 minute 15 seconds

Figure 5: Simulation showing high density lane



If any emergency vehicle is detected on a lane then the traffic signal of that particular lane can be manually triggered to green allowing that vehicle to freely pass. The sensed data on the hardware setup is processed and sent to IoT Gecko for the simulation via the Wifi module.

V. CONCLUSION AND FUTURE SCOPE

On a daily basis, heavy traffic jams can be experienced at the crossings. As the number of automobiles on the road grows, it has become a part of everyday life. As one cannot reduce the number of vehicles on the road, it can be managed using smart methods. We thought of a system so that the congestion can be reduced to minimum by proposing IoT based traffic management. The major purpose is to reduce time delays by prioritizing the lane with approaching emergency vehicles, as many lives have been lost as a result of ambulances being trapped in traffic for long periods of time.

We have presented a project which is taking care of most of the problems mentioned. Our project is based on IoT to manage the traffic signals more smartly and minimum human involvement is required for operation, lowering labor costs and making maintenance easy.
This project can be further enhanced by automating the traffic system in case an emergency vehicle is detected near the traffic signal using high definition cameras or RFID readers. An algorithm can also be implemented to create a green corridor for emergency vehicles by coordinating with other traffic signals which will also find the shortest path for the vehicle.

VI. REFERENCES

[1] Li Z, Shahidehpour M, Bahramirad S & Khodaei A, “Optimizing traffic signal settings in smart cities”, *IEEE Transactions on Smart Grid*, Vol.8, No.5, (2017), pp.2382-2393.
[2] Pable SN, Welekar A & Gaikwad-Patil T, “Implementation on Priority Based Signal Management in Traffic System”, *International Journal of Engineering Research Technology (IJERT)*, Vol.3, No.5, (2014), pp.1679-1682.
[3] W. S. Associate, "Transportation and Economy Report" *MDOT State Long Range Transportation Plan*, Karachi, 2007. C. S. D. L. T. Authority, "Annual Vehicle Statistics," *Annual Vehicle Statistics 2015*, Karachi, 2015.
[4] M. P. a. B. B. Sivasankar, "IoT Based Traffic Monitoring using Raspberry Pi," *International Journal of Research in Engineering, Science and Technology (IJRESTs)*, vol. 1, no. 7, pp. 2454-664x, 2016.
[5] B. J. Saradha, G. Vijayshri and T. Subha, "Intelligent traffic signal control system for ambulances using RFID and cloud," 2017 *2nd International Conference on Computing and Communications Technologies (ICCCT)*, Chennai, 2017, pp. 90-96. doi: 10.1109/ICCCT2.2017.
[6] Pable SN, Welekar A & Gaikwad-Patil T, "Implementation on Priority Based Signal Management in Traffic System", *International Journal of Engineering Research Technology (IJERT)*, Vol.3, No.5, (2014), pp.1679-1682.
[7] Ksiksi, S. Al Shehhi, and R. Ramzan, “Intelligent Traffic Alert System for Smart Cities,” 2015 *IEEE International Conference on Smart City/SocialCom/SustainCom (SmartCity)*, Dec. 2015.