

PRIORITY BASED TRAFFIC LIGHT AUTOMATION USING IR SENSOR THROUGH IOT

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ABSTRACT – In the modern world, it is our prior responsibility to save energy effectively. Nowadays, traffic congestion is a major problem in our country, which affects the modern city's daily life routine and disturb environments. There are many problems such as travel time delay, fuel wastage, air pollution and create issues related to transport. So, traffic monitoring and controlling is the biggest challenge for traffic management authorities. So we are proposing the system whose main objective is to automate the current traffic controlling system in India. It will detect the traffic density using IR sensor. The IR sensor will send the data to the micro-controller which will be fitted in the signal post and according to the density of the traffic, the micro-controller controls the switching of the traffic light. The system will check for the multiple IR sensors reading for the density of the traffic. If the density is higher than any other lanes then the lane will get higher priority and longer time duration (green signal) for clearing out traffic. One more drawback of the old traffic management system is that the emergency vehicles are not getting that much priority as needed.

Key Words: *IoT (Internet of Things), IR Sensor, micro-controller, Arduino, Traffic density detection.*

1. INTRODUCTION

Nowadays, due to an increase in population, several roads, vehicles are increasing rapidly. Handling traffic and controlling it becomes a major challenge in many cities in our country. Most metro cities in the world are still suffering from traffic congestion and related problems. Due to this, it takes a lot of time to reach from source to destination, Fuel wastage at the intersection, air pollution due to emission, death on roads due to accidents and many transport-related problems. Studies show 30% of dioxide emissions are from transportation systems, inefficient traffic management leads to fuel wastage of billion gallons per year, also poor designed traffic signals produce disruptions to traffic flows and increase delays. As per the article in The Times of India [1], the number of vehicles registered per day in India is almost 53,700 which shows that the number of vehicles keeps on increasing faster rate than ever before. So, there has to be an accurate method to control the traffic. Two major cities are connected by expressways, which are causing deaths in accidents due to the number of vehicles and increasing their speed on highways. In recent years, researchers examined highway accidents involved many road users (vehicles, pedestrians, animals) and resulted in Fatal

victims and more than serious injury victims, which is neglected by human beings and government authorities. To solve such problems, intelligent road traffic management systems and authorities required in the highways which can monitor real-time traffic and traffic status at an intersection in cities. Because of this problem one traffic police has to keep a continuous eye on the status of traffic, which could be done by using the Internet of Things (IoT) technology and wireless technology. The latest technology such as IR Sensors can be used for real-time traffic monitoring.

2. LITERATURE SURVEY

Varsha Sahadev Nagmode in [2] proposed a system in which they described the new method by using Ultrasonic sensors which are used for the detection of vehicles and these Sensors are mounted at the roadside. Roadside sensors are detecting vehicles and find the traffic level at that lane. Such levels are low, medium and high which mounted at the particular distance gap. The data sensed continuously and send to the controller for detecting traffic levels. If the traffic level is high, then controller control signal timing at that lane and gives more time to pass vehicles. If low traffic level detects then controller control signal timing at that lane gives less time to pass a vehicle. So this system gives priority to the emergency vehicle at a high traffic level. The controller communicates with the priority system through RF Transceivers. The disadvantages of this system are What if Sensors stop working? It does not have any backup plan for monitoring the traffic if the proposed system fails. To overcome the limitations of the system it should also contain the traditional method of traffic monitoring at the time of emergency.

Paul Jasmine Rani, Khoushik Kumar, et.al., in [3] proposed a system in which IR Sensor is used to detect the traffic on the road. Raspberry Pi is used to instruct the traffic controller to give the appropriate signals based on the denseness of traffic. Infrared sensors are employed at either sideways of the road, makes note of incoming vehicles towards the signal. These signals which have the 'congestion' mark will indicate the Raspberry-Pi processor, which was installed inside the signal. The Raspberry-Pi instructs the traffic controller to show the appropriate signals based on the denseness of the traffic. The major advantage rules out the happening of 'unwanted wait' for the vehicles in the more crowded region.

Om Prakash, Mukul Aggarwal, et.al., in [4] proposed a system in which the system uses GPS-enabled Android phone and when users are stuck in traffic he sends the notification to others of traffic. The primary working principle of the system is the Global Positioning System (GPS). It checks the latitude and longitude of the place and pinpoints the location. Any change in the value of latitude and longitude will measure the distance covered in a certain time interval and thus we will calculate speed. The calculated speed will be displayed and compared with the standard value. If the speed is consistently low, then message will be displayed, and SMS will be sent to particular Contact. The disadvantage of the system was There is a possibility that the user does not communicate with others and that may increase the traffic problematic while network problems. To overcome this problem the system should have a backup plan for the situations where the network gets lost in traffic.

Sabeen Javaid, Ali Sufian, et.al., in [5] proposed a system in which the system is designed to govern traffic at road networks, sensing through sensors, surveillance cameras, and RFIDs which are embedded on roadsides. The system works in a distributed manner, it processes sensors' data at the node level and videos' data at the local server, calculates cumulative density to regulate the traffic according to density. The disadvantage of the system was the time taken by the calculation to generate the desired output.

The existing technologies mostly use Vehicular Ad hoc Network (VANET) which is prone to flooding in the route discovery phase, wasting bandwidth, delayed signals, and increasing network congestions. Numerous models involve managing the traffic which uses Arduino boards. These boards have the lesser capability of handling external physical objects. Some existing models require the geographical-nature of the area and road conditions where they're being employed, making the model more expensive and non-usable. The algorithm which relies on the speed of the vehicle makes the drivers urge, ending up in accidents and increased discomfort. Dynamic algorithms are not employed in the systems where all of the above-mentioned disadvantages are ruled out, making the model slower and non-compatible to use in real-time. Previously, the system cannot detect the actual density of traffic on each lane, therefore time is wasted even when the lane is empty, or else the vehicle stays for a longer time needed. One more drawback of the old traffic management system is that the emergency vehicles are not getting that much priority as needed. To overcome this problem, many systems had introduced but those systems also have some drawbacks.

4. PROPOSED SYSTEM

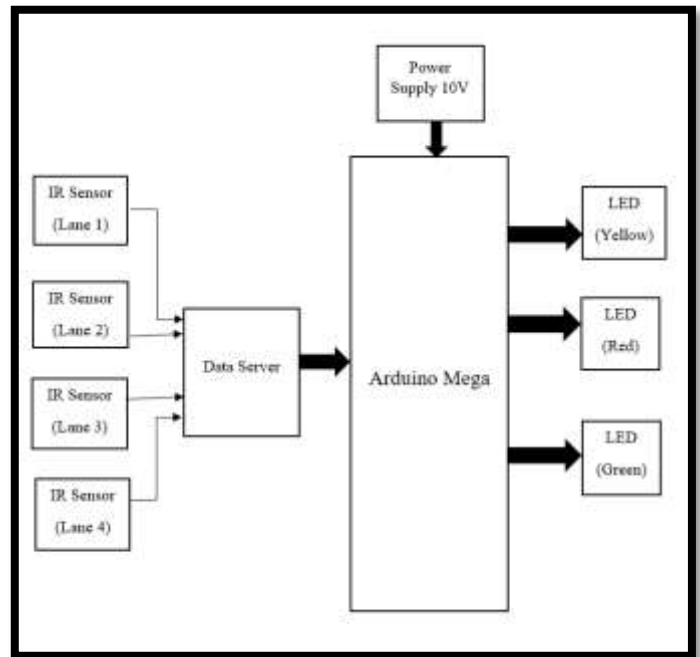


Fig1. System Architecture

The main aim of the system is to automate the current traffic controlling and monitoring system in India. It detects the traffic density using the IR sensor which is density-based and accordingly Arduino controls the switching of the traffic light. The system checks for the multiple IR sensors reading for the density of the traffic. If the density is higher than any other lanes, then the lane gets higher priority and longer time duration (green signal) for clearing out traffic. The data collected from the IR Sensors go to Data Server.

It collects the data of about 5-8 minutes and stores it and forward it to Arduino. When Arduino receives the data, it sets the time of a particular lane according to the number of vehicles it contains. If any two of the lanes are having the same number of vehicles then it sets the signal time according to priority.

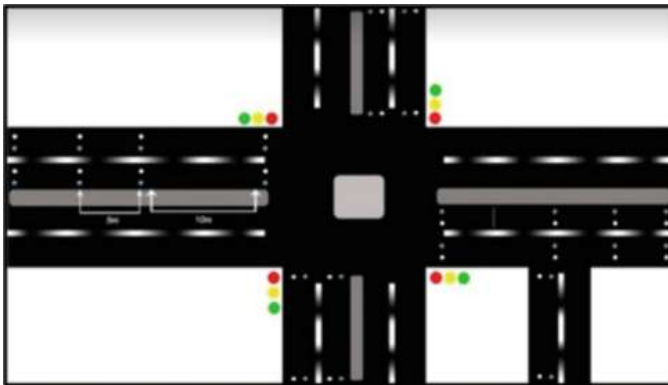


Fig2. Pictorial representation of a system

According to fig 2, the Position of the sensor in this project is beside the road. There will be a sensor grid beside the road and it will sense the traffic over the road. White and blue dots are the grid of the IR sensors and arrows show the gap between two blocks (in meter). Blocks distance depends on the length and width of the road, normally rectangular area. As it is a grid, we get to know the exact density of the traffic in terms of length. There is a calculated gap between the first block and the second block of sensors (Fig. 2). The reason behind this is that traffic is considered to be normal traffic until it reaches the second block and till that period, the traffic signal works normally.

There will be three levels of traffic “NORMAL”, “MEDIUM”, and “HEAVY”(Fig. 2).

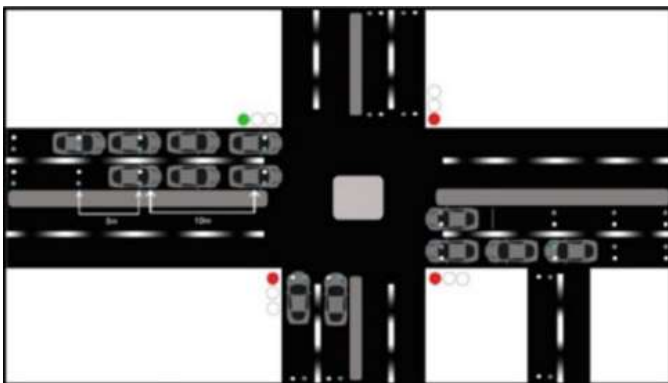


Fig3. Traffic Scenario

The density of each road will be measured in these three categories and time will be allocated (Fig. 3) accordingly to each road. If there is a scenario that any or all the sensors stop working, then the contingency in the signal starts working as normal with fixed time intervals. Figure 3 shows that lane with a higher density of the vehicles gets higher priority and timings over other lanes.

5. CONCLUSION

Our country is ranked highest in the world for traffic-related problems, thus there is the need to reduce traffic-related issues such as long traveling time, fuel wastage, air pollution, and transport-related problems. Here, the system reduces all these problems. The existing scheme faces a major demerits of changing the traffic controller in a clock-wise manner, it does not make note of the traffic denseness. The denseness of the traffic is calculated and the timer display is shift dynamically. This major advantage rules out the happening of ‘unwanted wait’ for the vehicles in the more crowded region. This IoT based automated traffic system can be a powerful step towards the development of future smart cities

6. REFERENCES

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