DENSITY BASED TRAFFIC CONTROLLING SYSTEM USING RASPBERRY PI

P. Hindusri, P. Lehasree, P. Venkata Naveen, S Vishnu UG Students, Department of ECE, Narayana Engineering College(Autonomous), Gudur, SPSR Nellore, AP, India
Dr. P. Rajasekar, Professor, Department of ECE, Narayana Engineering College(Autonomous), Gudur, SPSR Nellore, AP, India :: purinihindusri@gmail.com

Abstract— Vehicle traffic plays a significant role in passenger and goods transportation. It is a key role in fuel consumption and vehicle maintenance. Traffic congestion is a series of issues in the modern traffic system, which leads to overburden to the individual as well as traffic authority. Presently the adopted traffic management systems mostly use the static based time management system which focuses only on the time duration for each lane. Presently, congestion management is not based on density, which is based on time slots. But our proposed system primarily focuses on the density of automobiles in the street, the congestion controls in automatic, which consists of IR sensors and raspberry pi module. The IR sensors detect that there may be an automobile in front of it. IR sensors sense the vehicles and send the detected signals to the main controller Raspberry pi. Based on the signal received from the sensors module, Raspberry pi control the traffic light.
Keywords— Traffic signals, Raspberry pi, Traffic density, IR sensors, Vehicle detection through IR sensor.

I. INTRODUCTION

Traffic congestion could be a relentless drawback in several cities around the world. Congestion means that many vehicles struck at a specific area. Traffic comes up with increasing of number of vehicles throughout the world [1].This projected system ends up in creating the traffic less and permits the vehicles primarily based upon the density of the road. [3]. Aim of this project is to cut back the traffic in areas wherever there's a significant density of vehicles by implementing the Raspberry Pi operation at the side of IR sensors.Raspberry Pi module is interfaced with IR sensors and LED lights. IR light falls on the vehicle and reflects back, IR sensor detects the IR light. It means that there are vehicles up to that distance where we have placed the IR sensor. Vehicles got struck up to that distance. Hence, IR sensor sends signal to the Raspberry Pi module, to which the IR sensors were interfaced at GPIO 26 and GPIO 19. RPI module on the LED lights at the lanes based on density of vehicles. At heavy density of vehicles the green light will glow. At the other side red light will glow. This is the methodology of our proposed system. [1], [3].

II. LITERATURE SURVEY

According to the current statistics, an average person spends around 4-6 months of his/her life by simply waiting for green light during the traffic. When the delay increases due to the provided time slots of traffic signals, a person has to wait at red signal eve there is no traffic.

The flaws of existing model include time slot technique which makes more time to get clear the traffic. Due to this time slot technique, it would not able to detect the traffic automatically. Based on the time mentioned for it, the red or green signal will appears, which makes delay [3], [4], [7].

The second is manual technique; in our existing system we are not using automatic clearance of traffic. due to this more traffic occurs and leads problem for clearing traffic. at that times man power needed to clear it. [6]

In past years, to overcome this traffic problem surveillance system has been utilized. There exist various methodologies to control traffic such as radar, ultrasonic sensors, and microwave detectors. But these all methodologies are expensive, with less capacity, these are difficult to maintain, difficult to implement, and needs extra maintenance charges. [9]

Our proposed system based on Raspberry Pi module with IR sensors to detect the vehicles and LED lights to glow at the junctions. In general we are having red, yellow and green lights at junction. But to the system automatic we simplified it to two lights which are red and green. Our proposed system is low cost and able to detect the traffic based on the density of vehicles.[7].

Iɴ. EXISTING SYSTEM

Our existing system which is in use today is not automatic and is time lapse based. According to survey an average 6 months of a person's life is spended at traffic signals to wait for green light.

Fig 3.1: Excessive traffic.

This time slot based technology not having too many advantages and having disadvantages instead. Whenever there is full of traffic the red light will be glow according to time, which leads to access traffic. When there is no traffic the red light will glow, which leads to again traffic. [3].

Fig 3.2: Traffic controlled manually by traffic police.

To overcome these situations a new system is going to implement which will manage those all conditions and manage traffic based on density.

III. PROPOSED SYSTEM

In our current proposed system, Raspberry Pi module and IR sensor plays a magic and major role. Taking an L- junction in our project and implementing it implementing it to other L- Junction too will make the traffic to clear in 4-way junction.The rule in our new proposed system is where there is no light grown in any way of road it says that there is no traffic in a road. So, we have to understand when neither red nor green LED glow at that road, our vehicle can able to move without any destruction. [4].
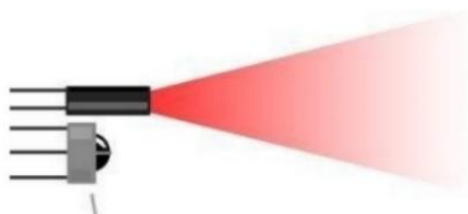

Fig 4.1: No object present- no IR light detected by sensor.

The first condition is, both sides no traffic. So, no light will glow on both sides and says that road is free of traffic as shown in Fig 4.1.

In the second condition, the second side of the road is blocked and first side is free of traffic. So that at second IR sensor it detects traffic. And at second road, green light will glow and at another road red light will glow.

In the third condition, the first side is blocked with the traffic and second side is free of traffic. So at the first road green light will glow and at another road red will glow until the first road gets cleared.
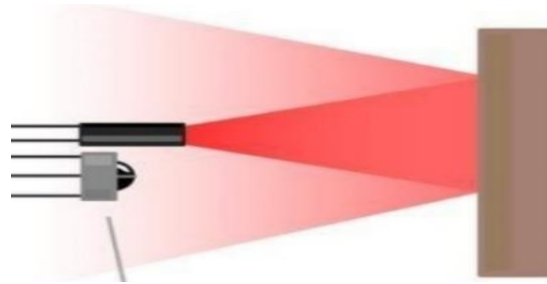
Fig 4.2: Object present-IR light detected by sensor.

In the fourth condition, both roads get stuck with traffic. So, here the implementation of time will occur.

The green signal will be giving to the sensor which had detected the traffic before the second sensor. Because 1 second is infinity for a machine, based on time which sensor got deducted traffic within fraction of second before the another sensor, that side will be getting green light first and after clearing that road, the second road will be getting green light.

This is our proposed system where automation comes to overcome the past system which are manual and creates time slots and are slow. This system reduces time and able to clear traffic automatically. [6],[9].
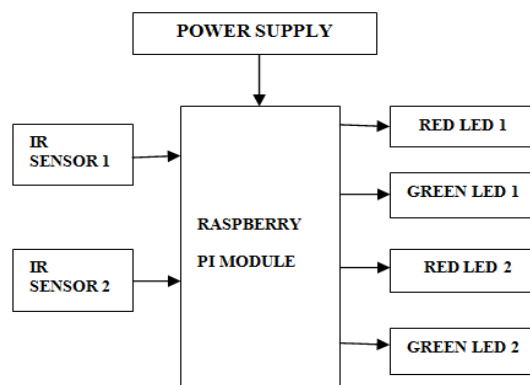
A. Block Diagram

Fig 4.3: Block Diagram of Proposed System.

The above shown diagram is the block diagram of our proposed system, which consists of Raspberry pi module, IR sensors, LEDs and power supply. The interfacing among raspberry pi module, IR sensors and LED lights occurred. Here IR sensors used for taking input, where input means the detection of vehicle. Whenever IR light sensed by the IR sensor, it sends signal to the raspberry pi. Then based on the program dumped in to the module, it provides either red light or green light accordingly. [7], [8].

Hardware requirements are Power supply, Raspberry Pi module, IR sensors, LED lights (red and green).

The code processing includes four logics:

Table4.1: Implementation of logic.

LANE 1	LANE 2	DESCRIPTION
0	0	No traffic at both lanes.
0	1	Traffic at 1st lane, no traffic at 2nd lane.
1	0	Traffic at 1st lane, no traffic at 2nd lane.
1	1	Traffic at both lanes.

In the above '0' indicates no traffic and '1' indicates traffic.

No traffic at both junctions can be taken as 0, 0 logic.

Traffic at 2nd junction can be taken as 0, 1 logic.

Traffic at 1st junction can be taken as 1, 0 logic.

Traffic at both the junctions implemented as 1, 1 logic.

For implementing it to 4-way junction, same logic will be applicable to another L-junction.[1], [4], [5].

IV. RESULT

The contemporary proposed system for detecting the vehicular traffic and giving signals based on the traffic is presented by the below shown pictures.
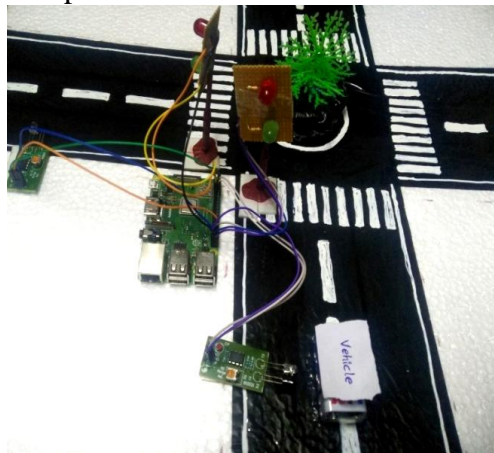

Fig 5.1: Interfacing traffic lights and IR sensors with Raspberry Pi.

The above shown picture which is fig 5.1 is interfacing of traffic lights and the IR sensors with the Raspberry Pi pins. The two IR sensors are interfaced to the raspberry pi pins of GPIO 26 and GPIO 19.
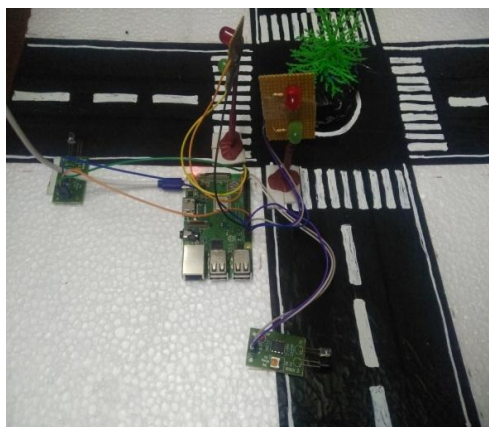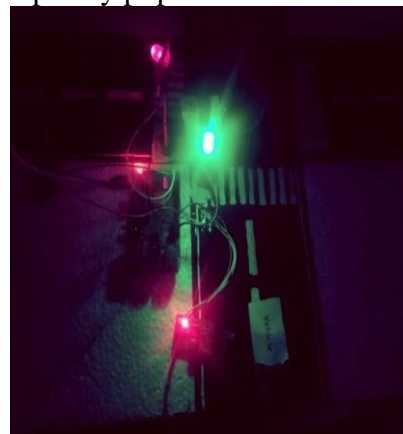

Fig 5.2: Hardware Setup.   Fig 5.3: Traffic Lights Output.

The above shown picture clearly gives the output. In the firstroad, traffic detected by the IR sensor. Hence, the green light glow at the first road and the red signal at the another road.
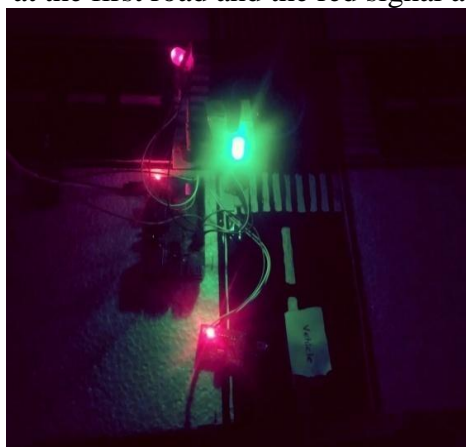

Fig 5.4: Traffic Lights Output

The results of this traffic controlling system which is controlled by Raspberry Pi module are shown in the above pictures. This project is quite different from our current system which is manually managed or else time slots based system. The green signal will be given to the lane which got struck by the traffic, that road will be cleared first and then the green signal will be provided to another lane. In our proposed system we

had taken two lanes which is considered as an L-junction. If we want to apply it for 4-way traffic road we need to implement the same logic to other two lanes.

V.CONCLUSIONS

Based on the density of the vehicles in heavy traffic areas we are using this methodology to reduce the traffic at those junctions. A camera module can able to install to monitor the vehicles. The theme of using the camera module for further implementation is, for penalty collection, when vehicle crosses the red signal. We are now collecting it manually by implementing it to the automatic mode we can able to increase the technology further. If we want to apply it to four lane then we have to implement another raspberry pi module at another L-junction.[3], [7]

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