IOT PHASE 2

INNOVATION IDEA IN TRAFFIC MANAGEMENT SYSTEMS

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INTRODUCTION

- Traffic congestion has increased drastically over the years and has had negative impacts that include road rage, accidents, air pollution, wastage of fuel and most importantly unnecessary delays.
- One of the many causes of traffic congestion is improper traffic management systems
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- One of the many causes of traffic congestion is improper traffic management systems.
- This traffic management system fulfills its duty circumstance the smooth movement of vehicles and it also has a fail-safe system which will prove useful in unexpected circumstances.

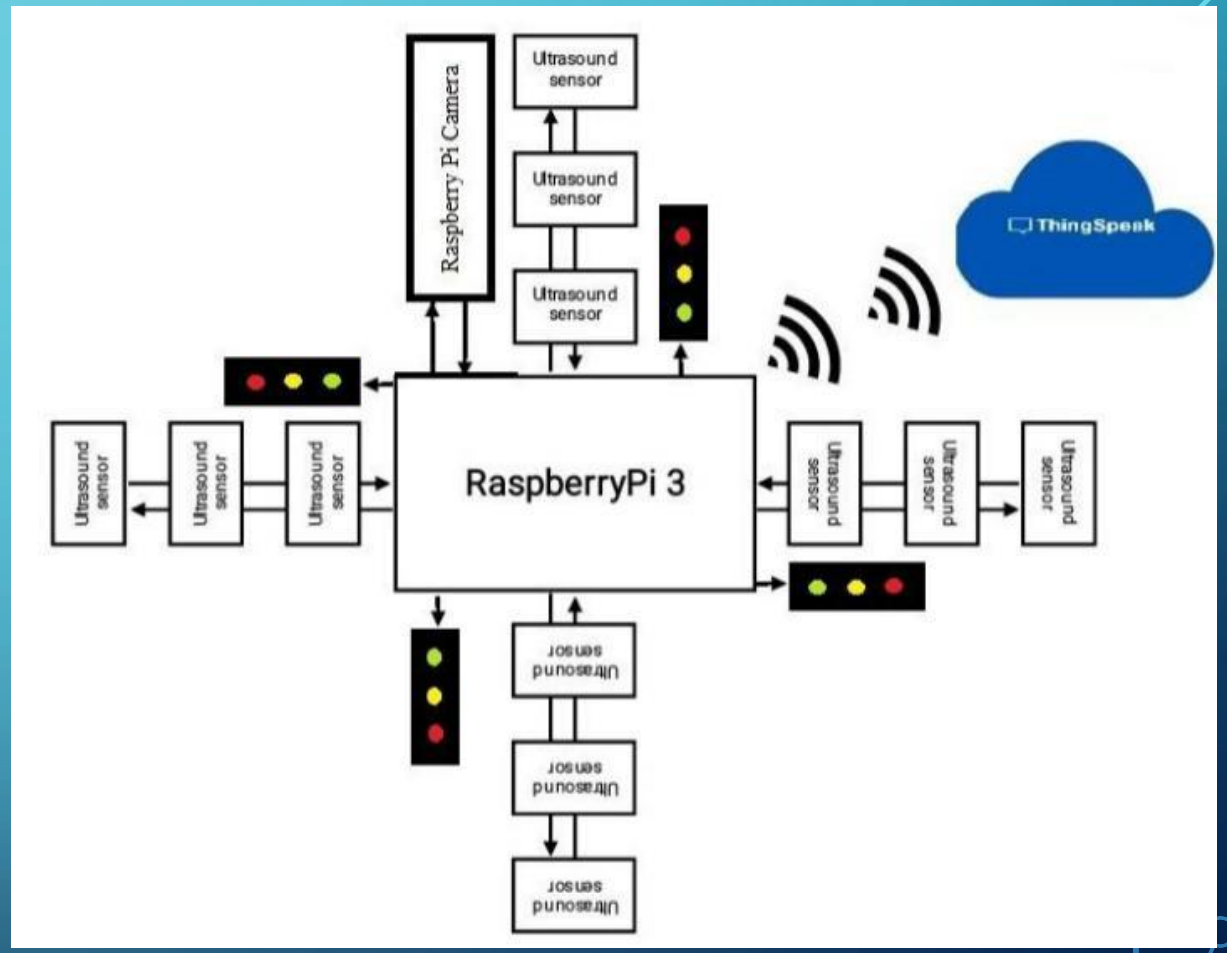
METHODOLOGY

Components required :

- Raspberry Pi
- Camera
- Yellow green and red indicators
- Ultrasonic sensors
- Thingspeak- iot platform

BLOCK DIAGRAM

- The ultrasonic sensors and the camera serve as input devices, the indicators as output devices, and the Raspberry Pi as the edge device that is used to communicate with the cloud.

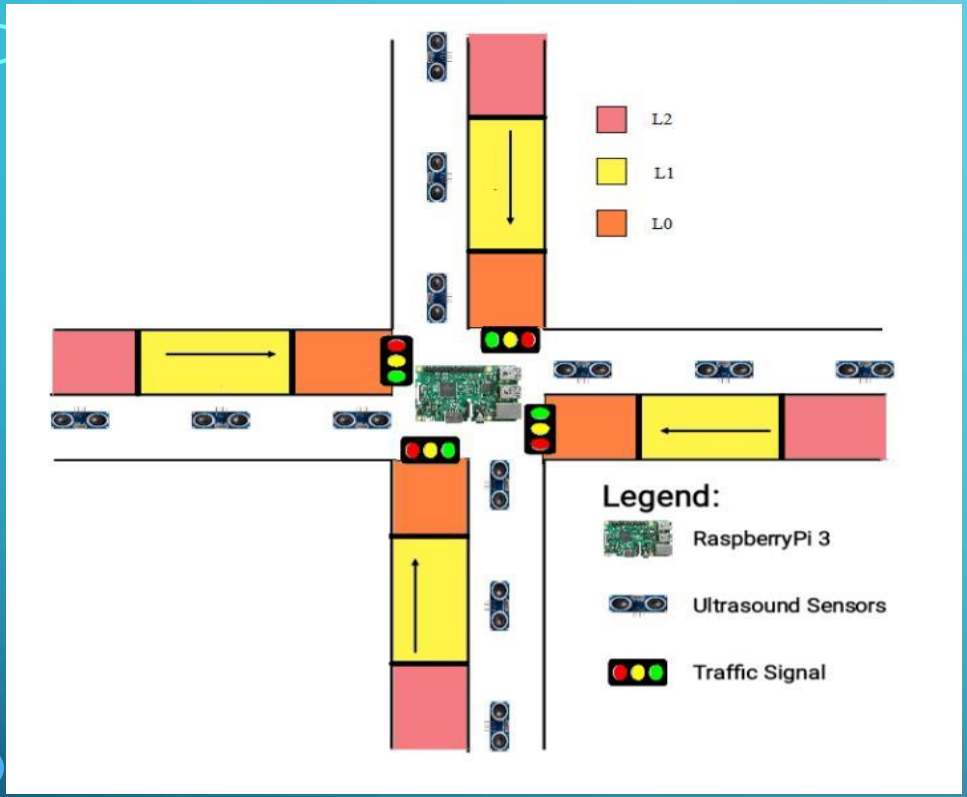


WORKING

- The main purpose of the smart traffic managements system is to allot timings to a traffic signal based on the level of traffic on a lane.
- In order to calculate the level of traffic on each lane the road is divided into three equally spaced sections.
- These sections are labeled L0, L1, and L2 shown in figure.
- Each section houses an ultrasonic sensor to determine if vehicles are present in that particular area. The ultrasonic determines the presence of an obstacle by finding the distance taken for a transmitted signal to be received.

WORKING

- In addition a camera is placed at the junction who takes images of the lane at periodic intervals. Using image processing techniques, the image of an empty road is cropped into the three sections.
- The mean value of this empty road is compared against cropped images of the actual road to find the level of traffic in the area.
- Based on the vehicles present in a section the level of traffic is classified as low, medium and high as portrayed in the table below.



Schematic diagram showing the different section L0, L1, and L2

Level Of Traffic	L0	L1	L2
LOW LEVEL	p	x	x
	x	p	x
	x	x	p
MEDIUM LEVEL	p	p	x
	x	p	p
	p	x	p
HIGH LEVEL	p	p	p

Traffic Levels based on presence of Vehicles in variation section

WORKING

- The ultrasonic sensors and the results from the image processing techniques are sent to the Raspberry Pi and based on the inputs received the Pi calculates the level of traffic and accordingly allots the time to the traffic indicators.
- These values processed by the Raspberry Pi are further sent to the IOT platform (ThinkSpeak) where they can be stored in the form of a database useful for analyzing traffic density patterns in a particular area.
- In addition, the Raspberry Pi compares the values provided by both the ultrasonic sensors and image processing results to make sure the level of traffic is the same in both the cases.

WORKING

- If there appears to be a large variation in readings on multiple occasions then the values stored on ThinkSpeak provide sufficient data to run the traffic lights in the absence of the sensor system.
- This does not provide accurate results, but the timing allotted to the traffic lights are based on previous levels of traffic calculated over an extended period of time.
- So saying the above mentioned system has a fail-safe system that can be used in case of failures too.

RESULT

- The results obtained are based on the prototype as shown in Figure of a four way traffic junction.
- The ultrasonic sensors used in the prototype is the HC-SR04 as portrayed in Fig.

HC-SR04 ultrasonic sensor

RESULT

- These sensors can be used to determine the presence of an obstacle which in our case is vehicles.
- Each lane houses three sensors which are placed at equal distances and are positioned vertically at the divider.
- For the four roads a total of 12 ultrasonic sensors are used.
- These sensors are connected to the Raspberry Pi using jumper wires and the information collected by the sensors is processed by Raspberry Pi.
- The Raspberry Pi camera module portrayed in Figure serves as to capture Real time traffic image.

RESULT

- These images are processed using Python Image Library (PIL) and Numpy libraries-supporting large multidimensional arrays and matrices.
- The Pi then determines the level of traffic and allots timing to the traffic light indicators which are the red, yellow, and green LED's. Figure shows the setup of the prototype housing the camera module, the Raspberry pi, the ultrasonic sensors and the traffic light indicators.
- Figure portrays how the ultrasonic sensors determine the level of traffic.
- As shown in the figure, the densities on Road 1,2,3,4 are respectively low, medium, no traffic and high. The corresponding values displayed on the python terminal confirm that the sensors read the same values.
- Every time the Raspberry Pi finds the level of traffic it updates the values to ThinkSpeak.

RESULT

- On the ThinkSpeak platform the values that are sent can be stored in the form of a graph as Every time the Raspberry Pi finds the level of traffic it updates the values to ThinkSpeak.
- On the ThinkSpeak platform the values that are sent can be stored in the form of a graph as shown in Figure Allowing the channel to be made public gives access to anyone who would like to view the level of traffic at a specific junction thereby enabling users to be well informed of the traffic density in a region shown in Figure Allowing the channel to be made public gives access to anyone who would like to view the level of traffic at a specific junction thereby enabling users to be well informed the traffic density in a region.

Four way traffic junction prototype

RESULT

- In addition these values can be converted in the form of a database using the data export option, which will also serve as a source of information of traffic levels. This data can be made useful in case the sensor system fails by finding the average density of traffic at specific time slots.
- This information gathered can be used to assess and control the traffic lights in real time depending on actual densities of traffic. This will intern help in saving time and reducing the negative effects of traffic congestion.

CONCLUSION

- This system configuration reduces huge traffic queues caused by the conventionally implemented system used in many places.
- The system also additionally reduces the workload of officers who would have to direct traffic in unexpected situations, or when the traffic lights are not responding.
- It also enables traffic lights to work continuously with less chances of malfunctioning.
- The system in simple words provides a simple yet effective solution to improper traffic management systems.