Automated Signaling based on Vehicle Density

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Abstract: Traffic Research need to be done to optimize traffic flow may be of human or of goods. As the number of people who uses roads is constantly increasing in proportion to resources provided by current infrastructure, intelligent traffic control will become an important solution to such problems. The increasing number of vehicles and minimal highways development policy is leading everyone to a traffic jam problem. Many aspects which lead us to traffic jam's like, number of vehicles on road s, human habits, social behaviors and mainly traditional traffic control system. The major factor is the traditional traffic control system which monitors the traffic signals. The system force us to deploy more number of traffic personals at intersection to manage traffic during peak hours, due to which we can say that the root cause can be an ineffective traffic light controllers. If effective control systems are implemented then capacity and performance of traffic control system can be resolved. A system which includes new technological advancements and traditional concepts together it is possible.

Keywords:- Automatic traffic, Internet of Things, Infrared sensors, AVR 328 microcontroller, Raspberry pi and camera.

1. INTRODUCTION

Urban population is continuously increasing and the massive effect is on mobilization of cities. According to United Nation the population of whole world constitutes 57% in 2015, with stead increase of 1.84% every year. As per survey around 64% of the developing countries and 84% of developed countries will be urbanized. And with this massive urbanization, the major issue need to tackle is traffic control in big cities.

The traditional traffic control system includes traffic lights with fixed timers, and manual control using Traffic Police, which is ineffective in today's congestion. The need is something different, which should include the real time traffic and manage signals accordingly. Traditional system may flash green light, though no vehicles are present on the route, and red light is flashed after stipulated time period though you have a heavy traffic on the given lane. This is due to fixed allotments of timers for all three types of lights.

Dynamic traffic control can be useful in this scenario. The system contains IR sensors for measurement of traffic density in three ways i.e. high, low, medium. The binary sensors are also used alongside IR. The sensors are mounted on road sides. The status of IR sensor which is mounted for around 100 mtr. area on roadside will help in measuring the density. We are mounting 10 IR sensors at a specific distance to perform the task. If three sensors are ON density will be measured as low, Six sensors are ON density will be considered as medium and more than six density will be HIGH. A Microcontroller is controlling the IR system, and based on density values it will operate signals dynamically.

Raspberry Pi is used in our project for another application of proposed system. The system will keep an eye on riders those who are breaking signals. Image of the rider will be captured if he crosses the boundaries mentioned i.e. Zebra Crossing Line, and image will be transferred to RTO officer for further actions. Our application also considering of a solution for Emergency Vehicles. Signal will automatically turn to green if it finds an emergency vehicle in front of it. An emergency signal will be passed on by Ambulance from inside. This functioning can be done with TSOP sensor and IR Remote.

2. PROBLEM STATEMENT

In traditional traffic control system, traffic management is done on the basis of fixed timers, which are unable to handle the extra flow of traffic. As in the human monitoring is needed for control and management. These problems are needed to be tackled and the proposed system is offering such solutions.

A. Heavy Traffic Jams-

As With increase in number of vehicles and mobilization of people from rural to urban areas, huge congestion problem urban crowd has come across. This congestion usually happens in the peak hours that are in morning and in evening. People spend a lot of time on roads dealing with it. We can solve this problem by developing a program, like for different junctions we can have different time delays.

B. Lane traffic management:-

At intersection points, it may happen that the traffic is all passed but still the signal is green and other lane where there are vehicles waiting, the signal is not turning green. If people break signal that means if signal is red and people pass by then they may have to pay fine. We have proposed a solution for the same, where system will detect the density of traffic and act accordingly for each and every lane. To elaborate more, if there are more vehicles at the signal then the system will allow green light to glow for more time and vice versa.

C. Emergency vehicle stuck in traffic-

Consider a certain traffic junction, where a number of vehicles are waiting for the green light to turn on. There can also be emergency vehicles like ambulance, fire brigade, police etc. stuck in that traffic. This can cause a critical problem and increase complications. The proposed system attempts to solve this problem in a very effective way. When an emergency vehicle comes across such situation then based on the remote provided to such vehicles the signal will turn green until that emergency vehicle passes the junction.
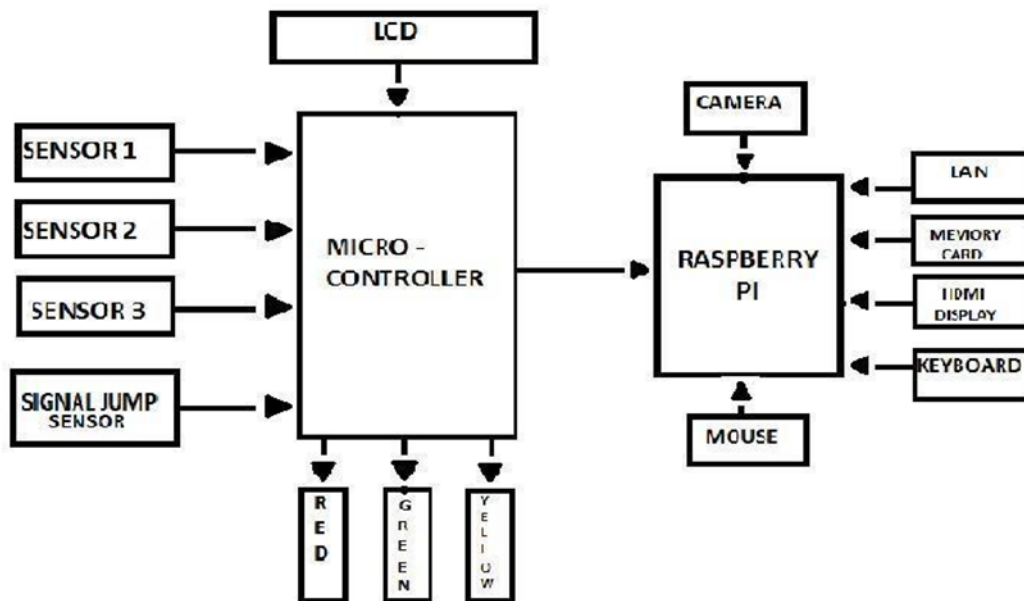
Microcontroller that is used in the proposed system is AVR 328. The program for change in time based on density of vehicles at the junction is stored into the microcontroller. This density-based operation will be performed by the IR sensors. Three IR sensors will be responsible for performing density-based operation, one for high density, one for medium density and one for low density. Whenever a particular density will be detected, may it be high, low or medium, the signals from the sensors will be sent to the microcontroller and accordingly the variation in time will occur and be displayed on the LCD. More appropriately, if high density is detected then green signal will be active for more time and when low density is detected then green signal will be there for less time.

The fourth sensor that you find in the above diagram, named as signal jump sensor is also an IR sensor and is used to perform the function of detecting the person breaking the signal. If it detects a person then it sends signal to Raspberry Pi for capturing the image of person breaking the signal which in turn runs a python script stored into it. This python script commands the camera to click photo and save it in the Home folder of Raspberry Pi. This saved image is further sent via attachment through mail to an authorized user for example RTO officer.

4. SOFTWARE INSTALLATIONS:

To deal with Raspberry Pi, Raspbian OS is installed into memory card. We can do it through Win32DiskImager.exe where in the installed version of Raspbian OS can be browsed.

Figure 2. Raspbian Installation

When we turn on the Raspberry Pi, certain software programs are installed like fswebcam, ssmtp, mailutils and mpack. This can be done through the command,

Sudo apt -get install <software name>

Following this syntax,

"Sudo apt -get install fswebcam" will install all the necessary inbuilt camera drivers.

"Sudo apt -get install ssmtp" will deal with mail sending protocols.

"Sudo apt -get install mailutils" will take care of the structure of mail.

"Sudo apt -get install mpack" will be used for attaching the image to the mail.

5. MAIL PROCESSING:

For sending mail you have to provide information like hostname, user, password etc through the command prompt and then process with the attachment.

Sudo nano /etc/ssmtp/ssmtp.conf Here,

Mailhub = smtp.gmail.com:587 Hostname = raspberrypi

AuthUser = trafficsignaliot@gmail.com (Mail id through which you have to send mail) AuthPass = iot12345(Password of the above account) X

At the end,
UsesSTARTTLS = YES (For low security)

For any program to run , the syntax goes like : sudo <program name> <File name>.<extension>

Example, sudo python email.py (This command will run a python script named email).

6. RESULT:

The result includes the successful working of the dynamic signaling system. To start the system, we will have to give power supply to Raspberry Pi and 12V DC supply through adapter to the PCB. As soon as the system is started, the signal lights that are green, red, yellow lights will start glowing with normal time. 4 sensors will be attached to the roadside like signal jump sensor, low density sensor, medium density sensor and high-density sensor respectively. When the light is red then a speed breaker will come up on the road. Based on the density of vehicles, there will variations in green signal time at the junction. If the signal light is red and still a person tries to pass by then that will be sensed by the signal jump sensor and immediately camera will capture the photo and send it via mail to any authorized person to take further actions.

7. CONCLUSIONS AND FUTURE SCOPE:

While designing this system, we have studied the optimized results of traditional traffic control system of City using AVR 328 Microcontroller, Raspberry Pi and Sensors. The system works on traffic related issues like Traffic Congestion's; unwanted delays while riding, emergency vehicle assistance during emergency signals. The emergency gate ways can be done by forcing current traffic to stop by external triggering through emergency vehicle triggering system and clearing the road clutters form smooth movement of it. The structure of a system is so simple so the benefits are more as compared to traditional one. The system is highly reliable, low costing, easy for installation and maintenance. The block diagram shown above will give a brief idea about proposed system. The system will help you to avoid traffic jam's caused due to traditional system. Based on Density the time variations can be managed to control each and everything. The person who is breaking a signal will be captured and sent to desired location for further actions.

The future extension of the system can be possible. The system can be extended in a way to automatically control the signaling system depending on the traffic on the road. This system can be extended and further it can have a huge scope like,

The system can be enhanced in some ways. The proposed system can be implemented for all signals of a city for a trial basis. The higher sensors can be used to detect sensors like Beacons. etc. The beacons are used to send IR signals, if they are connected to all vehicles we can more accurately calculate the density on each lane. The system can be switched off automatically if no vehicles are detected for a stipulated amount of time.

Even time duration for a day can be considered, when the density of vehicles is more. By considering the time slot system can manage the traffic control system.

Scope of enhancement can be like, if any one attempts to break the signal then directly the amount from their account will be deducted and they will get a message of that.

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