Gridlock Surveillance and Efficient Reconciliation

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ABSTRACT

Nowadays road congestion is a major problem due to increasing number of vehicles especially in cities. At present, video monitoring and surveillance systems have been widely used in traffic management. This project is designed in order to achieve effective traffic management. Here we use camera which is placed on the traffic pole that captures the image regularly in the traffic junction and calculates the vehicle density (approximately) in lanes using digital image processing technique. After calculating the density of vehicles, the high-density lane is detected. According to that, the signal timing is allotted by using a raspberry pi. This also provides facility to handle emergency vehicles automatically and efficiently by using IoT.

Keywords: Traffic Control, Raspberry-Pi, Image Processing, Density Calculation, Emergency Vehicle.

1. INTRODUCTION

India is a developing country and ranks second in world’s population. The population, in turn, increases the usage of transportation. The existing traffic control system is based on the time which is already assigned in the system. According to these times, the signals are working in each lane. But in these system condition is occurs as all vehicles in lane (L1) are passed and vehicles in another lane (L2) still in waiting state because time is not over and hence signal is still red. These systems are very inefficient because they are unable to handle various simple situations which occur throughout the day. The major drawback is it has unnecessary waiting time and there is no facility to handle emergency vehicles. The project is designed to develop a system which performs execution based on the density of vehicles (Vehicle Count) using the camera. After calculating the number of vehicles we will come to know in which side the density is high based on which signals will be allotted for a particular side. Raspberry Pi is used as a microcontroller which provides the signal timing based on the traffic density. And can provide facility to handle emergency vehicles automatically and efficiently by using IoT, the signal from the emergency vehicles are given to the controller so that the desired signal is controlled in the junction.

2. EXISTING TRAFFIC LIGHT CONTROL SYSTEM ARCHITECTURE

In this system, signal timing is fixed equally for all the lanes, even though the vehicle count varies in the lanes.
BLOCK DIAGRAM:

Components used in this system are

a) ZIGBEE MODULE CC2500:
ZigBee is an open, global, packet-based protocol designed to provide an easy-to-use architecture for secure, reliable, low power wireless networks. The RF transceiver is integrated with a highly configurable baseband modem. The modem supports various modulation formats and has a configurable data rate up to 500kbaud.

b) GSM MODULE SIM 300:
A GSM module is a combination of “GSM IC” and some interfacing circuitry. This GSM IC is same as the GSM IC present in our cell phone. It provides serial TTL interface for easy and direct interface to microcontrollers. The examples for GSMIC are SIM300, SIM900, and SIM900D etc. Besides these, there may be Audio I/O interface, serial Communication terrace present in the module.

c) RFID READER-125KHz-TTL:
RFID (radio frequency identification) systems use data strings store inside RFID tags or transponders) to uniquely identify people or objects when they are scanned by an RFIDreader. These types of systems are found in many applications such as passport protection, animal identification, inventory control systems, and secure access control systems, robotics, navigation, inventory tracking, payment systems, and car immobilization.

d) MICROCONTROLLER (PIC16F877A):
This controller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it uses FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output. PIC16F877A is used in many pic microcontroller projects. It is used in remote sensors, security and safety devices, home automation and in many industrial instruments.

Drawbacks of Existing System:
In the existing system, fixed time concept is used. The limitation of this system is unnecessary waiting time and there is no facility provided for emergency vehicles. These systems are very inefficient because they are unable to handle various simple situations

3. PROPOSED GRIDLOCK SURVEILLANCE AND EFFICIENT RECONCILIATION ARCHITECTURE
The proposed system reduces the traffic jams, by capturing images using camera which is fixed at the junction and densities of lanes are found. Based on the density, more timing is given to high-density lane than low density. Hence reduces the waiting time for vehicles. It also provides the clearance for the emergency vehicle if any. For e.g., Fire emergency, ambulance emergency etc.
In this proposed system, raspberry pi is used as a microcontroller. The camera placed at the traffic poles capture the image that is further processed in an open cv software. The approximate density of vehicles is calculated by using this count the processor changes the signal timing. The timing is allotted more for high-density lanes when compared to low-density lanes. In case if any emergency vehicle crosses the lanes, it sends message to the server and then server command the server to clear that particular lane. After crossing the signal vehicle acknowledges its departure, the process continues as before. It involves,

- Density Measurement.
- Time Allocation (based on vehicle density).
- Emergency vehicle detection.

1) DENSITY MEASUREMENT
The camera captures the image, and the following process takes place.

i) SOURCE IMAGE: In this system, the source image is the RGB image which can be given by the users for getting the contour image and the vehicle count in the output screen.

ii) GRAYSCALE IMAGE: The gray scale image can be used to display the object in the form of black and white. The source image is converted into gray scale image.
iii) **THRESHOLD IMAGE**: The threshold image, brightness or contrast the grayscale image. In this system, we can convert the grayscale image to threshold image.

![Threshold Image](image1.jpg)

iv) **CANNY IMAGE**: Canny image is the image of the edge detector that can be used to outline the edges of the objects. It can be helpful for finding the objects. Here we have converted the threshold image to canny image.

![Canny Image](image2.jpg)

2) **TIME ALLOCATION**

Now the image is in black and white form, (the green strip area- white color and background – black). Green pixel area of this image is measured. Based on the pixel count, traffic signal timing is allotted for the lanes. The three traffic conditions (low, medium and high) are specified.

- High traffic- 35 seconds
- Medium traffic-30 seconds
- Low traffic-25 seconds
- No traffic- default (minimum)

3) **EMERGENCY VEHICLE DETECTION**
The proposed system also gives importance to the emergency vehicle. For eg:- fire emergency, ambulance, etc. Every junction is provided with an identification number. Whenever an ambulance enters into any junction, it communicates with the server through that number. The server sends the request to raspberry–pi kit and the kit will change the signal. The vehicle acknowledges the server after it passes the junction then the normal process continues.

**PROPOSED SYSTEM FLOW:**

![Diagram showing the proposed system flow]

**4. HARDWARE SPECIFICATION**

A) **Raspberry-pi Device**: A Raspberry Pi is a credit card-sized computer originally designed for education, inspired by the 1981 BBC Micro. Creator Eben Upton’s goal was to create a low-cost device that would improve programming skills and hardware understanding at the pre-university level. But thanks to its small size and accessible price, it was quickly adopted by tinkerers, makers, and electronics enthusiasts for projects that require more than a basic microcontroller (such as Arduino devices). The Raspberry Pi is slower than a modern laptop or desktop but is still a complete Linux computer and can provide all the expected abilities that imply, at a low-power consumption level.

B) **Power supply**: As per the power requirement of the hardware in traffic light control system using raspberry-pi is the required power supply of 5V with respect to Ground.

C) **Light emitting diode**: A light-emitting diode (LED) is a semiconductor device that emits visible light when an electric current passes through it. The light is not particularly bright, but in most LEDs it is monochromatic, occurring at a single wavelength. The output from an LED can range from red (at a wavelength of approximately 700 nanometers) to blue-violet (about 400 nanometers). Some LEDs emit infrared (IR) energy (830 nanometers or longer); such a device is known as an infrared-emitting diode (IRED).

D) **Camera**: A camera is an optical instrument for recording or capturing images, which may be stored locally, transmitted to another location, or both. The images may be individual still photographs or sequences of images constituting videos or movies. The camera is a remote sensing device as it senses subjects without any contact. The functioning of the camera is very similar to the functioning of the human eye.

**5. SOFTWARE REQUIREMENTS**

A) **Raspbian OS**: raspbian is a debian-based computer operating system for raspberry pi. there are several versions of raspbian. raspbian is highly optimized for the raspberry pi line's low-performance arm cpus.raspbian uses pixel, pi improved xwindows environment, lightweight as its main desktop environment as of the latest update. it is composed of a modified lxde desktop environment and the openbox stacking window manager with a new theme and few other changes.

B) **Python**: Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. Python is available on a wide variety of platforms including Linux and Mac OS X. Python is designed to be highly readable.
6. OUTPUT

Density measurement

a. Image capturing

![Image captured by the camera which is further processed for vehicle count.](image1.png)

b. Edge Detection

![By this process approximate vehicle count is calculated.](image2.png)

Based on this output, signal timing is allotted for the particular lanes.

**Emergency Vehicle Clearance**

When emergency vehicle enters the junction, then it sends arrival information to the server by using Iot. Then the processor and server communicate between them for lane clearance.
7. FUNCTIONS

- Turning ON-OFF of Traffic lights in sequence.
- Control for ambulance-receiving the signal from the server and making the respective lane's traffic light green.
- Control for VIP vehicles-receiving the signal from IR receiver and making the respective lane's traffic light green.
- Density control - receiving a signal from IR receivers and changing the delay of traffic light green signal from 6sec to 12sec.
- Sending a message to the processor, changes the signal timings.

Advantages:

- Less human intervention as the whole system is automated.
- It provides a facility for emergency vehicle clearance.
- Continuous monitoring of the traffic junction for vehicle count and according to that count the signal timing changes.
- Efficient system.

8. CONCLUSION

This proposed system reduces the possibilities of traffic jams, caused by high red light delays and provides the clearance to the emergency vehicle, to an extent successfully. In this system, we find the traffic density using Morphological filtering Blob analysis. The roads highest priority is cleared first. The proposed system also gives importance to the ambulance. If any ambulance is waiting for a signal then the particular lane is given high priority and the traffic in that lane is cleared. Whenever emergency vehicle enters the lane, by using camera image, Morphological filtering and blob analysis detects vehicle and sends signal it to microcontroller and raspberry-pi. The raspberry-pi gives high priority to the emergency vehicle and clear the traffic density depends on python programming.

9. FUTURE SCOPE

Blinking of traffic signal light according to the traffic level present on the road. This system manages traffic when any emergency vehicles come. For example ambulance, fire bridged etc. The proposed system will have a wider future scope that user can get traffic information on mobile phone.

10. REFERENCES