INTELLIGENT TRAFFIC LIGHT AND DENSITY CONTROL USING IR SENSORS AND Raspberry Pie.

Bhavana Yogesh Mohite, Renuka Molavade, Priyanka Patil ,Utkarsha Raikar, Prof: Santoshi Gupta

Abstract:

Nowadays congestion in traffic is a serious issue. The traffic congestion can also be caused by large Red light de-lays, etc. The delay of respective light is hard coded in the traffic light and it is not dependent on traffic. Therefore for simulating and optimizing traffic control to better accommo-date this increasing demand is arises. In this paper we stu-died the optimization of traffic light controller in a City us-ing raspberry pie and IR sensors. Thus I propose multiple traffic light control and monitoring system. The system tries to reduce possibilities of traffic jams, caused by traffic lights, to an extent. The system is based on image processing using python during day time and ir sensors in the night. The micro-controller used in the system is Raspberry pie. The system contains IR transmitter and IR receiver which are mounted on the either sides of roads re-spectively. The IR system gets activated whenever any ve-hicle passes on road between IR transmitter and IR receiver in night. Microcontroller controls the IR system and counts number of vehicles passing on road. Microcontroller also store ve-hicles count in its memory. Based on different vehicles count, the microcontroller takes decision and updates the traffic light delays as a result. The traffic light is situated at a certain distance from the IR system. Thus based on vehicle count, microcontroller defines different ranges for traffic light delays and updates those accordingly.

In our system there is a special priority to ambulance and fire brigade. A smart card is issued to all the ambulances and the fire brigade buses which will be detected at the signal and will be allowed to pass the signal without any interruption.

Keywords— IR (infrared)sensor, Image processing, Raspberry Pie, Smart Card.

Introduction:

Traffic research has the goal to optimize traffic flow of people and goods. As the number of road users constantly increases, and resources provided by current infrastructures are limited, intelligent control of traffic will become a very important issue in the future. However, some limitations to the usage of intelligent traffic control exist. Avoiding traffic jams for example is thought to be beneficial to both envi-ronment and economy, but improved traffic-flow may also lead to an increase in demand. There are several models for traffic simulation. In our research we focus on optimization of traffic light controller in a city using IR sensor and devel-oped visual monitoring using microcontroller Raspberry pie.

Traffic light optimization is a complex problem. Even for single junctions there might be no obvious optimal solution. With multiple junctions, the problem becomes even more complex, as the state of one light influences the flow of traf-fic towards many other lights. Another complication is the fact that flow of traffic constantly changes, depending on the time of day, the day of the week, and the time of year. Roadwork and accidents further influence complexity and performance. In this paper, we propose two approaches, the first approach - to take data/input/image from object/ sub-ject/vehicle and in the second approach - to process the input data by Microcontroller and finally display it on the traffic light signal to control the Closed Loop System.

Methodology:

Conventional traffic light system is based on fixed time concept allotted to each side of the junction which cannot be varied as per varying traffic density. Junction timings allotted are fixed. Sometimes higher traffic density at one side of the junction demands longer green time as compared to standard allotted time. The proposed system using a RASPBERRY PI 3 microcontroller duly interfaced with sensors, changes the junction timing automatically to accommodate movement of vehicles smoothly avoiding unnecessary waiting time at the junction. The sensors used in this project are IR and photodiodes are in line of sight configuration across the

loads to detect the density at the traffic signal. The main heart of this traffic system is microcontroller.

Steps To Prepare For Project:

1.To study on equipments and tools used and their specifications.
2.To study on the features of microprocessor to more focus in respect of working and functionality.
3.To study on the pin diagram of microcontroller to build the proper circuit.
4.To study the IR sensor circuit and its functionality.
5.To study on the program to be developed and the software to be used to burn the program on microcontroller.
6. Drawing and preparing for circuit.
7.Writing the program to control the traffic system.
8.Connecting IR sensors and GPIO pins.
9.Power on the system and testing the functionality of it placing some obstacles in front of the IR sensors observing the LED glow.

Data Structures / questions:

To make the automatic traffic control system the input data is arranged from the history of the traffic system, it's way to work, the survey of suffered and not suffered people, the public survey at a congested traffic junction. The respective points are checked and created a problem description, and found the solution of it to operate the traffic signal lights, based on the presence of vehicles. Evaluated the thought and studied on the microcontroller, it's internal structure and pin diagram, the circuit of the IR sensor to detect the presence of vehicles and built the circuit. Studied to write the program and the burning process on the microcontroller to get desired function.

History:

- Traffic lights are signaling devices positioned at road intersections, pedestrian crossings are today used in almost every city of the world.

- On December 10, 1868, the first traffic lights were installed outside the British houses of parliament in London, by the railway engineer J.P. Knight.

- The modern electric traffic light is an American invention, policeman Lester Wire invented the first red-green electric traffic lights.

- The first four-way, three-color traffic light was created by police officer William Potts in Detroit.

Where To Use Traffic Signal:

General Traffic Volumes:- When traffic volumes at most of the intersection approaches reach the point where other forms of control cannot efficiently assign right of way to the approaching rush drivers.

Interruption of Continuous Traffic When traffic on a major street is so heavy that traffic on a lightly travelled side street has little opportunity to cross or enter

the main street traffic.

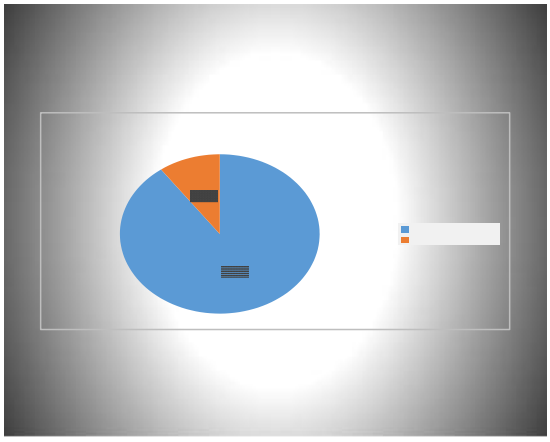
Pedestrian Volumes: When pedestrian traffic is heavy enough to justify the interruption of vehicular traffic.

School Crossings - If judged necessary by the traffic engineer, a traffic signal may be used to facilitate the crossing of school children

Progressive Movement - Sometimes a traffic signal will help keep platoons of cars tightly formed to enhance the coordinated flow along a street and encourage an appropriate speed.

Accidents - Traffic signals are sometimes effective in reducing accidents that result from the inability of rush drivers to safely assign their own right of way. These accidents typically involve right-angle collisions

PUBLIC SURVEY



Initially the signals are started by giving the power supply. The first step is to check that the all signal lights(here LEDs are used) are working. The next step is to write the program and burn on the microcontroller to control the signal lights based on detecting the presence of the vehicles by the IR sensors, keeping the programming switch SW2 in programming mode. The next step is to connect the four IR sensors to Port C of the microcontroller and the LEDs to Port B and Port D of the microcontroller. Then the LEDs are to be arranged as like as the traffic lights. Then the IR sensors are to be placed properly, one IR sensor for each road. Now the normal traffic system based on time can be seen. Now if an obstacle is placed infront of any IR sensor, then the traffics at that particular path are allowed to pass by glowing the green light. Finally turned of the power supply.

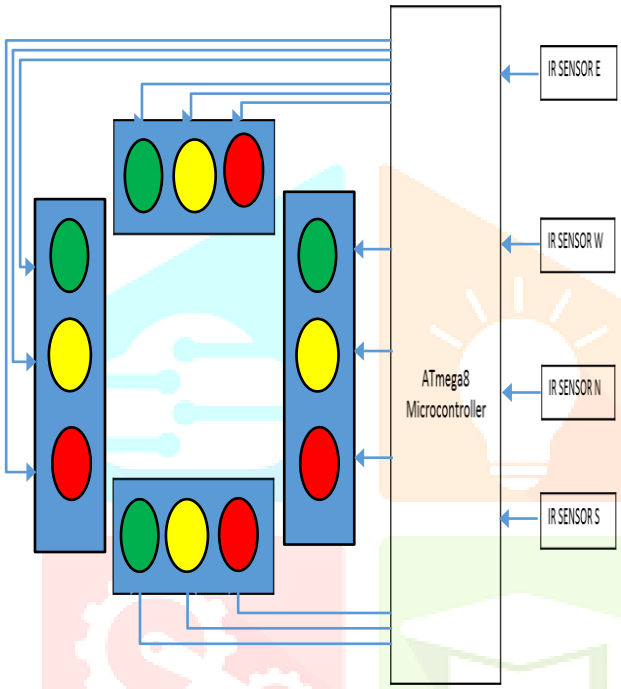
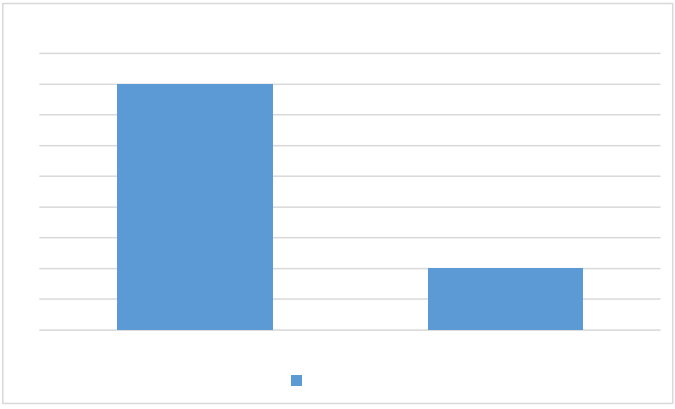


Fig: Automatic Traffic Light Control System Graph

IR Sensor:

The IR sensor circuit contains IR transmitter and IR receiver. IR transmitter looks like an LED. This IR transmitter always emits IR rays from it. The operating voltage of this IR transmitter is 2 to 3v. These IR (infrared) rays are invisible to the human eye but can be viewed through camera.

IR receiver receives IR rays that are transmitted by IR transmitter. Normally IR receiver has high resistance in order of mega ohms, when it is receiving IR rays the resistance is very low. The operating voltage of IR receiver also 2 to 3V.



These IR pairs are to be placed in such a way that when an obstacle is placed in front of this IR pair, IR receiver should be able to receive the IR rays. When the power is given, the transmitted IR rays hit the object and reflect back to the IR receiver.

Here 330 ohm resistor is used to drop the voltage otherwise IR transmitter may get damaged. To vary the obstacle sensing distance, a potentiometer has been used. The output is from transistor collector. This sensor gives the digital output.

Image Processing:

A. Image acquisition

The image is captured by a webcam. It is then transferred to the Raspberry Pie The image acquisition and further processing is done by using Python.

Fig. Image acquisition flow diagram

B. Image processing

The image is captured by using a webcam placed at the road junction. It has the capability of taking images of all the roads meeting at the junction. The webcam is mounted on the DC motor. The motor is responsible for capturing images from all directions in steps of fixed time interval. The speed of rotation of the camera is designed to be such that it is greater than the click-to-capture time of the camera. The acquired image is converted to grey scale image for further processing. The grey scale image is then converted to a binary image that contains only two colours, black and white. This image is known as the threshold image. The main purpose of thresholding the image is a radical reduction of information in order to simplify further processing. The thresholded image is then complemented for further image processing.

Fig.3 Original Image

1) Image cropping

The desired portion of the image is retained and the rest is cropped. Only the lane at which there is an incoming traffic at the junction is to be processed. Hence the image is cropped to select that section of the lane.

2) Image Enhancement

In this process the images are adjusted in such a way that the results are more suitable for further processing. In this, the obtained image is converted into a greyscale image.

3) Thresholding

Thresholding is transforming the greyscale image into black and white image (binary: white=1, black=0). The main purpose of thresholding is a radical reduction of information in order to simplify further processing. White colour is assigned to all the pixels that have luminosity greater than the threshold level and the others as black.

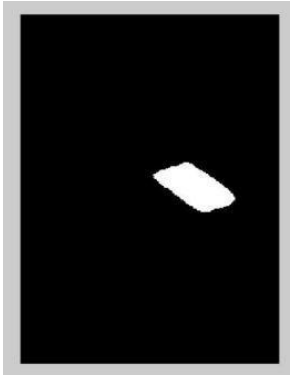
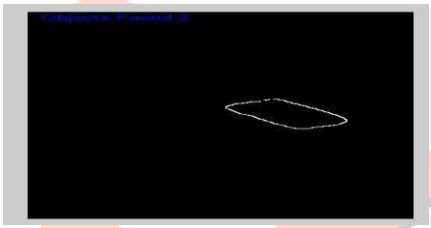


Fig.Threshold Image

4) Edge detection

Edge detection refers to the process of identifying and locating sharp discontinuities in an image. The discontinuities are abrupt changes in pixel intensities which characterize the boundaries of objects in an image.It filters out useless information, while keeping the important structural properties of an image. In this proposed system, canny edge detection technique is used. The boundaries of each image are found and the number of objects is calculated.



Circuit Diagram:

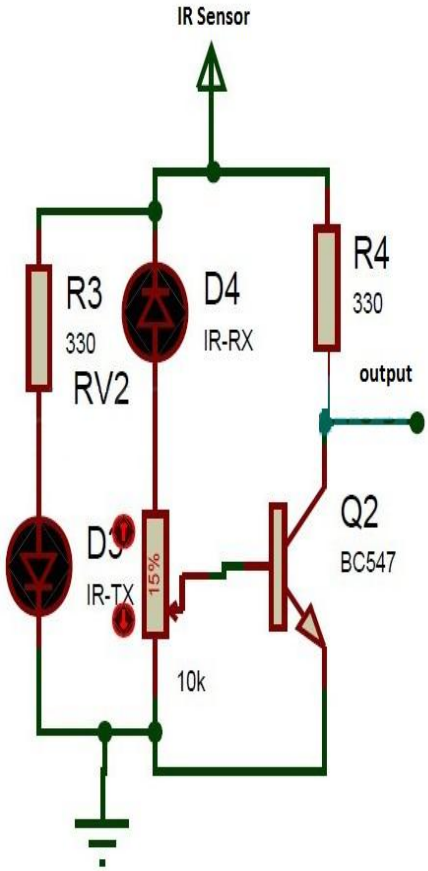


Fig: Circuit Diagram.

The circuit diagram is as shown in fig above .
The intelligent traffic signal control system is implemented with the help of circuit shown above.

Raspberry Pie:

The Raspberry Pi is a credit card sized single-board computer with an open-source platform that has a thriving community of its own, similar to that of the audio. It can be used in various types of projects from beginners learning how to code to hobbyists designing home automation systems.

There are a few versions of the Raspberry Pi, but the latest version, has improved upon its predecessor in terms of both form and functionality. The Raspberry Pi Model B features:

• More GPIO
• More USB
• Micro SD
• Lower power consumption
• Better audio
• Neater form factor

Higher-spec variant increases the Raspberry pi GPIO pin count from 26 to 40 pins. There are now four USB 2.0 ports compared to two on the Model B. The SD card slot has been replaced with a more modern push-push type micro SD slot. It consumes slightly less power, provides better audio quality and has a cleaner form factor.

To get started you need a Raspberry Pi 3 Model B, a **5V USB power supply** of at least 2 amps with a **micro USB cable**, any standard USB keyboard and mouse, an **HDMI cable** and monitor/TV for display, and a micro SD card with the operating system pre-installed

Conclusion:

We conclude the Density measurement by using image processing using python during a day tool as software for image processing by just displaying the various conversion of image in the screen and finally surrounding the box on the vehicle in the given image, the number of vehicle is calculated. We can calculate the density of the vehicle by using IR module during the night In this paper we have shown the density measurement in the signal by using IR module in the System. We can use matlab also for image processing. For ambulance and fire brigade we have used a smart card system which will be detected at the signal and the ambulance or fire brigade bus will be allowed to pass the signal

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