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Density based Traffic Light Control System using Edge Detection Algorithm for Accident Mode Analysis

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***Abstract*: These days clog in rush hour gridlock is a significant issue. The traffic blockage can likewise be brought about by huge Red light deferrals, and so forth. The postponement of separate light is hard coded in the rush hour gridlock light and it isn't reliant on traffic. Hence for mimicking and advancing traffic control to all the more likely suit this expanding request is emerges. In this proposed work the streamlining of traffic way control in an urban usage microcontroller is finished. The framework endeavours to decrease conceivable outcomes of congested roads, brought about by traffic lights, to a degree. The microcontroller utilized in the framework is PIC. The framework contains IR donor and IR acceptor which are coated on the either sides of streets individually. The IR sensor gets enacted at whatever points any vehicle crossing on path between IR donor and IR acceptor. Microcontroller rules the IR sensor and tallies number of vehicles crossing on path. Microcontroller likewise store vehicles include in its memory.**

In light of various vehicles check, the microcontroller takes choice and submits the traffic light postponements subsequently. The traffic light is arranged at a particular splitation from the IR framework. In this way dependent on vehicle tally, microcontroller characterizes diverse reaches for traffic light postponements and updates those as needs be. The framework records vehicle include in its memory at client predefined recording interim on ongoing premise.

This recorded vehicle include information can be utilized in future to dissect traffic condition at separate traffic lights associated with the framework. In this paper, a structure to control the traffic by evaluating the continuous vehicle in path have any mishap or any deterrent will be distinguished by utilizing watchful edge recognition with advanced picture handling is proposed and different traffic control conditions is represented with legitimate schematics and the last outcomes are checked by equipment execution.

***Keywords*: Density Traffic Control, Image Processing in Accident Detector, IR (infrared) sensor, Micro-controller (PIC), LED, GPS/GSM**

1. Introduction

Traffic look into has the objective to streamline traffic stream of individuals and products. As the capability of street users always higher, and assets given by current frameworks are restricted, insightful controlling traffic will turn into a difficult issue later on. In any case, a few confinements to the usage of density traffic control exist. Maintaining a strategic distance from car influxes for instance is believed to be gainful to both condition and economy, yet improved traffic-stream may likewise prompt an bigger sought after. There are a few models for traffic regenerated. In our examination we centre around streamlining of traffic light controller in a city utilizing IR sensor and created visual observing utilizing PIC microcontroller. Traffic light enhancement is a mind boggling issue. Not with standing for single intersections there may be no undeniable ideal arrangement. With numerous intersections, the issue replicate into be significantly increasingly mind boggling, as the condition of one light impacts the process of traffic towards numerous different lights. Another complexity is the way that progression of traffic always shows signs of change, contingent upon the season of day, the day of the week, and the season. Roadwork and mishaps further impact multifaceted nature and execution. In this process, we propose two methodologies, the principal approach -density based vehicle counting and second one will be accident or obstacle prediction in the lane.

2. Limitations of current systems

The fundamental target of our existing system in this traffic light controller is to give modern control and coordination to affirm that traffic moves as easily and securely as would be prudent. This task utilizes LED lights for sign reason and a microcontroller is utilized for auto changing of flag at indicated scope of time interim. Driven lights gets consequently turns on and off by making comparing port stick of the microcontroller "HIGH". The LEDs get naturally turned on and off by making the relating port pins of the microcontroller high, in view of the 8051 microcontroller and its programming done by utilizing KEIL programming. At a specific timeframe, just the green light hangs ON and different lights stay OFF, and after at some point, the changeover traffic light control from green to red happens by rolling out the succeeding improvement for glowing of LED. Conventional traffic light controller is based on allocated time provided to both direction of the lane which can't be changed as per varied traffic density. Junction timings are fixed. Some case higher traffic density at one side of the junction provide higher green colour growing time as compared

to standard time. The capacity of the moving vehicles is measured in three ways i.e., low, moderate, high based on which timings are allotted along with accident mode detected in the particular lane.

3. System overview

In this paper is expected to develop a thickness based incredible traffic banner structure. The banner planning changes normally on distinguishing the traffic thickness at the crossing point. Crossing point timings assigned are fixed. A portion of the time higher traffic thickness at one side of the convergence demands longer green time when stood out from standard circulated time. The proposed structure using a microcontroller of 8051 family suitably interfaced with sensors, changes the crossing point timing thus to oblige improvement of vehicles effectively avoiding unnecessary holding up time at the convergence. The sensors used in this errand are IR and photodiodes are in discernible pathway structure over the piles to recognize the thickness at the traffic banner. The thickness of the vehicles is evaluated in three zones i.e., low, high reliant on which timings are administered moreover. By using the propelled picture getting ready technique can recognize the impediment or incident which occurred in the two diverse ways way which will be the message gone to the near to station through the hardware (GSM/GPS).

4. Hardware tools

This circuit graph utilizes a precious stone oscillator for creating recurrence clock beats. The LEDs are interfering to the Ports of the microcontroller and are completed with 5v power supply. The LEDs get naturally turned on and off by making the comparing port pins of the microcontroller high, in light of the 8051 microcontroller and its programming done by utilizing inserted c programming. At a specific timeframe, just the green light hangs ON and different lights stays OFF, and after at some point, the changeover traffic light control from green to red happens by rolling out the succeeding improvement for shining of LED.

A model of traffic light control structure is made by using Infra-Red sensors close by huge parts Microcontroller and LEDs which are used for controlling traffic signals subject to the thickness of the traffic. The crossing point mulled over is a four-side convergence with the traffic stream on each side is only one way. This traffic control structure includes the going with three essential parts:

Show Unit: It comprises of 3 LEDs: Green, Red and Orange on each side of roads - an aggregate of 12 LEDs of three hues are put at the inter connected.

Finder Unit: It comprises of a consolidated game plan of photograph diode and IR LED at each intersection for distinguishing the nearness of vehicles dependent on the adjustment in opposition.

Infrared Sensors:

An infrared sensor is an electronic instrument that is used to detect certain functionality of its surroundings by either discharging and immersing to identifying infrared rays. It is likewise equipped for estimating warmth of an article and identifying movement. Infrared waves are not noticeable to the human eye. In the electromagnetic range, infrared radiation is the district having wavelengths longer than noticeable light wavelengths, yet shorter than microwaves. The infrared locale is around divided from 0.75 to 1000µm. The wavelength district from 0.75 to 3µm is named as close infrared, the area from 3 to 6µm is named mid-infrared, and the locale higher than 6µm is named as far infrared. Infrared innovation is found in a considerable lot of our regular items. For instance, TV has an IR locator for deciphering the flag from the remote control. Key advantages of infrared sensors incorporate low power prerequisites, basic hardware, and their versatile element.

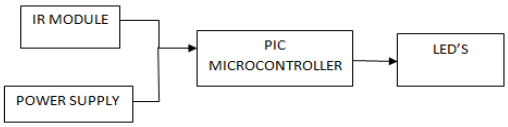


Fig. 1. IR Sensor Block Diagram

Controller Unit:

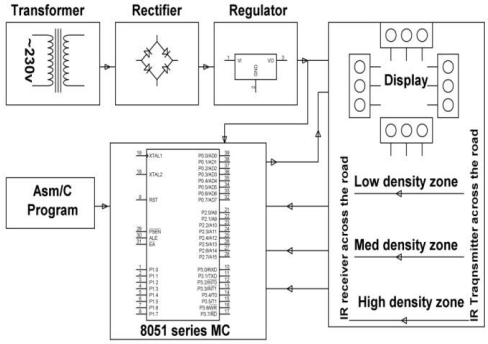


Fig. 2. Traffic control block diagram

This control unit contains a microcontroller which gets the yield information from the IR Sensors and controls the gleaming of LEDs dependent on the programming. The main concern is to plan and build up a density based common traffic control system. The flags timing changes automatically by detecting the traffic thickness at each occurrence.

Green glowing second based on density under various path moving vehicle counting through IR sensor.

Table 1
Green signal allocation

Percentage Allocation	Glowing green signal time
0%-50%	70 seconds
51%-60%	60 seconds
61%-70%	55 seconds
71%-80%	40 seconds
81%-100%	30 seconds

In the code section sensorState1 reads and stores the state of sensor-1. If the state of the analysis in more than the existing

satisfies the case, then the statement in parenthesis gets lost. Again the detector gets increased to decrease mode and so on so.

This could cause the counter to extend twofold whenever an automobile passes, to avoid this downside the counter is augmented only if the detector goes low to high. If (sensorState1 == HIGH) avoid the count once the detector State goes increased to decreased state.

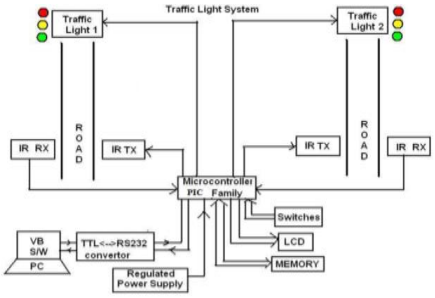
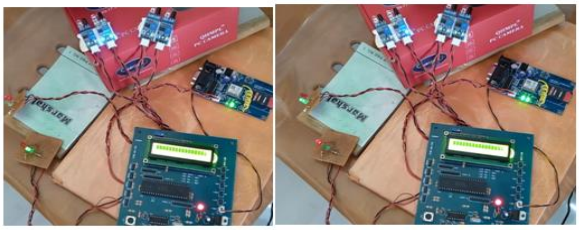


Fig. 3. Architecture diagram

The changeover traffic light control from green to red happens by rolling out the succeeding improvement for shining of LED.

Lane Detection of Density:

The detection of the vehicle in two-way lane will be illustrated.



(a) 1st lane density detection (b) 2nd lane density detection

Fig. 4. Lane density detection

5. Software tools

In this paper, a system in which density of traffic is measured by IR sensor and detecting the obstacle or accident in lane through captured image with real time webcam traffic information against the image of the empty road as reference image is proposed.

The entire image processing before edge detection i.e. image acquisition, image resize, RGB to gray mode and noise reduction is explained canny edge detection operation and white point count are depicted. Canny edge detector operator is selected because of its greater overall performance. Percentage matching for different sample images and traffic time allocation for them are demonstrated.

A. Image preprocessing

In this segment, picture preprocessing is performed to change over the crude pictures into increasingly open structure for edge location. At initial, four pictures of various traffic situations are chosen and picture of the vacant street is picked as reference picture. Every one of the pictures are then resized into 400*400 pixel utilizing the accompanying equation for consistent spatial goals and more prominent computational effectiveness.

Original height/original width*new width = new height (1)

Original width/original height*new height = new width (2)

As gray scale picture has better flag than commotion proportion contrasted with RGB picture, it is profitable to change over RGB pictures into gray scale for further handling. While changing over a RGB picture to gray scale, it is appropriate to consider the RGB esteems for every pixel and make as yield a solitary esteem mirroring the brilliance of that pixel. One of the methodologies is to take the normal of the commitment from each channel: (R+B+C)/3. In any case, since the apparent splendour is frequently overwhelmed by the green segment, an alternate, more "human oriented", and strategy is to consider a weighted normal:

$$I=0.3R+0.59G+0.11B \quad (3)$$

B. Edge detection

Edge discovery is utilized to recognize particular sorts of shapes. In this paper, it is utilized for confining diverse states of vehicles from rest of the picture. In the wake of looking at changed edge finders, shrewd edge indicator is discovered appropriate for this test. At first, pictures are smoothed by applying Gaussian channel to diminish undesirable surface and subtleties,

$$g(x,y) = G\sigma(x,y) * I(x,y)$$

where,

$$G_\sigma(x,y) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{\left(\frac{m^2+n^2}{2\sigma^2}\right)} \quad (4)$$

Image conversion from RGB to gray scale mode

(a) Input image (b)gray scale image

Fig. 5. (a) rgb colour image (b) gray scale conversion

Then the intensity gradient is computed using Canny gradient operator,

$$M(x,y) = \sqrt{g_m^2(x,y) + g_n^2(x,y)} \quad (5)$$

Where T is so chosen that all edge elements are kept while most of the noise is suppressed.

and,

$$\theta(x,y) = \tan^{-1} g_n(x,y) \Big/ g_m(x,y)$$

Threshold M

$$M_T(x,y) = \begin{cases} M(x,y) & if\ M(x,y) > T \\ 0 & otherwise \end{cases} \quad (6)$$

From that point forward, non-maxima concealment is connected by checking whether each non-zero MT(x,y) is more noteworthy than its two neighbors along the slope course ș(x,y). Provided that this is true, MT(x,y)is kept unaltered, something else, set to 0. The resultant yield models after edge recognition are outlined.

Canny edge detection occurred:

Fig. 6. Canny Edge Detection

Different pictures likewise share a similar likeness. After edge recognition, the resultant pictures are twofold picture with just highly contrasting pixels. Double picture is initially a two dimensional framework of qualities 0 and 1. The esteem '0' means dark shading while esteem '1' signifies white shading.

The white pixels basically speak to the distinguished edges. In this way, pictures with various traffic conditions will have diverse white point checks. Since the reference picture has least number of vehicles, it would have minimal number of white pixels among these five pictures. Hence, this picture is utilized as a unit picture to gauge the traffic thickness.

All out number of white pixels is determined for every individual picture proposed for coordinating reason

All this collected information are composed in the following table.

Table 2
Allocated threshold value to detected the mode of the lane in the traffic control

Real time captured images	Threshold value	Name of the mode in lane
Image A	0.001	Accident zone
Image B	0.053	Accident zone
Image C	0.123	Normal zone
Image D	0.289	Normal zone

These LEDs are controlled by the output pins of the PIC, which are controlled by the threshold value occurred from the mat lab code obtained through real time webcam, based on the threshold allocated to each consecutive lane will be detected the normal as well as accident zone in the particular lane at the detection in the lane the traffic signal colour of LED will stop and it will sends the messages to the nearby station or junction along with the location of that lane. therefore, by through this kind of technique from the real time capturing process will provide more accuracy detection of the zone in the lane will be getting the elapsed time of normal mode 0.192549 and the accident mode prediction was quit more accuracy in elapsed time is 0.000002.

Threshold value will be initialised from the image processing to hardware port.

Overflow diagram:

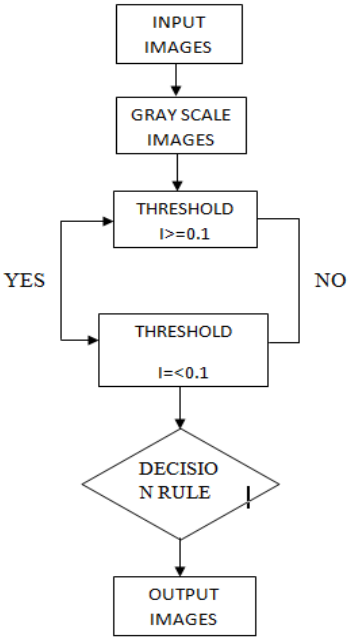
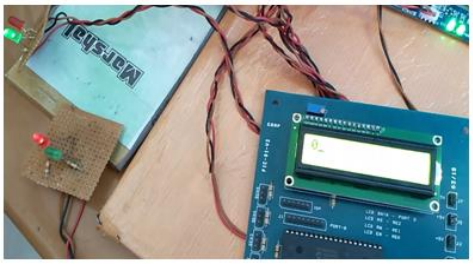


Fig. 7. Overview of accident mode detection



(a) Accident mode in lane

(b)Normal zone in lane

Fig. 7. (a) Threshold value “0” initialized, (b) Threshold value “1” initialized

6. Conclusion

In this paper, a traffic control framework profiting picture handling as an instrument for estimating the density has been proposed. Other than clarifying the constraints of current close out of date traffic control framework, the upsides of proposed traffic control framework have been illustrated. Upon completion of edge detection by using the image processing sector can detect the accident zone in the two way lanes, furthermost it can be transit to the nearby station as a message. Other than introducing the schematics for the proposed savvy

traffic control framework, all the essential outcomes have been checked by equipment execution. In the future we can enhance this traffic control technique for the emergency (ambulance) case in lane.

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