

Smart Traffic Control System by Using Image Processing

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Abstract: The reality is that, the population of every city along with numbers of vehicles on roads are increasing rapidly. With increasing urban population and hence the number of vehicles, the need of controlling streets, highways with small roads is major issue. The main reason for increasing traffic problem is the techniques that are used for traffic management. The traffic management system used in today's has no emphasis on live traffic scenario, which leads to inefficient traffic management systems. This project has been implemented by using Matlab software and it aims to prevent heavy traffic congestion. For implementing this project, we have used Image processing technique. Firstly, the film of lane is captured by a camera. A web camera is placed in a traffic lane which will capture the images of road on which we want to control traffic. Then these images are processed to know the traffic density. According to the processed data from mat lab, the controller will send command to the traffic LEDs to show particular time on the signal to manage traffic.

Keyword: Population of city, Traffic congestion, Image processing, Traffic density, Adaptive Signal Controlling

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I. Introduction

In day-to-day life we have to face many problems one of which is traffic congestion which is becoming more serious every day. It is said that the high volume of vehicles, the scanty infrastructure and the irrational distribution of the development are main reasons for traffic jam. The major cause leading to traffic jam is the large number of vehicles which was caused by the population and the development of economy. To solve this problem, the government should encourage people to use public transport or vehicles with small size such as bicycles or make tax on personal vehicles. Particularly, in some Asian countries such as Viet Nam, the local authorities passed law limiting to the number of vehicles for each family. The methods mentioned above is really efficient in fact. That the inadequate infrastructure cannot handle the issue of traffic is also a decisive reason. Besides, the highway and roads are incapable of meeting the requirement of increasing number of vehicle. Instead of working on roads to control the traffic on roads various techniques have been devised to control the traffic like embedded controllers that are installed at the junction.

Standard Traffic Control Systems Manual Controlling

Manual controlling, as the name says it require man power to control the traffic. Depending on the countries and states the traffic polices are allotted for a required area or city to control traffic. The traffic polices will carry sign board, sign light, particular uniform and whistle to control the traffic.

Automatic Controlling

Automatic traffic light is controlled by timers and electrical sensors. In traffic light each phase a constant numerical value loaded in the timer. The lights are automatically getting ON and OFF depending on the timer value changes. While using electrical sensors it will capture the availability of the vehicle and signals on each phase, depending on the signal the lights automatically switch ON and OFF.

Drawbacks

In the manual controlling system, we need more man power. As we have poor strength of traffic police we cannot control traffic manually in all area of a city or town. So we need another and better solution to control the traffic. On the other side, automatic traffic controlling uses timer for every phase. Using electronic sensors is another way in order to detect vehicles, and produce signal. But in this method the time is being wasted by a green light on an empty road. Traffic congestion also occurred even if we use electronic sensors for controlling the traffic. All these drawbacks are supposed to be eliminated by using image processing.

Image Processing in Traffic Light Control

We propose a system for controlling the traffic light by image processing. The vehicles are detected by the system through images rather than electronic sensors. A camera will be placed alongside the traffic light. It will capture images in sequence. Image processing is a better technique to control the state change of the traffic light. It shows that it can decrease the traffic congestion and also decreases the time being wasted by a green light on an empty road. As it uses actual traffic images it is reliable in estimating vehicle presence. It visualizes the practicality, so it functions much better than those systems that rely on the detection of the vehicles metal content

II. Detailed Description Of Our Project

Many techniques have been developed in Image Processing during the last four to five decades. Image Processing systems are popular due to easy availability of powerful personnel computers, large memory devices, graphics software's and many more.

Image processing has many issues related to image representation, compression techniques and various complex operations, which can be carried out on the image data. The operations that come under image processing are image enhancement operations such as sharpening, blurring, brightening, edge enhancement. Traffic density of lanes is calculated using image processing which is done on images of lanes that are captured previously using digital camera. We have chosen image processing for calculation of traffic density as cameras are not expensive as compared to other devices or sensors.

Making use of the above mentioned virtues of image processing we propose a technique that can be used for traffic control.

III. Literature Survey

1. In early 1920s Bartlane cable picture transmission system used to transmit newspaper images across the Atlantic, though the images were coded.
2. After 1920s-improvements were made to the Bartlane system resulted in higher quality images with the increased number of tones in reproduced images. In 1960s: Improvements in computing technology and the onset of the space race led to a surge of work in digital image processing.
3. In 1964: computers used to improve the quality of images of the moon taken by the Ranger 7 probe Such techniques were used in other space missions including the Apollo landing.
4. 1970s, digital image processing begins to be used in medical applications. In 1979, Sir Godfrey N. Hounsfield & Prof. Allan M. Cormack share the Nobel Prize in medicine for the invention of tomography,
5. 1980s - Today: The use of digital image processing techniques has exploded and they are now used for all kinds of tasks in all kinds of areas.

Block Diagram



Edge Detection

Edge detection is a set of mathematical methods which aim at identifying points in a digital image at which the image brightness changes sharply or more technically. The points at which image brightness alters sharply are typically organized into a set of curved line segments termed edges.

Edge detection techniques

Different colors have different brightness values of particular color.

-Green image has more bright than red.

-Blue image or blue image is blurred image.

- Red image is the high noise image.

Following are list of various edge-detection methods: -

- Sobel Edge Detection Technique
- Pewit Edge Detection
- Roberts Edge Detection Technique
- Zero cross Threshold Edge Detection Technique
- Canny Edge Detection Technique

In our project we use “CANNY EDGE DETECTION TECHNIQUE” because it has many advantages as compared to other techniques.

Canny Edge Detection

The Canny Edge Detector is one of the most commonly used edge detection techniques. It is a multi-step process. It can be implemented on the GPU as a sequence of filters. Canny edge detection technique is based on three basic objectives:

1. Low error rate
2. Edge point should be well localized
3. Single edge point response

IV. Implimentation Algorithm

The steps included in the algorithm are:

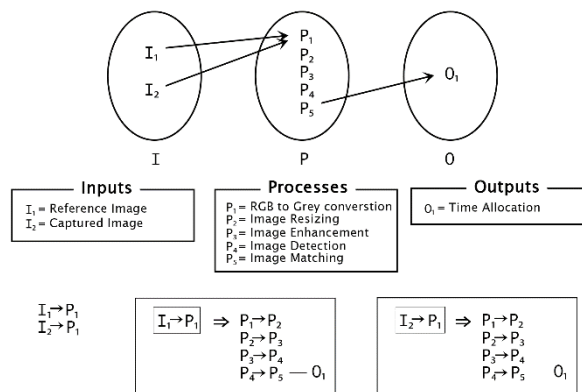
1. We have a reference image and the image to be matched is continuously captured using a camera that is installed at the junction.
2. The images are pre-processed in two steps as follows
 - a. Images are rescaled to 300x300 pixels.
 - b. Then the above rescaled images are converted from RGB to gray.
 3. Edge detection of pre-processed images is carried out using Canny edge detection technique.
 4. The output images of previous step are matched using pixel to pixel matching technique.
 5. After matching the timing allocation is done depending on the percentage of matching as
 - a. If the matching is between 0 to 30% - green light is on for 90 seconds.
 - b. If the matching is between 30 to 50% - green light is on for 60 seconds.
 - c. If the matching is between 50 to 70% - green light is on for 30 seconds.
 - d. If the matching is between 70 to 90% - green light is on for 20 seconds.
 - e. If the matching is between 90 to 100% - red light is on for 90 seconds.

System Architecture:



(a) System Architecture

Mathematical Model :



(b) Mathematical Model

- 1) I₁ is taken as first input which is the image of an empty road is captured.
- 2) Then I₁ is passed to process P₁ which is converting the RGB image to gray image then to process P₂ in which image resizing will be performed after that it will be passed to process P₃ which is of image enhancement then to process P₄ for image detection.
- 3) I₂ is taken as second input which will be captured continuously and the same processes will be applied on I₂ as on I₁.
- 4) Then process P₅ will be performed on both inputs which is of image matching.
- 5) Then according to image matched percentage the final output O₁ will be provided in which time will be allocated to traffic signal.

ADVANTAGES:

- More Convenience
- Energy Management & Savings

- Easy to detect than sensor
- Reduces accidents as well as waiting time
- Better traffic flow

APPLICATIONS:

This system can be partially implemented in real time where the vehicle density is very high at the junction roads.

V. Conclusion

- Problem is overcome and traffic control are improved.
- Flexibility in dealing with uncertainty.
- Traditional method caused wastage of time by a green light on a less congested road as compare to more congested road.
- Image processing is a better technique to control the state change of traffic light.

FUTURE WORK

The focus shall be to implement the controller using DSP as it can avoid heavy investment in industrial control computer. The hardware implementation would enable the project to be used in real-time practical conditions. In addition, we propose a system to identify the vehicles as they pass by, giving preference to emergency vehicles and assisting in surveillance on a large scale.

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