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Traffic Management using Image Processing

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ABSTRACT: Internet of Things (IoT) is an ecosystem of connected physical objects that are accessible through the Internet. IoT is referred to as "connecting the unconnected things". In modern life, we must face many problems, one of which is traffic congestion becoming more dangerous day by day. Because of the increase in vehicle traffic, many problems emerged, such as traffic accidents, traffic congestion and so on. Traffic congestion was a very difficult problem. The purpose of this paper is to propose a solution which can be adopted in ease of controlling the traffic. This method uses image processing techniques to count the number of vehicles on road and estimate the density. The number of vehicles found can be used for surveying or controlling the traffic signal. The frequent traffic jams at major intersections, classification of highway lane vehicles[1][2] call for an effective management system. This method suggests implementing a smart traffic controller using real-time image processing. The sequence of the camera is analyzed using different edge detection algorithms and object counting methods.

KEYWORDS: Image aquistion; image preprocessing; real-time images; timers.

I. INTRODUCTION

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too.

There are two types of methods used for image processing namely, analogue and digital image processing. Analogue image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. Digital image processing techniques help in manipulation of the digital images by using computers.

Fast transportation systems and rapid transit systems are nerves of economic developments for any nation. Mismanagement and traffic congestion results in long waiting times, loss of fuel and money. It is therefore utmost necessary to have a fast, economical and efficient traffic control system for national development. The monitoring [3] and control of city traffic is becoming a major problem in many countries. With the ever-increasing number of vehicles on the road, the Traffic Monitoring Authority must find new methods of overcoming such a problem. One way to improve traffic flow and Safety of the current transportation system is to apply automation and Intelligent control methods. Traffic congestion may result due to heavy traffic at a junction. To avoid congestion there are so many traffic management techniques available. We have made an attempt to provide some traffic management strategy which is self-changing in nature, so as to fit into continuously changing real time traffic scenarios. In this system time is assigned to traffic light of particular lane according to the traffic density on the road with priority given to ambulance. Also, we can indicate signal break in a particular lane. If there is an obstacle LCD is used to display the message of obstacle detection to avoid inconvenience.

II. CHARACHTERISTICS OF IMAGE PROCESSING

Relevant Characteristics of Image Processing Architectures: Image processing architectures can be classified based upon processing power, data bandwidth and interim storage.

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a) *Characterization of Processing Power*: Processing power is the capacity of architecture for performing manipulations of image data per unit of time. Since different architectures have different sets of manipulations in their instruction set a common denominator of operations is required for use as a scale of measurement of such capacity.

b) *Characterization of Data Bandwidth* : As in other real time data processing and communication application areas, the guiding and movement of data among operating nodes may impact system responsiveness or throughput as much or more than the operation timing itself.

c) *Characterization of Interim Storage*: The previously discussed two attributes of an architecture provide insight into the raw power to manipulate and move data at a relatively elementary level of image operators.

III. LIMITATIONS OF EXISTING SYSTEM

Traffic signals are vital to helping vehicles and pedestrians safely travel. They increase the efficiency and order of traffic to reduce the number of accidents. They provide clear guidelines regarding when cars or pedestrians can enter an intersection or when they should stop and wait. While they are necessary to control traffic and keep commutes as smooth as possible, there are both advantages and disadvantages of traffic signals. Following are the issues of the existing system.

A. Manual Traffic Control

A traffic police standing at junctions, or at cross roads, is the simplest and the oldest method used for the traffic management. It includes human effort in controlling the traffic. A traffic police is placed on each cross sections of roads, and he manually controls the traffic. The police officer gives signals to the vehicle driver whether to drive or start, he always monitors every road and decides which lane has to be given first priority. This method is the most efficient among all other system, if traffic police monitors traffic without error. As it includes a human effort, the efficiency depends on that particular officer. So, this might not be good for heavy traffic conditions and for the whole day.

B. Automated Traffic Signals

As like we see every day, the automatic traffic signal system includes 3 color traffic signals. Normally 120 seconds of green light is switched on for each lane. A yellow light will flash before the green light for 20 seconds, signaling the vehicle owners to start their vehicles and be ready. When the green light is turned on in one lane then all other lanes will display a red light. Where red signal indicates stop, yellow light signal indicates ready to go, and green light signal indicates proceed forward. The major problem with this system is it cannot identify the amount of traffic in one particular line, so there is a chance of traffic jam.

C. Sensor Based Traffic Control

In this method the density sensing sensors are mounted on to the pavements which inturn measures the density and allocates the green light for a longer time for the lane which has highest density. The main drawback of this system is that the sensors cannot sustain extreme weather conditions and requires a high cost maintenance.

IV. IMAGE PROCESSING FOR TRAFFIC MANAGEMENT

Firstly, the image of the empty lane is captured for reference purpose. It is considered as a raw data. Image captured is then pre-processed. Pre-processing is done to get a clear image. Since the images are extracted, images can be blurred when the weather is foggy or rainy, images can be darker when captured during night. Therefore, pre-processing methods are applied on the images to improve the quality of image.

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Fig 1. Traffic Management using Image processing

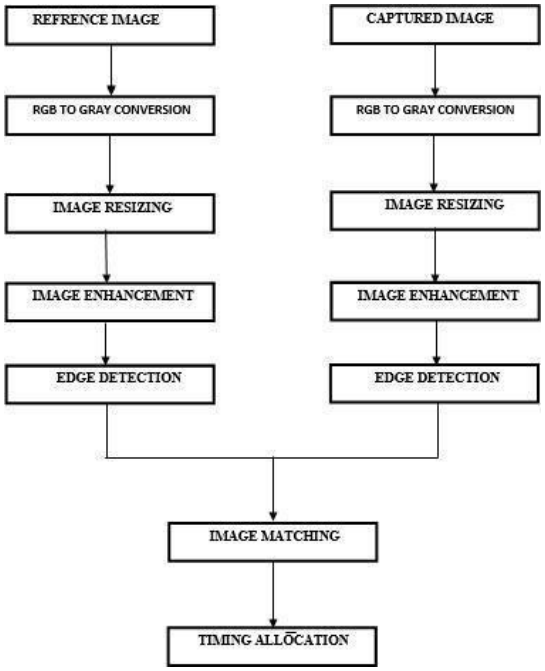

Fig 2. Block Diagram of Traffic Management

The following gives a brief description about the block diagram:

a) Density calculation:

Density is the number of vehicles occupying a given length of the highway in a traffic lane. Density calculation is used to calculate the traffic density.

b) Traffic control:

The edge detected reference and real time images are matched and accordingly the traffic light durations can be set.

c) RGB to grey conversion:

Real time image of lane is captured, and converted to grey scale, because processing with black and white images are easy. Processing with coloured images are quite difficult.

d) Image Resizing:

Each processor has its own ability to process the image. The image is resized according the process.

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V. IMPLEMENTATION ALGORITHM

The algorithm behind the block diagram consists of following steps :

A. We have a reference image and the image to be matched is continuously captured using a camera that is installed at the junction.

B. The images are pre-processed in two steps as follows
   1) Images are rescaled to 300x300 pixels.
   2) Then the above rescaled images are converted from RGB to grey.

C. Edge detection of pre-processed images is carried out using canny edge detection technique.

D. The output images of previous step are matched using pixel to pixel matching technique.

E. After matching the timing allocation is done depending on the percentage of matching as :
   1) If the matching is between 0 to 30% - green light is on for 90 seconds.
   2) If the matching is between 30 to 50% - green light is on for 60 seconds.
   3) If the matching is between 50 to 70% - green light is on for 30 seconds.
   4) If the matching is between 70 to 90% - green light is on for 20 seconds.
   5) If the matching is between 90 to 100% - red light is on for 90 seconds.

VI.CONCLUSION

This paper "Traffic Management using Image Processing" is a cost effective, practical and the best way to reduce the density of traffic. The paper infers that image processing is a better technique to control the state change of the traffic light. It shows that it can reduce the traffic congestion and avoids the time being wasted by a green light on an empty road. It is also more consistent in detecting vehicle presence because it uses actual traffic images. It visualizes the reality, so it functions much better than those systems that rely on the detection of the vehicles' metal content. Overall, the system is good, but it still needs improvement to achieve a hundred percent accuracy.

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