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An Application of Image Processing: Traffic Management

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ABSTRACT: *Traffic management is becoming one of the most important issues in rapidly growing cities. Due to bad traffic management a lot of man-hours are being wasted and increase in pollution level. Increasing Congestion on highways and problems associated with existing detectors has generated an interest in vehicle detection technologies such as video image processing. Regarding this problem, development a self-adaptive system which can help in better traffic management using the technique of image processing is a necessity. Existing commercial image processing systems work well in free-flowing traffic, but the systems have difficulties with traffic congestion. The suggested feature-based tracking system will detect vehicles under various challenging conditions. Using image processing operations to calculate traffic density is cost effective as cameras are cheaper and afffordable devices compared to any other devices such as sensors. Using the information obtained the development of an android application will be done, in which the user will get the traffic density at the location of choice.*

Keywords: *Traffic Management,Traffic Density, Traffic Light Control, Image Processing*

I. INTRODUCTION

In Modern Life we have to face with many problems one of which is traffic congestion becoming more serious day after day. It is said that the high volume of vehicles, the inadequate infrastructure and the irrational distribution of the development are main reasons for increasing traffic jam. The major cause leading to traffic congestion is the high number of vehicle which caused by the population and the development of economy. To unravel this problem, the goverment should encourage people to use public transport or vehicle 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 method mentioned above is really efficient in fact. That the inadequate infrastucture cannot handle the issue of traffic is also and decisive reason. The public conveyance is available and its quality is very bad, mostly in the establishing countries. Besides, the highway and roads are incapable of meeting the requirement of increasing number of vehicle.

Manual Controlling the name instance 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 the traffic. The traffic polices will carry sign board, sign light and whistle to control the traffic. They will be instructed to wear specific uniforms in order to control the traffic[1].

Automatic Traffic light is controlled by timers and electrical sensors. In traffic light each phase a constant numerical value loaded in 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[2].

II. MOTIVATION

Recognizing that vehicle safety is a primary concern for mototrists, many natoinal and international companies have undertaken specialized research projects to investigate new technologies for improving safety and accident prevention. Looking at the statistical projection of traffic fatalities concerning during year 2013 1,37,000 people die in traffic crashes relating to motor vehicles. One serious road accident in the country occurs every minute and 16 die on Indian roads every hour.

The Traffic Lights that are in widespread use today do not do much intricate reasoning when deciding when to change the lights for the various road users waiting in different lanes. How long the signal stays green in one lane and red in another is most often determined by simple timing that is calculated when the crossing is designed. Even though today's methods are robust and work well when traffic load is distributed evenly across the lanes in the intersection, the systems are very inefficient because they are unable to handle various simple situations that arise throughout the day. Unnecessary waiting time in the signal can be avoided by determining in which side the green signal shuld be large during traffic. In case the structure of the traffic[3].

III. EXISTING METHOD FOR TRAFFIC JAM DETECTION

Several approaches have been taken to detect traffic jam. The most widely used basic approach for this is to employ a person at important traffic points. But with the advent of technology and increment of traffic flow, it is more convenient to have automated systems. Magnetic Loop Detectors are used to count the number of vehicles using magnetic properties. Current traffic control techniques like magnetic loop detectors buried in the road, infra-red and radar sensors on the side provide limited traffic information and require separate systems for traffic counting and for traffic surveillance. Inductive loop detectors do provide a cost-effective solution, however they are subject to high failure rate when installed in poor road surfaces, leading to decrease in pavement life and obstruct traffic during maintenance and repair.

IV. APPLICATION OF TRAFFIC MANAGEMENT USING IMAGE PROCESSING

1. Need for Image Processing in Lane Detection and Tracking:

Nowadays, the growing volume of the traffic all around the world requires higherlevels of the traffic safety[4]. On the road, there are so many unsafe driving cars that the driver requires more careful while driving. Important for driver is being careful when he/she must change lane, especially in new driver who absolutely cannot keep too much information at once and has no confidence for driving[5]. Driver may be loss of concentration and control car. In fact, Human behaviors are indeed hard to recognize, predict and handle by current available equipment. Therefore, a monitoring and warning system focusing on the vehicle behaviors are needed while the car is moving on the road[6].

Based on the prevous work done in lane detection field. A Hough trasform and Edge detection,basic techniques for image processing, are used for detecting lane marks that can reduce the loss of views to the front street in real time. The system is designed to work in conjuction with the general principles of the webcam image processing[7]. The algorithm helps the driver by increasing decision-making while driving[8] in order to monitor the movement of vehicles through the lane and estimate the lane more efficient than previous work.

The lane detection algorithm is proposed by using information of camera and road. Firstly, the acquired video stream file is extracted to image frames. Secondly, Converting RGB image to an intensity image and then to Y'CbCr image. Thirdly, creating an image filter to implement and detect edges. Fourthly, setting threshold to make a binary image. Fifthly, Using Hough transformation and Hough lines to detect road lane markers and defination the analytic areas. Finally, several experiments are conduced to demonstrate the effectiveness of the proposed algorithm[9].

2. Need for Image Processing in Vehicle Speed Detection:

Vehicle speed detection is very important for observing speed limitation law and it also demonstrates traffic conditions. Traditionally, vehicle speed detection or surveillance was obtained using radar technology, particularly, radar detector and radar gun[10].

The radar system operation is known as Doppler shift phenomenon. The basic concept about this system is Doppler shift that happens when the created sound is reflected off a moving vehicle and the frequency of the returned sound is slightly changed. This method, with spatial equation and equipments, obtained the speed of a moving vehicle. However, this method still has several disadvantahes such as the cosine error that happens when the direction of the radar gun is not on the direct path of the incoming vehicle. In addition, the cost of equipment is one of the important reasons, and also shading and radio inference are two other influential factors that cause error for speed detection and finally, the fact that radar sensor can track only one car at any time is another limitation of this method.

A new algorithm proposed that uses the digital video, image processing and computer vision to automatically detect vehicle speed in an accurate manner. The alorithm needs only a single video camera and a Cor2Duo computer processor with Matlab software which is installed on computer to operate the detection of the vehicle. The procedure only requires installing the camera directly above the roadway. The camera calibration which is based on a geometrical and analytical model is simple. In addition, the calibration does not require any information about the camera and only the specification of the camera, like its frame rate and frame size, which are obtainable through the software, are essential[11].

3. Need for Image Processing in Traffic Light Control:

We proposed a system for controlling the traffic light by image processing. The vehicles are detected by the system through images insted of using elecronic sensors embedded in the pavement. A camera will be

placed alongside the traffic light. It will capture image sequences. Image processing is a better technique to control the state change of the traffic light. It show that it can decrease the traffic congestion and avoids the time being wasted by a green light on an empty road. It is also more reliable in estimating vehicle presence because it uses actual traffic images. It visualizes the practically, so it functions much better than those systems that rely on the detection of the vehicles' metal content[12].

Intelligent Image detection systems are part of the centralized approach to modern traffic management. This has arises from the need for more cost effective and efficient monitoring of traffic. In turn, this has increased the scope for automatics analysis of urban traffic activity from CCTV in recent years. This increase can be contributed in part to the additional number of cameras and other sensors, enhanced infrastructure and consequent accesibility of data. The simplest way for controlling a traffic light uses timer for each phase. Another way is to use electronic sensors in order to detect vehicles, and produce signal that cycles but it is very costly than CCTV camera. We propose a system for controlling the traffic light by image processing. The system will detect vehicles through images instead of using CCTV camera in the pavement. A camera will be installed alongside the traffic light. It will capture image sequences. Setting image of an empty road as reference image, the captured images are sequentially matched using image matching. For this purpose edge detection has been carried out using Prewitt edge detection operator and acccording to percentage of matching traffic light durations can be controlled.

V. TECHNIQUES USED FOR TRAFFIC MANAGEMENT SYSTEM

1. Density Measurement:

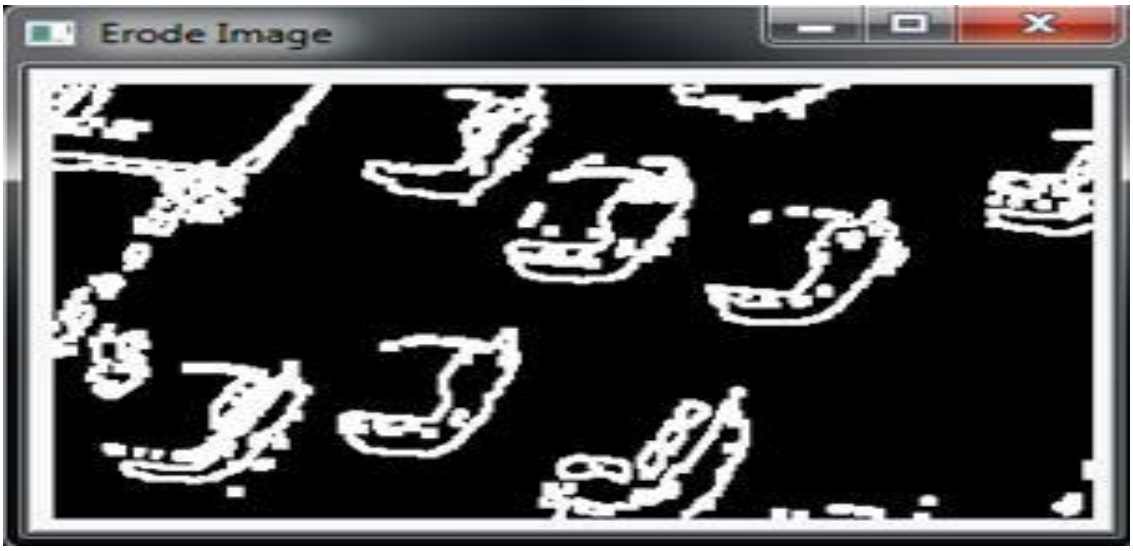
A. Source Image: In this System the source Image which can be given by the users for getting the contour image and the vehicle count in output screen.

B. Grayscale Image: The grayscale image can be used to display the object in the formate of black abd white. In this sysrem the output will be display the grayscale image after getting the source image only, because source image only converted into the grayscale image.

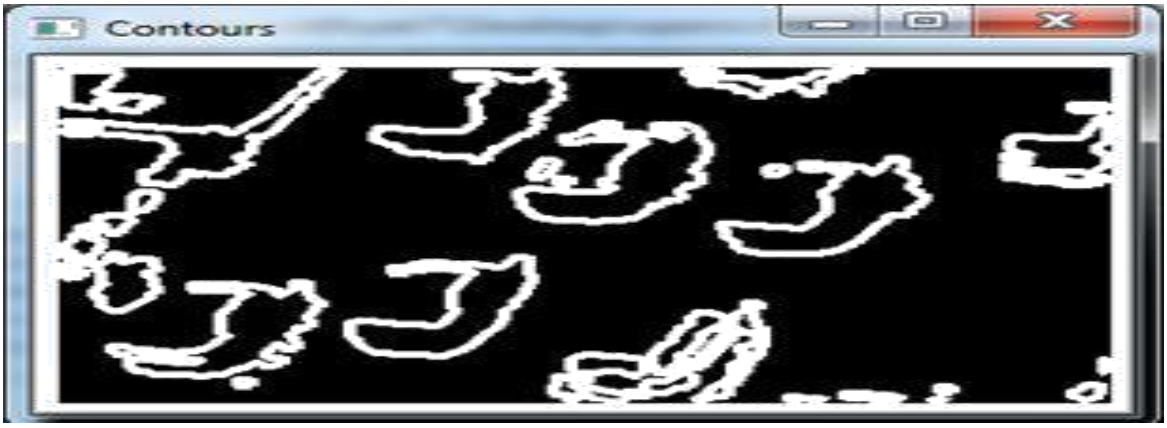
C. Threshold Image: The threshold image brightness or contrast of the grayscale image. In this system we can convert the grayscale image to threshold image.

D. Canny Image: Canny Image is the image one of the edge detector that can be used to outline the edges of the objects. It can be helpfull for find out the objects. Here we have convert the threshold image to canny image.

E. Erode Image: The Erode image also like the canny image it can be used find the edges of the vehicles are detect with the darked lines Before converting the canny image to Erode image, the Canny image will be destroied.

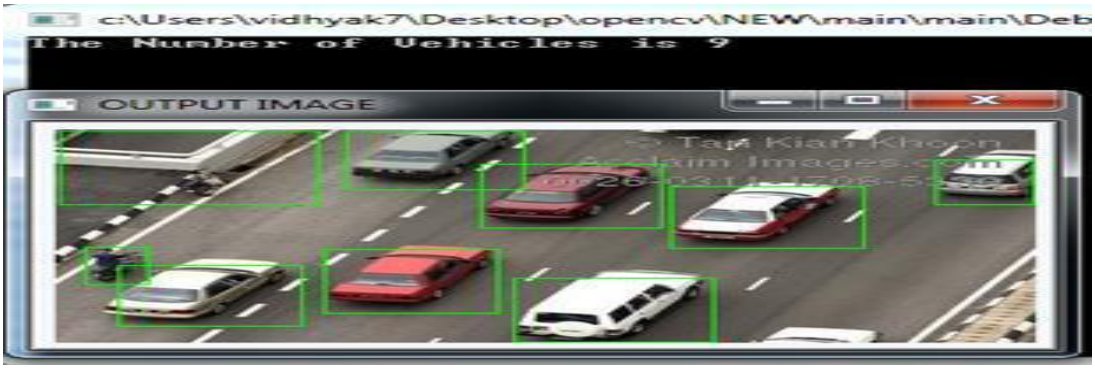


F. Contour Image: Before showing the vehicles count and output screen the Erode Image converted into the coutour image. This image is the final step to find the vehicled counts and output screen.



G. Output Screen: The two types of output screens are displayed in this system.

1. First output screen display the output image. In this image will display the original RGB Image and in this screen the vehicles are boxed for the find the count.
2. Another output screen is the command prompt. In this command prompt will be open when the user run this system, in final stage after getting the output image the command prompt will display the vehicle counts.



2. Procedure of Traffic Light Control using Image Processing:

Phase-1:

i. Initially Image Acquisition is done with the help of web camera
ii. First image of the road is captured, when there is no traffic on the road
iii. This empty road's image is saved as reference image at a particular location specified in the program
iv. RGB to gray conversion is done on the reference image
v. Now gamma correction is done on the reference gray image to achieve image enhancement
vi. Edge detection of this reference image is done thereafter with the help of prewitt edge detection operator

Phase-2:

i. Image of the road is captured.
ii. RGB to gray conversion is done on the sequence of captured images
iii. Now gamma correction is done on each of the captured gray image to achieve image enhancement
iv. Edge detection of these real time images of the road is now done with the help of Prewitt edge detection operator

Phase-3:

i. After edge detection procedure both reference and real time images are matched and traffic lights can be controlled based on percentage of matching.
ii. If the matching is between 0to 10%- green light is on for 90 seconds. If the matching is between 10 to 50%- green light is on for 60 seconds. If the matching is between 50 to 70%- green light is on for 30

seconds. If the matching is between 70 to 90%- green light is on for 20 seconds. If the matching is between 90 to 100%- red light is on for 60 seconds.

VI. CONCLUSION

Past researches have showed a promising result for including image processing in traffic light control. Earlier in automatic traffic control use of timer had a drawback that the time is being wasted by green light on the empty. This technique avoids this problem. Upon comparision of various edge detection algorithms, it was inferred that canny edge detector technique is the most efficient one. Analysis of various contour tracing and object counting methods reveled the Moore neighbourhood technique to be more robust when compared to the others. The paper demonstrates that image processing is a far more efficient method of traffic control as compared to traditional techniques.

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