A Technique on Road Traffic Analysis using Image Processing

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***Abstract* – The basic mode of transportation for limited distances is mostly through road ways. As the problem of urban traffic overcrowding spreads, there is a pressing need for the introduction of advanced technology and equipment to improve the state-of-the-art traffic control. Nowadays traffic problem are increasing because of the increasing number of vehicles and the limited resources provided by the current infrastructures. Due to this, there is a need to wait more time in front of the signals. This leads to wastage of time. In concern with this problem, we have designed a paper that will help for Traffic flow monitoring and traffic analysis based on computer vision techniques. The article presents an application of computer visualization method to traffic flow monitoring and road traffic analysis. The application is utilizing image-processing and pattern recognition methods planned and personalized to the needs and constrains of road traffic analysis. These methods joint together gives well-designed capabilities of the system to observe the road, to initiate programmed vehicle tracking, to calculate the speed, and to recognize number plates of a vehicle. Software developed was useful in and accepted with video monitoring system, based on usual CCTV cameras related to wide area network computers.**

***Keywords:* - Monitoring, Recognition, Pattern, Sequences, Tracking, Segmentation, Pattern recognition, CCTV Camera, Videos of traffic, GSM Modem, speed computer vision, speed measurement.**

I. INTRODUCTION

Traffic flow monitoring and traffic analysis based on computer visualization techniques, and specially traffic analysis and monitoring in a real-time mode raise valuable and complicated demands to computer algorithms and technological solutions. Most realistic applications are in vehicle tracking, and the critical issue is initiating a track automatically. Traffic analysis then leads to reports of speed violations, traffic congestions, accidents, or against the law actions of road users. A variety of approaches to these tasks were suggested by many scientists and researchers [1–3].

The approach in this article focuses on methods of image processing, pattern recognition and computer vision algorithms to be useful to road traffic examination and monitoring. One of the most important aspects was to modify these algorithms to fit to real-time road monitoring processes, and as a consequence the model of system for traffic analysis was developed. Technically this scheme is based on stationary video cameras as well as computers linked to wide area network.

Capabilities of the system consist of vehicle tracking, vehicle speed measurement (without use of traditional sensors), and recognition of authorize plate numbers of stirring vehicles, street jam detection. Other extra features of the system are object/data searching and archiving, statistical analysis. Image processing tasks utilized in the system are image filtering, correction and segmentation, object modeling, tracking and identification, morphological, geometrical and statistical methods. Technical responsibilities used are motion shooting, video sequence transmitting, frame extraction. The work of traffic monitoring and analysis will be done by using image processing in MATLAB software.

Problem description

Image processing and pattern recognition of moving objects, selected for the system, lead to complex mathematical, algorithmic and programming problems .Various articles have considered particular question associated with : scene modeling, object geometry accounting, image contours processing. There is a require of information on methods and algorithms used in digital monitoring technology, perhaps for business reasons. The problem of road monitoring as it is chosen in our research is presented as a sequence of autonomous processing steps intended to solve tasks logically associated to each other. These steps supply of the following order of algorithmic processing: video flow input to computer, its conversion to a sequence order of single frames, street masking, background elimination, noise and blobs filtering, object contours removal, linking and labeling, contour parameters estimation, moving vehicle tracking, speed calculation, street conges.

Such a sequence of steps is determined by the order of logical stages. For the first of all initial information have to be given in the form of video stream, and then processed to locate observed vehicle in every frame. The imaging events like segmentation, filtering and edge detection ones are arranged and utilized, that allot vehicle contour surrounded by frame examination zone. The next stage is to find and mark a restricted center of vehicle presented by its contour area, in order to estimate speed of an object, and to track it within frames. Third stage is to tag contours, which assist us to mark and determine a number of moving objects in the observation zone, and thus approximation lane

congestion. Next stage gives a opportunity to detect vehicle category, by using matching criteria for judgment of vehicle contours segmented to typical outlines of cars, trucks, pickups and buses. The last stage contains capture and recognition of vehicle number plates.

There may be two types of data used in the system, interrelated with the location of stationary camera: motion scenes may be filmed with a view from above to the road surface, or motion scenes may be filmed from road level, under the fixed angle to vehicle movement. In the first case data are suitable for vehicle tracking and velocity measurements, and in the second case – for number plate detection. Notice that in the system there are no sensors used or electromagnetic loops installed in the roadbed to identify moving vehicles.

Scope of Problem:

- This System will monitor activities at traffic intersections for detecting congestions, and then predict the traffic flow which assists in regulating traffic.
- In the proposed project, initially image is captured with the help of the camera and then processed in Matlab to count the number of vehicles in the captured image and the count value is fed to the SQL server.
- By sending the message along with the signal name, we can find out the traffic density.

II. METHODS AND TECHNOLOGY

Techniques Used:

Segmentation and Pattern recognition

Segmentation

Segmentation procedures partition an image into its constituent parts or objects. In general, autonomous segmentation is one of the most difficult tasks in digital image processing. A rugged segmentation procedure brings the process a long way toward successful solution of imaging problems that require objects to be identified individually. On the other hand, weak or erratic segmentation algorithms almost always guarantee eventual failure. In general, the more accurate the segmentation, the more likely recognition is to succeed. Under segmentation technique background subtraction is used to eliminate background portion.

Recognition

Recognition is the process that assigns a label (e.g., "vehicle") to an object based on its descriptors. we conclude our coverage of digital image processing with the development of methods for recognition of individual objects. Pattern recognition is mainly used for pattern matching recognition technique.

III. RELATED WORK

Wang Feng et al [8], In this paper, a latest method of real-time road mapping and vehicle data extraction is presented. It includes three major components:

- Establishment of UAV remote sensing platform;
- Real-time processing of the acquired images;
- Vehicle information extraction form image sequence.

The experimental results show that this method can efficiently get the image and map of roads, also can take out the vehicle information in real-time. But there is still potential for future improvement, i.e. the embedding implements can't offer accessorial data exact enough.

Tahere et al *[9],* this paper presents calculating of vehicles density in traffic images is a challenging research. This paper proposed a simple method for traffic density computation in multiple vehicle based on counting object pixels and assigning a distance index to each region of image that concentrates on time and computational complexity and accuracy in traffic density calculation. However the accurateness of this method is not very high, but it's speed is very good, for real-time work speed of method is very important. This accuracy is superior for most of application, but for better accuracy we can split image to more section.

H. Chinthaka N. Premachandra et al [10], this paper proposed the latest transmitter finding and tracking methods were planned utilizing high-speed camera image processing for a road-to-vehicle Visible Light Communication system. With the proposed methods, the entire LEDs in the transmitter can be used for achieving uninterrupted communication, which was not possible with previous methods. According to the experiments, new proposals are very effectual in desired finding and tracking. But this method unable to find and track traffic lights, when they are overlapped with supplementary light sources.

Ms. Pallavi et al [11], this paper presents image processing is a better technique to manage the state change of the traffic light. It shows that it can decrease the traffic congestion and avoid the wastage time by a green light on an empty road. It is also more reliable in detecting vehicle existence because it uses definite traffic images. It visualizes the reality so its function much better than those systems that rely on the recognition of the vehicles' metal content. In general, the system is first-class but it still needs improvement to achieve a hundred percent accuracy.

Angusundaresh Krishnakumar et al [12], In this paper, the waiting time at every signal for the automobile user at the signal will be decreased and the traffic progress will be much smoother than the current automobile blockage. The experimental results show that the accuracy of counting vehicles was 96%.

IV. PROPOSED METHODOLOGY

In this paper the main approach focuses on methods of image processing, pattern recognition and computer vision algorithms to be useful for road traffic analysis and monitoring. One of the most important aspects was to modify these algorithms to fit to real-time road monitoring processes and as a consequence the prototype of system for traffic analysis was developed. Technically this system is based on stationary video cameras as well as computers linked to wide area network. Capabilities of the system contain vehicle tracking, vehicle speed measurement (without use of traditional sensors), and recognition of license plate numbers of moving vehicles, lane jam detection.

GSM Modem: We would be sending the SMS to the drivers with the help of GSM Modem in case there is over speeding or Lane Changing by the driver's vehicles.GSM modem is an challenging issue in traffic monitoring to send message to the driver of vehicle if over speeding is there while driving vehicles.

There are five modules require to implement road traffic monitoring and analysis application process. They are as follows:

1. Network formation module:

It consists of information related lane masking and background elimination .Lane masking is used to separate the part of road where vehicles are moving in one direction and background elimination is used to removes all stationary objects from lane observation zone except only vehicles and some details, which are changing from frame to frame. The technique of thresholding is used for image segmentation purpose and background elimination is used for region detection process. In the thresholding process, each individual pixels in an image are marked as "object" pixels, if its value is greater than some threshold value and as "background" pixels otherwise. This principle is known as threshold.

2. Traffic generation module:

This module concern with the information related to how traffic will generate and how traffic density increased. Its traffic detail will be sent to the corresponding user by sending message to that driver providing the name of the signal area. According to the received message from the signal area, people choose their alternate way or wait until signal get cleared as per automatic interval of time for timely reach to their destination.

3. Congestion module:

This module consists of information about traffic congestion. How the traffic will manage through congestion occur related that all work will be done in this module.

4. Traffic density optimization module:

It has the technique of optimization which is used for object or image optimization purposes.

5. Result evaluation and system optimization module:

Result related information and final execution with evaluation can be done in this module.

Project Scope:

The Motivation of this research work is to focus on the issues related with traffic density. The captured images will be sent to the server. MATLAB software will be installed in the SQL server. To identify the presence of an object the image is scanned in the image. The information of the registered object keeps track on the number of vehicles. During the period of green signal buffer will be get cleared. Initially cameras capture the traffic image in a continuous interval of time. The captured image will be processed using the MATLAB software. MATLAB software subtracts the background image and counts the vehicle number and stores the information in the dataset of personal system. Microcontroller sends the count value to the server database through GSM Modem.

Significance of the project:

This project will be able to be used for these tasks:

Traffic problems nowadays are increasing because of the growing number of vehicles and the limited resources provided by current infrastructures. Due to this, there is a need to wait for more time in front of the signals. This leads to waste of time. In concern with this problem, we have designed a paper that will help the people in taking the alternate routes in times of long traffic so traffic movement will be smoother and traffic monitoring can possible through this task.

V. CONCLUSION

The waiting time at each signal for the automobile user at the signal will be decreased and the traffic movement will be much smoother than the present automobile congestion.. 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.

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