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A STUDY ON TRAFFIC SIGNALING SYSTEM

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Abstract- Traffic blocked has become a major problem in every large city of the world. To make certain that will occur a suitable transportation system it is important to have an intelligent traffic control system. The very first step to do is to acquire traffic data. Traffic data may be acquired from different methods. However in recent day's image processing techniques has been very important and promising topic to deal with traffic related problems because of its ease of maintenance and being more intelligent system. Most of the work detects edge of the vehicles and counts the number of traffic on the road. The disadvantage of the method is that counting the number of vehicles may give fault results when space between the vehicles on the road are very small (i.e. two cars very close to each other may be counted as one vehicle). In theproposed method by Lakshmi & Kalpana, firstly calculates the amount of area occupied by vehicles on the road rather than finding number of vehicles. The greater the amount of area occupied by vehicles on the road the greater the amount of traffic blocked. This way every kind of vehicles can be accounted for traffic space. Using this traffic data, the proposed model automatically controls the traffic signaling in a particular order depending on the amount of traffic on the road.
Keywords- Traffic congestion, signaling system, Image Processing

1. INTRODUCTION

Road transport is one of the primitive modes of transport in many parts of the world today. The number of vehicles using the road is increasing exponentially every day. Due to this reason traffic blocked in city areas is becoming unmanageable. Inefficient management of traffic causes wastage of invaluable time, pollution, wastage of fuel and cost of transportation. Traffic blocked is the major problem that every country faces today due to the increase in number of vehicles. Traffic jams also create many other critical issues and problems which directly affect the human routine lives andsome time reason for life loss also.In the following sections we have studied different traffic management systems which includes manual and automatic traffic management system and new system which was proposed by Ch.Jaya Lakshmi & S.Kalpana.

2. DIFFERENT TRAFFIC MANAGEMENT SYSTEMS

Generally there are two different standard traffic control systems, they are Manual controlling and Automatic controlling. They are explained briefly in the below sections.

2.1 Manual Controlling

Manual controlling as the name itself implies that it requires man power to control the entire traffic. Depending on the countries and states the traffic police are allotted for a required area or city to control traffic. The traffic police men's will carry sign board, sign light and whistles to control the traffic.

2.2 Automatic Controlling

Automatic traffic lights is entirely controlled by timers and electrical sensors. In traffic lights each phase a constant the distance of two vertical line loaded in the timers. The lights are automatically getting ON & OFF depending on the timersvalue changes. While using electrical sensor it will capture the availability of the vehicles and signals on each phase depending on the signal the lights automatically switch on and off by itself.Magnetic loop detector are used to count the number of vehicles on the road using magnetic properties. We use Current traffic management techniques like magnetic detectors which are buried in the road, radar and infrared sensors on the side of roads provide limited traffic information. It shows the requirement of separate systems for proper counting of traffic and correct supervision.Inductive loop detectors[8,9] provides a cost-effective solution for traffic controlling but along with this it is also true that their failure rate is high when they are installed in poor road surfaces, leading to fall in pavement life. At the time of maintenance and repair it obstructs the traffic.Use of light beams like infrared ray's[10] LASER etc. can also be used for controlling functioning of traffic. But in this method the light beams are obstructed as traffic flows causing improper results.

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2.3 New traffic control System proposed by Ch.Jaya Lakshmi & S.Kalpana

Traffic Density (TD) Extraction: Intelligent traffic signaling system where vehicles are detected by the systems through imagesinstead of using electronic sensors embedded in the pavement[1]. A camera will be placed alongside the traffic light. It will capture image sequence. Image processing is a better technique to control the change of the traffic lights. It shows that it can decrease the traffic blocked and avoids the time being wasted by a green light on an empty roads. It is also more reliable in estimating vehicles presence because it uses the exact traffic images. It visualizes the practicality.So it functions much better than those systems that detectthe vehicles metal contents. The system has the potential to change traffic surveillance and control technology because of its low cost and potential for large scale.

In this system the feedback signal is entered to traffic light system by adding camera on the intersection, and uses this camera to calculate the number of pixels for each path using image processing technique which corresponds to the total traffic density of a particular road. This technique analyze the images from camera and import to the controller the traffic density for each direction, then the controller estimates a period of time needed by each path to open each traffic light based on the traffic density in a fixed sequence, it is also used to monitor the traffic. The system consists of additional features such as opening one traffic light and closing the others.

The proposed method finds out total amount of pixels in a video frame which corresponds to the amount of area of occupied by vehicles on the road rather than finding number of vehicles. The greater the amount of area occupied by vehicles on the road the greater the amount of traffic blocked. This way every kind of vehicles can be accounted for traffic density. Using this traffic data we propose a model for traffic signal control depending on the amount of traffic on the road. Time allocated for each road is made variable by weighing its time allocation depending on the traffic density. Traffic signals are controlled through the unit.

3. STEPS INVOLVED IN THE NEW SYSTEM:

Acquisition of Foreground and Background Images : In this section process of extracting traffic information from image is seen. Assume that a video camera, placed at appropriate position, is employed for image acquisition. From the camera video stream data is processed frame by frame. Our goal is to determine how much traffic is on the road.Preprocessing After acquiring the foreground andbackground images necessary operations are done. In most computer vision systems, simple temporal and/or spatial smoothing are used in the early stage of processing to reduce camera noise. Smoothing can also be used to remove transient environmental noise such asrain and snow captured in outdoor camera. For real-time systems, frame-size and frame-rate reduction are commonly used to reduce the data processing rate. If the camera is moving multiple cameras are used at different locations. Obtained RGB image is converted to grayscale for processing.Sobel Edge Detection:Edge detection is an image processing technique for finding the boundaries of objects within images. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision, and machine vision.Background Subtraction: Identifying moving objects from a video sequence isa critical task in video surveillance, traffic monitoring and analysis, human detection and tracking, and gesture recognition in human-machine interface. A common accessible direction to identifying the moving objects is background subtraction, where each image frame is compared against a reference or background model. Pixels in the current frames that deviate from the background are considered to be moving objects. These foreground pixels are further processed for object localization and tracking. The background subtraction method[3] is particularly suitable for detecting a foreground objects on fixed background. Here the empty road will be the background image and subsequent frames from the camera will be the foreground image. By subtracting background image from the foreground image we can find out traffic density present in a frame.Morphological Image Closing Operations: Closing isan important operator from mathematical morphology. Like its dual operators opening it can be derived from the fundamental operations. As with other morphological operator, the exact operation is determined by a structuring element itself.Flood Filling Operation: Flood fill, also called seedfill,Flood fill algorithm helps in visiting each and every point in a given area. It determines the area connected to a given cell in a multi-dimensional array. Following are some famous implementations of flood fill algorithm.After that we perform flood fill operation to fill the holes in the objects with closed contours and we get image with solid foreground objects.

Gray Scale To Binary Image Conversion: To convertthe processed grayscale image to binary image, apply the thresholdingmethods.Globalthresholding process based on Otsu method is used to compute the threshold which classifies the background objects with foreground class object. Therefore these are the operations performed on captured images and then binary images from gradient method and direct subtraction method are obtained. The output from this two methods are added in order to reduce the drawbacks from the each method. In Direct subtraction method color of the vehicle can be problematic in finding TD. If the vehicle color is black it may not detected with direct subtraction method. This problem is solved by the gradient magnitude method where vehicle color is not a factor. But in gradient magnitude method there can be certain situations where detected edges may not form closed contour. This problem is easily solved using direct subtraction which detects this portion of the vehicle. Thus, the total image is obtained by adding the twobinary images. Traffic density is calculated by adding the total pixel values in the final binary image i.e total image.Estimation of signaling time for Each Road .Traffic densities of different roads at any certain time are considered as input. Based on the output from the processed algorithm in MATLAB[14] traffic cycle is estimated. Traffic Cycle (Tc) is the total time required for one complete rotation of the signal lights at any traffic point. The traffic cycle is taken as a function of total traffic density (TD) of vehicles given as

TC= f(TD) The denser the traffic, longer is the traffic cycle. This method is applied for longer cycle duration when there is more traffic (as in rush hour) so that more vehicles can pass at a time. When there is less traffic, the traffic cycle is shortened so that vehicles do not have to wait for a long period of time in signal transitions. The second parameter is weighted time allocation of vehicles. Our main target is to pass traffic from the road with the higher density. For this reason, a weighted time allocation is chosen. The weight is the relative traffic density of a particular road in a traffic junction. Mathematically.

$$Wp = \frac{Traffic\ density\ on\ a\ particular\ road}{Total\ traffic\ density\ of\ all\ roads}$$

The signal time (i.e., green light) allocated for a particular road is given bySTp= TC * Wp
After the computation of this signal time for a specific road , this data is transmitted to the aurdino from the MATLAB interface directly. This board controls the signals,lights as per the time received from the processed algorithm tabale 1

Table 1 -Traffic Densities, Weighted input and Signal time for different roads

Roads	**CASE 1**			**CASE 2**		
	TDp	**Wp**	**STp**	**TDp**	**Wp**	**STp**
R1	16853	0.2008	0.4006	25188	0.2814	0.5628
R2	19904	0.2366	0.4732	17045	0.1904	0.3809
R3	23388	0.2780	0.5560	23578	0.2634	0.5268
R4	23986	0.2851	0.5702	23697	0.2647	0.5295
Total	84131	1	2	89508	1	4

By using the image processing techniques, successfully the total traffic on the road is computed. By using this traffic information the aurdino which takes the decision about the time of green light to be glows on the each road by considering the information received from the MATLAB through serial communication. In this proposed method there is less involvement of any human work at each junction and by employing this method , man power at traffic junctions to maintains the traffic management can be reduced.

4. CONCLUSIONS

Traditional traffic signals are having lots of bugs. The proposed one by Lakshmi & Kalpanais better than the traditional traffic control signaling system. The amount of traffic on roads is estimated through measuring the total area occupied by vehicles on the road instead of vehicle count in terms of the traffic density. Variable traffic cycle is selected depending on the total traffic density of all the roads at the junction. Depending on the traffic density a weight is determined for each road and total traffic cycle is weighted for the roadsWith the proposed system, the challenges involved in the traditional signaling system can be overcome. This problem can be overcome with some improvements.

5. REFERENCES

[1] Ch.Jaya Lakshmi & S.Kalpana, Intelligent traffic signaling system, Dept. of EIEV.R. Siddhartha Engg. College V.R. Siddhartha Engg. College Vijayawada Vijayawada.

[2] T Cherrett,., B Waterson,. and McDonald, M. Remote automatic incidents detection using inductive loops. Proceedings of the Institutionof Civil Enginee,: Transport, 158, (3), 149-155.

[3] Courtesy of Math Works - MATLAB and Simulink for Technical Computing.URL: http://www.mathworks.com/

[4] Georgios Vigos, Markos Papageorgioua, Yibing Wangb, "Real-time estimation of vehicle-count within signalized links", Journal ofTransportation Research Part C: Emerging Technologies, Volume 16, Issue 1, pp.18–35, February 2008.V. Kastrinaki, M. Zervakis, and K.Kalaitzakis, "A survey of video processing techniques for traffic applications," Image and Vision Computing,vol. 21, pp.359-381, Apr 1 2003.

[5] I. Sobel, An Isotropic 3x3,376-379, 1990, Gradient Operator, Machine Vision for Three Dimensional Scenes, Freeman H., Academic Pres, NY, pp.

[6] M. Piccardi, "Background subtraction techniques: a review," IEEE 42 International Conference on Systems, Man and Cybernetics 4, pp 3099- 3104,Oct. 2004.

[7] Marcin Bugdol et.al."Vehicle detection using magnetic sensors" Problemy Transportu Volume 9 Issue 1,2014.

[8] W Michael. Szeto and C Denos. Gazis, "Application of Kalman Filtering to the Surveillance and Control of Traffic Systems", Journal of Transportation Science, vol. 6 pp.. 4419-439 , November 1972.

[9] M Papageorgiou, C Diakaki, V Dinopoulou, A Kotsialos,.,"Review of road traffic control strategies", Proceedings of IEEE, Vol. 91, Issue 12, pp. 2043-2067, November 2004.

[10] P. Soille, Morphological Image Analysis: Principles and Applications, Springer-Verlag pp. 173-174., 1999.