Automatic Signal Scheduling For Efficient Traffic Management

Sumer Singh, Ravindra Kumar Sharma, Kirti Vyas, Abhishek Mathur

***Abstract*— There is an urgent need to improve traffic control and management. Vehicle flow detection appears to be an important part in today's traffic management system. The traffic flow shows the traffic state in fixed time interval and helps to manage and control the traffic especially when there is a traffic jam. In this project, we propose anautomatic traffic management system for vehicle detection and counting and automatic signal scheduling. The camera supplies video input to the processing engine. Processing engine will implement BLOB algorithm for vehicle detection and counting which will thereby schedule the signal timer accordingly.In case of emergency vehicles,ORB algorithm will be implemented so as to give them higher priority. In case of violation of traffic rules, the image of that particular vehicle will be captured andsent to the admin. This system is a real time application.**

***Index Terms*— Blob algorithm, Blob analysis, Signal scheduling, Template matching,Vehicle counting**

I. INTRODUCTION

As the numbers of vehicles on the roads are increasing, they are creating heavy traffic that is difficult to control and maintain safety. This problem is much serious and unsafe for pedestrians, especially in large cities like Pune, Bangalore and Mumbai.Growth of traffic here is non-linear as compared to the development of infrastructurelike roads, intersections and bridges. It is difficult for most of the time and sometimesimpossible to modify or broaden them in existing cities. To smoothen flow of traffic at intersection, options available with traffic control department are to impose one way, use traditional traffic monitoring and controlling in addition to existing automatic signalling system.

Traditional systems are effective but are limited. Traffic policemen decide time for traffic signal control depending on the density at particularlanes. Existing automatic system uses pre-set signal timings to control traffic at intersection. Time to be Pre-set time is again decided by the traffic officer depending upon his/her survey about traffic condition for a particular intersection. Most of the time, these methods are ineffective, because of sudden fluctuations in flow of traffic apart from peak hours. The cyclic signalling method with existing pre-set timing in automated system will be inappropriate in situation of waiting, even if few or no vehicles available on the other road. Fixed timing will not be inappropriate in caselarge number of vehicles waiting to cross the junction. Inconvenience will be caused by unnecessary waiting; people will lose time, miss opportunities and get frustrated. Traffic congestion problems create a deep impact on companies production and transportation of goods. Need is for automatic adjustment of the signal timing with changing traffic conditions, in similar fashion asto what the officer does in traditional system. System must be capable to handle emergencies.

Hence we propose a system that manages traffic flow by manipulating the signal timer according to the density of vehicles. The system supplies video input to the processing engineand BLOB algorithm is applied to count the vehicles and also record the type of vehicle in the database. The signal timer is first pre-set to some time, for example in a four lane road suppose the time for each signal is 30 seconds. Then according to the density of vehicles the system will increase the wait time for other lanes if a lane is having heavy traffic as compared to other. This will manage the traffic flow to a great extent. But the signal timer will not decrease its wait time in case an emergency vehicle comes into picture.

Also the system will recognise emergency vehicles like ambulance and fire brigades and will stop all the lanes and will give green signal to the lane on which there's an emergency vehicle. This system is a real time application.

II. RELATED WORK

Collision occurring at traffic signals is an important road issue. Safety and time saving is top most priority in traffic management. Several systems have been implemented and proposed so far for traffic on straight road, in cities, at junctions. Systems are designed with artificial vision with the help of good quality outdoor camera, sensors, supporting hardware and software.

The Adaptive Signal-Vehicle Co-operative control system [1] provides an optimal traffic signal schedule as well as an optimal vehicle speed advice. The traffic signal scheduling is achieved using Adaptive Dynamic Programming which has the advantage of reducing the computational requirement so as to bring about a feasible implementation.

An interactive fuzzy signal controller proposed in [2] makes use of neighbouring traffic information to tackle congestion. The output of the controller decides whether to extend, early cut or terminate the current signal phase depending on the observed traffic conditions.

In Intelligent Traffic Light and Density Control using IR Sensors and Microcontroller [3] it is proposed that the delay of Signal not depend on traffic density. Optimizing the traffic using microcontroller, this system reduces traffic jams problem cause by traffic light to extend. The system contains

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IR Transmitter and IR Receiver. IR count the vehicles on the road Microcontroller generates the result.

There has been significant research work in vehicle detection and counting also. There are several methods for detecting moving vehicles taken from a stationary camera. Generally, they are categorised into three groups; background subtraction, frame by frame differencing and optical flow approaches. In background subtraction method, the object is detected by pixel wise subtraction between the current frame and the background frame. Using some threshold limit, all pixels belonging to object (that are not present in the background image) are detected and grouped together. A comprehensive survey on vehicle detection appears in [4]. Tracking of moving vehicles in video sequences has been an active research topic in field of computer vision. The main idea of the tracking processes is to keep the identity of each detected vehicle over the whole sequences of the video. Thus, eliminates possible multiple counts in the vehicle counting stage.Artificial vision along with image processing techniques is used to separate background from the area of interest leading to the extraction of objects and with the help of morphological processing, removes the small lines and shapes. Finally remaining contours area is calculated. This is compared with experimentally obtained rate to determine the occupancy level of road. Known occupancy level is used to calculate time for signal lights control.

III. SYSTEM ARCHITECTURE

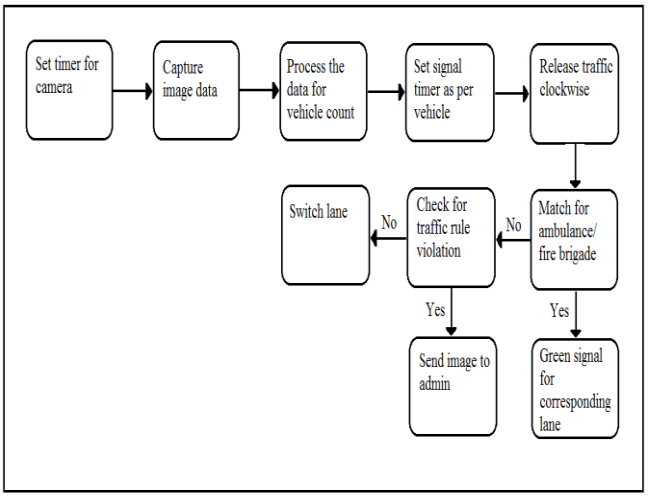

Figure 1: System Architecture

The system architecture starts with a module in which we are setting initialtime for each camera from which we are taking video as input data. The input is real-time continuous streaming of data. Video is set of frames and when we capturethe video, we are capturing numbers of frames as input. In 1 second we are capturingat most 40 frames of data. In our project we are using mobile phones camera to takeinput video which is real time live streaming of data.

After capturing the input data the data is send to processing unit where the data isprocessed to get vehicle count and detection. In this processing unit we are usingBLOB algorithm and ORB algorithm to extract details likevehicle count and detection. After this, timer is set for every signal according to vehicle density on corresponding lane. The lane which have maximum traffic will get maximum release time and the lane which have minimum traffic will have minimumrelease time but traffic is released in clockwise direction only to maintain therotational flow of signal.

But meanwhile if the system found that there is emergency vehicle like an ambulanceor fire bridge, then instead of taking priority as vehicle count, system willgive emergency vehicles first priority and release the corresponding lane in whichemergency vehicle is travelling and at that time all other signal of other three lanes will be given red signal. And if no emergency vehicle is there on any lane then thesignal will be scheduling normally as per time allocated based on number of count.

This system is also useful in traffic rule violation detection. The cameras present on signal also captures image of those vehicles, who are breaking traffic signal rules orexceeding the speed limit and that traffic rule violation data is send to in charge authorityadministrator of traffic rule violation. They can use the data for taking actionsagainst the owner of that vehicle.

IV. CONCLUSION

This system is a video based traffic controlling system which is a real time application. It will manipulate the signal timer according to the density of vehicles andhence manage the traffic flow. It will capture the frames in fraction of seconds thusmaking the system to work fast and efficiently in real time. Also the signal timerscheduling will be done very effectively thus controlling heavy traffic and will consider emergency vehicles like ambulances and fire brigades, giving them priority to go.

Thus, this system will be very useful to manage heavy traffic in metropolitan cities

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