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Automatic Signal Scheduling For Efficient Traffic Management

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Abstract-- Traffic congestion is one of the major problem in today's world, which is need to be solved 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 an automatic 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 and sent to the admin. This system is a real time application.
Keywords-- Blob algorithm, Blob analysis, Signal scheduling, Template matching, Vehicle counting

I. INTRODUCTION

The population of the developing countries is increasing gradually due to which the traffic density is increasing at a high rate which requires the need of automatic traffic management system to replace the conventional, manual and time based traffic signal system. The increased traffic has lead to long waiting time, fuel wastages, slower speed, and increased vehicular queuing.

Researchers are trying to explore technologies to detect traffic congestion and make the traffic management system efficient. There are various technologies used to detect traffic congestion like the inductive loop system, the detectors that count the number of vehicles during a unit of time, GPS devices and webcam, radar technology etc. These technologies have drawbacks, such as they are expensive to install, they demand traffic flow disruption during installation or maintenance, they are not portable and they are unable to detect slow or stationary vehicles.

The commonly used Traffic Signal System in developing countries is the time based system. This system involves a preset time interval setting for each road junction. The system is based on one minute time interval, the vehicles are allowed to move at the junction where the traffic light is green for a certain interval of time, but after one minute it comes to a stop when the traffic light turns red. Sometimes there are no vehicles on a particular lane but still it is given green signal because the traffic signals change depending upon time interval.

Urban areas are facing severe traffic congestion problems which need to be solved and this is not possible by existing traffic systems which works on predefined technique instead of real time data. An automatic traffic management system can solve these problems by continuously sensing traffic density at different signals and accordingly adjusting the timer for traffic lights on the side at which there is more vehicular density. It will also communicate and synchronize with neighbouring traffic signals. This traffic management system will additionally provide us useful information such as traffic flow density, the length of vehicular queue, average traffic speed and the total vehicle count in a fixed time interval. In this project, video camera is implemented as a traffic sensor because of its low cost and its ability to collect vast amount of information such as the number of vehicles, vehicles speed acceleration which can in turn predict information like accidents, speeding, traffic statistics, etc. Video based systems are easy to install, they can be easily upgraded and they offer the flexibility to redesign the system and its functionality. These systems allow vehicle detection, counting, and the identification of traffic incidents. Implementation of this system will eliminate the problems related to traffic such as traffic signal delay, traffic congestion, waiting time for low vehicle density. The main objective is to develop a method for automatic vehicle detection and vehicle counting on lanes. The traffic signals are changed depending upon the count of vehicles. The system supplies video input to the processing engine and BLOB algorithm and then background subtraction technique is applied which is used to detect and count driving vehicles efficiently and also record the type of vehicle in the database. The system will digitally process and analyze these videos in real-time in order to extract reliable data on traffic flow and to detect traffic incidents and traffic violations. As a result of such video analysis, traffic density at major junctions can be estimated and the

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data may also be used as input for traffic models and related planning problems.

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. The basic priority of any traffic management system is maximizing the safety and saving the time. There are several systems that have been implemented and proposed so far for managing the traffic on straight road, in cities, at junctions. These systems are designed with artificial vision with the help of good quality outdoor camera, sensors, supporting hardware and software.

The growing issue of traffic in metropolitan cities is also due to parking and double parking which is creating congestion on roads thus leading to unwanted traffic incidents [1].There is a need of a system which will effectively control and manage the traffic flow in these metropolitan cities. The required system should be digital and real time which will work robustly for better traffic flow in metropolitan cities where traffic congestion is consistently growing problem. The existing traffic signal junctions are not synchronised with each other which is also a major drawback of existing traffic system and there is no data base in existing system which will keep records of all the vehicles running on the lanes or crossing traffic signal.

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. They are categorised into three groups namely 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.

III. SYSTEM ARCHITECTURE

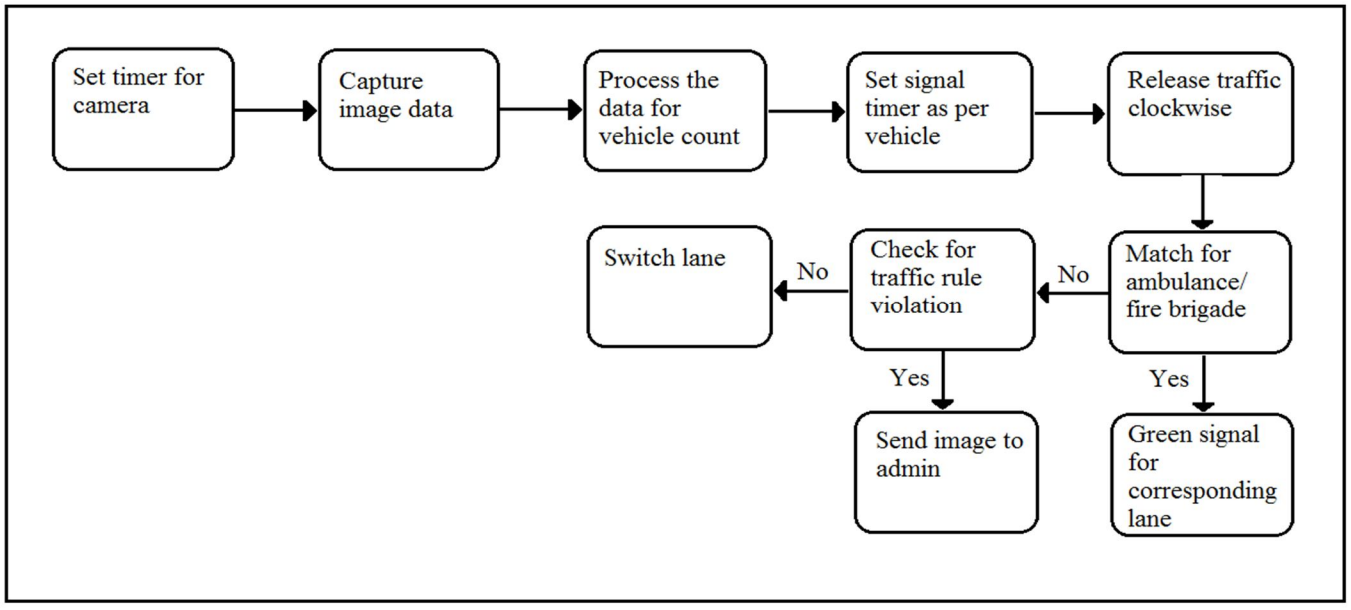

Figure 1: System Architecture

The system architecture starts with a module in which we are setting initial time 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 capture the video, we are capturing numbers of frames as input. In 1 second we are capturing at most 40 frames of data. In our project we are using mobile phones camera to take input video which is real time live streaming of data.

After capturing the input data the data is send to processing unit where the data is processed to get vehicle count and detection. In

this processing unit we are using BLOB algorithm and ORB algorithm to extract details like vehicle 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 minimum release time but traffic is released in clockwise direction only to maintain the rotational flow of signal. But meanwhile if the system found that there is emergency vehicle like an ambulance or fire bridge, then instead of taking priority as vehicle count, system will give emergency vehicles first priority and release the corresponding lane in which emergency 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 the signal 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 or exceeding the speed limit and that traffic rule violation data is send to in charge authority administrator of traffic rule violation. They can use the data for taking actions against 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 and hence manage the traffic flow. It will capture the frames in fraction of seconds thus making the system to work fast and efficiently in real time. Also the signal timer scheduling 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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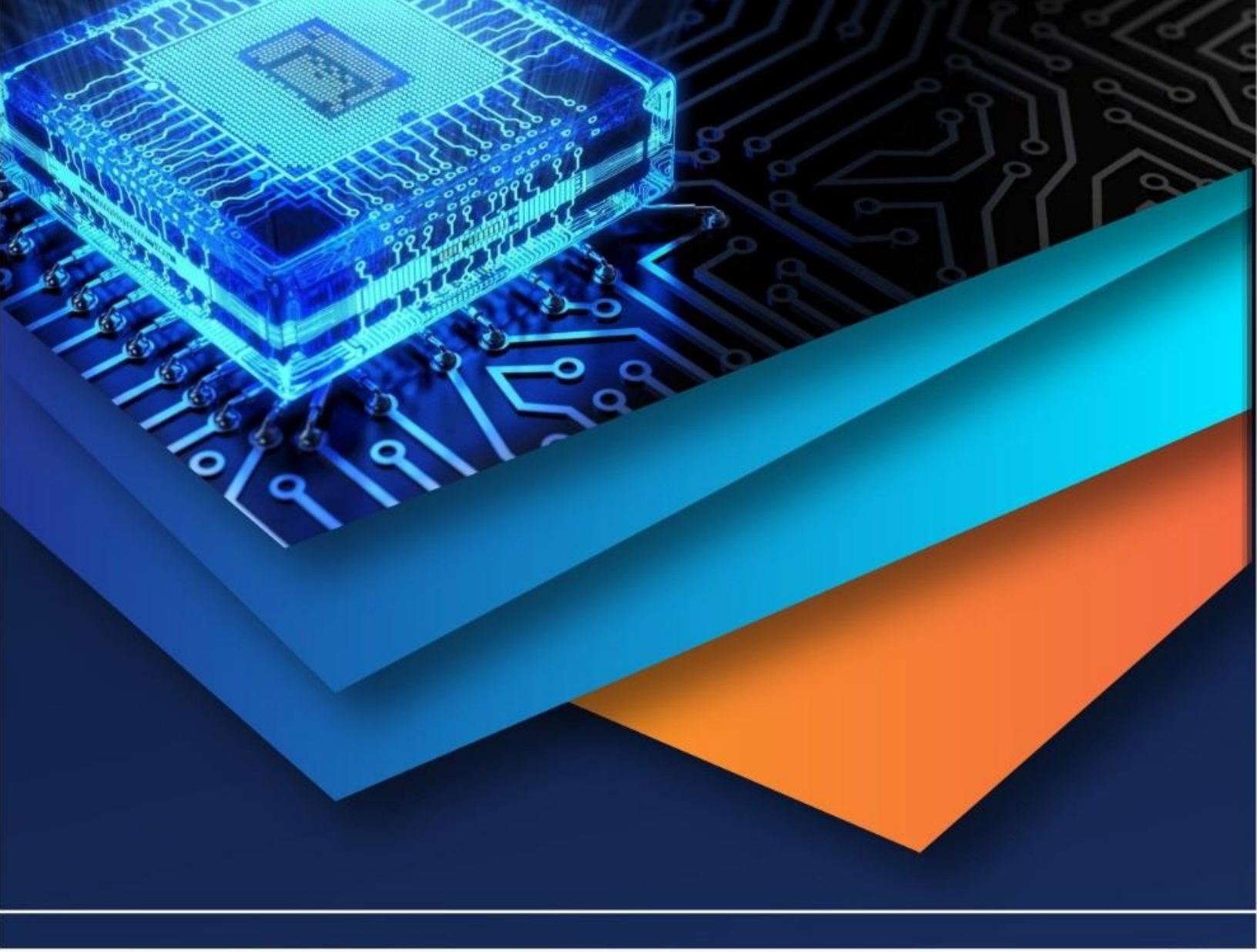

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