Survey on Traffic Monitoring System using Image Processing

Nikhil Lende
Maharashtra Institute of Technology
University of Pune
Pune, India

Prof.S.S.Paygude
Maharashtra Institute of Technology
University of Pune
Pune, India

Abstract— **Growth of total number of vehicles around the world is increase exponentially during past decade. Traffic monitoring is become a big issue in many countries. In India, Many cities having manned traffic monitoring system. A manned traffic monitoring system has certain issues like availability, accuracy of management staff. In this paper, we study different traffic monitoring system. Each system describes a way to handle vehicle traffic on road by minimizing human support. This includes identifying vehicle in traffic; detect traffic congestion on a road, calculating speed of vehicle and avoid accidents on road. This paper study sensor based image processing and vision based image processing techniques. It shows that vision based system gives more accurate data in less cost for traffic management system.**

Keywords— *Traffic monitoring system; Traffic congestion.*

I. INTRODUCTION (*HEADING 1*)

In India traffic is growing four times faster than the population. Safety of roads has become a main issue for governments and transport vehicle manufacturer in the last twenty years. City infrastructure not widely developed as number of vehicles, so congestion of vehicles on road has become a main problem. Traffic congestion also cause due to time delay to remove accidents related vehicle on highways and weather condition. Due to traffic congestion, there is waste of time and energy of vehicle as well as victim. Traffic analysis done by different methods of traffic monitoring system like traffic on roads may have higher at working time of a day compared to night. Traffic information on road can be extracted using magnetic loop detectors, radars and video cameras.

By using magnetic loop detectors and microwave sensors, traffic monitoring system can detect vehicle and its count. This method of extracting traffic parameter is autonomous, require low maintenance and reliable. But it also has disadvantages like it require dig up the road therefore this method becomes costlier to install. It also gives limited amount of information than other methods of traffic monitoring system. Radar gun is other way of getting information about speed of vehicle but it gives less traffic information. Same with pressure tubes reliable but give limited information about traffic.

Computer vision is next famous way of handling traffic as it can collect many information like flow rate, speed, queue length of vehicle and easy to install with low cost. This method is not reliable when there is varying lighting condition and weather. In this paper, we study different architecture of traffic monitoring system based on above basic methods.

This paper organized as follows. In section II, we study and analyze traffic monitoring based on RFID. In section III, we delve traffic monitoring by traffic density calculation using video processing. In section IV and V, we study traffic monitoring using GPS/GPRS technique and MANET respectively, discuss conclusion in section VI.

II. TRAFFIC MONITORING USING RFID

A. Structure of RFID System

RFID is a wireless radio frequency identification technology. Data communication between server and vehicle is done through radio waves. Computer system and network system manage tag information in a reader [1]. The tag is installed on vehicle license plate. It has a range from 1~10m.
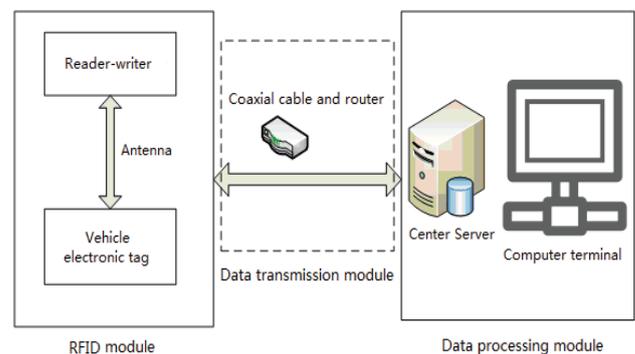

Fig. 1. The traffic monitoring system

B. Software architetecture

In this reader position is stationary and placed on each intersection. As tag is placed on vehicle it gets activated when comes in reader's range. It sends parameters about a vehicle to reader. Then SCM generate an interrupt request and writer

receives the date. Again writer sends date to data processing center.

This method has many advantages as well as disadvantages. This is sensor based method for controlling traffic and it solves the problems of magnetic loop detectors. It also gives perfect count of vehicle only when it is in reader's range. Also if particular vehicle is found in accidents and tags module affected by this then other system has no use.

III. TRAFFIC MONITORING USING VIDEO PROCESSING

Image is showing traffic on road through camera and gives information about changing traffic density of vehicle on road [2].

Fig. 2. Four way road junction

Fig. 3. Camera installed on traffic signal

Algorithm for traffic monitoring controls traffic light and its results.

A. Methodology

In this system camera for observing traffic is placed on each side of traffic junction. So there are total four video cameras will be installed over the red lights facing the road as it is four way junction. Video Cameras would be capturing traffic parameters on road and send this information to the servers. Server is using video and image processing techniques. The Calculation of vehicle density of road is done on four side of road and an algorithm is applied to change the traffic lights accordingly.

This system has used MATLAB toolbox and C++ compiler for image and video processing. In this system live video is converted into grey scale images for image processing. It also considers empty road image for comparison as a reference image. On basis of reference image, image subtraction technique is applied for extraction of traffic parameter. After that it calculates the size of a matrix and adds all values present in matrix of subtracted image. After adding all values of remaining matrix, it is divided by a constant.

Constant is calculated by considering height of camera on road, number of rows in subtracted image of matrix, number of columns in subtracted image and number of frames per second in a video [2]. After dividing by a constant, system gets approximate density of vehicle is get extracted from video. Fig 4 shows density of a vehicle at a time. Density scale is mentioned on left side of this image.

Fig. 4. Traffic density calculated image

B. Comaprison

In this system comparison between hard coded algorithm and dynamic coded algorithm takes place. It shows that dynamic coded algorithm gives better result than hardcoded algorithm. This system will lessen the unwanted delays and lessen the number of accidents by reducing congestion on a road.

IV. TRAFFIC MONITORING USING GPS

This system is a low cost system which is based on GPS signal coming from Arduino based systems [3]. GPS signal coming from mobiles are mostly used to build color traffic map and based on that shortest or best path finder software is developed [4]. Such mobile monitoring system has certain limitations like accuracy problem, battery problem and

security problem. But this system combines traffic information coming from inductive loops and camera installed on roads as well as information coming from GPS device to improve traffic monitoring system. The important difference between this system and the one presented in [5] where user mobile gives traffic information.

A. Architecture for monitoring traffic flows from GPS signals

There are several ways of monitoring vehicle flow using tubes or magnetic loop detectors [6], traffic videos [7] even in environments with little luminosity [8], and with GPS signals coming from user's mobile[9].
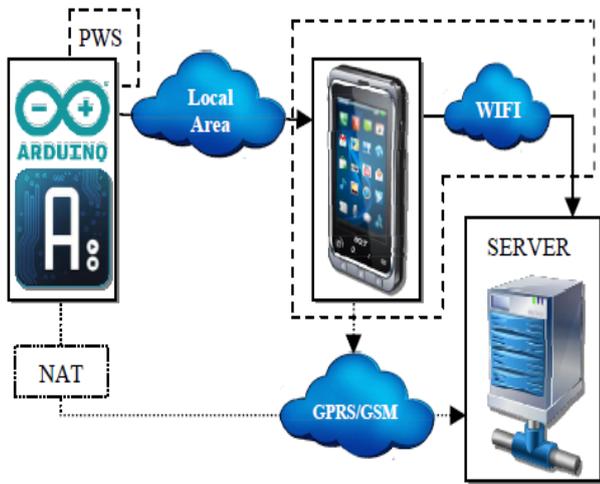

Fig. 5. Arduino based monitoring system

Arduino system provides GPS shield used for driver tracking. This system is very fast that allow the server to calculate the travel time for each road section in real time. From the traffic parameters that are coming from Arduino based tracking system it is possible to display current traffic flows on the map of user's mobile. The extracted traffic parameters used to help user's activities, running on main server or on driver's mobile by getting current traffic conditions. This system also corrects the data which is incorrectly sends from GPS by using control algorithm. Control algorithm uses maximum speed limit to decide threshold of control algorithm.

V. INTELLIGENT TRAFFIC MONITORING USING MANET

This system is an integration of image processing and communication protocols [10]. Image processing extracts the data from region of interest (ROI) and computes them. Information is computed based on video sequence. MANET receives that data. Each receiving node could initiate decision process based on importance of obtained information.

Data acquisition is done by image processing and a mobile Ad-hoc network ensures data delivery.

Main purpose of this system's identification part is to identify vehicle in ROI correctly. This system achieves around 98% c
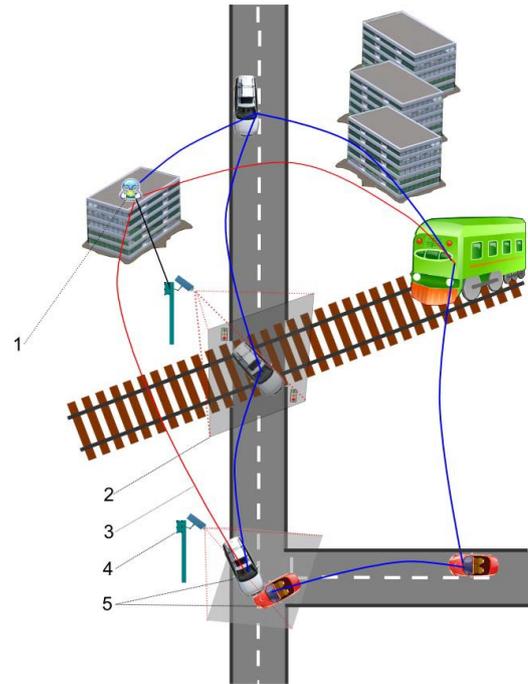

Fig. 6. Intelligent traffic monitoring system 1:Computational center (image processing). 2:Possible representation of ROI. 3: Communication between objects. 4: Camera focused on affected ROI. 5: Objects participated in communication.

This system evaluates every frame of a video. It also has some flaws like error occurs in situation when there were some shadows. Also detected an object but there was nothing. Results of this system shows reliable control of environment appropriate form of receiving and evaluating messages. This system proposes safety of traffic monitoring system by providing efficient way of data delivery.

VI. CONCLUSION

In this paper, we studied different traffic monitoring system. These systems are the recent progress in traffic monitoring.

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