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An Automation of Traffic Management System for Better Efficiency and Emergency Services

Krunal Lad[1], Swikruti Kore[2], Khushaboo Jawale[3], Dnyaneshwar Bhabad[4]

[1]Department of CSE, MUMBAI University, MUMBAI-32
Email: kunallad5473@gmail.com
[2]Department of CSE, MUMBAI University, MUMBAI-32
Email: swikruti97g@gmail.com
[3]Department of CSE, MUMBAI University, MUMBAI-32
Email: khushaboojawale@gmail.com[4]
[4]Department of CSE, MUMBAI University, MUMsBAI-32
Email: dnyaneshwarbhabad@viva-technology.org

Abstract*—The problem of traffic congestion has effectually increased in India. With the increase in growth in private vehicle ownership and automobile sector, the growth of road networks of India is slow compared to other countries, resulting into various loopholes such as Traffic Congestion, Losses faced by transport agencies and most importantly the emergency vehicles can't reach their destination on time as vehicles get stuck in traffic which turns out to be matter of life and death in some cases [13]. The major reason for traffic congestion problem in India is that the current traffic management system uses static timers to manage the traffic flow across the country. Also there is no appropriate system to clear traffic for emergency services like Ambulance, Fire Brigade, etc. The system proposed in the following paper makes the timer dynamic which analyses the congestion at each lane and assigns appropriate system. The emergency services will get the top priority when they arrive at a particular junction, thus clearing the traffic prior to the arrival of emergency vehicles. Results illustrate that the proposed system can work more efficiently and effectively compared to the current traffic management system.*

Keywords—Dynamic timer; Emergencyvehicles; Scheduling.

I. INTRODUCTION

India is one of the country which have second largest road network in the world. Out of total length of 5 to 6 million km of road network, maximum area is covered by national highways. Major cities like Mumbai, Delhi, Kolkata and Bengaluru are facing a huge and critical problem of traffic [14]. People are getting stucked in traffic. Traffic is the major reason why people are getting delayed in reaching their destinations. Emergency vehicles like Ambulance, Fire Brigade are unable to reach their spot on time because of irregular management of traffic [9]. It can be a problem of life and death in some cases. People may lose their life because of this. One of the major reasons why India is facing the problem of traffic congestion is because of the usage of static timers at the signals. So for reducing traffic congestion this paper focuses on various ideas which are Dynamic timer, Priority to emergency vehicles and communication between 2 signals.

II. LITERATURE SURVEY

Shaif Choudhury, et.al[1] has suggested a vehicle detection system and traffic monitoring systems. They had used parallel processing to store and process videos more quickly. They had used OpenCV and a python wrapper named cv2.They demonstrate a way to detect vehicles using Haar cascades to implement the system. A machine-based learning methodology involving both positive and negative data set for training purposes. Algorithm extracts feature from these images. The framework combines several features into cascade, i.e. aorder of tests on the image or on particular regions of interest, organized into several phases, each based on results of one or more different Haar features Detection of occlusion of vehicles using a generalized deformable model for an Automated Traffic Surveillance System. When the object goes through all classifier stages it becomes remembered. Researchers also worked on some of the featured based approaches, such as Automation of Traffic Flow

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Measurement Using Video Images, A Trainable Framework for Object Detection in Images and Video Sequences, Vehicle classification system based on a local feature algorithm using model images from CG.

Elkerdawi,et.al[2] proposed this system. This model captures the real time framework that detects and tracks vehicle from a stationary camera. The system consists of three main stages. First using haar-like features, vehicles are defined.In the following process, an adaptive appearance based model is built to keep the detected vehicles continuously tracked. This model is also used to combine the identification and tracking results in the third phase of the data association. For detection it uses Adaboost cascade classifier and tracking is done using compressed features and naïve bais classifier. They used two main parameters for experiments, For detection Haar detection scale percentage parameter is set to 1.3 and thus balancing real-time and high true positive accuracy detection and search window is set to 15.For Tracking, on given target location, the search window is relatively proportional to the target size. Positive samples generation are 4-pixels around the target. Negative samples' inner radii is set to 10 pixels around the object while the outer radii is 1.5 multiples the search window. They proposed a simple and robust framework that uses haar like features and Adaboost cascade classifier generating a general rule that learns vehicles appearance.

A. Khan, et. al. [3] have proposed a framework is created to control and screen the blockage of traffic. The primary inspiration is to identify the nearness and nonappearance of vehicles out and about utilizing factual methodology incorporated with traditional picture preparing procedures. For this reason, they have build up a "Probability Based Vehicle Detection (PBVD)" calculation based Vehicle Detection System (VDS) incorporated with present - handling subsystems on structure a total traffic control framework. The framework has the capacity to get vehicle measurements during controlling traffic. Reenactments are performed by creating total model traffic design. Correlation is finished utilizing the outcome obtained from model framework and preparing a continuous video of traffic scene. Stimulation results show the viability of the proposed plan.

J.Chung, et. al. [4] have proposed existing approaches to check vehicles from a street picture have relied on both hand-made element designing and rule-based calculations. These require numerous predefined limits to recognize and follow vehicles. This paper gives an administered learning procedure that requires no such element designing. A profound convolutional neural system was formulated to check the quantity of vehicles on a street portion dependent on video pictures. The present procedure doesn't view an individual vehicle as an article to be identified independently; rather, it all in all tallies the quantity of vehicles as a human would. The test outcomes show that the proposed procedure beats existing plans. For the most part, it is hard to represent how a CNN can tally the quantity of vehicles precisely. Be that as it may, channels were relied upon to extract the highlights of a picture, objects were perceived by the highlights, and the items were then tallied through the last completely associated layer.

Quanlong,et.al[5] proposed PLQF Scheduling Algorithm. The algorithm considers both the queue length and incoming traffic also.This algorithm considers current traffic density plus the incoming traffic and then calculates the overall vehicle count for each lane. The lane which has highest density will be given the first priority. Accordingly timer will be decided for each lane. The PLQF algorithm is designed to achieve minimal Cell Loss Ratio(CLR)when the incoming traffic is bursty.The main idea behind PLQF is to provide the scheduler with the information regarding incoming traffic. The resource is allocated to the user with the highest probability of overflowing in the near future, based on that information.

Irunokhai,et.al[6] Modified Scheduling Algorithm (Round Robin) for Vehicle Traffic Control System.This algorithm is specially designed for a time allocation system such as the scheduling of traffic light signal at road junction for the route of vehicles. The algorithm integrates assignment of priority for emergency vehicle arrival. Java programming language with Any Logic Java based simulator was used in implementation.The design of the vehicle under the scheduling of the round robin algorithm in the control of the vehicle traffic, the traffic control barricade and the priority assignment for emergency vehicles arrival at the road junction. When non-emergency vehicles are on the traffic, the traffic control system schedule each road based on the traffic density on each lane but whenever there is arrival of emergency vehicle, priority is giving to the road where the emergency vehicle is approaching from and the traffic control barricade shuts down all other alternate roads. Sensors are used to sense the siren sound of the emergency vehicle which confirms their arrival at traffic junction.

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Younes,et.al[7] proposes an ITLC (Intelligent Traffic Light Control) algorithm. This algorithm considers the constant traffic highlights of each traffic stream that proposes to go across the street convergence of intrigue, while booking the time periods of each traffic light.The communications of Vehicular Ad-hoc Networks technology i.e. VANETs enable the utilization of real-time traffic characteristics of all surrounding flows.This algorithm aims to minimize the queuing delay at each intersection by using the length of the jam in front of the traffic light as an input. Each traffic light tries to solve the detected jams with the traffic light scheduling algorithm.

B.Younes,et.al[8] This algorithm also uses VANET technology to gather the realtime traffic characteristics of each competing traffic flow at isolated traffic light road connections. These traffic highlights are considered while setting the sequence of phases and the time of each phase in the traffic light timing cycle. In ITLC, the most dense traffic flow is scheduled to cross the signalized intersection first. Moreover, the time of each phase is set based on the location and speed of the last vehicle that is expected to cross the signalized intersection during the scheduled phase. Wireless sensor networks (WSN) have been also used for dynamic traffic management of signalized road intersections. They implemented a dynamic traffic light scheduling algorithm. This algorithm schedules the opposing flows at any signalized connection, to allow the more compressed traffic flows to cross the intersection first. The allocated time for each phase is set based on the traffic sharing over its traffic flows.

Deshmukh,et.al[9] This system creates an android application in which emergency vehicle will enter its source and destination information. This data will be shared to Traffic Control Room via Application server thus helping to clear traffic on that road before arrival of emergency vehicle. Location of vehicle will be tracked through GPS system. The working is based on two important modules The GPS system and application server.There could be certain decisions that the software needs to take based on the situation of the signal lights.In this paper the proposed system is very efficient as it makes the use of data send by location provider which is almost very efficient. The android application not only focuses on traffic light controlling but also sends message to the hospital and the concerned doctor so that the arrangements are ready at the hospital. The hospital will assign priorities to the patient, to assign priority the information is to be given by the staff with the ambulance.

R.Deviet.al[10] proposed this model.The model works on the principle of altering traffic signal delay based on the number of cars that travel through an allocated road segment. In four sides of a four-lane highway, there are four sensors that count the number of cars passing through the sensor-isolated area. Here, system uses traffic control system replacement IR sensors to build a density based traffic signal network. The IR sensor detects the vehicle and sends the microcontroller the information. The microcontroller counts the number of vehicles and gives LED the blinking time depending on the vehicle distance.

Nellore et.al[11]proposed a way to deal with plan crisis vehicles in rush hour gridlock. The methodology consolidates the estimation of the separation between the crisis vehicle and a convergence utilizing visual detecting strategies, vehicle tallying and time delicate ready transmission inside the sensor arrange. The separation between the crisis vehicle and the crossing point is determined for examination utilizing Euclidean separation, Manhattan separation and Canberra separation procedures. The deliberate data like vehicle check, separation and speed are helpful for a traffic the board focus to oversee crisis traffic proficiently. The size of the system or the quantity of hubs shows its effect on the normal start to finish delay.The start to finish postpone increments with the hub number. Remote Sensor Networks (WSNs) consider installed sensors to be interconnected for watching and controlling shopper and mechanical activities .The application of Vehicular Sensor Networks or foundation WSNs have been demonstrated to be promising answers for observing and the board of traffic. WSNs are adaptable regarding and vitality proficiency and information assortment type, e.g., video.

N.B.Soni[12] provide their review on IOT devices which are useful in traffic management system. They wrote about different methods of traffic management which are Video Data Analysis,Adaptive Traffic Control System (ATCS),Wireless Sensor Network.They provide information about some sensors which are Inductive loop Detector which is works on the principle of electromagnetic induction. A load cell is a type of transducer that converts the force applied into electrical signals.IR sensor or infrared sensor contains two packages Transmitter and receiver. Radio frequency identification(RFID) as it uses radio waves for object identification. Applications of RFID are Automatic collection of toll charges,Parking Guidance,Automatic vehicle speed detection.

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III. ANALYSIS

The following table is the summary of various research papers on Traffic Analysis and different techniques of vehicle detection and scheduling.

TABLE 1
ANALYSIS TABLE

Sr. No.	Title of paper	Techniques used	Datasets used	Accuracy/ Efficiency
1.	Vehicle Detection and Counting using Haar Feature-based Classifier.[1]	Moving object detection technique and fast vehicle detection and counting using Background subtraction technique	Real time data capture by CCTV camera in Kolkata city of India	Experimentalresultsshow that theaccuracy ofcounting vehicles isabove 90%.
2.	Real-Time Vehicle Detection and Tracking Using Haar-Like Features and Compressive Tracking.[2]	Vehicle detection	Real time data	The framework achieves 93% accuracy and overall average running time of 0.2017seconds.
3.	Modeling, Design and Analysis of Intelligent Traffic Control System Based on IntegratedStatistical Image Processing Techniques.[3]	A Probability Based Vehicle Detection(PBVD) algorithm. The method for counting and classifying vehicles.	Not Mentioned	Thefinal results are satisfactory and show that the systemcan cope with a noisy environment.
4.	Image-Based Learning to Measure Traffic Density Using a Deep Convolutional Neural Network[4]	Convolutional Neural Networks.(CNN)	Snapshots from video streaming.	Acceptable Accuracy.
5.	Improving the Network Performance using Prediction based LongestQueue First (PLQF) Scheduling Algorithm.[5]	Prediction based Longest Queue First algorithm Asynchronous transfer mode	Not Applicable	Achieve minimal Cell Loss Ratio(CLR) when theIncoming traffic is burst .
6.	Vehicle Traffic Control System Using modified smart optimized Round robin scheduling algorithm.[6]	A Java programming language with Any Logic Java based simulator. Programmable Logic Control(PLC)	Real time data	Reduced vehicles ' overall and avera ge waiting time by 11.61 percent, alt hough with a 13.52 percent decrease as the arrival of emergency vehicles i ncreased.
7.	An Intelligent Traffic Light Scheduling AlgorithmThrough VANETs[7]	Isolated Traffic Light Intersection	Not Mentioned	ITLC decreases the delay by 25%.
8.	An efficient dynamic traffic light scheduling algorithm	Fuzzy Logic, Genetic algorithm and Oldest	Real time	Enhance Traffic lightscheduling algorithm (ETLSA) decreases the

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	considering emergency vehicles for intelligent transportation system.[8]	Job First algorithm	data	waiting delay time of the emergency vehicles by 50% compared to the ITLC algorithm,and by 60% compared to the OAF algorithm.
9.	IOT based Traffic Signal control for reducing time delay of an Emergency Vehicle using GPS. [9]	GPS system, Raspberry pi	Not Applicable	The proposed system is very efficient as it makes the use of data send by location provider which is almost very efficient.
10.	Density Based Traffic Signal System Using Arduino Uno. [10]	IR sensors are used to calculate the density of traffic, Arduino Uno that serves as the microcontroller.	Not Applicable	Acceptable accuracy
11.	Traffic Management for Emergency Vehicle PriorityBased on Visual Sensing	MAC protocol, VANET	real-time video feed from the cameras	The suggested PE-MAC achieves lower end-to-end latency compared with the schemes under consideration.
12.	A Review of IoT devices for TrafficManagement System	Video Data Analysis Adaptive Traffic Control System(ATCS)Wireless Sensor Network:	Not Applicable	This devices provide good efficiency for projects

IV. CONCLUSION

Previously there are many drawbacks in traffic management system like static timer, problems with emergency vehicles, improper scheduling etc. This research introduces deep learning techniques alongside image processing. It introduce proper scheduling algorithm for measuring traffic density accurately and thus allotting timer based on density of each lane. It will make traffic scene dynamic. It will be able to clear the traffic prior to the arrival of emergency vehicles. Reduces the unnecessary wait during the congestion.

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