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Smart Traffic Management System using IoT

Aniket Tiwari
Academic Research Student, Department of Information Technology, B.K. Birla college of Arts, Science and Commerce (Autonomous) Kalyan, Thane, India

Abstract: ***Our country (India) is the second largest population of world; according to that vehicles are increased day to day life. Here, the questions arise! how to avoid the congestion in the road; that means traffic management. Traffic management has since quite a while ago existed in some frame, from the beginning of railroad flagging or movement lights on city lanes, yet the improvement and execution of modern coordinated applications in light of Intelligent Transport Systems (ITS) has developed apace lately, because of effective research and technological advances. Develop a system which can be used to predict high level of traffic congestion using data collected from live video stream analysis sensors image processing traffic congestion system can utilize the power of cloud computing and the strength of artificial neural networks traffic is increasing in every major city, which raises an average commute time. Los Angeles has the highest time lost in traffic congestion and parking search while minimizing implementation costs and requirements of maintenance.***
Keywords: Traffic Management, IOT, RFID Technology, Traffic Violation, Traffic Signal Management.

I. INTRODUCTION

In urban areas vehicular traffic congestion is a crucial problem for the town planners as the number of vehicles getting added on the road are increasing every day. To defeat this issue many efforts has been taken by the government and the town planners but still the outcomes are not satisfactory till date most of the attempts have been made to add more roads and flyovers, but in the country like India the population is so high that the number of vehicles is crossing the road capabilities. Traffic congestion has negative impacts such as inability to predict travel times, delay, maximization of fuel consumption and wastage of manpower to control the panic situations. In order to overcome traffic congestion and dynamically make the decisions to manage traffic on roads regular traffic data updates are required to be made available at the traffic management center. Hence management of traffic data plays an essential role in design of transportation systems in smart cities. Many countries like USA are taking advantage of Intelligent Transportation Systems (ITS) to overcome traffic congestion [1]. ITS consists of Traffic Management Center (TMC) where traffic data is collected, analyses and combined with the other operational and control centers to manage congestion. In last few years more research efforts have been investigated in application of Internet of Things for smart cities where heterogeneous devices and wireless sensors seamlessly interact on integrated communication platform. Major IoT applications consist of heath, transportation, smart homes and smart grid systems. In the context of smart transportation IoT can facilitate real time traffic monitoring, analytics, dynamic congestion management, accident alert and rescue system, smart parking, vehicle to vehicle communication, voluntary people participation for traffic data and many more. Paper proposes an innovative traffic management system with the use of smart barricade system. The prototype of the proposed system is developed based on available embedded systems.

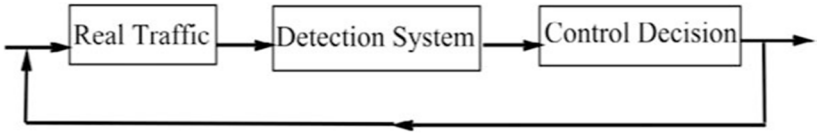

Fig. 1 Intelligent transportation system (ITS)

II. LITERATURE REVIEW

Traffic management needs to be robust and smart to collect effective real time data. ITS gather the raw traffic data using various methods and sources such as magnetic loops, radar detectors, acoustic sensors. They can be traffic light cameras or sensors embedded in the road or vehicular sensing. In vehicular sensing raw data is collected from the vehicles running on the road [2]. Authors have proposed a framework for collection of data using vehicular sensing and road side units are used to aggregate and retrieval of summarized data as per request. Traffic lights are considered as the most guaranteed technique to synchronize the traffic flows. The warning lights which alerts the vehicles to avoid use of some direction can be very helpful if implemented along with the regular traffic lights [3]. The results show effectiveness of two level strategy in terms of rate of vehicles route-changes, operational time interval of strategy and traffic density of the traffic network on a congestion dissipation process.

The proposed methodology can be improved further with the application of techniques in accidental situations for reducing traffic congestion. Changing lane suddenly is risky on highways. Authors in [4] have proposed an algorithm to predict the safe inter vehicle gap and the time to perform lane change whenever.

The behaviour of the algorithm in congestion can be further evaluated to improve the quality. High priority vehicles such as ambulance can't be neglected in the design of modern transportation system. A novel model for high priority vehicles such as ambulance has been proposed. It detects and serves the high priority vehicles by adjusting the traffic green light phase based on traffic congestion [5]. The road pricing policies can be thought of way to manage traffic congestion. Various traffic congestion avoidance algorithms have been proposed. A particular section of the road can be designated congestion price zone. Dynamic road pricing scheme has been proposed where road pricing is changed dynamically based on previous traffic statistics [6]. Authors in [7] proposed an innovative RF transmitter which continuously updates the vehicle information to the traffic monitoring centre through a ow Cost road side trans- receiver. VANET is a fast growing technology for ITS. Driver's smartphone can be installed with an android app to collect the traffic data. Traffic congestion status can be obtained by collecting time and location (latitude, longitude) from the GPS sensors and analysed at the database to inform vehicles about the congestion status [8]. Metaheuristic has helped to solve real world problems such as traffic congestion to some extent. The nature inspired algorithms are gaining popularity in optimizing the scheduling the traffic light cycles. The performance comparison of DE (Differential Evolution) and PSO (Particle swarm optimization) has been studied leading to new investigation in dynamically scheduling traffic light cycles [9]. SUMO is used to evaluate the approach with real world scenario. Once the congestion is detected next step is to predict the delay caused in travelling time due to traffic congestion. This can be predicted based on likelihood finding of the road in same state [10]. Forecasting of this prediction will definitely help drivers to plan their routes during congestion. With the concept of smart city vehicle networking is gaining importance. Vehicular networking is the inherent part of traffic management. Currently Wi-Max, Wi-Fi and cellular communications are the technologies to implement vehicle to infrastructure (V2I) communication [11]. WAVE (Wireless access in Vehicular Environment) can be used to implement the vehicle to vehicle (V2V) communication. Vehicular communication is inherent part in ITS. The communication can be V2V (Vehicle to vehicle) or V2I (vehicle to infrastructure). For an ITS to be efficient vehicles should be able to have multiple wireless communication interfaces such as 802.11p WAVE, Wi-Fi, Cellular and infrared. The details of characteristics for each kind of technology can be found in [12]. The article further discusses enabling technologies and application technologies for vehicular communication systems. Authors in [13] have shown the analysis of ZigBee in complex car environment for intra- car environment. Results proved that ZigBee is versatile technology for intra car wireless communication network. The same concept can be further enhanced if ZigBee communication is explored with inter-car communication. It will be challenging as lot of VANET parameters such as speed, distance (topology changes) between vehicles, environmental effects are going to play important role. Authors in [14] have proposed traffic signal settings for dynamic traffic control. A ZigBee based prototype was developed to verify the algorithm. They showed the throughput maximization with real time implementation. The concept can be further enhanced with congested traffic conditions to observe the performance in dense environment. Authors in [15] have investigated the Bit Error Rate performance of Lora under different V2X scenario. ITS found that for Lora to be used in V2X communication should be implemented with higher bandwidth and lower spreading factor to reduce the fast fading due to doppler shift. Authors in [16] have tested Received Signal Strength Verses distance to check the Lora performance in terms of node mobility in the area of 5 kms and 9 kms.

Fig. 2. Concept of proposed traffic management system in IoT

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III. OBJECTIVE

In many cities, traffic collision doesn't have the right solution, present traffic light delay methods were not satisfying the waiting queue of the travelers on the road. The right solution is that we will give or allot green signal timing delays based on the number of vehicles waited on the particular direction. This is possible because the controllers can create different environment called non-stationary, which each controller adopting the other controller signals. In multi-agent learning environment this situation is inefficient and computationally challenging one, i.e., the efficiency losses with the increase in the number of controllers [17]. Using RFID technology the stolen vehicle can identify, Nevertheless, there are some weaknesses and limitation, such as camera needs to be fixed, and the changes of brightness and the undesired environment (e.g. the shadow of vehicles, raining) that will misjudge the testing result in some cases [18]. When different traffic monitoring videos are put it into the program, the vehicles on both traffic violate simulation model and real road condition that can be detected. Furthermore, the changes of brightness and desired detecting condition are also important when a fixed camera is capturing the traffic condition. When the above condition is being improved, it can be more accurate to be obtained for the traffic violate condition detection. Moreover, this method used in the traffic violation detection system by the background subtraction is successful regarding to this effective method for detecting, checking and counting the moving objects [19].

IV. METHODOLOGY

There are various problems of traditional vehicle monitoring system in different conditions, such as license plate is blocked. Therefore, it is not easy for prosecuted the offender by the police force due to the different traffic situations. Thus, a new method is that combining those to achieve the traffic violation detection system, and RFID technology is used to aid some main functions. In this study, it is assumed that all the noise factor which affected RFID system is ignored and all the data get from the RFID system should be appropriated. It is aimed that recording the RFID tag's sensitivity signal within a small range for the use of getting the data of the vehicles when it violates from a simulated real road situation. Since a real-time transportation situation has been simulated, RFID tags as an electronic license plate, a fixed camera is being set for vehicles monitoring and RFID reader place above the road for receiving the vehicle's data through the tags and using OpenCV for motion detection of vehicles in the traffic violation detection. Thus, it can be prosecuted the offender by the police force due to the different traffic situation. The reader used in this study is RF-CODE 433 MHz M250. RF Code tags sent the radio frequency messages to the reader. The maximum range is 45 meters when the tags are being sensed, more than 100 tags are read per second.

A. RFID Tags Sensitivity Range Quantity

Working: Place the automatic self-control model car with RFID tags is attached on the top in the corridor of Industrial Laboratory of the University of Macau, as shown in Fig. 3. For more accurate data, it is necessary to place the model car on the road on the same starting point. Once the vehicles reach the end of the road model and then repeat the same operations of getting the RFID tag's data. Then the RFID tags sensitivity range between the start and the end of the road model can be obtained.

Fig. 3. Model car with RFID tag

OpenCV parameters		
src	interpolation	iterations
ksize	src2	borderType
dst	code	borderValue
sigmaX	value	image
dsize	dstCn	contours
sigmaY	thresh	hierarchy
fx	maxval	mode
fy	type	method
border Type	element	offset
src1	anchor	pt1
pt2	lineType	fontFace
color	maxLevel	fontScale
thinkness	externalColor	baseLine
lineType	holeColor	baseline
shift	text	font
contourIdx	text_string	text_size

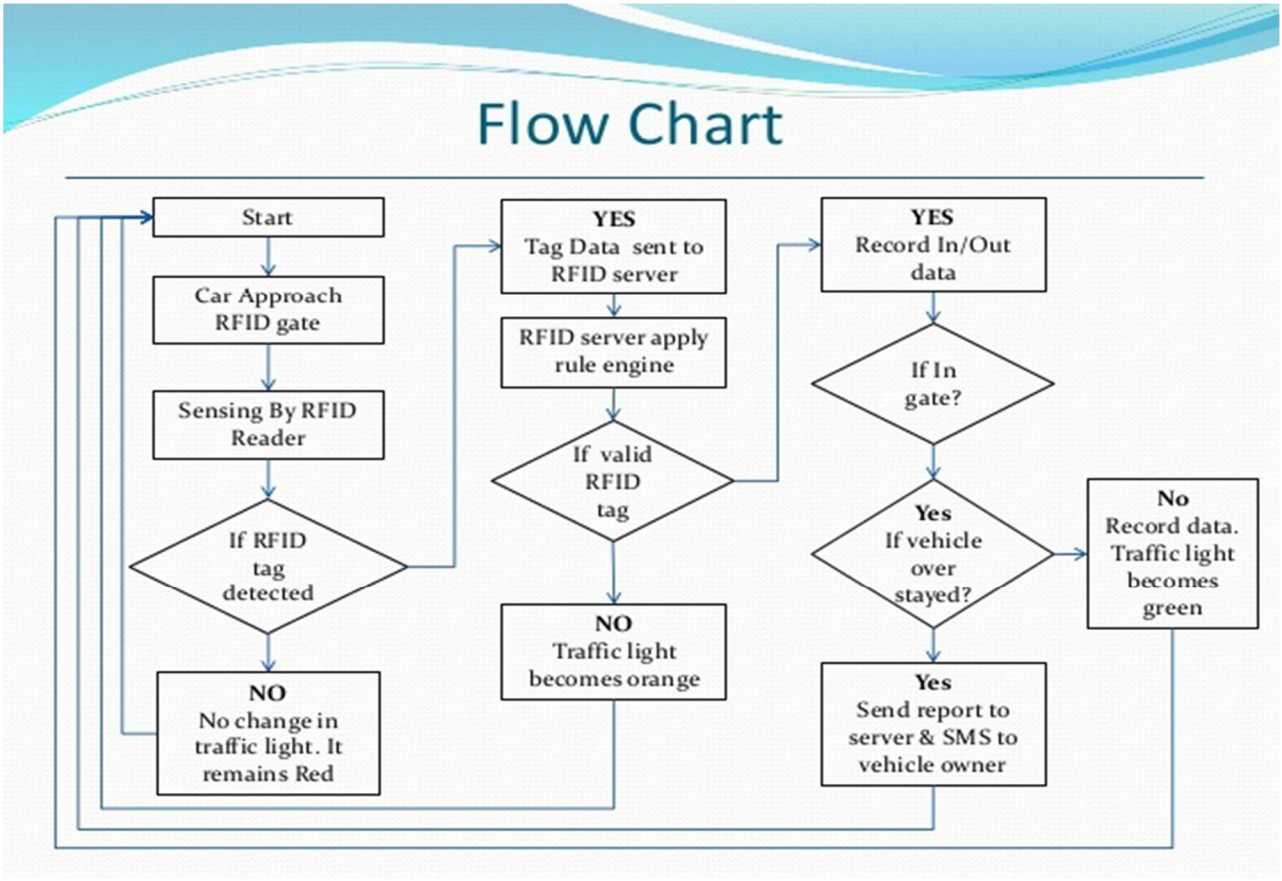

Fig. 4. RFID Gate Management System

V. EXPERIMENT

A survey was taken with the help of google form in that various question were asked regarding traffic management such as questions. The outcomes of survey analysis conducted by chi square test with variables categories (will improve, will improve very much, will improve some extent, will not improve not at all) got x^2 calculated = 10.095 and x^2 tabulated = 7.815 here x^2 calculated > x^2 tabulated therefore alternate hypothesis accepted i.e. Traffic management improve some extent. Fig 5. shows that the responses result of the survey question (will traffic management improve).

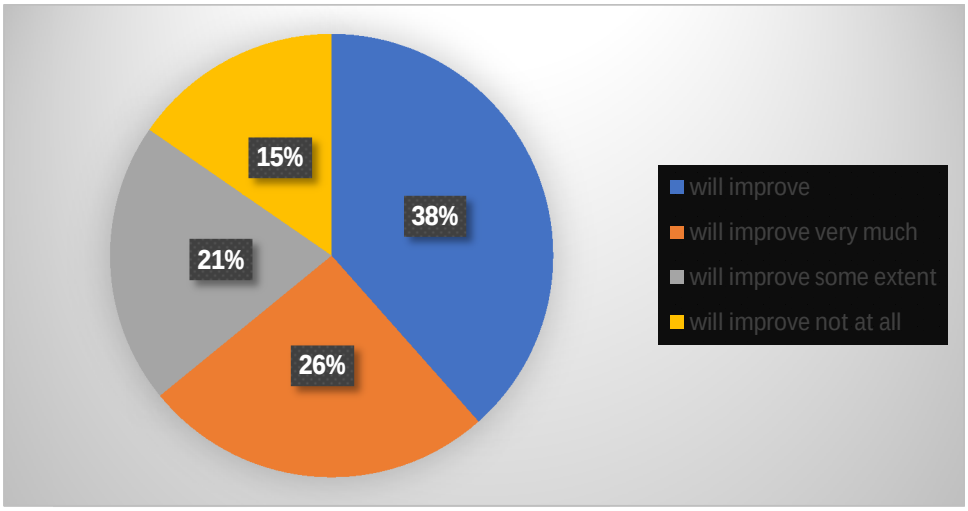

Fig 5. Survey question responses (will traffic management improve?)

VI. RESULT

The test scores of samples rendered through survey analysis calculated using the chi square test resulted null hypothesis (Traffic management will improve not at all) was rejected and alternate hypothesis (Traffic management will improve some extent) was accepted. The results also rendered that there was a significant level (0.05) in scores of parameters checked in chi square table Therefore, the alternate hypothesis "is accepted.

VII. CONCLUSION

This research presents an efficient solution for rapid climb of traffic flow particularly in big cities which is increasing day by day and traditional systems have some limitations as they fail to manage current traffic effectively. Keeping in sight the state of the art approach for traffic management systems, a sensible traffic management system is proposed to regulate road traffic situations more efficiently and effectively. It changes the signal timing intelligently consistent with traffic density on the actual roadside and regulates traffic flow by communicating with local server more effectively than ever before. The implementation of existing system cost is extremely high and it also depends upon the condition. In future Our proposed system fulfils all the standards for measuring, controlling and avoiding the traffic. The procedure is gainful than the present system.

VIII. ACKNOWLEDGEMENT

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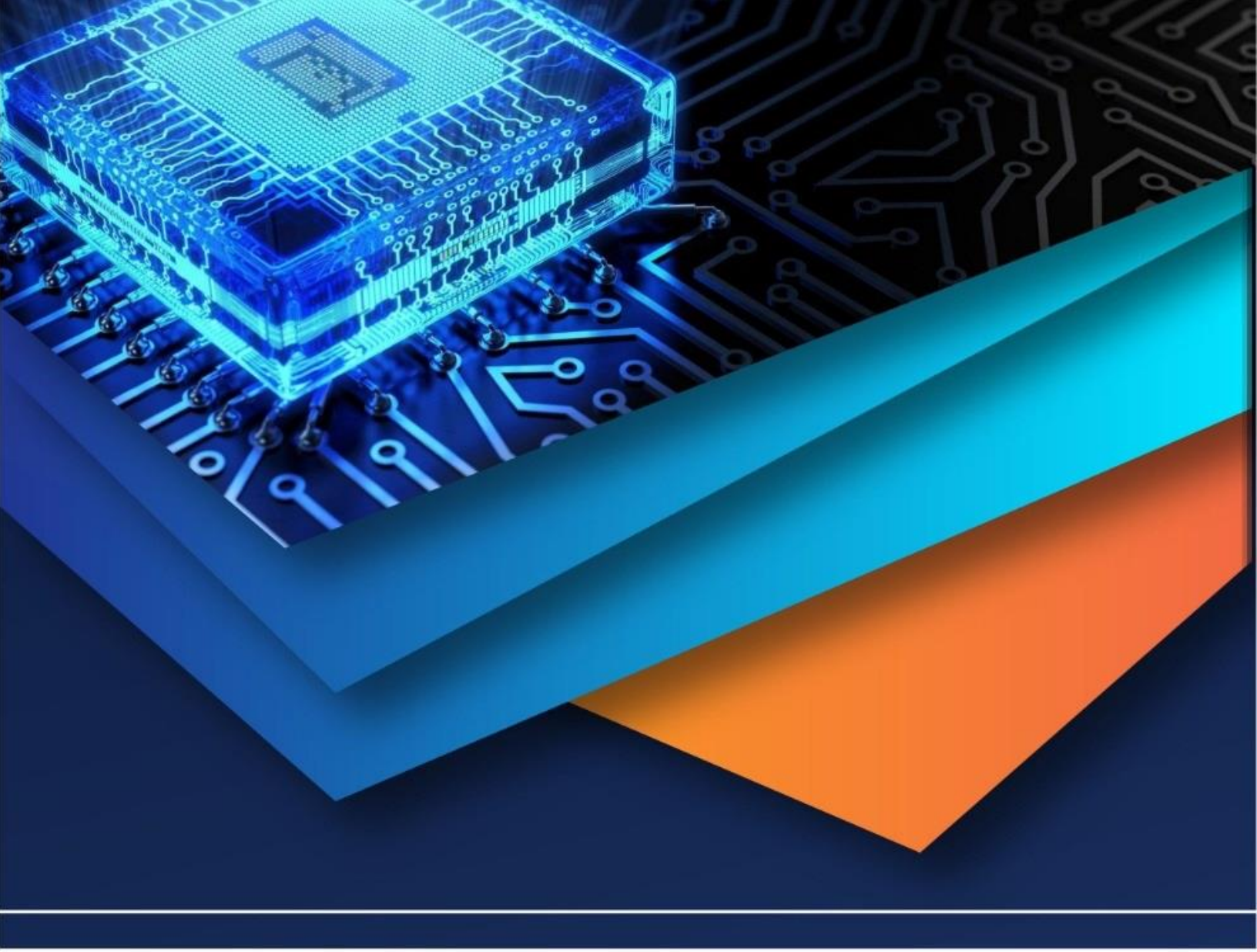

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