

A Comparative Study on Road Safety Problems

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Abstract - Road safety is an important consideration in the transportation system. Many accidents occur due to road safety problems. Road accidents in India are increasing day by day, due to the rapid growth in a number of vehicles. The traffic congestion is growing at a rate of 7 to 10 % per annum while the vehicles are 12% per annum, hence this is one of the primary factors for the road safety problem. Every year nearly 1 million people died and 50 million are injured due to road accidents around the world. Particularly in India, 70,000 people died every year, this problem needs to overcome to save the life of the people. In this paper, a survey is done based on the various road safety problems and the comparison is done to identify the problem which leads to major accidents. Here the idea is proposed based on the statistics of the road safety issues to reduce the number of accidents that occur in a year.

Keywords – Road safety, Traffic Congestion, Transportation system, Road accidents.

I. INTRODUCTION

In developing countries, the number of vehicles and the population is increasing day by day which leads to road traffic problems, especially in urban cities. In metropolitan cities the vehicles spend more time in traffic jam leads to health problems and environmental hazards. The world health organization stated that road accidents are a major public health problem as more than 1.25 million were died and 50 million were injured with 90% of traffic accidents occurring in developing countries[1]. The most common factors which lead to the accidents are based on the road user behaviors, like the driving style of the people or cycling on the road, and also other factors like the stress of the driver, breaking of traffic laws, age, etc. In countries like India due to inexperienced drivers, the risk of accidents gets increased. The road accidents are increasing in spite of the measures taken by the government like awareness programmes and enforcement of laws. The report of Ministry of Road Transport and Highways (MORTH)[2] states that the road accidents are reduced by awareness about wearing helmets and immediate actions against the rule brakes, it gives positive result during 2017 in Tamilnadu. The Total Number of road accidents occur in 1994 to 2017 is compared and the results[3] are shown in fig-1. There are two methods to solve these problems, first one infrastructure management which involves wider roads, expressways etc. The second one is traffic management with the existing infrastructure and the technology. Some of the major road safety problems include,

- a) Pedestrian safety,
- b) Traffic light scheduling problems,

- c) Emergency vehicle issues,
- d) Roadside parking, and
- e) Traffic rule violation.

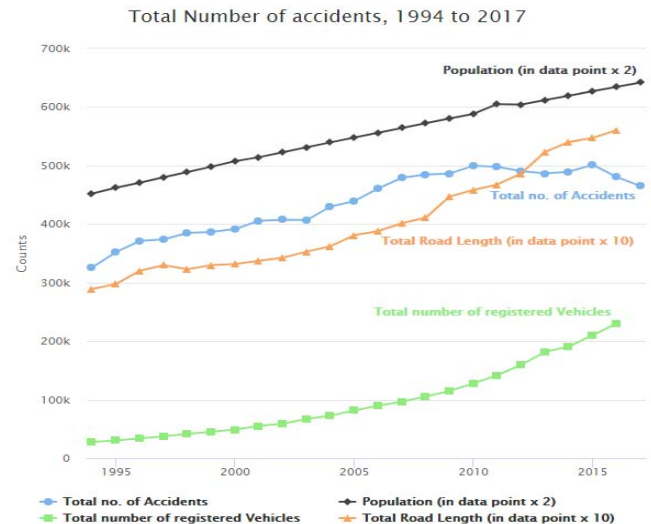


Fig-1: Comparison of Accidents in 1994 to 2017

II. PEDESTRIAN SAFETY

People are also one of the road users, hence there should be equal importance for both the pedestrians and the vehicle drivers for the safety measures, as both the vehicles and the population are increased drastically over the years. The traffic control lights are placed in the road intersection which is to regulate only the traffic caused by the vehicles, they didn't consider the pedestrians who are also often cross the road, this is the main cause for the road accidents. We can say that all the road users, are also pedestrians should provide the facilities to decrease the road accidents.

At every intersection of the road, lies a traffic control signal, which is kept only for the traffic management of the vehicles, and there is no any system for the pedestrian safety who is also the road user, hence this is one of the main reason for the accidents [4]. To overcome this problem, a system is developed for benefiting both the vehicles and the pedestrian to manage the traffic flow thereby the accidents are reduced. This system works based on the number of pedestrian and the number of vehicles it takes a decision. It is more helpful in reducing the number of accidents by considering pedestrian safety.

The system is developed for detecting the pedestrian crossing the road. This scheme is based on the classification model, in which the action of the pedestrian is detected by classification [5]. The parameters, which the system detects, are the pose of pedestrian, speed, environment layout. The body language, mass, width, and height is used to determine the pedestrian pose. The movement of the pedestrian is detected by tracing point of human centroid region. These models are separated hierarchically based on their actions. For these process, a human model is developed and observations are taken. With this parameter, the pedestrian crossing the road is detected by the human model. This system is evaluated by ETH datasets, and the performance result shows 98% accuracy.

The different behavior of the pedestrians crossing the road in an unmarked roadway with changing directions and speed, this results in high chances of road accidents [6]. They have modeled the paths of the pedestrian at the unmarked roadways to better understand the behaviors of a pedestrian; as a result, they perceived risk with efficiency. The possibility of risk is mainly from the location and position of the road and the vehicle speed. The observation is carried out for 135 pedestrians, and the intelligent transportation systems are discussed with their limitations.

By thinking something and talking to someone else through a mobile phone, the people suddenly cross the road [7]. The system is proposed to focus on sudden pedestrian crossing which the major cause for the accident occurrence. The pedestrian crossing at night is detected by the proposed system which consists of a Far Infrared camera mounted on the vehicles' roof. This system is modeled to detect pedestrian on the summer season, as major accidents occur only that time in Korea than other seasons. They have done a real-time processing, with the optimal levels of image scaling, which is associated with road segmentation for detecting virtual reference based on the information of the road color and the direction to which the vehicle turns. The Sudden pedestrian crossing is detected with the parameters of spatiotemporal and the pedestrian features like the direction, magnitude, and reference lines overlapping ratio. This system is implemented and tested with different datasets of the pedestrians. Here the data is captured by the FIR camera mount on the vehicle's roof and the results are verified and compared with the other methods

III. TRAFFIC LIGHT SCHEDULING PROBLEMS

Most commonly in India, the traffic problems are increasing day by day due to the increase in vehicles and the traffic light scheduling problems. The traffic congestion occurs due to the failure of signals, bad traffic management, poor law enforcement and also poor infrastructure. In India the major problem is that the road infrastructure cannot extend more, therefore the only option available is optimizing the traffic in an efficient manner. This problem brings environmental hazards like pollution, which is a negative impact. Mostly in every country, the traditional traffic control

signal is based on the fixed timing to change the signal (red, yellow, green) it causes the traffic congestion during peak hours as it won't react to the changing traffic conditions. Various methods are available for the better traffic management some of them are infrared sensors, inductive loop detection, video data analysis, image processing, wireless sensor network, VANET, etc, it will bring a smart solution for this problems.

The system of Dynamic Traffic Light Control, a novel framework of the sensor network [8]. The DTLC system is a sensor network which collects all the traffic data and makes decision dynamically. To optimize the congestion and to ensure efficient traffic flow, the protocols are used in this framework. They propose a low overhead algorithm which is more suitable to employ in live traffic scenarios. With the help of analysis and simulation, they demonstrate the DTLC system for varying traffic scenarios, and performance is measured. It will be a step forward smart system for the future smart city.

The Intelligent Transportation system to optimize traffic congestion. This system mainly focuses on improving traffic efficiency, in which the Intelligent traffic light control plays an important role [9]. In the existing traffic, light control system faces challenges such as avoiding roadside sensors, avoiding single point failure, then resisting malicious vehicles. To overcome these challenges, they propose an Intelligent traffic control system with enhanced security with the help of fog computing. The Diffie Hellman algorithm and hash collision are used for the security of the system. Moreover, these systems assume the traffic light control as the fogging device. The Diffie Helman approach is designed to defend against the denial of service attacks. But when the density of the vehicle increased this system won't give the accurate result. Then the collision system is used to verify the validity of the vehicles in an efficient manner.

The system to improve the efficiency of the existing system of automatic traffic signaling system is proposed. This system is based on image processing with an adaptive signal control [10]. In this system, the timing of the signal is calculated dynamically based upon the traffic load. The proposed system is an enhancement of the existing system in which the signaling is automated. The system consists of the digital camera mounted on the controller system which can face four side lanes and sense the traffic density by capturing the image of the particular lane. This camera is controlled by the microcontroller to change the direction in steps of 90 degrees and the image is captured. Then it is processed using image processing techniques to detect the traffic load. Based on estimated traffic density the duration for the particular lane is calculated and the signal lights are controlled. The experiment analysis is done based on the comparison with the existing system. The proposed system will calculate the time for every cycle dynamically and operated in a cyclic manner.

A smart traffic management system to reduce traffic congestion is proposed. This is the major problem in many cities of India across the country [11]. The traffic congestion occurs due to signal failure, breaking of traffic rules and poor management of traffic. It creates a negative impact on the

environment. The proposed system is developed based on the RFID (Radio Frequency Identification), it will be more effective and require less time for the installation. This system aims at effective management of traffic congestion.

IV. EMERGENCY VEHICLE ISSUES

An emergency occurs at any time, anywhere in various ways leads to danger, so it is important to provide an immediate and efficient technique to reach the healing centers without delay. Due to the increased population, traffic congestion has grown at an alarming rate. This issue has to be addressed with the appropriate measures. The highest priority has to be given to the emergency vehicle even if every vehicle has its own need, thereby reducing the waiting time of the emergency vehicle and the decreasing the probability of the risk. During emergency conditions, the transportation of the patient is difficult in peak hours. At the time of accidents, there should be an efficient emergency response system to take immediate measures. But there are more communication issues, hence the information cannot be communicated easily and the location is also cannot be monitored.

The existing technology is discussed, and the system is proposed to overcome the limitations of the existing one, the number of the vehicle has been increased drastically as leads to demands on transport infrastructure. The main tools in the existing system are a parking support system, real-time information system based on the availability of roads, the adaptive control at intersections, all these systems require the information about the current traffic conditions [12]. They propose a system to get the current state of the traffic condition with the help of magnetometers and microphone. The magnetometers can be used to measure all the parameters need, such as count, speed, presence etc. They develop a system equipped with magnetometer and microphone. Which detects the emergency vehicles by the analysis of the acoustic signals. The Fig-2 represents the overall network diagram.

An application for emergency vehicles implemented in VANETs (Vehicular Ad-hoc Networks) [13]. VANET provides vehicle to infrastructure and vehicle to vehicle communications. In this application, a novel smartphone application integrated to control the traffic problem and also an effort is taken to clear the path for the ambulance and other emergency vehicles are developed. The overall framework consists of the Onboard unit (OBU), and the application named SMaRTDRIVE (systematic Management of road traffic through data retrieval). Then in the VANET environment, RSU-roadside unit is deployed to sense the input and a server is used for the control. Here OBU is kept in the vehicle and RSU is at the intersection of the road. The server manages the database and application.

An Intelligent Emergency system (IES)[14] is proposed which is implemented using Vehicular Ad hoc Network (VANET) which is a promising technology for the smart vehicle systems. The IES is designed with the technology of GPS (Global Positioning System), digital maps, sensing devices, video cameras, and other wireless communication

devices. With the help these sensing devices the get the necessary information about the condition of the roads for the traffic management to improve the traffic efficiency, reduce the waiting time and fuel consumption and traffic congestion. For security, the IES will encrypt the information of Cooperative Awareness Messages (CAM) based on the priority of CAMs exchanged between the roadside units and emergency vehicles. The message transmission is signed using SHA2 (secure hash algorithm) to differentiate from the normal messages. The IES system extracts the features from the trace file that will be used to describe the normal and urgent behavior in the VANETs. The system is evaluated for its performance and accuracy and observed that False Negative Rate (FNR) is decreased.

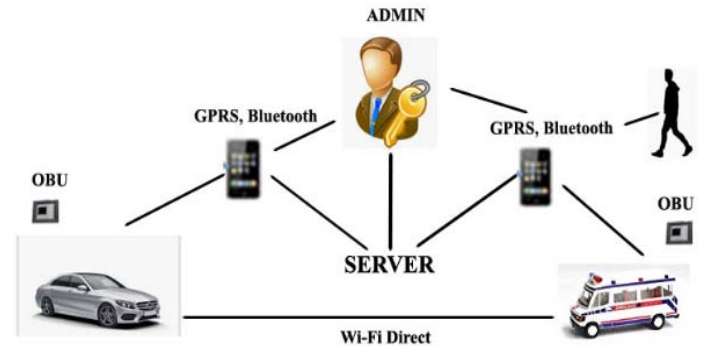


Fig-2: Overall network Diagram

The alert system for emergency vehicles using the Radio communication system is proposed. It is an early alert signal system based on the analysis and performance. [15]. The radio frequency signals are emitted with modulation frequencies among different carriers. These signals are received by receivers of radio of nearby vehicles, thereby notifying the drivers hence the way is cleared for the emergency vehicles. This system helps in decreasing the arrival time of the emergency vehicles

V. ROADSIDE PARKING PROBLEMS

In the rush cities, the major problem is in finding the parking space to park the vehicles. The drivers of the vehicles choose the nearby available spaces for parking. The unavailability of parking slots leads to congestions like scrambling for roads with bikes, parking temporarily in an illegal area, these activities not only break the traffic laws but also create air pollution and consumes more fuel. The illegal parking of the vehicle also leads to road accidents and public safety problems.

The design and implementation from the perspective of algorithms for an automated parking system [16]. Designing with the low-cost and functional safety is a difficult and challenging process to handle all the risk. In this paper they also demonstrate the camera systems used in identify the parking space, then the robustness of the sensor in measuring distance. The key modules they discussed is parking use cases,

parking slot marking identification, recognition of free space and the performance measurement of the robustness of the system.

The problem of roadside parking [17], propose a system in which the availability of the parking spaces is identified by image processing techniques. The image is taken by the event recorders which is embedded in the vehicles. With the help of the application, the parking slots are known to the driver when the request for the parking space the system searches and navigate the drives to the nearest parking space. It is more effective in reducing traffic. The structural architecture of the application is shown in Fig-3.

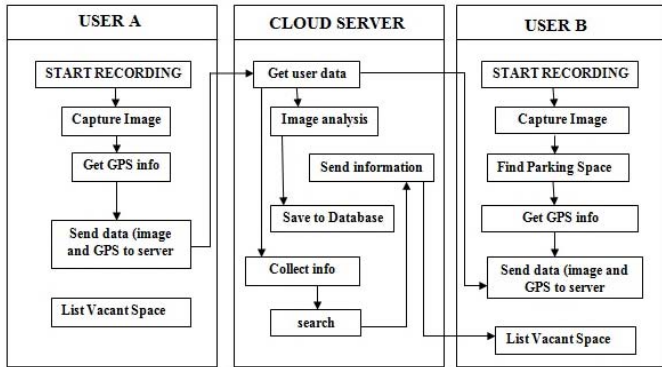


Fig-3: Communication Structure

(Owayjan, 2017) In this work, the parking problems in malls are addressed with the help of the mobile application [18]. They introduce the mobile application system for the parking management, which consists of two parts, the hardware part, and the software part. In the first part, the sensors like phototransistor and infrared transmitter are used, for detection of the parking space and to identify whether it is free or occupied. In this system, the Arduino microcontroller is used to which acts as a central controller. The second one is the software part which is developed with the help of Eclipse IDE and Android platform. This application helps the users to find the free parking space in the mall and can check the fee, then pay using this application itself. Finally, the functionality of the system is tested.

The smart parking management system, in this to reduce the parking problems, the provide a real-time description of the parking slots vacancy to the drivers through the mobile application. The ultrasonic sensor and the Raspberry Pi were used, this system is placed at the entrance of the parking areas to sense car and analyze the count of the parking vacant slots [19]. They also discussed the technique of video surveillance cameras to track the vacant slots and MATLAB (Matrix Laboratory) for doing computer vision techniques like deletion and updating of the vacancy information. Then sensor circuits are designed, with RFID (Radio Frequency Identification) tag, a theft management facility and a digital payment mode. This system is also developed for the motorcycles, as they are the majority mode of transportation. This can be accessed and monitored remotely with the help of this applications.

VI. TRAFFIC RULE VIOLATION

The people use vehicles based on their comfort which leads to traffic congestion and environmental pollution. In addition to that traffic rule violation problem are also increases, as everything becomes fast and speeds. It is applicable to all various aspects of life. The governmental and nongovernmental programs carry out training programs for the awareness of the rule and regulation of the traffic for the people. The increase in speed of the vehicle and violation of the traffic rules like not wearing a helmet, crossing red signal, leads to frequent accidents. If the speed of the vehicle increases the rate of risk of an accident also increased. Everyone knows the speed limit but in spite of knowing the danger and risk, they are violating the rules. Nowadays 90% of the accidents occur due to the rule violation. The government should take immediate measures to overcome this problem in a smart way.

A tool to detect the traffic violation, which is deployed in the toll booth [20]. This system will monitor the flow of vehicles, if any vehicle violates didn't follow the traffic rules by over speeding or crossing the red signal and another traffic rule system will take a picture of the particular vehicle, then identifies the number of the vehicle, sends the details to the next toll Booth within seconds with the help of high-speed transmission techniques, so that they can take necessary steps to enforce the law. This tool is underperformance and testing process. If it gives a satisfactory result, then it can be installed in near future.

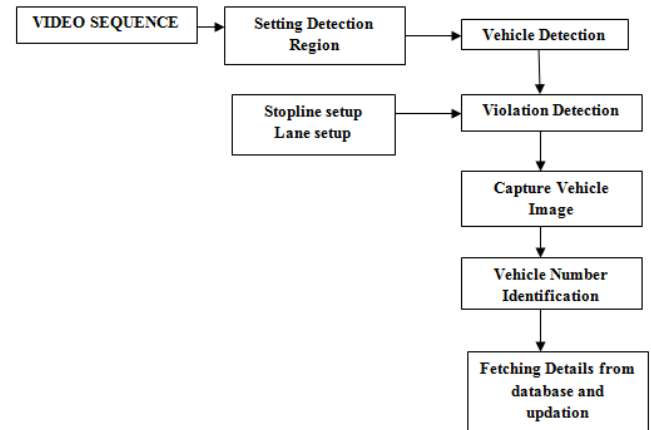


Fig-4: Block diagram for traffic rule violation detection

An automated traffic rule violation system based on methods of video processing [21]. This system only detects the red signal crossing and changing lanes violation based on the movement of the vehicle, the with the help of stopline and signal status, then from other systems such as inductive loop detectors, and traffic signal control box. On detecting the particular vehicle which violates the rule the system takes a snapshot and identifies the vehicle number. The schematic diagram of application is represented in Fig-4. Then with the help of application, the details of the particular vehicle are fetched from the database by the authorized officer and a

warning alert and fine notification is sent to the owner of the vehicle.

A system to trap the vehicle which violates the rule which is developed for office, college or any organization [22]. This system automates the process of a traffic violation, in which the camera is used to take pictures of the vehicle. With this image, the vehicle number is identified by the process of image techniques and by Optical Character Recognition technique. The number of the particular vehicle is detected and displayed on the notepad in the text. With the help of this number the detail about the employee is compared, when there is a match, the warning message is sent to him/her on their registered mobile number. In this system, the offenders disobeying the traffic rules are trapped without the

involvement of manpower. This approach gives high accuracy, can be extended to cities as well.

Mariya et.al proposed a framework which gives a continuous information discovery and warning to detect the traffic violation [23]. In this proposed framework includes techniques to recognize whether the driver is drunk or not, then measuring the speed of the vehicle, then a warning is sent to the vehicle along with the fine notification if the fine is not paid the vehicle is ceased. This system is built by utilizing the RFID innovation, thereby reduce the major accidents that occur.

A comparative analysis of Road safety problems has been provided in Table I to V.

Table I: Comparison of Pedestrian Safety

Reference	Problem Addressed	Proposed Solution	Pros	Cons
(Kumari, 2017)	Pedestrian safety	The alert system is developed based on the pedestrian number with the help of sensor	Accidents are minimized and traffic is reduced	Not applicable in all weather conditions
(Hariyono, 2016)	Number of accidents	The Caltech and ETH algorithm is proposed	High performance	High computation
(Zhuang, 2015)	High chance of Accidents	Based on the behavior of the pedestrian, the risk is reduced	Reduce accidents	Poor accuracy
(Jeong, 2017)	Sudden pedestrian crossing issues	The system with FIR (Far-Infrared) is proposed	Accurate results with high performance	Cost effective and high computation

Table II: Comparison of Traffic light scheduling problems

Reference	Problem Addressed	Proposed Solution	Pros	Cons
(Younis, 2017)	Fixed timing of the traffic signal	Traffic light control with dynamic change of time-based on the density of the vehicle is proposed, based on the sensor network	Traffic congestion is optimized	Difficult to maintain
(Liu, 2018)	The security of the traffic control system	Intelligent traffic light control with high-security schemes in fog computing, with Diffie-hellman Puzzle	Reduces security problems of VANET	Not reliable, cost-effective
(Jadhav, 2016)	Traffic congestion	Image processing technique to optimize the traffic	Waiting time of the vehicle is reduced	The accuracy of the image should be considered
(Lanke, 2015)	Traffic congestion in India	The proposed system based on RFID, to optimize the traffic	Less installation time. Effective management	High Cost

Table III: Comparison of Emergency vehicles issues

Reference	Problem Addressed	Proposed Solution	Pros	Cons
(Karpis, 2017)	Emergency Vehicle issues	Sensor-equipped with magnetometer and microphone are used to detect based on the analysis of acoustic signals	Produce better results	Unable to identify the direction of the vehicle
(Sumayya, 2016)	Priority of the emergency vehicle	The onboard unit is kept in the vehicle and roadside units is placed at the road intersections which helps in clearing the path for emergency vehicles.	Gives high priority for the emergency vehicles and reduces traffic	Cost effective and requires high energy
(Saadoun, 2018)	Delay of the emergency vehicle	Intelligent Emergency System (IES) with Global Positioning System (GPS), digital maps, video cameras, sensing devices and the Wireless communication devices to optimize the traffic and emergency vehicles	High accuracy nearly 99.3%	The network is exposed to various types of attacks
(Bosquez, 2017)	Emergency vehicle problems	Alert system based on software-defined Radio	High Accuracy	Inefficient in bad weather conditions

Table IV: Comparison of Roadside parking problems

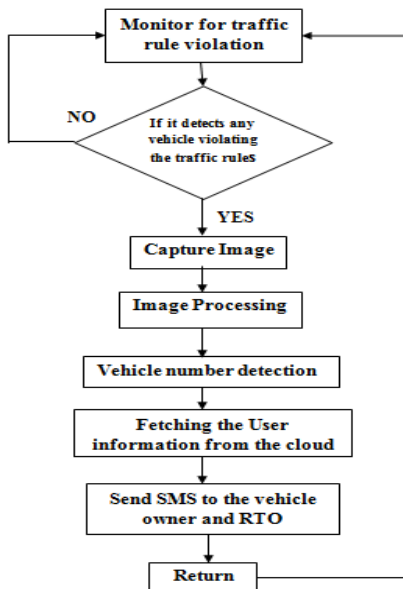
Reference	Problem Addressed	Proposed Solution	Pros	Cons
(Heimberger, 2017)	Roadside parking problem	Automating the parking system with the help of a camera and active distance measuring sensors	Efficient for automated driving car	Computation is very high
(Yang, 2017)	Traffic congestion	Parking slots are identified by image processing, the images are captured by the event recorders in vehicles.	Reduces traffic congestion	The accuracy of the Image must be considered
(Owayjan, 2017)	Parking space identification	The mobile application is developed to manage and track the parking space, phototransistor and infrared transmitter is used,	Reduces traffic and saves time and fuel	Strong network connection is required
(Yashaswi, 2018)	Searching for the parking space	A smart parking management system based on the RFID	Remote access	Only for Malls

Table V: Comparison of Traffic Rule Violation

Reference	Problem Addressed	Proposed Solution	Pros	Cons
(Aravinthan, 2016)	Monitoring of traffic rule violation	The tool is designed, which is deployed in the toll booth, it monitors the vehicles which violate the rules and take pictures of it	Provides a better solution to automate the system	Only the speed limit is considered
(Chaudhari, 2017)	The manual process of traffic rule violation detection system	The Traffic violation detection system is automated by video processing techniques. Randomly changing lane and the red signal jumping are only considered in this system	High performance Reduces bribery percentage in India.	Cost effective requires a constant network connection
(Agarwal, 2018)	Traffic rule violation in a particular organization	Automatic License plate recognition is used to find traffic rule violations in an office, college, etc. here image processing and OCR technique is used.	High accuracy in recognition of license plate number	Not applicable for all weather conditions
(Mariya, 2017)	Traffic rule violation detection	A proposed system based on RFID tag to identify the vehicle	Effective management	Some violation can't be detected

VII. PROPOSED IDEA

From the comparison of all the road safety problems, it is clear that the traffic rule violation causes major accidents. To overcome this problem, we proposed an idea to automate the system of traffic rule violation detection by continuous monitoring of vehicles.

**Fig-5 Overall System Architecture**

This system is placed in every intersection of the road where the traffic control signal is placed. This system consists of a camera, controller and sensor, the sensors are used for collecting data from the vehicle, the controller is used for decision making and the camera captures the image of the particular vehicle which violates the traffic rule. The traffic rule violation of the vehicle is detected based on image and video processing technologies. By image process the vehicle number is extracted by the OCR method, then the information about the particular vehicle is fetched from the RTO (Regional Transport Office) database. A warning alert and fine notification are sent to the vehicle owners mobile number. The RTO database is stored in the cloud environment. The overall system architecture is shown in fig-5

VIII. CONCLUSION

The ultimate goal is to reduce the number of accidents that occur in India. In this paper various road safety problems like roadside parking, pedestrian safety issues, emergency vehicle problems, traffic light scheduling problems and traffic rule violation are discussed. A broad literature survey is done for these road safety problems and the impacts of each problem are analyzed. Form the analysis result, the impact is high for the traffic rule violation. An idea is proposed is to reduce the number of accidents. The proposed system is the automation of the traffic rule violation monitoring system.

REFERENCE

- [1]. Sanjay Kumar Singh – “Road Traffic Accidents in India: Issues and Challenges” – science direct - 2017
- [2]. Road safety issues - <http://www.missionroadsafety.com/total.html>
- [3]. Statistics report of Accidents - <http://morth.nic.in/writereaddata/linkimages/Key%20Issues%20To%20ny%20Bliss-0828551088.pdf>
- [4]. Anubha Kumari, Deepshikha -“ Automated Traffic Control for Pedestrian Safety” - International Conference on Innovative Mechanisms for Industry Applications - 2017
- [5]. Mira Jeong, Byoung Chul Ko - “Early Detection of Sudden Pedestrian Crossing for Safe Driving During Summer Nights” - Transactions on circuits and systems for video technology, IEEE vol. 27, no. 6, June 2017
- [6]. Xiangling Zhuang and Changxu Wu-“Modeling Pedestrian Crossing Paths at Unmarked Roadways”- Transactions on intelligent transportation systems, IEEE, vol. 14, no. 3
- [7]. Joko Hariyono and Kang-Hyun Jo - “Detection of Pedestrian Crossing Road using Action Classification Model”- International Conference on Advanced Intelligent Mechatronics (AIM), IEEE, 2016
- [8]. Ossama Younis, Nader Moayeri – “Employing Cyber-Physical Systems: Dynamic Traffic Light Control at Road Intersections” - Internet of things journal, IEEE, vol. 4, no. 6, December 2017
- [9]. Jian Liu, Jiangtao Li, - “Secure intelligent traffic light control using fog computing” - Future Generation Computer Systems, Elsevier Page no 817–824, 2018
- [10]. Prashant Jadhav, Pratiksha Kelkar, Kunal Patil-“ Smart Traffic Control System Using Image Processing”- International Research Journal of Engineering and Technology (IRJET), 2016
- [11]. NinadLanke, SheetalKoul-“Smart Traffic Management System”- International Journal of Computer Applications Vol 75, Page no 0975 – 8887 No.7, 2013
- [12]. Ondrej Karpi - “System for Vehicles Classification and Emergency Vehicles Detection” Vehicular communication, 2017
- [13]. P.A.Sumayya, P.S.Shefeena –“VANET Based Vehicle Tracking Module for Safe and Efficient Road Transportation System” - International Conference on Information and Communication Technologies, Science direct, 2016
- [14]. Mohammed Saadoun and Abdul Kareem, - “Early Alarm for Emergency Response Based on the Priority Associated with the Cooperative Awareness Messages in Vehicular Adhoc Network.” – Journal of Engineering and Applied Science, Medwell journal, 2018
- [15]. Carlos Bosquez, Ronald Moreira-“Alert System for Emergency Vehicles Using Software-Defined Radio”- International Conference on Microwaves, Antennas, Communications and Electronic Systems (COMCAS), IEEE, 2017
- [16]. Markus Heimberger, Jonathan Horgan – “Computer vision in automated parking systems: Design, implementation and challenges”- Image and Vision Computing, Elsevier Vol 68, page no 88–101, 2017
- [17]. Ching-FeiYang, You-HueiJu, Chung-Ying Hsieh,-“ iParking – a real-time parking space monitoring and guiding system”- Vehicular Communications, Elsevier Vol no 9, Page no 301–305, 2017
- [18]. Michel Owayjan, Bahaa Sleem-“Parking Management System Using Mobile Application”, IEEE, 2017
- [19]. Yashaswi-“Parking Management System: A Review”- International Journal on Recent and Innovation Trends in Computing and Communication, Vol 5 Issue: 5, 2017
- [20]. P. Aravinthan, N. Gopala Krishnan, N. Vigneswaran – “Monitoring and Transmitting the Details of Vehicle not Obeying Traffic Rules to the Nearby Surrounding Stations for Instant Action”- IEEE, 2015
- [21]. Parul Agarwala, Kritika Chopraa, Mohd Kashifa –“Implementing ALPR for detection of traffic violations: a step towards sustainability”- International Conference on Computational Intelligence and Data Science (ICCIDS), Science Direct, 2018
- [22]. Pratik Chaudhari, Rajesh Yawle and Pratiksha Chaudhari-“Traffic Violation Detection and Penalty Generation System at a Street Intersection”- International Conference on Data Engineering and Communication Technology, Advances in Intelligent Systems and Computing 468, Springer, 2017
- [23]. Angel mariya, Aishwarya., Freny Varghese, Livya George-“Traffic Violation Detection System”, Journal of Emerging Technologies and Innovative Research Vol 4, Issue 03, 2017

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