Dynamic Traffic Contol System With Advanced Emergency Management System

Ms. M. Piryadharshini[1], P.S Aythroos Ali[2], S. Navaneethakrishnan[3], R. Muthukrishnan[4]
[1]Assistant professor, Dept of CSE
[2, 3, 4]Dept of CSE
[1, 2, 3, 4] Valliammai Engineering College

Abstract- *Due to the proliferation in the number of vehicles on the road, traffic problems are bound to exist. Therefore, the use of Intelligent Transportation Systems (ITS) has become mandatory for obtaining traffic Information from roads. Congestion on a busy road is a common view these days which leads to waste of time and is quite important issue of concern for millions this issue can be dealt with using intelligent transportation system it can help to reduce and prevent from collision on road side. The central controller, collect the number vehicles waiting for open signal through IR sensors about the latest real time traffic condition these, information match with all other lanes which lane having more number of vehicles that's got priority for open signal in case arriving any emergency vehicle on particular signal those vehicle information collect through RFID readers before 500 meter it can help for open signal to emergency vehicles. And some people not obey traffic rules on signal like jumping the signal while red signal so using metal stripes for avoid it, and installed one RFID reader on signal for collect all vehicles details when passing the signal these, information used for identifying vehicles The proposed system is to design implement collision free and emergency vehicles headway.*

Keywords- Intelligent transport system (ITS), Real time traffic monitoring, IR sensor, RFID, Emergency vehicle head way, Advanced Emergency Management

I. INTRODUCTION

With a growing number of vehicles in many countries, traffic congestion becomes a serious problem and has spread like a plague from major metropolitan areas to numerous small to mid-size cities. It increases human travel time, fuel consumption and air pollution. Traffic research data helps to monitor and control the traffic in real time. This is new approach for controlling Traffic System. The proposed system uses a concept of Internet of things. Metal spike strips are used to control the traffic violation. Density of the traffic will be decided with the help of IR sensors. RFID is used to collect the vehicle's data and used for identifying vehicles. RFID tag with high frequency helps to identify the emergency vehicles. A machine controlled Aggregation of vehicles (traffic) power to direct system that smartly used to avoid crowding of vehicles, ambulance headway and detection of stolen vehicles. Each transport vehicle is furnished with (RFID'S)Radio Frequency Identification tag to ascertain in aggregation of vehicles (traffic) signals. A RFID Reader counts the vehicles that is used to cross a particular road for specific duration. Based on a count of vehicles, if any aggregation of vehicles (traffic) density had inflated and detected by IR Sensor, a green light is turned on and vehicles get passed in a evenly manner. If a RFID Reader reads a tag of a stolen vehicle and then traffic light is in red the spike is automatically open. In addition, when an ambulance is at hand through for message passage way towards a aggregation of vehicles (traffic) signal junction, it will transmit information to a aggregation of vehicle (traffic) power to direct unit (controller) to turn it to green light. Atmega328 micro-power to direct is connected with all oar components and act as a center point. Over the last two decades, traffic congestion has become a "worldwide" phenomenon as a result of increased motor vehicles and population growth. Some time occur delay on emergency vehicle managements. Using new approach for handle these problems Emerging wireless technologies, such as Radio Frequency Identification (RFID) network, have a significant impact on improving the efficiency of the road traffic management system. Internet of Things helps to control and gather data from various devices and sources on real time road transport system.

1.1 LITERATURE SURVEY

1. Shunsuke Kamijo et al[1] proposes A **Traffic Monitoring and Accident Detection at Intersections** Among the most important research in Intelligent Transportation Systems (ITS) is the development of systems that automatically monitor traffic flow at intersections. Rather than being based on global flow analysis as is currently done, these automatic monitoring systems should be based on local analysis of the behavior of each vehicle at the intersection. This model only consist of only detection of accidents no controls that's. 2. Klashinsky et al[2] proposes A **Traffic Monitoring System** this mode invented for monitoring the traffic systems based on light signals 3. J. Sherly et al[3]

proposes **Internet of Things Based Smart Transportation Systems** in this model only suit for private parking area having two sensors parking sensor and road sensor collecting information from the vehicles and send to garage owner so it's not comfort for public transport system and road transportations. 4. Harshini Vijetha et al[4] proposes **IoT Based Intelligent Traffic Control System** this model having automatic data collection and send to server and monitoring done by camera and watching every time from control room so it's need controller and don't have any prevention measure from traffic violation 5. Varsh Rabde et al[5] **Density Based Traffic monitoring system Using IoT Technology** proposes density based traffic control system and capture the live image from various lane then match with another lane so it's take some times for that and don't have any traffic control systems and emergency vehicle head ways. 6. Antonio Celesti et al[6] proposes **An IoT Cloud System for Traffic Monitoring and Vehicular Accidents Prevention Based Mobile Sensor Data Processing** in this system having mobile application interface for control and monitoring the system not have prevention methods from traffic rules violators. 7. Suhail Odeh proposes **Management of An Intelligent Traffic Light System by Using Genetic Algorithm**

1.2 PROBLEM ON TRAFFIC

Road accidents is a negative externality associated with expansion in road network, motorization and urbanization in the country. Road traffic injuries are recognized, globally, as a major public health problem, for being one of the leading causes of deaths, disabilities and hospitalization, imposing huge socio-economic costs. In case of India, road Injuries is one of the top four leading causes of death and health loss among persons of age group 15-49 years.

Traffic junctions are points of conflict and hence, are prone to road accidents. About 37 per cent of total accidents took place on junctions itself during the calendar year 2016. Within traffic junctions, uncontrolled ones contributed to a major portion of road accidents underscoring the importance of traffic control mechanism at junctions.

Tamil Nadu topped the number of road accidents in the entire country with a percentage share of 14.9 per cent followed by Madhya Pradesh (11.2 per cent) and Karnataka (9.2 per cent). In case of road accident deaths, Uttar Pradesh topped the list with a percentage share of 12.8 per cent followed by Tamil Nadu (11.4 per cent) and Maharashtra (8.6 per cent). Tamil Nadu reported maximum number of persons injured in road accidents in the entire country with a percentage share of 16.6 per cent followed by Madhya Pradesh (11.7 per cent) and Karnataka (11.0 per cent) respectively. Inter-state comparisons reveal that over the last four years only marginal changes have taken place in the rankings of bigger 13 States. These States account for more than 86 per cent of number of road accidents and persons injured and about 84 per cent of persons killed in road accidents.

II. DENSITY BASED VEHICLE COUNT

The principle of an IR sensor is working as an Object Detection Sensor .An IR sensor consists of an IR LED and an IR Photodiode; together they are called as Photo – Coupler or Op to – Coupler. When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined. It depends on what kind of IR sensor you are using. If it is reflector type sensor where both Tx and Rx sit side by side, it gives you a maximum distance of 10–15Cm.May vary slightly depending on the brightness of the IR led. The use of IR sensor in this system is used to count the number of vehicles which passes the signal. The IR sensor allows used to save time while standing in the signal. The IR sensor collects the data of number of vehicles which passes through the signal and sends the data to the main controller in order to change the signal according to it.

In this project, the transmitter section includes an IR sensor, which transmits continuous IR rays to be received by an IR receiver module. An IR output terminal of the receiver varies depending upon its receiving of IR rays. Since this variation cannot be analyzed as such, therefore this output can be fed to a comparator circuit. Here an operational amplifier (op-amp) of LM 339 is used as comparator circuit. When the IR receiver does not receive a signal, the potential at the inverting input goes higher than that non-inverting input of the comparator IC (LM339). Thus the output of the comparator goes low, but the LED does not glow. When the IR receiver module receives signal to the potential at the inverting input goes low. Thus the output of the comparator (LM 339) goes high and the LED starts glowing. Resistor R1 (100), R2 (10k) and R3 (330) are used to ensure that minimum 10 mA current passes through the IR LED Devices like Photodiode and normal LEDs respectively. Resistor VR2 (preset=5k) is used to adjust the output terminals. Resistor VR1 (preset=10k) is used to set the sensitivity of the circuit Diagram. Read more about IR sensors. Mostly RFID used for simplify the data collection as per some pre defined conditions and loops the particular system.

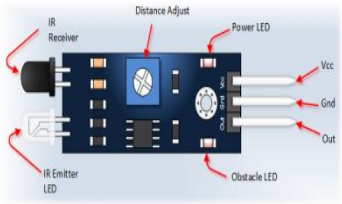


Chart 2.1 IR sensor

III. RFID TAG

RFID tagging is an ID system that uses small radio frequency identification devices for identification and tracking purposes. An RFID tagging system includes the tag itself, a read/write device, and a host system application for data collection, processing, and transmission. An RFID tag (sometimes called an RFID transponder) consists of a chip , some memory and an antenna . RFID tags that contain their own power source are known as *active* tags. Those without a power source are known as *passive* tags. A passive tag is briefly activated by the radio frequency (RF) scan of the reader. The electrical current is small -- generally just enough for transmission of an ID number. Active tags have more memory and can be read at greater ranges. All the vehicles should be provided with the RFID Tag. RFID Reader is placed near the signal in order to receive the signal from the RFID Tag. Once the vehicle with the RFID Tag crosses the signal the reader gets the information of the vehicle and stores the information in the server. This might be used for the investigation, if any illegal activity is done through vehicle can be easily identified.

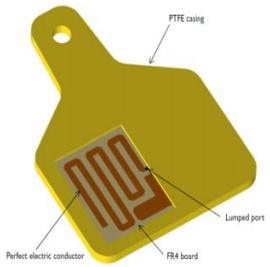


Chart 3.1 RFID Tag

RFID belongs to a group of technologies referred to as Automatic Identification and Data Capture (AIDC). AIDC methods automatically identify objects, collect data about them, and enter those data directly into computer systems with little or no human intervention. RFID methods utilize radio waves to accomplish this. At a simple level, RFID systems consist of three components: an RFID tag or smart label, an RFID reader, and an antenna. RFID tags contain an integrated circuit and antennas, which are used to transmit data to the RFID reader (also called an interrogator).The reader then converts the radio waves to a more usable form of data. Information collected from the tags is then transferred through a communications interface to a host computer system, where the data can be stored in a database and analyzed at a later time.

3.1 RFID READER

In a basic RFID system, tags are attached to all items that are to be tracked. A RFID tag is comprised of a tag chip (sometimes called an integrated circuit or IC) attached to an antenna that has been printed, etched, stamped or vapor-deposited onto a mount which is often a paper substrate or Poly Ethylene Therephtalate (PET). The chip and antenna combo, called an inlay, is then converted or sandwiched between a printed label and its adhesive backing or inserted into a more durable structure. Finished tags are available in a wide variety of shapes and sizes including labels or stickers, apparel hang tags, security tags, and industrial asset tags used on pallets and heavy machinery. Advancements in RAIN RFID have made it possible to tag liquids and metals. The type of tag needed depends on the item being tagged and where and how connectivity devices will engage it.

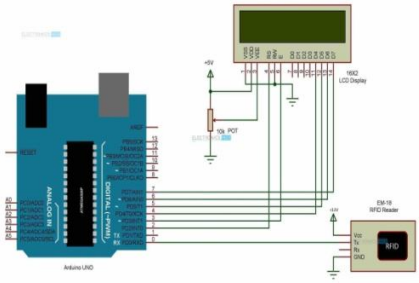


Chart 3.2 RFID Reader circuit diagram

IV. EMERGENCY VEHICLE MANAGEMENT

This module is ambulance headway. The basic idea behind this is to give free way for ambulance at an emergency situation. The ambulance will be provided with a special RFID Tag. RFID Reader will be placed near the road. When the ambulance crosses the reader then the information will be sent to the main controller. Once the information is received, the controller will change the signal accordingly. If the signal is in RED then it will change it to GREEN and if it is in GREEN then it will increase the time.

V. ACCIDENTS AT TRAFFIC AND POLICE CONTROLLED AREAS

Road transport is the dominant mode of transport in India, both in terms of traffic share and in terms of contribution to the national economy. To meet the demand for

road transport, the number of vehicles and the length of road network have increased over the years. A negative externality associated with expansion in road network, motorization and urbanization in the country is the increase in road accidents and road crash fatalities. Today, road traffic injuries are one of the leading causes of death, disabilities and hospitalization in the country imposing huge soicio-economic costs. It may be seen that the maximum number of accidents occurred at uncontrolled areas during the calendar year 2016 which caused 128,263 accidents with a share of 72.9 percent in road accidents at Traffic controlled/Police Controlled areas as against 1,66,158 number of accidents (67.6 per cent) reported in 2015. The details regarding road accidents at Traffic Controlled/ Police controlled areas indicating the number of accidents; persons killed and injured are given in. Table 5.1 depicts the percentage distribution of accidents at Traffic Controlled/ Police controlled areas.

Table-5.1 Total Number of Road Accidents at various Traffic Controlled Areas/Junctions

	Accident	Killed	Injured
Traffic Light Signal	15,125(8.6)	4,322(8.0)	12,995(7.6)
Police Controlled	11,386(6.4)	3,076(5.7)	11,761(6.9)
Stop Sign	11,221(6.4)	3,609(6.7)	11,002(6.5)
Flashing Signal/Blinke r	10,009(5.7)	3,012(5.6)	10,138(6.0)
Uncontrolled	1,28,263(72.9)	40,010(74.0)	1,24,491

SOURCE: *Road Accidents In India – 2016 Government Of India Ministry Of Road Transport & Highways Transport Research Wing*

5.1. ACCIDENTS ON ROAD JUNCTIONS

Road junction are the points of traffic merging and hence are prone to accidents table 5.2 gives the number of accidents, persons killed and injured at traffic junctions. About 37 percent of total accidents took place on the junctions itself during 2016 as against 49 percent reported during 2015. The highest number of accidents occurred at T-Junctions during 2016 causing 63,243 accidents with a share of 35.9 per cent of the total road accidents on Road junctions.

Table-5.2 Total number of Road Accidents, Number of persons killed and injured based on Junction Type (2016)

	Accidents	Killed	Injured
T-Junction	63,243(35.9)	19,884(36.8)	59,923(35.2)
Y-Junction	41,006(23.3)	12,706(23.5)	40,048(23.5)
Four arm Junction	42,829(24.3)	12,342(22.8)	40,704(23.9)
Round about Junction	25,612(14.6)	77,771(14.4)	26,797(15.7)
Rail Crossing	3,314(1.9)	1,326(2.5)	2,915(1.7)

SOURCE: *Road Accidents In India – 2016 Government Of India Ministry Of Road Transport & Highways Transport Research Wing*

5.2 ACCIDENTS DUE TO VIOLATION OF TRAFFIC RULES

Traffic rules violation is the major reason for occurring accidents on road junctions hence causes more fatal accidents and driving on wrong side are among important factors for road accidents. Accidents due to Head On Collision was as high as 96,466 during 2016 resulting in 27,446 deaths accounting for a share of 20.1 per cent and 18.2 per cent respectively in total road accidents and fatalities in the country. Hit from back, Overturning, cases are also high next to Head on Collision cases.

Table-5.3 Accidents occurring traffic rules violation

Responsibilities	Accidents	Killed	Injured
Jumping Red Light	4,491	1,260	4,636
Driving on Wrong Side	17,654	5,705	17,908
Jumping/Changing lanes	8,513	2,795	8,177

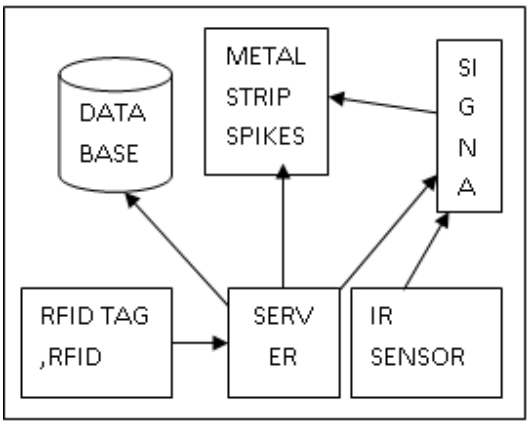
SOURCE: *Road Accidents In India – 2016 Government Of India Ministry Of Road Transport & Highways Transport Research Wing*

5.2.1 ROAD TRAFFIC SAFETY POLICY

Road safety knowledge and awareness will be created amongst the population through education, training and publicity campaigns. Road safety education will also focus on school children and college going students, while road safety publicity campaigns will be used to propagate good road

safety practices among the community. The Government will encourage all professionals associated with road design, road construction, road network management, traffic management and law enforcement to attain adequate knowledge of road safety issues. Installation of crash barriers: Installation of crash barriers in accident prone areas in hilly States have been sanctioned in a length of 143 km at a cost of Rs. 88 crore in 2016-17. Crash barriers in a further length of 137 km at a cost of Rs 85 crore have been sanctioned in 2017-18 till August 2017. These are at different stages of bidding.

VI. SYSTEM LAYOUT OF THE PROPOSED SYSTEM



VII. ALGORITHM

This section describes the decision making algorithm the second part of our proposed system. The decision making algorithm is designed to provide optimal performance of traffic lights system, which will decrease the congestion and traffic jam of some abnormal traffic pattern. This algorithm consists of a genetic algorithm. The goal of this algorithm is to develop an intelligent system that makes decisions in real time. The management of the traffic lights, and decisions making to each one, is extremely challenging and complex. To simulate the real world several assumptions had to be made in order to accommodate all possible situations that can occur either normally or abnormally such as car accidents, special events (sport events, festivals ... etc.) and even emergency situations. But here we simulate our system for normal conditions. In both cases various assumptions are made and are as what follows The system control for four intersections, I1, I2, I3, and I4 . Each intersection is controlled by an intelligent traffic light. The intersections are assumed to be relatively "busy" and under-saturated with significant demand variations in all the approaches. The intersection is assumed to be four roads label by following number 1, 2, 3, and 4. All vehicles are travelling in the same speed 40 km/h. The distance between each intersection is 200 m. So many rules can be created, which reflect the current situation of the traffic. C_{IM} is the vehicles number in the intersection I and in road M. RE_{IJ} The intersection I is connected to intersection J by road labeled in even number. RO_{IJ} the intersection I is connected to intersection J by road labeled in odd number. By these terms we can create the following logical statements:

Rule 1$(C11 + C13) \geq (C12 + C14)$ & $(C21 + C23) \geq (C22 + C24)$
Rule 2$(C11 + C13) > (C12 + C14)$ & $(C21 + C23) < (C22 + C24)$
Rule 3$(C11 + C13) < (C12 + C14)$ & $(C21 + C23) > (C22 + C24)$
Rule 4$(C11 + C13) < (C12 + C14)$ & $(C21 + C23) < (C22 + C24)$

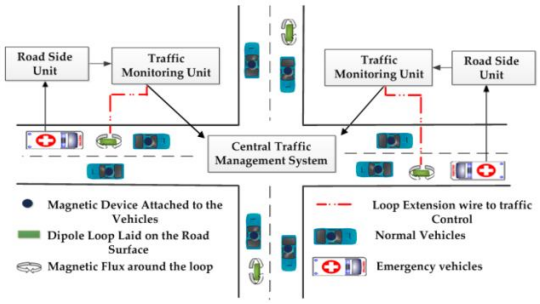
If the congestions are coming from outside of the four intersections as shown in the following cases, the input traffic to the intersection I1 from (road 1 and 2) will affect road one of the intersection I2 and can be represented by I21; and I42. Similarly intersection I2 (road 2 and 3) will affect I13 and I32, intersection I3 (road 3 and 4) will affect I24 and I43, and lastly intersection I4 (road 4 and 1) will affect I31 and I14. If the congestion is one of the following cases the traffic at I13 will affect I42, I42 will affect I31 The genetic algorithm used in this work has the following details Codification of a chromosome. A candidate solution (chromosome) is a vector of 16 random numbers (genes). Each gene corresponding to a green traffic light time consists of a random number, between 40to60 sec. Evaluation of a chromosome. A fitness value is given to each chromosome in the following way. We assume here each vehicles needs on average 3 seconds to leave the current location. $C'_{IM} = C_{IM} - t_g/3$ Where the C'_{IM} is the number of vehicles after the green light, t_g is time of green light. Fitness function $1/\sum_{i=1}^{4} Wi$ Selection of mating pool. We have followed the Baker roulette method. In this method, each chromosome is given a circular section of a roulette wheel directly proportional to its fitness. Then the selection is made by playing a ball in the roulette wheel. This way, chromosomes with high fitness are more likely to be passed onto the mating pool and also to next generation. Cross over operator. The crossover operator is applied with probability pc. We have used the standard one-point crossover. Two chromosomes are randomly chosen from the mating pool x' ; $y'i \in p'i$ Then, a cross point is chosen randomly and the operator is applied producing two new chromosomes $x''i$; $y''i \in p''i$. Mutation operator The mutation operator is applied with a probability per gene p_m. This operator flips a random bit of the chromosome. The algorithm below is repeated each 60 sec. according to this time allowing to a certain number of

vehicles to pass away and change their location. So the situation conditions of the intersection will be changed.

1) Weight of traffic is calculated for each intersection $Wi = \sum_{M=1}^{4} C_{IM}$
2) The maximum weight selected over all intersections.
3) The maximum C_{IM} is selected.
4) The extension time is added according to our constraints.

VIII. WORKING

Proposed system working based on some conditions and loops IR sensor installed certain distance from traffic signal it emit infrared rays then sensing reflected signals from vehicles continued this process controller get the sensed signals from IR sensor counting the vehicles based on density repeating this process. Setup the conditions on centralized controller if arrived 20 vehicles on particular lane signal go to Green. Metal strip spikes installed on signals from crossing level it will open when signal is Red signal is go to Yellow notify by buzzer for coming up the metal strip spikes in this component used for avoid the traffic signal jumping. Installed RFID reader on signal it would used to read all vehicles details while crossing particular signal then send collected data to antenna then stored on database through server these data help for find missing vehicles. Ultra High frequency Radio Frequency Identification Device tag fix on emergency vehicles produce the high radio frequency by this tag. Inform to server when receive the ultra high frequency radio signals controller consider that signals coming from Emergency vehicle then signal will be open some case signal having Red certainly open for that if Red signal remaining 50 seconds suddenly reduce the time to 20sec with notification hence signal always in Green increase the signal open time. Green remaining only 20sec that time increase to 50sec or open until cross the Emergency vehicle in particular signal.



Incase same number of vehicle on all lane in junction using pre-defined loop for open signal consider loops A, B, C, and D all lane having each 20 vehicle using loop priority for this situation but any lane have Emergency vehicle with 20 vehicle given first priority for emergency vehicle's lane. Above all vehicles details stored on database using RFID tag and RFID reader.

IX. CONCLUSION

The other inputs can be added to our proposed system, and can improve the Dynamic Traffic Control System with Advanced Emergency Management System of intelligent transportation system to decrease the waiting time of emergency vehicles, intersection based crashes and congestion in the city. These inputs can be acquired by using various techniques like Internet of Things Using Arduio Uno micro controller, RFID data reader V2I (Vehicle to Infrastructure) Communication and I2I(Infrastructure to Infrastructure) system and can be used to control the Traffic light and Metal strip spikes that break the violation of traffic rules. The system will send all collected data to controller and will make announcements for traffic mode (e.g. Light and Buzzer notification...etc.). Theoretically, the waiting times across the city could be reduced by 20%, when the Signals use ITS techniques and V2I to change the avoid traffic jams. Another input can be added to our Database to determine the vehicles details detecting the missed vehicles units and special RFID placed at the Emergency vehicles , as these vehicles have the priority over regular city traffic. Based on real time traffic conditions, these vehicles will obtain the best way to their destination, involving the cooperation of other vehicles, which will create a collision free roads for emergency vehicles.

X. ACKNOWLEDGEMENT

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