Automatic Speed Monitoring and Reporting of Vehicles Using Internet of Things (IoT)

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Abstract- *With the number of Vehicles increasing every day and equally increasing Traffic violation of speed limits, the number of accidents that are caused because of the speeding have increased at an exponential rate. There are existing law enforcements that do condemn these activities but the human nature tends to break those. With an autonomous and automated system to regulate the Speed control by taking the advantages of advancements in technologies available can help to bring down the violations of law and thereby bringing the law enforcements at a stricter fashion. Automatic Speed Monitoring and Reporting Using Internet of Things (IoT) makes it easy for the Law enforcers to make the riders to follow the rules in a more permissive way without affecting the flow of traffic and the ride. Connected with Radio Frequency Identification and Wi-Fi with a Controller, the system, when implemented can bring down the speeding problem, with the controls lying on a human hand for more accurate and real-time traffic monitoring, thereby not affecting the flow of traffic too. An Indigenous monitoring and reporting system autonomously files the reports when the limits are crossed, making the process of penalising more sophisticated, thereby exploiting the full potential of the system.*

Keywords- IoT – Internet of Things, RFID – Radio Frequency Identification, Wi-Fi – Wireless Fidelity, Traffic Sign Boards, Speed Control, Overspeed Monitoring, GSM – Global System for Mobiles, GPS – Global Positioning Systems, Arduino.

I. INTRODUCTION

It is known that road accidents are increasing day by day. Numerous road accidents are happening because the automobiles are driven at higher speeds even in the places like sharp turnings and junctions exist. Running the automobiles at high speeds even at those places is the major cause for the accidents. 80% of road accidents are caused by human error says a report. Incidentally, the number of accidents for 100 vehicles in India is as high as 3.5 while the figure ranges from 0.4 to 1 in developed countries. The seriousness of running a red-light in the traffic signal and speed violation on highways can be seen from the statistics given in figure 1.

Reduction of number of such accidents is the prime step needed to be taken. Many systems have been developed to prevent these road accidents but most of them are prone to fraudulent activities of the drivers. There arouses a need for the system where it is easy to implement globally and also easy to implement. We analysed various existing systems and found that the implementation of this system as a dynamic model with the help of Radio Frequency Identification Systems (An Active Transmitter and a Passive transceiver) which are fixed to the nearby traffic signal poles and the Vehicle respectively as shown in figure 2.

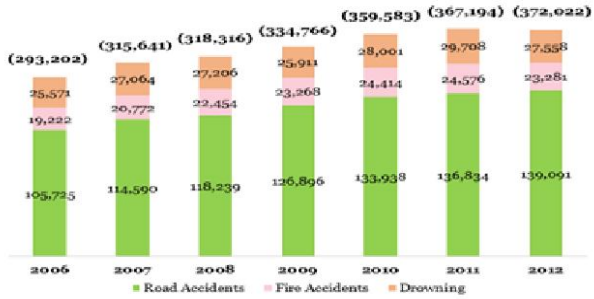

Fig. 1 Statistic Report on Number of Toad Accidents.

This System, when implemented becomes dynamic where the speed controls needed according to the traffic and the flow can me set by the traffic controller and that will be transmitted by the beacon at the traffic signal sign boards and thereby the vehicle's driver will be notified. Violation of the Law for more than a particular number of times can be intimated through Internet of Things where all the vehicles are connected to the central server. After a particular number of Violations done, the vehicle can be made immobile until the fine levied is cleared and the case is closed. This provides a more secure and dynamic control system to the traffic controllers without needing to worry about the legal procedures that have to be done manually which is time consuming and less efficient.

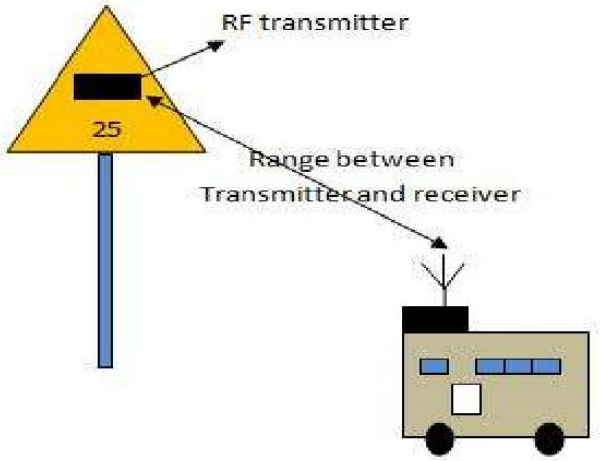

Fig. 2 Traffic Signal posts equipped with RF Transmitter and a vehicle equipped with RF Transceiver.

The Proposed System consists of an Arduino Control Board with a Passive RF Transceiver and a RPM Sensor to determine the speed of the vehicle and a Wi-Fi Module to transmit the signal to the server at the Vehicle's side and an active RF Transmitter at the Transmitting end which acts as the beacon for the vehicles. There are also a 16*2 Liquid Crystal display and a Buzzer to notify the user when a violation is caused and intelligent breaking mechanisms to stop the vehicle when the violation is caused more than the predetermined count.

LITERATURE REVIEW

A. Introduction

The Process of Speed Control is done on a variety of types and based on various models proposed due course of the time. Many systems have the basic infrastructure in common and they differ in the application part. Here the major references considered are briefly discussed.

B. Review

The Speed of the Vehicle Becomes the major Problem for any system which is in the process of monitoring. There are two types of technology by which the speed can be measured. One being the Usage of Global Positioning Systems and other considering the Motor speed of the Vehicle in pursuit. Considering either one, the exact speed of the vehicle can be measured and monitored. By using a GSM Module or RFID, the speed needed can be fed into the system for consideration and the control unit does its work of controlling the speed. [1]

Most of the vehicles which are at a high speed, are made to control their speed by setting a high-speed limit to the vehicle but that isn't the right way to monitor the speed of the vehicle since the traffic isn't considered in this mode. The Vehicle is made to stop abruptly when it reaches the overspeed limit. The breaks are applied automatically with the help of The Break Sensors attached to the foot pedals of the breaks in the busses and other multi-axil vehicles. [2]

The Traffic Signals used in the streets are static signals which just portray the rules to be followed. Instead, making them a beacon that signals the rules to be followed to the Automobiles with any available systems. This makes the process of speed Monitoring more dynamic and real time. Keeping a transmitter at the Sign boards and a transceiver in the vehicle side makes it perfect system by making the vehicles to be in a network and run in unison. [3]

Linking Vehicles together over a network using Internet of Things provides us with a lot of opportunities by exploiting its full potential. One of which is Making Vehicles to communicate with the Server to which they are linked together and other one is controlling the speed at which the system is being moved. By applying the concept of Internet of Things (IoT), The system can be linked to a huge demographic area thereby maximising the range and potential of the system. [4]

In the era of Autonomous vehicles, there is a need for the control of vehicles to be monitored every minute so that there is no collision of vehicles occur. There is a way to monitor the vehicles and connect them together and monitor the speed of the vehicles. A method, which uses the identification model of vehicle and simulation of the same, to obtain the initial parameters of the controller and set the limits for the autonomous vehicles by using Common PID Controller with fixed Parameters and an active learning algorithm inbuilt. [5]

Vehicles these days that run on the roads actually are randomised according the Driver's moods. To know the position of the vehicles and to control the speed at which they move, the position and speed at which the vehicles move are needed to be known. So, by using a variety of sensors like the Hall sensor and active traffic signals where the speed at which the vehicles have to move will be broadcasted by the signals and the sensors in the vehicles respond accordingly can be implemented by altering the basic infrastructure of the vehicles that are manufactured. [6]

One of the major need for the speed reduction in the roads is to control the number of accidents that can happen

during the course of commute. To give a hand to that, there should be a clean n fair road that has to be laid on the city. While laying such roads, there can be a method where the roads are laid with different colours where each colour specify each speed limit like green for highways where the speed can be at 60mph and white for urban roads where the traffic is more and speed has to be maintained at 20-30mph. Keeping a colour sensor in the vehicles to sense the colour of the roads and a hall sensor to know the speed of the vehicles can be a method to reduce the speed of the vehicles that are in commute on road. [7]

Whenever a vehicle meets an accident, the news of the accident reaches the Commuter's family and the emergency services at a slower pace. So, keeping an in-built GSM Module where the SOS Message can be broadcasted to the registered numbers can be done for this system. The availability of GSM Module in the vehicle can also help in the speed monitoring and reporting systems where the reporting can be done with the help of the same method as an SOS message is sent and the speed can be calculated using the sensors like accelerometers in the motor and the reception of the signals from the traffic signals can also be done so that the vehicle can know at what speed it has to move on the roads. [8]

One out of three accidents that happen on the road due to over speeding is due to the ignorance of road signals by the commuter. Every commuter needs to pay attention to the road rules but that don't happen most of the times. To overcome this the road signals can be made visible inside the vehicle to the driver and the vehicle can be made self-aware of the road signals. To implement this, Advanced RISC Machines can be used inside the vehicles which, according to the area in which it travels, takes the instructions accordingly and implements that on the vehicle in which the ARM machines are implemented. This makes the control of the vehicle more autonomous and the driver ignorance problem can be evicted completely. [9]

Interaction between the User and the vehicle can be restrained at times and that causes the accident because the latency between the hitting of break and the time it is applied can play a major role in preventing the accidents. By Providing a method where the Driver can control the vehicle using his voice commands, can be of more efficiency where the break sensors are applied to the vehicle the instance when the commuter's voice is heard. This removes the latency and increases the efficiency of the vehicle stopping time. [10]

C. Conclusions

Considering the pros and cons of the existing systems, an amalgamation of everything can be done so that a new system with a completely wide and robust uses can be introduced. The Automatic Speed Control Measures set the Maximum speed to be reached by the Vehicle. However, the maximum speed can be too high considering the real-time traffic and the physical location of the system. Breaking the automobile instantly makes the other one following it to hit it instantly causing the risk of accidents to be high. So, the proposed system must be able to stop the vehicle by reducing the speed gradually until the safe speed for stopping has been attained. This provides a safe and sound breaking mechanism. When the process of speed limiting is made dynamic, the commute becomes live and less disturbed and that is how a vehicle must move in the traffic. Controlling Vehicles using Voice commands can be futuristic but it can't be implemented in real time where the driver may be in a position where he can't speak or he may be inaudible or illegible and at that condition the system may be of a failure. GSM Modules can be considered but the potential of the system is limited to the places where network coverage will be established. Painting the roads in the future that are being laid can be done but modifying the entire system of existing roads is not feasible because it takes a million miles of roads to be laid or painted again that is extremely not feasible considering the cost efficiency and other factors. But taking the positives of all the systems and blending them together, we can create a new system where the potentials are used fully. And also, to mention, Considering the potential of Internet of Things, linking of vehicles to a central server helps us to automate the process of fine collection, which helps us to be more productive and automated thereby enforcing the law at a stricter and more advanced manner by which the commuter can neither break the law nor forge it thus enabling a network of connected vehicles that follow the rules and move peacefully and in a clear flow.

III. EXISTING SYSTEM

In the Existing System, the vehicles are made aware of the speed limits on road by using speed control beacons which statically give the data of the speed limits to the commuter for each area. The speed control for the heavy vehicles and multi axil vehicles are done by installing an on-board speed control machines where the maximum speed that can be attained by the vehicle without causing a violation is stored and once when the user tries to exceed the speed, the vehicle is not allowed to move beyond that speed. This lacks fluidity to the system and the flexibility is also drastically reduced. The Collection of Fines for such violations is also not so feasible in the existing system as there is no easy and regulated method to monitor the process.

IV. PROPOSED SYSTEM

In the proposed system, as shown in figure 3, all the vehicles should be equipped with the automatic control system unit. This includes an RFID reader, a control board, an LCD screen, a buzzer and an ECU. Tags are installed at the beginning of speed limit zone and at traffic signal. When a vehicle enters the speed limit zone or the speeds indicated by the beacons of the Sign Boards, RFID transceiver installed in the vehicle detects the tag code. This code indicates the speed which is to be maintained at that area. Transceiver transfers tag code to Control Board. When the controller gets the code, it senses the speed that is to be maintained in that area and registers. Then it compares the speed of the vehicle with the specified speed limit. If vehicle speed is lower or equal to the specified speed limit, no action is taken. But if vehicle speed is more the siren turns ON and the commuter is asked to reduce the vehicle speed down to the obtained limit. If the traveller reduces the speed, the vehicle is allowed to move. Instead if the speed is not reduced within the stipulated time, the Engine control unit (ECU) takes over and stops the vehicle and a notification is sent to the server that the speed limit has been breached in that particular vehicle.

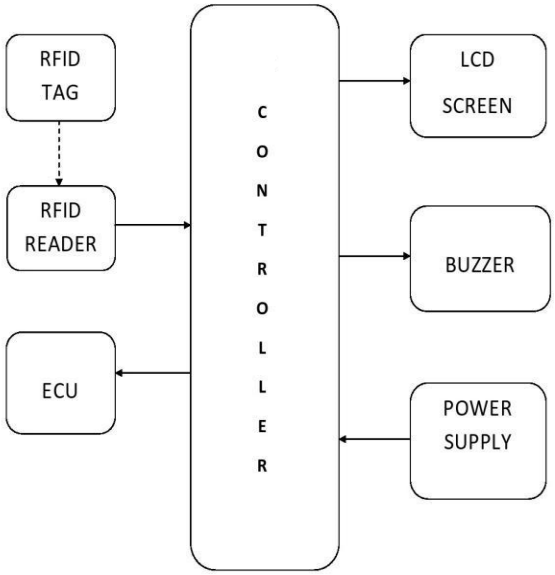

Fig. 3 Block Diagram of the entire proposed System.

When this speed breach happens for more than the specified count that is registered in the server, the vehicle is not allowed to turn on after it is being turned off and it can again be turned on only after the clearance of the overspeed charges that is imposed on that particular vehicle. This process ensures the active monitoring and fine imposition on the vehicle automatically and more accurately.

V. CONCLUSIONS

The Proposed System when implemented over a huge Geographical area, can be utilized for the monitoring of the traffic and control of it at a much advanced and automated way. The Fine collection and case imposing for the speeding violation is also automated. Thus, the commuter is made to follow the rules without being able to break the law of the particular region thus maintaining the flow and harmony of the traffic and also reducing the death toll due to the overspeed accidents caused everywhere.

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