Proceedings of the Fourth International Conference on Trends in Electronics and Informatics (ICOEI 2020)
IEEE Xplore Part Number: CFP20J32-ART; ISBN: 978-1-7281-5518-0

An IoT based Smart Monitoring System for Vehicles

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***Abstract* - There is increased adoption of penalty and fine for traffic rule violators in the public sector but there is a tendency for people to evade from those imposed fines and restrictions for their own safety. Our system will completely monitor all the traffic violations namely over speeding, rash driving, drunken driving, driving without a seat belt, and so on right from the starting of the car. There is an increasing demand to develop a system to check passengers without coming out of the vehicle. A new system for the police force to check the vehicle's details with a smart device placed in the vehicle. The device is equipped with speed monitoring, Alcohol detection, Seat belt checking, etc. If any violation is detected the controller sends an emergency data to the cloud, thus the vehicle is in continuous monitoring mode, and RTO will get updates about the vehicles which are violating rules. Alcoholic breath sensor will continuously monitor the driver's breath, speed sensor will be connected with the speedometer and checks for over speeding, Seat belt sensor will warn the driver if he/she is not using the seat belt, vehicle details including license, pollution details, insurance, etc. will be uploaded to the server or cloud. If any of the above things are violated, automatically defaulter will be imposed fines and the details will be sent to the Motor vehicle department.**

Keywords—Regional Transport Office (RTO)

I. INTRODUCTION

Day by day the number of vehicles is increasing at a rapid rate. The rate of accidents is exponentially increasing. Majority of the traffic accidents can be avoided if everyone follows traffic rules. A lot of manpower is required for manual vehicle inspection and monitoring. There is a tendency for people to evade traffic checking. Problems faced by the traffic officers skyrocketed from the previous decade. Traffic officers to vehicles ratio are very low. Impatience and hasty attitude of road users. Traffic officers face various health issues [9]. Most of the accidents cause severe casualties or even death. The government of India has made traffic laws and penalties more stringent.

People tend to follow traffic rules if they are being monitored. A vehicle monitoring system will be installed in each vehicle. The third eye will be continuously monitoring vehicle data and violations such as

- Over speeding [12].
- Drunken driving.
- Driving without seat belts [10].
- Driving without a license.
- Pollution certificate, insurance, etc.

Any violations will be detected by the system it will be reported to cloud storage and the RTO monitoring station [1]. The link between vehicles and devices causes challenges in terms of storage and computing capability, the energy of vehicle and network's control, and management [2]. To restrict people from violating traffic rules, to make Roads safer, to reduce the work of traffic and police officers, to reduce the number of accidents, to obey rules [8].

Design a vehicle monitoring system to reduce the workload of MVD (Motor Vehicle Department) or Police Officers. The proposed model has the capability to reduce the violation of traffic rules and people will follow the rules.

II. LITERATURE REVIEW

The most commonly used method for checking of the vehicle is by manual checking by the police officers or Motor vehicle department officers. The project is intended for granting a base start for further explorations in the future. This project aimed at the exiting efforts of vehicle checking developments, in the hope of implementing it in real life to improve road safety [1]. Internet of vehicles is the evolution of new vehicle network Automatic Vehicle checking will reduce the workload of Motor vehicle department or traffic officers. By deploying this system the violation traffic rules by the drivers can be controlled. GPS and GSM modules can be used in the system to know the details about the vehicle [6]. RFID technology can be used in license and smart speed boards [7]. Summing of three networks: vehicular mobile Internet, an intra and inter-vehicle network in which the vehicle is considered as a smart object equipped with powerful different sensors platform, connectivity, and communication technologies, enabling it to communicate with the world [11]. The communication between vehicles and devices causes challenges in

terms of storage, the energy of the vehicle, etc. Security is important on the Internet of vehicles and it is required to protect vehicles from crimes and accidents [2]. Car insurance details are linked with the mobile phone of the user and the insurance companies [3]. There is no method to find pollution, insurance, seat belt, alcoholic, etc. details automatically nowadays. Data collection and calibration platform based on general packet radio service and the internet to collect the driving data of electric vehicles remotely [4]. An automatic monitoring system can reduce the workload of traffic or Motor vehicle department officers. So, it can be understood that the process of Automatic Vehicle monitoring consists of several steps that require a lot of effort. The Checking Device, includes Wi-Fi or Bluetooth to send the driving information of the driver to the Programming area, backup the driving record, and finally the system sends the driving record to the Driving Information Collection System of the insurance company [5]. Such a scenario tends to push people towards violating traffic rules, to reduce these situations an automatic vehicle monitoring system is used.

III. DESIGN AND IMPLEMENTATION OF PROPOSED SYSTEM

The prototype consists of DC motor, DC motor driver, proximity sensor, microcontroller, buck and boost converters, RFID card, receiver and transmitter, MQ3 and MQ2 sensors, GSM module, and a GPS module.

A. *Control unit*

A microcontroller is used to control the whole process. Arduino has an open-source platform that includes hardware and software which is adaptable and easily accessible. A variety of Analog inputs and outputs, pulse width modulation (PWM), serial interface, and digital inputs and outputs are available. It can update and change the program when it connects to a PC using USB. It can communicate using standard serial protocol. Arduino software used is free and the hardware is low-priced. A dc motor is also incorporated in the design. The DC motor speed can be controlled using Pulse width Modulation signals. The speed can be varied by varying the duty cycles.

B. Communication Unit

A GSM (Global System for Mobile Communication) module is used in the prototype. The communication between the archetype and user is recognized using a chip circuit present in the GSM. GSM module is a kind of mobile type Equipment. It also requires the SIM card like the mobile phone, which is used to connect the vehicle in which the system is placed to connect it with the RTO server. GPS (Global Positioning System) also used in this system to recover the GSM problems faced in the hilly areas where the Mobile cannot be reached.

C. Driving Unit

The L293 unit is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. These devices are designed to drive loads (inductive) such as relays, bipolar stepping motors, and solenoids. All inputs are TTL compatible. The driving unit which controls the input towards the DC motor. Input supply will be controlled according to the speed need to run the motor. Buck and boost converts are used to control the input voltage towards the circuit equipment such as sensors, switches, GSM modules, LED displays, etc.

The system consists of two modes of operations

1. Automatic Mode
2. Manual Mode

In Automatic mode, the speed of the vehicle is controlled by using a proximity sensor. The proximity sensor measures the number of rotation per turns of the wheel. It is a sensor that can identify the presence of close objects with no physical contact. This sensor often emits a beam of electromagnetic radiation (infrared, for instance), and gets a return signal. Detecting the RFID smart speed boards, the speed of the vehicle automatically reduced according to the smart board speed.

In Manuel mode RFID license card is showing to the RFID reader module then only the vehicle will get turn ON. RFID valid license is a must for starting a vehicle. License details will be in the RTO server, a valid license will be only read by the reader in the vehicle.

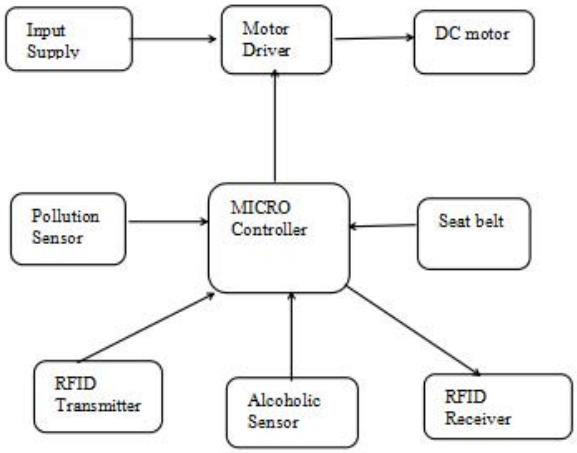

Figure 1: Basic Block Diagram of System

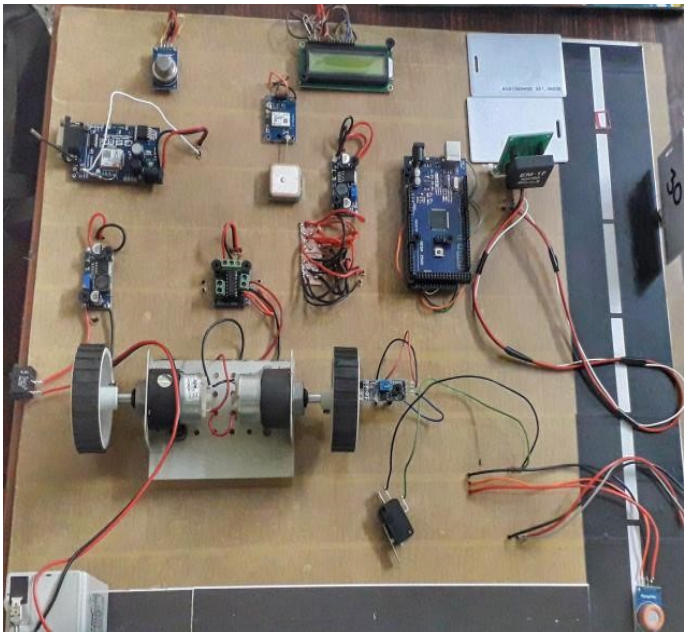

Figure 2: Vehicle Monitoring System

IV. CONTROL LOGIC OF THE PROPOSED SYSTEM

An alcoholic breath analyzer sensor will continuously monitor the driver's breath, which will be installed near the steering (MQ3 Sensor). The speed sensor will be connected with the speedometer and checks for over speeding (RPM). The seat belt sensor will warn the driver if he/she is not using a seat belt (leaf switch) and the vehicle will not start. The vehicle details including license, pollution details, insurance, etc. will be uploaded to the server or cloud. If any of the above things are violated, automatically defaulter will be imposed fines and the details will be sent to the Motor vehicle department. RTO officer has a Cloud arrangement to know the details of each vehicle with its details (Vehicle number, Owner name, etc.).Cloud arrangement consists of Insurance details, pollution status, Seat belt Detection, Alcoholic, or Not. The product also has a Speed controlling setup by Using Speed Smart board (I e RFID Speed smart board). The vehicle consists of an RFID System to detect the smart board.

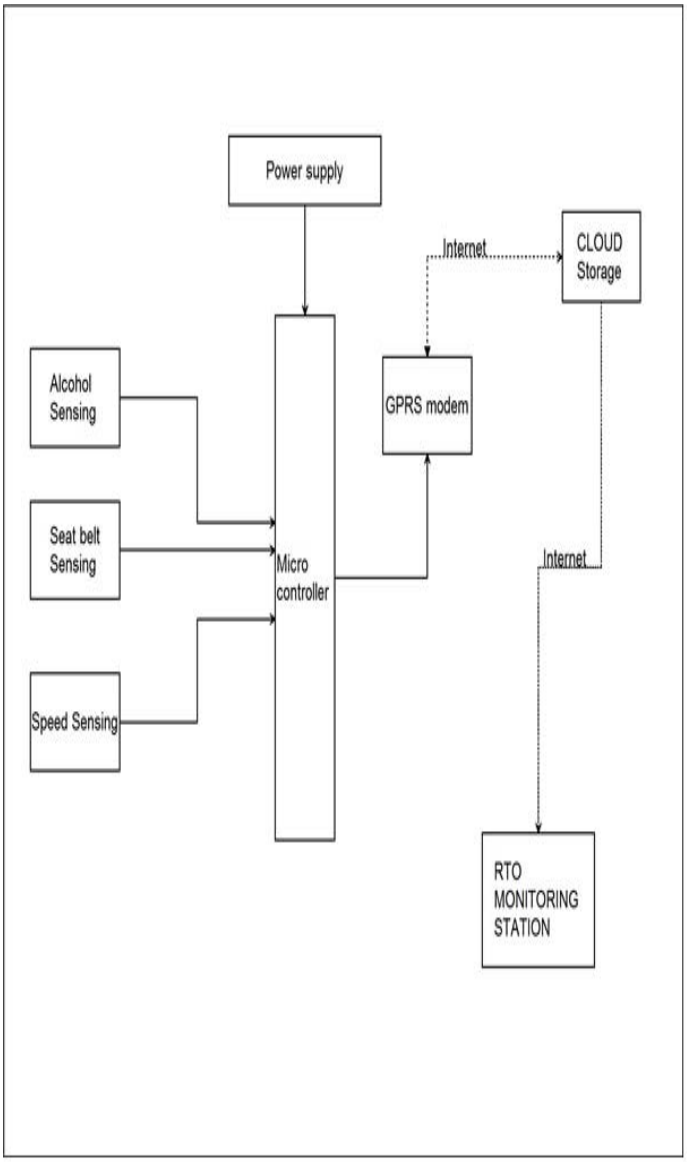

Figure 3: Prototype Block Diagram

The monitoring systemconsists of

- Alcoholic Level
- Pollution Level
- Insurance

These values will be updated in the RTO Server (Cloud) of each vehicle and by looking at the data of the vehicle available in cloud arrangement, the fine can be given to the vehicle owner. Each graph shows each details (alcoholic, pollution, insurance) with 2 values 0 and 1. 0 (OK condition) and 1(Violation Condition).

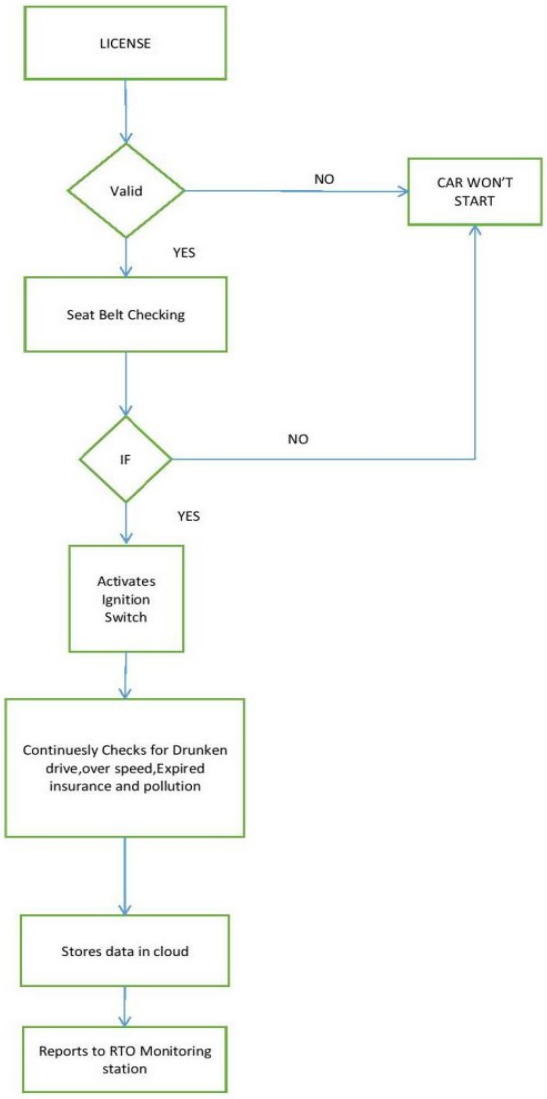

Figure 4: Monitoring Section

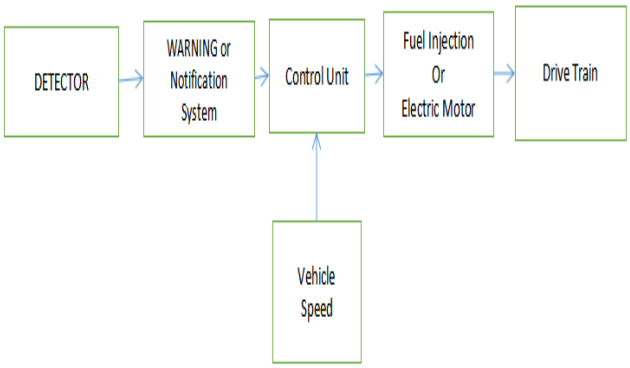

Figure 5: Speed Limiting Section

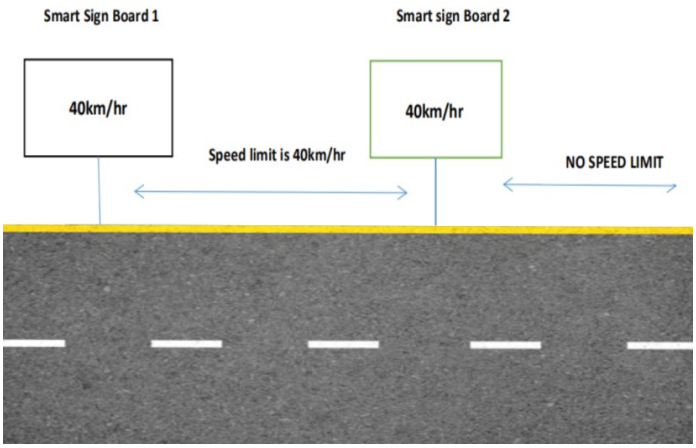

Figure 6: Concept of Speed Limiter

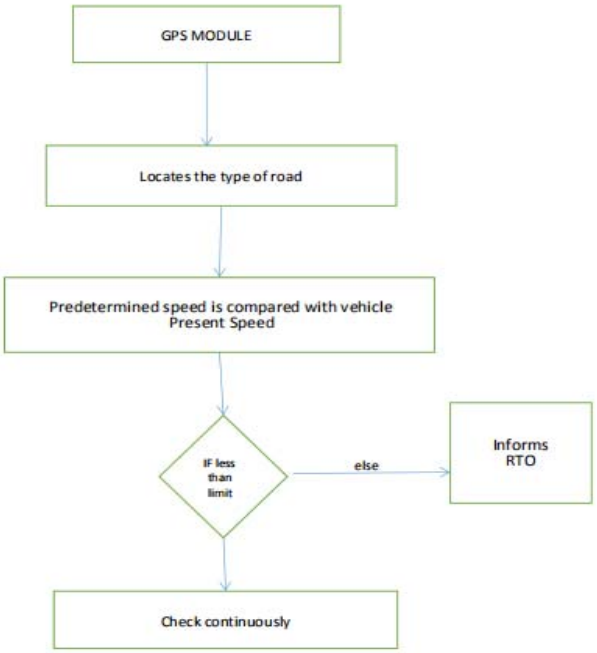

Figure 7: Over speed Section

Traditional speed limit signboards will be replaced with smart boards incorporated with RFID that will be installed inroads. The working of the speed limiter is as follows. Consider an area like a school or hospital, where smart signboard will be installed. The area will be between two smart signboards. One of such boards will be installed before the beginning of the school and after school. So the area of regulation will the. When a vehicle enters the area and after passing the first smart signboard the RFID detector detects the permissible speed limit and the notification or warning system alerts the driver through the LCD screen inside the vehicle. The vehicle's speed will be also noted. The control units check whether the vehicle's speed is above the speed specified in the smart signboard. If so the process of speed limiter comes into action. Now the speed of the vehicle has to be limited to a permissible limit, for that is controlling the fuel injection rate of the fuel injector. Currently, the vehicles are riding with the help of wire technology and programming. So the fuel injector will be programmed in such a way that it won't go beyond the permissible speed even if the drives give more throttle. For electric vehicles, the motor driver will be controlled.

After the detector identifies the second smart signboard the fuel injection rate or the motor driver will be back to the normal. When the vehicle is moving at very high speeds the detection system will not be able to identify the smart signboard, in the case over speeding can also be detected. That will be done by deploying the over speed monitoring section.

V. PROTOTYPE TESTING AND RESULTS

The detection, monitoring, automatic speed regulation, and data handling system of IoT based smart monitoring for vehicles are tested. The RFID incorporated licenses are read readily by the RFID reader which is installed in the center console of the vehicles. The presence of passengers inside the car is detected with a temperature sensor installed in each seat with fewer errors using LM35. The GPS module can locate the vehicle with much accuracy and can identify the type of road through which the vehicle moves. The alcoholic sensor MQ3 which is installed in the driver's seat belts continuously monitors the presence of alcohol in the driver's breath with high sensitivity. The RFID reader reads the smart signs boards that are installed in areas where speed regulation is necessary with a speed less than 80 km/hr. and adjusts the motor speed or the fuel injection of the vehicle to regulate the speed as specified. Insurance, Pollution details on expiry will be notified to the user and upon further use of vehicle inroads which will be detected by the GPS module will be sent to the RTO monitoring station. Any violation as specified will be monitored and reported to the RTO monitoring station through the GSM module and will be in the cloud storage. The experimental results prove the efficiency of the proposed scheme eliminates traffic violations and in turn reduction of accidents as well as workforce and workload.

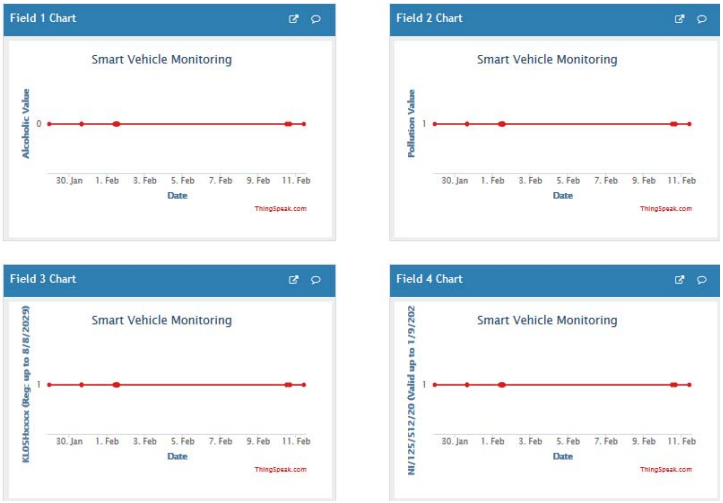

Figure 8: RTO Monitoring Section

Figure 8 shows the details of the RTO monitoring section, it includes pollution details, alcoholic value, vehicle details, and insurance details. The monitoring section shows the values when there is a fault in the above-mentioned conditions.

The system will monitor any violations like over speeding, drunken driving, expiry of pollution, license, and then it will be sent to the RTO monitoring stations. Each vehicle will have each unique cloud and violations values can be seen RTO monitoring stations in real-time. Also, the RTO monitoring station will be able to locate any vehicles using GPS modules in the system. The speed of the vehicle is controlled at different road locations such as school areas or City region. A vehicle monitoring system that follows rules that needed to follow by a driver is mandatory to drive the vehicle.

VI.CONCLUSIONS AND FUTURE WORKS

The Vehicle monitoring system, which reduces the workload of MVD (Motor Vehicle Department) or Traffic police officers. Mainly this project helps to reduce the traffic rules violation and Accidents. 60% of the vehicle users are not obeying the traffic rule. Vehicle monitoring will be helpful for MVD or Traffic police. Manuel checking of vehicles in the country is a very difficult task, mainly vehicle checking is done to reduce the traffic violations and to obtain 0% accidents. Officers' workload can be also reduced by implementing the system. The vehicle which violates the traffic rules will get fine and it will automatically send the message to the vehicle owner. Traffic officers to vehicles ratio are very low. Impatience and hasty attitude of road users. A lot of manpower is required for manual vehicle inspection and monitoring. Traffic officers face various health issues. Most of the accidents cause severe casualties or even death. Automatic vehicle checking can reduce the casual attitude of drivers towards the traffic rules and help them to save their life. By implementing our project, the rate of Violation such as not putting the seat belt, Alcoholic, pollution expired, over speeding, and driving without a license can be controlled up to a certain limit mostly better than ordinary checking system.

Some of the future works are more sophisticated coordinates and the map system has to be developed so that the GPS will be able to identify the type of road through which the vehicle moves. Touch and breath-based alcoholic sensors using Infra-red spectroscopy have to be developed.

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