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Real Time Automated Vehicle Monitoring and Control System Using Internet of Vehicles

Nalina V[1*], P.Jayarekha[2]

[1*]Department of ISE, BMS College of Engineering, Bangalore, India
[2] Department of ISE, BMS College of Engineering, Bangalore, India

[*]*Corresponding Author:* nalinav.ise@bmsce.ac.in, *Tel.: +00-94483-87416*

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Abstract— Many traffic violations occur every day yet there is no proper tracking system to keep a check on such occurrences and the consequences that occur thereto. Presently there is a manual system wherein a traffic police goes to drivers and vehicles which are suspicious and then checks the vehicle and license documents. There are many instances where all documents though accurate and to date, the driver would have missed to carry all the said documents. On a given business day to conduct this process is a tedious one and not an adaptable solution both for the traffic personnel and the public considering the inflow of the vehicles to and fro in to the city especially in metro cities. The proposed system helps control all the tedious tasks and aims to automate the monitoring and tracking of vehicles.

Keywords— Automation, Monitoring, RFID[Radio-frequency identification]

I. INTRODUCTION

The Internet of Vehicles (IOV) is a merging of the mobile Internet and the Internet of Things. It has requirement of vehicles combined with two-way Radio Frequency equipment. IOV is a merged technology that encloses information communication, environmental conservation, energy protection, and safety. Internet of Vehicles refers to dynamic communication between mobile systems that intervenes with vehicles, humans, sensors, roads and infrastructure. This leads to V2V (vehicle-to-vehicle), V2I (vehicle-to-infrastructure) V2R (vehicle-to-road), V2H (vehicle-to-human) and V2S (vehicle-to-sensor) interactions. It collects data and information from the surroundings and also does information sharing [1].With the increasing number of vehicles, activity clog and transportation delay on urban arterials are expanding around the world. In this way it is critical to create, check and approve straightforward yet effective models that offer assistance in planning and enhancing the security as well as the productivity of transportation. Automated Vehicle Monitoring System is basically used to monitor the various statuses of the vehicle and driver. It is mainly to ease the efforts of vehicle drivers and traffic police to take the basic data regarding the vehicle without having to trouble the driver while on the move and it can also be used to track the vehicle whereabouts in case the vehicle goes missing using a network called RFID [Radio-frequency identification] sensors.

Today, digital vehicle monitoring is required as everything is on cloud and Internet of vehicles is gaining priority over the manual records day-by-day and nowadays almost everyone has a smart phone and access to cloud and Electronic Communication System such as E-mail and mobile applications. Today, especially in cities the number of vehicles is increasing constantly and manual verification of each and every vehicle and driver is highly not a feasible solution. Thus the need of the hour is develop an highly automated and portable vehicle monitoring system that performance with cost effectiveness. This proposed system fulfils all the above requisites and notifies the driver, i.e. owner of the vehicle and RTO [Regional Transport office] in the form of an E-mail which contains all the information about the violation such as type of violation, date and time about when it occurred and where it occurred. This method provided the driver as well as the concerned authorities regarding the violations and thereby allowing them to take futuristic actions even though there were not physical present at the site of action. The immensely cut down time, and cost.

The main purpose of the project is to avoid the complications and manual work involved in the present run system. The new digitized system aims at eliminating all the existing flaws and decreases the manual work by and also brings in the ease transparency in to the system, with a solution that is efficient, cost effective and portable.

The objective is to have a system which is completely automated and that is in compliance with real-time. It avoids lot of manual work and brings transparency in the system thus avoiding sleaze in the current system. Rest of the paper is organized as follows, Section I contains the introduction. Section II contain the related work on Internet of Things, Section III contain the proposed methodology and the system architecture. Section IV contains the results and discussions. Section V concludes the research work.

II. RELATED WORK

Drazen Pasalic et.al [2] has proposed IOT based setup for vehicle toll cost paying. This application implements integration of IOT devices. The model works based on destination and source point selection. When the vehicle arrives at the toll paying at a certain distance a camera is placed and the camera scans the vehicle number and that information in turn is transmitted to the local system to analyse the payment details for current vehicle based on obtained data. After the successful payment green light from the toll point it gets opened and which enable the vehicles to drive through the toll station without retention.

Hu Lingling [3] has proposed a vehicle monitoring system using IOT, which collects vehicles information and then monitors the condition of road interconnections in real time. This system provides a platform to the traffic management of vehicles on road.

Chi-man Yong et.al [4] have proposed a WINS [Wireless Inspection and Notification System]. WINS works under the idea of IOT for managing vehicle emissions inspection. Even a MAXST [Maximum Spanning Tree Algorithm] is used to elect proper traffic lights.

Serge Popv et.al [5] proposed approach of achieving the IoT to benefit both vehicle operator and commuters get the entrance to data services. The concept of the system is to design an inventive model for the implicit object communication that imitates the presence of the whole traffic mesh.

Avik Ghose et.al [6] describes about a lane situation controlling system and alert enabling function applying the in-vehicle smart devices as linked servers. These are pertinent to an IOT platform by the internet. They demonstrate smart devices based road condition controlling alert system.

III. METHODOLOGY

Automated Vehicle Monitoring System is a technology that eases the work of traffic police without troubling the driver. Usually the technology which is presently used involves the manual approach of police to the driver, it wastes a lot of time for vehicle driver as well as traffic police and the driver should carry every single document related to his vehicle, if he misses even a single document he will be in problems. Automated Vehicle Monitoring System makes this process easy, the vehicle has to just pass through the RFID sensors and the vehicle needs not stop either.

The system includes fixed RFID tags, Raspberry Pi as shown in Fig.1 every vehicle should have a set of RFID tags attached to them. Post which every time a vehicle having the RFID card passes through RFID sensor, it records the RFID tag number of the card, once the Raspberry Pi gets this number, it compares it with the entries on cloud as Raspberry Pi is connected to the internet through Wi-Fi modem, and once it gets the details of the vehicle it checks for the various types of violations, the same happens with both vehicle card and driver card. On the basis of the initial characters of the tag, the differentiation between card ID of driver and vehicle is done and also completed the necessary violation checks in the process and intimates the driver or owner of vehicle and with RTO personnel with the necessary updates.

The data will be taken from RFID sensors to Raspberry Pi and it is synchronized with cloud data. The data is stored in the cloud. Microsoft Azure cloud platform has been used for cloud data services. The information available on cloud is used by the website maintained by RTO which cater the live time data of vehicle movement. Practicing cloud storage to save the data adds advantage such as scalability, convenience, and flexibility to the proposed system.

The proposed system makes use of the following:

A. Hardware requirements

- Active RFID tags
- Raspberry Pi B+ model
- RFID sensors
- WIFI Adapter

B. Software requirements

- Raspbian OS or NOOBS software
- Minicom is a control and terminal emulation program.
- Microsoft Azure, a cloud computing service is used to record the inputs of the afore said sensors.

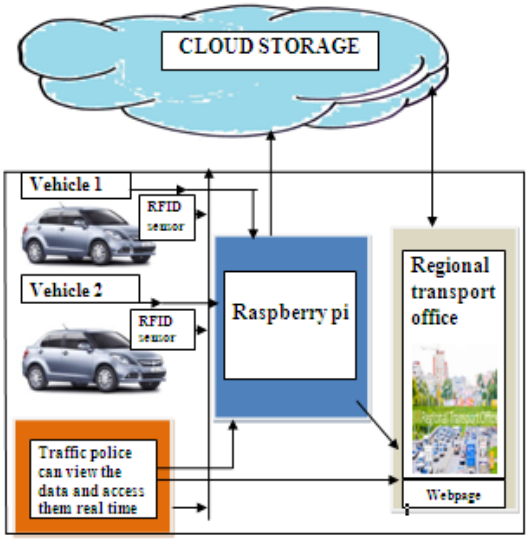

Figure 1: Block diagram

i. Electronic data collection from the vehicle and driver

Car and driver's information are collected and stored in a database. In future it is planned to develop automobile and the driver's identification data can be printed in electronic smart cards. These generated smart cards can be used with each one for automobile identity and the other for the driver identity.

ii. Traffic information collection of driver and vehicle real time

The vehicle passes through the monitoring base station. The base station has active RFID [Radio Frequency Identification] installed in them. The system receives the information regarding vehicle and driver's identification. The information collecting and controlling base stations will be installed at all traffic signal points. This base station can be constructed as handhold devices also which can be used by traffic police officers for monitoring the vehicles and driver's documents without delay. When an illegitimate vehicle passes through the base station if there occur anomalous data which is scanned by RFID. This vehicle fleeting is noticed to be abnormal data. Then it is transmitted to the data centre along with the origin of the abnormal condition. The traffic policeman gets the signal of abnormality from the database. The humans can interfere and block the abnormal recorded vehicle and then the message is passed to all traffic control system to track the vehicle. Further, the base control system according to the demand for safer law enforcement it can query the local repository to resolve if the present vehicle and driver are on the black list.

iii. Data Transfer

Vehicle and driver identification data are collected and transferred to RTO [Regional transport office] to keep updated information. Information integration of application vehicles and drivers data is saved in the data centre. The vehicle data system is built for the management of the vehicles and for sharing the data.

iv. Performance in different or unexpected conditions

The RFID tags used work in all weather conditions like rain, high temperature. The different types of RFID readers with respect to frequency are Low Frequency (LF), High Frequency (HF), Ultra High Frequency (UHF), Dual Frequency (DF). All these readers minimally get affected for the environmental conditions, such as water or metal interference. UHF RFID tags do not get affected even if it is covered with ice/frost. Conditions apply where the ice layer is thicker than 10mm then the transmission power needs to be increased.

IV. RESULTS AND DISCUSSION

To test the working of the system, research and development were conceded out over a mirroring of road condition in accessible area of around 150 square meters, on a seven meter height pole was used traffic signal light simulation. Vehicles assembled with the sketch out RFID tag will drive in this region. The RFID reader was equipped on the pole. As the vehicle mounted with RFID tag passes through the simulated traffic signal light, the RFID reader reads the data and gives it to Raspberry pi for processing. The circuitry connection of the hardware is shown in the Fig. 2 In the system RFID reader, and the cloud Storage is connected to Raspberry Pi. Power is the life for hardware components. To ensure the working of the components power supply is provided from the vehicle battery system. To make a complete reliable system proper power supply with correct wiring is expected. External power supply of 12v and 1 amp should be provided to the RFID reader via an adapter. There are two RFID tags in vehicle. One for storing vehicle details and another tag is to store driver details. RFID reader reads the tag and gives tag ID to Raspberry Pi which will access database and checks if there exist any violation, if found any violation then notification will be sent to authorized personnel via E-mail. The data is stored on cloud and can be easily accessed by any authorized user through web page. As the cloud platform was used, the system was found to be expandable for a greater vehicle sets and will preserve entire data.

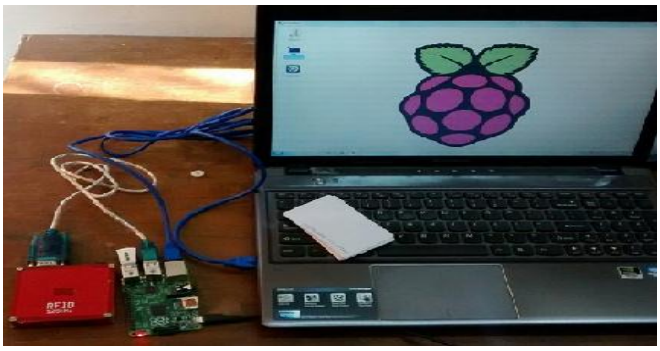

Figure 2: Experimental Circuitry Setup

V. CONCLUSION

This proposed system massively reduces all the tedious work and aims at making the system completely automated, where in a large number of vehicles can be monitored and tracked by a single system. The system requires a Raspberry Pi and RFID[Radio-frequency identification] reader, given that all vehicles have two RFID tags attached to them, one which gives details about the Driver and another one which gives details about the vehicle, the RFID tag need not give all the details. It just needs the RFID tag number and this number consists of all the vehicles details which are stored in the cloud database that in turn checks for traffic rule violations. The details of the users are stored in the database. E-mails to notify the user as well as notify the RTO [Regional Transport Office] personnel regarding any type of traffic rule violation for both security and safety.

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Authors Profile

Nalina V is working as Assistant Professor in the Department of Information Science and Engineering at BMS College of Engineering, Bangalore, India. She has received BE(VTU Belgaum) in Computer Science and Engineering in 2008 and M.Tech in Computer Network Engineering from Dayananda sagar College of Engineering (VTU),Bangalore in 2010. Currently persuing her Ph.D degree. Her area of research interests includes VANET, Cloud Computing.

Dr. P Jayarekha holds M.Tech (VTU Belgaum) in Computer Science securing second rank and Ph.D. degree in Computer Science. She has nearly two decades of experience in teaching field. She has published more than 20 research papers in referred International Journals and also few in national and international conferences. Research Scholars are working on various fields like cloud computing, WSN and related areas under her guidance. Currently, she is working as Associate Professor in the department of Information Science and Engineering at BMS College of Engineering, Bangalore, India.

