Design and Development of Fleet Tracking and Management for Improved Productivity using Sensor Nodes

SuryaprakashShanmugasundaram, M.Mathankumar, TamilarasuViswanathan

Abstract: This paper describes about the work done in design and development of low cost fleet tracking and management for improved productivity and security features.The system is divided into three major parts such as fleet tracking, fleet management and security. The problem of identifying good driver who ride the vehicle with maximum fuel consumption and security is really a hard thing for the big management.This problem is solved by the devised model. Fleet tracking is based upon the inbuilt GPS which gives accurate position of the location of the vehicle, security is made by two components such as OTP based vehicle unlocking and prevention of unlocking when the driver seems to be drunken. All the On-board sensor datais collected and send through the remote server through Wi-Fi Protocol. The gained information is breaking down and handled and send back to the proprietor of the vehicle through SMS and online administrations. The created framework is verified by the functionality with developed prototype.

Keywords: Tracking, Vehicle Management, RFID Secured, IoT.

I. INTRODUCTION

Around the globe, the quantity of vehicles robbery cases has been expanding at a quick rate though the rate of recuperation of the stolen vehicles is as yet negligible. Moreover, numerous specialist organization need legitimate armada administration framework which causes low productivity of administrations and decreased benefit as the organization couldn't screen transportation tasks. An ongoing remote vehicle following and control framework is one of the conceivable answers for defeat these issues. In this paper, we have developed a multi-objective layout and improve the intense after and control system for trucks remembering the ultimate objective to dodge robbery, control, and screen. The proposed model will join the foundation of an electronic contraption in a vehicle with the inspiration driving made PC programming to near the proprietor or an outcast to track the vehicle's zone, gathering data about the status of the vehicle by methods for the limit device and it will be moved into the web. At present a large portion of the vehicles were driven by drivers which may prompted vehicle burglary while driving instability places, fuel robbery, and mishap may occur because of poor driving execution. The place of the vehicle recognized utilizing

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SuryaprakashShanmugasundaram,Assistant professor, Electrical and Electronics Engineering, Kumaraguru College of Technology, Coimbatore, India

M.Mathankumar, Assistant professor, Electrical and Electronics Engineering, Kumaraguru College of Technology, Coimbatore, India

TamilarasuViswanathan, Assistant professor, Electrical and Electronics Engineering, Kumaraguru College of Technology, Coimbatore, India

Global Positioning framework using GPS report the status on request through Global System Mobile communication (GSM).

This model is more secured, dependable and minimal effort system than the previous systems.

II. RELATED WORKS

Vehicle Tracking and Management has been a research area for the past few decades. The following are the related article taken into reference while developing the proposed model. R. Gao et al. [1] describes about the smart phone based Real Time Vehicle Tracking in Indoor Parking Structures. In this model a software called Ve-track and a GPS based system is developed, based on the GPS data the author constructed the pattern for identifying vacant space in parking area. The algorithm used is sequential Monte Carlo framework to represent vehicle state probabilistic ally and harness constraints by the garage map and detected landmarks to robustly infer the vehicle location.

J. Patra et al. [2] describes about the development of Android based application of Bus Management system for ST bus Services in Nagpur. The models consist of three modules such as driver module, passenger module and database service. The Google mapping service is utilized for mapping the vehicle data with real time map data. The model helps in reduce the guessing of the bus on the road. M.Mathankumar et al. [3] describes about the design of security system for smart car using multi sensor technique. O. A. Basir [4] devised a patent, which describes about the vehicle monitoring device, in which the device will monitor the vehicle dynamic behavior, location and status of the vehicle. RamalathaMarimuthuet. al., [5] developed accident prevention system by implementing the driver fatigue detection using image processing.

An RFID tag-based vehicle unlocking features is devised, such that, system will manage the different driver profile based upon the tag Id.

So that system consists of GPS vibration sensor, gyroscope and fuel level sensor, individual driver driving profile is created and stored in the database of the system. The driver profile is identified based upon his driving pattern. The drawback of the existing system for vehicle management is listed as follows.

- Driver Profile is not maintained
- Event triggered attention at the time of accident is not developed

• Driver's Driving pattern is not addressed
• Security towards vehicle unlocking.

III. PROPOSED MODEL

The proposed model consist of multiple number of sensors were incorporated such as for vehicle tracking GPS receiver which provides the data such as latitude, longitude and altitude, accelerometer for to provide the orientation of the vehicle in 3D view with respect to X, Y and Z axis, gyroscope is a tilt sensor, fuel level sensor to measure the fuel level with respect to time and security features such as remote locking of vehicle through GSM service and unlocking of vehicle by RFID tag OTP based service obtained from remote server. The user interface service like LCD panel for output and keypad and RFID reader as input device. The block diagram of the proposed Vehicle Control device is shown in Fig. 1.
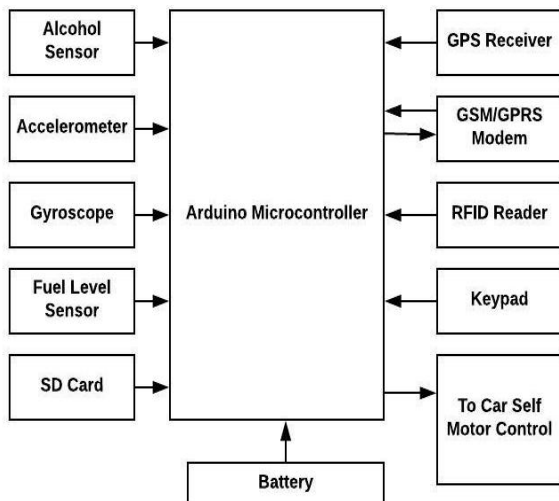

Fig. 1. Block Diagram of Proposed Vehicle Control Model

A .Tracking Algorithm

The Transmit (Tx) pin of GPS receiver is connected to the digital pin of arduino. To acquire the GPS receiver data in serial communication portal of arduino, it is programmed using UART protocol of 9600 baud rate. The data obtained from GPS receiver is in degree minute format (ddmm.mmmm), it has to be converted into decimal degree format by using the following formula.

Decimal Degree Coordinate = Degree + Minute/60 (1)

Similarly for the longitude, the obtained data has to be converted. The information of longitude is transmitted through to the server utilizing GSM module. At the server side they obtained data is mapped into the Google maps service with respect to time. So that dynamic behavior of vehicle is monitored and tracked with respect to time.

B. Working of Proposed System

The server is designed using Raspberry pi with GSM modem and the block diagram of server design is shown in Fig. 2. The data is obtained from the vehicle node board through SMS/GPRS service. The data consist of Location information and sensor data such as alcohol detector, fuel level detector, RFID tag detail and status of the vehicle such

as ON and OFF data. If the alcohol consumption of the driver is detected the vehicle engine is turned off immediately and won't turn ON until the remote server authorize it. All the data can be monitored using Live Web page or Android Application.
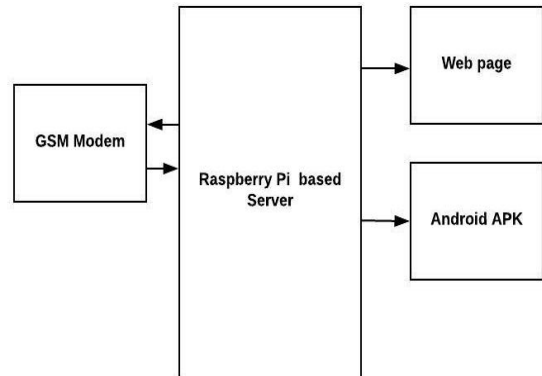

Fig. 2. Block Diagram of Server

Whenever the person enters the vehicle, the driver must the pass the alcohol test, and then he uses his RFID based ID cards as a key to start the engine. Once the driven shown his RFID card to the Reader of the Vehicle control board, the control board sends the tag data to the server using the SMS service.

The server receives the message the and process the data so as to compare the data with data of the drivers profile stored in the database and match the tag data with the profile data and checks for the validity of the driver profile. If the driver is eligible to drive, the system will to send the One Time Password (OTP) to the driver mobile and the vehicle control board so that if the driver enters the correct password using the keypad attached to the vehicle control board, the vehicle ignition will turn on by actuating the self-motor of the vehicle, if password mismatch happens for more than 3 times, the vehicle control board reports to the server module for immediate action. The flowchart of the flow of control is shown in Fig. 3.

C. Database Management

The data plays an important role in this vehicle management system because if the vehicle control network has to be connected to the internet for start of the vehicle for proper authentication. We made a scheduled authentication such as only during the morning time i.e., when the vehicle start from the garage it will prompt for the OTP and authentication. So that if the vehicle stopped at the middle of the road, only by Local RFID based authentication is needed to start the vehicle. The all the sensor data read by the micro controller will be stored in the separate flash memory using a dedicated memory card. This card can be used by the used insurance agencies if in case of vehicle met with an accident, can be used for faster claim approval by verifying the data such as driver details and driving pattern.
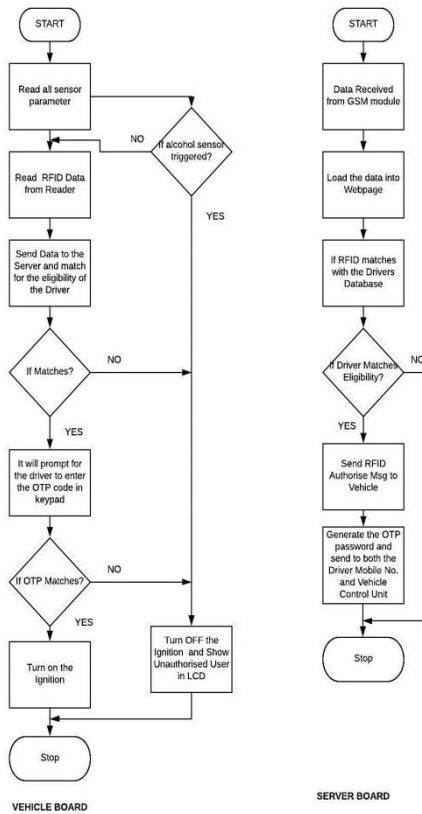
Fig. 3. Flowchart of Sensor and Server Model

D. Communication Network

In the proposed system, the all the sensor and on-board LCD connection is made by I2C protocol, which is a serial communication protocol. The communication between the Vehicle control board and Server is made by the GSM based communication. The sensor data is transmitted by the SMS service. In the server model, the raspberry pi is a minicomputer which is connected to the internet using on-board Ethernet service and data is received by GSM service.

E. Power Supply

The Vehicle Control Board is available inside the vehicle so which is powered by the battery power supply, since all the sensor are power efficient sensor, and chosen arduino controller will consume 25mA of power. The server Raspberry board is powered by separate power supply from wall socket.

IV.   SIMULATION DESIGN AND HARDWARE OUTPUT

The code for the Vehicle Control Board is written and simulated by the ARDUINO IDE and hex file is generated. Before loading into the actual control board it was simulated using the Proteus, which is a Hardware Simulation Tool. After successful simulation the code is dumped into the controller and hardware connections were made. The Proteus simulation is shown in Fig. 4.
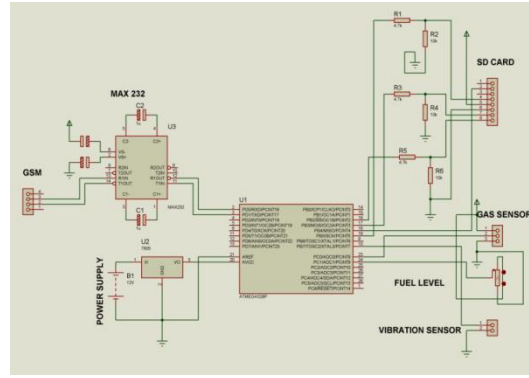

Fig. 4. Simulation of Vehicle Control Board

The recorded data which is stored in flash memory card and On-board LCD panel output is shown in Fig 5. The LCD show the data such as Fuel Level, speed of the vehicle and alcohol level detected and the remaining data will be sent to the server for viewing in Mobile using Android Apk and Web page using server. The location indication and accident occurrence, detection and intimation is made to the owner using SMS service which is shown in Fig. 5 .
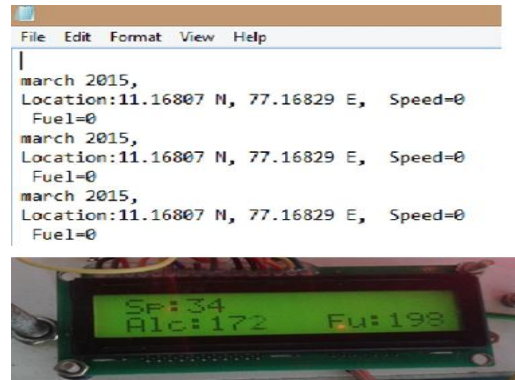

Fig. 5. LCD Display output and SD Card Output

The hardware arrangement is made using prototype model and tested for validating the concept under various situation. The developed prototype model is shown in Fig. 6 .
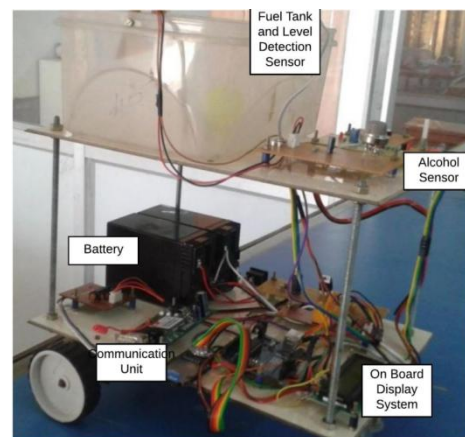

Fig. 6. Prototype Model of Proposed System

V.   CONCLUSION AND FUTURE SCOPE

The proposed model provides the solutions such as highly secured authentication to the driving the vehicle, RFID based aauthentication helps to classify the driver profile based on the driving pattern and the distance covered by him for a particular period of time, so that owner of the vehicle can have the better productivity by analyzing the data. The accelerometer and gyroscope were also used when the driver run the vehicle with severe joggling, then lifetime of the wheel and gearbox will be reduced. The accident is indicated to the owner of the vehicle with accurate location and partial reason for accident can be deduced by accessing the data stored in the flash card. The future scope of the proposed design can be made by addressing the problem such as when a driver is being drunk at the middle of the drive or if the driver is feeling drowsiness how the vehicle the being controlled for parking in the safety region without disturbing the passing vehicle. The proposed scheme can be applied such as bus management system, bank transaction vehicle and military transportation vehicle.

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