

Comparative Study on Vehicle Tracking, Monitoring and Alerting System

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Abstract: The main goal of this paper is to study previous work of vehicle locking, tracking, monitoring system and to identify the innovative methods to meet the challenges of existing technology. There are different techniques for tracking the vehicle and to provide solutions for theft and accidents. In this paper, the main technology reviewed is the system based on ARM7, Android, Cloud-based system, Raspberry Pi and VBBS. The detailed and comparative study of each work is reviewed in this paper.

Indexed Terms: GPS, GSM, Microcontroller, Real-time data monitoring, Sensors, Vehicle tracking.

I. INTRODUCTION

According to the statistical report by the Association for Safe International Road Travel (ASIRT) nearly 1.3 million people die in a road accident each year on an average 3,287 death per day. Also, 20 – 50 million people are injured or disabled across the whole world. Unless actions are taken seriously this can become the fifth leading cause of death by 2030 [1]. Statistics revealed from FBI shows that in the US approximately 765,484 theft occurs and \$ 5.9 billion was lost in 2016 [2]. As the population increases, demand for privately owned vehicle and public transport increases. Safety of vehicle and people are extremely important. Mainly road accident occurs due to the carelessness of drivers like reckless driving, being drunk or fatigue.

Keeping in view of this ever-increasing accidents and theft, there are different methods to track and monitor vehicle and alert the control station/ authority to rescue the people from an accident or to prevent theft. Vehicle tracking and monitoring process are to locate the vehicle and obtain important parameters to monitor real-time data. In this paper, five technologies are mainly compared to track and monitor the vehicle.

II. LITERATURE REVIEW

In paper [3], the proposed vehicle data monitoring system which records various parameters of the vehicle. ARM7 is the embedded controller used for designing the system. The main advantage of the ARM7 processor system is low power consumption, more battery life and very economic. Another important aspect of the system is that it uses GPS and GSM modules to identify the position of the vehicle and to send various information of the vehicle to control station respectively. Various parameters like temperature of the vehicle, seat belt status, alcohol consumption of driver, accident or crash to the vehicle, drowsiness of driver and speed of the vehicle is measured by temperature sensor, seat belt sensor, alcohol sensor, accident sensor, eye blink sensor and speed sensor are obtained through sensory network respectively.

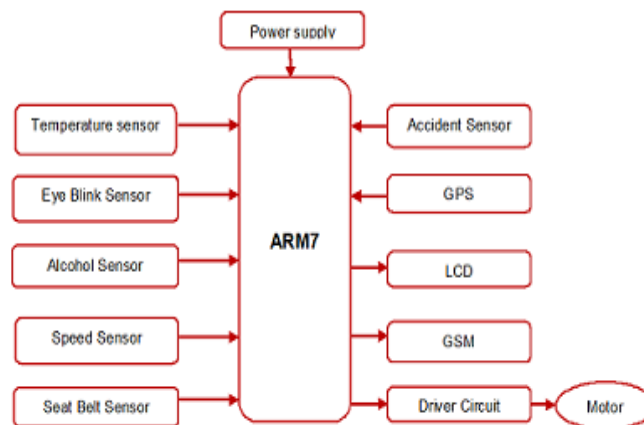


Fig. 1: Block Diagram Design ^[3]

In this proposed system restricted zone location is identified by GPS and controls the speed of the vehicle based on the location. ARM7 microcontroller is interfaced with all sensors, GPS, GSM, and LCD display. The output values of the sensor are displayed on LCD are also sent to the controlling station by GSM module. This system is RTDM (Real-Time Data Monitoring) in which central station can view various parameters and can be stored in the server database. Encryption algorithm helps to avoid falsification of data and makes data more secure.

The paper [4] makes the following contribution. One can track the vehicle through a specially designed application in the smartphone and can lock/unlock vehicle remotely. PIC microcontroller is the backbone of the system. Ignition sensing is done by a simple circuit to indicate whether the vehicle is started or not. Also, a solenoid valve connected between microcontroller and path of fuel supply. It works according to authorization response. GSM module helps to receive a specially coded message from mobile unit to PIC microcontroller and sends respective command either to ignition cut-off or fuel cut-off which avoids the theft of the vehicle. With the help of GPS, the exact location of the vehicle is sent to the mobile unit as SMS. PIC Microcontroller is the backbone of the system and it makes the system more reliable and malfunctioning of PIC Microcontroller is comparatively less. MP Lab v8.40 software is used to develop the program for PIC Microcontroller. Mobile unit with user contains two modules; user interface and Android smartphone. A User interface is specially designed for application on the smartphone which can be used by an authorized person with security code. It contains a button to lock/unlock, also to locate the position of the vehicle. Android smartphone utilizes Advanced ART (Android Run Time) to run the application. Utilization of SMS technology makes the system more reliable, inexpensive and convenient. Also, android technology is open source and readily available.

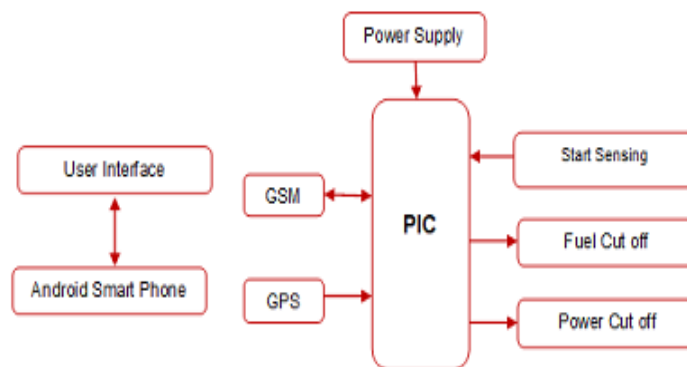


Fig. 2: Block Diagram Design [4]

The paper [5] presents a system to track multiple vehicles of a different kind in the large environment using GPS and GSM. The special feature of this system includes remote locking and opening system for the vehicle along with a network of sensors for the security of the vehicle. All these objectives are achieved by using the cloud platform.

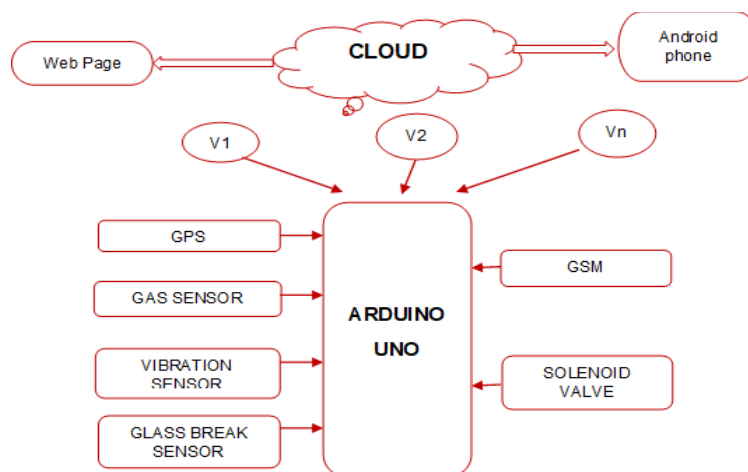


Fig. 3: Block Diagram Design [5]

Data from the cloud can be retrieved either by computer or through the smartphone. Open source microcontroller board Arduino UNO is used in this system and is interfaced with GPS, GSM, vibration sensor, alcohol sensor, glass break sensor. In addition to that, the controlling station can send messages to turn off the vehicle by using the solenoid valve which is interfaced with embedded controller. Glass break sensor and vibration sensor are used to detect theft and accident. The gas sensor is sensitive to SnO₂ which helps to detect the alcoholic level of the driver. Eclipse IDE with the Android development tool (ADT) software used to create the android app. Google maps API software can locate the position of the vehicle on Google map. This proposed system is based on the cloud computing platform and the Microsoft Azure software used to log values from the aforementioned sensors. This cloud computing-based system is envisioned in two different modules which are multi-vehicle tracking system and multi-vehicle locking system adds advantages like scalability, accessibility, and flexibility

In the paper [6], the proposed system continuously monitors and track school vehicle in a real-time environment in the smartphone. If the vehicle path goes wrong means it gives alert to the smartphone as well as in the audio system in the vehicle. Along with this sensory network provides a safe and secure environment for students. Regular updating and storage of vehicle parameters like speed, time, location and date are used to detect vehicle theft. The system works on GPS/GPRS/GSM SIM 900A module get interfaced with Raspberry Pi along with interfaced sensors like a temperature sensor and gas leakage sensor. This advanced system is based on Embedded Linux Board and Android application. This system utilizes raspberry pi, a mini-CPU or minicomputer SOC can run multiple programs at a time. The Web page for the server of this system is developed by HTML, PHP, and CSS software. In the proposed system, already a safe and secure path is decided and specified within the Raspberry Pi system. So, if the driver drives in wrong path alert message is sent from the system to both Android Phone and audio system in the vehicle. Also, in GPS/GPRS/GSM SIM 900A utilizes a GPS to obtain the current location, GPRS sends tracking information to server and GSM to send SMS to phone. This advanced system is reliable, secure and more flexible.

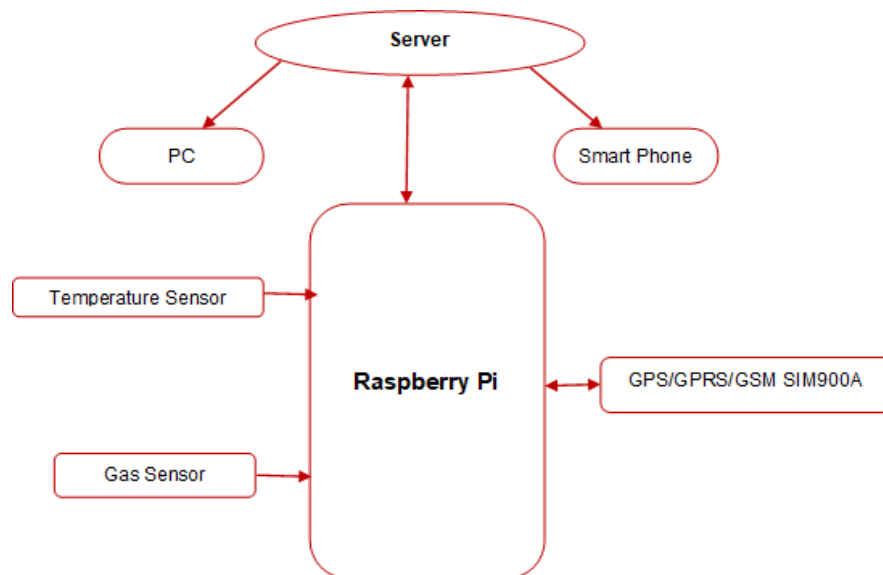


Fig. 4: Block Diagram Design ^[6]

The paper [7] mainly presents two approaches to implement VBBS (Vehicle Black Box System). First is how to record the data detected and secondly how to present recorded data in a simple way. The first approach is fulfilled by using the required sensors interfaced with the microcontroller.

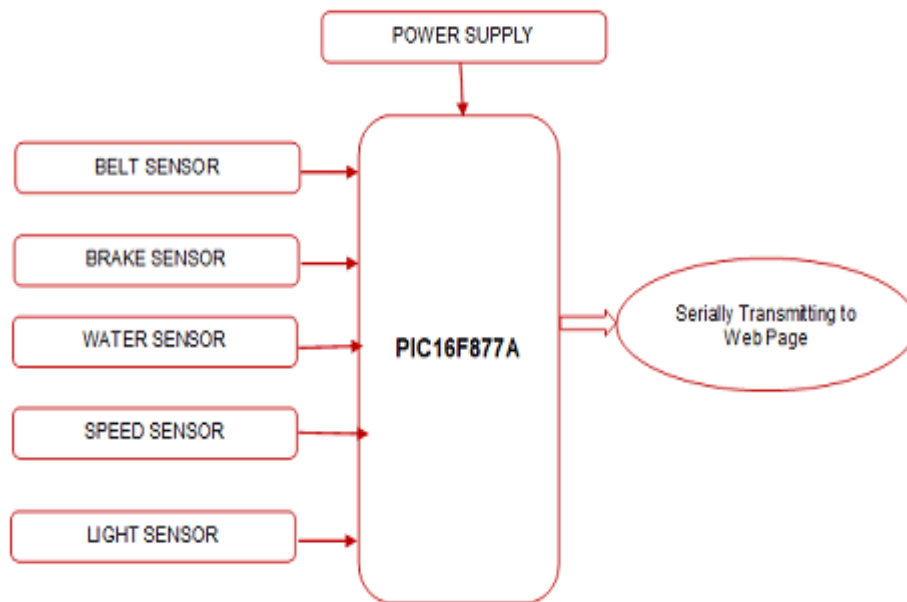


Fig. 5: Block Diagram of VBBS^[7]

This system uses a belt sensor, water sensor, brake sensor, speed sensor and light sensor. The microcontroller PIC16F877A is used in VBBS to control all the input of sensors in the system. The prototype VBBS mainly needs large EEPROM to record data detected. PIC16F877A is used for its memory capacity for data storage. The handshake method is used between the microcontroller and VB.NET program to transmit data without any error and loss of data. A basic .NET program is used to record appropriate data before, during and after an accident using a simple method. The idea presented in this paper (VBBS) is highly reliable to monitor the condition of the vehicle and analyse the data.

| Existing System | Platform/ Technology | Methodology | Comments |
|--|-----------------------------|---|-----------------------------------|
| RTDM with intelligent vehicle tracking [3] | ARM 7 | Monitoring sensor values, GPS tracking, | Low power and economic system |
| Vehicle tracking and security system using android [4] | PIC16F877A & Android | GPS tracking and lock/unlock vehicle by the user, commands through GSM | Readily available technology |
| Cloud-based multiple vehicle tracking and locking system [5] | Cloud Storage & Arduino UNO | Remote lock/unlock system, store data in the cloud to track multiple vehicles | Flexibility & scalability to data |
| Embedded Linux board-based vehicle monitoring and tracking [6] | Raspberry Pi | Track and monitor school vehicle, alert for the wrong path | Expensive and complex |
| Vehicle black box system [7] | PIC16F877A | Sensor values are stored and display these data's | Reliable and user-friendly |

Table 1: Study and Comparison of Existing systems

III. CONCLUSION

The study of various paper helps to analyse the problems in existing systems. Each author has implemented different types of methods and algorithm for the same application. With the rapid rise in technology, future enhancement of a vehicle system can be developed using the latest potential technology IoT, which is marked as next-gen technology. So, an IoT based vehicle allocation plus tracking and RTDM system will be a very innovative contribution to this field. Here vehicle can be allotted according to the request of the user from an Android smartphone. Also, the internet of vehicles can be implemented for sharing data to nearby running vehicles. This system will be useful for different applications like fleet telematics, transport logistics application, car sharing etc.

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