

A Survey on Vehicle Tracking System using IoT

Baravkar Deepak Sanjay¹, Ghogare Shivraj Hanumant², Hole Mrunal Madhav³, Mehak Bhat⁴,
Prof. Poonam Deokar⁵

¹Student, Dept. of Information Technology, Dr. D.Y. Patil Institute of Technology, Pune, Maharashtra, India

²Student, Dept. of Information Technology, Dr. D.Y. Patil Institute of Technology, Pune, Maharashtra, India

³Student, Dept. of Information Technology, Dr. D.Y. Patil Institute of Technology, Pune, Maharashtra, India

⁴Student, Dept. of Information Technology, Dr. D.Y. Patil Institute of Technology, Pune, Maharashtra, India

⁵Professor, Dept. of Information Technology, Dr. D.Y. Patil Institute of Technology, Pune, Maharashtra, India

Abstract - Nowadays the number of public/ private vehicles is increasing steadily, it has thus increased the importance of tracking and theft prevention. Recently the vehicle tracking systems are getting wide popular and can be used in tracking stolen vehicles. Real-time applications like Vehicle Tracking System are developed using an Arduino/Raspberry pi board with a microcontroller. With the passage of time, it has turned out to be elementally crucial to have adaptability in analyzing and controlling the actual properties and individual information separately. During our survey about various papers regarding our topic we came across the multiple ways of providing vehicle security like face detection, fingerprint scanners and live location tracking etc.

Key Words: Antitheft security, Vehicle tracing, Raspberry Pi, GPS, Live Location, IOT, Security, GSM, Arduino Uno

1.INTRODUCTION

As the theft cases of vehicles are rising day by day, it has become an important research topic. The model will provide anti-theft security by verifying the driver's identity through alert messages. Parental control is achieved by monitoring the speed and live location of the vehicle using GPS and GSM technologies. Keeping track of the ignition activities of the vehicle will also be notified to the admin panel and history of tracks will be stored on the server side for future analysis. In this research, different approaches had been implemented. For the storage purposes, the memory was stored directly on the hardware in the previous research, many approaches to detect the travel time were used, like toll-tag matching, number plate matching and many more. But, the latest technologies like GPS are introduced to tackle this problem. In our research, we will use raspberry pi which is 40 times faster than Arduino. So, the clock speed performance will automatically increase.

In a survey, [1] states that Considering the spike rate in the crime regarding vehicles during transportation, and even the latest reports by insurance association of the Malaysian committee confirms approx. 60 vehicles are

stolen every day. In our research work, we found that Arduino based vehicle tracking system using technologies like GPS and GSM, helps to display the exact coordinates and the current location of the vehicle. It also helps calculate distance travelled by the vehicle and stores in the database for further analysis. The data can be viewed in real time or on the demand. An algorithm which predicts the arrival and departure time is also used.

In 2019, Mohammed Hazim Alkawaz put forth a vehicle tracking and reporting system using robust algorithm. In this system, raspberry pi was used. The issue of keeping track of stolen vehicle was solved in this system. [2]

In 2020, Bernard Akindade Adarmola put forth vehicle tracking system using arduino microcontroller. The GPS-GSM based tracking system for vehicle was constructed based on optimum material consideration. [1]

In 2019, Kungpeng Dai implemented Multiple Vehicle Tracking Based on Labelled Multiple Bernoulli Filter Using Pre-Clustered Laser Range Finder Data using Raspberry Pi as mainboard. [2]

In our research paper [11] The Smart Vehicle Monitoring and Tracking System (SVMTS), we analyzed that their system, uses IOT, some sensors were used to determine the vehicular distance to avoid the collision related problems and ferret the accident comparatively in lesser time and sending an alert to make the control team and thus making them aware about the forthcoming dangers. In case of any theft, the owner will have full control over the tracking of the live location of their vehicles using GPS through their cell phone application. According to our survey, their application helped and gave the best results which could get over them at any time of mishappening like road accidents, thefts, unknown access to the vehicle and maintaining the track of their vehicles.

The system [12] proposed by Apeksha P Kulkarni and Vishwanath P Baligar, proficiently figures out how to recognize the vehicles from the encompassing ecological fluctuation and works on the low goal recordings through Histogram adjustment procedure to keep up with consistency of recordings in terms of goal and furthermore

in expulsion of clamor from recordings. System utilizes a notable stage called Linux server for reconnaissance and recording video utilizing Raspberry-Pi. The methodology utilizes Raspberry pi to record a video when something moves inside the observed region.

The go along of this survey paper will be as follows. Section II gives brief analysis on the review of system model. Section III continues to throw light on the embedded platform followed by the Section IV about discussion of the surveys, and thus with the section V as the conclusion.

2. SYSTEM MODEL

GNSS (Global Navigation Satellite System) -

GPS (Global Positioning System) - [2]

The Global Positioning System (GPS) is a satellite radio navigation system. Global Positioning System (GPS) is a worldwide radio-navigation system formed from the constellation of 24 satellites and their ground stations.

GLONASS- GLONASS is another emerging Radio based satellite navigation system. It provides an alternative to GPS and is the second navigational system in operation with global coverage. GLONASS made more satellites available to them, meaning positions can be fixed more quickly and accurately, especially in built-up areas where buildings may obscure the view to some GPS satellites.

GALILEO- Galileo, the first satellite positioning, navigation and timing system specifically designed for civil use, will offer state-of-the-art services with outstanding accuracy, availability, integrity and guarantee.

Why We use GPS:

According to survey GLONASS & GALILEO provides more accuracy than GPS but their receiver costs very high. As per the project is concern, GPS is the best technology considering its availability and receiver cost.

Monitoring unit:

Monitoring unit can be an Android Application or a Web Application through which user will get to know the actual position of the vehicle. The Application will display the different co-ordinates (longitude and latitude) receiver from tracking device and plot them on Google Maps.

2.1 Technologies Used:

1.Arduino Uno R3

Arduino Uno is used by the previous researchers to integrate into various electronic and electrical projects. It

is an opensource microcontroller chip board with a 16MHz ceramic resonator in it.

2. SIM900A GSM/GPRS Module

SIM900A module is a cost- effective solution which allows the benefits from small dimensions as it is integrated with AMR926EJ-S core. The major advantage of this module is that it is a wireless module working on the frequencies between 900-1800 MHz

3. GY-NEO6MV2 GPS Module

The GY-NEO6MV2 is a GPS engine module that uses the advanced technology and it gives the exact and accurate positioning observation. It comprises of a larger built in of around 25*25mm active GPS antenna including a UART TTL sockets.

4. Liquid Crystal Display-

A liquid-crystal display (LCD) is a device which is used for the visibility of the message to be displayed on the panel. It is also referred to as the light-modulating properties of liquid crystals.

5. ThingSpeak-

The important use of thingSpeak as committed by the researchers is sending the alert messages in case of any trouble in the vehicles. It sustains with free time-series data storage in different channels of the model. It's a proof of conceptual theory of IOT.

6. Freeboard

Freeboard is an HTML-based platform that allows data to be displayed using user customised different layouts. Using freeboard, any person can create and visualize data from different devices and variety of open API's.

7. Arduino IDE

IDE stands for (Integrated Development Environment). It behaves as a simple text editor normally like a notepad. It comprises of variety of functions. It is software, where we can write we can code, compile it to check its working and then the same code is uploaded on the Arduino for the further analysis and working of the hardware model.

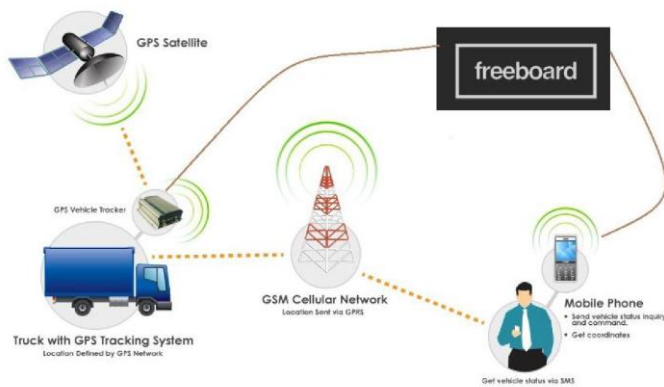


Fig. 1. Complete circuit of Real-time vehicle tracking for theft prevention using Arduino (2-2)

3. EMBEDDED PLATFORM

The surveyed system model uses a raspberry pi 4 as a mainboard for vehicle tracking system. It also comprises with Neo 6M GPS module, SIM800A GSM/GPRS module and Fingerprint scanner R307. SIM800A and Neo 6M modules are connected with raspberry pi 4 with GPIO pins and the fingerprint scanner R307 is connected with USB2.0 port. This embedded system provides basic connection to implement vehicle tracking system with security by verifying user's fingerprint. SIM800A GSM/GPRS module is used to provide the internet services to the system and is also used for cellular communication such as messages and calls. While Neo 6M is used to provide geographical position of vehicle. It is used to collect longitude and latitude of the vehicle and to provide these details to the main board which will send the data to the server side for further operations.

In 2019, Ali Mustafa put forth a smart real-time tracking system using GSM/GPRS technologies. [2] In this system Arduino NANO was used instead of raspberry pi 4. It also used the NEO 6M GPS module, GSM SIM800L etc. This system was useful for android users. It also used the DHT11 sensor to detect the temperature of the system to protect system from burning due to high temperature. It also comprised with SQL database. To display the locations on the map, Google Maps API was used.

In 2019, Kungeng Dai implemented Multiple Vehicle Tracking Based on Labelled Multiple Bernoulli Filter Using Pre-Clustered Laser Range Finder Data using Raspberry Pi as mainboard. [4] In this system theft prevention was implemented by using Raspberry Pi and PIR Sensor. PIR sensor can detect any movement in front of it and system will give alert message to authorized person and tier an alarm for security.

In 2019, Mohammed Hazim Alkawaz put forward a vehicle tracking and reporting system using robust algorithm. [6]

In this system, raspberry pi was used. The issue of keeping track of stolen vehicle was solved in this system. Also, it was designed such as it gives the alerts on over speed, standing vehicle at same place for more than two hours etc.

In 2020, Bernard Akindade Adarmola analysed vehicle tracking system using arduino microcontroller. [5] The GPS-GSM based tracking system for vehicle was constructed based on optimum material consideration. [5]

Various researchers have included different types of sensors in vehicle tracking system to make it on advanced level. Huang et al. have introduced a vision-based vehicle speed warning system by using PAC Duo embedded platform. While Casares et al. advanced the new system to reduce the problem of limited resources of the embedded board when it is added to the camera sensor for object detection and tracking. Vehicle tracking system based on embedded video is also given by Yucheing et al. using S5PV210 arm development kit. There are different types of embedded devices have been implemented by various researchers using different types of sensors like fuel detection sensors, distance detection, temperature, etc. The embedded system for vehicle tracking system is implemented using different processing boards like raspberry pi (different versions), arduino uno, arduino NANO, S5PV210 Arm Development Kit, etc. Mainly these boards are being used by the various researchers to implement vehicle tracking system.

Embedded system for vehicle tracking systems comprises various hardware components like raspberry pi/ Arduino uno/Nano / S5PV210 Arm development kit as a main processing board. It also consists different types of GPS, GSM/GPRS module, different types of sensors/ fingerprint or face detection modules for security, power relays, different resistors, buck converters, potentiometer and many more. Embedded system includes different components as per requirements of research. They vary from researchers to researchers.

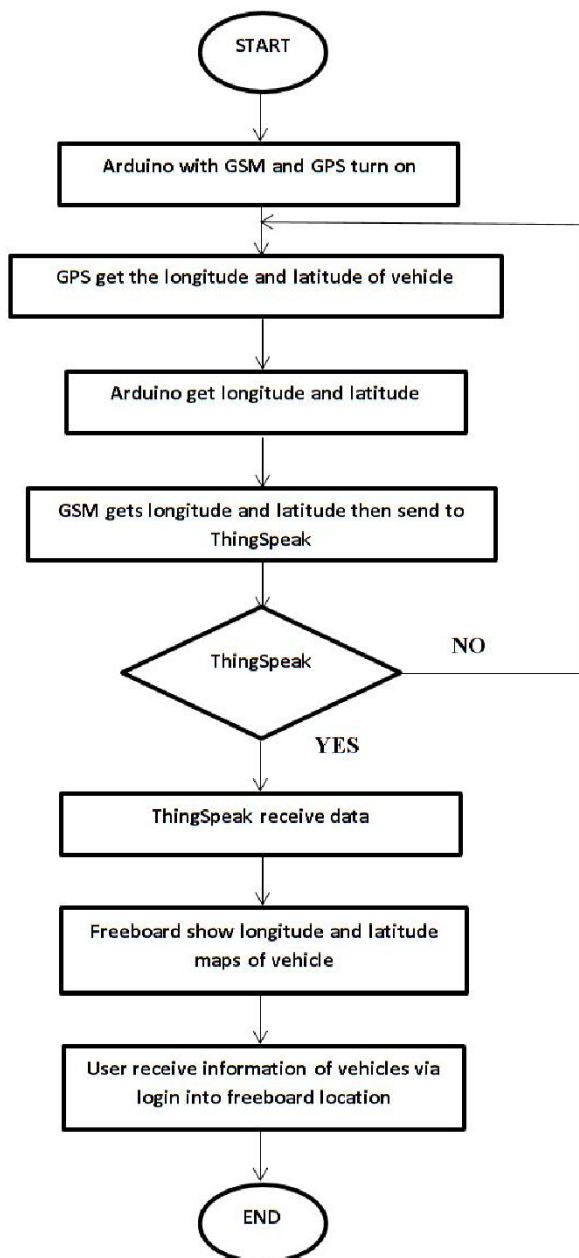


Fig. 2. Flow Chart of Real-time Vehicle Tracking

4. DISCUSSION

As per the study, we analyzed that most of the researchers are troubled with various problems in the existing system in storage purposes, on-chip memory storage gave them many limitations. For the speed and accuracy, they found restrictions in Arduino. Table 1 shows the comparison between the Arduino and Raspberry Pi 4. Even though Arduino is more flexible and cost effective, but in terms of speed and accuracy, Raspberry pi is more appropriate and faster than Arduino. Table 2 observes the comparison between the storage on the server-side v/s on-chip

memory storage. Furthermore, server-side storage has many future scope advantages and proves more beneficial.

Table.1. Difference between Arduino and Raspberry Pi

| Arduino Uno | Raspberry pi 4 |
|---|---|
| 1. It requires external hardware for most of the functions. | 1. It has memory, processor, USB ports and Ethernet port and doesn't require any external hardware for functioning. |
| 2. It is slow and processes the functions at the slower pace. | 2. It is 40 times faster than other hardware devices including Arduino when it comes to clock speed. |
| 3. Cost effective but lags in RAM Capability. | 3. It is more advanced in terms of RAM. |
| 4. It lags behind in processor functions. | 4. It includes high performance ARM Cortex A72 4x 1.5 GHz quad core processor and this improves a lot more functions in processing. |

Now taking our survey further in terms of the database management, where according to the previous researchers, the database was stored directly on the hardware. Besides, it was cost effective, but it gave them many limitations. Here now, Table 2 briefs the comparison between on-chip and server-side memory storage.

Table.2. Difference between On Chip and Server-Side Storage

| On- Chip Data storage | Server-side storage |
|---|---|
| 1. Despite it gives ease, but it has no security, as the fault in the hardware will lead to the loss of the data. | 1. Even if there is any fault in the hardware, the data on the server will be absolutely safe and secure. |
| 2. Any changes to be made in the database, needs the presence of the hardware each and every time. | 2. As the data is directly stored on the server, any alterations or changes can be made at any time with ease. |
| 3. Storing the data in the hardware, will make it difficult to access the data if required in the future. | 3. Server-side data storage will make it very easy to access the whole data of the project at any instance of time in the future. |

4. CONCLUSIONS

The various models were thus successfully implemented in real time and played an important role in tracking and monitoring of vehicle providing antitheft security. Fingerprint sensors and alert messages used for the ignition activities and the unauthorized access to the vehicle added up to the utmost security in the system. Tracking of the vehicle using GPS and GSM modules helped the admin in tracking the vehicle anywhere and at any time provided with the exact locations.

Whenever there was any vehicle theft situation or vehicle's accident situation, the advanced system provided the vehicle's current location, speed to the vehicle owner's end. Hence this benefitted in tracking the vehicle as early as possible.

The Vehicular System provided the information of a vehicle position, through a GPS module and GPRS connectivity using GSM module and sent the location of a vehicle to a monitoring station and the monitoring station displayed that information on GUI also stored that in database for further process and analysis

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