ISSN (Print) : 0974-6846
ISSN (Online) : 0974-5645
Indian Journal of Science and Technology, *Vol 9(39), DOI: 10.17485/ijst/2016/v9i39/87427, October 2016*

Certain Investigation on Significance of Internet of Things (IoT) and Big Data in Vehicle Tracking System

S. Kannimuthu[1]*, C. K. Somesh[1], P. D. Mahendhiran[2], D. Bhanu[3] and K. S. Bhuvaneshwari[1]

[1]Department of Computer Science and Engineering, Karpagam College of Engineering, Coimbatore - 641032, Tamil Nadu, India; kannimuthu.me@gmail.com, bhuvana.me@gmail.com
[2]Department of Information Technology, Karpagam College of Engineering, Coimbatore - 641032, Tamil Nadu, India; maha301@gmail.com
[3]Department of Information Technology, Karpagam Institute of Technology, Coimbatore - 641032, Tamil Nadu, India; bhanu.saran@gmail.com,

Abstract

Objective: The primary objective of this work is to review the vehicle tracking system, discuss the challenges in Internet of Things (IoT) based vehicle tracking system. IoT is used to get intellectual connecting the objects with each other via information sensing in the physical world and broadcasting devices linked with the internet. **Analysis**: This paper provides a comprehensive investigation on vehicle tracking system in association with the IoT and Big Data Analytics. This paper anlalyze the challenges pertaining to the IoT based Vehicle tracking system. **Findings**: This paper provides the novel methodology for assessing the quality of vehicle tracking system and identifies opportunity for future research in this area. **Applications**: The importance of QoE can be realized in vehicle tracking system for the improving the performance of the surveillance system.

Keywords: GPS, GSM, IoT, IST, QoE, Vehicle Tracking System

1. Introduction

Vehicle Tracking System (VTS) is the scheme of automatically determining and transmitting the geographic location of a vehicle by using Global Positioning System (GPS). This system uses software to collect geographic location of a vehicle data for a complete picture of vehicle locations. There are two kinds of vehicle tracking system: 1. Passive: Devices store GPS location, speed, and triggering event such as either key is on or off and either door is open or closed. 2. Active: Collects same information by transmitting the data in real-time via mobile/satellite communications to a computer or server for evaluation purposes. Vehicle tracking systems provide information about the vehicle position, fuel amount, tire pressure, engine temperature, driver's activities etc. The main intention of having VTS is to help us to optimize the business. The major functionalities of vehicle tracking system are depicted in Figure 1.

The core components of VTS are: 1. GPS satellite 2. Vehicle with tracking module. 3. Cellular network. 4. Server. 5. Computing devices like computer/hand-held devices. Tracking module in the vehicle collects and transmits data via a cellular network. The data delivered from the vehicle can be accessed through the web on a computer or hand-held devices. These data can be used to do necessary actions. VTS are not only used for shipment management, but also for the entire organization's business[1].

The significant facilities such as vehicle dynamics monitoring, intelligent navigation and value-added services are not provided by commercial vehicles. Nowadays, these facilities are incorporated by using the Internet of Things (IoT) that can connect anything with an electronic system to the existing internet communications[2]. Contemporary research in VTS utilizes Cloud Computing and Big Data Analytics along with IoT to build intelligent system in a networked environment.

Author for correspondence

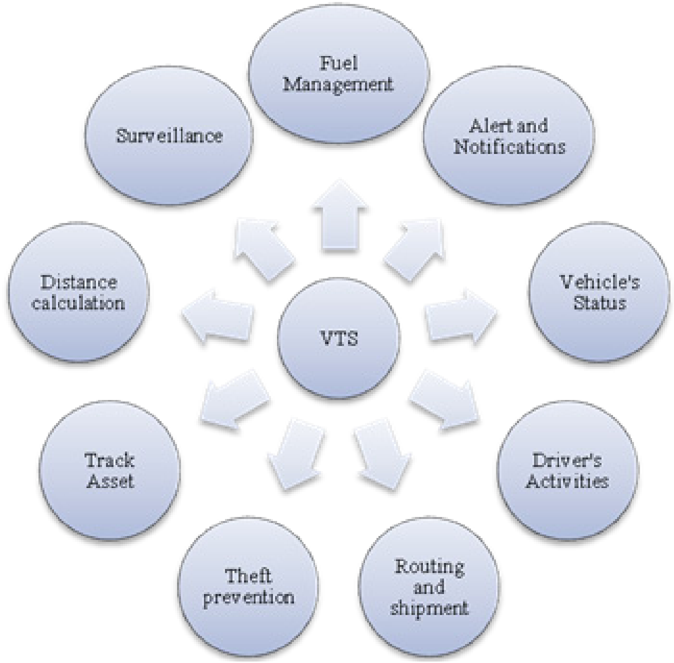

Figure 1. Functionalities of VTS.

The main contribution of this article is threefold:

- Detailed survey on vehicle tracking system is presented.
- Challenges in IoT-based vehicle tracking system are discussed.
- Way of assessing the Quality of Experience (QoE) in vehicle tracking system is given.

The remainder of this paper is structured as follows. Section 2 presents a detailed review of vehicle tracking system. In section 3, the focus is on the discussion of challenges faced in IoT-based vehicle tracking system by considering various aspects. Section 4 discusses about the method to assess the QoE in vehicle tracking system. Section 5 presents the conclusion and possible trends for future research directions.

2. Investigation on Vehicle Tracking System

The Global Positioning System (GPS)/Global System for Mobile communication (GSM)/General Packet Radio Service (GPRS) Technology is used to prevent from the theft of any vehicle which is connected with this technology and to track the level of movement of vehicle from any location at any time[3]. This system makes use of smartphone environment and microcontroller. The system is in-built with the vehicle uses GPS, GSM and GPRS technology for vehicle tracking. GPS and GSM/GPRS modules are controlled by the microcontroller. In this system, a mobile application is developed to maintain and periodically monitor the vehicle place.

The concept of a multilayered vehicular data cloud set up by obtainable and utilizing cloud computing and IoT technologies[4,5]. To make use of vehicle warranty analysis they proposed a methodology called a vehicular data mining cloud service and an intelligent parking cloud service in the IoT environment. To strengthen the vehicular data mining cloud service, they proposed two modified datamining models which make use of a Naïve Bayes model and a Logistic Regression model.

The smart investigation systems taking up the vision of the system and pattern appreciation systems are organized to deliver intellectual video analysis and uncontrolled object finding, to increase public security. From the previous smart surveillance techniques, the methodologies that they have installed in the few places and here the methodologies are Automatic License Plate Recognition (ALPR). Few of techniques can provide big scale data retrieval across wide area, integration and data analysis to achieve intelligent urban surveillance. In[6], used a novel system called Snake Eyes, which aspires to carry together automatic license plate recognition engines and to realize massive data analysis using cloud computing technology. The vehicle in a town or any place with a given license number targeted by enabled detection and tracking system which can grandly make things easier and gather speed the process of fetching security issues.

During night driving many accidents happens because of the drowsiness of the vehicle driver. The use of Eye Blink Monitoring System (EBM)[7] alerts to prevent from the accident during state of drowsiness. Eye actions and head actions are useful in alerting the drivers in initial sleep cycle phase of drowsiness for monitoring psychological state of vehicle driven. The sleep state analysis of vehicle driven can be strong-minded by periodically monitoring vehicle driver eye actions and head actions. Those eye and head actions are identified by using IR sensor and an accelerometer. A regular eye blink speed has no result of the system. Moreover, there is no effective output if the driver is in normal eye blink rate. However, if eye blink rate is in excessive state of sleep-cycle, then an alarm is indicated to wake the driver to prevent from the accident. Here the excessive state of the eye blink state level is identified and it received by suing IR sensor.

An Intelligent Transportation System (ITS) is the software that includes computer, electronic and message to communicate with each other into vehicles and roadways for scrutinizing traffic situation, decreasing jamming, and so on. It leads to the disappointment of vehicle counting and classification while vehicle occlusions caused by shadow. A new shadow-elimination algorithm is used in[8] to remove unwanted shadows from video sequences and a new normalization method is used to normalize vehicle size. Here vehicle size is kept to be constant for accurately classifying vehicles. The found lane-dividing lines produces main information for vehicle size most invariant and it produce the more accuracy of the classification.

In general, if the vehicle is theft, then we go to the police station and complaint regarding this issue. Then they take legal action against complaint. It takes more time to gets their vehicle back. Even if it is GPS enabled vehicle, we can only track and monitor the vehicle. we cannot stop the stolen vehicle. The methodologies of AIR SOLENOID and WATER SOLENOID used to track the stolen two-wheeler and to stop it[9]. Vehicle tracking system is one of the models of Global Positioning System (GPS). Nowadays security and theft prevention are one of the focused areas to solve it. It is used to fetch the place of the vehicle in an around the world. GPS is used to fetch the vehicle current position of the two wheelers. Once the data has been fetched then it will be send to the user mobile phone through the GSM.

The uses of GPS, GSM and web application for making vehicle more secure. This approach is used to track the vehicle and keep periodically monitor on them[10]. This kind of tracking methodology can tell us the place of the vehicle. Easily we can identify the vehicle location by providing the web application in which includes in it. This mechanism also identifies to monitor in any weather conditions.

An anti-interference protocol and data clearing algorithm are used to solve identification uncertainty problems[11].This kind of methods will have broad software in traffic IOT to keep maintenance of traffic scheduling, traffic monitoring, special vehicle tracking and traffic flow statistics. To make efficient two way communication and for successful automatic identification for periodically monitor the vehicle done by using Radio Frequency Identification, the main advantage is easily we can track the vehicle in any situation such as good or bad weather conditions. IoT is made use of interacting with each other and to connect everything in the real world by take advantages of RFID, WSN and other sensing methodologies. Traffics such as bridges, roads, tunnels, vehicles, drivers and traffic signals connected with the help of Traffic IoT[12]. This Traffic Internet of Things used to produce periodically monitor all the information which is related to traffic. Moreover contemporary traffic management is creating and maintaining is fully based on internet of things for the traffic system.

Nowadays more number of vehicles is stolen due to less security. Author in[13] developed a well-organized vehicle tracking techniques to identify the place of the vehicle anywhere at any time. The methodologies handled by using microcontroller with Smartphone application. The developed vehicle tracking system uses Global System for Mobile communication/General Packet Radio Service (GSM/GPRS) and Global Positioning System (GPS) technology is used to track the vehicle. A microcontroller is mainly used to manage the GPS and GSM/GPRS modules. The GPS technologies is periodically maintains tracking the vehicle. A Smartphone application is used in this approach for continuous monitoring the vehicle location. The smartphone contains an application called Google maps API to exhibit the vehicle in it. So, users can able to track a moving vehicle with continuous manner.

In recent days, the on-road stream of vehicle has previously grown to be people's primary concerns of intelligent transportation. One can understand more data from the video than the loop which is a major constraint for vehicle tracking and recognition. Author in[14] proposed two kinds of algorithm such as Mean Shift algorithm and CamShift algorithm. To accomplish effective head and face tracking in a perceptual user interface, CamShift algorithm is used. MeanShift is purely based on static distributions, which are not modernized till the object experiences important changes made in color or size, shape.

Author in[15] presented an approach supporting a Moving Object Structured Query Language by using web-based transportation vehicle management system. Its major role is to keep tracking vehicle and aircraft to produce suitable solution to the users. In this approach, the vehicle tracking system for the efficient vehicle management in transportation is developed. The proposed methodology used in this system is Moving Object Query Language (MOSQL) based query processor for analyzing the vehicle information.

To avoid vehicle stolen by the thief, many kinds of methodologies are followed. Lee makes use of video image detector methods using tracking methodologies that can be managing more problems such as vehicle detection, occlusion and shadow by night time also. This model obtains the occupancy time, complete traffic information, speed, and volume count, under kaleidoscopic environments. By using the analysis of edge distribution of vehicle and shadows, Author in[16] have developed new algorithm named shadow cast algorithm.

Author in[17] presented a lightweight security scheme verification and key protection management to develop a secure channel for Vehicle Tracking System. They implemented a mechanism called low cost symmetric payload embedded key based robust authentication and key management on Constrained Application Protocol (CoAP). This protocol is a lightweight application protocol and by eliminating expensive handshaking for reliability based on vehicle circumstances information specifically when the vehicle is running at a high speed.

RFID is an automatic technology which support systems to identify objects, record metadata or control target through radio waves. Human can track and monitor the objects when the RFID reader connecting to the Internet. In order to prevent theft of vehicle, RFID based device of immobilizing a motor vehicle[18] installed in more cars. The RFID provides visibility, traceability, flexibility, and added security to the automotive industry.

3. Challenges in Iot-based Vehicle Tracking System

In recent days, technological improvements are happening frequently. So, automobile manufacturer faces difficulties to integrate new technologies with IoT middleware application. Table 1 illustrates the major challenges in IoT-based Vehicle Tracking System.

The major challenges for the manufacturers are to design the system that improves reliability, enhance the security and augment the user experience. One of the

Table 1. Challenges in IoT-based vehicle tracking system

Sl. No	Challenges	Description
1	Scalability	Difficult to handle the dynamically changing number of vehicles
2	Technology Integration	Difficult to integrate new technologies with IoT middleware application
3	Performance	Performance degradation because of traffic overhead and poor communication
4	Reliability	Communication is irregular when vehicles are on the move/ unreliable.
5	Quality of Service	Much support needed to reduce the response time, improve availability and increase fault tolerance.
6	Security	Because of Lack of infrastructure in IoT based Vehicle Tracking System, security and privacy is low.
7	Lack of Standards	Since many key players involved in IoT based system, it is difficult to devise global standards.

major things to consider in VTS is to reduce the operational costs. While developing VTS, designers are in a position to consider following key factors:

- Better Efficiency.
- Enhances Safety.
- Ease of Use.
- High Reliability.
- Low Cost.

4. Assessing Quality of Experience (QOE) in Vehicle Tracking System

Vehicle tracking system can be best assessed by using Quality of Experience (QoE). QoE is defined as "the overall acceptability of an application or service as perceived by the end user"[19]. There are three types of QoE assessment: Subjective, Objective and Hybrid methods. The Subjective QoE scheme is the most fundamental and reliable way of assessing the perceived system's quality. In our scenario, Human subjects are involved in assessing the vehicle tracking system in a controlled environment. The most preferred scheme of subjective QoE evaluation is by Mean Opinion Scores (MOS), which provides an average human rating (say 1to 5 scale) of the performance of the vehicle tracking system. Objective QoE metrics estimate the quality level of vehicle tracking system through certain mathematical models.

Quality of Experience is essential role in an application development life cycle based on the end users experience in their day to day life to care about the product selection. Then only the product will be a valuable one and placed in the market for vehicle tracking system. Here price may not be a matter for people. The end user should feel that the product is useful as per their requirements. There is more number of methodologies developed for tracking the vehicle for similar purpose, the chance of succeeding over other applications will depend not only on the technical quality but to a major degree, on the gratitude of the application by the user based on his/her subjective experience and satisfaction level from the end user for tracking the vehicle system.

5. Conclusion

This paper has reviewed and analyzed the current research literature on the various methods for tracking the vehicles. The challenges faced in IoT based vehicle tracking system have been discussed. A novel method for assessing the quality of vehicle tracking system is presented in this paper. Vehicle tracking system is very essential in major cities and nowadays vehicle thefting is rapidly increasing, with this there is a necessary to implement various methods for tracking the vehicle. This literature survey further enhanced to improve the Quality of service and security. By improving QoS we can reduce the response time and improve the fault tolerance. Many methodologies provide vehicle tracking related information will support us to track and maintains the information of vehicle. And also it increases the security threats due to possible misuse of the information. Internet of Things will raise this challenge expressively for vehicle tracking system. The IoT based vehicle tracking system uses devices connected to the internet for periodically monitor the vehicle in the real world environment.

6. References

1. Vehicle tracking Systems. Available from: https://en.wikipedia.org/wiki/Vehicle_tracking_system
2. Building an intelligent transportation system with the Internet of Things (IoT), Available from: http://www.intel.in/content/dam/www/program/embedded/internet-of-things/blueprints /iot-building-intelligent-transport-system-blueprint.pdf
3. Lee SJ, Tewolde G, Kwon J. Design and implementation of vehicle tracking system using GPS/GSM/GPRS technology and smartphone application. IEEE World Forum on Internet of Things (WF-IoT); Seoul. 2014. p. 353–8.
4. He W, Yan G, Xu LD. Developing vehicular data cloud-services in the iot environment. IEEE Transactions on Industrial Informatics. 2014; 10(2):1587–95.
5. Mahendran D, Gopi M, Priyadharshini S, Karthick R. A study on cloud resource management techniques. International Journal of Innovative Research in Computer and Communication Engineering. 2013; 1(1):58–61.
6. Chen YL, Chen TS, Huang TW, Yin LC, Wang SY, Chieueh TC. Intelligent urban video surveillance system for automatic vehicle detection and tracking in clouds. IEEE 27th International Conference on Advanced Information Networking and Applications (AINA); Barcelona. 2013. p. 814–21.
7. Aishwarya SR, Rai A, Charitha, Prasanth MA, Savitha SC. An IoT based accident prevention and tracking system for night drivers. International Journal of Innovative Research in Computer and Communication Engineering. 2015; 3(4):3493–99.
8. Hsieh JW, Yu S-H, Chen Y-S, Hu W-F. Automatic traffic surveillance system for vehicle tracking and classification. IEEE Transactions on Intelligent Transportation Systems, 2006; 7(2):175–87.
9. Vigneshwaran K, Sumithra S, Janani R. An intelligent tracking system based on GSM and GPS using smartphones. International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering. 2015; 4(5):3487–903.
10. Verma P, Bhatia JS. Design and development of GPS-GSM based tracking system with google map based monitoring. IJCSEA. 2013; 3(3):33–40.
11. Yu M, Zhang D, Cheng Y, Wang M. An RFID electronic tag based automatic vehicle identification system for traffic IOT applications. 2011 Chinese Control and Decision Conference (CCDC); Mianyang. 2011. p. 4192–7.
12. Chongdeuk L. N2N traffic congestion control for wireless coverage sensor networks. Indian Journal of Science and Technology. 2015 Jul; 8(13):1–6.
13. Lee SJ, Tewolde G, Kwon J. Design and implementation of vehicle tracking system using GPS/GSM/GPRS technology and smartphone application. 2014 IEEE World Forum on Internet of Things (WF-IoT); Seoul. 2014. p. 353–8.
14. Jia L, Wu D, Mei L, Zhao R, Wang W, Yu C. Real-time vehicle detection and tracking system in street scenarios. Communications and Information Processing. Berlin Heidelberg: Springer-Verlag; 2012. p. 592–9.
15. Jung YJ, Ryu KH. The vehicle tracking system for analyzing transportation vehicle information. Advanced Web and Network Technologies, and Applications. Berlin Heidelberg: Springer-Verlag; 2006. p. 1012–20.
16. Lee IJ. A vehicle tracking system overcoming occlusion andan accident detection monitoring using tracking

trace. Advances in Computer Science, Enovironment, Ecoinformatics, and Education. Berlin Heidelberg: Springer-Verlag; 2011. p. 68–76.

17. Ukil A, Bandyopadhyay S, Bhattacharyya A, Pal A. Lightweight security scheme for vehicle tracking system using CoAP. ASPI'13 Proc of the International Workshop on Adaptive Security; New York, NY, USA. 2013.
18. Jia X, Feng Q, Fa T, Lei Q. RFID technology and its applications in Internet of Things (IOT). Proc of 2nd International Conference on Consumer Electronics, Communications and Networks (CECNet); Yichang. 2012. p. 1282–5.
19. ITU-T, P.10/G.100 (2006) Amendment 1 (01/07): New Appendix I, Definition of Quality of Experience (QoE); 2007.