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A SYSTEMATIC REVIEW OF CLOUD ASSISTED IOT BASED VEHICLE RADAR PROGRESS

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Abstract:

Internet of Things is being developed to offer vast opportunities to enhance the seamless services for the users and developing such systems became feasible and cost-effective in real-time. Developing a robust vehicle tracking system is mandate to provide safety and security measures to the school students commuting between schools and homes. Children's safety is considered to be a major concern and an effective research should be carried out to avoid the child missing cases. In this paper a detailed survey of development of IoT automotive industry, IoT based school bus tracking system and cloud based IoT enabled smart vehicle systems are carried out. A comprehensive IoT application with general vehicle monitoring conceptual framework in real time is also described here. The outline of future perspectives of cloud assisted IoT based vehicle tracking system and its impact in the development of IoT platform in automotive applications is also given.

Keywords: Automotive Applications; Internet Of Things; Children's Safety; Vehicle Tracking System; School Bus Tracking.

INTRODUCTION

The communication technology is improved day by day along with remarkable advancements that provide incredible interaction and connectivity between the human and their physical infrastructure. These occurrences can be well handled with the popularly developing terminology called Internet of Things (IoT) [1]. The networking infrastructure and the embedded systems are converged and interconnect the end-user system with the physical objects in order to access, process, collect and transfer the data with the proper internet assistance. IoT summarizes huge vital functionalities like software intelligence, sensors and detecting elements, and worldwide internet connection. IoT have tremendous applications in developing smart cities, smart homes, industrial sectors, smart buildings, environmental monitoring, smart agriculture, automotive and resource management, logistics etc due to its attributes and ubiquity.

In significance of vehicular communication perspective the IoT plays a major role for the enhancement of overall efficiency in transportation and to comfort the travelling activities by using a model named Intelligent Transportation Systems (ITS) [2]. This process reduces the accidental rate and travel disruptions by properly sharing the collected data among the vehicle users and other related authorities. In addition the IoT can able to act as the real time enabler for remote vehicular monitoring [3] process and also detects the irregularities of vehicles and improves production within smart automotive manufacturing.

Transportation is a crucial area that nations around the globe attempt to manage proficiently particularly with the developing number of children and more seasoned kids driving among

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homes and schools. Student`s security has forever been a main issue and a prolific area of exploration which acquired a great deal of consideration across the globe. The Smart Cities worldview [4] thinks about the need to give a good climate to kids' making the most of every situation. The main concern for parents is the children commutation from the schools to their homes. It is common that the children gets on to the wrong buses and gets off to the wrong home locations. Also the vehicle driver cannot able to recognize and remember all the children`s in order to check the students count. Also, numerous families send a driver to get their kids, which represents a test in ensuring that the youngster gets on the right vehicle. Guaranteeing wellbeing and security of school students [5] is of essential concern for the general public at large. Occurrences of kidnapping of school students returning or to school, and school bus delay due to street traffic, have placed more stress on families and the society.

Importance of IoT for Intelligent Transportation System

The major challenge of highly automated automotive vehicles is intelligent processing and decision-making [6] which is considered as a central part of the automotive IoT ecosystem that offers the value added services. It is done through incorporating the functional key elemental layers such as sensing connecting, analyzing and data aggregating and interfacing layers. Sensors that are placed is considered to be a sensing layer that receives physical data about the environmental condition and transfers to other devices using an electrical signal. The sensing element plays a crucial role in collecting information from designated points. Cameras, Radio Frequency Identification (RFID), Gyroscope, level sensors etc are some of the sensing devices used in IoT to collect the data [7]. To establish a link between the transferring and receiving terminals the connecting layer is applied. This connecting layer also takes the analysis responsibility of transferred data from the sending point to the receiving terminal through internet and cloud-fog computing methodologies [8]. This layer comprises of relevant technologies of connectivity that is more suitable for the vehicle/automotive network or ecological unit. Moreover the transformation of smartness and intelligence in vehicles/automotives emerged a big evolution in the automotive industry through IoT technology and its applications. Initially IoT is developed with RFID technology as a compulsory communication instrument and later the communication system was developed by introducing the communication devices like Global Positioning System (GPS), Wireless Fidelity (WiFi), Bluetooth etc.

Vehicle Communication Networks

To ensure the safety measures and to provide security to the passengers various automotive communication networks are available which provides traffic information, sending notifications about vehicle positioning and environmental conditions around the vehicle, traffic management contributions which helps in reducing accidents. Vehicle to Vehicle (V2V), Vehicle to Infrastructure (V2I), Vehicular Adhoc Networks (VANET) are some of the popularly used vehicular communication paradigms [9]. To avoid traffic congestions, accidents and usage of emergency braking the V2V communication paradigm is used which shares the required information between the vehicles by notifying the preventive measures in prior. The most fundamental part of ITS is VANET and it provides the most efficient communications by

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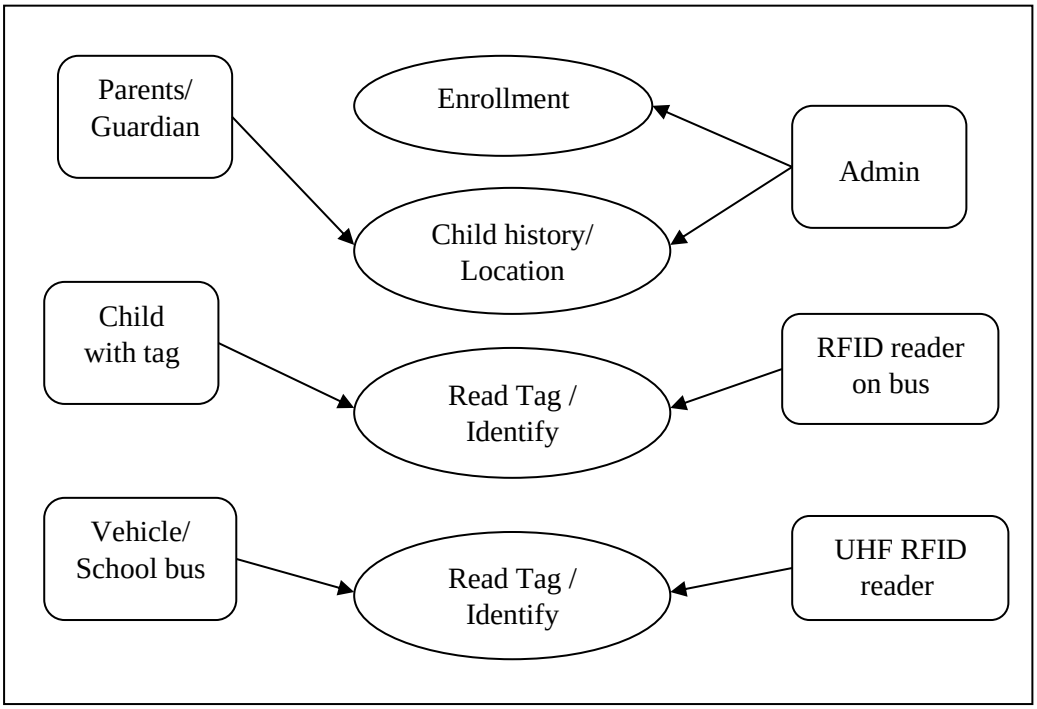
utilizing the available internet services in vehicles. In VANET the majority of computation is supported by cloud computing technology and also it highly helps in processing the long-term data storage. Nevertheless, latency and networking overheads of remote cloud resources degrades the entire network performance [10].

IoT based School Bus Tracking System

Several research works has been carried out for the school bus tracking system using IoT and cloud based system. Some of the works are discussed here for IoT-based systems to track students in school buses. Most of the student tracking system in school bus is done using the combination of sensing elements such as GPS, RFID, GSM technologies. Figure 1 shows the functional entities used for the vehicle/school bus tracking system. Various modes of predictions are implemented to compute the arrival time of school buses in addition with respect to start time [11]. An IOT based tracking system was proposed in real time in which the parents/guardians and the school admin have access to track the children in order to ensure their comfort and safety measures in school bus during the travelling period [12]. Some of the developers developed a vehicle tracking system based on IoT using GPS, Android platform and Raspberry Pi controller which highly helps in tracking both public vehicles and school buses as well [14]. But the performance of GPS is not good in the tunnel areas and in-between the high building roadways.

Figure 1: Functional Entities for Vehicle Tracking



The combination of RFID technology with fingerprint identification algorithm was proposed [13] in order to send the notifications of students. The details of each student's entry and exit

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during travelling in school bus are sent as notification to the parents and school admin through this algorithm. However including fingerprint component increases the computation cost of the system and this will not work if the student suffers with skin diseases. IoT based intelligent bus monitoring system was proposed in [15]. To track and monitoring the students here the RFID technique is applied during their trip from (and to) homes on school/college buses. Additionally the speed feature is included in this system and the parents can able to access the arrival time of the students through GSM if required. However using GSM to send messages to parents is not more reliable under worst case network scenario since parents mobile might be off or not reachable.

IoV - Cloud-based Technologies

With increasing the number of vehicles it is also important to provide passenger safety traffic management and improved infotainment issues and therefore the conventional vehicular schemes faces a lot of technical challenges like poor connectivity, less flexibility, low scalability and faulty intelligence. To overcome these issues Internet of Vehicles (IoV) based cloud computing technologies are developed to provide effective decisions even in the vast number of connected vehicle environments [21]. To overcome the collateral damage an enhanced IoV was proposed [22]. Edge Cloud Computing (ECC) is the best option for processing enormous amount of data and this ECC can function well even in the vast number of connected vehicles. Three types of ECC are fog computing, mobile edge computing and cloudlets.

Real time vehicular monitoring purpose

A conceptual framework named real time vehicular monitoring purpose was developed for making the vehicular monitoring system more efficient and more elaborate. Figure 2 describes the conceptual framework of real time vehicular monitoring system. Information requester in the figure involves demands to know information about the vehicle. Vehicle Owner (VO), Vehicle Driver (VD), Maintenance Engineers (ME), and Vehicle Manufacturers (VM) are represented as a requester for the information obtained through the decision engine using fuzzy logic approach [16]. The requested information are collected from the sensors and devices (information providers) and delivered to the end-users with necessary confinement analytics. As per the requester demands the sensors are more responsible to provide data to the Fuzzy logic based decision engine in real-time [17]. Large amount of data is generated and shared among the requester on demand basis. The most crucial factor is to analyze and store the large amount of generated data and therefore the Machine Learning/ Deep learning technique Enabled Big Data Analytics theorem used in this case to conceal the functional data from these collected information [19].

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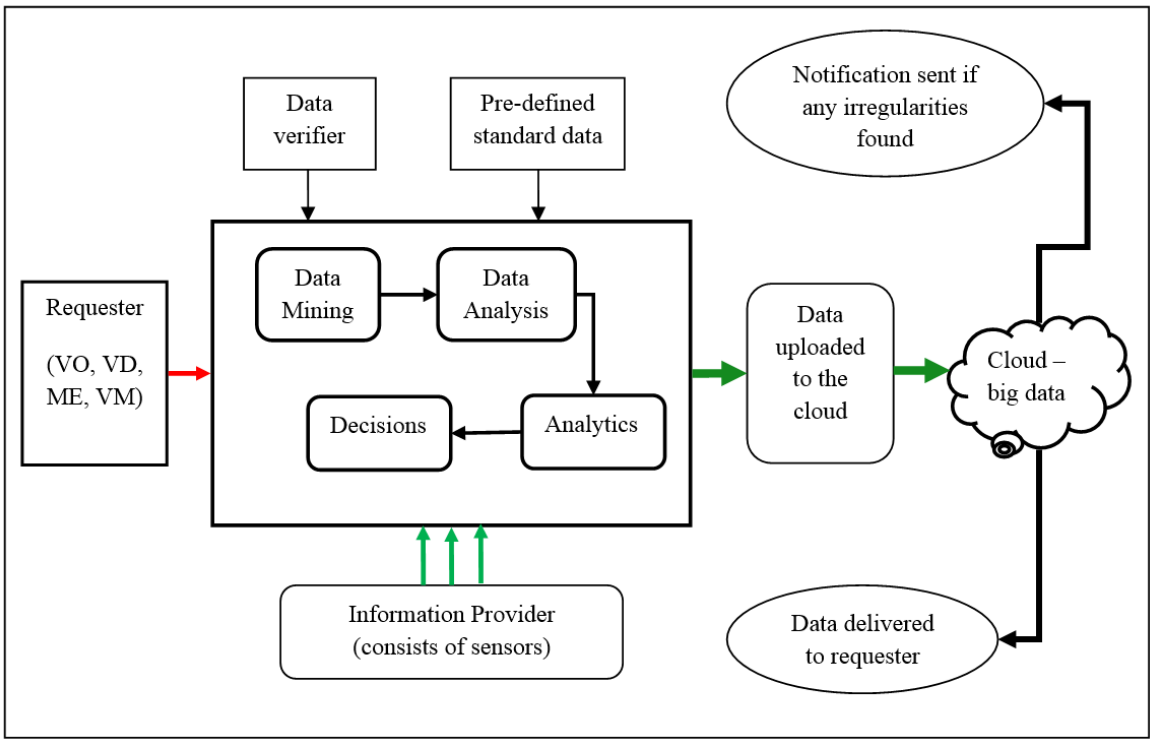
Figure 2: Vehicular Monitoring System using IoT



The decision engine acts as the integral part of this vehicular monitoring framework and this is synchronized with the vehicular engine control unit. This collects the whole system information and subsequently programmed using fuzzy logic. This will be more responsible for accumulating, verifying and forwarding the selected information to the cloud storage system [18]. The data verification process ensures the accuracy by comparing with the already stored pre-defined standard data. Therefore requesters such as VM, VO and ME can obtain the details using IoT technology as per user demand/request.

Challenges

The overall IoT based vehicle tracking system and traffic management is developed using different connectivity techniques and embossed with various algorithms and control devices. Therefore the system requirements are large and this process consumes certain level of power supply continuity. The entire system may enters into a chaotic situation if the data is absent for making the decisions when there is lack of electricity or if no sufficient amount electricity is supplied [20]. However supplying certain amount of power certainty is a big challenge.

Most of the children get into the wrong buses and getting off at the wrong stops. Bus drivers can not able to identify that each and every children are getting off at the right stops. The consequences results in major concern for parents. Most families send driver to pick up their children and there is no guarantee that the child gets on the right vehicle.

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CONCLUSION

From the analysis it is concluded that the development of robust vehicle tracking system is mandate to provide safety and security measures to the school students commuting between schools and homes. Children's safety is considered to be a major concern and an effective research should be carried out to avoid the child missing cases. A detailed survey of development of IoT automotive industry, IoT based school bus tracking system and cloud based IoT enabled smart vehicle systems are carried out here. In future real time cloud assisted IoT based school bus tracking system is developed with the necessary algorithms. To analyze the generated reports in real time with various activities of buses and other transportations at the school/college level in future.

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