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IoT Based Fleet Management Systems : A Review

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***Abstract*—** The Internet has undergone numerous stages of development. The world uses the Internet for maximum of the tasks but it has fundamentally been about connecting computers. Nowadays, internet has entered in its new age called as "Internet of Things" which involves connecting physical objects over the network. Amongst many applications of IoT, Fleet management system is the best-known application in the area of transport. Fleet management system finds its importance in many sectors such as industrial and security ones. Many companies or organizations need to keep track and optimize their fleet. Fleet management systems when empowered with IoT, contributes to efficient and effective management of vehicles. In this survey article, brief overview about the concept of IoT is presented. This review mainly focusses on Fleet Management and Vehicle Tracking. Along with IoT, various technologies contributing in any fleet management system are discussed. Various researches carried out on the concept of fleet management and vehicle tracking are reviewed.

***Keywords*—** *Internet of Thing, Fleet Management System, Vehicle Tracking.*

I. INTRODUCTION

These days, many people around the world make use of the Internet for web browsing, sending and receiving emails, retrieving multimedia content and services, playing games, using social media networking and many other tasks. As most of the people are gaining access to such global information and communication infrastructure, an Internet has become a platform for machines and devices to communicate and coordinate with each other.

So, within the next decade, the Internet will likely evolve as a complete standard network of connected objects. Thus, by making content and services always available around us, internet has provided the way to new applications along with new ways of working and interacting. A fundamental development of the present Internet into a Network of interconnected objects that not only senses information from the environment and interacts with the physical world, but also uses existing Internet standards to provide services for information transfer, analysis, applications and communications. With this perspective and these services, the term ''Internet-of-Things'' (IoT) is broadly used [1].

Internet of Things can be defined as a network of uniquely identifiable "things" that can communicate to each other without human interaction. The Internet of Things provides solutions based on the combination of information technology, that refers to hardware and software components and communications technology which includes electronic systems used for enabling communication between those components.

Potentialities offered by the IoT make possible the development of a huge number of applications, of which only a very small part is currently available to our society [2]. There are many domains and environments where in new applications would help us in improving the quality of our lives. Though these environments now do have integration of objects with intelligence, they do not have any communication capabilities. So, by enabling the possibility of communication between these objects as well as analyzing the information gained from the surroundings infers that a very wide range of applications can be deployed in these different environments. The Internet-of-Things has become a novel idea which offers a great set of opportunities to users, manufacturers and industries. In fact, IoT technologies will find wide applicability in many productive sectors including, e.g., Transportation and logistics, Environmental monitoring, Healthcare domain, Inventory and product management, Smart environment for workplace and home support, security and surveillance.

In case of Transportation systems, IoT applications extends to various aspects such as vehicular communication, vehicle control, smart parking, smart traffic control, electronic toll

collection systems, logistic and fleet management, and safety and road assistance. One of the biggest problems logistics industry faces is the tracking of fleet. With Vehicle Tracking solutions powered by IoT devices would result into a Vehicle Tracking System. When we talk about the Internet of Things in regards to fleet management, the "things" are vehicles and the people who drive them. When vehicles are given sensors, we can manage and control them through web applications.

Fleet management systems focuses on the vehicle's operations and technologies that can be applied to them to improve vehicle and fleet planning along with scheduling and other operations [3]. Fleet management can improve the efficiency and safety of the vehicles, which results into a reliable system which will make the fleet related operation become more cost-effective. Figure 1 depicts typical Fleet Management Scenario.

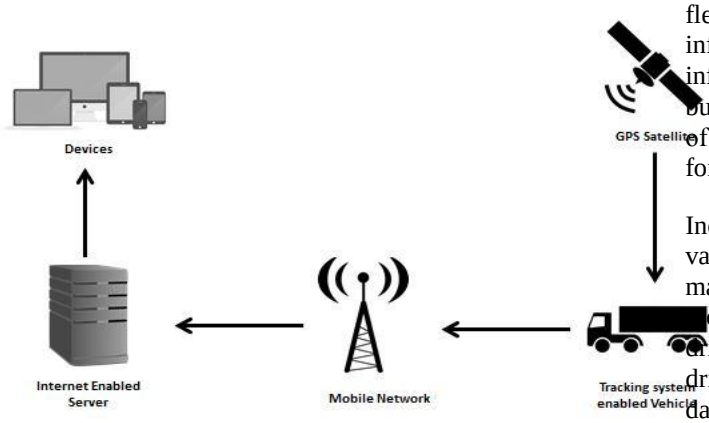

Figure 1. Fleet Management Scenario

The placing of hardware sensors inside the vehicles makes it easier and efficient to get complete control of fleet. Fleet management solutions depend upon two things, first is the nature of the fleet and second is company's need to coordinate transport-related actions. These actions include vehicle financing and maintenance, driver and fuel management, vehicle tracking and diagnostics and many other functions. Fleet management companies provide services that focus on improving fleet efficiency, increasing productivity, minimizing vehicle investment costs and risk of theft, analyzing driver behavior and reducing associated transportation costs.

In this survey article, the emerging concept of IoT i.e. Internet of Things is briefly presented. The article's prime focus is on IoT enabled Fleet Management Systems. Hence, how IoT has influenced traditional fleet management systems is defined in section II along with section III which explains basic fleet management system. Functionalities that are part of fleet management systems are summarized in section IV. Various technologies which are participants of any fleet management or vehicle tracking systems are overviewed in section V. In section VI various researches performed in the area are reviewed followed by conclusion.

II. IMPACT OF IOT IN FLEET MANAGEMENT

For tracking and managing thousands of vehicles, fleet management must be effective and efficient in order to run operations smoothly. This increased need for operational efficiency is one of the main factors for the development of the fleet management market. A rise in vehicle maintenance costs, fuel consumption, regulations and accidents have all made the need for better and more effective fleet management solutions and service a requirement. One way to get an increase in operational efficiency and effectiveness is the use of Internet of Things (IoT) with big data. IoT and big data together provide better tools for fleet management solutions to be more efficient. For a company of number of fleets, IoT and big data allow processing of the stored information and getting some useful insights from that information which will contribute in a more efficient business. The IoT is not only helping to increase efficiency of fleet operations, but it's also creating up new opportunities for fleet management solutions.

Increased connectivity between devices and integration of various devices is a major benefit of the IoT, and fleet management requires nothing different. IoT offers many new tools like in-vehicle streaming camera, parking assistance, driver mobile apps, traffic reporting, effective routing, driving behavior monitoring, average speed etc. Collective data from IoT devices assist for daily operations and track fleets anywhere, anytime and on any device.

As shown in the figure [Figure 2], there are six core areas identified, where IoT solutions have had the largest impact on fleet management. Connected devices enable fleet managers to monitor the health of their vehicles thereby ensuring preventive maintenance. Such devices typically come up with alerts for service needs such as coolant temperature, low battery and servicing reminders. By having all these devices, drivers and vehicles connected to each other, fleet managers can better understand their money expenditure and also, they are able to analyze areas in which costs can be reduced for example in case of total fuel expenses. As fleet managers are able to get insight into a fleet performance and driver behavior, safety management goals can be achieved, where vehicles and drivers are at all times and potential problems can be identified much sooner with reducing risks before they become larger issues. Energy optimization across the industry is supported by IoT solutions. By monitoring vehicle activities such as vehicle idle time and active time with CO2 emissions and dashboards that provide details about the emissions, fleet managers can monitor fleet's environmental effect. Huge amount of data and detailed data analysis enables predictive

modelling and allows fleet managers to carry out fleet operations more efficiently and cost-effectively. Now with the advancement of IoT and big data, fleet managers are looking to maximize what and how much they can get out of their data. With the help of vehicle location tracking, current traffic updates can be obtained contributing to the intelligent routing.

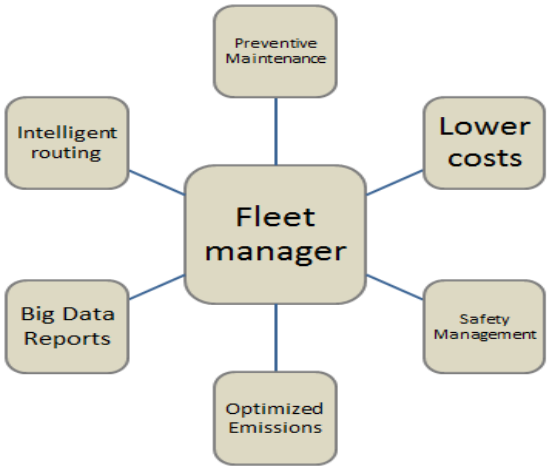

Figure 2. IoT enabled Fleet Management

III. BASIC FLEET MANAGEMENT SYSTEM

Fleet management system finds its importance in many sectors such as industrial and security ones. Many companies need to keep track and optimize their fleet. Fleet management depends on GPS receiver which exists nowadays in many life applications. GPS depends in its service totally on the spread satellites all over world which transmit information free of charge. Fleet management system available in two forms:

1. On-line form
2. Off-line form

Online tracking enables the user to monitor the position of the vehicle online. This form of systems sends the data either by cellular networks or by using base stations. The Offline tracking systems provide full day tracking information of vehicles when these vehicles return to the parking place in contrast the online unit provides real time tracking of vehicles. Most of the fleet management system contains three parts. The first part is the in-vehicle embedded unit which is installed in the vehicle and interfaced with the GPS and other systems of the vehicle. The second part is the communication part. This part job is to send the collected data to the base station for processing. The third part is the fleet management software in the base station or in the web server. In the on-line systems cellular phone networks are used as communication tool with the base station. Transferring data to the base station in the online version is done either by sending a text message (SMS) to the base station or more commonly using GPRS that connected to the web server. The receiver can be any computer connected to the Internet or any computer able to receive SMS.

Most fleet management systems are using satellite services and GPS tracking systems which can provide immediate real-time data. Fleet management starts with installing a monitoring device in the ship or the vehicle, which can be a car, a truck, or a motorcycle. The module connects itself via the GPRS system and transforms gathered data with the use of GSM network to specialized computer monitoring systems with fleet management software. As a result, the company receives processed information that can be used for the fleet management solutions and managing of company resources.

It should include important findings discussed briefly. Wherever necessary, elaborate on the tables and figures without repeating their contents. Interpret the findings in view of the results obtained in this and in past studies on this topic. State the conclusions in a few sentences at the end of the paper. However, valid colored photographs can also be published.

IV. FUNCTIONALITIES OF FLEET MANAGEMENT

Following are the main functions of Fleet Management

1) Vehicle Tracking

Location tracking is the basic function of every vehicle fleet management system. Most modern vehicle tracking systems use GPS technology for locating vehicles. A vehicle tracking system comprises the automatic vehicle location (AVL) within the vehicles and software that collects fleet data for getting a complete picture of vehicle locations. When installed in a tracking device the software enables tracking systems to operate with data about fleet's location. This allows you see where vehicles are, adjust to traffic conditions and receive updates and alerts about any issues concerning your fleet of vehicles. Depending on the data transmission functionalities, vehicle tracking devices can be active or passive. Both devices store GPS location, speed, heading but the only difference in both is that "Passive" devices operates on historical data while on the other hand "active" devices usually transmit real time data via cellular or satellite networks.

2) Route Management

In addition to location tracking services, most fleet management programs have the feature to plan routes in real time. This is possible through GPS trackers implemented in

the monitored fleet. GPS technologies enable to know the exact location of each vehicle at any time, so routes can be efficiently planned. Besides planning of routes and travel times, some programmes provide real-time traffic updates such as toll roads or small streets unsuitable for large vehicles.

3) Vehicle Maintenance

It includes various functionalities such as Fuel consumption, speed management and other mechanical diagnostics such as engine tire etc. Fuel costs are the single most expensive operational expense for fleet owners. Therefore, controlling the fuel consumption can save money and increase productivity. Speed management is definitely something that needs to be considered in order to make route calculations and time schedule.

4) Vehicle Theft/Loss

Fleet operators can avoid vehicle theft with remote vehicle disabling systems (RVDS) that can stop engines from starting, and stop or slow down moving vehicles. These systems use GPS technology to let operators know precisely where vehicles are located, significantly increasing the chances of recovering a stolen vehicle.

5) Driver Behaviour Monitoring

Fleet operators can continuously monitor driver behaviour, and for those driving recklessly, send them an alert. Accelerometer and GPS data sent over OBDII to the control centre may be used to detect speeding, and harsh cornering and breaking. When necessary, the control centre can send the driver a warning in the form of a pop-up text-to-voice notification.

V. TECHNOLOGIES

Following are some technologies that are part of any fleet management systems or typical vehicle tracking systems

A. GPS

GPS, or Global Positioning System, is a satellite based global navigation satellite system, GNSS that is used to provide accurate location and time information anywhere on or near the Earth. Typically, GPS is able to provide position information to within a few metres, allowing accurate positioning to be made. It is also possible to extract timing information that enables frequencies and time to be very accurately maintained.

1. GPS basics

   The basic concept behind GPS is that signals are transmitted from the satellites in space and these are received by the receivers on or near to the surface of the earth. Using timing it is possible to determine the distance from each satellite and thereby using a process of triangulation and knowledge of the satellite positions the position on Earth can be determined. The satellites all send timing information so the receiver knows when the message was sent. As radio signals travel at the speed of light they take a very short but finite time to travel the distance from the satellite to the receiver. The satellites also transmit information about their positions. In this way the receiver is able to calculate the distance from the satellite to the receiver.

2. GPS satellites

   The satellites are orbiting above the Earth [Figure 3]. Their orbits are tightly controlled because errors in their orbit will translate to errors in the final positions. The time signals are also tightly controlled. The satellites contain an atomic clock so that the time signals they transmit are very accurate. Even so these clocks will drift slightly and to overcome this, signals from Earth stations are used to correct this.

3. GPS receivers

   GPS receiver is a device that is capable of receiving information from GPS satellites and then to calculate the device's geographical position. Using suitable software, the device may display the position on a map, and it may offer directions. GPS devices are able to retrieve location and time information from the GPS system in every weather condition, anywhere on the Earth or near the Earth. A GPS receiver requires an unobstructed line of sight to at least four or more GPS satellites that means they should be in open. Presence of trees, buildings etc may cause poor signal conditions. Today, most standalone GPS receivers are used in automobiles navigation system for many purposes such as traffic congestion maps or tourist attractions.

   The GPS receiver integration with smartphones has resulted in many services to smartphones consumers. There are now many applications which provides free mapping and location services, localised advertising etc. Some of the applications that are widely used are Google Maps and Apple Maps.

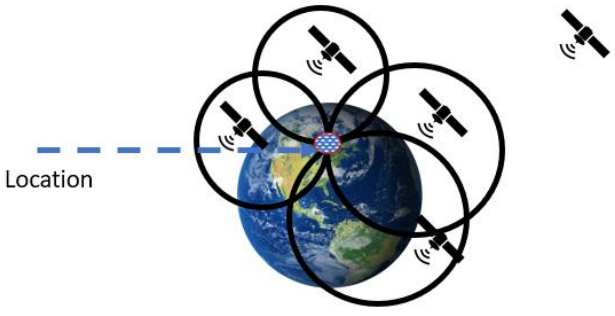

Figure 3. GPS Satellites

B. GSM

The GSM system is the greatest widely used cellular technology in today's world. There are various reasons behind this successful cellular phone technology including the ability to roam worldwide with the ability of being available to operate on GSM networks. The GSM system was designed as a second generation (2G) cellular phone technology with the aim of achieving greater capacity than the previous first-generation systems. Over the last three decades multiple generations such as 3G, 4G have been standardized and deployed for voice and data communication [4]. The capability for data communication has been extended to be used for M2M communications. Though GSM has lower data rates, it is widely used for M2M communications amongst the 3GPP technologies because of its better coverage than 3G and 4G. Recently 3GPP have introduced modifications to GSM and LTE standards for M2M communications as M2M requires less complexity and cost along with greater coverage.

- GSM Services

  Voice call is the primary function for the GSM cellular system. In addition to the that, one service that has developed hugely is the short message service. The service was developed as part of the GSM specification and it has also been incorporated into other cellular technologies. GSM technology also supports a variety of other data services, though the performance is less compared to 3G.

C. GPRS

GPRS technology is the upgraded version of GSM technology with high speed data rate. It was widely deployed to provide accurate data capability via cellular communications technology. The key component of GPRS technology is that it is based on packet switching technology rather than circuit switching, in which user's running cost will be based on the amount of data sent regardless of connection time. GPRS and GSM can operate along one another on the same network and the same base station. GPRS technology has allowed many real data applications to be used and enabled the new phones to become mobile computers. GPRS technology provided much higher data rates to be transferred over a cellular network than GSM that was mainly for voice communications.

- GPRS Communication Mechanism

  GPRS is based on IP communication. It allows the network to transmit IP packages to external networks. The connected device must provide an IP address before a connection can be established. For this the mobile phone or laptop must be connected to the GPRS network and then dynamic IP should be assigned to the mobile device and only after that the exchange of data over GPRS can take place. GPRS technology has become the intermediary between second-generation GSM technology and 3G W-CDMA system hence it is compatible with both 2G and 3G networks.

D. Cloud Platforms

As IoT encompasses merging of several "things" with the utilization of Internet as the backbone of its communication system. Businesses are adopting the Internet of Things by connecting internet-enabled devices to their assets and communicate that information back to the decision makers, hence causing the necessity of a platform that could store, manage and analyse all of that information. Cloud being an important component of an IoT world, provides valuable application or domain specific services in many areas. Many IoT cloud providers are available in market which offer appropriate and precise IoT based services [5].

There are lots of options in the market, with all of the big players in public cloud (AWS, Azure, Google Cloud Platform and IBM) providing IoT platforms, as well as smaller pure-play options for more industrial IoT (IIoT) uses. All the obtained information for each vehicle is stored on a scalable Cloud Platform. Cloud platforms enable viewing the real time information displays of vehicle locations and status. This is used to monitor circumstances in real time and to perform actions across vehicles that are needed to be coordinated altogether to achieve mission goals. The Cloud Platform allowed easy configuration and customization of alert thresholds and alert generation algorithms to ensure a fit for purpose solution that could keep up with new vehicle introductions and localization of alerts based on geographic conditions.

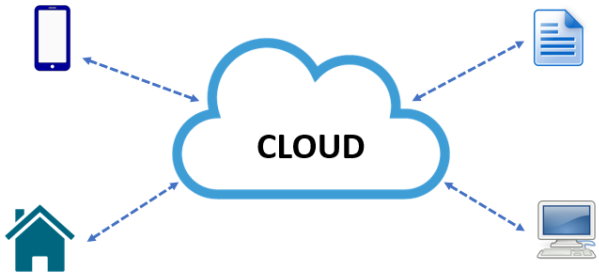

Figure 4. Cloud Platform Scenario

E. OBD

OBD stands for "On-Board Diagnostics". Advanced vehicle fleet management OBD can collect data about vehicles such as tire pressure and engine temperature that will help for vehicle diagnostics. Advanced diagnostics can be obtained through alerts in various occasions such as if the engine light comes on including the diagnostic codes that will help you identify the problem. Basic OBD system consists of an ECU (Electronic Control Unit), which uses input, from various sensors (e.g., oxygen sensors) to control the actuators (e.g., fuel injectors) to get the desired performance.

There are two kinds of on-board diagnostic systems: OBD-I and OBD-II. OBD-I refers to the first generation OBD systems which were developed throughout the 1980s. These early systems use proprietary connectors, hardware interfaces, and protocols. A mechanic who wanted to access diagnostic information typically had to buy a tool for every different vehicle make. In the early 1990s, Society of Automotive Engineers (SAE) and International Standardization Organization (ISO) issued a set of standards which described the interchange of digital information between ECUs and a diagnostic scan tool. All OBD-II compliant vehicles were required to use a standard diagnostic connector (SAE J1962), and communicate via one of the standard OBD-II communication protocols.

F. Smartphone App

The smartphone is not widely considered an IoT device by most people, but it is actually one of the first IoT devices available to the general public across the world. The smartphone has always played a very important role in IoT, communicating data with Wi-Fi and Cellular at first then other standards like Bluetooth, which is now one of the major enablers to communicating data from sensors to the internet. Smartphones apps will continue to play an important role in IoT particular where there is a need to collect data around human interaction and sensor information from IoT. Smartphones apps that are equipped with Wi-Fi, Bluetooth and NFC will continue to communicate and control applications and many different use cases for IoT. The mobile apps will eventually be the primary user interface for applications as they provide real-time data to be manipulated on site, which will increase efficiency.

Figure 5. Smartphone Application

Mobile technology plays a big role in the future of fleet. Many people within the fleet industry want technology on their phones so that they could complete their tasks on-the-go. From capturing real-time data to allowing clients to access their vehicle reservations from their smartphones, the SmartApps suite has the capabilities to help your fleet continue growing in today's connected world.

G. Microcontroller Unit

Connected heterogeneous hardware devices are at the heart of any IoT network. IoT devices are able to monitor real-world objects or things such as home appliances, buildings, industrial equipment, cars, and in some cases people. When we develop new IoT solutions, various hardware and software components are designed, prototyped, and refined through an iterative process of feedback and evaluation. In the context of IoT, each IoT device is a hardware component that has been designed or modified for a specific purpose. It refers to individual hardware components including sensors and actuators. So, amongst all the hardware devices present in every IoT network, the very essential device or main hardware device is the Microcontroller Unit.

A microcontroller unit is a small, self-contained computer that is housed on a single integrated circuit, or microchip. They differ from desktop computer as they are typically dedicated to a single function, and are most often embedded in other devices (e.g. cell phones, household electronics). They don't require operating systems to function, and can be easily interfaced with other external devices such as sensors, actuators and motors. As they don't need any kind of external dependencies, it makes them easy to set up. MCU can deliver all the needed processing power and functionality. Overall, MCUs are best in terms of economic aspect for IoT applications and they offer simple and secure functionalities with little cost. Sensors and actuators can connect to the microcontroller devices through digital or analog General Purpose Input/output (GPIO) pins or through a hardware bus. Along with it, standard communication protocols such as I2C and SPI can be used for communication between devices and components that are connected with the bus.

Some of the widely used hardware platforms are Arduino, NodeMCU and Raspberry Pi. These are very helpful in the process of rapid prototyping and refinement, as they are readily available and require less investment than designing and fabricating custom printed circuit boards (PCBs)

H. Fleet Management Software

Every fleet organization has large amount of data, including data on vehicles, assets, drivers etc. So, fleet management software can help in improving fleet operations through enhanced decision-making based on existing data. Fleet management software (FMS) is computer software that enables people to achieve a series of specific tasks in the

management of any or all aspects about a fleet of vehicles operated by a company, government, or any organisation. These specific tasks incorporate all operations related to administration of the fleet. The main function of fleet management software is to collect, store, process, monitor, produce reports on and export information. It comprises of functions such as Vehicle management, Driver management, Incident management and Tracking. Although most fleet management systems can be accessed mainly with the use of computer software programs, a fleet management system may be tracked also with the use of a mobile phone.

VI. RELATED WORK

IoT is used for many applications in the field of transportation and vehicle telematics. Applications include vehicle position tracking systems, vehicle anti-theft tracking systems, fleet management systems, and intelligent transportation systems (ITS). Following are some related work carried out based on these applications.

With the use of GPS and GSM modules along with Intel Galileo Gen 2 development board authors [6] have developed an electronic device which when equipped with vehicle is able to track and monitor its location and speed. SIM908vehicle speed sensor and 'ThingSpeak' cloud server remote storage are used. In the vehicle anti-theft tracking system [7] used the RFID module to control the power switch where RFID tag was attached to the car key. And making use of Vibration sensor and pyro electric infrared sensors car intruder could be detected. GSM and GPS module helped in getting real time location via SMS. The owner was able to forcibly lock or unlock the car with the Android application. The vehicle tracking system developed by [8] has hardware parts by u-blox first is NEO-6Q GPS receiver and second is LEON-GIOO GSM module. Arduino UNO microcontroller was controlling these hardware parts. By using the CadSoft Eagle software and its CAM processor actual industry-standard Gerber format files were obtained.

The system [9] uses GPS, GSM modules and AT89C52 microcontroller for detecting vehicle accident. The system consisted the IR sensors to sense the obstacle. The GPS longitude and latitude values of the vehicle met with an accident was sent to remote devices through message. The GPS/GSM Based System [10] proposed is vehicle tracking system and also able to lock engine motor. Whenever the theft is identified, the authorised person could send a SMS alert to the microcontroller which thereby would issue the control signals to stop the engine and then the doors could get unlocked only with specific set password. IR sensors used were able to sense any interruptions from sides of doors. This paper describes a vehicle embedded data acquisition system [11] capable of analysing and automating fleet management. This system design was based on WiFi along with the database server and web interface. The in-vehicle embedded system could get the location of the vehicle from GPS receiver, the vehicle status from OBD interface, and the driver ID from the RFID. Then it connected the vehicle to web server through WiFi network to transmit the collected data. The system was able for monitoring the performance and diagnosing remotely through database and web interface.

Reference [12] has presented a complete fleet management solution mainly comprising of identifying fuel consumption, driver identification and collision prevention system. The vehicles in the fleet were equipped with GPS and GPRS modules and sensors for fuel status and detecting collisions. All the data from GPS device was transferred to a server in a cloud system through GPRS. And then that data is stored and saved in the cloud for customers receive it from any device that can have access to a web page. The overall framework of a user interactive and assistive system [13] comprised of a set of dedicated hardware interfaced with a car's OBD computer which provided various Electronic Control Unit (ECU) sensor readings via CAN bus. These readings were transmitted to a remote server for processing and analysing. Raspberry Pi microcontroller was used for communication with the OBD port, GPS device and a 3G module for wireless data transfer to remote server. The obtained data was further analysed for evaluating driver's driving style. The fleet management system [14] made the combined use of OBD II, GPS, and WiFi technologies. The developed OBD II reader was exploited for connecting to a vehicle's OBD II port and reading real-time sensor data from a vehicle's ECU. Vehicle's location was obtained by GPS module. Data from OBD-II reader was transmitted to a remote server through WiFi network and various parameters such as speed, distance travelled and fuel consumption was evaluated. A database management system and a graphical user interface (GUI) were developed for storage and management of transmitted data and for analysing the transmitted data. In the research presented in [15] fuel filled and fuel consumption was examined along with vehicle tracking. For the fuel consumption analysis Reed Switch was used which worked based on the principle of Hall Effect. MSP430F149 microcontroller was used to interface all other devices with each other. Real Time Clock (RTC) and GPS were used to track real time and vehicle location respectively. Two fuel sensors i.e. reed switches were used to sense the quantities of fuel filled and fuel consumed. All the data is visualized on LCD display.

A vehicle tracking system [16] worked on a GPS module and a GSM modem to find the location of a vehicle and offered a range of control features. The project focussed on remotely tracking a vehicle's location, remotely switching ON and OFF the vehicle's ignition system and remotely locking and unlocking the doors of the vehicle. An SMS message was sent to the tracking system and the system responded to the users request by performing appropriate actions such as turning heater on/off, radio on/off etc. Location of the vehicle could be seen on Google maps through a web page. A novel approach [17] for controlling and monitoring of a fleet management system using GPS/GLONASS-based automatic vehicle locators i.e. Rad100, GPRS/GSM cellular network and web-based software 'PayaRadyab' was proposed to show

the exact location of the desired vehicle on different maps. Along with locations the detailed reports of the mission, travelled path, fuel consumption rate, speed limits, and other necessary information could be retrieved according to the customers' requests. The most significant features of this system were its global covering, high positioning accuracy, easy operation by the user at any location, and easy energy management.

Real Time Vehicle Fleet Management and Security System is developed by [18]. The system is built on Linux Based embedded microprocessor. GPS Receiver is interfaced for vehicle location tracking, GSM-GPRS modem is used for communication and for Security purpose a physical panic button, Biometric sensor, Camera, and speakers are used. A dedicated server used for data acquisition and a GUI renderer is created for user interface. This GUI-renderer will plot and displays the real time data dynamically. The paper [19] presents GPS based tracking system for monitoring the movement of any equipped vehicle from any location at any time. GPS, GSM and microcontroller are embedded with the aim of enabling users to locate and monitor their vehicles. In this work, MATLAB GUI algorithm is developed which reads location values and plot them on Google Earth.

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CONCLUSION

Internet of Things in fleet management makes it possible to obtain real-time information on routes, vehicle maintenance and driving conditions. Fleet management focuses on the operation of the vehicles and technologies that can be applied to improve vehicle and fleet planning, scheduling, and operations. Fleet management can improve the efficiency and safety of the vehicles, which results in a reliable system that could help the operation become more cost-effective. This paper describes the detailed analysis of technologies used in fleet management system. Also, various researches carried out in the field of IoT and fleet management system are discussed.

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