REAL TIME MOVING VEHICLE FLEET ANALYTICS

ANALYSIS

INTRODUCTION

In earlier GPS technology was designed primarily for use by the military. The uses for the military were clear in the 1980s and 1990s, but public interest in GPS technology was minimal. In 1996, President Bill Clinton determined that the system would be an asset to civilians as well as the military, and issued a policy directive that would require the creation of a dual-use system benefitting the everyday user. This policy change made GPS technology available to the average individual, including fleet managers, who could see the benefit of using the technology to keep tabs on their vehicles. By the mid-2000s, GPS navigation technology had evolved into tracking systems. This was in part due to the improvements of machine to machine (M2M) communications, which is the predecessor to the Internet of Things (IoT). Along with cloud-based technology and sensor parameters, GPS tracking became increasingly accurate.

The basic concept of fleet tracking has not changed since its inception. A GPS tracking system uses the Global Navigation Satellite System network. This network incorporates a range of satellites that use microwave signals that are transmitted to GPS devices to give information on location, vehicle speed, time and direction. Essentially, a GPS tracking system can potentially give both real-time and historic navigation data on any equipped vehicle. GPS provides special satellite signals, which are processed by a receiver. These GPS receivers not only track the exact location but can also compute velocity and time. Fleet tracking has been embraced by both fleet managers and the drivers they hire. This technology provides accountability and protection to both parties, helping drivers do their jobs better and providing fleet managers with accurate information about fleet vehicles.

In December 2015, a new option for the modern fleet tracking system became necessary when the Federal Motor Carrier Safety Administration (FMCSA) published a ruling that will require all commercial vehicles to maintain electronic logs instead of paper logs. According to the mandate, electronic logging devices will have to replace paper record-of-duty logs in trucks by Dec. 16, 2017. Because electronic logging capabilities are built into most modern fleet tracking systems, this new mandate is expected to increase the use of GPS fleet tracking systems among fleets that are not currently using the technology.

AIM OF THE PROPOSED WORK

The Aim of the Proposed Work “Real Time Moving Vehicle Fleet Analytics“ is to grab the data from vehicles and to form a database. Real time on board computing (RTOBC) technologies are designed to track and improve various elements of fleet performance. Private Fleets are using these technologies to increase operational efficiency. It is being used to monitor a driver’s service hours electronically. Instead

of relying on an inefficient paper logging process, this technology keeps better accurate records while being more user friendly to the driver.

Growing global database of vehicle and driving behavior across a range of industries and locations can provide you with the information you need to make informed decisions related to:

- Logistics
- Supply chain
- Traffic management
- Predictive traffic
- Insurance
- Emissions
- Urban planning

OBJECTIVES OF THE PROPOSED WORK

The purpose of Fleet Management in a business is to ensure the work vehicles of a business are operating smoothly, are constantly seeking ways to improve performance, are able to keep operation costs at a minimum, and maintain compliance with government regulations.

The work is focused to achieve the following objectives in Fleet management systems.

- Acquire more control over drivers and vehicles.
- Less time spent on predicting time of departure and arrival, getting hold of traffic updates and road conditions improves productivity.
- Save on fuel consumption.
- Prevent delays on deliveries.
- Reduce road accidents.
- Improve driving habits.
- Prevent dubious reporting.
- Prevent unauthorized use of vehicles.
- Track and recover lost vehicles.
- Customer get better service having real-time access about the location of their assets.
- Lessen driver frustration while on the road, increasing employee satisfaction all around.

SCOPE AND SIGINIFICANCE OF THE PROPOSED WORK

The Moving Vehicle Tracking and Fleet Management Systems would benefit lot of people including end customers, commercial vehicle owners to keep track on their moving assets, curtail unnecessary expenses on fuel, identify vehicle misuse, increase operational efficiency and automate its day to day operations. The main scope of the project is

i) Live Signal Tracking of Fleet

ii) Internet of Things

iii) Data Transformation

MODULES

RESEARCH ISSUES

- An information delay of even just a few seconds can compound over the course of the day with multiple drivers and routes, which can create significant delays and inefficiencies.
- Accuracy problems are usually caused by an error in location, it's probably because your antenna is having difficulty in picking up or maintaining satellite signal.
- Transformation of real time tracking data into IOT servers.
- The outcome of the research is simplistic moving vehicle real time data analytics which is much needed in the fleet management systems.

METHODOLOGY

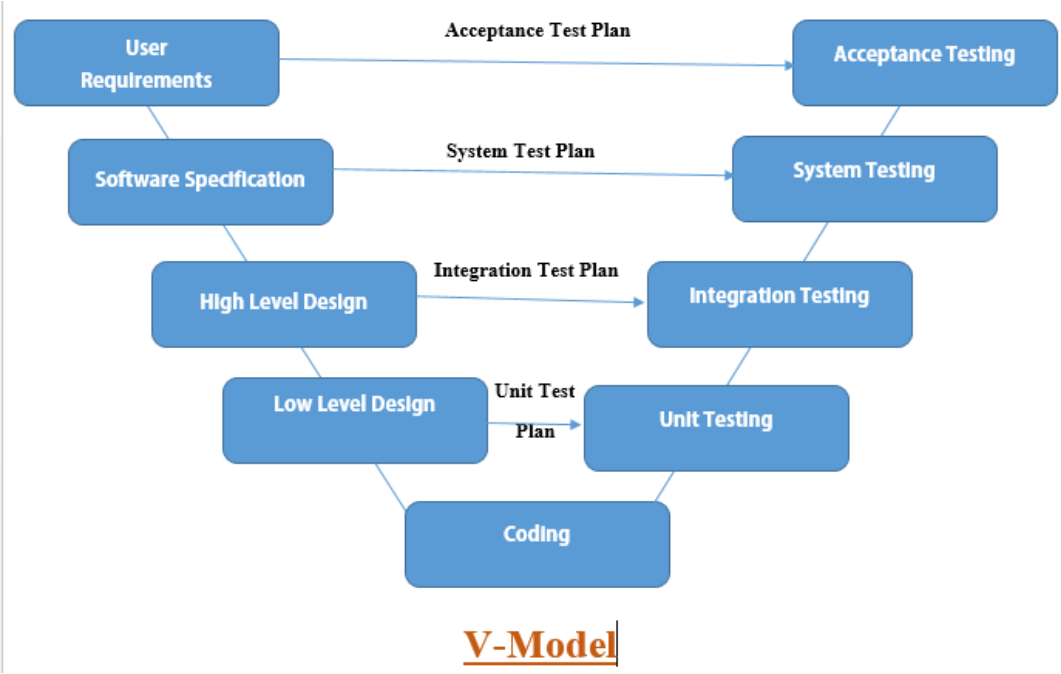
Methodology used for this project is V-model. The V-model is an SDLC model where execution of processes happens in a sequential manner in a V-shape. It is also known as Verification and Validation model. The V-Model is an extension of the waterfall model and is based on the association of a testing phase for each corresponding development stage. The Figure 1.1 demonstrates the relationships between each phase of the development life cycle and its associated phase of testing.

In the V Model Software Development Life Cycle, based on same information (requirement specification document) the development & testing activity is started. Based on the requirement document developer team started working on the design & after completion on design start actual implementation and testing team starts working on test planning, test case writing, test scripting. Both activities are working parallel to each other. The corresponding testing phase of the development phase is planned in

parallel. So, there are Verification phases on one side of the 'V' and Validation phases on the other side. The Coding Phase joins the two sides of the V-Model.

Reason for using this model given below:

- Testing starts in early stages of product development which avoids downward flow of defects and helps to find the defects in the early stages
- Test team will be ready with the test cases by the time developers release the software which in turns saves a lot of time
- Testing is involved in every stage of product development. It gives a quality product.
- Total investment is less due to less or no rework.



V-Model

PLAN OF WORK

The plan of work goes according to following timeline given in figure 1.2. Review 0 was on 8th of January 2019 for finalizing identification of the domain and title of the paper Review 1 was on 27th of January 2019 which included presentation on literature Survey and problem identification. Review 2 is on 20th February 2019 which includes Presentation on Architecture Design, Module Description, and Implementation. Finally, Review 3 will be on 4th March 2019 for final submission, assessment and seminar.

REVIEW OF THE EXISTING SYSTEMS

GPS Technology

Even before GPS was developed, fleet telematics was invented in 1974 -- or at least the origins of it. The U.S. automobile industry had begun a form of fleet telematics; as new cars rolled out of assembly plants via the Ford, Chrysler and General Motors manufacturers, they were cataloged using an electronic process. When orders were placed, a mainframe-to-mainframe method of communicating was used to process orders electronically, and vehicle status reports were generated using computer technology. This was the beginning of fleet tracking.

By 1978, the phrase “telematics” was invented. In France, a government report by Simon Nora and Alain Minc developed the concept of telematics to define using telecommunications to transfer information. However, it was not until a decade later that the European Economic Community began conducting research on the application of telematics and driver safety. Fleet telematics was tested to see if this technology could also help reduce the environmental impact associated with operating motor vehicles.

The history of GPS vehicle tracking had another milestone in 1978. The experimental Block-I GPS satellite was launched into space in 1978. Manufactured by Rockwell International, this system was a successful test; and by the end of 1985, 10 more Block-I satellites were launched to further validate the concept.

In the early years, GPS technology was not yet operational, due to an insufficient number of satellites orbiting the earth. On Jan. 17, 1994, after years of gradual growth, the final of the first 24 satellites was launched, and the GPS system was considered fully operational. Today, fleet tracking taps into this same technology.

Computer Technology and The Internet Pave the Way for Widespread Vehicle Tracking

During the 1980s and 1990s, two major tech evolutions occurred that spawned fleet telematics systems that we have today. First, the production of the personal computer enabled businesses of all sizes to use this technology. No longer was it only accessible by government agencies, but small businesses could now use computers for handling fleet information. More importantly, personal computers made it easier for individuals with a limited computer science background to use this technology.

For fleet managers, computers that could fit on their office desk transformed the way they did business. By the early 1980s, fleet managers could connect with the mainframe of their management firm’s computer. This allowed an easy transmission of information both offline and online via a modem. In 1982, fleet company ARI designed the first-ever fleet maintenance management system to operate online. This greatly improved fleet managers’ ability to reduce lead times for vehicle deliveries.

Then, with the advent of computer accessories for storage — such as PC diskettes and later USB drives — fleet managers could increase their ability to share this information for research and billing purposes. In the 1980s, real-time updates on driver and fleet data were also enabled. This sped up the system of transmission to an even greater capability.

Early GPS technology was designed primarily for use by the military. The uses for the military were clear in the 1980s and 1990s, but public interest in GPS technology was minimal. In 1996, President Bill Clinton determined that the system would be an asset to civilians as well as the military, and issued a policy directive that would require the creation of a dual-use system benefitting the everyday user. This policy change made GPS technology available to the average individual, including fleet managers, who could see the benefit of using the technology to keep tabs on their vehicles.

Personal computers were transformed when the World Wide Web became accessible in the 1990s. In fact, the first Internet-based fleet management system called PHH Inter Active was established in 1997. At a rapid pace, all fleet management programs on computers became web-enabled. As a result, fleet managers and drivers could share data pertaining to maintenance records, vehicle sales and vehicle ordering using the online portals. Also within this decade, General Electric created Fleet Tools, which was a type of fleet management software that also enabled management teams to run reports using fleet data.

In the 1990s, further modifications were made to GPS technology. These included policy and accessibility changes. In 2006, the last GPS satellite was launched.

GPS Navigation and the Fleet

Another major technological advancement in the 1990s was the consumer use of GPS technology. This, coupled with the use of the Internet, gave fleet telematics systems the biggest boost to date. In the early days of fleet tracking, in order to properly track a fleet, each vehicle had to be enabled with a costly GPS device. The company was required to pay a typically high monthly fee to use the satellite tracking system. While helpful, these early systems were difficult to implement, costly to use and sometimes inconvenient for drivers and fleet management alike. Thus it took several years for the concept to catch on. In the earliest days, only large, wealthy fleets took advantage of the technology.

The government granted access to GPS tech in 1993, which meant commercial drivers could finally use this method of mapping for route development. Fleets were able to implement GPS vehicle navigation systems. This reduced the environmental impact of vehicles thanks to decreased driving times and improved routing for fleets.

By the mid-2000s, GPS navigation technology had evolved into tracking systems. This was in part due to the improvements of machine to machine (M2M) communications, which is the predecessor to the Internet of Things (IoT). Along with cloud-based technology and sensor parameters, GPS tracking became increasingly accurate.

Fleet tracking has been embraced by both fleet managers and the drivers they hire. This technology provides accountability and protection to both parties, helping drivers do their jobs better and providing fleet managers with accurate information about fleet vehicles.

Modern GPS Vehicle Tracking

Cell phones and tablets progressed right along with the use of GPS navigation technology. During the 2000s, mobile phones were able to perform GPS navigation and tracking processes using apps. Commercial vehicles were also equipped with dashboard computerized systems and communications platforms, such as Qualcomm.

These systems enable drivers to communicate directly with their dispatchers and fleet managers using in-cab, web-connected technology. At the same time, individuals in the office can locate drivers and freight from 1,000 miles away using these GPS-based fleet telematics systems.

The progression of telematics has advanced dramatically since the beginning of the 21st century. As a result of mobile technology, GPS, cloud computing and high-speed Internet capabilities, telematics can provide fleet managers with highly sophisticated data.

Managers have the tools to track trucks in real time using high-resolution maps updated on a regular basis. Thanks to monitoring software, these mapping systems can be accessed from anywhere on Earth via cloud computing.

The use of telematics helps fleets do more than just keep drivers safe. The technology allows fleet managers to monitor freight and provide secure geo-fencing zones. More secure freight leads to fewer losses and freight claims. As a result, shipping customers are more confident and ultimately satisfied with their freight services. This increases business operations and helps trucking companies improve return on their investment with telematics.

Telematics is combined with other technologies, such as routing, for increased optimization. For instance, managers can now use this data to determine how much fuel was used for a route and if an alternative route is more fuel-efficient. Fleet telematics also helps fleet managers monitor driver behaviors — such as speeding, hard braking and accelerating. By identifying these behaviors, managers have the data they need to implement driver training or other methods for correcting these issues.

Technologies involving GPS, big data and IoT will continue to evolve in the coming years. As such, we can expect to see far more from the use of fleet telematics systems in the trucking industry.

The modern fleet tracking system provides the necessary data to fleet managers allowing them to run their operations more efficiently. Reports on driver behavior, vehicle performance and fuel use all make it easier for the fleet manager to cut costs and increase efficiencies. These systems go beyond simple reporting of each vehicle's location, offering fleet managers a wealth of information about their vehicles and their drivers.

Today, fleet managers have a number of fleet tracking technologies they can use. These include:

• • • Cellular • Tracking — Cellular tracking taps into the growing cellular network to provide GPS data in real time.

• • • Satellite Tracking — Ideal for fleets that regularly travel outside of cellular coverage. Satellite tracking uses traditional GPS satellites to track vehicles. Real-time satellite tracking is possible.

• • • Passive Tracking — Whether it be satellite or cellular based, passive tracking provides periodic location updates rather than real-time tracking data to help with asset management and vehicle tracking.

These three options show the clear evolution of the technology to the point that it now can accommodate fleets of all types and sizes. Today, GPS tracking is increasingly efficient, able to provide data in real time and able to be used on mobile devices for tracking on the go. Fleet management professionals can have as little or as much tracking data as they want at their fingertips, making it a viable option for small fleets as well as large corporations.

A new option for the modern fleet tracking system became necessary when the Federal Motor Carrier Safety Administration (FMCSA) published a ruling that will require all commercial vehicles to maintain electronic logs instead of paper logs. According to the mandate, electronic logging devices will have to replace paper record-of-duty logs in trucks by Dec. 16, 2017. Because electronic logging capabilities are built into most modern fleet tracking systems,

this new mandate is expected to increase the use of GPS fleet tracking systems among fleets that are not currently using the technology.

What does the future of fleet tracking hold? Only time will tell, but based on its current evolution, we can expect to see an increased demand for accuracy, more data to track and improved mobile capabilities. If you are ready to embrace fleet tracking or if you need help ensuring that your fleet is operating in line with the FMCSA mandate, contact Track Your Truck to discuss your options. Our simple-to-use fleet tracking systems will make it easy for you to be compliant while offering all the benefits of GPS fleet tracking.

SYSTEM DESIGN

PROPOSED SYSTEM

FRAMEWORK OF THE PROJECT

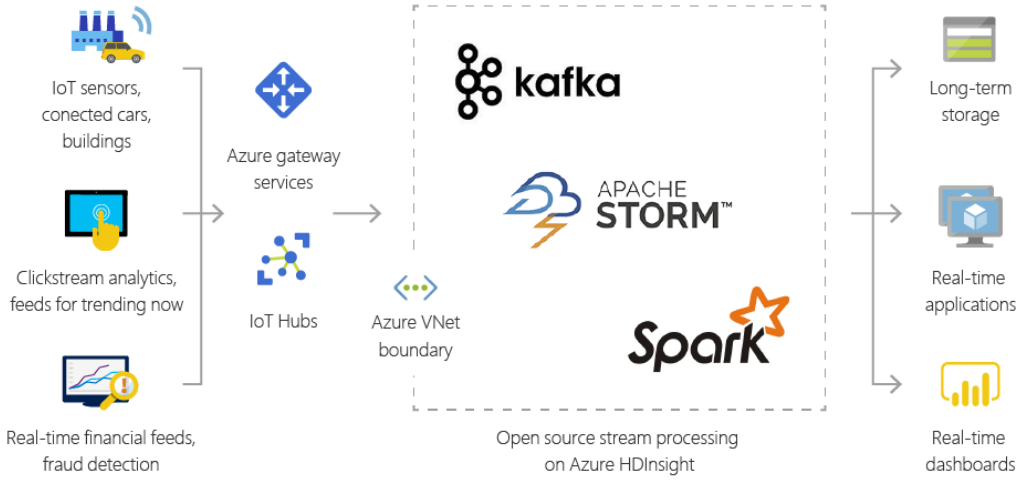
Real time On board computing (RTOBC) technologies are designed to track and improve various elements of fleet performance. Private Fleets are using these technologies to increase operational efficiency. It is being used to monitor a driver’s service hours electronically. Instead of relying on an inefficient paper logging process, this technology keeps better accurate records while being more user-friendly to the driver. It keeps track of date& time details, odometer readings, fuel pumped and

usage details, states travelled. These details are helpful in calculating Fuel and Mileage Tax amount

for every customer on monthly, quarterly or annually basis and reports are generated as per customer desires

In addition OBC system helps in real time tracking of vehicle through its GPS incorporated systems with help of which entire activity of the Fleet can be monitored. Real time tracking ensures safe and on time delivery. It also helps in Truck navigation and leverage real time traffic to avoid delay. All the information that is gathered through the OBC system is used to make the best business decision

Data ingestion and acquisition is done through Sqoop and NIFI, Queued into distributed Kafka queue, Enriched using Spark, pushed into Elasticsearch, analyzed in real time using Kibana and batch analytics will be done using Hive.



USECASE

Telematics data has a range of potential applications including:

- Current Traffic Services
- Historic Traffic Patterns
- Driver Risk Modeling
- Emissions reporting/management
- Supply Chain Management
- Logistics /Freight tracking
- Vehicle Performance Research
- Macro-Economic Trending

DESIGN & DEVELOPMENT

REQUIREMENT ANALYSIS

SOFTWARE REQUIREMENT SPECIFICATIONS

- Hadoop Distribution (Cloudera, Hortonworks,...)
- Hadoop Eco-systems (Hive, Sqoop, Zoo Keeper)
- Spark, Kafka
- ELK Stack
- Database for unusual Activities
- RDBMS Dataase

KEYWORDS

Linux Shell, Sqoop, HDFS, NIFI, Kafka, Spark - SQL, Stream, Core, Elastic Search, Kibana, Hive.

HARDWARE REQUIREMENT SPECIFICATIONS

- Devices for Internet Connections
- Sensors for Data Capturing
- GPS Chip
- Remote Server

FUNCTIONAL REQUIREMENTS

PRODUCT PERSPECTIVE

- To make database of the subject
- To recognize the subject in real time
- To identify the activities

PRODUCT FEATURES

- Fleet Organizations
- Small team
- Small budget
- Ease of use

USER CHARACTERISTICS

- Should be familiar with Bigdata Tools
- Should be familiar with RDBMs Systems
- Tamper Proof GPS Chips & Sensors to be used

ASSUMPTIONS & DEPENDENCIES

- Well Tuned environment
- Subject available in real time
- Virtual Environment of Hadoop Distribution
- Dependencies like JDK are installed in the system

DOMAIN REQUIREMENTS

- Spark 2.3; Scala 2.11
- HDP 2.6.5 or CDH 5.5
- Sqoop 1.4.6
- Hive 2.1.0
- Kafka 1.0
- NiFi 1.5
- Elastic Search/Kibana 6.1
- Apache Hadoop 2.7.3

NON-FUNCTIONAL REQUIREMENTS

PRODUCT REQUIREMENTS

- Hadoop Distribution is Stable & working fine
- Spark Version is Stable
- Database is successfully created
- Training datasets is successful
- Unusual activities are detected successfully
- Files are transfered successfully

LIMITATIONS AND SCOPE FOR FUTURE WORK

This project is successfully completed and all the functionalities of the project are working as given. All the modules are working and giving results as expected. However, there are some limitations of the project and correspondingly scope for future work. It is listed below:

- Sensors & Chips used in the project can be made better.
- Better chips can be used in future for better feature extractions of the location data.
- Database used is a folder which can be edited. In future, MySql can be used for better security of the database.
- Subject should be in well tuned environment & Moving.
- The hardware used is having quadcore processor. It can be replaced with better hardware to have faster computations.
- The project is already cheaper and having low budget. However, it can be made even cheaper.
- The project can be launched in open market by a firm to make it accessible for masses, i.e., for all organizations.