Onboard Telematics for Automobile: A Blessing in Disguise

Arjun Reddy[1] Dr.A.Rengarajan[2]

[2]Professor

[1]Department of Master of Computer Application

[1]Jain University Bangalore, India [2]School of CS and IT, Jain University, Bangalore, India

Abstract— The modern telematics methods have a great deal of applications in teleservices and the impact on the engineering methods and applications is very huge. Telematics is a field which cartels together the telecommunications and vehicular technologies which mainly highlight on road safety, road transportation, and how it can be amalgamated with computer science. It is the technology of that is used to control remote objects such as automobiles by sending, receiving and storing information by using the telecommunication devices. The paper is done to analyze the possibilities of telematics to understand the performance of the fleet which in turn leads to the fuel efficiency tracking, fault code information for fleet health and also the behaviors of the driver for better safety management, using telematics in vehicles so that the organizations can access the critical data such as the GPS location, the movement made by the vehicle which can be seen in the accelerograph, and the data related to the engine which can be obtained from vehicle diagnostics data bus.

Keywords: Telematics, trailer tracking, GPS, transportation

I. INTRODUCTION

Telematics has a very important role in today's transportation and automobile infrastructure. Telematics is a reliable and also an essential way to improve the safety for the automobiles while they are in motion. The modern telematics methods have a great deal of applications in tele services and the impact on the engineering methods and applications is very huge. In telematics a lot of various methods are used such as informatics, optoelectronics, telecommunications, and automatics which are used for the reduction of costs of managing the transport system, also improving the reliability and the security of transport system in the desired automobile. The very important aspect that is taken into consideration in transportation in automobiles is about the system safety and its reliability on how it can gain the output, which is generated during the transportation process that is used for quality and quantity testing and generating that information into the final products which are of some use so that a final decision can be made.

The study of telematics is a field which combines both the telecommunications and vehicular technologies which mainly emphasize on road safety, road transportation, and how it can be merged with computer science. (Wahlström, 2017) It is the technology of that is used to control remote objects such as automobiles by sending, receiving and storing information by using the telecommunication devices. These telecommunication devices are mainly used when the vehicles are on the move or when they are in motion. The above information is a basic study about what "Telematics" actually means.

Recently a Dutch based digital marketing company has hired Barclays in the month of September to conduct a review of their Telematics division. The company is working on methods come to a fair and a reasonable price which will help the businesses to save the money by making use of the Telematics software to monitor and also make some improvements in the performance of their cars and fleets of their trucks. Tom-tom is a company that is setup in 1991 which was a pioneer in navigation devices which are mounted on the dashboards and as of now they are competing a German based firm known as HERE and also with google to sell the digital maps which will be integrated into the cars software and control panels.

A few practical applications that are available in the vehicle telematics which help improve the safety are tracking of the vehicle, tracking of the trailer, tracking of the container, and the management of the fleet. (Saidani et al., 2018) The trailer tracking is used for the tracking the movements of the vehicle's trailer part where a location sensor will be attached to the trailer and position will be tracked with the help of mobile communication network. The vehicle tracking is a method which used to track or monitor the status, movements, location of that vehicle or a fleet of many other vehicles. All these features can be obtained by combining a GPS receiving device and a device which is electronically powered which could be installed in each vehicle and the process of communication must happen between the user and pc-based or web-based software. Container tracking is also a similar method as that of trailer tracking where the GPS tracker technology which is powered by a battery is used. The management of the fleet is generally a management of a particular company's fleet. It mainly includes the ship's management or it also can be vehicles such as cars, vans and trucks which are basically run on motors. Management of the fleet has a huge range of functions which are maintenance of the vehicle, financing of the vehicle, telematics fitted in the vehicle, health as well as safety management, management of the person riding that vehicle, dynamic vehicle scheduling and the fuel management.

Another important aspect in the field of telematics is the navigation that can be tracked through the satellites where the telematics of the vehicle and the technology of GPS usage and mapping tool powered electronically is enabled for the person riding the vehicle and his exact position can be located and route would be planned and navigated.

II. LITERATURE REVIEW

The telematics related to automobile can be defined as the information that is intensively used in the applications that are enabled in the vehicles by combining the computing technology and telecommunications. Telematics in its nature requires capturing of data from the sensors, exchange and storage of data to obtain control over remote services.(Gupta et al., 2019) The telematics data has to be protected in order so that the automotive telematics to grow to its full potential. The protection of data must include the security as well as

privacy for the users, providers of service and providers of these applications.(Duri, 2000)

OGSi (based service and architecture gateway for mainly Intelligent automobiles) is an extraordinary concept in the field of telematics and the core intentions is to integrate the development of an electron in the automobiles and also take notice of a developing it broadly for applying OGSi. (Khelifi et al., 2019) The results offered here depicts the humongous benefits which OGSi technology platform offers for the networks related to automobiles. It is also added that in future it would provide notice for an on-board developing landscape for applying OGSi for manufacturing the automobiles on a larger scale.(Yuantao,2005)

The study of Telematics and its importance in the field of transport states the multitude of development user friendly input attendant and the points that are present within the vehicle.(Wessel et al., 2019) The way it has been represented through this ideology is very different as graph theory is used as the route planning application and the study about telematics was based on this framework. The overall concept mainly suggested the opportunities that are benefited from self-propelled telematics hardware. To add to the future references, it has to work on the topic such as the telematics and its low end version with a user friendly interface. (Neumann,2018)

A navigation system based on turns for automotive telematics terminal is mainly dependent on step-by-step process on how navigation works, and the main objective is, it highlights several unique features of navigation system based on turns and to present them to the user. (Glazunov et al,. 2015) The result was also a navigation system based on turns which was used as terminals in telematics and developed and designed by LG Electronics and it was a new idea that was brought in and the method that was implemented in several automobiles. It is also mentioned that through their application they wanted to invent another application that would maintain an up to date map in the system and to display the map more realistically for the user's convenience. (Chang, 2003)

Method and apparatus for dynamic telematics network selection and utilization deals with the networks and how the utilization of cellular networks are used to provide connectivity between the vehicle and remote networks. A method was found which connects to a new telematic network by following an issuance of an instruction to a device and it was a new idea.(Oliver,2018)

III. OBJECTIVES

– To analyze the possibility of using telematics to understand the performance of the fleet which in turn leads to the fuel efficiency tracking, fault code information for fleet health and also the behaviors of the driver for better safety management.
– To analyze the possibility of using telematics in vehicles so that the organizations can access the critical data such as the GPS location, the movement of the vehicle from a specific device termed as accelerometer, and the data of the engine which can be obtained from vehicle diagnostics data bus.

– To analyze the benefits of telematics for the managers as they aim to ensure that there is a timely delivery along with the driver safety, reduction of the cost and environmentally friendly initiatives.

IV. METHODOLOGY

There are various topics such as Automotive Telematics application, Privacy, Challenges, Framework for protection of data and in the summary it is mentioned the main aim of the paper was to enable the sharing of the data that is termed private according to the owner's policies (Gruteser,2002). The highlighted part of the paper is that they mentioned the challenges for protecting the telematics data related to the automobiles and also he has provided a framework to address the challenges. In this paper he has taken the topic and found the challenges and provided a solution to those challenges and also as a future reference he wants to implement them in the automotive infrastructure. The overview of the whole Automotive Telematics System is represented in the form of an interlinking diagram where there is a telematics service provider which is placed in the center which takes the data from the vehicle and also again sends it back to the car and also it links the data to Pay for Usage Insurance, Location-based Information and also Diagnostics & Road-side Assistance.

The Open Services Gateway initiative (OGSi) is an independent and non-profit corporation working to define and promote open specifications for the delivery of managed services to the networked environments (Yuantao,2005). The whole paper was written in five different parts and the first sub-division talks about the Infrastructure for Networked Automobiles. In that section it is described the open standard-based, service-oriented automotive infrastructure for the automotive telematics architecture in the form of a diagram. The architecture also includes OGSi gateway, service infrastructure and self-automobile. The next section talks about the OGSi based Automotive ServicePlatform,which is a standardized, component-oriented, optimal J2ME-based software framework, which supports the deployment of extensible and downloadable service applications known as bundles for networked devices. In the next sub-division, the topic is OGSi-based Automotive Architecture where the architecture is explained using a typical example. A range of different devices that are found in an automotive environment, such as navigation, diagnosis, entertainment, sensors and liquid crystal display (LCD) are connected to automotive network using several different protocols. The next part describes about the Java-Based Functions and Frameworks in Automobiles which explains the conjunction of OGSi specification and Java technology in the fields of automobile electronics. Firstly, it also depicts the software development from the point of view of automobile electronics and the next following presents a novel design pattern in hardware and software components. The last division it specifies about the OGSi-based and Service-Oriented Automotive Gateway mechanisms and analyzing the four above specified subdivisions this section is designed. The paper concludes by specifying that very soon this concept will be introduced to the automotive industry.

A turn-by-turn navigation system for automotive telematics terminals is a navigation system that is present is a car navigation service in which the calculation of the route is done, and it guides the user to follow the route. The whole idea of this navigation is divided into different modules and it is depicted through a picture in the system architecture module which shows the connections between the user interface, route guidance, route planning, map matching, positioning, GPS, sensors and digital map. The digital map mainly consists of Normalized co-ordinates, Fixed length records, Bit fields, Partitioned map. The position determination module specifies about the vehicle's position by using three sensors a GPS sensor, a gyroscope and a wheel sensor. Route planning module calculates an appropriate route from the current position of a vehicle to a destination. The User interface module plays voice instructions and displays a route map screen and a turn arrow screen according to the graphic instructions. Route guidance module consists of two tasks which are maneuver generation and route following. The maneuver generation is to generate turn-by-turn guidance information for the route following. As the vehicle moves, the route guidance module continuously updates the vehicle's current position and determines the next maneuver and this task is referred to as route following. The user interface module plays voice instructions and displays a route map screen and a turn arrow screen according to graphic instructions.

The importance of telematics in the transport system is very important as it is the essential way that improves the reliability and safety in transport systems and optimizes cargo motion routes and reducing the cost for them. The whole concept is portrayed in the very simple form where it begins with the basic definition of telematics, future and trends of telematics development, advantages of telematics in the context of the development of the transportation systems. The whole telematics system is shown in the form of an architecture and it is represented in the form of a diagram which consists of hardware layer, communication layer, and a data layer. In the next section a detailed explanation of automotive telematics which has three main fundamental capabilities which include two-way communication capabilities, situation technology, computing model for system rule and interface to self-propelling electronic systems. Graph theory as an application in route planning is also mentioned as it is used in many applications such as transportation, routing, communications, economical and so on, where graphs emerge as a mathematical model of the real-world system. Path finding algorithms is proposed for the transit network which are used to handle the special characteristics of networks such as city emergency handling and drive guiding system, in which the optical paths must be found.

The method and apparatus for dynamic telematics network selection and utilization is shown as a whole in the form of four diagrams in the beginning itself in the form of flowcharts where the first diagram shows an illustrative vehicle computing system, second diagram shows an illustrative process for cellular signal utilization, third shows an illustrative process for selected network registration, fourth shows an illustrative process for cellular signal/device selection. The topic is presented from the main aspect such as

the background of the telematics which mainly gives everyone a brief description of how vehicular telematics services utilize cellular networks to provide the connectivity between the vehicle and remote networks and devices and the cellular networks are accessed using for example, an onboard modem or a user cellular device connected to a telematics control unit(TCU). The summary as a whole is mentioned through three illustrative embodiments where in the first it is mentioned about a system that includes a vehicle-based processor configured to store SIM profiles of a locally connectable wireless device in vehicle memory. In the second embodiment, a computer-implemented method includes automatically selecting and connecting to, via a telematics control unit, a second network associated with a previously stored SIM profile, responsive to a determination that a signal strength of a first network has dropped below a predetermined threshold. The third embodiment, a computer-implemented method includes automatically selecting and connecting to, via a telematics control unit, a new network associated with a previously stored SIM profile and corresponding SIM profile connection information, responsive to a signal strength of a currently connected network dropping below a predetermined threshold.

V. ANALYSIS

The main goal for the network related to data protection is to make sure that the telematics platform is built in such a way that it can be trusted by both users as well as the providers of that particular services. Ex: Users have to trust the telematics platform in order to protect the privacy which contains personal information and the providers of the service also have to trust them with the integrity of the data. . In order to build their trust, the framework employs three key concepts. At first, it is the usage of defense which focuses on depth in the design which is used for building a secure platform from the scratch. Second, the aggregation of the data has to be enabled close to the computing system source which in turn must be trust-worthy by the user. Third, the last framework uses policies of user defined privacy for getting the content of the user before the usage of data and its collection. The bottom up approach is used for building a system that both trust worthy for the driver as well as providers of the service for the applications. The security functions are available in all the layers of software as well as hardware.(Duri,2000)

After analyzing the four sections of the OGSi service gateway mechanism of automobile its ready to be presented to the outside world. The intelligent automobile consists of five components that are resources that are concrete, translators of service, managers of service, implementation of service, and providers of service. These components are the packages that can be plugged to the OGSi bundles of service so that they can be deployed and remotely managed. The OGSi can also be used as a platform for automobile manufacturers to provide products to their customers which in turn gives an opportunity to check their new services which can keep the end users updated and it does help them improve the operation as well as keep an eye on the maintenance process.(Yuantao,2005)

The whole navigation system based on turns architecture is composed of five parts which are map that is

digital, determination of position, planning of route, guidance of route, and also interface of the user. The determination of position part consists of matching of map sub-module and positioning and the position of the vehicle can be determined through GPS(Global Positioning System) and the vehicular sensors. The planning of the route module requests a center which is designated, a route that is appropriate from the position of the vehicle to its final destination and the route is received from the center. The planning of the route part calculates a route that is appropriate for itself whenever it is required. On getting a notification about the route, the route is generated in form of turns and the information is referred as maneuvers.(Neumann,2018)

The importance of telematics in the transport system is mainly dependant on some workable communication medium in order to transmit data from a mobile vehicle is described in the primer on real-time traffic system which also includes cellular technologies such as GSM, CDMA, GPRS, WCDMA, EDGE, iDEN, TDMA, WiDEN. All these cellular technologies are more suitable for real-time data delivery due to its availability and the types of network it can support. In this framework, CDMA is chosen as a medium for data delivery of real-time for the vehicle information as it is very suitable for geographical implementation of the system. The data collection methods can also be done through on-board sensors, embedded, acoustic, video and radar sensors.(Chang,2003)

In the methods and apparatus for dynamic telematics network selection and utilization, by using the SIM profiles of available devices in conjunction with the vehicle telematics hardware, improved signal strength may be realized while traveling. By providing the capability to dynamically swap between networks based on available signal strength of all available networks, better connectivity strength can be maintained automatically throughout a journey, without having a user instruct manual swap between the available networks upon noticing that a present network signal strength has degraded. These concepts can improve an overall user in-vehicle telematics experience and reduce dissatisfaction.(Oliver,2018)

Sl.No	Onboard telematics technologies	Usage	Merits	Demerits
1.	Framework for Security and Privacy in Automotive Telematics	Not yet implemented	Tampering of the data related to the owner of the vehicle is restricted.	None since it's just a concept
2.	OGSi-based Service for Intelligent Automobiles	Not yet implemented	It helps and teaches the drivers to improve the operation and maintenance process	None since it's just a concept
3.	Turn-By-Turn Navigation System for Automotive Telematics Terminals	Developed by LG Electronics	Route planning, guidance, and a user interface model has been presented.	The map won't get updated.
4.	TransNav	Not yet implemented	Ship routing network and also avoiding adverse weather conditions and solves the path of least time to reach the destination	Needs a lot of funding
5.	Dynamic Telematics Network Selection and Utilization	Implemented but on a test vehicle	The signal strengths of the telematics applied devices can be tracked	A lot of data has to be kept as back-up

Source: Author's findings

Table 1:

VI. DISCUSSION

The paper is done to analyze the possibilities of telematics to understand the performance of the fleet which in turn leads to the fuel efficiency tracking, fault code information for fleet health and also the behaviors of the driver for better safety management, using telematics in vehicles so that the organizations can access the critical data such as the GPS location, the movement of the vehicle from the device known as accelerometer, and the data of the engine which can be obtained from vehicle diagnostics data bus.

In many other ways it is also possible that low-end system integration with a proper user interface and the system integration that is attached to a radio will be the end solutions. Even the telematics benefits soften the assurance diligence related to locomotives, providers of healthcare, general agencies related to safeness and many other industries. The savings related to amount, annulment of the price and functional efficiencies that can be amended will be graduated in the coming 15 to 20 years.

VII. CONCLUSION

Through this paper I can conclude that I have dealt with the protection of important data in the telematics related to automobiles and the goal was to enable the sharing of that particular data which is private and according to the terms and conditions agreed by the owner. It is even assured that the providers of the service that the important data is not altered or tampered with the origin point (starting point) or anywhere in the process of the chain. The various challenges have also been showcased to protect the data related to automotive telematics and a framework has been presented to put down these challenges. To enable real world applications an alternative solution for the protection of the proposed data framework is to be intended. The fuel efficiency tracking, and the behaviors of the driver is monitored and even by using the telematics the specific organizations can access the critical data such as the GPS location and the vehicle movement by using the accelerometer. Also, a navigation system mainly based on turns has been designed for the telematics terminals present in the automobiles. In addition to that, several features

which are very unique of the navigation system based on turns has been showcased. The mass production of telematics terminal is still currently in preparation. The main benefits of telematics for the managers is that they aim to ensure that there is a timely delivery along with the safety of the driver and telematics also can the insurance and the costs regarding to liability, by reducing the number of accidents on the road. With the telematics coaching tools, the drivers are encouraged to follow safer driving habits such as driving within the speed limit, braking smoothly, accelerating smoothly. In the fleet world, the drivers are trained to reverse in when they reach their destination as it is safer and reduces the risk of accidents.

REFERENCES

[1] Wessel, G., Altendorf, E., Schreck, C., Canpolat, Y., & Flemisch, F. (2019). Cooperation and the Role of Autonomy in Automated Driving. In *Control Strategies for Advanced Driver Assistance Systems and Autonomous Driving Functions* (pp. 1-27). Springer, Cham.

[2] Khelifi, A., Talib, M. A., Nouichi, D., & Eltawil, M. S. (2019). Toward an Efficient Deployment of Open Source Software in the Internet of Vehicles Field. *Arabian Journal for Science and Engineering*, 1-23.

[3] Duri, S., Gruteser, M., Liu, X., Moskowitz, P., Perez, R., Singh, M., & Tang, J. M. (2002, September). Framework for security and privacy in automotive telematics. In *Proceedings of the 2nd international workshop on Mobile commerce* (pp. 25-32). ACM.

[4] Li, Y., Wang, F. Y., He, F., & Li, Z. (2005, June). OSGi-based service gateway architecture for intelligent automobiles. In *IEEE Proceedings. Intelligent Vehicles Symposium, 2005.* (pp. 861-865). IEEE.

[5] Park, C. W., Joe, M. J., Byun, S. C., Choi, H. W., Jung, M. H., & Kim, Y. I. (2003, June). A turn-by-turn navigation system for automotive telematics terminals. In *IEEE IV2003 Intelligent Vehicles Symposium. Proceedings (Cat. No. 03TH8683)* (pp. 21-24). IEEE.

[6] Neumann, T. (2018). The Importance of Telematics in the Transport System. *TransNav: International Journal on Marine Navigation and Safety of Sea Transportation*, *12*.

[7] Gupta, M., Benson, J., Patwa, F., & Sandhu, R. (2019). Dynamic Groups and Attribute-Based Access Control for Next-Generation Smart Cars.

[8] Glazunov, V., Kurochkin, L., Popov, S., & Chuvatov, M. (2015, April). Prototype of the telematics map cloud service. In *2015 17th Conference of Open Innovations Association (FRUCT)*(pp. 50-55). IEEE.

[9] Wahlström, J., Skog, I., & Händel, P. (2017). Smartphone-based vehicle telematics: A ten-year anniversary. *IEEE Transactions on Intelligent Transportation Systems*, *18*(10), 2802-2825.

[10] Saidani, M., Yannou, B., Leroy, Y., & Cluzel, F. (2018). Heavy vehicles on the road towards the circular economy: Analysis and comparison with the automotive industry. *Resources, Conservation and Recycling*, *135*, 108-122.