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INTERNET OF VEHICLES (IOV): A 5G CONNECTED CAR

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Abstract

Transportation Engineering has been growing technically since the commencement of electronic gadgets in vehicles. Transportation in future urban areas will be about self-driven smart vehicles with correspondences between them just as between infrastructures. We discuss the benefits of Internet of vehicles (IOV) along with various challenges in the field of Internet of vehicles (IOV). The Fifth Generation (5G) cell system can be viewed as the path to the universal Internet and inescapable worldview. We further discuss the various techniques in the working of self-driven car to get knowledge about various components of self-driven car. Other than the numerous open doors that Internet of Vehicle (IOV) presents, there are as yet numerous difficulties and issues that must be considered with incredible consideration. The appearance of Internet of Things has changed the classical vehicular systems in to smart vehicular systems called Internet of vehicles. Finally, we present future development of self directed using IOV network.

1. Introduction

Now-a-days, Vehicle is a daily necessity of a human being for travelling purpose. People are using vehicles at an enormously growing speed. The number of vehicles on road is rapidly increasing which is creating more traffic and can lead to accidents on the roads. This issue is considered as one of the major problems in day-to-day life.

1.1. Internet of Vehicles (IOV)

Internet-of-Vehicles (IOV) is identified as an extension to Internet-of-Things (IOT) with a purpose to enhance the features of VANET which can

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reduce the traffic and accidents in urban traffic environment [14]. IOV is an interconnection between wireless network technologies and various road networks. The two key elements in the current Intelligent Transport System (ITS) are VANET and IOT [12]. Vehicular communications require some wireless communication infrastructure to always have signal coverage. The 5G cellular network emerges as a new strong alternative to allow such connections, in a reliable, secure, and fast way. The vehicular are associated with the Internet by methods for APs utilizing a Wireless Local Area Networks (WLAN), for example, WiFi, WiMAX and Bluetoot. Self-driving cars are mainly driven by the instructions given by the GPS. In connected vehicles, driver is not keeping an eye on the road constantly during autonomous mode. This means the vehicles will constantly have a driver but this is not the compulsory condition for self-directed technology which is previously able to do all of the essential function for vehicles to move safe and sound without anybody on board in any way [3]. It gives the clear view of highway. A random network of PCs does process the data that generates a current map of mobile and immobile things in the environment.

Figure 1.1. IOV through cellular 5G network [1].

Self-driving cars are all-round way that produces accurate position and a 360º sight of the vehicles external environment. A grouping of multiple radars, cameras and laser sensors are required to achieve this goal. The cameras with dynamic range are able to handle fast changes in illumination. Sensor is used to detect and identify any objections to car on the road. It can detect the speed board in the highways and goes on that speed with the help of car cloud services [15]. It connected to the traffic authorities control centers. It has a backup facility as in the airplanes to ensure to autopilot will

remain working safely even though a component of the structure gets disable. IOV will help improve traffic conditions, reducing the time of avg. traveler spend after the wheel a year and fuel consumption. Allowing the car to act automatically is vital when moving towards the future cars will not crash at all [9].

1.2. Connected Car Components

When we compare autonomous car and normal car both are totally different. Components include in the self-driving car are:

I. Ultrasonic sensors

II. Radars

III. Cameras

IV. GPS unit

V. Laser scanners

VI. Backup system as in the airplanes

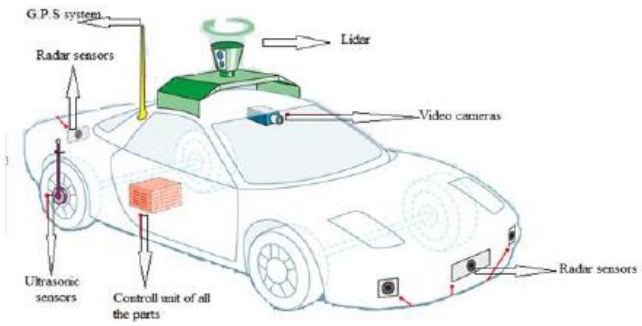

Figure 1.2. Working model of autonomous car [10].

Along this there is a Cloud based 3-d digital map. Now we discuss one by one, how its work in the autonomous car.

1.2.1. Ultrasonic Sensors

Ultrasonic sensors can be used to compute the location of objects near to the vehicles, for example hurdles and additional vehicles and maintain self-directed drive at low speed. These sensors are based on the tools used for current parking aided functions improved with advanced signals processing.

A usual instance of usefulness of the technology is locating unpredicted circumstances like pedestrians and threats on the road near to the vehicle. It has a setup with 04 sensors observing backward, 04 sensors observing forward and 04 sensors observing the sides.

1.2.2. Camera

In this, we have three main Trifocal cameras. The main cameras are the popular aril alexia and two small indie GS2K satellite cameras which create 3D field-view1 by combining 3D cine photography. A trifocal camera is located after the upper side of the wind-screen; is a 3 in 1 camera giving a board 140º view, next 45º view and along range with narrow 34º views for enhanced depth perception and faraway object recognition the cameras can spot sudden appearing pedestrians and expected highway hazards.

1.2.3. Radars

RADAR uses radio waves and act as an objective recognition system to control the range, height, track and velocity of objective. In a self-driving or autonomous car, four surrounded radars are used. These four radars after the front plus rear bumpers cone (on each side-corner of the car) are capable to trace objects in all direction. With sweeping together left and right, transmit waves jump off signs, poles and tunnel use monitor a complete 360º around the vehicle.

1.2.4. GPS unit and cloud services

Global Positioning System (GPS) satellites signals are joined with reading from Tachometers, 3º freedoms of altimeters and 3º freedom gyroscopes to give more perfect position than is not feasible using GPS alone. By matching the 360º view, images are produced by the altitude of sensors using the wrap image function. By joining the data from the sensors with the map self-driving vehicle is capable to select the finest route in real time factoring of variables such as the road curves, speed limits, traffic signs and further traffic rules. The cloud based service is linked to the "Traffic Authorities Control Center" (TARC). This assures that the latest traffic information is always available.

1.2.5. Laser Scanner

The scanner is capable of identity objects in front of the connected vehicle

and ensures extremely high angle resolution. It can also differentiate among objects with unique laser sensor having a range of 150m for cars and covers a 140^{o} field-view1. These sensors will jump pulse of beam in the adjoining. These are analyzed to recognize as markings of tracks and the edges of highways.

1.2.6. Backup system

In addition of all these system, there is a backup system facilities is present as in the airplanes. It is use full if any one component is not working properly while moving. On that time it gives a backup system to that component and makes the car moving safely. This is essential to the autonomous car, e.g. the chances of failing the brake system are very less however a connected car needs a second self-regulating system to brake-up the speed of the car to stop.

2. Literature Review

I. C. R. Storck et al. 2019 [1] specifies Communications and Challenges of new system model of IOV in the operational modes.

II. S. Sarkar and B. Mohan 2019 [3] addresses the basic Knowledge about operation of autonomous vehicle and its techniques.

III. S. A. Hussain et al. 2019 [4] addresses the Challenges in IOV and delivery of Node to Node service. Data delivery is significant in IOV environment.

IV. B. Schwarz et al. 2010 [5] provides an overview of how LIDAR is use in generation of maps for 3D surroundings.

V. L. Alton et al. [7] tells about future of self-driven cars in 2020 that is going to be a great year.

3. Working Principle

3.1. Mapping and Localization

Before making any decisions related to finding the directions (i.e. navigation), the car initially make a map of its surrounding and accurately confine itself within the map. Laser range-finder scans its surrounding using

strips of laser-beams which estimates the distance up to adjacent entities by calculating the moment it takes for each and every laser-beam to reach that object and come back [8]. A Video camera is perfect for capturing color of scene. Benefit of laser range-finders is that detailed information is easily accessible to the car in the construction a 3-D map.

3.2. Avoidance of Obstacles

An internet car's inside map include the present and predicted position of all stationary objects like buildings, traffic signals, stop-start signs and moving objects like different cars as the obstacles in its surrounding area. The car uses a probability based representation to find the predicted potential [2] path of speedy objects based on its shape, form and earlier route.

3.3. Planning of Path

The aim of planning a pathway by the data collected from the map of car to securely move the car to its target while escaping hindrances and follow the high way rules. However car makers' designing algorithms will be separate on the basis of their navigational aims and sensors, this type of planning algorithm can used for military vehicles. The current, previous or predicted potential positions of all obstacles in the car's surrounding area are integrated into its local internal map use by car to plan its path planning.

3.4. Scanning of Road Ahead

Automakers have made major developments in the last 10 years towards production of autonomous vehicles used on highways in developed countries. There are still many technical issues that automobile makers must overcome previous to launching self-driving vehicles on-road. Initially, vehicles will perform only a small set of tasks like parking as well as driving in stop-and-go traffic situations automatically [6].

3.5. Communications

Vehicles will communicate with other vehicles and their environment. There are several kinds of modes for ICT applied to the driving system given below:

I. Laser radar + sensors mode

II. Visual identification + sensors mode

III. Vehicle to Everything (V2X) communication mode

IV. High precision positioning + high precision map mode

V. Big Data + Edge cloud computing + AI mode

Only integrating all these technologies can realize the full automated driving.

3.6. Challenges

I. The equipment's used like radar, LIDAR [5], HD cameras are costly.

II. End to End delivery [4] of data is analytically without compromising with any QOS parameters such as Delay, Jitter, Bandwidth etc.

III. Present road conditions may vary, which will affect the decisions made by our smart real time AI based judgment software. Due to this decisions made by other human drivers will also vary.

IV. Impaired mobility and congestion are current challenges.

4. Conclusion and Future Scope

In this paper, we have tried to understand the basic elements of Internet of vehicles (IOV) and various components, techniques and challenges of self-driven car. After enormous improvement in a traffic security 1.2 million of population are killed in road accidents every year. The existing system for auto braking lane keeping assistance and adaptive cruise control are examples of the first steps towards autonomous driving.

In coming days, you will be capable to use your phone and simply relax while secure and safe autonomous driving. Automated vehicles (AVs) already navigating on roads of United States and few other developed nations around the globe [8]. As far as self-driving cars are concerned, 2020 will be a big year [7]. As the number of on-road smart cars will increase, privacy will remain a major concern in case of an insurance company, the Automakers, a local dealer and police authorities. Life-saving technologies like automatic anti-lock brakes will take few years to come. The vehicle helps the driver, cautions the driver, and after that naturally brakes.

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