

Applications of Internet of Things (IoT) in Automobile Industry: A Review

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Abstract

When we talk about the web then we were discussing the associated world since what the web is and what it does?. So fundamentally web is a method of network between the people groups and we consider similar web for gadgets then it is referred to be as the Internet of things(IoT). So fundamentally IoT is the new arising world with brimming with promising circumstances for everybody. IoT implies the gadgets that are associated with the web and are autonomously working for eg. Shrewd Bulb, these sort of bulbs stay associated with the web and you can change their splendor and shading by providing straightforward voice orders with your voice collaborators like google or by controlling it by the maker's application. We are utilizing this innovation in each field for as of now. In auto area vehicles furnished with IoT innovation we call them as associated vehicles, autonomos vehicles, keen vehicles and driverless vehicles, etc. As the IoT innovation is arising step by step and with a similar speed auto area is developing. IoT assumes a significant part in car area when we talk about driving the vehicle with utmost care on street so the quantity of lethal mishaps will diminish. This investigation essentially examines about the IoT innovation in car industry, its application, its benefits and impediments.

Keywords:- IoT, Smart Cars, Connected Cars, Internet, Intelligent Vehicles, IoT Risks and Challenges.

I. INTRODUCTION

As the technology is growing day by day and there is lot of advancements happening around the world and in the today's busy and fast paced world human don't have time for himself and want the machines to work for him. Therefore we have seen that their is the significant increase in demand of smart devices in the recent few years. These devices are enough smart that they can help us to complete tasks with increased effieincy with minimal human touch. Such inclination will proceed in development, and now every vehicle is coming with these kind of technology inbuilt because there is the need of this technology right now in the automotive sector. Basically there is not a single definition of IoT, it is explained differently by different authors. Vermesan er.al.[1]defined the web of things as collaboration between the physical and computerized universes by means of the sensors, actuators and so on IoT gadgets are outfitted with sensors, actuators, processors for interconnection. The information is caught by the sensors, actuators which is put away and prepared keenly to get valuable interfaces from them. This information can be prepared, shared by means of organization or far off worker for additional activity. The correspondence between IoT gadgets is principally wirelessbecausetheyareinstalledatgeographically various areas. In the wake of accepting information move should be made based on the inferred deductions.

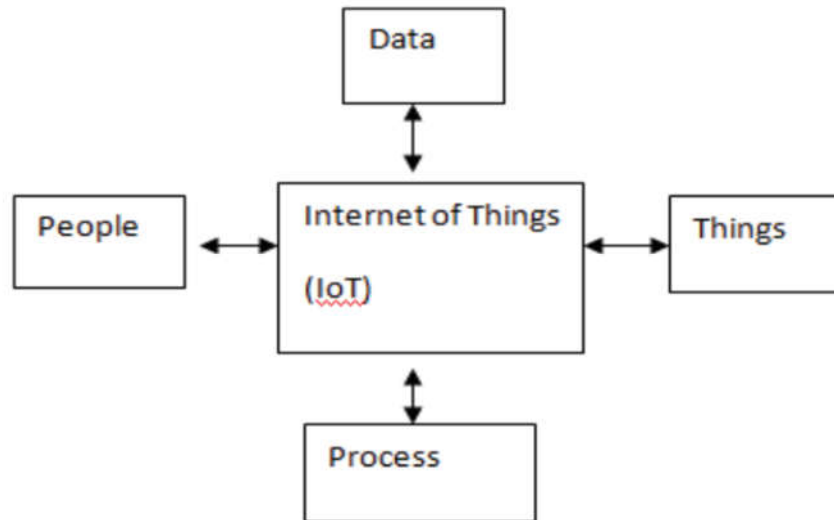


Fig. 1. Major Parts of IoT [1]

1.1 Method of Approach:

The approach applied in this paper is mainly focused on the below mentioned keypoints:-

1. The Study of Internet of Things(IoT).
2. Applications of IoT in Automotive Industry.
3. Advantages
4. Its concerns and challenges.

II. LITERATURE REVIEW

IoT altogether affects car industry. Car fabricating organizations, network access suppliers, and programming organizations are meeting up to assemble associated vehicle framework. Associating vehicle sets up correspondence between vehicles, with other vehicle gadgets. As of late there are exceptionally less vehicles which are web empowered yet it is normal that the number will rise significantly in under 10 years' time[2][3]. Infotainment alludes to a framework in vehicles that conveys a blend of diversion and data administration. Highlights of In-Vehicle Infotainment (IVL) framework are giving route highlights while driving, overseeing general media diversion content, conveying back seat diversion, availability with PDAs. [4].

Sensors like Gyroscope or direction sensor and accelerometer can be utilized to display the driving conduct. Utilizing PDA in vehicle, information from these sensors can be utilized to identify driving examples like sharp turns, abrupt speed increase, hard slowing down, floating and speeding. This method assists with sharing driver's data with insurance agencies for tweaked expenses.

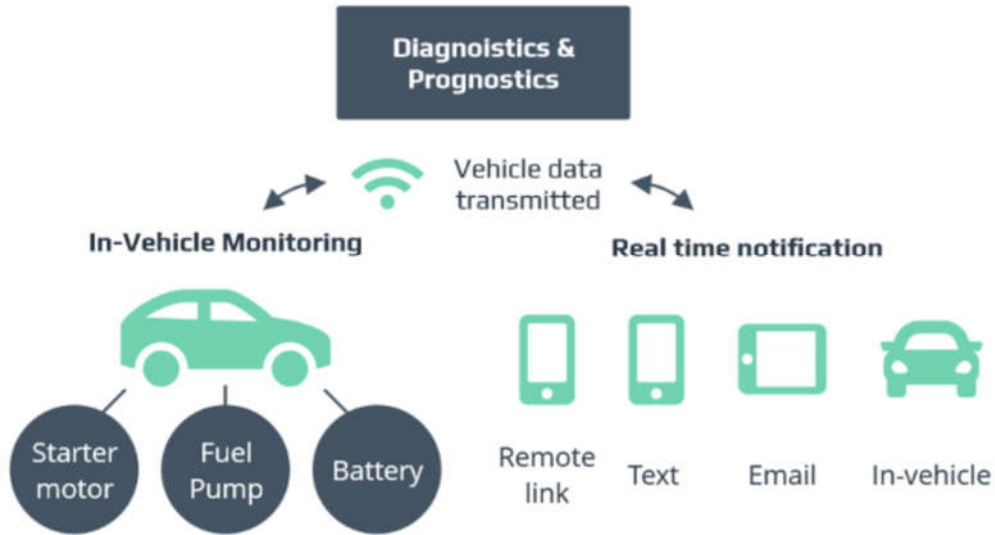


Fig. 2. IoT in Automobile

2.1 What is Internet of Things (IoT)?

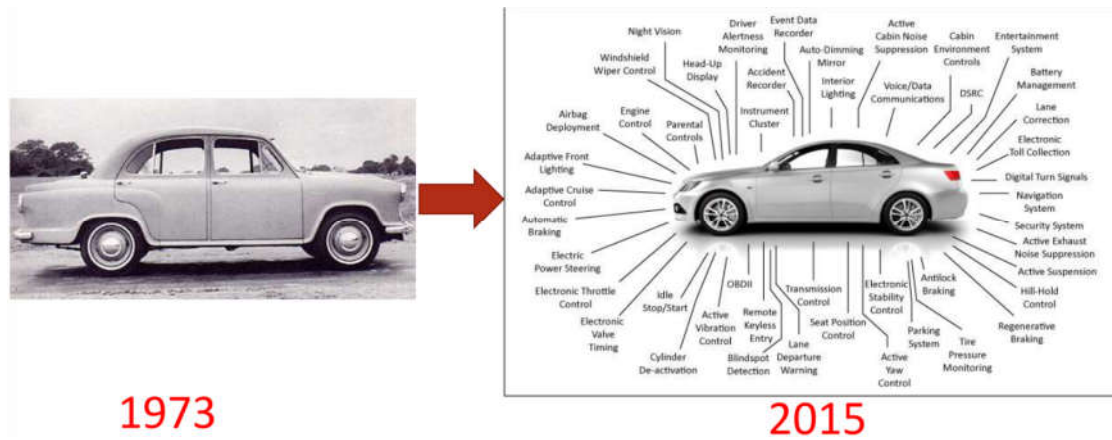
The Internet of Things (IoT) alludes to the billions of actual gadgets all throughout the planet that are presently associated with the web, all gathering and sharing information. On account of the appearance of super-modest CPUs and the universality of remote organizations, it's feasible to turn anything, from something as little as a pill to something as large as a plane, into a piece of the IoT. Interfacing up every one of these various items and adding sensors to them adds a degree of advanced knowledge to gadgets that would be generally imbecilic, empowering them to impart continuous information without including a person. The Internet of Things is making the texture of our general surroundings more intelligent and more responsive, blending the computerized and actual universes.

IoT plays an major role in automotive industry, because it makes the vehicle easy and safe to drive for oneself and for others too. IoT altogether affects car industry. Car fabricating organizations, network access suppliers, and programming organizations are meeting up to assemble associated vehicle framework. Associating vehicle sets up correspondence between vehicles, with other vehicle gadgets. As of late there are exceptionally less vehicles which are web empowered yet it is normal that the number will rise significantly in under 10 years' time.

2.2 Evolution of IoT in Automobiles

IoT plays an important role in automobiles if we consider the current scenario of the world where the accidents are very common due to the carelessness of the driver so to counter these issues there is the need of something that can help in decreasing the accidents for eg. Driverless Car, it is an smart car which drives between the two points with the help of sensors, cameras, radar and artificial intelligence with minimum human effort[5]. The first smart car developed around 23 years back in 1998 but was not succesfull. It is noticed that the idea is expediently gotten by the client local area furthermore, ventures to make the idea a reality. Since the origination of IoT in 1999, a long time 2005 and 2006 saw academician and ventures directing

meetings committed to IoT organization procedures. Remote correspondence is the principle turn of the wide utilization of IoT as of late[6].



1973

2015

Fig. 3. Evolution of Technology in Automobile

The excursion of remote correspondence norms from RFID to Wi-Fi to IoT in autonomous vehicles is fascinating. The scope of RFID and Zigbee is 10 to 200m and 1 to 75meters separately. Bluetooth turned into a norm in all versatile furthermore, electronic contraptions for savvy range correspondence inside 10 meters with a transmission capacity of 720kbps. The mass utilization of advanced mobile phones in 2012 market had a incredible effect on IoT applications [7].

Evolution of Connected Vehicle

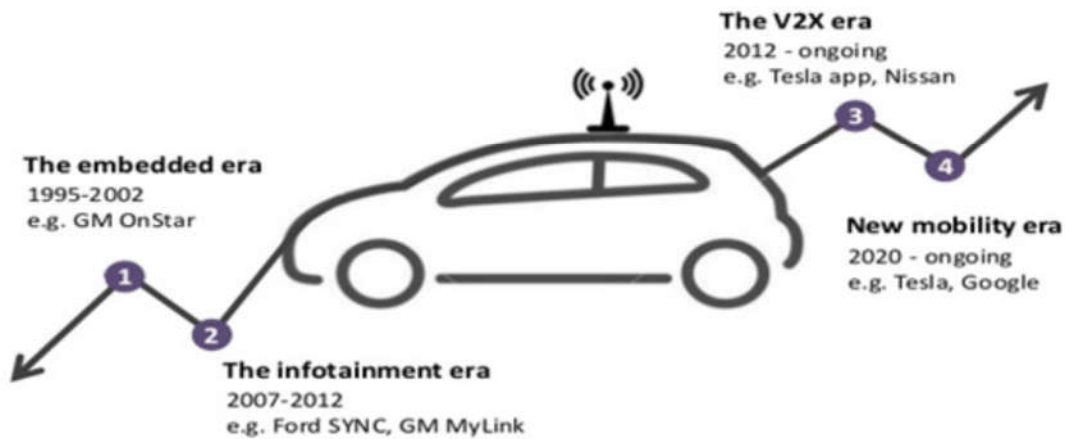


Fig. 4. Source: SimonNinan,2015;Edited by Dr. Kenny Huang

The justification this is essentially the simplicity of application improvement on advanced mobile phones for applications explicit plans. Wi-Fi is the speediest correspondence media accessible as on year 2015 with data transmission of around 11000 kbps. IoT is additionally seeing new and inventive application plan in interactive media correspondence. IoT is infiltrating in green registering, information mining and business information investigation, logical information examination in light of distributed computing stage accessible as a plan element [8].

III. ARTIFICIAL INTELLIGENCE (AI)

Without AI IoT is nothing, AI is an crucial part of the IoT. AI is the specialized stream of computer science which deals only with the machines than can think like a human, make decisions on their own and can speak like a human.

Artificial Intelligence word is made of two words Artificial which means that it is not real it is created by human and intelligence which means that they are intelligent enough to think and speak like a human[9]. AI is used in most of the fields from small to large size devices. When we use AI in vehicles then we call those vehicles as autonomous vehicles, smart vehicles or intelligent vehicles because now they has the ability to think like a human in various conditions and even the AI keeps learning with the usage habits of the users that makes it much useful by the passage of the time.



Fig. 5. Various uses of Artificial Intelligence [10].

IV. APPLICATIONS OF IOT IN AUTOMOBILE

There are various applications and uses of IoT in various fields but here we are going to discuss the uses and applications of IoT in automobile industry that what are the things that IoT can do in a vehicle and what kind of safety features it can provide. IoT can provide various features to the drivers like safety features, advanced information about the traffic and road conditions and many more when we implement it in the vehicles. Importance of IoT is increasing in vehicles from time to time. The IoT works with the improvement of horde industry-arranged and client explicit IoT applications. While gadgets and organizations give actual network, IoT applications empower gadget to-gadget and human-to-gadget connections in a reli-capable and powerful way. IoT applications on gadgets need to guarantee that information/messages have been re-ceived and followed up on appropriately in an ideal way. For instance, transportation and coordinations applica-tions screen the situation with shipped products like organic products, new cut produce, meat, and dairy nudge ucts. During transportation, the protection status (e.g., temperature, moistness, stun) is checked continually and fitting moves are made auto-matically to keep away from deterioration when the association is out of reach.

Today, clients of IoT gadgets can assess motor execution, control air temperature, and measure actual wellbeing pointers with a couple of snaps. By 2020 there will be in excess of 20 billion IoT gadgets being used. Car organizations and related organizations can presently don't stand to disregard the meaning of IoT in car.

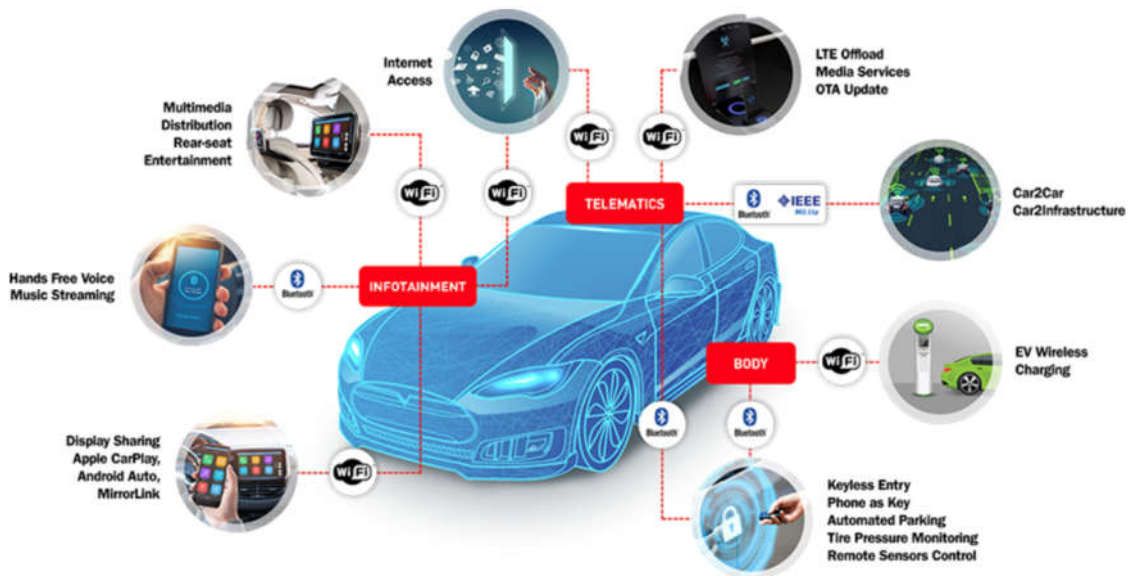


Fig. 6. Applications of Connected Cars

4.1. Connected Cars

In this day and age when everything is associated with the web why vehicles can't be associated with the web? Be that as it may, a vehicle can be associated with the web and when a vehicle interfaces with the web then it is known as the associated vehicle and it can speak with different vehicles which are close to it. Essentially an associated vehicle utilizes a remote neighborhood to interface with the web and it will assist the vehicle to impart the web to different gadgets which are outside or the gadgets that are available inside the vehicle. This innovation assists the client with performing different tasks like keyless section, GPS following of the vehicle, Engine on/off, etc. Associated vehicles are new-age vehicles that offer the client a lot of safety highlights and assist the client with keeping up his vehicle by giving warnings of support.

- a. **Vehicle to Vehicle:-** Vehicle to Vehicle is the method of correspondence that permits the vehicle to share information like speed and area with different vehicles inside the reach. It stays away from accidents and assists with giving the best approach to ambulances and fire engines like crisis vehicles.
- b. **Vehicle to Network:-** In this sort of method of correspondence a vehicle associates with the organization to alarm the driver about the terrible climate and impending traffic conditions or about a mishap which can assist the driver with settling on a choice of their decision. The driver can utilize his voice to work the gadgets present in the vehicle like music framework and route arrangement of the vehicle while driving.

4.2. Driverless Car

As the name recommends driverless which implies there is nobody present in the vehicle which can drive the vehicle in light of the fact that in the driverless vehicle no driver is expected to drive it, it drives itself with the assistance of installed sensors, cameras, radars, and GPS System[11]. Driverless vehicles are otherwise called self-governing vehicles. These vehicles fundamentally make a guide of the accessible things around it with the assistance of LiDAR and different sensors and Radar sensor assist the vehicle with keeping a mind the close-by vehicles or people. Cameras can recognize the impediment after and before the vehicle and can check the traffic lights and signs as well. LiDAR sensor assists the vehicle with ascertaining the distances. All the information accessible from the sensors and cameras are gathered and prepared by the virtual products preinstalled in the vehicle and afterward the information shipped off the actuator of the vehicle which controls the brakes, speed increase, and directing of the vehicle.

	Stage-0[12]	Stage-1[13]	Stage-2[14]	Stage-3[15]	Stage-4[16]	Stage-5[17]
Framework Capacity	Total human help required	Partial human help required			No human help required	
Execution of controlling and speed increase and Monitoring of driver climate	Driver required	Framework required	Control/Driver	Framework Control		
Manufacturer's	A 1967 Porsche 911[18]	Adaptive Cruise Control[19]	Tesla Autopilot[20], Volvo Pilot Assist, Cadillac Super Cruise.	Audi[21]	Google's defunct Firefly pod-car.	Waymo[22]

Fig. 7. Stages of Smart Cars require human assistance and the Manufacturer's[23]

This innovation is useful in light of the fact that the greater part of the occasions mishaps happens with the indiscretion of the drivers so this innovation will diminish the mishaps happen by the carelessness of the drivers.

4.3. Maintenance System

The vehicles that accompany the IoT gadgets preinstalled can assist the driver with keeping up his vehicle appropriately. Since this is the significant benefit of IoT in automotive is the prescient investigation. It can examine the state of the pieces of the motor with the assistance of the sensors present in the various parts by gathering the information and sharing it to the stage. After the handling of this information by specific calculations that can foresee the future parts of the segments dependent on its performance. IoT car upkeep framework additionally assists an individual with finding a way fundamental ways to forestall its vehicle parts from abrupt breakdown. Actually like dashboard markers of a vehicle, this framework alarms the driver about plausible breakdowns. Notwithstanding, the cautions are shipped off the driver's versatile, path before the issue even happens. This assists the driver with making practical and efficient strides to keep away from segment disappointment while driving.

4.4. In-vehicle infotainment and Telematics

In-vehicle Wi-Fi Capabilities controlled by 4G LTE association has empowered telematics highlights to IoT based car. Telematics alludes to the long transmission of mechanized information. By utilizing vehicular telematics a vehicle proprietor can keep a sharp vision see on its vehicle even from distant areas.

Through a cell phone empowered dashboard, vehicle proprietors can be guaranteed about its security, observation, and wellbeing consistently. Outer sensors and cameras monitor the vehicles' condition and send the information to a versatile application. Telematics framework alongside continuous ready framework sounds an alert in the proprietor's cell phone on the off chance that somebody attempts to powerfully enter the vehicle without legitimate access. The brilliant vehicle empowered with IoT likewise calls concerned specialists promptly like emergency vehicle or firemen in the event of a crisis.

Wi-Fi abilities have additionally brought about brilliant infotainment frameworks alongside other shrewd vehicle highlights. The proprietors can associate diverse gear like music framework and GPS in a vehicle with their cell

phone and work them indirectly. Right now, there are different in-fabricated and outsider applications that an individual can use to interface his vehicle with versatile[24].

Voice order availability in these application permits an individual to play its number one music, transfer a video, or go to calls without making the slightest effort. The GPS and GNSS framework in the infotainment frameworks additionally offers locally available route and far reaching data about close by petroleum siphons, eateries, and different places of interests.

4.5. Fleet Management

Fleet management is the new technology that comes across the automobiles in a recent few years. It helps the companies to arrange and get in contact with vehicles with the objective to improve efficiency, reduce costs and provide compliance with local government regulations. GPS positioning systems are also used to track the vehicle and other tracking systems are also used to monitor the driver behaviour and proper vehicle use. Fleet managements assists the organize in:-

1. Keep a eye on the real time location of the fleet.
2. Time and driver assistance and management.
3. Keep a check on the road conditions.
4. Weight/Volume monitoring of cargo in the fleet.
5. Truck's working condition and fuel and mileage information.

V. ADVANTAGES AND DISADVANTAGES OF IOT

5.1 Advantages of IoT

1. IoT provides a lot of software and hardware that makes the vehicle more attentive and is more aware of the surrounding around it.
2. IoT will definitely increase the efficiency of the vehicle by giving alerts and notifications of maintenance to the driver.
3. IoT will help the person to easily locate the vehicle remotely in case of vehicle theft.
4. Fleet management helps the organize to keep a check on the fleet, driver behaviour and vehicle condition.
5. It will alert the driver about the road condition, give advanced weather forecast and traffic conditions which will save a lot of time of the driver.
6. It will help in the easy parking of the car with minimum human effort.
7. With the use of IoT the number of accidents has been reduced in the recent few years.

5.2 Disadvantages/Risks of IoT

There are some disadvantages or we can say the risks associated with the use of IoT in the vehicles. Below are the some risks associated with IoT:-

1. Because the car is connected to the internet there is a chance of car hijacking or a certain device hijacking.
2. Autonomous cars stay connected to the internet all the time and there are too many sensors which means that there are more potential surfaces exposed to hackers, with that, privacy concerns are there.
3. If there is any loophole in the system of the autonomous car then cybercriminals could exploit it and can take advantage of it.

4. With the increasing use of mobile applications to control the autonomous cars there is the chance of apps vulnerability that if a hacker gain access of the app then he can gain access of the car. On the off chance that the self-sufficient vehicle is electric, programmers could even deliver it stable by depleting the battery.

5. Because autonomous car manufacturers rely on third party sellers for the software and hardware so there is a chance of supply chain vulnerability.

CONCLUSION

Although there are many benefits of IoT in automotive industry but there are some limitations of the technology, so to overcome these issues more developments are required in this field like in driverless car there is a probability that a car can meet with an accident so to avoid this more security features are required and how the software processes the data should be analyzed. Basically the autonomous cars are going to be the future of the automobile industry because there are lot of features and advancements that only IoT can provide. Smart vehicles made the life of human very easy by providing easiness in driving and giving much more benefits like security features, traffic condition and weather forecast.

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