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Internet of Autonomous Vehicles
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Internet of Autonomous Vehicles

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***Abstract*— With an increasing number of drivers, road safety is becoming a greater concern. To increase safety, car makers have begun to include various sensors to assist drivers in parking, emergency breaking, adaptive cruise control, etc. Even with this technology, a driver cannot know the intentions of surrounding drivers. Communication between vehicles locally and via the internet are key components to creating fully autonomous cars. Sharing information simultaneously between moving vehicles and the internet is difficult. This paper discusses methods of creating a network, known as the Internet of Vehicles, for effective communication between vehicles. This paper also discusses few challenges encountered in implementing such a network. In addition to challenges, results from recent advancements in this field are discussed. With this network implemented, transportation via autonomous cars will become safe, fast, and comfortable.**

***Index Terms*— Autonomous vehicles, internet of things, internet of vehicles, smart grids, vehicular ad hoc networks, vehicle to vehicle, vehicle to infrastructure**

I. Introduction

THE number of vehicles and drivers in United States is increasing every year. As a result, the probability of a traffic jam or an accident increases. The traffic jams and crashes are caused by lack of information drivers have of their surroundings. Roughly 16,000 crashes occur everyday in the US because of the lack of information [1]. To keep drivers informed, automakers have included various technologies in vehicles.

Automakers have equipped vehicles with lane assist, blind spot assist, auto-park assist, etc. These features communicate with the drivers and inform them of their surroundings. Information is vital to drivers because it allows them to better judge the situation [1]. For example, consider a law and order judge making an important decision on a case. The judge can make a better decision if a great amount of information is provided for the case, which can prevent an innocent person from going to jail. Similarly, information of vehicles' surrounding can aid drivers make better decisions, which can prevent accidents.

The various technologies in vehicles mentioned earlier are not always effective. Full attention of the driver is still needed [1]. As a result, automakers, like Tesla, have started to make autonomous vehicles. Unlike drivers, who can get distracted, autonomous cars are constantly processing and using data to center the car in lane and adjust speed depending on traffic. However, current autonomous cars don't communicating with other vehicles [2]. The lack of communication between cars can lead to accidents.

Internet of Vehicles (IoV) model is one way of bridging the communication gap.

The Internet of Things (IoT) is becoming prominent as the number of devices that are capable of connecting to the internet increases. The idea of IoT comes from smart devices connected to the Internet that communicate with each other with minimum human input. An excellent example of IoT is a house where devices such as smart thermostat and security cameras are installed. A smart thermostat could be set up to turn on an air conditioner to desired settings when a person is near their house. The smart thermostat knows the persons location via their smartphone, which now a day almost everyone keeps on them. This set up will keep functioning long as the smartphone and the smart thermostat are connected to internet. With a smart thermostat, the house temperature will be set to a users comfortable setting long before the user has entered the house. Similarly, a security camera that is connected to the internet can be set up to notify a person via their smartphone if it detects any movement. The nonfictions can be very helpful because it informs a person of any suspicious activity happening inside or outside of their house. With this information, the person can take proper precaution. Both the smart thermostat and the security camera are designed to ultimately make a persons day to day life easier.

The Internet of Things is not just a house with smart devices installed. It can be applied to many things. Fig. 1 above shows an illustration of devices that are used regularly in our day to day life. While Fig. 2 shows how IoT can be broken apart into smaller sub categories.

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Internet of Vehicles (IoV) is derived from the Internet of Things concept. In the IoV model, autonomous vehicles will be communicating with each other via the Internet, like the way devices communicate in IoT. However, IoV is more complex and difficult to implement. Since there will be very minimum user input, the autonomous vehicles must efficiently communicate with each other to maintain a steady traffic flow. The interesting aspect of vehicular network is that vehicles3 will be sharing valuable information. In the case of an accident, the first vehicle to encounter the scene will share the information it collected with nearby vehicles. With this information being spread out, vehicles can navigate to an alternate path and keeping the traffic jam to minimum. This information can also indicate vehicles near the accident to clear a path for any law enforcement vehicles, ambulances and fire trucks [1].

To create a massive network of IoV, communication between vehicles is very important. There are many challenges that currently face IoV. However, this paper focuses on couple of communication challenges. One, autonomous vehicles must be equipped with sufficient sensors and communication devices. Two, the vehicular network needs to efficiently manage and share information between vehicles. The IoV combined with autonomous vehicle will lead to safer, faster, and more comfortable vehicle transportation.

II. Materials and Methods

Artificial Intelligence can be used for many components that make up an autonomous car. However, since there are a lot of components, this paper focuses on summarizing path planning and vehicle detection.

III. Conclusion

In conclusion, the feature of Artificial Intelligence in autonomous cars seems promising. Each component in the cars will have use of AI. Path planning and vehicle detection are only couple of the component that already use AI. However, they are not perfect and are being constantly improved. AI for autonomous cars is an important area to research because its market is growing. Ultimately, fully autonomous cars will make everyones day to day life easier and safer.

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