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THE NECESSITY OF 5G FOR AUTONOMOUS VEHICLES

This article shows advantages of 5G and developing self-driving cars when we can widespread use of 5G.

INTRODUCTION

With the development of 5G technology, autonomous vehicles have once again become the focus of attention.

I. OVERVIEW AUTONOMOUS VEHICLES

The degree of automation can be classified into 5 levels. Undeniably, as a cutting-edge brand, Tesla's products have approached level two and are striving towards higher levels of autonomous driving, but there is still a big gap from level three. This is because our eyes must be firmly fixed on the road ahead in order to take control of the vehicle in the event of an emergency.

In order to achieve higher levels of automation, the complementary technologies of Laser Rangefinder, HD Map, and Short-Range Communication are needed to replace the most important human abilities of vision, perception and judgment. 5G or the next-generation 6G makes it possible.

II. LASER RANGEFINDER

Compared to various mainstream cameras or radars, the Laser Rangefinder used by Google is currently the most reliable [1]. Laser Rangefinder can accurately detect the distance and outline of every object in the environment, and even operate in low-light conditions. However, the detection distance of the omnidirectional laser scanner used in cars is much worse than that of the human eye. Laser Rangefinder alone are not sufficient to achieve the goal of fast and safe autonomous driving.

III. HIGH-DEFINITION MAP

Taking commercial GPS as an example, its accuracy unit is approximately 5 meters, which is insufficient for autonomous vehicles. A HD Map is a database that stores maps with an accuracy unit of centimeters, which includes altitude. If the map is completely correct, all dangers will be displayed, and speed can be unrestricted. Laser Rangefinder detects that the environment it scans does not match the data in HD Map, it will activate a voting mechanism where subsequent cars will focus on scanning that specific area to decide if update of that part of the cloud data. The map needs to be updated in real time, so offline maps are not suitable. The amount of data in HD Map is so huge that it cannot be used with 4G, that's why it is necessary to use 5G or 6G.

IV. SHORT-RANGE COMMUNICATION

If communication and interaction cannot be established with other vehicles, the speed of map updates may not be sufficient to avoid objects. Therefore, autonomous vehicles need to have social attributes like bees and ants. C-V2X which is completely developed based on the 5G network can be used in connect vehicle with other devices. Vehicle to Vehicle (V2V) enables cars to exchange accurate HD maps with each other, improving efficiency and reducing the need for 5G base stations, even in tunnels or areas with poor 5G coverage [2]. Vehicle to Pedestrians (V2P) can enable vehicles to avoid pedestrians more safely, while also allowing the vehicle to automatically locate its owner. To enable vehicles to distinguish between countless people, mobile phones can be used as a medium. The mobile phone is a device that has multiple sophisticated sensors integrated into it. GPS can get the location of pedestrians. The barometric pressure sensor measures the pedestrian's altitude, thus determining whether the pedestrian is on the street or in an underground passage.

V. CONCLUSION

In order to achieve the ultimate goal of Level 5 autonomous driving, 5G communication technology needs to integrate with other technologies. When the artificial intelligence serving autonomous driving technology becomes smarter, the ethical judgment system becomes more accurate, high-precision map resources are more abundant, C-V2X technology becomes more mature, the coverage of 5G networks becomes wider, regulations become more open, and a series of other issues are improved, more and more cars supporting this system will become more and more popular, and even more advanced Level 4 and 5 autonomous driving systems will arrive. At that time, cars may usher in their next form.

1. Waymo Driver [Electronic resource]. - Access mode: https://waymo.com/intl/zh-cn/waymo-driver/.

2. NHTSA Report: "Vehicle-to-Vehicle Communications: Readiness of V2V Technology for Application".

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