1. What does it do?

Over the last two decades, autonomous vehicles have advanced tremendously and are regarded as the most promising industry for addressing numerous traffic challenges. Many large corporations, such as Google, Tesla, and others, are applying the abundant of high-tech engineering to emulate for the largest segments in autonomous vehicles market.

- Auto Pilot was introduced in Tesla car models during a conference in 2016, and Elon Musk stated in July 2020 that they will have the minimum capabilities for Level 5 autonomy by the end of this year; however, Tesla vehicles still only have SAE level 2. This means that Tesla's technology necessitates ongoing driver monitoring, even if the assistance features handle some of the steering and braking. (Inverse - 10.26.2021)

Figure 1: Sensor technology on Tesla, by Automa

- On the other hand, Waymo, Google's parent company, has successfully established self-driving taxi services in California with level 4 SAE (High Driving Automation), which means it can operate without driver supervision and in certain weather and terrain situations. However, outside of their test areas, the technology that powers them is not yet suitable for mass-market use. This is mainly because while Tesla vehicles rely solely on cameras and ultrasonic sensors, Waymo's hardware is far more robust than Tesla's. It employs a number of redundant sensor systems, including lidar, radar, updateable HD maps and cameras, to produce a real-time picture of its surroundings. The company also maps places ahead of time by manually driving the cars through them. (Rani Molla - Oct 6, 2021)

Figure 2: Sensor technology on Waymo, by Automa

Beside the technology, internal and external experiences are also required to be consider. The companies not only need to satisfy the AV customers experience but also need to care about other drivers and pedestrians.

The mass development of technology has brought us closer to fully autonomous vehicles and I think it is possible to reach SAE level 5 in the near future for the autonomous vehicles:

- AI plays the most vital role in the development of full driving automation; consequently, when vehicles achieve SAE level 5, they will no longer require the accelerator and brake pedals; instead, AI will fully control the vehicle and operate it smoothly on any type of road.

- Vehicle sensor technology, such as laser radar or LiDAR systems, is expected to be the new cornerstone of self-driving vehicles. Laser radar works in conjunction with other sensors such as cameras, ultrasonic, and long-range radar to assist cars and trucks in navigating their surroundings. (Ann Neal - Apr 24, 2018)

- Smart roads necessitate smart vehicles. The wireless transmission of data between automobiles and road infrastructure is known as vehicle-to-infrastructure (V2I) communication. Sensors embedded in road markings, intelligent traffic light systems, intelligent speed bumps, and communication with traffic signals are all part of the process of optimizing our path to autonomous driving. (Rgbsi – n.d)

- The onboard censors will be unable to detect moving objects hidden behind buildings or other cars, especially at intersections where hundreds of vehicles pass every day. To improve the

quality of the AV, companies must also install road censors to support autonomy in specific blind spots for safety.

- Standard GPS is accurate to within a few feet, but that is insufficient for autonomous navigation. Industry participants are working on developing dynamic HD maps that are accurate to within inches, giving the car's sensors almost everything on the road. For example, the HD map knows the exact location of the traffic sign, as well as its size, position relative to the road (left, above, right), color, category, sub-category, and text. (Vincent Demuynck - Dec 19, 2019)

- Advanced drive Assistance systems (ADAS): is a system that can improve driver safety by detecting weariness and alerting you when your attention is no longer fully focused on the road. Some technologies, for example, can detect indicators of tiredness in the driver. The technology will notify the motorist, allowing incidents to be avoided. (Intertraffic - 10 August 2020)

2. What is the likely impact?

Potential of this development:

- Full autonomous vehicles will allow passengers to travel without any contact with the steering wheel or pedals, and with the technology, it will be able to operate accurately and in accordance with road signs. This can assist automobiles in adhering to speed limits and causing fewer accidents while going overland. Furthermore, many car accidents occur as a result of the driver tiredness, misoperation, dangerous driving or having consumed alcohol prior to driving, and the AV would resolve these issues, allowing individuals to get home safely.

- The majority of enterprises producing AV are embracing electric vehicles since cameras and censors require a large amount of electricity, which the batteries in AV can completely respond to, resulting in decreased carbon dioxide emissions into the environment. Furthermore, decreased usage of fossil fuels reduces the quantity of exploitation of it, which does not impact the surrounding environment.

What is likely to change: The development of AV is not only bring better living conditions to the people worldwide but also change they awareness about electric vehicles and protect the environment. The autonomous vehicles will be far safer than vehicles driven by humans for they are programmed to identify and respond to traffic signals, signs, pedestrians, and enhance occupant' internal experience. AV cars emit no pollutants to the environment and provide peace and quiet while traveling, resolving noise pollution included.

Change of world: It will be an opportunity to fully automate taxi systems, which Google has previously established and is running for the public in California State beginning in 2020. Traditional taxi drivers and other chauffeurs may lose their jobs if this technology is used for

communal services; thus, people will be more excited with an AI driver rather than the common ones for it bring novel experience and privacy environment inside the vehicles. In addition, Traditional taxi firms will lose their taxi market share to large technology syndicates with driver-less taxi systems.

3. How will this affect you?

In my daily life, having an AV is extremely convenient for my trip; with self-driving vehicles, I will not have to worry about the distance that I have to drive, which will not cause any fatigue and tension. Driving in Ha Noi at rush hour is especially inconvenient; it typically takes hours to go to my house at that time, so if I had an AV, it would transport me home and all I would have to do is sit and relax. Furthermore, using Google Maps while traveling might be inconvenient because it can distract me from driving, and it is not always correct on every route. Av can solve this problem because it uses HD dynamic maps and has various censors that allow it to send me to any area without infringing traffic regulations.

After every party, my father typically can't drink much alcohol because he has to drive and having an alcoholic while driving is risky because it not only causes dangerous scenarios but also causes police to arrest and revoke the driver's license. Furthermore, having an AV can cut the money spent on private chauffeurs for my family and my father's company, which can save a great amount of money annually.

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