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Artificial Intelligence in Autonomous Vehicle

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A B S T R A C T

Application of Artificial intelligence in automobile industry is one of the greatest invention in the modern World. Although it faces a lot of irregularities and challenges, the R&D temas in this autonomous vehicle filed works really hard to make it happen. Today we can able to achieve a certain level of automation in automobile filed. Some of the major companies include Tesla, GM,Fordetc works and implement this ideas in their vehicle and running into success.As it faces many challenges including security, safety, privacy issues etc.. we can wish it could be rectified and build a revolutionary world with this automation techniques.

Keywords: Artificial Intelligence, Automobile industry, Tesla, GM Ford

1. Introduction

The possibility of autonomous vehicles started becoming possible that is real. Although it may face many challenges, autonomous vehicle will surely become a reality but it takes a lot of years as it is not easy to manufacture autonomous vehicles. It uses the principle of artificial intelligence. Many AI algorithms are used for developing such vehicles. A number of tasks must be performed by Autonomous vehicles as these vehicles need to collect many important Datas, plan and execute their trajectory and many more.

Replacing the human driver car to autonomous vehicles is not a little thing. Many challenges faced by such vehicles must be overcomes to make it a reality. Autonomous vehicle industry is a fast-growing industry. Artificial intelligence plays a major role in developing self-driving cars. Many AI algorithms should be implemented for manufacturing such autonomous Vehicles. Path planning is one among the major task where AI is used. It works with the help of navigation systems. AI has to interact with sensors and want to use data in realtime. This is one of the main challenges faced in developing such self-driving cars, also some AI algorithms are hard to use with CPU having speed and memory restrictions. Safety of the passengers is also important while using these cars for these modern vehicles uses real-time systems. Also, electric vehicles depend on the charge of the battery hence more power is used in using such vehicles. We can have secure transportation as AI becomes far better in future years. It is impossible to solve a big problem easily.So, the manufactures have divided the problem into smaller pieces and are working on them to achieve this goal.

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2. Self Driving Cars

Self-driving car (Autopilot) also known as autonomous vehicle, is a vehicle which is capable of moving safely by sending its environment and surrounding with little or no human contact. Autopilot is a mode which is available in self driving cars which enable the car to steer, accelerate and brake automatically.These types of self-driving cars have various sensors to sense their surroundings for processing its path. These include radar, sonar, lidar, GPS, odometry and internal measurement units. Also, advances control systems help to identify the appropriate navigation path to drive forward by overcoming the obstacles on the road. Tesla plays a big role in changing the image of self-driving autopilot vehicle in the business market. They provide the most advanced and safe autopilot program in all their cars.

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Levels of driving automation

There are 5 levels of automated driving:

Level 0:In level 0, there is actually no automation present. Here the system shows some warnings and signals only which assist the driver.

Level 1: In Level 1, the driver and the automation system share a little control of the vehicle. For e.g., Cruise control, which can maintain the speed of the vehicle to a constant.

Level 2: In level 2, the automation system takes a partial control of the vehicle. In this level, the vehicle can perform steering and acceleration but only in the presence of a driver.

Level 3: In level 3, a conditional automation of vehicle is taken by system. Here, the system is capable of performing most driving tasks, but a human override is still required.

Level 4: In level 4, a high automation capability of the system presents. Here, the vehicle can perform almost all driving tasks under a specific circumstance. Here, the humans override is an optional.

Level 5: Level 5, is a full automation level in which the vehicle performs all driving tasks under all conditions. No human attention is required in this level.

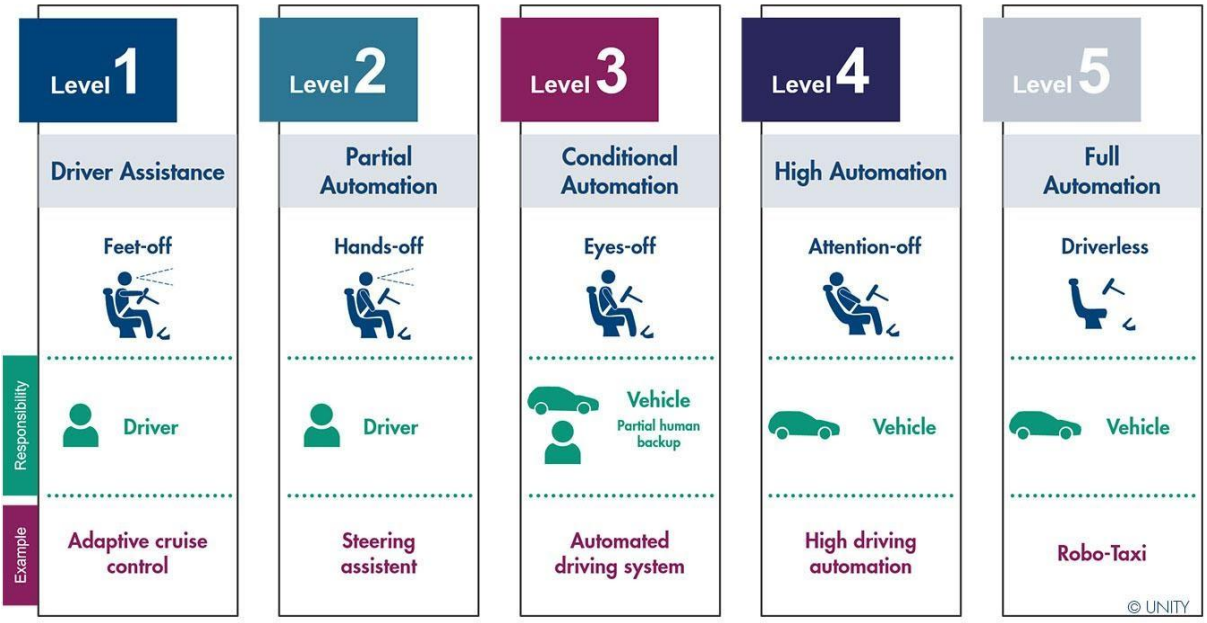

Fig-1.Level of driving automation

4. AI in Autonomous Vehicles

According to human perspective, one should stop the car at a red light or wait for a pedestrian. These decisions are quickly taken from our memory on building an autonomous vehicle, these decisions are quickly made by an Artificially created memory. That can be achieved by providing these vehicles with sensors, memory**,**.decision-making, logical thinking which makes them capable of driving like a human being**.**

4.1Perception Action Cycle in Autonomous vehicle

There exists a repetitive loop, which is called **Perception Action Cycle**, which is created, when the AI system of an autonomous car works. These are created when the AI collect the environment Datas, which are sufficient for the running of these cars. These loops help to make decisions and enable the vehicle to perform specific actions. These Perception Action Cycle consist of mainly 3 components.

- In-vehicle data collection and communication system
- Autonomous driving platform
- AI-based functions in autonomous vehicle

These 3 components are capable for sense, process and provide output for the working of an autonomous vehicle. These create an environment for running of a car by sensing the surroundings by different sensors, sending the signals to the action center where the processing take place and then provides the output to the vehicle to perform regarding to the external environment.

These flows of controls are taken care by providing different algorithms. Wide varieties of AI algorithm are used for the proper functionalities of these systems. These data flow can be easily understand by the following figure.

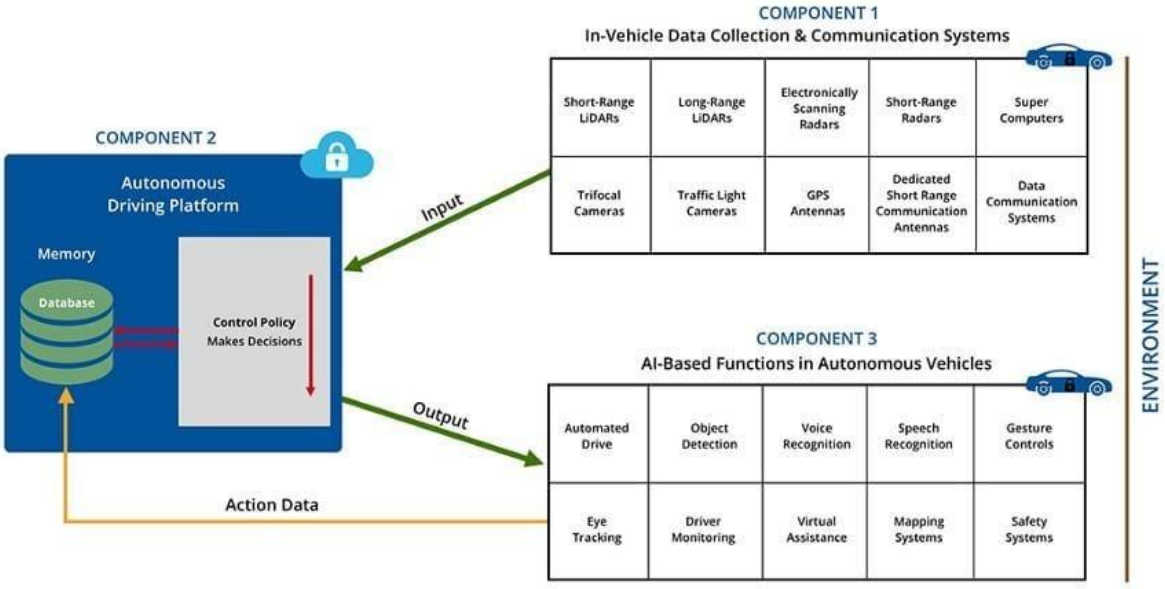

Fig .2-Perception Action Cycle in Autonomous vehicle

5. Advantages of Automous Vehicles

- Autonomous(Autopilot mode) can ensure greatest safety. A recent study claimed that 94% of accidents are occurred by human error. Hence the autonomous safe travelling.
- The application of AI can improve inter connectivity of transportation.
- Autonomous system can reduce pollution and better full efficiency unlike human driving method, application of different driving ergonomics algorithm can reduce the amount of pollution andemission of car, and can improve fuel efficiency which results eco friendly driving.
- Improve greater mobility options such as providing easy and safest transportation facility for young, old, and even for disabled user
- Automation system reduce maintainces and cost of vehicles since it drivers by the condition of its environment, the system are capable od drive itself without making damages to the vehicles on road hence, it reduce the maintainace and service cost of the vehicle.

6. Limitations of Autonomous Vehicles

- Since the automation system are under development, this system will cost a lot of money which make it very expensive to have in a car.
- Even though the vehicles are run by refined algorithm, there is a chance for occurring malfunctions and can cause accidents on road. This can only overcome by heavy researches and development.
- Security and privacy since these autonomous vehicles need to collect data and receive data, its need to have online connectivity which can be get hacked or attacked, which may cause several pproblems

6.Conclusion

The idea of self driving cars are achieved only upto a certain level of automation. The researches and development teams in this field are working to achieve the level of 5th automation system ,where no steering or presence of human is required for the driving of a car. There are lots and lots of challenges to overcome to achieve this task. Top automotive vehicles brands such as Tesla ,GM, Ford are working on their vehicles to improve the performance and quality regarding with the automation system. This can be created a huge revolution in the future world.

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