SELF-AUTOMATED CARS AND THEIR FORENSIC CHALLENGES

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INTRODUCTION

We, humans, have been constantly evolving with the help of technology. In the current era of digitalisation, this process is taking place at a rapid rate. There are multiple innovations taking place in all fields, including the medical and pharmaceutical industries, banking sectors, and automobile industries. One such innovation of the automobile industry is Self-Automated Vehicles (SAVs) which is witnessing constant upgradation with the improvement of technology.

KEYWORDS: Working of Self-Automated Vehicle (SAV); Progression by leading companies; Forensic challenges

Fig 1. An illustration of a self-driving car

An autonomous car is a vehicle capable of sensing its environment and operating without human involvement. A human passenger is not required to take control of the vehicle at any time, nor is a human passenger required to be present in the vehicle at all.

An autonomous car can go anywhere a traditional car goes and does everything that an experienced human driver does.

The Society of Automotive Engineers (SAE) currently defines 6 levels of driving automation ranging from Level 0 (fully manual) to Level 5 (fully autonomous). These are:

- NO AUTOMATION: The human performs all driving tasks (steering, acceleration, braking, etc.).
- DRIVER ASSISTANCE: The vehicle features a single automated system (e.g., it monitors speed through cruise control).
- PARTIAL AUTOMATION: The vehicle can perform steering and acceleration. The human still monitors all tasks and can take control at any time.
- CONDITIONAL AUTOMATION: Environmental detection capabilities. The vehicle can perform most driving tasks, but human override is still required.
- HIGH AUTOMATION: The vehicle performs all driving tasks under specific circumstances. Human override is still an option.
- FULL AUTOMATION: The vehicle performs all driving tasks under all conditions. Zero human attention or interaction is required.

WORKING OF SELF-AUTOMATED VEHICLES (SAVs)

Autonomous cars create and maintain a map of their surroundings based on a variety of sensors situated in different parts of the vehicle. Radar sensors monitor the ultrasonic sensors in the wheels to detect curbs and other vehicles when parking position of nearby vehicles. Video cameras detect traffic lights, read road signs, track other vehicles, and look for pedestrians. LiDAR (Light Detection and Ranging) sensors bounce pulses of light off the car's surroundings to measure distances, detect road edges, and identify lane markings.

Sophisticated software then processes all this sensory input, plots a path, and sends instructions to the car's actuators, which control acceleration,

braking, and steering. Hard-coded rules, obstacle avoidance algorithms, predictive modelling, and object recognition help the software follow traffic rules and navigate obstacles.

PROGRESSION BY LEADING COMPANIES

A. Cruise: Cruise is a self-driving automobile firm based in the United States. Cruise introduced Origin, a completely autonomous automobile with no steering wheel or pedals, in January 2020.

B. Waymo: Waymo was started in 2009 as a driverless car technology business. The initiative, developed by the internet giant Google, aims to offer driverless automobiles. Its self-driving cars have travelled 20 million miles and are close to Level 5 autonomy. One billion simulated miles of test driving were done by Waymo cars in 2016.

C. Ford aimed to have a fully autonomous vehicle on the road by 2021. Ford planned to launch its self-driving business in 2022 with vehicles based on the Ford Escape Hybrid crossover.

D. Audi stated that it would deploy a level 3 vehicle by the end of the year 2017 and a highly automated vehicle by 2020. According to the corporation, the company's autonomous automobile would make use of NVIDIA's AI (Artificial Intelligence) technology. The new system, known as Autonomous Intelligent Driving, is used across the whole Volkswagen brand. In 2018, Audi unveiled the second-generation Q3, a larger, more comfortable vehicle with the ability to operate partially autonomously. Audi then partnered with Cognata Ltd, a maker of systems for autonomous vehicle simulation, to hasten the development of autonomous vehicles.

E. Huawei: The Chinese telecom giant, Huawei, has shifted resources in recent years to the creation of autonomous vehicles. In October 2018, Huawei declared that it would work with Audi to create self-driving technology for cars sold in China. The partnership will concentrate on creating so-called Level 4 technology, which is a car that drives itself from beginning to end inside a specific area as specified by the

Society of Automotive Engineers.

F. In 2016, Apple revealed for the first time that it is developing autonomous automobiles. In California, Apple boasts the third-largest fleet of self-driving test vehicles.

G. By 2030, Kia, a division of Hyundai Motors, wants to market a completely autonomous vehicle.

FORENSIC CHALLENGES

Fig 2. Image shows the various possible entities that could be liable when an accident occurs by an SAV

AV forensics framework imposes several unique challenges for forensics investigation. The significant challenges of AV forensics are:

- Huge amount of data: An AV generates a huge amount of data each day. In each second, radar and ultrasonic sensors generate 10-100 KB (Kilobyte), GPS (Global Positioning System) generates 50 KB, cameras generate 20-40 MB (Megabyte), and LiDAR generates 10-70 MB data. On average, an AV generates 4000 GB (Gigabyte) of data each day. Such massive amounts of sensor data impose challenges in AV forensics.
- Log accessibility: Proper access control of information and logs collected from AV is essential. The developers of AD (Autonomous Driving) systems and the investigators should be able to access the low-level information. However, any third-party malicious entity should not

be able to extract any meaningful data from the logs.

- Evidence Examination: An AD system may generate a considerable number of logs due to dynamic road scenarios. The investigator may face challenges in correlating the logs of different AD modules to extract crucial information as all the AD components work together. The investigator also must be able to construct the proof in front of the court.
- Evidence integrity: Current event data recorder systems installed in the AVs do not ensure the integrity of the collected data. A dishonest party can manipulate the data before presenting it as evidence. Hence, the integrity of the collected data is essential and challenging in AV forensics.

CONCLUSION

As technology expands throughout the world, self-driving cars will become the future mode of transportation universally. The legal, ethical, and social implications of self-driving cars surround the ideas of liability, responsibility, and efficiency. Autonomous vehicles will benefit the economy through fuel efficiency, the environment through reduced carbon emissions, society through more togetherness, and the legal system through a simpler system. As technology advances, the security technology regarding self-driving cars will also continue to grow to combat hackers, improve the accuracy of internal systems, and prevent accidents.

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