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Problems in Autonomous Driving System of Smart Cities in IoT

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ABSTRACT

This paper focuses on the problems & challenges during self-driving. In the modern era, technologies are getting advanced day by day. The field of smart city has introduced a new technology called "Autonomous Driving". Autonomous driving can be defined as Self-Driving, Automated Vehicle. Google has started working on this type of system since 2010 and still in the phase of making changes in this technology to take it to a higher level. Any technology can reach up to an advanced level but it cannot provide a full-fledged result. This paper facilitates the researchers to understand the problems, challenges & issues related to this technology.

KEYWORDS: *Autonomous driving, self driving, automated vehicle, Smart city, IOT*

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1. INRODUCTION

1.1. Autonomous driving

Automobile field is becoming advanced from the past decades and focuses more on the safety, comfort. The researchers are interested to do research in automobile field to make the vehicles automated. The research is started in this field by Google since 2010. Google is working on this and the first innovation is Google-Waymo. Waymo is started as a self driving car project in 2009.

Some Companies are working with the technologies like- Google: Waymo:-Self driving subsidiary, Tesla: Tesla Autopilot, Baidu: Developing Level 4 automation, General Motors: Developed first production, Toyota: Working with UBER-Autonomous Rideshare, Ford: Planning to release fully autonomous vehicle in 2021, BMW: Working with Intel & Mobileye to provide a driverless car till 2021.

Automated vehicle or Self driving system can be defined as a vehicle which is capable of automated driving. The components included in automated vehicle are Data Storage, Drive-by-wire, Power, Sensors, LiDAR, RADAR, Ultrasonic, Software.

1.2. Automation Levels of Autonomous cars

Self driving has been started from 0th level & rised up to 5th level by performing research execution of previous level. Then they moved to the further level by learning errors of previous level and by finding the solution for those errors.

This level of hierarchy can be understood by the following Figure:

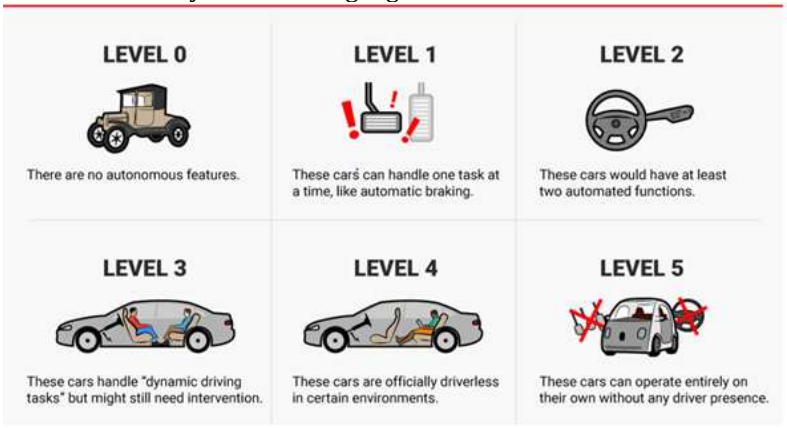


Fig1: Automation levels of Autonomous cars [Source: SAE International]

These are the levels of automated driving technologies but still it has some issues. This paper covers all the issues regarding self-driving technology.

2. Literature Review:

According to Marlon G. Boarnet (Ross, 2014, p. 90), a specialist in transportation and urban growth at the University of Southern California "Approximately every two generations, we rebuild the transportation infrastructure in our cities in ways that shape the vitality of neighborhoods; the settlement patterns in our cities and countryside; and our economy, society and culture" and as many believe, autonomous driving cars are this new big change everyone is talking about. (Reference: A Review and Analysis of Literature on Autonomous Driving, *Juan Rosenzweig, Michael Bartl,* THE MAKING-OF INNOVATION, E-JOURNAL makingofinnovation.com, OCTOBER 2015,pg:1)

The author of the research paper on autonomous vehicle & augmented reality Dr. Yusuf Uzun stated that "how the outside world is perceived with AR technology to make the passengers traveling in the vehicle feel safer".

In publication of IOP Conference Series: Materials Science and Engineering, there is a paper of Barabas which is concluded the current challenges in Autonomous Driving is as follows:

[1] Environmental and traffic safety benefits: Human errors cause a significant part of traffic accidents. By excluding the driver as the weakest link, it is expected that the automated vehicles will travel more safely, reducing the number of accident.

[2] Legal Aspects of Autonomous Driving: The legal challenges are among the most critical issues, including the public policies, traffic code, technical standards, and tort law.

[3] Moral and ethical aspects: Is it a duty of the car to protect its owner at any cost? Would the dilemma change if not one but two people stepped on the road? Who is responsible for the consequences: the owner, the user or the computer programmer, who stays in his ergonomic chair some thousands of miles away and has no idea what happened? There is, however, a strong need to develop moral algorithms that can solve such situations according to acceptable moral norms.

[4] Market: Autonomous vehicles are marketed following three scenarios: 1) traditional carmakers are integrating more and more automatic components into their products until the vehicle becomes fully autonomous, 2) new market players brake into the market with new concepts, 3) co-operation of traditional car manufacturers with new market players delivering a technology that allows the production of 3rd or 4th cars.

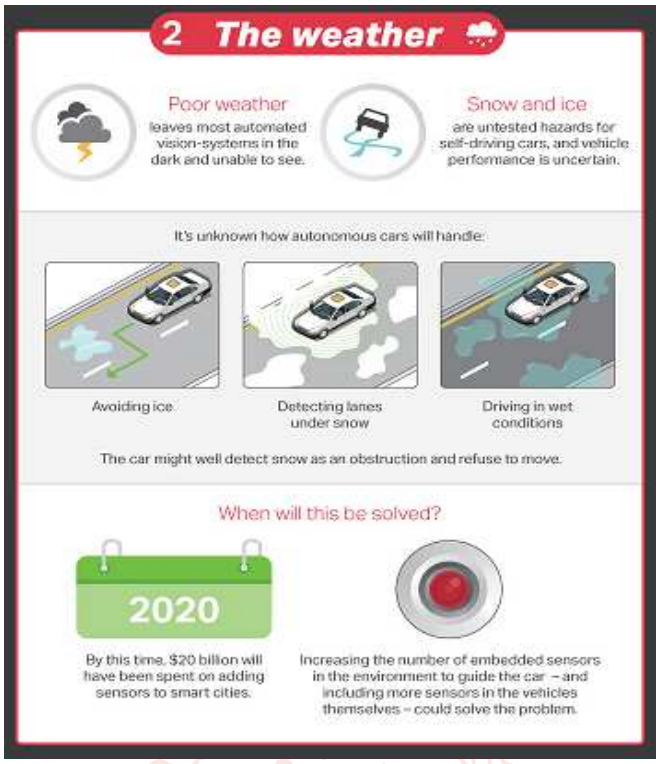
3. Issues/Problems in Self Driving

3.1. Human Interaction

[Fig Source: By Click Mechanic]

In a busy four-way intersection on field, for instance, somebody's driver is aware of pedestrians can cross before of them. Forward to indicate pedestrians they're getting to move, and eventually get through the intersection. Associate degree autonomous vehicle, however, can sense that there are a unit individuals or vehicles occupancy the intersection and won't move in any respect, probably obtaining stuck for a minute.

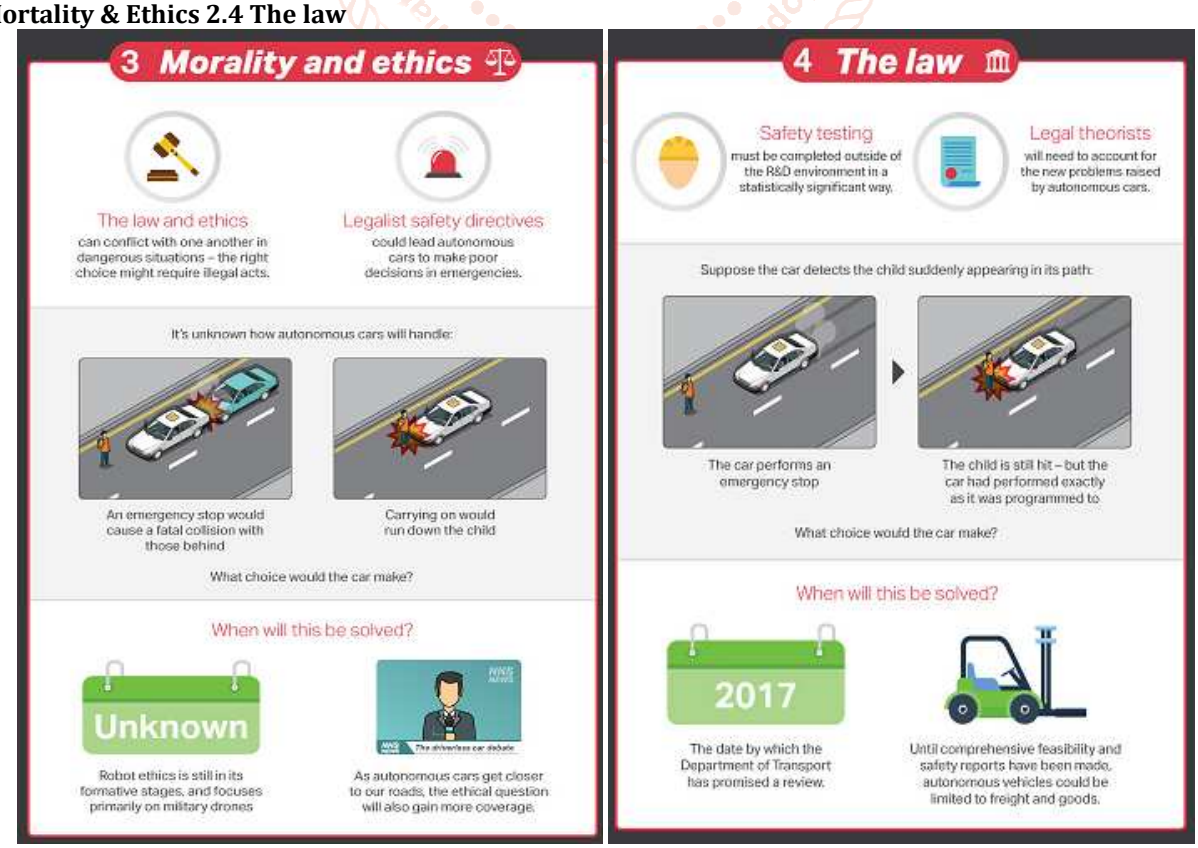
3.2. The Weather



[Fig Source: By Click Mechanic]

1. **Hydroplaning** — The vehicle must build a fast judgement appeal the correct course of action, in conjunction with having spatial awareness before it tries to achieve or regain management.
2. **Slippery Road Conditions** — The vehicle must modify its "driving" capabilities per the slippery conditions. Additional caution must be taken, as well as going away ample area between vehicles, fast and breaking well before.
3. **Water Build up** — The vehicle must sense the puddle ahead, or higher nonetheless, gauge however deep it's before driving by, or around it. as an alternative, throughout rainy conditions, it conjointly must take into account the most effective route to succeed in its destination.
4. **Sensors** — measuring system, a measuring technique, is usually the first sensory device in every vehicle

3.3. Mortality & Ethics 2.4 The law



[Fig Source: By Click Mechanic]

The ethics of reasonableness

The reasonable robots run into issues once it involves ethics. The risk is inherent to driving & deciding the way to distribute risk between associate moral elements. How will robots decide the way to follow the law, distribute risk & minimize harm in the virtuously ambiguous situation?

"No-Win" Scenario

The hierarchy of protective most vulnerable first(pedestrian), followed by cyclist& then cars with human passengers is that the natural answer, but it's going to not gift clear resolution all told cases. As an example, if associate AV should make a choice from flaming into a wall & killing all of its human passengers or turn to miss the wall & killing many pedestrians, what is the correct answer?

AVs exploitation judgment to interrupt the law

There are variety of things during which the driver's good judgment can override the letter of the law, & truly thus. For example, if a baby runs into the road in front of your automobile, you would swerve over the double yellow line to avoid hitting the kid. For AVs, it is up to developers to come to a decision once the double yellow line laws ought to be broken, & once it's safe to try to thus.

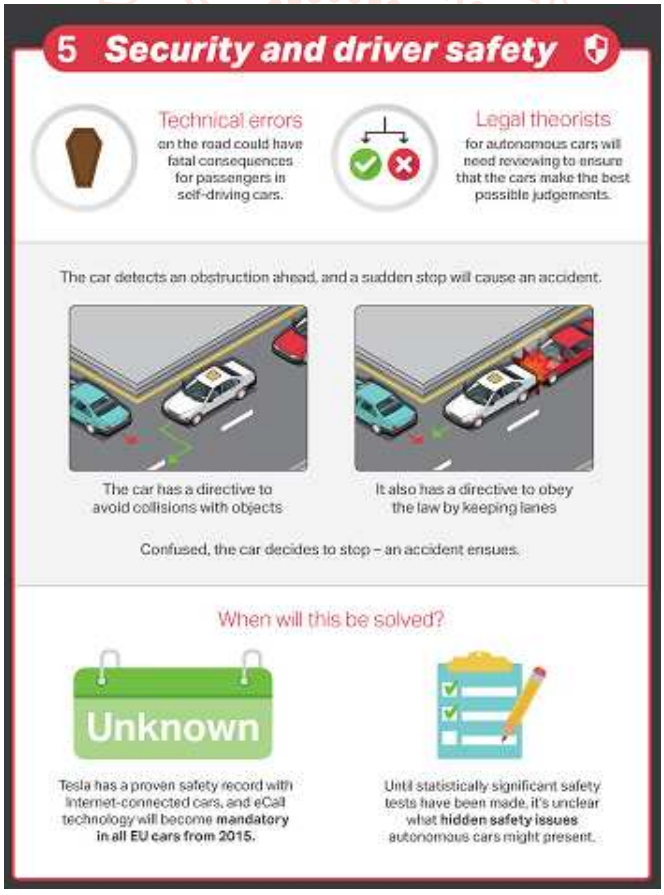
Ethics & minimizing liability

Google fictitious one risk minimization strategy for its AVs in an exceeds 2014 patent. Here Google imagines its machine-driven automobile driving on a 3 lane road with the tiny automobiles on its left & an oversized trick on its right. The Ab would keep in its own lane, but slightly off-centre, closer to smaller automobiles, thus optimizing its own safety.

Ethics as associate engineering challenge

Seeing ethics as associate engineering drawback suggests that obeying some strict constraints whereas optimizing on many dimensions.

3.4. Security & driver Safety



[Image Source: By Click Mechanic]

The foundation of the "Safety 1st for machine-driven Driving" study square measure its twelve Guiding Principles:

Safe Operation: however the system reacts if important parts become unstable or stop functioning

Safety Layer: The system recognizing its limits and minimizes risk in returning management to the motive force

Operational style Domain (ODD): The operation conditions within which the system is intended to perform

Behaviour in Traffic: The system behaviour has to be straightforward to grasp and predictable for encompassing road users

User Responsibility: The user's state should be appropriate for a takeover procedure

Vehicle-Initiated Handover: If the motive force doesn't accommodates a takeover request, the machine-driven driving system should perform a maneuver to attenuate risk.

Driver-Initiated Handover: Activating and deactivating the machine-driven driving system shall need a precise driver's intent

Effects of Automation: Overall analysis of system safety shall take automation effects on the motive force under consideration

Safety Assessment: Verification and validation shall be accustomed make sure that the security goals square measure met

Data Recording: once an occasion or incident is recognized, machine-driven vehicles shall record relevant information during a manner that complies with applicable privacy laws

Security: Steps shall be taken to shield the machine-driven driving system from security threats

Passive Safety: Vehicle layout shall accommodate changes to crash eventualities caused by vehicle automation

4. Analysis & Inference

This paper, through a systematic review of the literature aim to determine the various Issues or Problems occur in Self driving technology. The future goal is that analysing the day-to-day travel behaviour and long-term changes in the structure of our cities. How this technology will help to catch the travelling issues and finding the solution for it to make the city become smart. This technology is the important fact in Smart cities.

5. Conclusion

Autonomous technologies are getting progressively refined and technically accessible, and in some cases, these will already be put in business vehicles. This technologies now in trend & it is the need of smart cities. The concept & reviews concludes that what is autonomous driving or self driving, levels of automation in this vehicle. The paper focused on the Problems occurs in building fully autonomous cars that there is no need of human interference. Because of this issues we cannot getting a fully autonomous vehicle. But researchers can works further and developer who will find the solution to avoid this problem, results in very soon we will travel by this vehicles. There are some programmers and analyst are still working for the future of this technology.

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