**Autonomous Driving Technology Ethical Research Project**

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**Introduction**:

1.1 What is Autonomous Driving Technology (ADT)?

It is that the technology that allow vehicles can sense and analyze the outside environment then make decision that how to move itself, within the whole process of the autonomous driving, vehicles do not or just need a little bit of human’s help.

The technology may use in Autonomous Driving include Computer Vision, Artificial Intelligent also with hardware like camera, range sensor etc.

1.2 Why we need to research ethical issues about Autonomous Driving Technology?

1.2.1 The race of Autonomous Driving Technology.

Many companies were start their developing of Autonomous Driving, including some traditional car company like Ford, Volkswagen and high-tech big company such as Google, Nvidia, and many new companies like Tesla, Pony.ai.

Also, the market of Autonomous Driving is keep growing since past few years, the value of it will grow more than a time until it reaches $556.67 billion[[1]](#endnote-1).

1.2.2 The developing of Autonomous Driving Technology.

The issue of development of ADT is a chicken or the egg question. It about the algorithm and data of ADT. The development of algorithm need data, but without algorithm and testing the program cannot produce data. The testing data should be closer to the reality it is means that Autonomous cars should be testing with human driving cars on the real road instead of some test ground in the laboratory.

1.2.3 Ethical issues of Autonomous Driving Technology.

The very first issue is about how to get data for the development of Autonomous Driving algorithm. The testing of the Autonomous car is actually let people who drive with these cars in danger.

Also, ADT will face a classic ethic problem similar to the Trolley Problem: if the car only has two choice one is turn the direction of the car to safe passenger’s life, but it will hit a truck and let driver die or car chose to drive over the passenger to avoid the hit, but it may kill the passenger. Even human have trouble to solve this kind of problem how can a machine decide for them in this situation.

1.3 Project aim:

This project will try to analyze and discuss about the ethical issue within ADT.

**Ethic issue:**

We can see an example first:

Tesla as the most radical developer of ADT, they keep pushing the implement and usage of the ADT on their own product, many Tesla Model X and Model S drivers is using Tesla Autopilot every day, when Tesla Autopilot release very first time, the whole system is not very perfect the car will make some mistake, by time past, the system will learn from the mistake and won’t make the mistake on the same mistake in every car again. The result is good, but the process was very danger, Autopilot make some mistake and cause human death several times.

Elon Musk the CEO of Tesla is encouraging Tesla employee to install Tesla full Autopilot tools and use the development version of the Autopilot for the testing of Autopilot. Elon himself is the most adventure which use an Autopilot with Mad Max mode which is the Autopilot will take most of the control of the car and decide in almost every situation.

To develop the ADT system developers may send their product to do the moose test, which is a test that when car driving on the road with a big object sudden jump to the road or directly hit the car, and the reaction of the car.’[[2]](#endnote-2)

According to this example we can found that there are some ethic issues.

2.1 Safety:

The very first issue of the ADT is safety, this is both technological and ethical concern.

2.1.1 How ADT effect public safety?

Every company or organization which developing the ADT will need on road testing for program, to test about the reliability of ADT system.

1. People may use ADT on road without other’s concern.
2. Testing of ADT product is no very safe, an ADT product may have bug but it already on the road.
3. By the thinking of moose test, if the object is a human instead of an animal or other obstacle, how can ADT decide what to move if it run into a Trolley Problem.
4. ADT may be hack by some people, the influence of it is horrible.

2.2 Privacy

Obviously, ADT have privacy issue since it need data to improve, the remember of Tesla Autopilot is an example, Autopilot make mistake, but it remembers this mistake and would not let it happen again. Hence, Autopilot or other ADT product need to collect user’s driving data, including road condition, GPS position etc.

**Proposed way forward:**

Many ADT developer had thought about the ethical issues before, but most of them is been pushing by their company and organization, since this kind of developing cannot be dominated by developers. These company maybe control by a radical CEO such as Elon Musk at Tesla, or by the commercial giants like Volkswagen. According to the example we can see that ADT already cause human injury it is kind of dangerous for keeping them the way before.

3.1 How to ensure the safety of public traffic?

3.1.1 Introduce a standard level of ADT.

There are two standards of Autonomous Driving Classify, one is introduced by NHTSA[[3]](#endnote-3), the other is introduced by SAE[[4]](#endnote-4).

A uniform standard can be the guidance of whole ADT industry. Developer can have a target for their product, and public can have a clearer view about ADT.

This standard also help government to make new law about ADT and prepare for the future change of public traffic composition.

3.2.2 control the giant companies

If The classification standard of ADT is determined and be recognized by the industry government can have a reference to make a new law about it. And the new law is necessary for control both racial technology giant and commercial giant.

Governments should introduce new law at lease including:

1. Which level of ADT using cars can drive on the road.
2. Which road can be use by ADT road testing.
3. What kind of situation people should control the car manually.
4. How much responsibility should ADT using car driver take when a car accident happens which ADT make the mistake.
5. Every ADT using vehicle should pass test for ensure it level of automation, the test should be hold by government.

These laws would ensure that

1. let other driver on the road does not need to worry about ADT using vehicle near.
2. companies cannot test their product on every road recklessly.
3. Low level ADT vehicle should manually control in some complex environment to ensure traffic safety (Tesla already have similar policy for their Autopilot using[[5]](#endnote-5), the whole industry should have a standard policy about this also)
4. Think about two ADT vehicle hit each other, can we apply existing human traffic law for this kind of situation?
5. This law protects both ADT industry and public safety, it gains trust from public by official test, and increase traffic safety by not letting low level ADT vehicles drive on the road. Since higher level ADT is smarter, agiler and more precise than humanity at the dangerous moment such as situation in Moose Test.

3.2.3 Avoid hack

This is the oldest problem when internet first invented, ADT developer should more concern about cyber safety since a little mistake may cause hundreds of lives lost.

3.2.4 About privacy.

At present, most people just ignore the data collection by companies, they even love to, since ‘They have nothing to hide’, and it help for their cars get OTA update and better Autonomous Drive services. But the data should be proper manage and ensure that data would not be use by illegal way. A public ADT data management organization should be a better way to solve this problem.

**Conclusion**:

ADT as one of the most popular technology industries, is changing public view of whole automotive industry. As we mention before, it should under supervision, because we cannot stop technology’s grow, it is coming anyway, but what we can do is help it grow in right way.

We can see that Autonomous vehicle would be the future, world traffic composition would change. Machine’s reaction is faster and more precise than human brain. Many Sci-fi novel describe a road with all autonomous car, we cannot know that if our future is exactly like that, but we need to push the improvement of technology. Hence, a better ethical concern is helping industry get away from wrong direction of technology development.

1. **Reference**:

   <https://www.techworld.com/picture-gallery/data/-companies-working-on-driverless-cars-3641537/> [↑](#endnote-ref-1)
2. <https://teknikensvarld.se/algtest/> [↑](#endnote-ref-2)
3. [U.S. Department of Transportation Releases Policy on Automated Vehicle Development](http://www.nhtsa.gov/About+NHTSA/Press+Releases/U.S.+Department+of+Transportation+Releases+Policy+on+Automated+Vehicle+Development). National Highway Traffic Safety Administration. 2013-05-30 [2015-09-27]. [↑](#endnote-ref-3)
4. [AdaptIVe system classification and glossary on Automated driving](http://www.adaptive-ip.eu/index.php/deliverables_papers.html?file=files/adaptive/content/downloads/Deliverables%20%26%20papers/AdaptIVe-SP2-v12-DL-D2.1%20System%20Classification_Draft.pdf) (PDF). [↑](#endnote-ref-4)
5. <https://www.tesla.com/autopilot> [↑](#endnote-ref-5)