

Opportunities and dangers of self driving cars

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Abstract: Nowadays the issue of self-driving cars has become quite recent almost everywhere in the world. Despite the fact that automakers are working on their development and increasing the level of security, this level does not give complete security to its users. In this study we are dealing with the positive and negative sides of self-propelled cars, because we believe that these cars do not currently have sufficient confidence, which is an important element in many ways.

Keywords: self-driving cars, automation levels, opportunities, dangers

1 Self-driving cars

Autonomous cars are those vehicles which are driven by digital technologies without any human intervention. They are capable of driving and navigating themselves on the roads by sensing the environmental impacts. With the help of the system built up by different sensors, hardware components and a complex software, the car can go from one place to another safely. Their appearance is designed to occupy less space on the road in order to avoid traffic jams and reduce the likelihood of accidents [10].

1.1 Levels of autonomy

In transport, the human factor has a prominent role beside the vehicle and environmental conditions, as one can correct the mistakes and shortcomings of the other two factors. To track what's happening as we make the transition from human to robot drivers – a transition that will have enormous repercussions for the way we live, work and travel in the future-, the National Highway Traffic Safety

Administration (NHTSA) adopted the levels of the Society of Automotive Engineers for automated driving systems, which provides a broad spectrum of total human participation to total autonomy [13].



Figure 1 Types of autonomous vehicles [1]

These are the levels of SAE:

Level 0: No Automation [1]

In this case, there is 100% of human presence. Acceleration, braking and steering are constantly controlled by a human driver, even if they support warning sounds or safety intervention systems. This level also includes automated emergency braking.

Level 1: Driver Assistance [1]

The computer never controls steering and accelerating or braking simultaneously. In certain driving modes, the car can take control of the steering wheel or pedals. The best examples for the first level are adaptive cruise control and parking assistance.

Level 2: Partial Automation [1]

The driver can take his hands off the steering wheel. At this level, there are set-up options in which the car can control both pedals and the steering wheel at the same time, but only under certain circumstances. During this time the driver has to pay attention and if it is necessary, intervene. This is what Tesla Autopilot has known since 2014.

Level 3: Conditional Automation [1]

It approaches full autonomy, but this is dangerous in terms of liability, so therefore, paying attention to them is a very important element. Here the car has a certain mode that can take full responsibility for driving in certain circumstances, but the driver must take the control back when the system asks. At this level, the

car can decide when to change lanes and how to respond to dynamic events on the road and it uses the human driver as a backup system.

Level 4: High Automation [1]

It is similar to the previous level, but it is much safer. The vehicle can drive itself under suitable circumstances, and it does not need human intervention. If the car meets something that it cannot handle, it will ask for human help, but it will not endanger passengers if there is no human response. These cars are close to the fully self-driving car.

Level 5: Full Automation [1]

At this level, as the car drives itself, human presence is not a necessity, only an opportunity. The front seats can turn backwards so passengers can talk more easily with each other, because the car does not need help in driving. All driving tasks are performed by the computer on any road under any circumstances, whether there's a human on board or not.

2 The outcome of the changes

To examine the influencing positive and negative factors for the acceptance, we collected the most important ones.

Public transport

Everyone likes to travel comfortably, so in case that everyone starts driving a self-driving car - those who used public transport before as well-, because it is much cheaper than a taxi, that will cause even bigger traffic jams. In Budapest, 60% of people travel by public transport and there are still plenty of cars on the road. Public transport vehicles are designed to accommodate as many people as possible, while cars can only accommodate 4-5 people [17]. We think that traffic jams can be reduced or even eliminated if public transport remains at least at the same level and further will be developed.

Environmental effect

Transport is currently one of the most important factors of greenhouse gas emissions and pollution. Autonomous vehicles are designed for fuel efficient operation, thus reducing environmental pollution. Using these cars, travelling will become more comfortable but in the future it is important that besides people want to travel more comfortably they need to understand that car sharing is necessary

because it also has a positive effect on the environment, not just to avoid traffic jams.

Reduction of accidents

One of the main benefits of self-driving cars is that they filter out human errors, which will reduce the number of accidents. As we examined the data of KSH, it can be seen that 93% of the accidents are caused by the driver, so if it could be filtered by using automated cars, the number of accidents would be greatly reduced [6].

Jobs

Many people are worried about losing their jobs, as some jobs will be removed / transformed by introducing self-propelled cars slowly. Which does not mean that all truck drivers, taxi drivers, bus drivers, etc. will be unemployed, just reallocating to other segments [14].

Hackers

In our opinion this issue is the most dangerous one because each computer that can communicate with an other one become accessible. In the recent years, many news came out that hackers broke into various databases, infected computers with viruses, and there were a number of terrorist acts around where cars were used as tools. Computer-controlled vehicles will increase the chances of these acts.

Malfunctioning

Everybody who has used some kind of computer device may have noticed that an unexpected error may arise for no reason. These failures are becoming more and more rarer, but if it happens at a high speed on a crowded road, it is no longer so harmless.

Examining the opportunities and dangers we can see that there are overlaps, everything is a matter of comparison, so a potential positive thing can be a source of danger. In the following figure, we illustrate the overall assessment of the collected factors as they are considered as negative or positive.

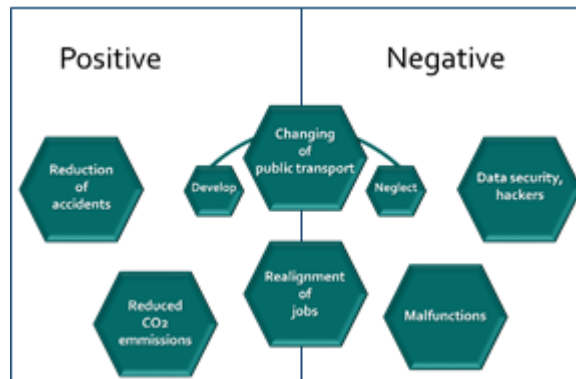


Figure 2 Changing positive and negative factors (Own data)

3 Research results

As the quantitative part of our research we made a questionnaire survey, where besides the issue of social acceptance we dealt with the issue of public opinion of self-driving cars.. The form was available online and we could reach 207 person. 110 male and 97 female. The youngest person was 16 years old and the oldest was 65 years old. In terms of age groups, most of them were from the 20-25 year-old group, thanks to the circle of acquaintances

Table 1 Age groups (Own data)

Age groups (N=207)	
15-24	50,7%
25-34	15,9%
35-44	18,8%
45-54	10,6%
55-64	3,4%
65-74	0,5%

3.1 Trust

Different researches prove that the attitude of accepting innovations in a given country can be considered as a kind of social institution, which also has an impact on economic growth in [12]. At the same time, innovation plays an important role in production and consumption as well [4][5].

We were eager to know what level was considered safe by the majority, so the 6 different automation levels had to be evaluated on a 5-grade scale. For better transparency, we have merged the values into 3 -Safe, Neutral, Unsafe- options.

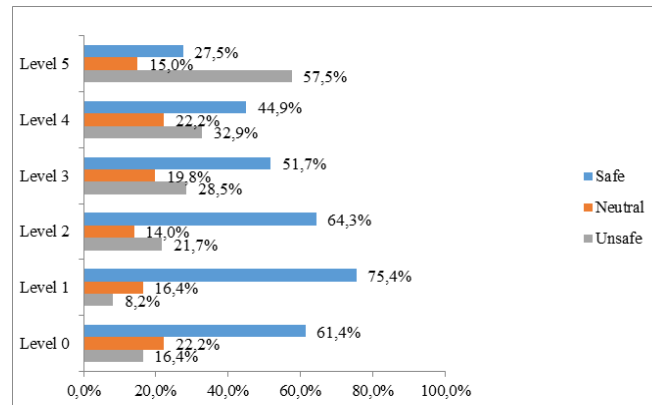


Figure 3 Opinion about safety (Own data)

As the figure shows, levels 0, 1, and 2 are still considered safe by the majority, where there is only some driving support system in the car, only partially automated. For Levels 3, 4, where the car may in some cases take control, the number of people who do not consider it safe is starting to grow. The fifth level is even more outstanding as it is considered unsafe by 57.5% of the participants.

3.2 Opinion about changes

To find the major concerns of people, we have highlighted some of them and we asked the respondents to indicate their degree. These were the major issues which are in connection with those negative factors that we have introduced previously:

- Hackers get into the car system;
- Malfunctioning;
- Does not decide how we would do;
- Fear of new technology;
- People lose their jobs (eg taxi drivers);
- Loss of control;
- High price;
- Loss of driving experience;
- Lack of personal data security.

They could evaluate each of them from 1 to 5 (1 = lowest, 5 = highest), depending on the degree of concern in each case. In most places, level 5 was the source of concern, from the highest -the primary concern is the loss of the driving experience (90 people); then malfunctioning (83 persons); hackers get into the system (77 people); loss of control (76 people); it does not decide how we want (65 people). Except for driving experience, outstanding results can be linked to security issues. Of course, these are not the only factors of fear, the basis for questioning was the most commonly occurring concerns in international researches [11].

Conclusions

The introduction of self-driving cars can bring many benefits, but it requires the right background and a target group to accommodate it. We believe that the society, or at least Hungary, is not yet ready for this development. Nearly half of the respondents in our questionnaire belong to the age group below 24, which will later be the potential customer circle[2][3].

As it turned out from international research and from our own survey, people are distrustful of the new technology [7][8][9] Positive effects, which will almost certainly come with the introduction of autonomous vehicles, are not believed by people. In addition, most of the concerns that are being investigated are a real problem for the majority, especially security issues. These concerns could be reduced by sharing information (eg, education) if automakers find a solution. I believe that the emphasis should not only be placed on cars, but also on public transport vehicles, as they can not be left out with the appearance of self-driving cars.

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