

Hungary's role in developing autonomous cars

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Abstract: In recent years, the topic of self-driving cars has become very popular. This innovation will have a great impact on many areas of our lives, and will cause a lot of changes just like the human presence will not be necessary and we will be only passengers in our own car. Nowadays, not only foreign multinational automotive companies are developing these cars and exploring this subject, but the university sphere has also started to take part in it. Recognising and taking advantage of opportunities, Hungary broke into the forefront of developments. The purpose of this study to prove an insight into the current situation of self-driving cars in Hungary.

Keywords: *self-driving technology, Hungary*

1. Introduction

The manufacture and use of cars has played a significant role in the world for decades. For some time, their development goes to a very new direction. Self-driving cars are coming, where the human factor will no longer be needed, as a driver, we will also serve as a passenger in our own car.

We are dealing with this issue because it is very actual nowadays and the society is not ready enough in our opinion. It turned out from different studies that people are concerned about this new technology. Research shows that the attitude of accepting innovations in a given country can be considered as a kind of social institution, which also affects economic growth. At the same time, innovation plays an important role in production and consumption [2][4][11].

Last year we wanted to find answers for these concerns, what are the causes and how can they be reduced, but now we would like to deal with the those developments which are placed in Hungary and serve that purpose to develop

safer cars. Thus we have collected those companies which has a main role in automotive industry in the world and then present those which are placed in Hungary. We dealt with the test track in Zalaegerszeg and its effect deeply, through an interview.

2. 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 [9][14].

Despite of this enormous developments accepted atomated cars on public roads in 2017, were not fully autonomous: each one needed a human driver who noticed when it is necessary to take back the control over the vehicle [8]. But there are some features that we can already use:

- Collision avoidance
- Drifting warning
- Blind-spot detectors
- Enhanced cruise control
- Self-parking

These cars belong to 0., 1., and 2., levels of automation.

Different sites rank different companies among the most prominent companies in the development of self-driving cars today, some of them collected in Table 1 below:

Company	Where are they now?	Partners	When?	Curiosity
Volvo	2. level of automation	Nvidia, Uber, Baidu, Nanyang Technological University	By 2021, 100 Swedish testers are planned	Take full responsibility for autopilot and self-driving cars.
Waymo	Testing the 4. level of automation	Part of Google	~ 2020	Only three collisions in a year.
Mercedes-Benz	2. level of automation, parking assistance and HomeZone	BMW, Bosch	2020	Radar localization map stratification.
BMW	2. level of automation, Surround View camera system	Intel, Mobileye, Mercedes	2021	~40 4. level automation cars are tested in Munich and California.
Nvidia	2. level of automation	PACCAR	-	320 companies have used the Nvidia Drive computer platform to accelerate the production of autonomous vehicles.
Continental	2. level of automation	Nvidia	~2020	The R&D Laboratory in Silicon Valley and they are also here in Hungary
Uber	Self-driving trucks in Arizona	Toyota Google, Ford, Lyft, Volvo, Arizona State University	2021	They plan to buy "ten thousand" self-propelled cars from Volvo.
Ford	Testing the 4. level of automation	Domino's Pizza, Postmates	2021	In 2016, tripled its test team.
General Motors	2. level of automation	Lyft	No schedule	Building R&D facility for Cruise Automation.
Toyota	2. level of automation	Uber, University of Michigan	2020	Establishing a Toyota Research Institute-Advanced Development Company.

Table 1
Self-driving car development companies [9]

From these data, it can be seen that most companies plan to have fully self-driving cars or at least they want to reach level 4 automation around 2020, which will be able to drive themselves on the road without accident.

Hungary is also at the forefront of testing and developing self-driving vehicles; these are the most prominent companies:

- Bosch- more than 2,000 Hungarian engineers are researching, developing and testing novelties. This is where the development of self-propelled, electrical technology and propulsion takes place. According to Bosch's vision, private cars will be the first to represent levels 2 and 3 with different assistants and partly with automated systems, while cars that are truly autonomous and without drivers are car sharing, taxi and driver services, and mass travel. to the roads [10].
- Continental- The globally determining German company, chose Budapest as the next R&D place. Artificial Intelligence Development Center is a milestone for Continental, bringing a step closer to full automation. In the new unit 100 software and hardware experts are working and it will soon shape from Budapest the future of partly or entirely self-driving technologies based on real-time software applications of critical safety [3].
- AIMotive- This is a Hungarian startup company, which has offices in Mountain View, California; and Tokyo, Japan. This company is the largest independent team working on self-driving technology. The biggest developments take place in Budapest, where a team of 140 highly skilled engineers is testing self-driving technology [13].
- RECAR- Research Center for Autonomous Road vehicles-was founded in September 2015 by BME, ELTE, MTA SZTAKI and Knorr-Bremse together with Bosch. Since then, several universities and industrial companies have joined to this the partnership. RECAR really important because they take part in the training of professionals in the field, so that Hungary can become the basis for autonomous vehicle development through the test track [1].
- ZalaZone Kft.- It is a test track that provides a comprehensive test environment for future vehicles and communication technologies, from multi-level testing to prototype testing and serial product development.

2.1 The Zalaegerszeg test track

People are concerned about self driving technology because of safety reasons [5][6][7]. So in our opinion to reduce this fear in the society these cars need more space to be tested. As the Hungarian government realized this, they decided to make a test track for autonomous technology, thus they could connect this demand with their aim to become one of Europe's most competitive bases for research and development. In the first part of this chapter we give a few information about the test track and in the second part the results of the interview are presented.

2.1.1. Main information

The vision of the project: “Establish a full range validation facility for the vehicles and communication technologies of the future enabling multilevel testing opportunities from prototype tests till serial products development [15].”

It is placed on a 265 hectares field, containing a lot of road section, where the car manufacturers and software developers can test at different speeds and surfaces. These are the main ones:

- Dynamic platform;
- Braking platform;
- Handling course;
- Highway and rural road;
- High speed oval;
- Bad road module;
- Slopes;
- Deep water.

Magyar Telekom has launched a 5G test station to monitor how the new network standard can be integrated with existing networks. Testing is done with routers and prototype tools, but there is no fixed date for actual 5G tests. There are a number of benefits to the new 5G network compared to what is now being used:

- Network response time significantly improves;
- Millions of devices can connect to a cell;
- Gigabit transmission speeds are also available;
- These features make 5G suitable for wired connections in certain situations.

According to Magyar Telekom's announcement, 5G will be available in Europe within a few years [12].

2.1.2. Interview

We have chosen to examine the effects of an institution that aims to provide space for testing automated technology of cars in safe conditions so that they can continue to be used on the roads later on. The quantitative part of our research was an interview with András Nagy, who is the manager of economic development.

In the interview, we dealt with the general questions, infrastructure and the effects of the test track, but we now we only present the impacts. Since even the test track is 50% ready, we were able to examine the effects only at the level of forecasts.

- Due to the complexity of the test track, it also requires the use of technological and other socio-environmental (eg educational) services, thus raising the value creation capacity of the region.
- The test track will create 4000 new jobs for people, so they will also build a workers' hostel on the test track site to help locate people from the countryside or from abroad.
- The technology used on the test track requires highly skilled, primarily technical labor, which is closely related to research and development activities, different companies and higher education institutions. They are connected with a number of universities, where students can take part in the development of new technology, thus ensuring the future professional workforce.
- As for the income effect: “We try to show the economic impact of the test track with three environmental factors. In this respect, the direct environment of the organization -where the value-creating nature of the service affects the cooperating companies more intensively- it is a smart field, moreover, a division of 50-100 km is HUB1, and then the wider environment is called HUB 2. In these three divisions, we try to examine the economic and income effects of the test track. –András Nagy”
- High value-added activities and development companies will make a significant contribution to the growth of regional GDP and the value produced by the region.

Conclusions

Overall, the effects of the test track are expected to act as catalysts. It can attract additional business activities, services, and higher education institutions. In addition, due to its innovative character, many technology companies specializing in research and development are expected to settle. Value creation is one of the most important positive aspects causing the growth of regional GDP. The income

effect, after the construction of the facility, can be better investigated from more accurate data. I believe that it will also have a positive impact on job creation.

András Nagy's answers were clearly positive. High quality; providing complex services; high level satisfaction of demands; and putting research and development at the forefront, all contributing to Hungary's advancement.

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