

**BASICS OF DEVELOPING OF THE LEGAL
REGULATION IN SELF-DRIVING CARS****AZ ÖNJÁRÓ JÁRMŰVEK JOGSZABÁLY-
ZATA FEJLESZTÉSÉNEK ALAPJA**NINKOV, Ivona ¹**Abstract**

Recently, a significant number of cars are partly self-driving, i.e. some operation are commended by human and partly automatically. However, in the future it is expected that the self-driving cars will be navigated entirely self-sufficiently without human intervention. It requires high technology progress. In addition, the corresponding law regulation for the self-driving cars has to be developed. In this paper the connection between the increase of self-driving properties and the necessary law regulation is presented. Due to large number of sensors and effective computers, newer vehicles may, pick up and record data on how, when, and where individuals drive. These information could raise privacy concerns if the information is stolen or improperly handled. Some of data may directly interrupt the safety and security conditions in the environment. The Data security regulation has to be improved. As the possibility of accident rates decrease, the Insurance law has to be changed. In addition, if there is an accident with a car with self-driving elements the new regulation is necessary which will give the answer about guilty: if it is the creator or purveyor of a self-driving car's algorithm or the human operators.

Keywords

self-driving car, insurance law, data security regulation, traffic accidents

Absztrakt

Az utóbbi időben jelentős számú autó részben önállóan működik, azaz egyes működések ember és részben automatikusan végez. A jövőben azonban várható, hogy az önjáró autók emberi beavatkozás nélkül teljesen önállóan navigálnak. Ez magas technológiai haladást igényel. Ugyanakkor be kell vezetni az önjáró személygépkocsikra vonatkozó törvényi szabályozást is. Ebben a cikkben megvizsgálom az önjáró tulajdonságok növekedése és a szükséges törvényi szabályozás összefüggését. Az újabb járművek a nagyszámú érzékelő és hatékony számítógép miatt felvehetnek és rögzíthetnek több olyan adatot, amely rámutat a vezetési módra és mikor és hol történik. Ezek az információk adatvédelmi agályokat vehetnek fel. Ezért javítani kell az adatbiztonsági szabályozást. Mivel a balesetek aránya csökken, a biztosítási törvényt meg kell változtatni. Ezen túlmenően, ha baleset merül fel egy önjáró és egy konvencionális autóval, akkor szükségessé válik az új szabályozás, amely választ ad a bűnösre: az önálló vezetésű autó algoritmusának alkotója vagy szállítója, vagy a jármű emberi kezelője, vagy mindkettő.

Kulcsszavak

Kína, társadalmi kredit rendszere, információbiztonság

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INTRODUCTION

During the third industrial revolution the computerization is brought into automobile industry making the driving function independent on human driver. The automated cars are designed where some of the functions and operation in driving process need not to be controlled by driver, but by corresponding software. Nowadays, in the era of the 4th Industrial revolution the tendency is to eliminate humans from the position of driver sitting with the steering wheel and to produce autonomous cars to fulfil the driving task without human action. It requires significant improvement in technology and in addition in computer power and sensors (which could include cameras, radar, and ultrasonic detections) which will be strictly connected with the driving function. Such autonomous vehicles are expected to change the whole transportation system. The prediction is that autonomous vehicles (AV) will become the reality in a short time on public roads. Analyst predict that completely autonomous cars will be for sale by 2025-2030 [1].

The aim of this paper is to point out that this new type of transport requires not only technical innovation but also a new legal regulation that will accompany the product implementation and vehicle operation. The legal instructions have to help such vehicles to come to life. These regulations has to be applicable for both, manufacturers and users of vehicles. The legal documents have to make changes in already known infrastructure regulations. In addition, the legal regulation of liability in the case of accident between AV and convention vehicle or two AV has also to be developed. In general, the traffic regulation has also to be modified. In some sense the urban plan needs some changes, as the number of parking places can be reduced. Namely, the number of individual vehicles will reduce and parking in front of the homes or in front of the workplace will be not necessary.

Based on the advantages and disadvantages of AV in all sphere (technical, ethics, social) in the paper the areas of legal regulation modification are suggested. The responsibility, liability, safety and security aspects for AV has to be defined in the future legal regulations.

SELF-DRIVING CAR: DEFINITION AND PROPERTIES

The term ‘self-driving car’ is widely used in a very wide concepts and the definition in technical sense is necessary to be mentioned. The ‘self-driving car’ is an autonomous vehicle (AV) which drives itself in most or all conditions [2]. In technical concept ‘autonomous’ means more or less that the system works independently of human inputs while fulfil certain tasks. Thus, ‘autonomous vehicle’ is driving without human commands [3]. However the most precise definition of AVs is given by the International Society of Automotive Engineers (SAE) in 2014 where the extent of automation is said to depend on the human driver’s role in performing the dynamic driving task [4]. So, AVs have different levels of autonomy. SAE made a classification on the level of autonomy of vehicle which is widely used by manufacturers and regulators.

SAE introduced 6 levels of automation: 0 is the lowest level – without automation and 5 is the highest level – with full automation [5]. The factors which define the level are:

- A. The agent responsible for executing steering and throttle control: human driver or autonomous technology (AT)

- B. The agent responsible for monitoring the external environment: human driver or AT
- C. The agent responsible for serving as ‘back up’ when a failure prompts a disengagement of the AT: human driver or AT
- D. Autonomous operations are allowed: without restriction – all modes of operation, or only for special conditions – some mode of operations (e.g. good visibility).

SAE level	Name	Narrative Definition	Execution of Steering and Acceleration/Deceleration	Monitoring of Driving Environment	Fallback Performance of Dynamic Driving Task	System Capability (Driving Modes)
Human driver monitors the driving environment						
0	No Automation	the full-time performance by the <i>human driver</i> of all aspects of the <i>dynamic driving task</i> , even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	Driver Assistance	the <i>driving mode</i> -specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the <i>human driver</i> perform all remaining aspects of the <i>dynamic driving task</i>	Human driver and system	Human driver	Human driver	Some driving modes
2	Partial Automation	the <i>driving mode</i> -specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the <i>human driver</i> perform all remaining aspects of the <i>dynamic driving task</i>	System	Human driver	Human driver	Some driving modes
Automated driving system (“system”) monitors the driving environment						
3	Conditional Automation	the <i>driving mode</i> -specific performance by an <i>automated driving system</i> of all aspects of the <i>dynamic driving task</i> with the expectation that the <i>human driver</i> will respond appropriately to a <i>request to intervene</i>	System	System	Human driver	Some driving modes
4	High Automation	the <i>driving mode</i> -specific performance by an <i>automated driving system</i> of all aspects of the <i>dynamic driving task</i> , even if a <i>human driver</i> does not respond appropriately to a <i>request to intervene</i>	System	System	System	Some driving modes
5	Full Automation	the full-time performance by an <i>automated driving system</i> of all aspects of the <i>dynamic driving task</i> under all roadway and environmental conditions that can be managed by a <i>human driver</i>	System	System	System	All driving modes

In Fig.1 the classification made by SAE is shown.

(AV levels of automation. Reproduced AS-IS with permission from SAE-International J3016TM, [4]).

Vehicles at levels 1, 2 and 3 are named ‘semi-autonomous’ or ‘automated’. Nowadays, mostly the semi-autonomous vehicles are developed [6]. In automated car the human driver makes the driving tasks on the roads, but the vehicle has systems that automate certain functions such as parking, adaptive cruises control, lane drift detection, automatic breaking i.e. emergency brake application which is without human driver control. Thus, the parking assist systems allows cars to steer themselves into parking spaces and the adaptive cruise control maintains a certain distance from the vehicle in front of the car. In semi-autonomous vehicle the driver is allowed to cooperate with the software which is the ‘brain’ of the vehicle, specially, if there is a failure. However in the level 3 of automation a problem appears which is not solved yet: there is not found a way how to redirect the control of the car to the human driver just in a fraction of a second as it is necessary in emergency. Some

manufacturers solved the problem by giving the limitation to the Level 3 only for lower speeds and small power vehicles.

Some companies already produced the so called ‘fully-autonomous’ cars of the level 4 and 5. Vehicles can drive themselves on existing roads and can navigate many type of road ways and environmental contexts with almost no direct human input. Recently, for these AVs it is prohibited to be sold on the market and to be freely included into the public traffic. The vehicles of level 4 and 5 can be only tested on public roads but it is required a human driver, who has undergo a specific training prescribed by the authorities, to be included into the driving process. The test drivers have to be always ready to take control of the prototypes of self-driving cars. In the second half of 2015, Tesla Motors began allowing owners (not just test drivers) to switch on its Autopilot mode [7-9]. In these cars the human being (professional driver or Tesla owner) has to sit in the driver’s seat and to keep hands near the wheel and eyes on the road. Special beeps and other warnings are installed into the vehicle to make sure they fulfil this requirement. That makes the vehicles street legal for now in California and Nevada in U.S.A. European regulators have allowed limited tests of self-driving cars and even tractor-trailers. The United Kingdom has begun reviewing road regulations to figure out how to eventually allow a fully autonomous shuttle. Japan allowed its first road test of an autonomous car in 2013, although much of the research being done by Japanese car companies is happening in the United States.

Thousands of kilometers of testing drive are necessary to be done in the future which will give the real features of the vehicle. Unfortunately the legal regulation for testing AV is very poor. California is one of rear countries to regulate the testing of AV on public roads by introducing the CA DMV rules in 2016. In other countries and states regulation for testing AV is necessary.

Remark: Due to the terminology of the National Highway Transportation Safety Administration (NHTSA) the autonomous and automated cars are in common called ‘highly automated vehicles HAVs.

BENEFITS AND PITFALLS OF SELF-DRIVING CARS

The purpose of introduction of self-driving cars, as a new cyber-physical product, will be to impact following requirements:

- Averting deadly crashes
- Decreasing the number of accidents
- Provide mobility for elderly and disabled
- Increase road capacity
- Save fuel
- Lowering emission in environment during transport.
- Reduce the necessity of parking areas

The AV will increase the person mobility and specially it would be very convenient for elderly and also disabled who are not able to drive the car. The AV may be a personal vehicle, or an on-demand one. If it is the last, shared rides may be realized. Then, some complementary benefits are evident. For example, the efficiency on roads is increased. The

explanation is, that the number of cars on the road is decreased and the fuel application would decrease and as the result emission of pollutions in the environment would decrease, too [10]. So, the human impact on environment is minimized. Due to decreased traffic, the road capacity would increase.

The improvement obtained with AV is the possibility to increase the work productivity and better time use of potential drivers, as the previous drivers may use the driving time for their work special if it is in the field of IT technology [11].

However, the greatest benefit in applying AVs is the reduction of traffic fatalities and the elimination of death-accidents. Level of safety in the traffic would be increased. Namely, it is proposed that the number of accidents would tremendously decrease and specially the death-ones. It is expected that 50 years from now, in the world there will be no traffic accidents. People will look back and conclude that human drivers were a design defect.

AVs have some disadvantages. The cost of the AV is very high. The question is what will be the cost of the on-demand service. In addition, the vehicle is proposed to be unsafe due to the fact that there is a risk to be hacked. In spite of continual monitoring the cyber-security may be interrupted. The privacy would be highly disturbed as self-driving cars are ultimate connected with each other, but also with a central station. The exact location and route of all passengers is known. In addition, self-driving cars continuously monitor other drivers on the road and obtained information could be applied in negative sense. Whether the gigabytes of generated information can be permanently stored—and how they can be used later—is not settled yet.

Using the benefits and pitfalls of semi-driving vehicles it is important to determine the challenges we will face in the near future and how to avoid them. The legal regulation system has to be improved and extended but also new documents have to be introduced in legal systems. Thus, at the moment there are no legal regulations which will give the answers for the case of accident: Who is guilty for the case when the accident is between two AVs or an AV and a conventional car? Is it the manufacturer of the AV or the vehicle owner liable for accident? To which limit is the liability of the producer or the person who makes the software. If the accident is due to sudden fail on cyber or in physical part, who is liable? Is it possible to introduce some legal regulation for cyber security and protecting AV from unsafety? Legal regulation of the road traffic with AVs is also necessary to be introduced.

The space for public transit has to be reconsidered. Self-driving cars will have a profound effect on city design. Parking spaces in the city center will take up and reconstructed into pedestrian zones, parks, shopping centers, etc. Self-driving cars will park themselves in peripheral areas of the city and pick up the passengers in the way as the taxis do it nowadays.

LEGAL ASPECTS OF SELF-DRIVING CARS

Every new step in progress of artificial intelligence in vehicle poses potential legal questions and requirements [12,13]. Some legal regulation already exist, but is important to be applied in a proper manner. Thus, for example, the regulation for intellectual property exists, but engineers developing new products in the sphere of AV will need to be advised on avoid it. However, legislation for protection autonomy and intellectual property has to

be extended with the aspects for patents and innovations in cyber-physical systems. The application the patent infringement and to regulation of intellectual property [5,14] is mandatory.

In some sphere of legal regulation there are some lacks. It is the case for:

- Liability and Product Liability
- Security including cyber security
- Data protection
- Safety issues

An enormous number of data are recorded by AV: how, when, and where individuals drive. Control of the position of the person travelling by AV is known at every moment. The privacy of the person is hardly damaged due to travelling by AV. The collected information obtained from self-driving cars may include proprietary codes, too. Because of that, data security protection is necessary. Security and cyber security of the AV has to be included into legal consideration. The rules have to be connected with data protection. New regulation is necessary to protect these data. However, the security of the persons has to be increased in spite of the fact that some private data are widely evident. The cyber security system has to eliminate the possibility of privacy interruption if the information are stolen or improperly handled.

Civil liability shifts has to be introduced and liability of manufacturers, owners and users of AV has to be defined. It is not clear which are the liability limits for all of these subjects in the matter. Besides, the object of liability has to be strictly defined. To determine the liability in this matter is a very complex and heavy task. Let us suggest two examples:

1. If there is an accident litigation the main problem is to define the liability: if in motor vehicle accident who was struck by a car with self-driving elements, is it possible to argue that the creator or purveyor of a self-driving car's algorithm shares some liability with human operators for a vehicle's actions. The criminal law has also to be changed. Namely, the person in AV who is sleeping is not guilty for happening in transportation. In conventional car the driver falling asleep at the wheel is guilty.
2. Second key question which is given in lawsuit concerning the product liability: whether the product had a "defective condition" that was "unreasonably dangerous." This often involves determining whether the product designer could have made the product safer at an acceptable cost. But what's "reasonable" for a new technology? Is "reasonably safe" defined by the average human driver, the perfect human driver, or the perfect computer driver?

Safety issues are mainly addressed on the manufacturer of AV and road traffic. It is necessary to prescribe the level of safety of the AV control system. This rules would be quite new, but has to be included into the legal system for protection in traffic. Some countries in Europe and in U.S. already included some law for road traffic with AV enable the AV to drive on public roads. However, all of these rules are quite strict and not enough for traffic regulation.

Some additional legal recommendation have to be developed. Thus, a very interesting question is given: if the employee has the work to check email or performs other tasks by driving AV, could he raise the wage and hours of work and ask for compensation issue from employer?

Problem with insurance law is very actual. Due to decrease of accidents number with AV, it is supposed that there will be crash savings. It suggests the Insurance regulation to change. Namely, may be the traditional car insurance can be moved away from the user as the accident number is thought to be decreased.

The final aim is to create a recognized licensing and testing framework and standards for AV, liability standards, security standards, privacy/default lack of privacy standards and norms for personal travel and regulation for impacts and interactions with other components of the transportation system. Thus, the progress of technology in AV requires the development of regulations. Somehow, it is obvious that the self-driving cars will be ready much earlier than the laws [15].

CONCLUSION

In this paper the basics of developing of the legal regulation in self-driving cars are presented. First, the term ‘self-driving car’ is determined and the level of automation in vehicle is considered. Advantages and disadvantages of autonomous vehicle in comparison to conventional car are discussed. Based on the research, the legal regulation of the AV is suggested. It is suggested to be done in two directions: firstly, to develop the laws considering the road conditions and secondly, in extending the security and safety regulation, liability conditions, privacy and data protection. Also, the introduction of AV in traffic and on the public roads requires some changes in insurance and public law.

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