

Research on tort liability of autonomous Vehicles in traffic accidents

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Abstract. In recent years, with the rapid development of information technology and artificial intelligence, autonomous vehicle technology has been further revitalized. As a result, the identification and assumption of tort liability in the event of human injury caused by autonomous driving technology become increasingly prominent. Due to self-driving cars with traditional cars are quite different, so the solution of the tort liability and liability issues is of great significance, both can improve the efficiency of dispute resolution, decrease the cost of rights, protect the legitimate rights and interests of the victim, safeguard social fairness and justice, and can promote the related legal norms perfect, promote the benign development of the auto industry.

Keywords: Artificial intelligence; Autonomous driving vehicles; Liability for traffic Accident.

1. Introduction

With the continuous update and promotion of artificial intelligence and computer networks, autonomous vehicles have also ushered in a Renaissance and development. The development of autonomous driving technology, to a certain extent, greatly reduces the threshold of driving, freeing the drivers, its popularity is also of great significance to reduce the incidence of accidents. However, new legal problems have emerged in the determination of tort liability and civil liability burden of autonomous driving vehicles. Currently, China's legislation on autonomous vehicles is still in its infancy, and there are no specific provisions on tort liability for damages caused by autonomous vehicles. The infringement phenomenon of traffic accidents caused by self-driving cars not only brings a new impact on the existing legal order, but also reflects the shortcomings of the existing legal system. Paper will be through the legal status of self-driving vehicles is described on the basis of which to automatic vehicle accident responsibility defined, and then puts forward the problem handling opinions and measures, in order to eventually set up automatic vehicle accident tort liability system, protect the legitimate rights and interests of victims, to promote the healthy development of the technology of artificial intelligence.

2. The definition of autonomous driving vehicles

2.1 The concept of autonomous vehicles

As for the definition of autonomous driving vehicle, according to the requirements of the Technical Guide for Energy-saving Vehicles and New Energy Vehicles, autonomous driving vehicle refers to the interaction and data sharing between the vehicle and the surrounding intelligent environment by carrying new vehicle sensors, controllers, actuators and other equipment, combined with modern communication and Internet technology. It has the characteristics of complex situation cognition, intelligent judgment and cooperative management, which can achieve safe, fast, comfortable and efficient operation. At last, it can realize the new vehicle controlled by human completely. According to relevant documents, China's definition of self-driving cars is also the same.

2.2 Classification of autonomous vehicles

To define the concept of autonomous vehicles, it is necessary to clarify the classification of autonomous vehicles. At present, the international Society of Mechanical Engineers (SAE) classification standard is widely used in the world. According to this global classification criteria, autonomous vehicles can be divided into six stages from L(0) to L(5) according to the intelligence

degree of unmanned vehicles. The L(0) and L(1) stages of autonomous vehicles are essentially the same as traditional cars, and the driving process is mainly carried out by the driver. The L(2) to L(4) stages of the autonomous vehicle will belong to the "human-machine hybrid driving mode". Although the autonomous vehicle in this mode will be able to automatically monitor the driving environment and drive itself, it still needs the driver's management and intervention in the normal driving process of the vehicle. L(5) will realize fully autonomous driving, and the role of human will be transferred from guiding the normal operation of motor vehicles to ordinary passengers who do not need to perform any functions of drivers at all.

2.3 Analysis of the legal status of self-driving vehicles

The present civil law of our country adopts the binary system of man and matter. How to determine the legal status of autonomous vehicles and whether autonomous vehicles can be incorporated into the current civil subject norms are the focus of the current theoretical debate. At present, there are three main theories, namely negative theory, positive theory and compromise theory. With the rapid development of automatic driving technology, automatic driving technology will produce more and more important social value, become an important part of social development. Therefore, although the automatic driving technology system does not have the fundamental characteristics of natural person personality, it also has the basic constituent elements of legal fictitious personality. Therefore, the automatic driving technology system has the objective conditions as the subject of civil law.

This paper argues that autonomous vehicles should be brought into the scope of legal relationship of civil liability subject, and should be given the identity of civil liability subject. Although autonomous cars have already shown some independence and strong intelligence, their creation and development have been controlled by human beings and their independence is relatively small. If they are qualified as ordinary civil subjects, it means that they have the same civil rights and obligations as ordinary civil subjects for autonomous vehicles. However, civil rights require the civil subject to have the right capacity, the right subject has the right to require others to carry out a certain behavior or not to carry out a certain behavior, in order to realize their own interests. At present, autonomous vehicles are not self-aware and have no capacity for civil rights, and they cannot enjoy and exercise the benefits derived from civil rights. Civil obligations refer to any person who engages in or does not engage in any activity for the purpose of realizing the rights and interests of the obligee. At present, autonomous vehicles can only complete certain behaviors under the control of the driver, and they cannot make any response to human beings other than the driver, let alone make certain behaviors or do not make certain behaviors according to the requirements of the right owner. From the angle of civil liability, civil liability is the legal loss that civil subject should bear for those who cannot perform civil service. At present, autonomous vehicles have no sense of autonomy or independent property, so they cannot bear the civil liability brought by their behaviors. If they are taken as the subject of liability, it is likely that the victims cannot get relief after their rights are violated, which is unfair to the victims, and may cause moral hazard and malicious transfer of responsibility. Therefore, at this stage, the autonomous driving vehicle should be in the civil legal object status.

However, according to the present stage in China's independent driving technology system is still in the test phase of the actual working condition, this article puts forward that China's autonomous driving vehicle is given does not yet exist urgency civil main body status, therefore, should incorporate Chinese autonomous driving technology system in civil law the object scope, shall not be granted civil main body status. The reasons are as follows. First of all, it is not urgent to endue automatic driving system with independent civil legal personality. At present, China's autonomous driving technology is still in the pilot stage, and self-driving cars still need to be supervised by safety supervisors. Therefore, if there is a driving traffic accident dispute, according to the current civil law theory, that is, the supervisor or the producer can be investigated for tort liability. Secondly, although the autonomous driving vehicle has a high degree of autonomy and intelligence, its operation is still under the control of people, and its autonomy is extremely limited. If the civil independent legal personality is given to it, it means that it has the same civil rights and bears the same civil obligations

as ordinary civil subjects. However, at present, autonomous vehicles do not have the consciousness of autonomy and the capacity for civil rights and civil conduct. They can only complete certain driving behaviors under the control of the safety supervisor of autonomous vehicles. And from the perspective of civil liability, the so-called civil liability refers to the judicial results that civil market subjects bear because they cannot perform civil services. At present, autonomous vehicles have neither independent consciousness nor independent property, so they cannot bear the damage consequences caused by their infringement. Once it is regarded as an independent civil subject, it is likely to cause that the rights and interests of the victims cannot be effectively relieved, thus harming the interests of the victims and not conducive to the maintenance of social fairness.

3. Identification of liability for accident infringement of automatic driving vehicles

3.1 The subject of accident liability is absent or difficult to define

On the one hand, it is difficult to define the "vehicle side" of autonomous vehicles. Because automated driving mode, the automatic drive a motor vehicle running and keep subject actually phase separation, automatic driving the operation of the vehicle body is usually automatic driving system, and automatic driving a car that it is the interests of the beneficiary, so to some extent, it is difficult for the existing "retain for motor vehicle party" on the tort liability of traffic accidents. Therefore, when a traffic accident occurs in automatic driving mode, it will lead to the absence of illegal content in the liability of traffic accident. On the other hand, when the automatic driving mode and manual driving mode switch, the attribution of tort liability becomes difficult to determine. Some researchers argue that take-over obligations could be introduced, meaning that the user can or should take control of the car if necessary. Other researchers further pointed out that car users should always maintain a high duty of care, and always in a high state of consciousness to control the vehicle, in order to correctly perform the duty of responsibility. But some developers see freeing humans from the task of driving as the main goal of autonomous vehicles. Taking responsibility not only deviates from the purpose and significance of autonomous vehicle research and development, but also intensifies the responsibility of users, thus hindering the development of technology.

It seems that whether and how people take over autonomous driving vehicles is not only an academic debate, but also the essence and difficulty of determining liability for accidents in disputes over autonomous driving vehicles accidents.

3.2 Challenge the fault identification standards of traffic accidents

If a traffic accident involving a self-driving car is not the fault of the self-driving car itself or the user of the self-driving car, it is difficult to hold the "self-driving car owner" liable according to China's existing civil rules. On the other hand, according to the requirements of China's existing tort liability legal system, if the no-fault liability theory is adopted, the self-driving car and the guarantor of the self-driving car will have no obligation and legal basis to bear tort liability once there is a traffic accident between the two parties of the motor vehicle. In a certain sense, this will increase the degree and cost of tort liability for China's motor vehicles; On the other hand, due to traffic accident between motor vehicles, non-motor vehicles and pedestrians has a variety of causes, comprehensively apply multiple imputation principle, if all use per capita no-fault self-driving cars, as the victim in addition to obtain appropriate insurance compensation, can only get an additional 10% compensation, tort liability law to fill the damage of navigation function will not be able to play. Note that in self-driving vehicles caused by traffic accident, if the self-driving cars itself rather than use per capita is not at fault, does not mean that all users self-driving vehicles and do not need to cover all the tort liability, but should be aimed at all except of self-driving vehicles user make research on the tort liability of the parties. Considering that it is quite difficult to confirm the tort liability of autonomous driving

vehicles, if the management of autonomous driving vehicles still follows the current liability system, the tort liability law cannot play the role of compensating for losses.

If the self-driving car and the user are at fault in a motor vehicle accident, it is difficult to determine whether the independent driving system or the user is responsible for the primary driving. First, autonomous vehicles are capable of performing the work of autonomous driving, but do not exclude the participation and control of natural persons. In the process of driving an autonomous vehicle, the vehicle can also be controlled by the manual driving system, and a traffic accident can also be caused by the user or independent driving system. Therefore, it is difficult to identify traffic accidents. Second, it is difficult to apply this standard to the assessment of current motor vehicle faults in autonomous vehicle users. The problem is that they have some differences in safety obligations: on the one hand, ordinary vehicle drivers need to strictly abide by transportation rules in the process of vehicle operation; On the other hand, the obligation of the user of a motorized vehicle to strictly abide by the rules of transportation only appears in the case of manual driving. Therefore, it is obviously unfair and irrational to determine the fault of the users of autonomous vehicles based on the requirements of previous regulations. Finally, because the decisions of traditional autonomous driving systems are made by complex computer algorithms and programs, the logic of system decisions has become unexplicable. When identifying and judging the defects of the automatic driving system, it is difficult to judge the fact that the harmful consequences are caused by the automatic driving control system because of the problems of data inconsistency, different understanding and scientific and technological progress.

3.3 The order and composition of the compensation liability for the main liability subject of the vehicle accident

According to article 1213 of the Civil Code, the first compulsory liability guarantee is adopted in the liability for vehicle accidents, and then the last infringer of the commodity insurance company is paid in the order of compensation. Autonomous vehicles, a new technology, bring new challenges to this insurance order. First of all, according to "Beijing automatic driving vehicle road test measures for the administration of article 8, article 5, each automatic drive car to buy not less than five million yuan of highway casualty, article 17 of the law on road traffic safety, and the third paragraph of article one hundred and nineteen of the" regulations on the administration of the compulsory motor vehicle traffic accident liability insurance stated in the second paragraph, The insured object of compulsory third party insurance in liability guarantee of expressway accident must be "vehicle". In short, autonomous driving vehicles that are quite different from traditional motor vehicles are difficult to be included in the insurance category of traditional motor vehicles. At the same time, as there is no professional insurance related to autonomous vehicles in China, there is still a legislative gap in related fields, and it is difficult for victims to obtain corresponding claims under the aforementioned insurance claim order. The Meaning of insurance in vehicle accident liability is clearly defined in the Civil Code. As an insurance system to disperse accident risks, whether and how to include autonomous vehicles in the scope of automobile insurance needs further discussion.

Secondly, compared with accidents caused by ordinary vehicles, traffic accidents caused by autonomous vehicles have their own characteristics. If autonomous vehicles are introduced into automobile insurance, it will have a great impact on the current insurance standards. In the past, motor vehicle accidents are often related to the driver of the motor vehicle, and the motor vehicle insurance premium is usually provided by the buyer of the motor vehicle. The difference is that when self-driving vehicles have accidents, there are many reasons involved in traffic accidents. In addition to manual safety supervisors, there are also designers, manufacturers, users, and protectors of vehicles, while the traditional human drivers have become the secondary subjects of accidents. This also makes automatic driving vehicle insurance expenses main body changes.

Finally, it is difficult to identify the perpetrators of autonomous vehicles. Autonomous driving vehicles, whether or not included in the vehicle insurance costs, will involve the liability of the

perpetrator, and in the accident liability of autonomous driving vehicles, it is difficult to determine the subject of liability. Therefore, the existing compensation rules can not be used to regulate.

4. Suggestions on improving the investigation of infringement of accidents involving autonomous driving vehicles

4.1 The relationship responsibility between the automatic driving system and the owner and user is clarified

The German federal legislation regulates the civil liability of autonomous driving vehicles in the German Road Traffic Law passed in May 2017. The regulation indicates that when the subject of civil liability is determined, the driving mode of autonomous vehicles should be studied first, and the subject of liability should be judged by different driving modes. Manufacturers of autonomous vehicles are liable for accidents in autonomous driving mode; And the user of automatic driving vehicle should bear the responsibility for the traffic accident caused by the manual driving mode. For example, in the mode of automatic driving, the automatic driving system sends an instruction to the user to request manual driving. If the user fails to fulfill the complete duty of care, the user of automatic driving should bear the tort liability of joint traffic accident. This provides a new idea for solving violations by autonomous vehicles.

Specifically, firstly, the automatic driving system must take necessary precautions. Autonomous driving control system has all the functions of autonomous driving vehicles, its main role is to control the performance of the car and driving activities, so its biggest safety problem is to strictly abide by the traffic rules. If an autonomous vehicle violates this duty of care, the manufacturer and designer of the autonomous vehicle should be required to assume liability for traffic accidents. Secondly, the owners or users of autonomous driving vehicles should also take necessary educational protection precautions. Although the autonomous driving system can independently control the operation of the vehicle, it does not mean that the owner and user are not responsible for safety. For example, if a traffic accident occurs due to the negligence of the owner and user of the autonomous driving vehicle system under normal operation, the user or owner should bear the corresponding civil tort liability. Specifically, the safety responsibility of the owner or user should cover the following three levels: First, the maintenance or maintenance responsibility of the owner or user for the autonomous driving vehicle in the operation of the autonomous driving service. If the owner or user fails to maintain the self-driving car in accordance with the agreement and incurs tort liability, the owner or user shall perform the responsibility of compensation. Second, users also have an obligation to use autonomous vehicles correctly. Therefore, users of self-driven vehicles in the travel, once the road traffic laws and regulations do not conform to the accident, the user also has the corresponding compensation liability. Third, the user shall perform the duty of driving the vehicle after taking over. If the user fails to do the duty to take over, and caused by the accident caused by the damage compensation, should be borne by the user of all compensation liability.

4.2 Introducing black box technology

At present, the operation of autonomous vehicles does not exclude the participation of natural persons. In the event of an accident, it is difficult to determine whether the vehicle is in automatic or manual mode. Therefore, we can introduce black box technology to deal with this problem, and the so-called black box technology is the accident data recorder, it can record and data transmission of the entire process of automatic driving. The specific contents include: First, record the occurrence time of the accident, and determine whether the user or the autonomous driving system controls the driving of the autonomous driving vehicle, so as to clarify the subject of specific tort liability. Second, record the state inside the car and the surrounding road conditions, including but not limited to the speed, acceleration, braking, clutch and system stability of the car in the driving process, as well as the personnel, climate and road conditions outside the vehicle. By analyzing this information, we can

determine the actual cause of an accident and determine whether it was due to user error, automatic driver system failure, or some other malfunction. At the same time, different damage compensation standards are applied according to different factors. Third, whether the record user has properly undertaken the take-over obligation. The information includes the physiological condition of the user, the working state during the operation of the car, and the corresponding protection measures taken. However, physical differences between users and takeover environment may also interfere with whether users fulfill their takeover obligations. Through the study of this group of data, it is helpful to clarify the user's responsibility more clearly and allocate the compensation responsibility to the infringing unit correctly.

To sum up, the black box method can continuously record the driving process of autonomous vehicles, which not only helps to determine the real cause of the accident, but also can determine the legal liability of the parties, which is very key to deal with the infringement disputes related to autonomous vehicles. First USES the "black box" information technology is able to alleviate the burden of proof is difficult of the victim, the information recorded by the "black box" chasing the claim for the insurance company's important prove basis at the same time, also can make the victim after applied for damages, no need to entrust someone investigate the influence of the information, and can be used directly.

4.3 Reshape the insurance mechanism for self-driving cars

Under the existing insurance system, the liability insurance mechanism of autonomous vehicles must be remodeled to solve the problem that it is difficult to identify the liability of autonomous vehicles in traffic accidents. In view of the actual development and operation of autonomous vehicles, there are two ways to choose: from the perspective of short-term development, autonomous vehicles can be introduced into the current traditional vehicle accident insurance system on the premise of modifying some relevant provisions; From the perspective of long-term development, when autonomous vehicles can operate independently and completely, independent laws and regulations specifically applicable to autonomous vehicles can be formulated to specifically solve the problem of tort liability rules for traffic accidents caused by autonomous vehicles.

First, autonomous vehicles will be included in the traditional motor vehicle accident insurance liability system. In 2017, the UK's Regulations on Automotive Technology and Aviation explicitly included autonomous vehicles in the vehicle protection category. Compared with ordinary motor vehicles, self-driving motor vehicles shoulder the social mission of maintaining the convenience and safety of daily life. Based on the principle of comprehensive relief for victims, the definition of "motor vehicle" may be expanded to include either a traditional manual driven vehicle or an autonomous driving vehicle. On the other hand, the developers, manufacturers, consumers and other market players of autonomous driving vehicles share their losses through different insurance systems, which can also promote the development of autonomous driving science and technology and promote the widespread application of autonomous driving vehicles. However, for the injured party, with the insurance system to protect its interests, it can promote the full and timely relief of rights and interests.

Secondly, the existing insurance mechanism should be adjusted to establish an insurance system for autonomous vehicles. Due to the differences in working mode between autonomous vehicles and traditional vehicles, the reasons for traffic accidents are also different, so the traditional auto insurance system needs to be adjusted appropriately. It can be divided into two aspects as follows: First, the basic compulsory liability insurance premium is mainly borne by the manufacturers and manufacturers of autonomous vehicles. Because in the traditional vehicle accident insurance, most of the insured accidents are caused by the fault of the driver, so the people who bear the cost of motor vehicle insurance are usually the buyers or owners of the car. However, because with the development of self-driving vehicles and widespread application, the main cause of accident is not only the faults of car drivers, and even spread to automatic driving vehicle itself problem or autonomous driving control system of the technical defects, so the basic compulsory insurance premium by the main burden of parties should also by buyers into automatic vehicle manufacturers, In order to match the

market chaos brought by autonomous driving technology, and promote the sustainable development of the automobile industry. Second, the applicant, designer, insurer and applicable manager of self-driving vehicles must purchase commercial insurance separately to fill the liability defect of compulsory insurance, so as to disperse the risk of traffic accidents and more reasonably relieve the economic interests of victims.

5. Conclusion

The emergence and popularization of autonomous driving vehicle technology has indeed put forward an impact on the traditional tort investigation system, but people should also see its benefits in reducing traffic accidents and facilitating people's life. We hope that by discussing the tort civil liability caused by self-driving vehicles, we can make reasonable adjustments to it while retaining the existing civil liability system, so as to find a balance between the protection of victims' legitimate rights and interests and the encouragement of innovation, so as to promote the healthy development of the self-driving vehicle industry.

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