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Trends and Issues of Autonomous Driving Technology

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Potentiality and Social Acceptance of Autonomous Driving Technology

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Research and development of autonomous driving technology are entering a new stage, as the concept of fully automatic operation with the core technology like AI and high speed communication that are evolving rapidly increases reality. In such a context, subjects such as a common definition of autonomous driving, standardization of technology, revision of the legal system and deregulation are being discussed at an international level. In each country, frameworks are being actively developed to promote autonomous driving as a national policy jointly by industry, government and academia, as autonomous driving has a wide influence on society and brings the possibility of industrial innovation. Also in Japan, a government-led roadmap for solving issues such as traffic accidents, aging and population decline, and demonstration experiments, are under way. On the other hand, in order to disseminate autonomous driving, it is necessary to understand society's expectations and anxiety, share accurate knowledge, and increase social acceptability.

Issues Concerning Application of Artificial Intelligence to Autonomous Vehicles

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Autonomous driving technology enables a machine/system to replace people in the process of cognition, judgment, and operation, which is required to drive a vehicle. In the cognition-related field, new technologies including a sensing system, the Japanese satellite positioning system (Quasi-Zenith Satellite System), and three-dimensional road map data are currently developing. Artificial Intelligence (AI) is anticipated to be used for autonomous driving systems to make a decision based on information collected by sensors, etc.

AI technologies including autonomous driving systems are expected to bring benefits to human society. On the other hand, there are rising concerns that they exert negative effects on us. There is concern that application of AI to autonomous driving systems will cause the following major problems: (1) People may not verify the inputs and outputs of AI systems (a kind of "black box"), and (2) What ethical principle should be reflected on AI systems (the trolley problem).

Industry Trends related to Autonomous Driving Vehicles

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Looking at the trend of the industry over autonomous driving vehicles, there are two directions. One is the partial automatic operation of cars, which is the direction to expand the function to support the driver. The other is a direction to promote autonomous driving without a driver on a bus or a taxi vehicle that provides mobile services.

The industry surrounding autonomous driving vehicles exceeds the classification of the automobile industry so far, and partnerships between automobile manufacturers and IT companies are expanding. With the progress of practical application of automatic driving technology, the following are expected: (1) increase of the relative importance of component manufacturers, (2) expansion of IT elements in automobiles, (3) shift from engine cars to electric vehicles, and (4) promotion of mobile services.

Standardization, and Science, Technology and Innovation Policy

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In science, technology, and innovation policies (STIPs), it is a significant challenge not only to promote research and development but also how to spread the achievements of research and technology to the society and market effectively. This means, in other words, that adequate STIPs are required to bridge between two ambivalent directions concerning the standardization and protection of intellectual properties (IPs). However, with regard to the Japanese STIPs, discussions to bridge these directions have still been insufficient. Looking at the international contexts of standardization and STIPs, it can be observed that there have been many trials and errors: active communication through discussions on technology, human capital, and policies in order to make a consensus on an international standard among related authorities, new attempts such as Industrie 4.0, and alteration in policies related to IPs and standardization. In Japan, it is necessary to accumulate more political knowledge and encourage discussion in the future.

II Legal and Social Issues

Ethical and Social Issues of Autonomous Vehicles

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Autonomous driving that we are hearing about is advocated as a technology for realizing "the world's safest and smoothest road traffic society". On the other hand, from ethical and social perspectives, there has been little argument to analyze what the autonomous driving society will be like and what the society should prepare for facing it. What kind of meaning does it have for our society to owe everyday driving, which directly relates to our life and limb, to a computer system? Picking up from the existing literature, this article introduces several issues to provide an opportunity to question the entire autonomous driving society from the ethical and social viewpoints, based on the recognition that the autonomous driving (above level 3) charged with all of the operation function is qualitatively different from the former stage.

Issues on Road Traffic Law over Autonomous Driving

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In recent years, we face the increase in traffic accidents partially caused by elderly drivers. Autonomous driving technology is, therefore, expected to be applied as a new measure to prevent traffic accidents. Various legal problems must be solved in order to put autonomous driving to practical use. In particular, the interpretation of a driver's obligation prescribed in the Road Traffic Law under the jurisdiction of the National Police Agency has a great importance since it affects judgment of the driver's criminal and civil liabilities. The National Police Agency has discussed institutional and other issues over autonomous driving since 2015, holding a study committee every year. From the results of the discussion in the committee, it established the assessment criterion and guidelines for a demonstration test of autonomous driving on public roads. Moreover, the licensing system for driving was argued in the committee as a challenge to the Road Traffic Law related to autonomous driving. The National Police Agency has still been studying in order to achieve autonomous driving at a higher level.

Legal Responses to Traffic Accidents by Autonomous Vehicles:
Should civil and criminal liabilities change?

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Nowadays, in Japan, revision and legislation of legal systems are in progress for disseminating automated driving. It is significant for realizing automated driving to consider the legislative response to accidents by automated vehicles as well as legal amendment. Thus, this research paper focuses on the civil and criminal liabilities of autonomous vehicle drivers and autonomous vehicle manufacturers when accidents occur.

In cases under level 2, both civil and criminal liabilities can be handled with the existing legal framework. However, in cases above level 3, it has already been pointed out that there are a few legislative problems in applying the current law to the cases. In cases of level 4-5, it will be required to take legislative measures especially for civil liability. Without the law reform, it is difficult to confirm the civil liability of an autonomous vehicle driver. Moreover, regarding criminal liability in cases above level 4, the subject of which should be accountable will be shifted from drivers to autonomous vehicle manufacturers.