Special Feature Article

Toward Accelerating the Spread of Self-Driving Vehicles

~Strategies and Current Status of Parts Suppliers~.

The automotive industry is accelerating its efforts to advance self-driving technology. In April this year, Nissan Motor Co., Ltd. announced its next-generation driver assistance technology with improved emergency avoidance performance. They aims to install the system in almost all new vehicles by 2030. Last April, Toyota Motor Corporation launched “LEXUS LS” and “Mirai”, both equipped with advanced driver assistance technology that allows hands-off driving. They continue to conduct self-driving experiments on public roads with the government of Aichi Prefecture. Honda Motor Co., Ltd. will also make its next-generation ADAS (Advanced Driver Assistance Systems) available in all four-wheel vehicle models sold in emerging countries by 2030. In the future, self-driving technology is expected to spread rapidly along with electrification, and the knowledge of parts suppliers will be essential for its realization. The areas of need are also diverse and complex. While discussing specific examples of our efforts, the latest technologies and the areas of components where future market growth is expected will be discussed.

Competition in the development of sensors and cameras continues to advance day by day.

Current self-driving technology is based on a combination of cameras and detection devices such as LiDAR (lidar and laser scanners) and millimeter-wave radar. “Ground Truth Perception”, Nissan's next-generation driver assistance technology mentioned above, is one such example, accurately capturing the surrounding space and object shapes, and identifying changes in real time.

Lidar is under active development for smaller size and higher performance. Toshiba Corporation has developed a product with a maximum measurement distance of 300 meters and made it in palm-size. They aim for commercialization in 2023. SteraVision Co., Ltd. has developed the world's first "Solid State LiDAR" without any moving parts. It is said to be able to detect objects that are difficult to see with the naked eye, such as in fog or in the distance. The system also features "unconscious AI (artificial intelligence)," which selectively extracts and recognizes important scenes, just like human vision.

Advanced technology is required to operate lidars and ADAS (Advanced

Driver Assistance Systems). Seiko Epson Corporation has developed a new crystal oscillator for automotive applications to meet the needs of high-performance lidars and ADAS. This product suppresses image fluctuations and bit errors in data transfer, and is less than half the size of existing products.

The SoC (system-on-chip), which can be considered the "brain", processes the data acquired by the onboard cameras and lidars, the "eyes" of self-driving. Renesas Electronics Corporation has developed “R-Car V4H”, a SoC designed for Level 3 (conditional self-driving in limited areas). In March of this year, They announced the expansion of cooperation with Honda to supply the main SoC for “Honda SENSING 360”, an all-around safe driving support system.

In Europe, the provision of necessary technology packages is also progressing.

Antennas and connectors are also core technologies. Mitsubishi Electric Corporation has developed "Antenna for high-precision satellite positioning terminals" for self-driving. It is the world's smallest antenna for satellite positioning terminals supporting four frequency bands, and is compatible with the world's major satellite positioning systems.

Stable high-speed transmission is essential for instantaneous processing of information obtained by sensors and cameras. IRISO Electronics Co.,Ltd. develops connectors for ADAS (driver assistance systems) and ECU (electronic control units). It is equipped with high-speed transmission at 25 Gbps and a function to control misalignment that occurs during mounting. In March of this year, they announced the construction of a new plant in Akita Prefecture to meet the growing demand for connectors, especially for automotive applications.

In Europe, where the trend has been developing, the necessary technologies, from sensors to software, are being offered as a package. Mega-suppliers such as Robert Bosch GmbH, Continental AG, Valeo Siemens eAutomotive, etc., will be setting up a one-stop supply system with a view to Level 4. In Japan, DENSO CORPORATION, AISIN CORPORATION, ADVICS CO., LTD., and JTEKT CORPORATION established "J-QuAD Dynamics". For self-driving, they are developing integrated vehicle control software that highly integrates sensors with steering and braking operations. In the future, it is expected that there will be an increase in the movement toward technological sophistication and efficiency, not only through the development of components by individual companies, but also through the development of interlocking processes from detection to vehicle body control.

Tire Manufacturers' Initiatives and New Technologies

The widespread use of self-driving could drastically change the way cars are used, and is expected to create a new market.

In this context, tire manufacturers are engaged in the data business. Sumitomo Rubber Industries, Ltd. is developing "SENSING CORE" technology that uses data such as tire rotation speed to determine load, air pressure, road surface conditions, and wear. In the future, it will be linked to driver assistance systems, with a view to applying it to technology for controlling vehicles. Yokohama Rubber Co., Ltd. is also working with ALPS ALPINE CO., LTD. on technology to visualize wear conditions using sensors mounted inside tires.

Toyo Tire Corporation is developing airless tires that do not require air and do not puncture. At present, there are issues with ride comfort and durability, and Road Transport Vehicle Law does not allow the vehicles with these tires to be driven on public roads. They could be considered for use in golf carts and small electric vehicles (EV) that would be driven on private property. Based on the know-how accumulated to date, research and development is underway in various approaches to provide better value for self-driving vehicles as well.

New ideas and proposals at Level 4 and above.

In Level 4 self-driving and above, the driver no longer needs to stay alert to changes in the environment and is virtually free from driving controls. Cars may be expected to play a role similar to that of a living room or office, and companies involved in in-car products are beginning to take new approaches.

Hitachi Astemo, Ltd. is taking on the challenge of developing technology to improve the ride quality of self-driving cars through software. They developed "Dynamics Planning", a trajectory planning technology to maintain a comfortable cabin space under self-driving conditions. By taking a driving line that minimizes stressful speeds and jerks (changes in acceleration) for the occupants, the system provides smooth driving and ride comfort with less shaking, just like an experienced driver. Research continues in conjunction with vehicle control technology that accurately traces the targeted trajectory.

At “Automotive Engineering Exposition 2022” held in Yokohama in May of this year, there was also an exhibit on new ways to utilize the interior space of vehicles. NHK SPRING CO., LTD. exhibited a reference exhibit of "Carsickness Reducing Seats”. The special headrest is said to restrain head tilt, which can cause

carsickness. In addition, for self-driving vehicles, an interface for operating the air conditioner and other controls on the ottoman and armrest in the driver's seat has been included. HAMANAKODENSO CO.,LTD. exhibited a "Seat Vibration Experience Demonstration" that simulates self-driving. If a pedestrian or other object is detected while the passenger is looking away, the system alerts the passenger with a vibration.

Sony Corporation has unveiled its first "Vision-S" in 2020, and the entertainment area is one that will be utilized as a differentiating factor from its competitors. This is an area of strength where Sony can fully utilize the audio/visual technologies it has cultivated over the years, and by creating new added value, it is establishing a presence in the EV market.

Lights are expected not only to ensure visibility and alert following vehicles, but also to serve as a means of communication. Imasen Electric Industrial Co., Ltd. will promote the application of light guide technology for rear combination lamps and other applications. Their technology is used in TOKAI RIKA CO., LTD.'s fender-retractable digital outside mirrors, which can project text, etc., onto the road surface. It is expected to be used as a technology to indicate to pedestrians the vehicle's intention to slow down or the direction of travel.

KOITO MANUFACTURING CO., LTD. will also focus on the development of communication lamps along with lidar and other sensors. Working on research and development of a "sensor lighting module" that integrates lamps and sensors and projects the direction of travel onto the ground to indicate to pedestrians and other vehicles.

Collaborate with local governments to conduct a series of verification tests

With the cooperation of local governments, self-driving demonstrations are being conducted in buses and other public transportation systems in various regions. Especially in rural areas, self-driving is expected to be widely used as a measure to assist the elderly and other vulnerable road users. In April of this year, Revised Road Traffic Law, which includes a provision allowing "Level 4" (fully self-driving under specified conditions) vehicles to drive on public roads, was passed and enacted at a plenary session of the House of Representatives, which is expected to provide a tailwind for the initiative.

In March and April of this year, Osaka City conducted an experiment in which 21 vehicles in seven types of self-driving buses, electric wheelchairs, logistics delivery robots, and other mobility devices ran simultaneously in an environment

similar to a public road with pedestrian crossings and traffic signals. Ten companies, including Osaka Metro Co., Ltd and Panasonic Corporation, participated in the project, which is scheduled to be implemented again this fall in preparation for the Osaka-Kansai Expo in 2025.

In Tsushima City, Nagasaki Prefecture, Meiji University's Institute of Autonomous Driving and other organizations are conducting a verification experiment with a view to utilizing the system for buses. “Target Line Paint”, a paint for self-driving vehicles developed by Nippon Paint Industrial Coatings Co., Ltd., was applied to a 1.6 km stretch of road. A vehicle that recognizes the paint proceeds based on the instructions. The paint assimilates with the asphalt, thus avoiding confusion with on-surface markings such as speed limits. Aiming at practical application for the purpose of support for the transportation-disadvantaged due to aging population and promotion of tourism.

Development of self-driving platforms targeting these public transportation applications is also under way. Schaeffler Technologies AG & Co. KG strengthened its cooperative relationship with Mobileye, affiliated with Intel Corporation, a U.S. company. The "Mobileye Drive" self-driving system will be mounted on the "Rolling Chassis" platform which is under development, and is expected to be used for self-driving shuttles and unmanned transportation, such as buses. They plan to continue development for mass production as a solution for MaaS (Mobility as a Service) and TaaS (Transportation as a Service).

The widespread use of self-driving technology will drastically change the way users and patrons value their cars. In addition, there is potential for growth in a variety of markets, including not only core technologies such as sensor areas and vehicle control, but also interior products that support user comfort and communication tools with pedestrians and other mobility devices. Parts suppliers are required not only to respond to requests from automakers, but also to propose unique technologies that contribute to the sophistication of self-driving and ideas that no one has thought of before.