

## Kudan

4425

TSE Mothers

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<http://www.fisco.co.jp>

## ■ Index

<b>■ Overview</b>	<b>01</b>
1. Kudan’s AP technologies are attracting the attention of advanced-technologies companies	01
2. The adoption of KudanSLAM is spreading throughout the world	01
3. Development of LiDAR SLAM and making a subsidiary of Artisense Corporation	01
4. The impact of the COVID-19 will be negative in the short term, but positive in the medium- to long-term	02
<b>■ Company Overview</b>	<b>03</b>
1. Company Overview	03
2. History and location, and human resources	04
<b>■ Business Overview</b>	<b>05</b>
1. Business Details	05
2. What is AP?	06
3. Characteristics of Kudan’s Technology	06
<b>■ The current state of business development</b>	<b>08</b>
1. Developments in FY3/20	08
2. Deepening partnerships with advanced-technologies companies	08
3. The integration of LiDAR and SLAM	09
4. Partnership with Artisense and making it a subsidiary	10
5. Involvement in autonomous driving systems technologies, etc.	12
<b>■ Performance Trends</b>	<b>13</b>
1. Earnings structure	13
2. Results Trends for FY3/20	13
3. Results Forecasts for FY3/21	14
<b>■ Medium-to-Long Term Growth Potential</b>	<b>15</b>
1. Possibilities for Kudan in the Field of AP Technologies	15
2. Management Philosophy and Medium-to-Long Term Development Plans	16
<b>■ Policy for Shareholder Dividends</b>	<b>17</b>
<b>■ Information Security</b>	<b>17</b>
<b>■ Glossary</b>	<b>17</b>

## Overview

### Despite the concerns about the impact of the COVID-19, is moving to an even higher growth stage

#### 1. Kudan's AP technologies are attracting the attention of advanced-technologies companies

Kudan (4425) (hereafter, also "the Company") is a company whose business model involves carrying out research and development in the field of artificial perception (AP) and providing software licenses to its clientele. AP, which can be thought of as providing machines with "eyes," is a key part of what is known as deep tech, functioning as the foundation for a broad range of industries, and will in the future be an essential element of all machinery featuring such devices as cameras or 3D sensors. Kudan is the only company that can provide commercially usable algorithms in this AP-technologies area. Therefore, it has been attracting the attention of the world's advanced-technologies companies and the expectations for its growth in the medium- to long-term are extremely high, including that its technologies have been adopted one after another by automotive, electrical machinery and other manufacturers. In terms of organization also, a feature of the Company since its foundation is that it has built a global management structure, including conducting R&D in the UK and administrative work in Japan. As a technology-development company, up until now it had been an organization with a small number of highly skilled employees, but in actuality the Company also had strong growth potential and is expanding in scale.

#### 2. The adoption of KudanSLAM is spreading throughout the world

Kudan has independently developed one of the core technologies of AP known as SLAM (Simultaneous Localization and Mapping) to a commercial level at which it can handle a wide range of practical industrial uses, and it provides to its customers licenses for the use of its software, KudanSLAM. KudanSLAM, which makes possible advanced spatial recognition and positional recognition based on data from cameras and other sensors, is already being adopted widely for next-generation products and solutions. Currently, the Company is strengthening its global structure and opening-up the market while forming partnerships with the world's leading advanced-technologies companies. In this situation, the markets in which its technologies can be applied are rapidly expanding to include autonomous driving systems and robotics, IoT (Internet of Things), and XR (the collective name for space-expansion technologies, including AR (augmented reality) and VR (virtual reality)), and alongside this, the Company's results are also rapidly growing.

#### 3. Development of LiDAR SLAM and making a subsidiary of Artisense Corporation

The impression is that the Company advanced to an even higher growth stage in FY3/20. In other words, it was a year in which it made major steps forward one after another, of expanding the scope of application of its technologies through deepening partnerships with leading advanced-technologies companies at various levels and becoming able to accumulate findings on technologies, and moreover, of strengthening SLAM itself and integrating technologies with the other base technologies of AI and IoT. Among these initiatives, the ones that are likely to be the powerful drivers of growth in the medium- to long-term are the integration of LiDAR and SLAM and making a subsidiary (planned) of Artisense Corporation of the US. SLAM itself has been strengthened by the development of LiDAR SLAM, and it is considered that it will be incorporated more deeply into technologies such as autonomous driving systems, robotics, and XR. Also, through making Artisense a subsidiary, the Company will be able to integrate SLAM technologies with different approaches and generate mutually complementary synergies with various AP technologies, which will make it possible for it, as an advanced-technologies company, to be the only true provider of commercial-use SLAM.

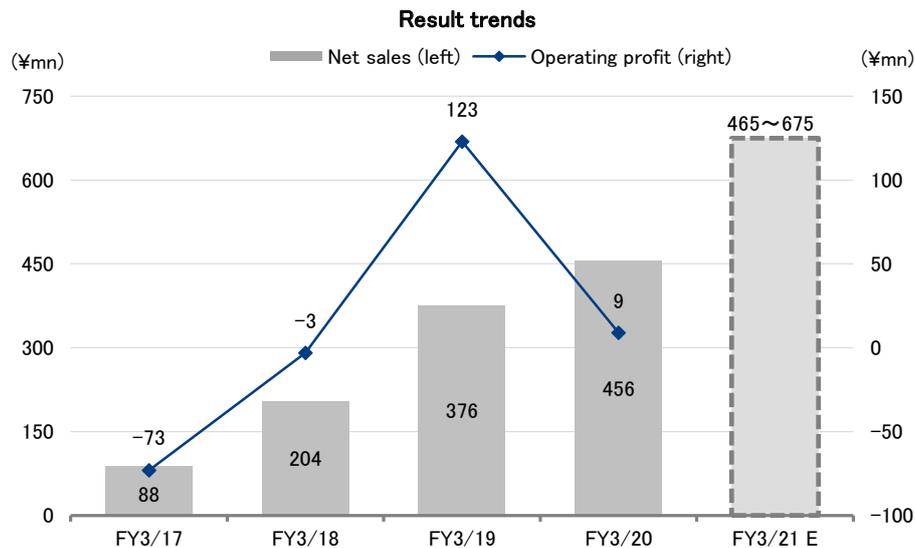
Overview

**4. The impact of the COVID-19 will be negative in the short term, but positive in the medium- to long-term**

In the FY3/20 results, net sales were ¥456mn (up 21.3%YoY) and operating profit was ¥9mn (down 92.4%). Business conditions had progressed smoothly and been basically as expected, but then due to the spread of the COVID-19, the traffic of people stopped and reductions and postponements of projects occurred in every region of the world, so the results were below the initial forecasts. For FY3/21, the Company is forecasting net sales in a range, of from ¥465mn to ¥675mn (up 1.9% to 47.9% YoY), but it has not decided on profit forecasts. It expects both existing and new projects to steadily grow, and it has started joint developments with Artisense and others. But due to the increasing uncertainty in the short term because of the impact of the COVID-19, it has only disclosed a range forecast for net sales. However, it seems that the impact of the COVID-19 will be to promote labor saving and the shift to remote operations, so it can be said that its effect will be positive in the medium- to long-term. Therefore, at FISCO we think it is fully possible that the Company will achieve net sales of ¥10bn to ¥20bn and an operating profit margin of at least 60% in 5 to 10 years' time.

**Key Points**

- Is forming a monopolistic position in the market for commercial-use SLAM
- The development of LiDAR SLAM and making a subsidiary of Artisense will spur-on growth
- The impact of the COVID-19 will be negative in the short term, but positive in the medium- to long-term



Source: Created by FISCO based on Kudan's summary of accounts

# Company Overview

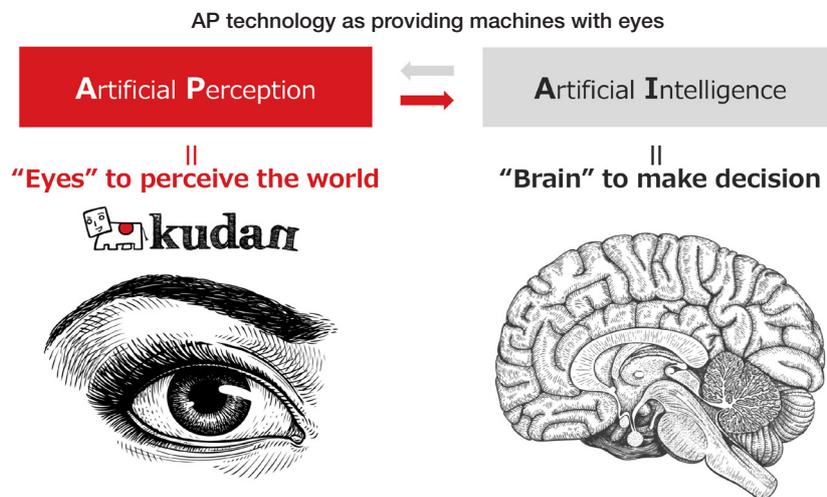
## Giving vision to robots and computers

### 1. Company Overview

With a stated vision of providing “Eyes for all the machines,” Kudan carries out research and development in the field of AP (artificial perception), a technology furnishing machines with the equivalent of human eyes, and it conducts its business through the sales of software licenses and related services. In recent years, AI (Artificial Intelligence), which is the “brain” of a machine, has been rapidly developed, while it is considered that AP technologies, which can be said to be the “eyes” of machines that make possible functions such as advanced spatial recognition and positional recognition, have evolved to create “functional machines” that for the first time are capable of operating autonomously away from human control. These AP technologies can be widely applied to various fields and they form the foundation that supports all industries, so they can be said to be so-called “deep tech.”

Among these AP technologies, SLAM\*, which the Company is deeply involved in, is a technology in which a machine-and-computer system uses 3D information, such as obtained from images and sensors, to construct a 3D map of a real-world environment while simultaneously estimating its own position within it. After that, the AI determines and evaluates the positional relationships in the real-world environment. These technologies are said to be revolutionary and up to the present time, SLAM technologies have remained only within the scope of academic research and have been swallowed up by huge companies such as GAFA (Google, Amazon, Facebook, Apple). But in the case of the Company, its technologies are even more revolutionary on the point that they can be applied in practical, real-world environments and used by any company throughout the world. Therefore, the attention being placed on the Company’s AP technologies by the world’s advanced-technologies companies is extremely high, and the number of companies acquiring a license for the Company’s SLAM and incorporating KudanSLAM into the products they are developing is rapidly increasing.

\* SLAM (Simultaneous Localization and Mapping): refers to a technology in which a machine-and-computer system constructs a 3D map of a real-world environment while simultaneously tracking its own position within it. Its types include Visual SLAM, which uses camera images, and LiDAR SLAM, which uses laser reflection. LiDAR (Light Detection And Ranging) is a sensing technology that emits a laser light onto an object and measures the distance to that object from the light’s reflection. It is intended for autonomous driving systems in order to accurately detect objects, but its large size and cost are problems.



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## Business scope is rapidly expanding

### 2. History and location, and human resources

Managing Director Tomo Ohno established Kudan Limited (currently a subsidiary of Kudan Inc.) in the United Kingdom in January 2011, and it began research and development on the company's own version of SLAM, a tool at the foundation of AP technology. Kudan Inc. was established in Japan in November 2014 as an operational base to develop a Japanese market for the company and to strengthen its managerial structure. After that, its business scope quickly expanded, including that it developed KudanSLAM, for which it provides software licenses, that it partnered with various manufacturers, and that it was listed on the Tokyo Stock Exchange (TSE) Mothers market. The Company has conducted technological R&D in the UK and administrative work in Japan, but in 2019, it increased personnel numbers in order to enter more deeply into industries in various regions around the world, including opening a business-development base in North America, and although it has postponed opening bases in China, this is still under discussion. Elsewhere, the Company plans to make a subsidiary of Artisense of the US, which has acquired an excellent reputation for the SLAM technologies it has developed, while it is also greatly expanding its technologies developers. The Company increased its number of personnel by nearly 4 times in the last 1 year and it currently has more than 40 personnel, who work in 4 bases around the world (including Artisense). It is solidifying its approach of gathering advanced technologies in both East Asia and the West.

#### History

Date	History
January 2011	Kudan Limited (currently a subsidiary of Kudan Inc.) established in the UK
November 2014	Kudan Inc. established with its headquarters in Chiyoda-ku, Tokyo
January 2015	Kudan Limited made into a wholly-owned subsidiary of Kudan Inc.
June 2015	Company headquarters transferred to Shinjuku, Tokyo
July 2015	AR engine "Kudan AR SDK" released
October 2016	Business partnership agreement signed with Hakuodo Inc.
December 2016	Evaluation demo version of "KudanSLAM" software developed
August 2017	Visual SLAM library "KudanSLAM Alfa" released
June 2018	Capital alliance signed with Kokusai Kogyo Co., Ltd., Zenrin-Datacom Co., Ltd and Xacti Corporation
March 2018	Visual SLAM library "KudanSLAM Carnelian" released
August 2018	RGB-D SLAM library "KudanSLAM Galena" released
December 2018	Visual-LiDAR-SLAM development partner program initiated, combining Visual SLAM with LiDAR
December 2018	Listed on the Mothers section of the Tokyo Stock Exchange
January 2020	Acquired shares of Artisense Corporation, a computer vision company that originated in The Technical University of Munich, Germany, toward making a subsidiary
May 2020	The Company and Artisense concluded a business partnership agreement

Source: prepared by FISCO from the Company's securities registration statement and press releases

## Business Overview

### Sells licenses of KudanSLAM, which gives vision to machines

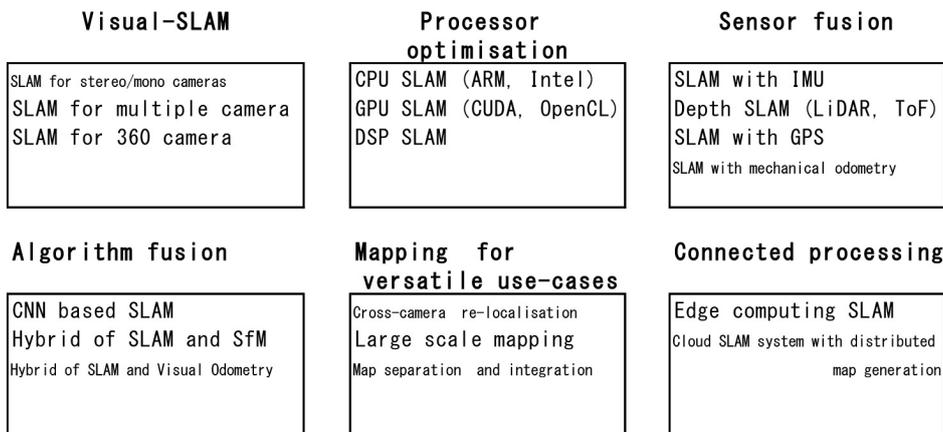
#### 1. Business Details

The Company sells software licenses for its KudanSLAM software, which is designed to incorporate the key AP technologies of SLAM, ALAM\*1, VIO\*2, SfM\*3 and other algorithms\*4 into the hardware of the customers it provides to. Up until FY3/18, it sold licenses for the precursor of KudanSLAM, an AR engine called Kudan AR SDK, to customers such as mobile application development companies. But it has since entirely transitioned its business to focus on KudanSLAM, with the aims evolving deep tech and expanding into areas other than AR.

- \*1 ALAM (Asynchronous Localization and Mapping): a technology in which a machine-and-computer system constructs a 3D map of a real-world environment and tracks its own position within it at different times.
- \*2 VIO (Visual Inertial Odometry): a technology that uses camera images to estimate position and orientation.
- \*3 SfM (Structure from Motion): a technology for estimating 3D structures from 2D camera images and motion.
- \*4 Algorithms: calculable mathematical models devised to solve specific problems. In many cases, they are expressed in the form of a computer program.

As a result of this transition, its main customers have also changed dramatically, from social VR developer MindMaze and social app and game developer enish (TYO: 3667) in FY3/17, to customers from FY3/18 onwards that include unicorn startup Magic Leap, a developer of mixed reality wearable computer systems; LINE Plus, a subsidiary of LINE (TYO: 3938); OEM Xacti, a developer of camera and image processing engines, and Nikon (TYO: 7731), the internationally-renowned manufacturer of single-lens reflex cameras. Moreover, in FY3/20, in which it expanded its lineup and integrated SLAM and LiDAR technologies, its customers grew to include Sony Corporation (TYO: 6758) and global automotive-related manufacturers. In such ways, the Company has been improving functions, from AR to smartphone cameras, expanding the application areas of KudanSLAM, including to autonomous driving systems, and more deeply entering-into industries as a deep tech company. Also, the pace is accelerating at which the world's manufacturers are incorporating KudanSLAM, the only product on a commercially usable level, into their own products as an elemental technology.

#### The SLAM technologies provided



Source: prepared by FISCO from the Company's website

## AP is essential for devices attached to cameras

### 2. What is AP?

To say it simply without fear of being misunderstood, the camera and other sensors serve as the eyes, which combine with SLAM as the vision (the optic nerve) to form AP, and AP sends information to the AI the brain, which evaluates it and makes decisions. In other words, AP technologies can give to machines high-level visual ability the same as eyes do for humans. Among these technologies, SLAM refers to a series of processes in which data acquired from sensors, such as cameras and 3D sensors, is mathematically processed by a computer program, which then outputs detailed, real-time data pertaining to the spatial elements (direction, distance, size, etc.) and motion elements (position, movement, etc.), and then compares it to memory data (existing sensory information stored as data). The Company has developed its own SLAM based on a reconstruction of the previously existing fundamental technologies for sensor data and imagery processing known as “computer vision.”

AP has proven itself to be an essential technology for the development of autonomous control for a wide range of machinery and robotics under their broadest definitions, including industrial robots, domestic robots, next-gen mobility (such as autonomous automobiles), and aerial devices (such as drones). In addition, it is an essential technology for spatial awareness in XR\*, which is the user interface for next-generation computers. Moreover, it will also function as a core technology for such applications as next-generation digital mapping and dynamic mapping (a fluid mapping system in which real-world environments and conditions are reflected instantaneously) to create big data, as well as for digital twinning (the creation of a virtual space that functions as a “twin” of the real environment and is synchronized with it in real time). In these ways, AP is a core technology that is absolutely essential for all machinery featuring cameras and other sensors, and which can be applied horizontally across various fields as a tool to create next-generation solutions.

\* XR (Cross Reality): the collective name for space-expansion technologies, such as AR (augmented reality) and VR (virtual reality).

## Its biggest characteristic is that it is the only technology able to withstand commercial-use

### 3. Characteristics of Kudan’s Technology

The Company’s SLAM has a technological design that is flexible and highly adaptable, so it is a highly competitive technology for which there is demand not only for existing products, but also for R&D into future technologies with strong elements of novelty and complexity. Moreover, its use is not limited to specific technological areas and industries and it can be applied over a wide range of areas. As well as these strengths, of its flexibility and range of applications, it also has a strong competitive advantage over similar technologies for basic performance (precision, speed, robustness, and versatility). Therefore, the Company SLAM’s can be said to be on a high level that is able to withstand commercial-use and that can be utilized for actual products and solutions.

#### Business Overview

Conversely, the technologies that are similar to those of the Company are either academic open source material that lack the versatility and performance levels necessary for commercial application, or that were developed for a very specific, narrow purpose on a given hardware platform and so also lack versatility (this also applies to SLAM development companies acquired by GAFA). In this respect, the Company has been able to strategically position itself to respond to the medium-to-long term needs of the expanding visual-technologies market. Due to this lack of direct competition in this emerging technological field, it has achieved widespread recognition among advanced technology firms, including many of the Forbes Global 2000 (the world's 2000 largest public companies as published each year by Forbes magazine). Incidentally, the sensor market, of cameras and LiDAR which function as eyes, is a red ocean market. To differentiate their products, manufacturers want sensors that are customized to their own products and KudanSLAM fitted to these sensors. Below, the characteristics of the Company's technologies that have resulted in its competitive advantages are explained.

#### **(1) Unique algorithms**

In comparison to the single open-source algorithms developed in academic circles, Kudan's technologies are broad ranging, and developed using a hybrid method with its own unique algorithms at their core but combining multiple algorithms which work in unison. It is for this reason that, when detecting a 3D geometric structure, for example, both speed and accuracy can be combined by integrating a technique which allows for high-speed recognition with another technique prioritizing superior accuracy and stability. Further, in order to optimize recognition accuracy and processing speed when dealing with a 3D structure (a 3D characteristic point cloud), the concentration of point clouds for recognition can be freely and flexibly adjusted to match the environment and purpose of use. The Company's software also incorporates a variety of other unique mathematical models to ensure its practicality, such as optimization calculations to sequentially improve the accuracy of detected point clouds, and high-speed comparisons with previously saved data.

#### **(2) Flexibility in arithmetic processing environments**

Flexibility in relation to arithmetic-processing platforms is also an important element to expand the applications of SLAM. In order to be compatible with a wide range of arithmetic-processing environments, the Company's technology makes possible the optimization and acceleration of the algorithms' arithmetic processing for various processor architectures (CPU, DSP, GPU, etc.). The technology can also be transferred to all the major operating systems (Linux, Windows, MacOS, iOS, Android, etc.), allowing it to function in a wide variety of system environments.

#### **(3) Flexibility of sensor use**

Kudan's technology is designed to function with a wide range of sensors and has a broad range of applications. Not only is it compatible with most cameras, it also exhibits flexibility with respect to number of cameras and lenses (single-lens, dual-lens and multi-lens cameras) and optical sensor data reading formats (sequential or simultaneous reading). Outside of cameras, also, the technology has the ability to combine data produced by a range of other 3D sensors (LiDAR, ToF, etc.), internal sensors (IMU, mechanical odometry, etc.) and location sensors (GPS, Beacon, etc.) to adroitly make best use of the strengths that each type of sensor possesses.

#### **(4) Flexibility in terms of use of partial functionality**

While the high-level application of SLAM requires complex integration with other technologies, Kudan's technology allows for the extraction and use of individual modules, whose functionality can be flexibly combined with existing systems owned by individual customers. These modules can be freely combined at a number of different levels, allowing for them to be optimized at the semiconductor or application levels, for example.

#### (5) Flexible, high-level performance

In addition to the fact that they allow for all processing to be carried out at high speeds, the uniquely developed algorithms used in Kudan's software allow for the simultaneous realization of high precision (whereby variance of outputted values from true values is kept to a minimum) and robustness (whereby functionality is maintained regardless of the environment or conditions in which it is used). They are also designed so that detailed individual functions, including detection accuracy, robustness, processing speed, data size and power usage, can be finely tuned in accordance with conditions of use and required specifications to optimize performance in a wide variety of applications.

## ■ The current state of business development

### In FY3/20, took a step forward toward securing an overwhelmingly dominant position

#### 1. Developments in FY3/20

The Company started providing KudanSLAM from FY3/18. Since then, it has progressed the expansion of its application to three areas: the AR and VR application areas, including for optical sensor manufacturers and optical equipment manufacturers and MR (Mixed Reality) glass manufacturers; the robotics and IoT areas, including for optical equipment manufacturers and heavy industry and industrial robot manufacturers, and transport equipment manufacturers; and the automotive and mapping application areas, such as for automotive parts manufacturers, digital map companies, and spatial information consulting companies. Then in FY3/20, the Company advanced to an even higher growth stage. That is to say, this was a year in which it made major steps forward one after another, of expanding the scope of application of its technologies through deepening partnerships with leading advanced-technologies companies at various levels and accumulating findings on technologies, and moreover, for strengthening SLAM itself and integrating technologies with the other base technologies of AI and IoT. The specific developments are described below.

### The progress for globalization and partnerships with advanced-technologies companies

#### 2. Deepening partnerships with advanced-technologies companies

Following its listing in December 2018, the Company rapidly expanded its business domains by increasing from a two-person business development (sales) structure to a six-person structure, thereby strengthening sales for global companies. It newly established a base with the aim of strengthening sales and business development in the North America market, while for Europe, as described below, it started the construction of a joint development structure with Artisense's German corporation. It has postponed opening bases in China due to the impact of the spread of the COVID-19, but the plan remains in place. For business development, with the aim of building a value chain through the fully-fledged spread in the use of its technologies, it has already concluded partnership agreements with advanced-technologies companies in various fields, including processor company Synopsys Inc. <SNPS>, Qualcomm Technologies, Inc.<QCOM>, sensors and LiDAR company Sony, the Thales Group, Quster, Cepton Technologies, Inc., technologies trading company and solutions company Nihon Unisys, Ltd.<8056>, MACNICA, Inc., Elematec Corporation <2715>, and Fixstars Corporation <3687>.

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The current state of business development

**The main recent business activities**

Period	Partner	Description
August 2019	Nihon Unisys, Ltd.	As a "business-scaling partner," entered-into a partnership agreement for advance artificial perception technologies, including autonomous driving systems
September 2019	MACNICA, Inc.	Started a partnership toward realizing solutions to technological problems at an early stage, including for sensing and high precision maps
November 2019	Sony Semiconductor Solutions Corporation	Developed RGB-D SLAM on smartphones using Sony Semiconductor Solutions Corporation's ToF sensors
December 2019	Fixstars Corporation	Is aiming to integrate SLAM technologies and Fixstars Corporation's software acceleration service to realize autonomous driving systems, etc., at an early stage
December 2019		Established a US subsidiary
February 2020	Artisense Corporation	Based on the purchase of some shares towards an acquisition, started investigating R&D and business partnerships
May 2020	Qualcomm Technologies, Inc.	Based on the technological partnership with Qualcomm Technologies, Inc., started providing a library for the Qualcomm Robotics RB3 Platform
May 2020		Postponed the establishment of overseas subsidiaries in China (Hong Kong and China) and a domestic subsidiary that it had announced in September 2019
May 2020	Analog Devices, Inc.	Succeeded in installing KudanSLAM into ToF cameras and started the joint development of 3D SLAM demonstration software

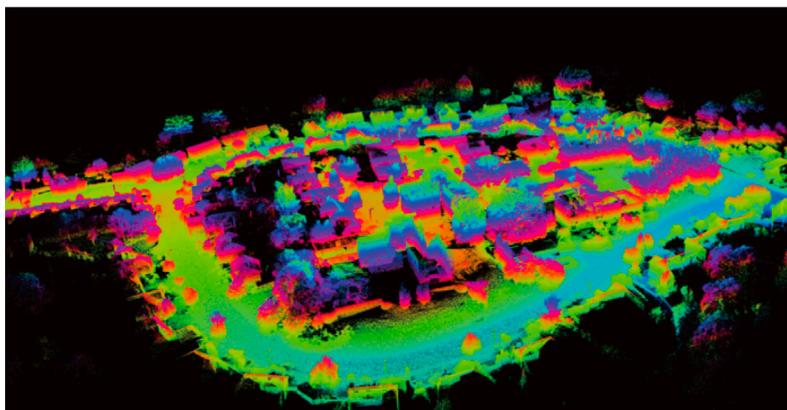
Source: Prepared by FISCO from the Company's press releases

## Toward becoming an elemental technology for autonomous driving systems

### 3. The integration of LiDAR and SLAM

The progress made in R&D and the expansion of the lineup of technologies are rapidly continuing. LiDAR SLAM, which is a technology that integrates Visual SLAM and LiDAR for next-generation sensors, has been launched to be a main pillar of sales. The Company is aiming to realize a more ideal product by constructing real-time 3D maps that are required for machine (robotics) control systems by integrating Visual SLAM, which is used for instantaneous position recognition and re-localization, and LiDAR technologies, which are used for highly precise and long-range 3D reconstruction. At the end of 2018, it started a LiDAR SLAM development partner program. This program makes it possible for customers to install the Company's technologies when they create the 3D digital maps that are required by vehicles' autonomous driving systems. Moreover, the Company's LiDAR SLAM overcomes the problems for estimating the self-position and creating digital maps that companies have faced up to the present time when using LiDAR, and it realizes higher precision, reduced map sizes, and lower latency.

LiDAR SLAM realizes higher precision, reduced map sizes, and lower latency



Source: Reprinted from the Company's website

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The current state of business development

## Is the one and only truly independent specialist

### 4. Partnership with Artisense and making it a subsidiary

In January 2020, the Company announced that it plans to make a subsidiary of Artisense of the US. It acquired some of its shares in January and the two companies concluded a business partnership in May, which marked the fully fledged start of their collaboration. Artisense is a computer vision company that originated from The Technical University of Munich in Germany, and the same as the Company, it is an independent company specializing in SLAM technologies. Its founder and chief scientific officer is Professor Daniel Cremers, who has been the head professor in the artificial intelligence and computer vision fields in The Technical University of Munich, and Artisense has a global leading track record in the fields of spatial AI and SLAM. Starting with Professor Cremers, Artisense has a team of more than 20 globally outstanding technicians, and through making it a subsidiary, the Company intends to create a globally leading independent technological group specializing in SLAM, and it can be said that the Company and Artisense have an extraordinarily complementary relationship.

For Vision SLAM, the Company's strengths include its indirect-method SLAM technologies, in which fast processing precedes the implementation, while Artisense possesses advanced, high-performance, and intuitive SLAM technologies. The Company has a technology that integrates LiDAR, high-precision sensors, and SLAM, while Artisense has GN-net, which enables stable recognition in complex practical environments through deep learning, and it is a pioneer in integrating AI and IoT. So, the Company's strength is in commercial-use applications through implementation and business development, while Artisense's strength is in next-generation technologies backed by academic research. By integrating these different strengths of both companies, they are expected to help create in the near future machines that are capable of rapid and intuitive recognition at the same level as humans. Also, as the leading SLAM-technologies development companies have been absorbed into GAFA, it seems likely that by making Artisense a subsidiary, the Company will enhance its status among advanced-technologies companies as the one and only truly independent SLAM technologies specialist. We are looking forward to the collaboration between Professor Cremers and Mr. Williams, who is essential to the Kudan's R&D activities.

#### Mutually complementary technologies



Strengths lie in the successful commercialization of independently developed and implemented technology



Strengths lie in its progressive next generation technology supported by world-leading research

AP tech	Vision	<ul style="list-style-type: none"> <li>• <b>Indirect SLAM:</b> High-speed processing; advanced practical implementation</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Direct SLAM:</b> High level with advanced functionality; an intuitive method more similar to human cognition ①</li> </ul>
	LiDAR	<ul style="list-style-type: none"> <li>• <b>LiDAR SLAM:</b> Higher-level technology than "vision"; set to become mainstream with the proliferation of LiDAR ②</li> </ul>	
Integration with AI			<ul style="list-style-type: none"> <li>• <b>GN-net:</b> Integration with deep learning via "Deep Feature"; essential technology for practical application environments ③</li> </ul>

Source: Financial results summary documentation

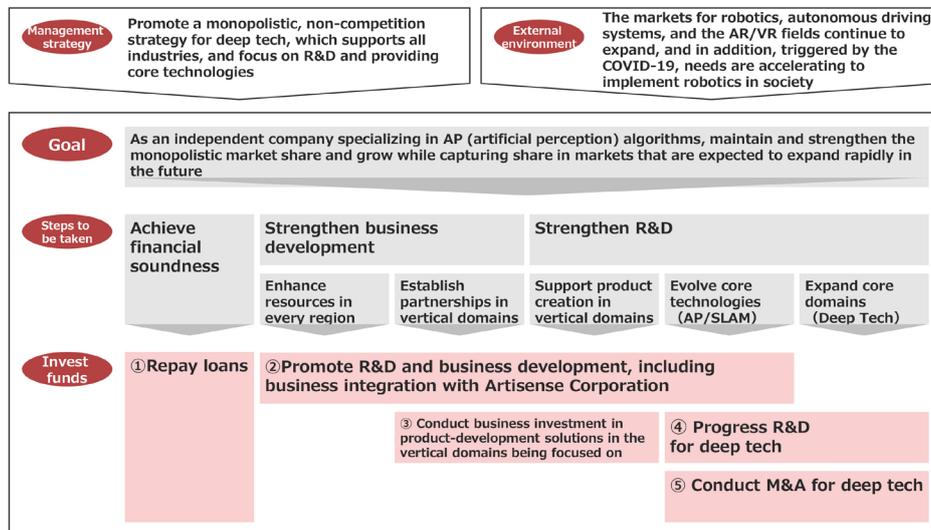
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The current state of business development

The Company acquired 12% of Artisense's outstanding shares in February 2020, and as phase 2, it plans to acquire another 26% on June 29, 2020. After that, it intends to acquire the remaining 62% subject to conditions, including that Artisense's operating loss becomes operating profit, and thereby make it a wholly owned subsidiary. To make it a wholly owned subsidiary, the total investment amount will be around a maximum of ¥2.9bn. As making Artisense a subsidiary was not included in the initial FY3/20 planning and large funds had to be raised for it, it was necessary to raise funds from external sources. Therefore, in May 2020, the Company issued the 11th tranche of new stock acquisition rights through a third-party allocation to Merrill Lynch Japan Securities Co., Ltd. The fees for this are slightly high compared to a capital increase through a public offering, but its fund raising through MS warrants is at the lowest level in the industry.

A total amount of ¥5,089mn will be raised from the fund-raising scheme, and for the uses of these funds, 1) ¥450mn will be used to repay loans, 2) ¥1,170mn will be for business integration with Artisense, R&D, and business development, 3) ¥500mn will be for product-solutions development, 4) ¥100mn will be for deep tech R&D, and 5) slightly less than ¥2,869mn will be for deep tech M&A. The spending on 1) to 4) is basically scheduled for during FY3/21. Also, from the Company's business characteristic, of being focused on partnerships, the probability is small that it will conduct a major M&A after making Artisense a subsidiary. Therefore, it will not necessarily spend ¥2,869mn as the funds for 5) M&A for deep tech, and there is also the fact that the Company can itself initiate the exercise of subscription rights, so it can be considered that share dilution will be limited. However, in this scheme, if the share price increases significantly, it is possible that they will be exercised by the third party to which they were allocated, at which time the existing shareholders will be able to reap the rewards from the rise in the share price.

Approach to using the funds



Source: Reprinted from the Company's press releases

The current state of business development

## Need for the Company’s SLAM is spreading in industry as a whole

### 5. Involvement in autonomous driving systems technologies, etc.

These sorts of initiatives, including the integration of SLAM and LiDAR, the partnerships with advanced-technologies companies and others, and the announcement that it will make Artisense a subsidiary, give the impression that the Company advanced to an even higher growth stage in FY3/20. Therefore, from FY3/21 onwards, it is considered that the movement in various companies toward creating products using the Company’s technologies as an elemental technology will become even more noticeable. For example, for autonomous driving systems technologies, the level-three conditional autonomous driving system will start in Japan, and it will be necessary for machines to instantly recognize the situation, make decisions, and operate at the same level as a human driver. For compliance with levels four and five, which do not assume operations by a human driver, it will be necessary for the vehicle itself to use every type of sensing technology, including LiDAR, to input information on the situation, for the Company’s SLAM to send visual information to the AI while accurately determining the current position, for the AI to make predictions and decisions while also considering risk, and for machines to drive the vehicle in response to this with even higher levels of safety and stability than those of a human driver. In this way, it can be said that the Company’s SLAM is indispensable in order to realize autonomous driving systems. But other than autonomous driving systems as well, its use is being progressed as deep tech for every type of AP technology, including for automated transportation, smartphone cameras, and XR.

Autonomous driving systems and drones



Source: Reprinted from the Company’s website

## ■ Performance Trends

### KudanSLAM software licensing fees as the company's primary revenue source

#### 1. Earnings structure

The Company's earnings are comprised of development license fees from customers that use KudanSLAM for R&D purposes and sales license fees after a customer has launched a product onto the market. Currently, earnings are centered on development license fees, including a method in which, after concluding the contract, fees start from the point in time that the algorithms are delivered and earnings from the license are recognized at the time of delivery, and also a method in which earnings are recognized according to the achievement of milestones from the evolution of the technology. In the medium- to long-term, the application of the Company's technologies is forecast to spread across a wide range of industries, so customer numbers are expected to increase 30% a year, and also around 30% of these customers are expected to create products.

### Progress was in line with the strategy, despite the impact of the COVID-19

#### 2. Results Trends for FY3/20

In the FY3/20 results, net sales were ¥456mn (up 21.3% YoY), operating profit was ¥9mn (down 92.4%), the ordinary loss was ¥12mn (compared to profit of ¥103mn in the previous period), and the loss attributable to owners of the parent was ¥29mn (profit of ¥103mn). The Company increased personnel for business development and product development, and while on the one hand it actively progressed many projects, on the other hand it expanded the scope of application of its technologies, including to the robotics business and the low-speed mobility field. It also made progress in opening-up and expanding new sectors by enhancing functions and creating product packages. Moreover, from the goal of acquiring long-term projects for cutting-edge business development, large-contracts that run over a long period, from the order to the delivery, increased, while in addition to license fees, transactions based on milestone revenue also rose. Against the backdrop of this expansion of sales channels and lineup of technologies, both the number of and the amount earned from development projects steadily increased.

However, the traffic of people has stopped due to the impact of the spread of the COVID-19, so one after the other, projects have been reduced or postponed throughout the world, including technological development in China that was heading toward a demonstration experiment. However, the Company is building and strengthening a structure on a global scale, so SG&A expenses, mainly personnel expenses, increased more than the growth of net sales, rising 76.0% YoY. Moreover, due to the impact of the COVID-19, it incurred a foreign-exchange loss of ¥18mn due to the weakening of the pound and the euro, and a ¥15mn valuation loss on investment securities in its domestic business and capital partners. Although the use of the Company's technologies is spreading and transactions are steadily growing as expected, it cannot be denied that the Company, which goes beyond the framework of country borders to develop technologies, is being negatively impacted by the COVID-19, at least in the short term. So, results were below forecast, net sales by ¥193mn, operating profit by ¥203mn, ordinary profit by ¥225mn, and profit attributable to owners of parent by ¥242mn.

## Performance Trends

## FY3/20 Results

(Units: JPY 1 million; %)

	FY3/19		FY3/20				
	Result	Ratio to net sales	Result	Ratio to net sales	YoY	Initial forecast	Difference with forecast
Net sales	376	100.0	456	100.0	21.3	650	-193
Gross profit margin	354	94.2	416	91.2	17.5	-	-
Sales costs	231	61.5	406	89.1	76.0	-	-
Operating profit	123	32.7	9	2.1	-92.4	213	-203
Ordinary profit	103	27.5	-12	-2.7	-	213	-225
Profit attributable to owners of parent	103	27.4	-29	-6.4	-	213	-242

Source: Created by FISCO based on Kudan's summary of accounts

## Has not decided on profit forecasts due to the effects of the COVID-19

### 3. Results Forecasts for FY3/21

In FY3/21, the Company expects new projects to increase globally, as in addition to the continuation of several long-term projects acquired in FY3/20, it will partner with advanced-technologies companies in Japan and overseas, including semiconductor manufacturers, technologies trading companies, and integrators, and also from the effects of expanding the technologies lineup through the market launch of LiDAR SLAM. In addition, prior to Artisense being made a subsidiary, within Japan and overseas the two companies will progress joint business development and a technological partnership in order to develop next-generation algorithms. Kudan USA, LLC, the US subsidiary, is further increasing business-development personnel to develop as customers LiDAR manufacturers, semiconductor manufacturers, and robot manufacturers within the US, and at the same time, it is forming partnerships, such as with the research institutes of advanced-technologies companies and start-ups that are concentrated on the West Coast of the United States, and its policy is to progress business development in North America.

However, for the FY3/21 results forecasts, the Company has set a range forecast, of net sales of ¥465mn to ¥675mn (up 1.9% to 47.9% YoY), as not only have projects been postponed or cancelled due to the COVID-19, there is uncertainty about the progress that can be made for ongoing projects and for acquisitions of new projects globally. Conversely, the Company has decided not to disclose specific monetary forecasts for operating profit, ordinary profit, and profit attributable to owners of the parent, because as it cannot read what the impact of the COVID-19 will be on costs in the future, such as for business development, it has put in place multiple plans that it can implement flexibly and in a mobile manner in China, the US, and Europe, including for business expansion and new recruitment.

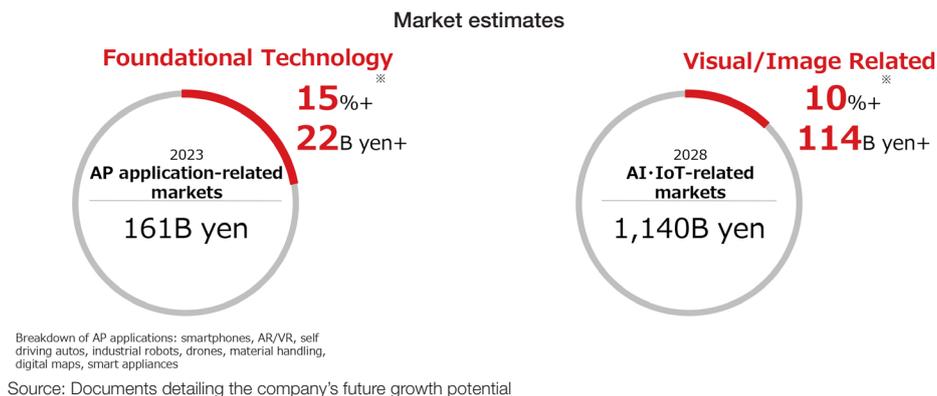
# ■ Medium-to-Long Term Growth Potential

## Deep tech will become the foundation of industry and society

### 1. Possibilities for Kudan in the Field of AP Technologies

The Company's AP technologies, of which SLAM is the core technology, are deep tech. So, as it can be said that it has hardly any competitors for commercial-use products, it is possible to depict an optimistic, large-scale scenario in the medium- to long-term. Today, the Company's technologies are already being utilized in various scenes not only for XR, but also for driving assistance and navigation, dynamic maps, drones, smart robots and other applications. Through the application and integration of technologies, it is expected that the scope of their application will move to an even higher level in the future, such as for autonomous driving systems and automated transportation, IoT platforms, and human augmentation (the integration of humans and technology and AI). Also, the Company's technologies are highly compatible with AI and IoT, which are adjacent to deep tech, and it is considered that through making Artisense a subsidiary, it will be able to progress the integration of its technologies with AI and IoT and increase their areas of application over multiple stages. So, the machines of various companies will be given eyes by the Company's technologies.

Within this development, the Company is forecasting that in the medium- to long-term, it will steadily achieve milestone revenue for R&D into technologies like AP, AP+AI, and AP+AI+IoT. As a result, its AP technologies will spread as deep tech across every industry. Due to the progress made in applications of AP technologies, the market for their related applications is forecast to grow to be worth ¥161tn in 2023. It seems that the Company is targeting around 15% of this market. Also, it is said that the AI and the IoT markets will be worth a total of ¥1,140tn by 2028, and it is considered that the Company is targeting more than 10% of this total. Whatever the case, these markets are extremely large, and it seems that Kudan's technologies will become a foundation to support industry and society as deep tech, the same as is currently the case for the communications, semiconductor, and aerospace-engineering industries.



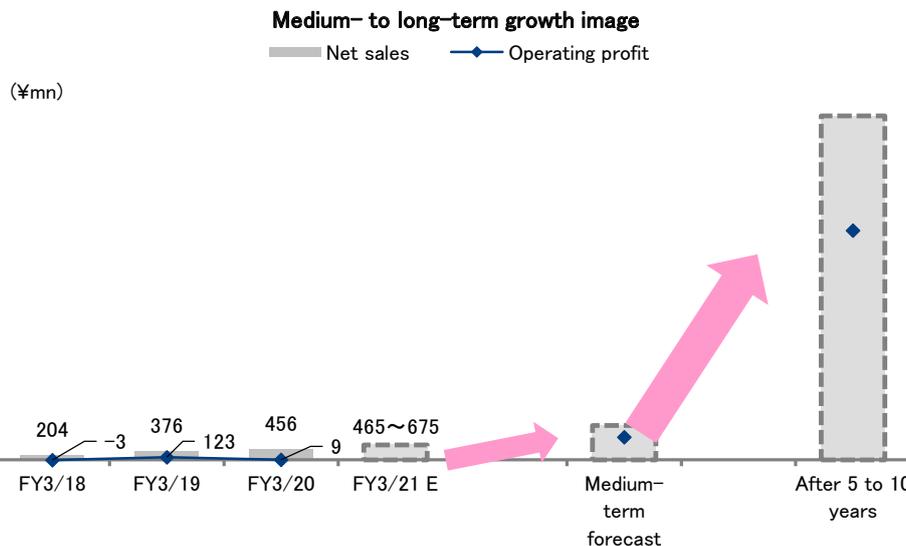
## Expects a dramatic increase in profits in the next 5 to 10 years

### 2. Management Philosophy and Medium-to-Long Term Development Plans

As a company of engineers making a living from R&D in the field of AP and from providing the results of its research to advanced technology firms, Kudan’s goal is to produce technical innovation through its continued efforts in its research sphere. Therefore, based on its management philosophy of “To stand alone, and dare to create what is new and different,” the Company is not afraid of doing what other companies do not and is prepared to reject the prevailing wisdom of what is thought to be right to progress R&D. As a result of this approach, it has an existence that cannot be compared to that of other normal companies and it has a one-and-only presence in the market. Against this background, it aims to not only develop its business and R&D but also increase profits for shareholders. On this point, it can be said that the Company’s AP technologies represent very well its management philosophy.

Currently, it seems that many companies want to give eyes to their machines. This has not changed since when the Company was listed, and indeed, it is thought that today this wish has grown even stronger among automotive, electrical machinery, and other manufacturers. Therefore, at FISCO we think that the scenario in which the AP market expands significantly and rapidly has become even more certain to occur. On the other hand, what has changed since when the Company was listed is the major social and economic turmoil throughout the world due to the spread of the COVID-19. It would appear that the COVID-19 will be with us for a long time in the future, so it is likely that even more rapid progress will be required for labor saving technologies and remote technologies for applications such as autonomous driving systems, automated transportation, and virtual meeting smart glass.

The Company’s AP technologies function as the eyes of machines and computers and are deep tech that are essential in order to realize advanced technologies and future technologies, such as robotics and AR. Moreover, by making Artisense a subsidiary, it seems that the Company has further sharpened its strategy of establishing a non-competition, monopolistic position in the “the eyes of machines” field. In the future, products that use its AP technologies will be continuously released onto the market and their use will become a reality for people. In this case, it is forecast that revenue will increase greatly not only from milestone revenue, but also from sales-license revenue. Therefore, at FISCO we think it is fully possible that the Company can achieve net sales of ¥10bn to ¥20bn and an operating profit margin of at least 60% in 5 to 10 years’ time.



Source: Created by FISCO based on Kudan’s summary of accounts

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## Policy for Shareholder Dividends

In terms of profit distribution, Kudan's fundamental policy is to regularly provide stable dividends to its shareholders, while retaining the funds necessary for future business expansion and reinforcement of its managerial structure. However, in spite of the impact of the COVID-19, at the current time it is not paying dividends and it has also not decided on the possibility of or the timing of paying them in the future. The Company's policy is to make a comprehensive decision on payments of dividends from surplus to shareholders in the future based on factors including how results trend, its financial condition, future business and investment planning, and the timing of its transfer to the TSF 1st Section, and also to investigate dividend payments while maintaining a balance with internal reserves.

## Information Security

Through its business operations, Kudan is often made privy to its client companies' confidential information (including strategically sensitive information) and personal information. Information security protocols are in place to govern the handling of this information, and every effort is made to ensure appropriate measures are taken at all times.

## Glossary

### Technological terms appearing in the report

*1 SLAM	An acronym of "simultaneous localization and mapping," it refers to a technology in which a computer system constructs a 3D map of a real-world environment while simultaneously estimating its own position within it
*2 ALAM	An acronym of "asynchronous localization and mapping," it refers to a technology in which a computer system constructs a 3D map of a real-world environment and tracks its own position within it at different times
*3 VIO	An acronym of "visual inertial odometry," it refers to a technology that uses cameras to output self-position and trajectory of motion
*4 SfM	An acronym of "structure from motion," it refers to a technology for outputting 3D structures from camera images
*5 AR	An acronym of "augmented reality," it refers to technologies that use computers to augment the real-world environment perceived by the user
*6 VR	An acronym of "virtual reality," it refers to technologies that enable the user to experience a virtual environment that appears as the real world, even though there are no actual, physical objects
*7 MR	An acronym of "mixed reality," it refers to technologies that enables the user to experience a fusion of the real world and a virtual world with no boundaries
*8 Algorithms	Refers to calculable mathematical models that are devised to solve particular problems. In many cases, they are expressed in the form of a computer program
*9 Patch	Refers to one image-recognition method, in which features extracted from small sections are recognized
*10 Descriptor	Refers to one image-recognition method, in which features are described centered on feature points
*11 Densification of feature recognition.	Refers to increasing the amount of feature points recognized within an image. While it increases the amount of useful information, it also slows down data processing
*12 Sparse method	Refers to a method of extracting feature points from an image and conducting post-processing based on these feature points
*13 Processor architecture	Refers to the interface that is defined for each processor (register configuration, command set, input-output, etc.)
*14 Single-lens camera	Refers to a camera composed of a set of one lens and sensors
*15 Dual-lens camera	Refers to a camera composed of a set of two lens and sensors
*16 Multi-lens camera	Refers to a camera composed of a set of three or more lens and sensors
*17 Rolling shutter	Refers to a form of optical sensor that sequentially reads data. A feature is that the outputted image is distorted when taking a photo while the camera is moving
*18 Global shutter	Refers to a form of optical sensor that simultaneously reads data. A feature is that the outputted image is not distorted even when taking a photo while the camera is moving
*19 LiDAR	An acronym of "Laser Imaging Detection and Ranging," it refers to a technology that measures the scattered light to an object from laser irradiation to measure the distance to that object
*20 ToF	An acronym of "Time of Flight," it refers to sensors that measure scattered light to an object in relation to infrared radiation emitted in pulse form to measure the distance to that object
*21 IMU	An acronym of "Inertial Measurement Unit," it refers to sensors that detect electromagnetically an object's angular velocity and acceleration
*22 Odometry	Refers to sensors for detecting speed mechanically
*23 Software module	Refers to software in which partial functions are grouped into a module
*24 Software standards	Refers to the level of abstraction of programming descriptions related to the processor's level of dependence
*25 Robustness	Refers to the ability to perform stably regardless of the usage environment and conditions

Source: Reprinted from the Company's briefing materials on growth potential



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