Approach to "Social Infrastructure x IoT" for SDGs

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Connecting everything around us to a network using IoT will accelerate distribution of information and collection of big data. Moreover, with the use of AI (Artificial Intelligence) in the analysis and response of the collected data, an era will be upon us in which various social issues are solved and new values are created. Referring to this new era as Society 5.0, the Japanese government is promoting activities aimed at a human-centered society that utilizes IoT and AI to balance economic development and social issue solving through social transformation.

Meanwhile, at the 2015 United Nations Summit, 193 member countries adopted the Sustainable Development Goals (SDGs), which are seventeen goals that should be achieved in fifteen years from 2016 thru 2030 to solve various social issues. The seventeen major goals are further broken down into 169 targets. This is suggestive of the business opportunities that companies should aim for in the future, and the approaches to achieving the goals are strongly demanded from the companies.

In this market environment, OKI's ICT business is accelerating various efforts to realize an advanced IoT society based on the keyword "Social infrastructure × IoT." This article introduces OKI's efforts and the relationship with the SDGs.

5G Mobile Communication and Automated Driving

As shown in **Figure 1**, the fifth generation mobile communication (5G) network scheduled for service in 2020 will feature ultra-high speed, multiple simultaneous connections and ultra-low latency, and serve as the foundation for IoT. Its potential to create new market fields is highly anticipated. Communication carriers and vendors around the world are accelerating activities such as study of use cases and demonstration experiments for commercialization of 5G.

Using 5G service as the IoT base, OKI has begun efforts in various fields, one of which is "5G x automated driving."

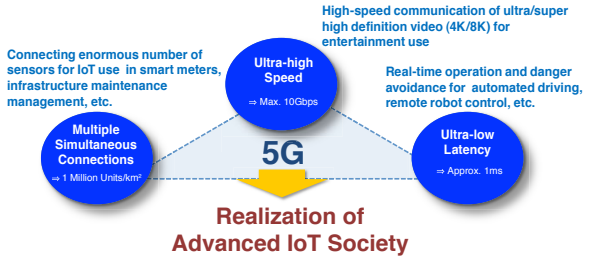

Figure 1. 5G Network Features

Automated Driving Support

Currently, efforts for automated driving are accelerating both within Japan and abroad. Domestically, the Cabinet Secretariat's National Strategy Office of Information and Communications Technology has established a Public-Private ITS Initiative/Roadmaps[1], and various efforts to realize it are underway. In particular, Automated Driving for Universal Services (adus) is one of the Cross-ministerial Strategic Innovation Promotion Program (SIP) themes, and targeting the planned demonstration experiment at the 2020 Tokyo Olympic and Paralympic Games as a milestone, active discussion is being conducted under industry, academia and government collaboration. In addition, automated driving is considered an important theme in multiple SDGs including SDGs 3, 8, 9, and 11. Especially, there is high expectation that automated driving will be the solution to meeting the goals of SDG 3.6's "halve the number of global deaths and injuries from road traffic accidents" and 11.2's "provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport."

As an ITS infrastructure vendor, OKI has been providing roadside devices such as VICS (Vehicle Information and Communication System), ETC (Electronic Toll Collection System) and ETC 2.0, and probe-related systems for road/traffic operators. Utilizing the expertise gained from the systems, OKI has also provided vehicle location management and business services to the private sector through its LocoMobi2.0 service. Now as "5G × automated

driving" gains attention, OKI is working on realizing an automated driving system based on its experience as an ITS infrastructure vendor and developing V2X (Vehicle to Everything) technology. Some specific examples of OKI's efforts are introduced below.

(1) 5GAA (5G Automotive Association)

5GAA is an organization that was launched in September 2016 with collaboration of the world's automotive and ICT industries to consider the realization of future ITS services based on the 5G standard. OKI has been participating in the most advanced discussion related to "5G × automated driving" since October 2017.

(2) SIP Automated Driving for Universal Services (SIP-adus)

OKI undertook the "Survey and Study on Message Set and Protocol for Automated Driving Assistance Communication" commissioned by the Ministry of Internal Affairs and Communications in 2017, and is developing specifications for automated driving assistance communication[2].

(3) Connected Car

OKI is a member of the "Study Group Focusing on the Realization of Connected Car Society"[3] set up by the Ministry of Internal Affairs and Communications in 2017. As a participant in the technical studies, OKI is proposing functions and use cases necessary for V2X mainly for automated driving.

(4) Cellular-V2X (Vehicle to Everything)

Utilization of LTE/5G based cellular-V2X for automated driving is attracting worldwide attention. In collaboration with Nissan Motor, NTT DOCOMO, Continental, Ericsson and Qualcomm, OKI has conducted demonstration experiments of Japan's first cellular V2X[4].

(5) Flying View

In anticipation of 5G deployment, OKI has developed a system that enables free viewpoint video monitoring surrounding the entire circumference of the vehicle. With the collaboration of NTT DOCOMO, OKI has succeeded in testing the system with a vehicle traveling at 160km/h, and is considering further development of the technology and expansion of applicable fields[5].

As we approach the year 2020, study of automated driving will advance triggered by the practical application of 5G. OKI will further advance its ITS-dedicated communication technology that have been cultivated up to now, and will proceed with constructing system interworking based on the features of 5G. Specifically, OKI is aiming to establish a technology for communicating with sensors of road infrastructure and to realize safe, secure and comfortable means of travel through an infrastructure cooperative automated driving system.

Advanced Disaster Management System

Disaster management is the theme of SDGs 11 and 13, and especially in SDG 13.1, "strengthen resilience and adaptive capacity to climate related hazards and natural disasters in all countries" is the goal.

It is predicted that in Japan the temperatures will rise (average of 4.5°C nationwide) and daily rainfalls will fluctuate greatly (rise in 100mm+, 200mm+ rainfalls and rise in the number of short torrential downpours) towards the future[6]. These circumstances together with the heavy rain disasters that occurred last year in northern Kyushu, has prompted the government to call for four countermeasures of "regional disaster management capabilities," "information provision/collection," "issuance/transmission of evacuation recommendations" and "disaster management systems."[7]

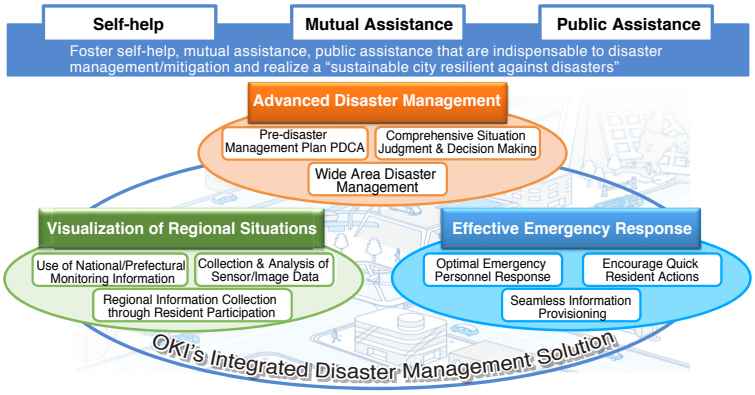

Figure 2. Integrated Disaster Management Solution

For the smooth facilitation of these four countermeasures, OKI has organized its conventional disaster management efforts into an integrated disaster management solution shown in **Figure 2**. The integrated disaster management solution emphasizes the coordination of self-help, mutual assistance, and public assistance, which are indispensable for strengthening the disaster management capability of each region, and the stages necessary for that is configured from three solutions of "visualization of regional situations," "advanced disaster management" and "effective emergency response." The solutions will be provided according to the operational situation of the municipality.

At the core of the integrated disaster management solution is the disaster management information system. Coordinating with various partners, it collects information of river/coastal water levels from sensors and telemeters, information provided by ministries and agencies, and reports from residents. It goes on to perform disaster management work such as planning, analysis and taking action. Then, information is delivered to residents and visitors (tourists, etc.) using various means. Through this, OKI aims to achieve an advanced and efficient "collection and management of numerous information," "information provisioning to various kinds of media," and "issuance and transmission of evacuation recommendations etc."

Digital Store Transformation using IoT and AI

In the fields of finance and distribution, response to the increases in network speed and capacity, cashless transaction due to the proliferation of terminal devices represented by smartphones, and laborsaving is accelerating. Additionally, there is an increasing demand for prompt response to customers as "individuals." These fields are the theme of SDGs 8, 9 and 10. Especially in the field of finance, SDG 8.10's "encourage and to expand access to banking, insurance and financial services for all" is a major goal.

OKI provides a digital store transformation solution called "Enterprise DX" that accelerates the rebuilding of business models using IoT and AI. As shown in **Figure 3**, "Enterprise DX" consists of three solutions, which are "storefront transformation" that maximizes the customer experience value and reduces storefront personnel costs, "operation transformation" that automates the administrative process for drastically reducing cost, and "service transformation" that enables one-stop provisioning of daily life services.

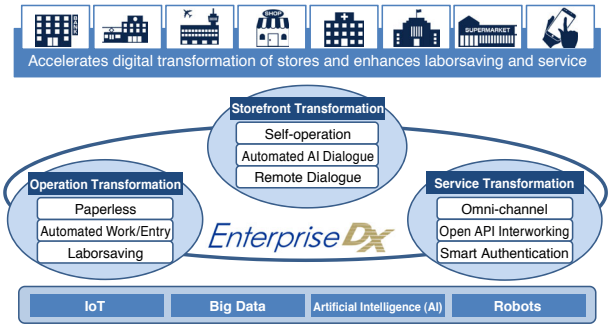

Figure 3. Enterprise DX Concept

The store transformation solution utilizes OKI's user interface technology and operation know-how cultivated from developing service counter/self-service terminals for financial and rail industries to provide new customer services that are in line with the changing society such as functions for unattended operation/remote customer service using AI and multilingual support for foreigners.

For operational transformation, expertise with centralized administrative solutions will be utilized to offer such solutions as centralized back-office solution that transfers storefront administrative work to the back-office, automation of image data entry, robot system to automate the administrative work itself, and document image storage system that complies with scanner storage software certification of Electronic Books Maintenance Act. This will all contribute to a paperless office, drastically cut administrative costs and improve productivity.

In service transformation, OKI will take advantage of its experience working with various network connections and SDBC (Smart Device Business Connector) to provide an infrastructure that enables customers to obtain optimal services anytime, anywhere on their own. Through this, OKI will deliver storefront-external service interworking and smart authentication environment in its effort to bring about a cashless society.

Marine IoT to Conserve the Richness of the Seas

The marine related field is touched upon by several SDGs including SDGs 9, 11, 13 and especially 14, in which the main theme is "conserve and sustainably use the oceans, seas and marine resources."

It is stated in SDG14.4, "by 2020, effectively regulate harvesting, and end overfishing, illegal, unreported and unregulated (IUU) fishing and destructive fishing practices" and in SDG 14.6, "by 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and

overfishing." Each country's implementation progress toward the abolishment of IUU fishery will be considered the indicator.

In conjunction with SDG 14.6, the main theme of Japan's "Headquarter for Ocean Policy Council's Opinion on the Formulation of The Third Basic Plan on Ocean Policy"[8] is "maintain and protect the marine environment." Additionally, from the viewpoint of marine security, measures for marine traffic safety are the main theme in the next basic plan on ocean policy.

Under such a market environment, OKI has begun efforts on marine IoT to solve various social and regional issues related with the ocean by utilizing underwater acoustic and optical fiber sensing technologies that have been cultivated over the years working in the defense field. IoT services using these technologies are introduced below. OKI's SEATEC II is the only domestic marine experimental facility in the private sector, and it can quickly provide various marine testing and co-creation activities/ demonstration environment with customers.

(1) IoT Service against Poaching

The Hokkaido region suffers more than tens of millions of yen annually from poaching of sea cucumbers and other marine life, and it is exactly the kind of regional issue previously mentioned that needs to be solved. Conventionally, poaching is detected by monitoring images from several surveillance cameras, but surveillance becomes extremely difficult in foul weather such as snow and at night.

OKI's underwater acoustic sensing technology is capable of detecting the intrusion of poaching vessels and divers in the water using multiple underwater acoustic microphones. Furthermore, by linking this technology with existing systems such as disaster management radio, security notification can be instantly made. This makes it possible to conduct poaching surveillance with an inexpensive system configuration regardless of weather or time of day.

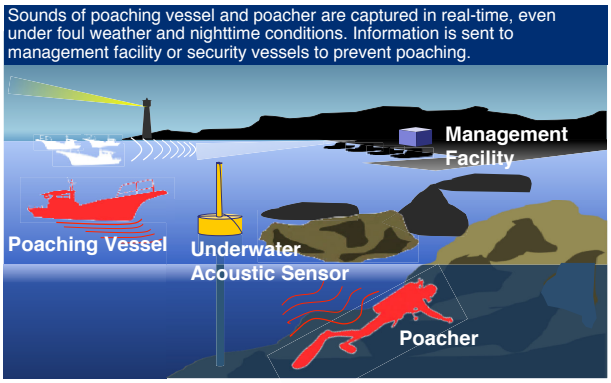

Figure 4. Intrusion Detection and Crime Prevention

(2) Ship IoT Monitoring

As a ship repeats voyage, hull cracks may occur due to twisting and stress causing a serious accident. Strengthening the ship's structure is insufficient to guarantee the ship's voyage, thus real-time monitoring of the ship's condition during the voyage is desired.

Under these circumstances, OKI is conducting a demonstration experiment in a co-creation relationship with shipbuilders on a solution to monitor a ship's hull in real-time and detect surface stress using optical fiber sensors and BOTDR (Brillouin Optical-fiber Time Domain Reflectometer) method, which until now was only effective for detecting point stress.

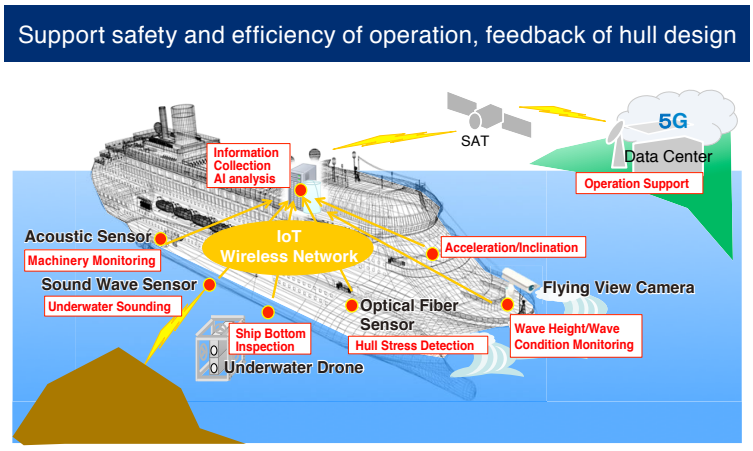

Figure 5. Ship IoT Monitoring

The large noises inside a ship are another problem as it prevents detection of machinery failures. Here, OKI is working on a solution using its acoustic sensing technology to filter out surrounding noises and only detect abnormal sounds of machineries.

Furthermore, it is anticipated that OKI's 920MHz multihop wireless SmartHop® *1) will be utilized for the ship's onboard wireless communication.

Conclusion

The Japanese government believes Society 5.0 will lead to the achievement of SDGs and is pushing forward digital transformation centered on IoT and AI. Under the keyword of "Social Infrastructure × IoT," OKI will utilize its strengths in sensing, network and data processing/ operation technologies together with its abundant use case experiences to deliver solutions/technologies that will resolve social issues in its strive to contribute to society. ◆◆

References

1) Prime Minister of Japan and His Cabinet, "The Strategic Headquarters for the Advanced Information and Telecommunications Network Society (IT Strategic Headquarters) Public-Private ITS Initiative/Roadmaps 2018," June 15, 2018
https://japan.kantei.go.jp/policy/it/2018/2018_roadmaps.pdf
2) SIP Automated Driving for Universal Services
http://www.sip-adus.go.jp/
3) Ministry of Internal Affairs and Communications, "Study Group Focusing on Realization of Connected Car Society," August 4, 2017
http://www.soumu.go.jp/menu_news/s-news/01kiban14_02000315.html
4) OKI Press Release, "Leading Automotive, Telecom and ITS Companies Unveil First Announced Cellular V2X Trials in Japan," January 12, 2018
https://www.oki.com/en/press/2018/01/z17041e.html
5) OKI Press Release "Success Testing the "Flying View" System Capable of Video Monitoring While Driving at Speeds of 160km/h in Collaboration with NTT DOCOMO," May 22, 2018
https://www.oki.com/jp/press/2018/05/z18010.html
6) "White Paper Disaster Management in Japan 2018"
http://www.bousai.go.jp/kaigirep/hakusho/pdf/H30_hakusho_english.pdf
7) Cabinet Office (Disaster Management), Government of Japan, "Future Evacuation Efforts based on the July 2017 Torrential Rain Disaster in Northern Kyushu," December 8, 2017
http://www.bousai.go.jp/kohou/oshirase/pdf/20171208_01kisya.pdf
8) "Headquarter for Ocean Policy Council's Opinion on the Formulation of The Third Basic Plan on Ocean Policy"
https://www.kantei.go.jp/jp/singi/kaiyou/sanyo/2017/sanyo_honbun.pdf

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*1) SmartHop is a registered trademark of Oki Electric Industry Co., Ltd.