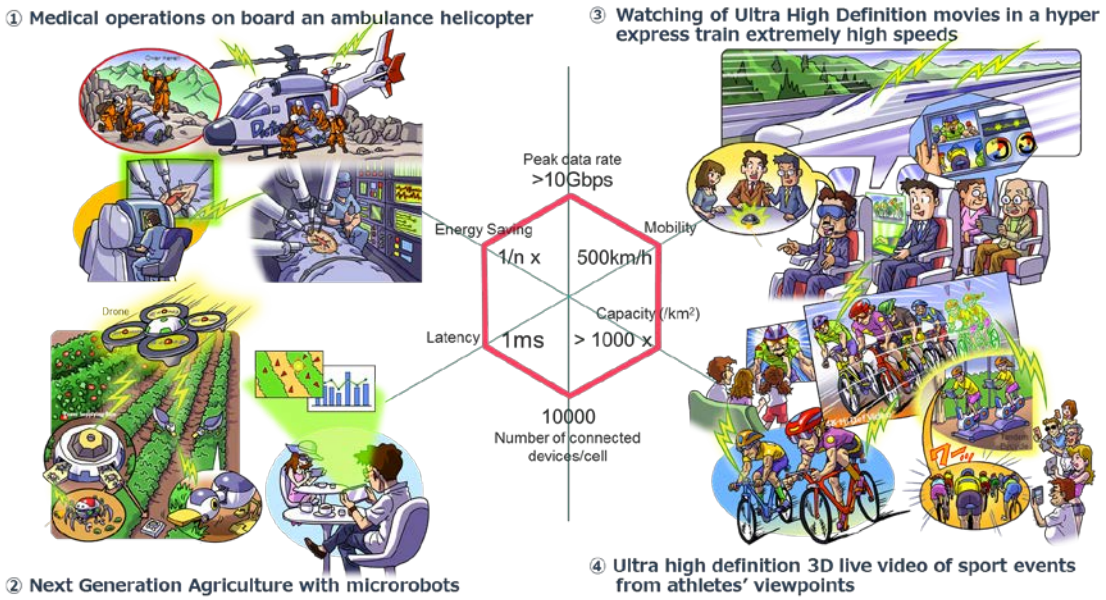
Annex：Future Business and Service

This chapter will introduce perspectives of future business and services for reference.

5G's special characteristics include a peak data rate of 10Gbps, mobility of 500km/h, latency of less than 1ms, and cells that can connect to more than 10,000 devices at once, a capacity over 1000 times more than 4G has per cell.　With these characteristics, there will be many uses available in many different fields.

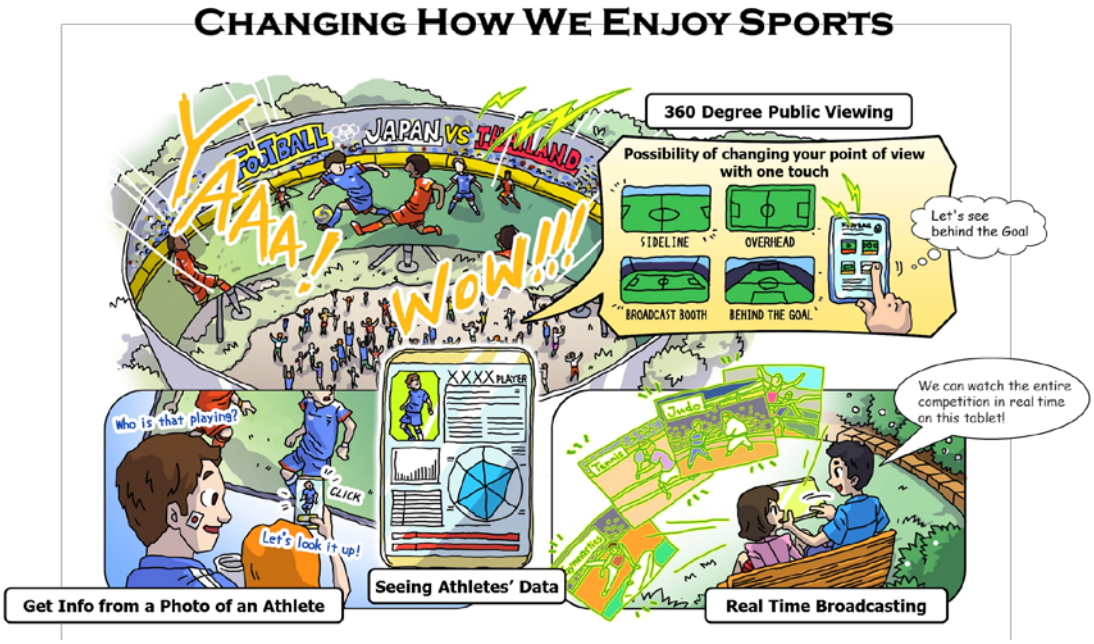


(『Excerpt from the Round-table Conference on Radio Policies 2020, Report (July, 2016))

Below is some proposed use cases for a 5G network, based on the market trends discussed in chapter 3.

①Sports
②Health
③Shopping
④Response of Disaster
⑤⑥Rural Lifestyle
⑦⑧Urban style
⑨⑩Work Style
⑪⑫⑬⑭Automobile
⑮Airport
⑯Train

① Sports



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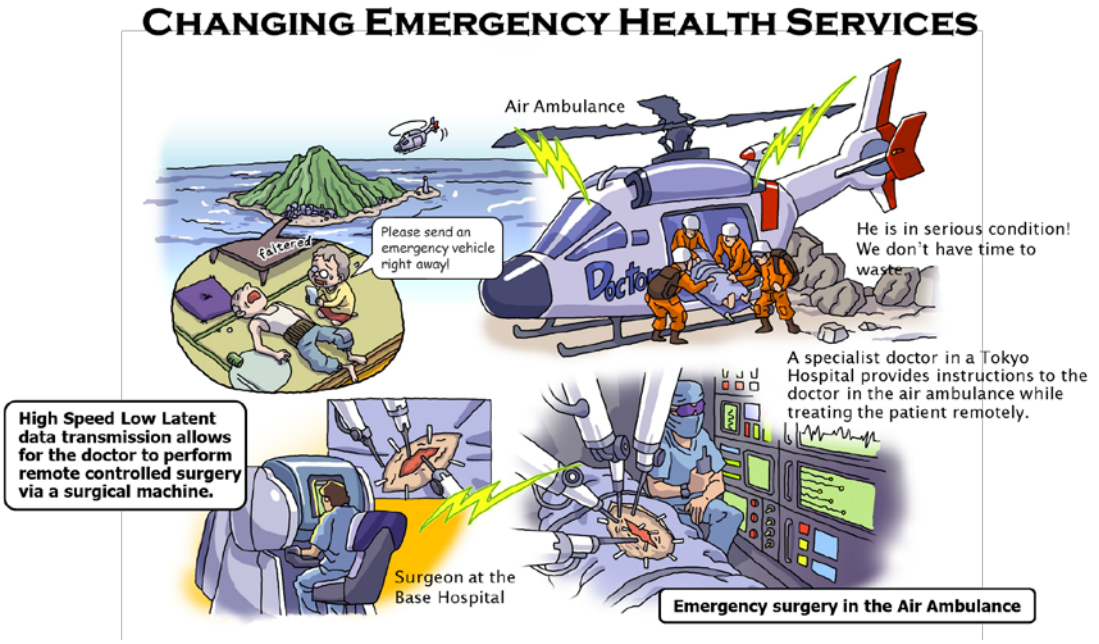
Spectators at sports events will use smartphones and tablet, which will increase the ways sports fans are able to enjoy sports that meet their personal interests. For example, information can be received on a particular athlete by taking a photo of them. Another example will be even if you are watching at home or in a park, spectators will be able to choose to view a match from multiple live high definition points of view.

② Health



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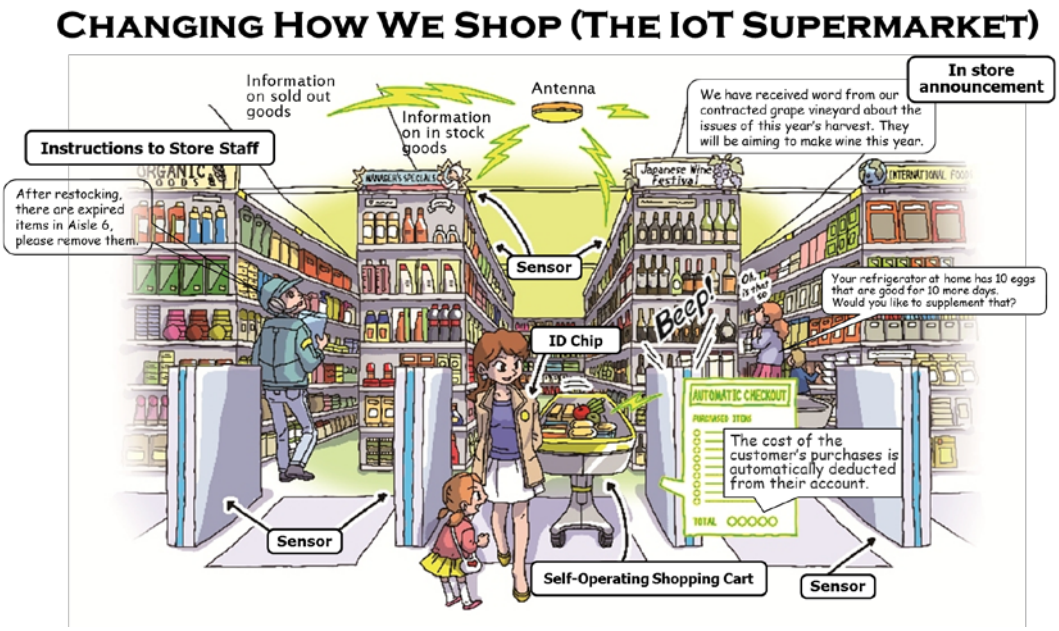
In the field of health, providing optimal heath diagnostics and care can be realized, such as providing sharing in real time with remote doctors the vital signs and situation of a patient in an emergency such as a rescue situation.

③ Shopping



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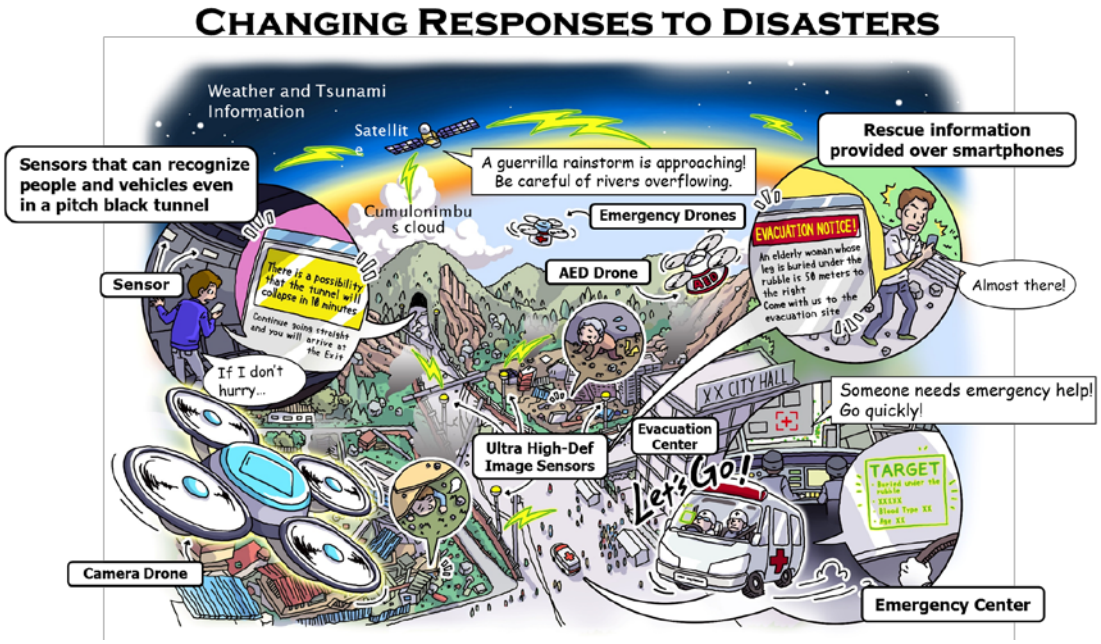
Shopping will be made into a more pleasant experience as users will be able to pay without waiting in line. In addition, stores will be able to know their inventory in real time, which will lead to time savings when managing a store.

④ Responding to Disasters



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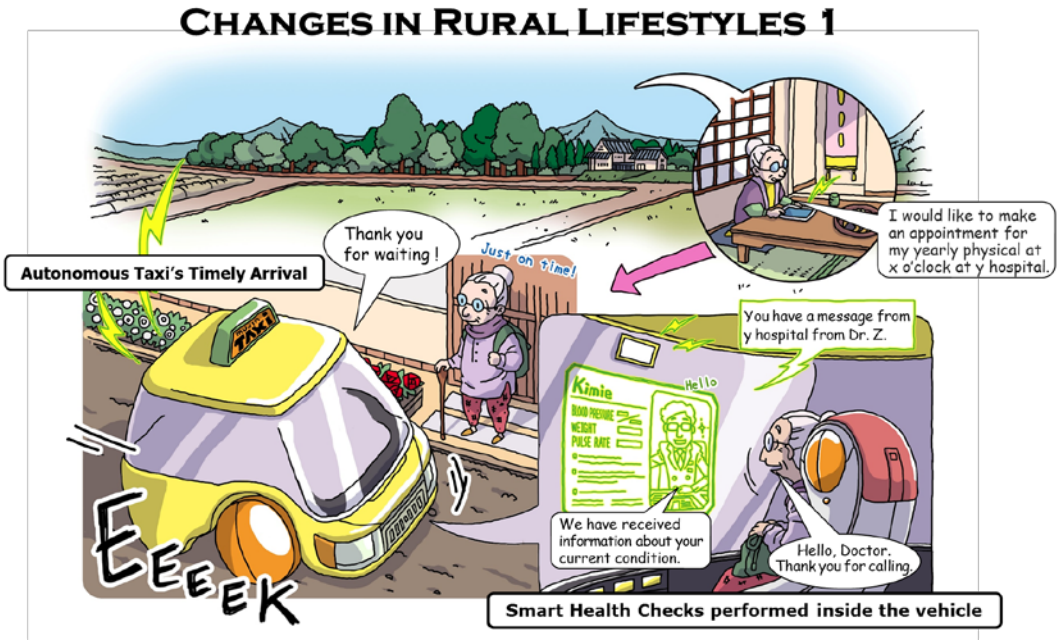
When accidents or natural disasters occur, a system can be created to help deal with them. This not only includes a rapid dispatch of rescue support teams, but local residents, stores, and municipal governments will be able to share information, and individual action plans will be created, detailing locations of the closest evacuation center as well as other individualized support information.

⑤ Rural Lifestyles 1



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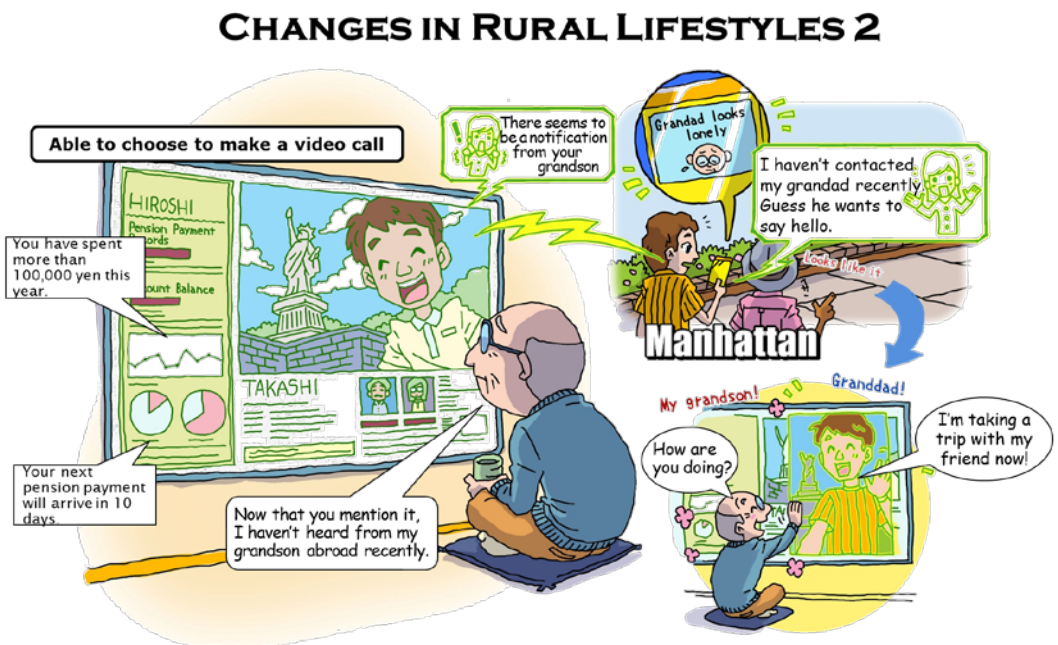
⑥ Rural Lifestyles 2



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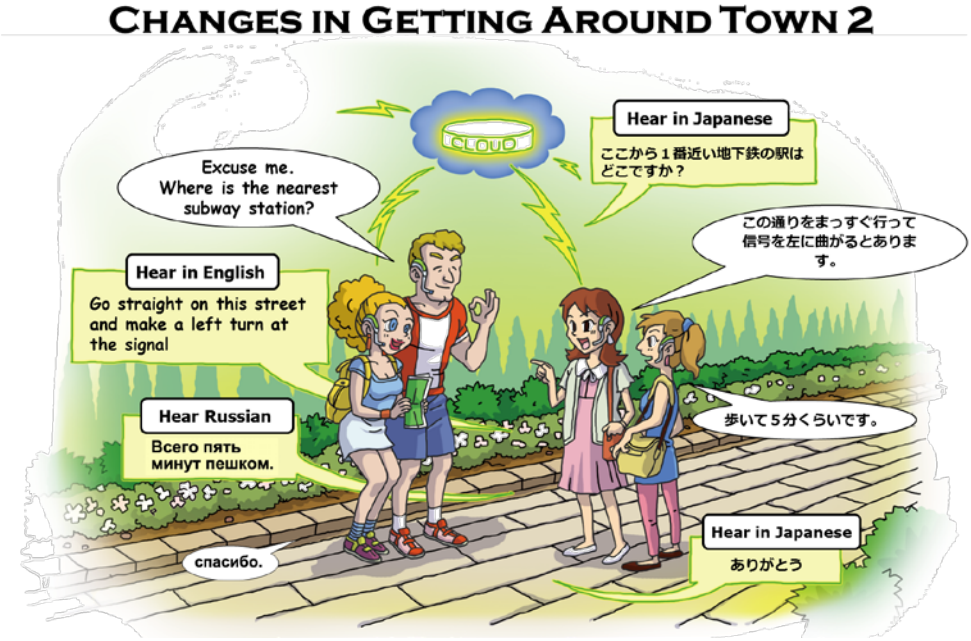
5G will be able to provide new welfare services for senior citizens as well as high level communication services to everyone living in rural areas. These services will allow people to enjoy services more than just simple conversations with people near them, but instead have access to services such as driverless taxis which will be dispatched to their homes and bring seniors to places which can provide them services or allow rural residents to not only talk with their families in cities, but receive video and other information about them.

⑦ Urban Style 1



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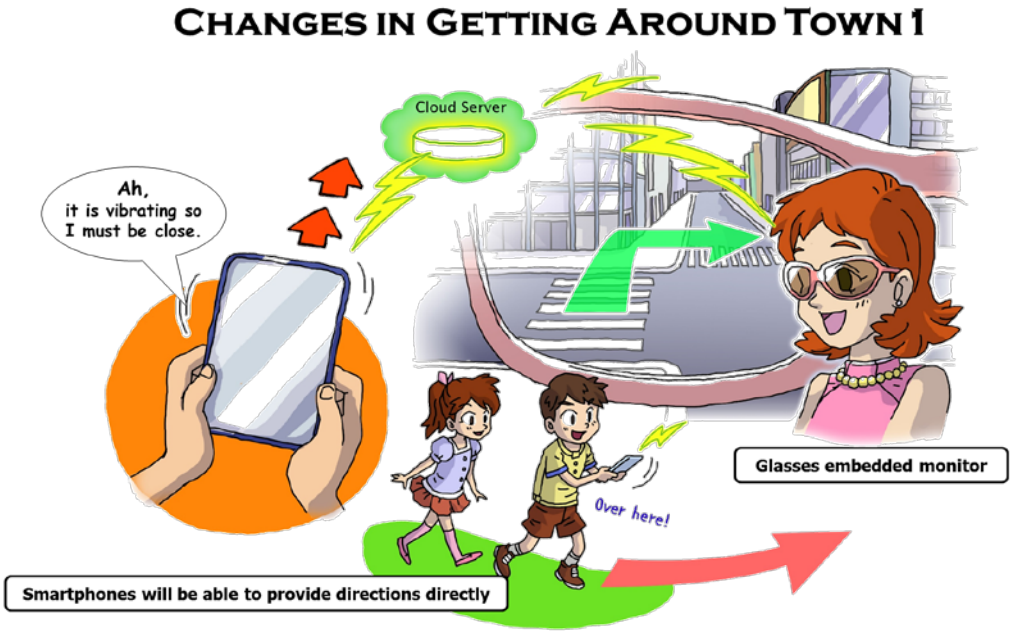
⑧ Urban Style 2



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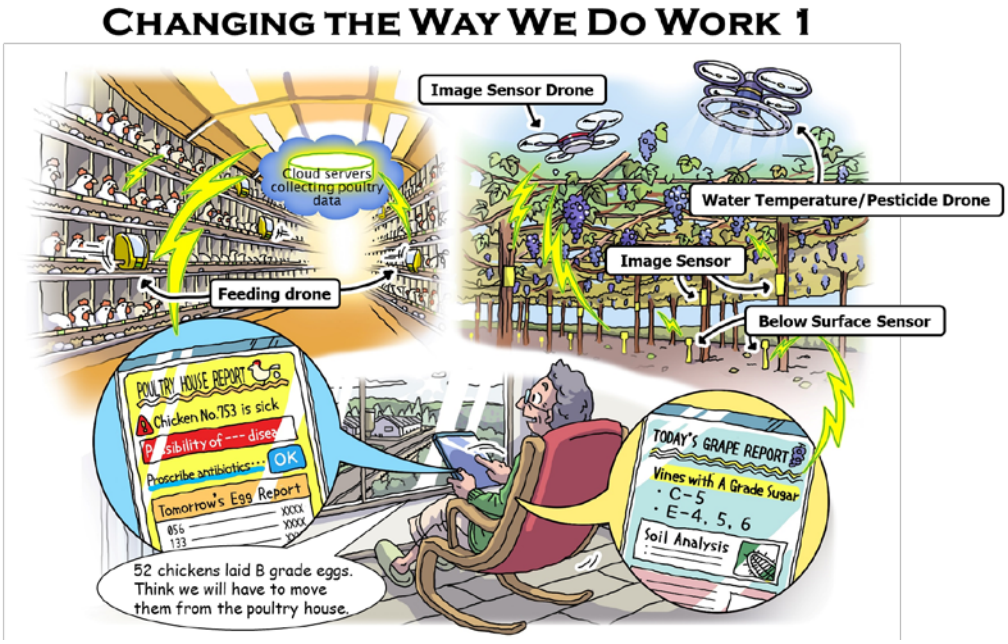
5G will facilitate new communication tools, for example, being able to communicate with foreign travelers without being concerned about the language barrier with easy to use real time translation tools. It will also help with new navigation tools, as individuals will be able to have their own high level personal navigation service as they will be able to connect many devices, starting with wearable devices, to the network.

⑨ Work Style 1



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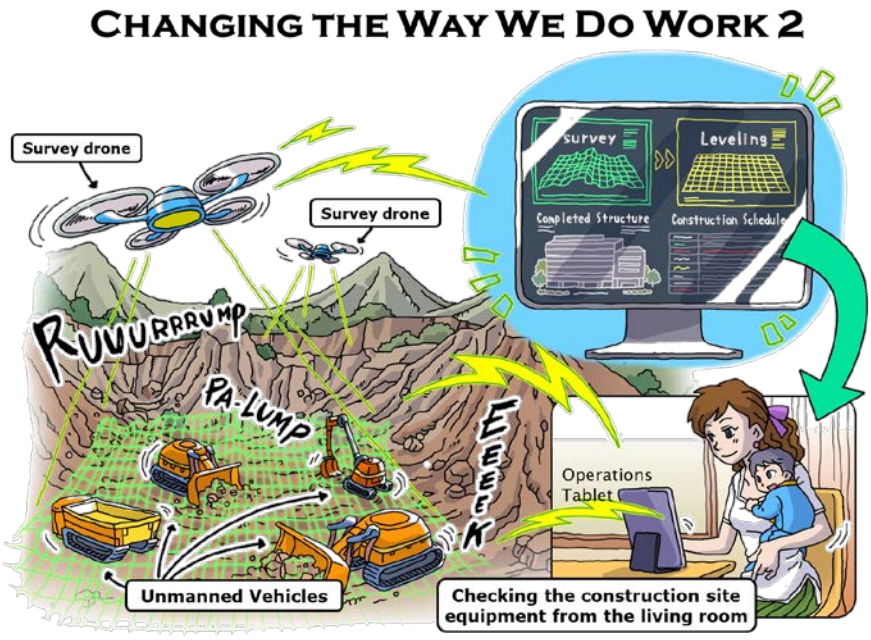
⑩ Work Style 2



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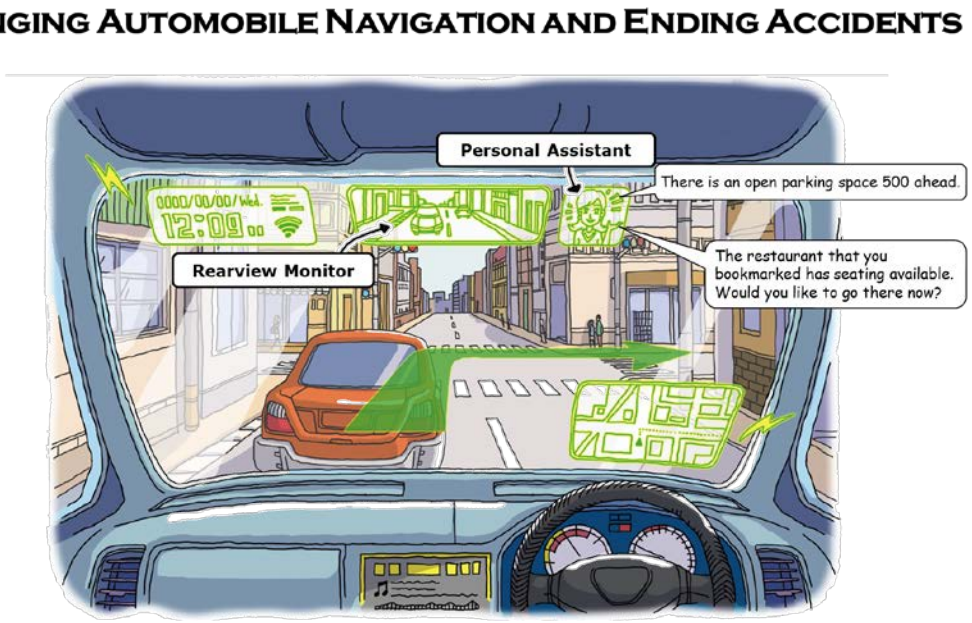
From being able to remotely control and manage heavy machinery to being able to get updates on a construction site in real time, a wide variety of industries will be able to employ more intelligent ways of work.

⑪ Automobile 1



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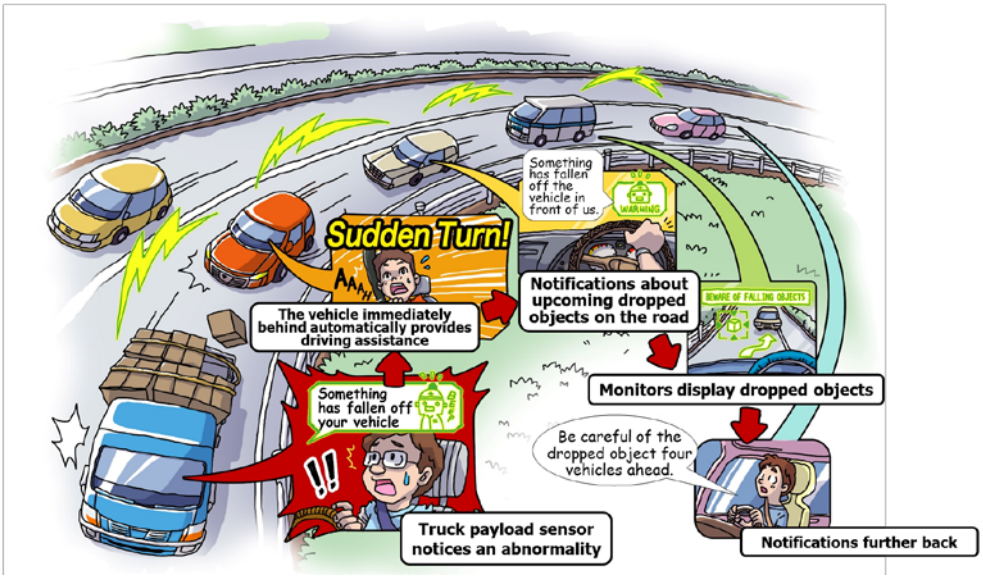
⑫ Automobile 2



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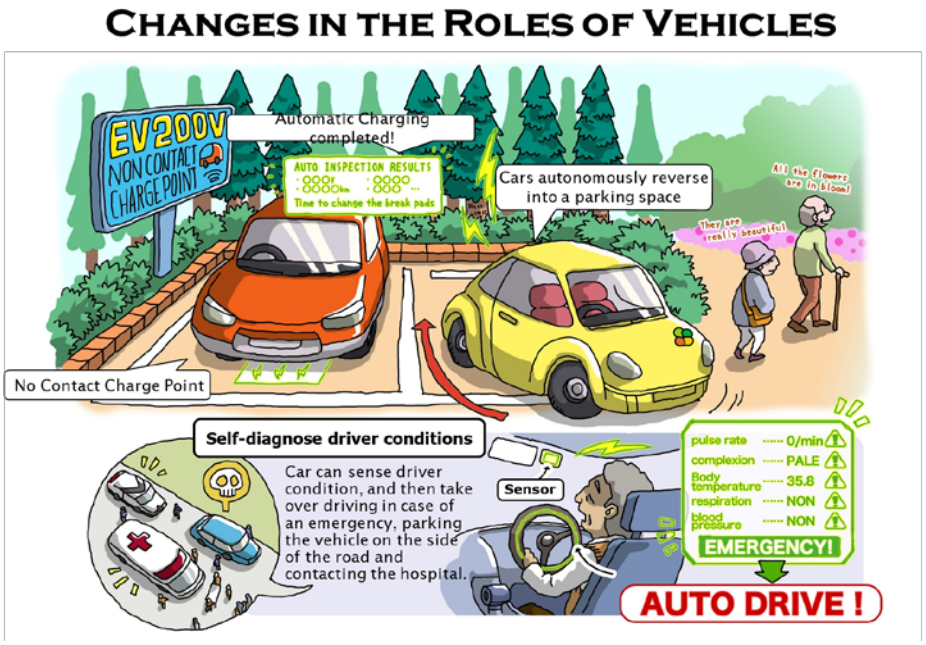
⑬ Automobile 3



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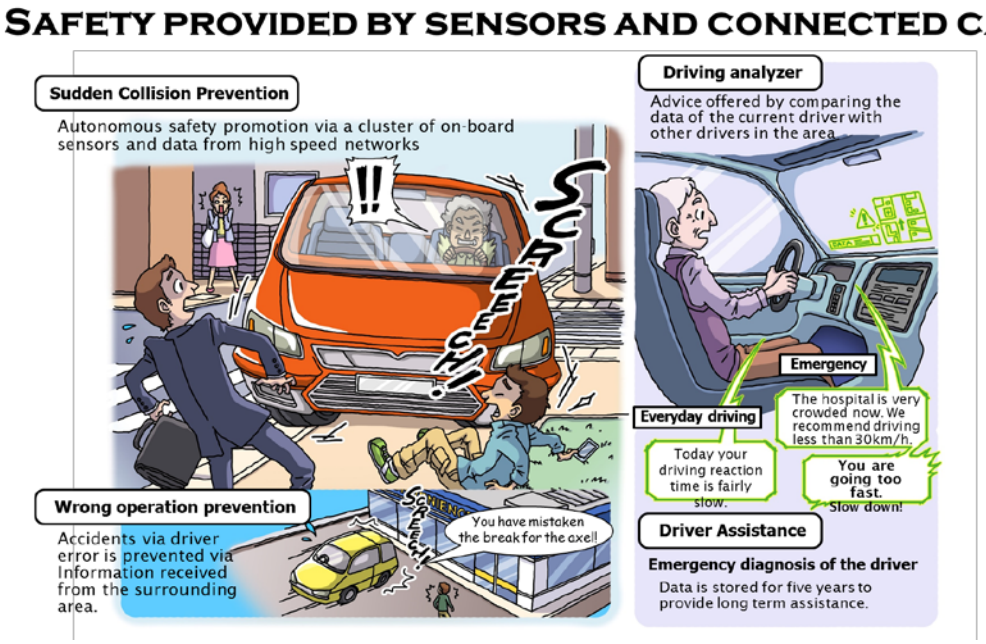
⑭ Automobile 4



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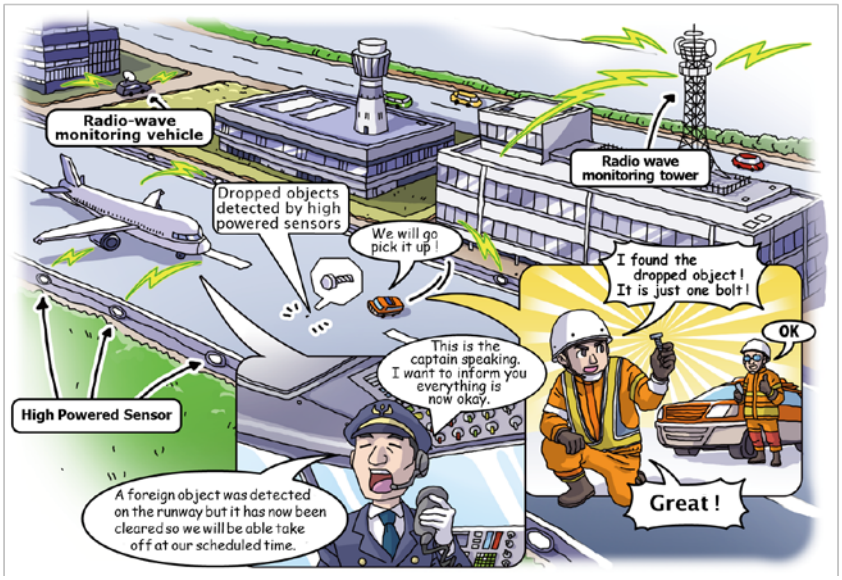
⑮ Airport

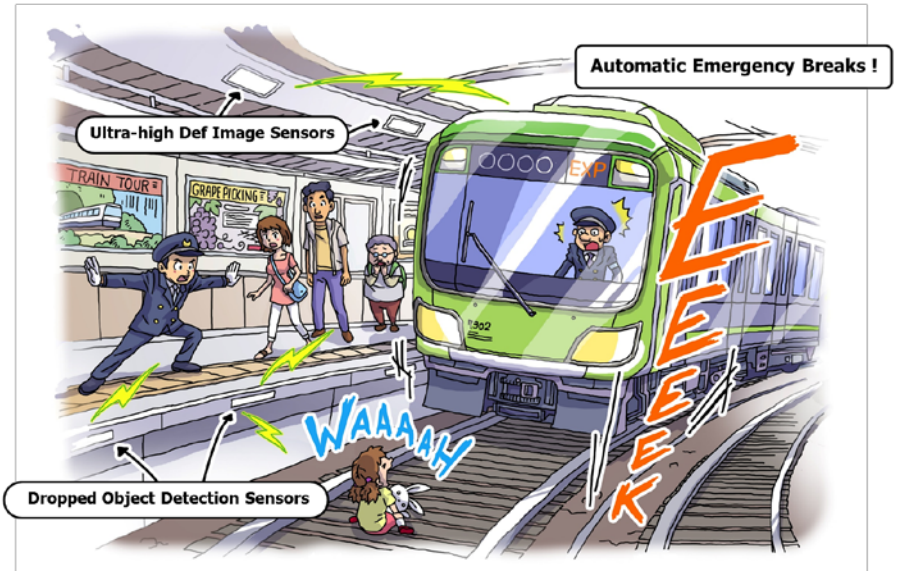
A New Airport and Train Station (Intelligent Airports)



(『Excerpt from the Round-table Conference on Radio Policies 2020, Report (July, 2016))

⑯ Train

A New Airport and Train Station (Intelligent Railways)



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In the field of transportation, more pleasant and more safety services and mechanisms

will be made available in use scenes for cars, airplanes, and trains. For example, while travelling in a car, an optimized dynamic navigation system will provide information on helpful services and unexpected changes in the traffic situation such as accidents. In addition, by connecting to surrounding sensors, it will be able to instantly detect dangerous situations and take control of the car

The following section introduces other businesses that it is thought 5G will influence.

(1) Location Based-Services using Small Cell Technology
(2) Mobile Operator Business Model Revolution
(3) Capability on Demand
(4) Other Application Services

1. Location Based-Services using Small Cell Technology

These days location information applications that use GPS, like Google Maps, are widely used. These applications, however, cannot report their location in areas, both inside and outside, where GPS signals cannot be detected. This problem will be solved with 5G. 5G small cells will be deployed in large densities in areas where large crowds of people gather, such as shopping malls, airports, stadiums, and inside office buildings. These small cells will connect with devices and will be able to determine their location based on the information the small cells receive from the devices. Here is one example of how this use of 5G will be able to provide new services. Mobile carriers will be able to this location information to service providers who apply to use it. However, before they pass this information to the service providers they will need to remove any personal information from the location information. Then, the service providers will then be able to offer new high-level services, such as offering high level real-time location information, over the 5G network

2. Mobile Operator Business Model Revolution

In order to deploy 5G across the country, a large amount of high level communications infrastructure is needed, meaning a large investment from mobile carriers is also needed. On the other hand, for users, 5G will mean an increase in convenience and services than what is offered today, the cost will decrease. With this background, mobile

carriers and related firms, will need to look for new business models to make up for huge equipment investments.

1. 【Flexibility in Equipment Maintenance】Retailers now think that providing WiFi access points will increase the numbers of customers that visit their stores. The same idea goes with 5G environments and it will be possible for retailers to install 5G small base stations in their stores at their own expense. Another strategy of mobile carriers could be to have local, independent organizations install 5G small base stations just like CATV community antennas are installed today. In addition, new business models such as individuals wishing to ensure their own optical connections will be able to install their own small base stations, and will be able to sell their own excess bandwidth back to mobile carrier will also emerge.

2. CDN in 5G: One consideration for 5G at the moment is that individual base stations will form an edge cloud. For service providers, being able to deliver content to an edge cloud will open up different areas for new optimized and more timely services than now. However, in order for service providers to understand how an edge cloud works and for content delivery firms to create new ways to deliver content to the cloud will require a large investment in R&D. Therefore, service providers may opt to use CDN services, making the revitalization of CDN businesses a possibility.

3. 【Using big data with personal information】The communications culture, beginning with SNS, will be able to offer personal information as long as it provides merits to users. Services offering location information can be offered as a 5G service along with small base stations, and these 5G services can be offered for free as a set with the collection of user histories. This will lead to the appearances of new businesses whose income can supplement mobile services as this information can be sold to secondary markets after big data analysis,

3. Capability on Demand for end users

5G has many distinctive features, such as broadband, high density, high speeds while moving, ultra-low latency, and power conservation. There are many ways new services will be able to exploit these functionalities, but they do not need to use all these specs at maximum levels at all times. For example, power conversation can be used in conjunction with a decrease in transmission speeds. Another distinctive feature of 5G is the ability of users to be able to call on which functionality of 5G when they need it. End users will be able to bring up a hexagonal chart on their devices control panel, which will represent the six features of 5G, and with this chart will be able to change the features they need to access at that time. For example, one feature would be security. If the user then chooses a high level of security, then the device will not automatically connect to open WiFi access points. This means that with a 5G communication infrastructure with the functions of SDN, it will not only be telecommunication providers who will have the ability to control network functions, but end users themselves will have this ability. This ability to provide extreme flexibility in providing capabilities on demand for end users has not been offered by mobile services up until now, but is something only 5G can provide.

Not only will end users be free to select these functions, but applications developers through accessing the 5G SDK/API on a device, will be able to create many kinds of applications that select and deselect various features as well. For example, a financial application that deals with stock transactions can in addition to just starting up the application can ensure low latency. Another example is a sports application which provides full support during long distance running, can be built to only allow for GPS transmissions, keeping other transmissions turned off while in power saving mode.

These capabilities can also be useful for IoT service providers. Businesses dealing with household electronics and appliances can have their good limit bandwidth use to save their customers money on communication costs, while they can change the latency and bandwidth features just at those times when a software update is necessary. This means an increase in functionality of the MNVO provider interface from what currently is used in 4G networks.

4. Other Application Services

(Narrowband IoT, broadband applications, increasing low latency, less advanced devices)

5G has many distinctive features. There are many ways new services will be able to exploit these functionalities, but they do not need to use all these specs at maximum levels at all times. One will be able to choose to restrict several functionalities from the data communications menu.

What users are most anticipating from the communications menu is that even with the same capabilities of 3G, the price will be a half or a third of current communication plans. 5G sales pitch is its high performance and early adapters will be satisfied, but for those in the late majority of users it will be the inexpensive communication menu which is desired. For the same price as 3G, users will have access to broadband capabilities of 5G's communication menu, which they haven't had access to before. And if they only want to access the same capabilities of 3G, with the communication menu they will able to lower their costs.

For example, agricultural field sensors and the current stock of individual vending machines do not need access to 5G broadband and high-speed handover capabilities. Access to narrowband systems will be sufficient. In order to keep costs down, a communication service providing a power conserving communications module is necessary. The ability to stay connected to a small base station for long period of times will be sufficient. So that in extreme situations, such as heavy rains or when the temperatures get too hot, a field sensor can take this information, start up the communications functions, deliver the information, and then shut down the communications functions once the specified information is sent. These functions will all be able to be controlled from the communications menu as well.

Buildings which want to install anti-theft security sensors can use the same specs as the agricultural field sensors, in addition to rules to ensure sending communication from a location (base station location) and times (specific time frames). It is also anticipated that the choice of using end-to-end encryption security will also be added to the communications menu.

On the other side, it is significantly important for the communications network to have low latency ensured for the field of autonomous driving, since levels 2 to 4 autonomous driving requires processing in to be done in the cloud. And this doesn't just mean

ensuring a certain latency time, either, but whether or not the entire network can ensure ultra-low latency. The communications menu needs to notify the car if it is connected to a network like 4G, which cannot ensure ultra-low latency.Users who use high definition video will need a strong connection to 5G small cells as well as communication menu that allow for using beam forming when possible.

This is said to be a revolution in the business model of communication carriers, but it is expected that the 5G communications menu will offer as a set along with cloud information processing functions. Various IoT use scenes are expected to only require devices with CPU with low level specs. The communications menu will not need to ensure transmission channels, but that the 5G network communications menu will be able to offer information processing performance assistance to IoT devices. This communications service menu will only be available with 5G.