

Policy Direction of Spatial Information for Hyper-connected Society

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Abstract: Due to development of sensors and ICT, our society has evolved a new information environment. The 'Hyper-connected Society' that connect people to people, people to things, thing to things even involving place is fast approaching. This paper focus on analyzes the relationship between the spatial information and IoT. Based on this, seeking a spatial information policy for hyper-connected society.

Keywords: Hyper-connected, Spatial Information, IoT, Policy, Geo-IoT

1. Introduction

Due to the Internet of Things (IoT) technology, our society is rapidly developing from the digital society to the hyper-connected society. Gartner, Inc. forecasts that 6.4 billion connected things will be in use worldwide in 2016, up 30 percent from 2015, and will reach 20.8 billion by 2020. In 2016, 5.5 million new things will get connected every day.

The fourth industrial revolution discussed at Davos Forum 2016 is the convergence industry based on the IoT technologies. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres. Fourth industry is expected to lead to a new industrial revolution and the ruling system and way of life through the application of artificial intelligence robots, IoT, mobile, 3D printer, self-driving car, nano-biotechnology.

Proactive policies and strategies are needed to cope with the core technology, IoT for the hyper-connected society. To create a new job and a new service though the IoT, Ministry of Science, ICT and Future Planning

(MSIFP), Ministry of Trade, Industry and Energy are pursuing IoT policy. In order to respond effectively to hyper-connected society the MSIFP has been announced the "Mater Plan of Internet of Things" in May 2014. Governments has plan to invest IoT infrastructure such as network, sensor, user interface, service platform etc. In addition, it is also urgent to develop the technologies and policies related to the IoT like artificial intelligence, virtual reality, spatial context awareness etc.

Spatial information is closely related to the IoT. All things are located somewhere. The users could obtain a more accurate and detailed information through integration the sensed data and the spatial information. Positions of all objects can be displayed on the map. Thus the spatial data is very important for IoT service. In the hyper-connected society, the advanced spatial information such as the high-accuracy positioning sytem, indoor 3D map and positioning system is required. These spatial information is used in industry and services such as self-driving cars, smart home, smart building, smart city, drones, robots etc.

It needs to analyze the changes of spatial information technology expected in the hyper-connected society. Based on this, we need to seek the spatial information policy that can effectively respond to the environments caused by IoT. The purpose of this paper is to explore

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the spatial information policy for the hyper-connected society.

2. Fusion of IoT and spatial information

Most of the sensing data collected from the things will require the spatial context such as location, light, smell etc. If the user aware of the circumstances may be better understand the data collected and utilize them for their purpose. Natural terrain, artificial facilities and sensor data has a position, dimension, orientation and spatial relationship between objects. Applying the spatial relationships, functions and models to the features and sensor data, it can effectively monitor the movement and behavior of the objects of IoT.

IoT and spatial information could create service model perceptively using their technologies. But if spatial information technologies fused with IoT, it may create a new service and can dramatically improve the existing business processes. The sensor data combined geospatial data will be apply more wide and useful. Fusing the sensed data with spatial information, it can visualize the spatial characteristics of objects, such as distribution, pattern. With this, it is possible to provide a service such as tracking, routing and geo-fencing.

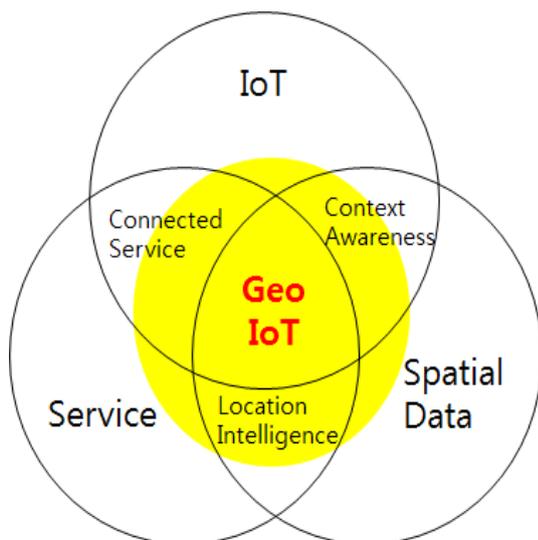


Figure 1. Relation of IoT and spatial data

If the sensor doesn't get the location information by an implicit program during data collection, sensor data will be combined with the spatial data through a map or GPS on the platform. The sensor data combined with spatial information is converted to a useful information over a spatial analysis such as pattern or spatial characteristics using a GIS software which lead to actionable insight,

$$\begin{aligned} &(\text{Sensing Data} + \text{Geo Data}) \rightarrow \text{Geo-analytic} \\ &\rightarrow \text{Intelligence (actionable)} \end{aligned}$$

So, location and geo-analytics is an important element for converting sensing data to an actionable knowledge. 'Actionable information' that derived geo-analytics transmitted to the devices and operating the actuator according the principles or send alarm message to the user. Figure 2 is the conceptual model combined spatial information, sensor and network.

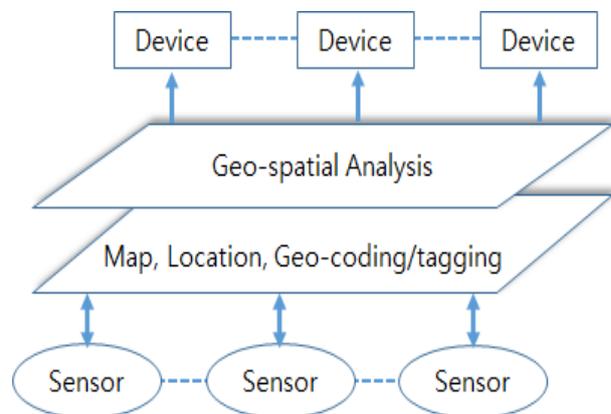


Figure 2. Fusion model of IoT and spatial data

3. Paradigm shift of spatial information

Current concept of spatial information is defined to the location and attributes of the object. But the concept of spatial information may be change from object oriented description to awareness of the spatial context in the hyper-connected society. Previously, producers, suppliers and consumers of spatial data was separated. But increasing use of smartphones and mobile devices,

user of spatial data become a producers of spatial data simultaneously.

The user of spatial data move to the ‘things’ from people. The sharing of data between things and things will be much more than people to things. Until now the spatial information focused to visualize the real world. However, spatial information may be focus to visualize cyber physical space in the future. Spatial information will be an interface for connecting a physical space and cyberspace. Most of Location-based services use a map. People have been recognized spatial information as a map. But spatial information will be play a key role for fusion of different data in the future. In the spatial information, the role of the public sector is decreasing gradually. Whereas the role of the private sector is increasing. Private companies provide spatial information, and will be continuously updated. The role of government will be define to provide an authoritative and confidential data to the people.

Table 2. Paradigm shift of spatial information

	current	future
concept	Object description	Context awareness
Data	Consumer	Prosumer
User	People	Things
Visualization	Real world	Cyber physical space
Application	Base map	Key factor for fusion
Driving Entity	Public sector	Private sector

4. Policy direction of spatial information

First, accurate positioning data is an essential infrastructure in the hyper-connected society. Location is very important when the sensor collecting data. It needs a highly accurate position data for self-driving cars,

drones, robots etc. The government must develop the “High Accuracy Positioning System”. The best way is providing positioning data with a precision of about 30cm to the public by government. More accurate data are provided by private company.

Second, it needs a high precision spatial data such as framework data, road map for self-driving car, 3D real map for cyber world, live map for real time connected vehicles and indoor map for indoor services. To this end government should provide data model, data spec, standard, guide line, principle etc. Also the government carry out a pilot project to applying a new spatial technologies.

Third, it needs to make an intelligence space based on ubiquitous computing environment. Intelligent space can recognize the physical environment and conditions, including events and spatial context. Intelligent space can apply disaster prevention, safety and security etc.

Fourth, we should understand the role of public sector and private sector. Previously, public sector such as National Geographic Information Institute (NGII) provide spatial data to the public. But these days, peoples are use the web map services provided by private companies. Therefore, it must re-establish the role of government and public sector.

References

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