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Trend and Comparative Analysis of LoRa Technology

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Abstract: Recently, there is a growing interest in the 4th revolution called 'fusion and connection' and 'high connectivity society' is in sight. As a result, interest in the internet of things has reached a record high and it is not limited to automation and connected cars. Therefore, the internet of things is expected to play an important role in building ecosystem of next generation mobile communication service. So in this study, we will introduce what kind of mobile communication is suitable for internet of things and the technology trend of internet communication for internet of things.

Key words: Internet of things, long range, internet communication, wireless network, the 4th revolution, technology

INTRODUCTION

Recently, interest in the 4th revolution with the essence of 'fusion and connection' is increasing. As the term 'connected society' comes into being, we are trying to fuse and connect a wide range of things that are not specific to automation and connected cars. It also considers the internet of things to be a key driver of the mobile communications industry. By 2020, 30 billion objects will be connected to the internet. In order to connect each object, wireless network technology is applied. Among them, Semtech's LoRa (Long Range) which is called next generation wireless standard for IoT extension is examined and technology trends and SigFox, long term evolution, WiFi, Bluetooth, 3G and other wireless networks to identify the advantages and disadvantages of each network (Sung-Yoon and Jinhee, 2016).

COMMUNICATION OF LORA

What is LoRa: Semtech's LoRa tecnology is a technology for long distance, low power consumption and secure data transmission. This technology enables a broader range of coverage over public and private networks compared to traditional cellular networks. It provides a solution that can easily connect to existing infrastructure and support battery-powered IoT applications. Semtech's LoRa chipset can be integrated into the products offered by the vast IoT partner network to integrate LPWAN, a global mobile network operator (Fig. 1).

It enables low-power, wide-area communication between the remote sensor and the gateways connected to the network using the unlicensed radio spectrum of Industrial, Scientific and Medical (ISM) bands. It provides

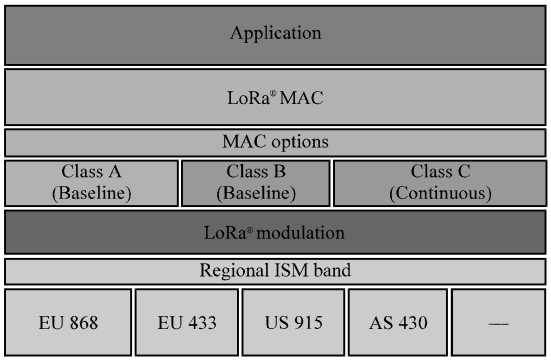

Fig. 1: LoRaWAN protocol, protocol specifications built on LoRa technology developed by LoRa alliance

two-way security, interoperability and mobile localization through a standards-based approach to building LPWAN and enables rapid deployment of public or private IoT networks using hardware and software (Fig. 2) (Anonymous, 2018).

Characteristic of LoRa: LoRa is an abbreviation of Long Range which is a low-power long-distance communication network that can communicate with low power, unlike existing smart phone communication networks such as 3G and LTE (Long Term Evolution). It communicates more than 10 km with minimal power consumption does not require high-speed, broadband network equipment like existing communication network and does not need separate base station or repeater equipment. Therefore, it is one of the advantages of LoRa that it has lower infrastructure construction cost and higher scalability than 3G or LTE. Typical features of LoRa include

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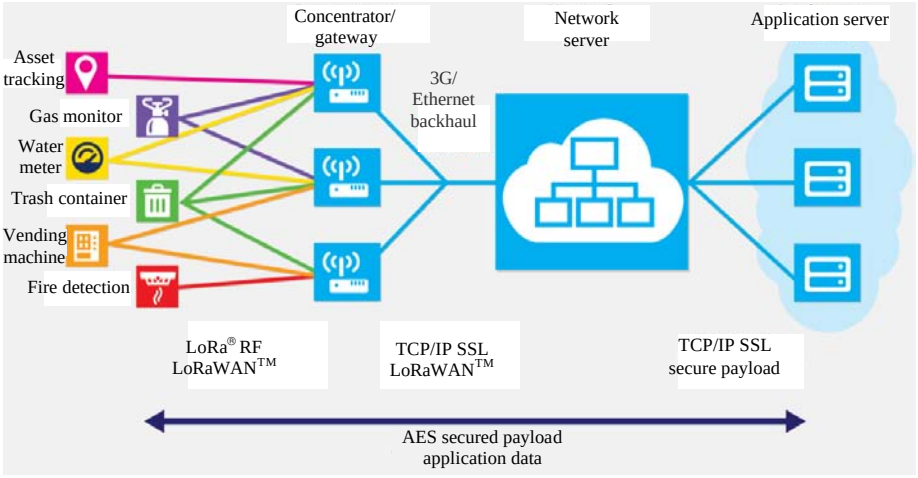

Fig. 2: LoRa network diagram this figure shows how LoRa communication is accomplished

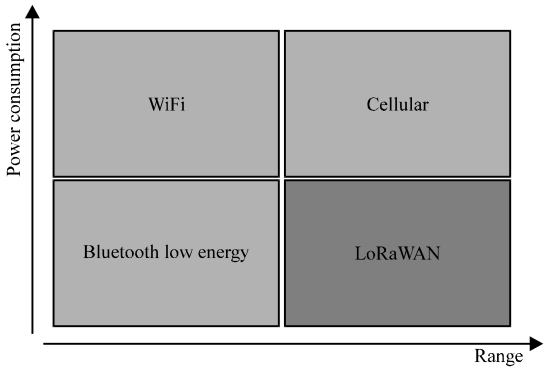

Fig. 3: IoT connectivity technologies segmentation, power consumption according to distance of communication technologies

low-power, more than 10 mile long communication, multiple sensor communication is possible with multiple sensors connected to one node and security that is further emphasized by IoT is also provided in accordance with AES128 (Fig. 3).

It shows power consumption according to communication distance of each communication technology. LoRa can communicate long distance but power consumption is low. Therefore, it is a communication technology suitable for IoT sensor which should be used for a long time with a small battery. LoRa generally meets the requirements for IoT service. This is why LoRa meets IoT service. It must be used for a long time at low power. Because it is typically installed in high ceilings and walls, direct connection of charging or electronic power is not easy. And minimizing the use of bridges that are capable of long distance communication as well as receiving multiple sensor values from one node. So, it can be save money (Dong and Suk, 2017).

LoRa communication technology has four advantages, one of which is energy efficiency (Fig. 4). It can be used for more than 10 years with one battery. The second feature is extensibility which allows multiple sensors to be connected with a single node. A third characteristic is the communication distance. Sensor nodes can communicate over distances >10 miles. Also, since, the communication speed depends on the distance, it is not a big problem to receive the data of the sensors. The fourth feature is security. AES128 can be used to secure the operation or eavesdropping.

Comparing other communication technologies: There are various kinds of wireless communication such as WiFi, Bluetooth, 3G, LTE and the like. Identify these communication technologies, compare their advantages and disadvantages with LoRa and identify which communications are appropriate for IoT. The first communication technology to compare is 3G and LTE communication technology which are most used in mobile. It is a feature that it is possible to transmit various data such as voice, text, photo, video developed by 2G which is the previous communication technology. The transmission speed was 144K~2.4 Mbps which is much faster than 2G. LTE which is an abbreviation of Long term evolution is an advanced mobile communication technology in high-speed packet access technology. It uses a packet method which is a method to utilize various lines instead of one line. With this high transmission rate and fast speed, communication distance is very long, 3G. The biggest drawback when LTE is used in IoT is that battery consumption is fast. It is difficult to change or charge the battery due to the nature of IoT.

As shown in Fig. 5, 4G, 3G and other transmission speed is very fast but the battery life is only a few

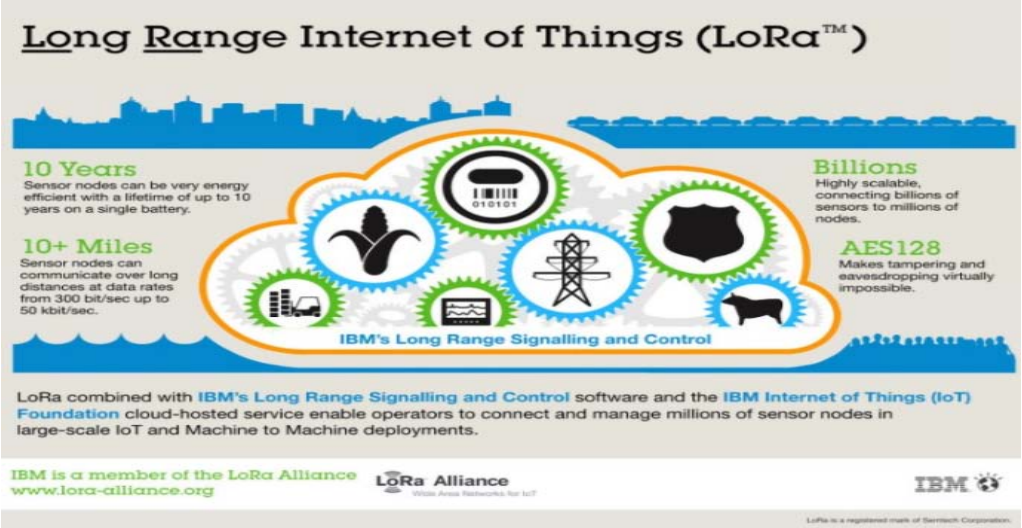

Fig. 4: Main characteristic of LoRa, it is a collection of representative features of LoRa and was produced by LoRa alliance

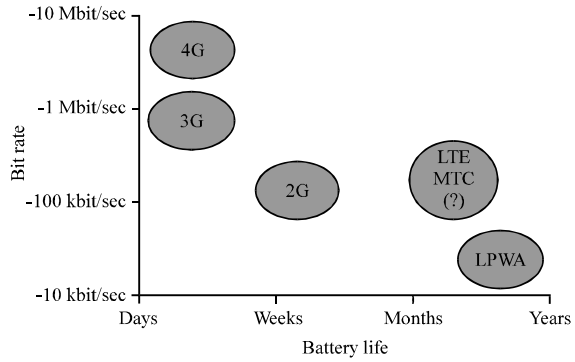

Fig. 5: Battery life by transfer rate, it is a graph showing transmission speed and battery life of LPWA which are the most used communication technologies in mobile

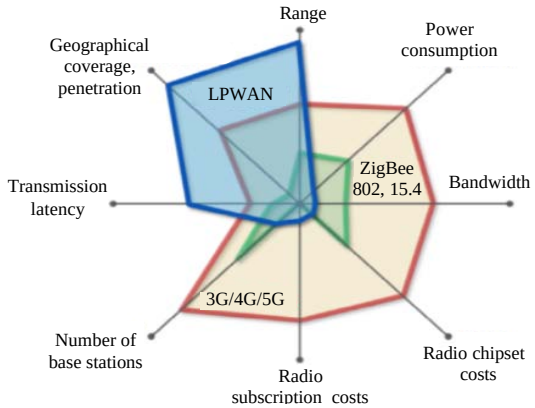

Fig. 6: Communication technology comparison graph, it is a graph comparing characteristics of LPWAN with other mobile communication networks

days. Also, the transmission speed is good but sensor data to be measured is not large, so, sending a lot of data at once is not suitable for IoT. And 3G and LTE are expensive to build and infrastructure is expensive to build.

Figure 6 shows the comparison of the same LPWAN communications and confirms the advantages and disadvantages. Among them, SigFox which is the most similar communication technology is compared and the advantages and disadvantages are confirmed. SigFox uses the UNB (Ultra Narrow Band) technology to use the license-free frequency band (ISM). Europe 868 MHz, US 902 MHz, Australia 918 MHz band is used. SigFox can transmit a relatively small amount of data at a low power 50 mW to a considerable distance (3-10 km in the city) and can be connected in MP2P (Multi-Point-to-Point) node connection is possible. Because of its narrow bandwidth, it supports mostly unidirectional communication. Due to its high power efficiency, it can be used with a 2.5 Ah battery for up to 20 years and can be used with existing base stations without having to build a separate infrastructure for cheap device prices (Anonymous, 2018).

As shown in Fig. 7, the systematic structure of SigFox and LoRa is not significantly different. Both communication technologies do not require infrastructure such as separate base stations and multi-connectivity and other technical features are very similar. The coverage range is about 10 km, the frequency band is also the same

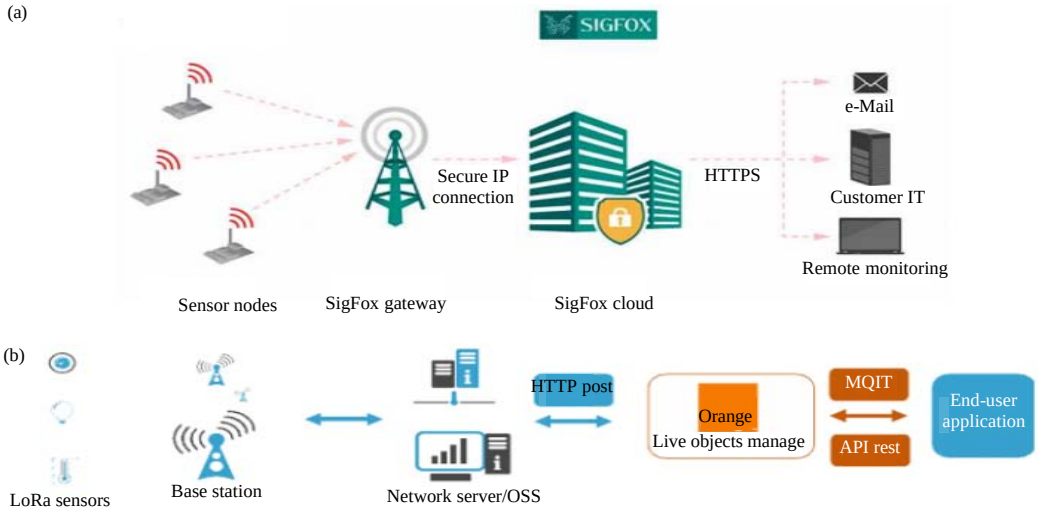

Fig. 7: SigFox and LoRa communication method: a) The overall communication method of SigFox and b) The overall communication method of LoRa

as the license-exempt 800~900 MHz band and the battery life is more than 10 years. However, in terms of transmission speed, SigFox is <100 bps while LoRa is 10 kbps (Junyeong *et al*., 2017; Dae-Young and Seokhoon, 2015).

CONCLUSION

In this study, we investigated LoRa, a low-power long-distance communication service developed for the internet service of things and compared with 3G and LTE mobile communications. We also compared LoRa with SigFox which is the same LPWAN. We also looked at why LoRa is becoming a standard for the internet of things. Currently, various communication technologies have been proposed and implemented for 'high connection' which is the essence of the fourth industrial revolution. In order to provide not only LoRa but also the internet service, it is necessary to satisfy low power, battery life, low cost equipment, infrastructure construction and security required by the internet service of things.

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