

Analysis of Component Technology for Smart City Platform

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Abstract

In order to solve the urban problems caused by the increase of the urban population, the construction of smart city applying the latest technology is being carried out all over the world. In particular, we will create a smart city platform that utilizes data generated in the city to collect and store and analyze, thereby enhancing the city's continuous competitiveness and resilience and enhancing the quality of life of citizens. However, existing smart city platforms are not enough to construct a platform for smart city as a platform for solution elements such as IoT platform, big data platform, and AI platform. To complement this, we will reanalyze the existing overseas smart city platform and IoT platform in a comprehensive manner, combine the technical elements applied to it, and apply it to the future Korean smart city platform. This paper aims to investigate the trends of smart city platforms used in domestic and foreign countries and analyze the technology applied to smart city to study smart city platforms that solve various problems of the city such as environment, energy, safety, traffic, environment.

Key Words: *Smart City, Smart City Platform, IoT, Big data*

1. INTRODUCTION

There are various urban problems due to the increase of urban population, traffic delay and safety environment problems are becoming serious due to population growth. In order to solve these urban problems, each country is investing and doing a lot of business to build smart city platform and solution through ICT technology.

Smart City will evolve as part of the fourth industrial revolution. The whole city plays a role as a living thing and the platform that becomes the brain of the city and the solution such as energy, environment, urban administration, traffic, safety become human hands and feet. The new network will form the blood vessels of the city. In this study, we investigate and analyze the case of smart city platforms that play an important role in smart city and describe the technology that constitutes these platforms.

In the future, the Smart City platform will collect and store and analyze various data generated in the city to provide a doctoral tool to solve the problems of the city more accurately and quickly in the future, and improve the quality of life of citizens.

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Also, it should be designed considering various types and scales of data, and it is necessary to make a plan to link meaningful data with each application solution. [1]

2. Technology for Smart City Platform

As the urban problems are increasing due to the increase of urban population, each country defines smart city and builds an ICT technology and city platform such as IoT, Big Data, Cloud, AI. It is promoting various projects to solve problems in various fields such as traffic, safety, environment, energy, education and medical care.

Smart City is widely used in various ways depending on the economic and development levels, urban situation and conditions of each country, and there is a difference in access strategy. Generally, “The urban model that can solve various urban problems and improve the quality of life by combining new technologies such as ICT and big data with the city” is defined. Also, it is used as a “city platform” meaning that various innovative technologies are combined with urban infrastructure and integrated space [2].

Legally, It refers to a sustainable city that provides various urban services based on the urban infrastructure built with the construction information and communication technology to improve the competitiveness of the city and the quality of life [3].

2.1 Smart City Application Technology

The technologies applied to smart cities are very diverse, but we will discuss the most important core technologies. The core technologies of smart city technology, IoT (Internet of Things), LPWA, cloud, big data, and AI will be covered.

Internet of Things

IoT is regarded as the most important technology to secure data of things, one of the most important data in smart city. Services that used to be independent services can store sensor data through the IoT and collect meaningful real-time data. The IoT is integrated with various technologies such as sensor network platform services, and the role of a standard platform that can efficiently provide data storage and retrieval of heterogeneous devices or sensors is also important.

IoT can be classified into device and network platform service. Among them, various network technologies are developed and spread for data transmission of things. In the existing M2M (Machine to Machine) communication method, data was transmitted to the server using 2G, 3G and LTE communication, but it was difficult to apply to various things communication due to high network cost and battery capacity. Low power area network (LPWAN) technology has been developed to solve this network problem.

This LPWA technology will be very useful for IoT applications in rural or rural areas such as smart villages.

Among them, LoRa technology will be described. LoRa is an Internet of Things network that can transmit radio waves very far in the sense of long range. Looking at its characteristics, it is a dedicated network that collects a variety of information

It is a low-power device that can be transmitted up to 14km by a long-distance streetcar transmission with a battery life of about 10 years. LoRa has a stronger feature than LTE using chirp modulation. Especially, LoRa uses LBT(Listen Before Talk) technology to avoid interference, and if it is judged that interference in the area is connected, it maintains communication quality using channels without interference. [4]

Lora's security manages SECURE BOOT technology that can prevent S/W modulation from the outside, various security related KEY and ID that allows only authentication terminals to be connected, and since the network base is not TCO/IP base, more hacking techniques are not applied. Terminal and cloud servers maintain security using the international algorithm AES (Advanced Encryption Standard) 128.

Cloud computing

Cloud computing is a type of Internet-based computing that refers to a technology that processes information with other computers connected to the Internet, not with its own computer. In the smart city

platform, cloud service has an important meaning. When constructing all city information as an open platform, it is necessary to share information with various data. The existing server data storage method is considered as an essential technology for building a smart city platform due to the space and operation problem to be installed by each local government such as security and cost. [5]

Cloud services are classified as IaaS, PaaS, and SaaS according to the scope of server resources.

The model that manages the infrastructure, platform, and application directly by the user is On-premise, which builds the IDC directly in the traditional way and manages the server, operating system and application by allocating the space.

IaaS (Infrastructure as a Service) is a cloud model that provides hardware as a service, managing OS and applications. Platform as a Service (PaaS) provides not only computer resources but also platforms. SaaS (Software as a Service) provides software, and provides it to real users rather than developer.

When you build an infrastructure based on cloud technology, you have to decide what way to apply cloud technology. Cloud technology divides public cloud, private cloud, and hybrid cloud according to the location and service method of the infrastructure

- Public Cloud is a service method that provides and uses services by applying technology that can distribute or recover virtual servers and network storage resources based on virtualization technology to the data center.
- Private Cloud is an infrastructure method in which its own company builds a data center and distributes and recovers virtual server network storage resources based on virtualization technology. It is necessary to maintain the initial cost and maintain the data center.
- Hybrid Cloud is a combination of public cloud and private cloud. Security data uses private cloud and the rest uses public cloud. The disadvantage is that it is necessary to manage the number of public clouds with the private cloud virtual resource distribution image.

Big Data

Big data means a large amount of fixed or atypical sets that exceed the capacity of data storage management analysis of existing database management tools, and a technology to extract values from these data and analyze results

The concept of '4V' is expanding as the feature of big data is focused on the value of data in the past '3V Volume Velocity Variety' based on the characteristics of data. In smart city, real-time data of various urban infrastructures due to the development of IoT technology, meta data of existing urban systems, and various fixed atypical data as well as video data are stored exponentially. To investigate some techniques to process such big data. [6]

Big data goes through a series of processes such as collection, storage, analysis, and search, and has distributed processing technology and real-time processing technology programming support technology.

- Distributed processing technology is big data is various and large amount of data, so it is impossible to process it on one server. It is a technology to disperse and process it. There are Google's MapReduce, Hadoop's MapReduce and Microsoft's DryAd. Google's MapReduce is a technology that processes data at high speeds in parallel using the function of a map that disperses big data and a reduce that collects and organizes distributed intermediate results.
- Real-time processing technology is not a technology to stack and process data, but an event real-time processing technology by processing data immediately when data is generated. Real-time data is a short message of social network, CCTV surveillance video data, and real-time sensing data of IoT. The processing technologies include IBM Infospeer Strings, Twitter Storm, and Yahoo S4.
- Finally, programming support technology is difficult to program directly with technologies such as MapReduce, so high-level language processing technology is needed for this. There is a map-reduce conversion using Google's Sawall, Hadoop's Pig, and Pigriton.

AI (Artificial Intelligence)

Artificial intelligence is a technology that allows machines to learn through experience, adjust their existing knowledge according to new inputs, and perform tasks in the same way as humans.

The way AI works is to help software that combines large amounts of data with algorithms that can quickly process repetitive tasks to analyze patterns and features that exist in the data and to learn automatically

Artificial intelligence implementation technology was used for genetic algorithm, BDI architecture, and fuzzy theory machine learning, but there was no visible result. However, in 2000, deep learning method using artificial neural network, an algorithm of machine learning, has achieved a result, and interest in artificial intelligence has increased.

The role of artificial intelligence in smart city is fast analysis ability, and it is possible to analyze and process parts generated through numerous urban data much faster than human learning and response. It is also based on rational grounds for decision making, and artificial intelligence's intelligent technology allows faster and more accurate decision making than human judgment in case of emergency such as fire or disaster. It will be possible to build intelligent smart city that can predict various data patterns such as traffic method safety energy. Deep learning is a method of machine learning proposed to overcome the limitations of artificial neural networks, which is an algorithm of machine learning, and deep learning is a method of learning machines to enable computers to distinguish objects by mimicking the information processing method in which the human brain finds patterns in a lot of data and distinguishes objects. Deep learning is characterized by artificial neural networks, big data, and computer performance. The features of deep learning are artificial neural networks. [7]

Blockchain

The new technology that attracts attention these days is blockchain. As an infrastructure that spreads AI of Smart City, the cloud is important, but on the other hand, there is a concern about the reliability degradation of data due to centralization.

On the other hand, blockchain is a P2P (Peer to Peer)-based ledger platform that allows participants to share all the specific information generated between participants. Here, p2p means sharing among individuals and has transparency. If the cloud is mid-to-large, the blockchain has a decentralized feature, and the blockchain also has the ability to prevent manipulation according to the majority rule. [8]

With these block chain technologies, it is expected to be applied to Smart City for personal information issues, large-scale processing infrastructure problems, and various citizen opinions

2.2 Smart City Platform Case

In the past few years, we have focused on single solution such as installation of CCTV and smart garbage can for smart city, but these fragmentary attempts have not been able to present a solution from the overall point of view on the fundamental mobility of the city, Traffic congestion, and safety. To solve the problem of independent platform, it is necessary to approach the open platform and the platform that can cross standardization. In terms of technology, the smart city platform is essential components such as IoT connectivity, various sensor communication devices, big data analysis, cloud, and security, and furthermore, block chain and AI should be used. Application fields should include areas such as transportation, energy, environment, urban administration, and safety.

The Smart City platform should satisfy all paradigms such as shared economy, partnership between public and public, business model and data governance.

We will investigate the platforms of open source platforms and overseas vendors and learn about the platforms that are being applied in Korea.

oneM2M PLATORM

It was established in July 2012 to develop IoT service platform standard and is an international standard service platform technology created by 226 companies including mobile carriers and vendor solution companies.

The main service areas are smart home smart cars, smart grids, and healthcare. Common platforms provide standardized service APIs that link various heterogeneous IoT devices.

The architecture of oneM2M has the structure of applications, common services, and network services, and CSE includes 12 CSFs, which are exposed to the outside through reference points to provide services

*CSE (Common Service Entity)

*CFS (Common Service Function)

Currently, oneM2M is a domestic demonstration project and is used in Busan, Daegu, and Goyang to provide services such as transportation, healthcare, and environment.

FIWARE PLATORM

FIWARE is an open source platform that is remarkable by the standardization of smart city platforms in Europe, providing various components and providing NGSI and context brokers, the next generation interface based on open API. Currently in use in countries around the world, Japan's NEC is also making its own safety platform by applying FIWARE's open source.

FIWARE is enabling a new generation of smarter applications which exploit large scale, real-time 'context information'. Our efforts focus on the promotion of the interoperability and the free flow of data within and between smart cities, the collaboration between cities for the adoption of common standards that can enable a landscape of diverse but interoperable Smart City solutions. FIWARE is boosting the creation of a sizable market on which developers can start investing and cities provide the basis for the development of an Economy of Data [9]

CISCO KINETIC FOR CITIES

Cisco also supplies Busan Smart City and Songdo Smart City platforms and solutions in Korea, especially Cisco's Smart City platform provides data collection, distribution, resource management and services.

Cisco provides the ability to collect data from various types of devices and sensors in response to the needs of the city, analysis of cross-domains, and APIs as open platforms, and manages security keys.

Huawei's OCEANCONNECT

Huawei's Smart City platform is basically a cloud-based IoT platform. It is centered on the IoT connection management platform, but provides open APIs and agents and implements end-to-end service networks. Key features support private cloud deployment and provide integrated security and real-time analytics intelligence modules.

National Strategy Data Hub Platform

The data hub platform under study as a smart city national strategic project presents a new concept smart city platform by presenting a data hub platform that stores and analyzes data of Usecase such as traffic, safety, environment, and energy for Daegu and Siheung. We are promoting construction. [10]

So far, we have looked at the case of Smart City platform, but there is no Smart City platform that can make everything possible around the world. There are separate IoT platforms, existing control platforms, and big data platforms, so there are only platforms that operate each city in each city. To solve these problems, each country should build standardized data formats rather than independent platforms, and through this, it is necessary to focus more on the use of data through the data hub platform that connects the platforms between cities and connects the overall data together and the cloud infrastructure for this.

3. CONCLUSION

So far, the definition of smart city platform, the case of construction of each country, and related solutions have been investigated and the technical contents to be applied to smart city have been examined. Based on these contents, smart city platforms should add various functions other than collecting, storing and expressing the analyzed results.

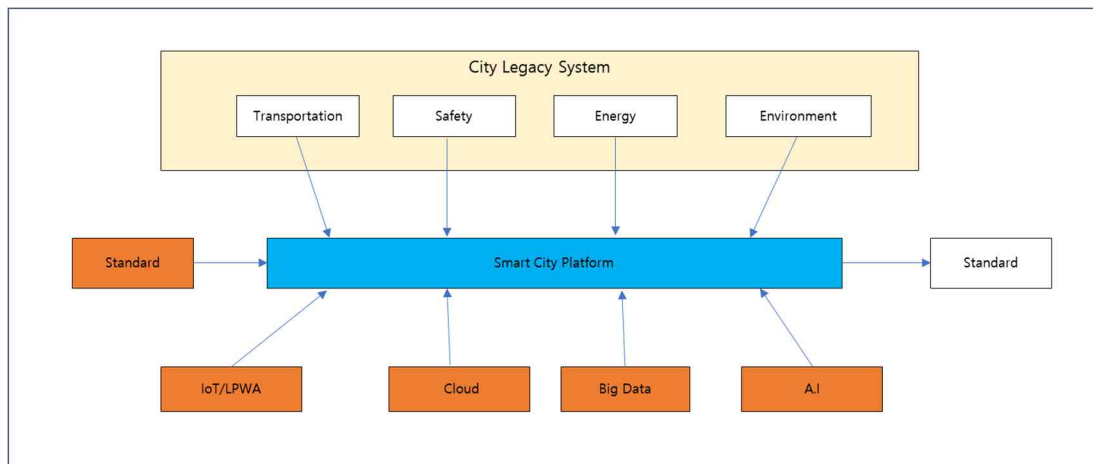


Figure 1. Overview of Smart City Platform

Smart City platform should integrate various systems such as traffic, safety, energy, and environment, which are existing city systems, and build future smart city platform through interworking with other city platforms by adding individual solution technologies such as IoT, cloud, big data and A.I technology.

If new technology comes out so far, it can be seen that the country or company that applied it first will lead the market without being culled. Smart City platform is a system that collects, stores, analyzes, and displays data from basic services through high-tech IoT, cloud, big data, and AI. However, if the Smart City platform does not become an open data platform, it will not share data in real time and play a role as a connection platform.

As the development of ICT technology and the number of devices in IoT have increased, the smart city platform generates various data and the volume is increasing, so ICT infrastructure and platform are needed to accommodate it. However, this will be the most basic platform now, and further research is needed to build a smart city platform continuously in the future.

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