

5G based SmartCity Convergence Service Platform for Data sharing

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Abstract—The SmartCity Convergence Service Platform (SCSP) based on the 5G, which supports high volume of data (e.g., real-time 4K media) to detect possible abnormal or dangerous situations in the urban, is leading to the provision of attractive services to meet smart city requirements. The 5G-SCSP data consists of collected service data, statistical analysis data, media-based event-metadata, and open data. The 5G-SCSP aims at the ease of smart city data collection, user-friendly accessible data utilization using an open interface and the flexibility of data collection for 3rd party services. This paper introduces the 5G-SCSP based smart city service approaching and easy usage of the collected city data and platform operation management of the provided service.

Keywords— *Smart City, 5G wireless, IoT*

I. INTRODUCTION

Contemporary cities still have many social problems, including traffic congestion, lack of parking spaces, aging facility management, environmental pollution, insufficient water management, and many other issues. Each city also should be able to solve these social problems according to its unique features and improve the quality of life by encouraging civic participation by considering the

revitalization of human capital utilization [1]. To fulfill these challenges, interest in smart cities around the world, including South Korea, is increasing and each country is approaching the development of smart city in various ways [2]. Remarkable growth of the information and communication technology (ICT) and Internet of Thing (IoT) networks are examined as the basis for smart city applications. Smart city services are considered one of the most promising, prominent and challenging parts of IoT [3]. In [4] explains what IoT technology for smart cities is used for, how can it will handle the predefined city problems and what the trends of smart city applications is.

In this paper, we will introduce contents of 5G based smart city demonstration service categorized four service scenarios defined for 5G-based smart city service project which is supported by 'The Cross-Ministry Giga KOREA Project'. We describe the 5G-SCSP function structure to process city issues and discuss collected service data sharing and its management of each service category. In future work, we will explain the 3rd party service authoring function. It is expected to expand the 5G-SCSP service applications by registering 3rd party service data and deploying new services using 5G-SCSP Application Programming Interfaces (APIs).

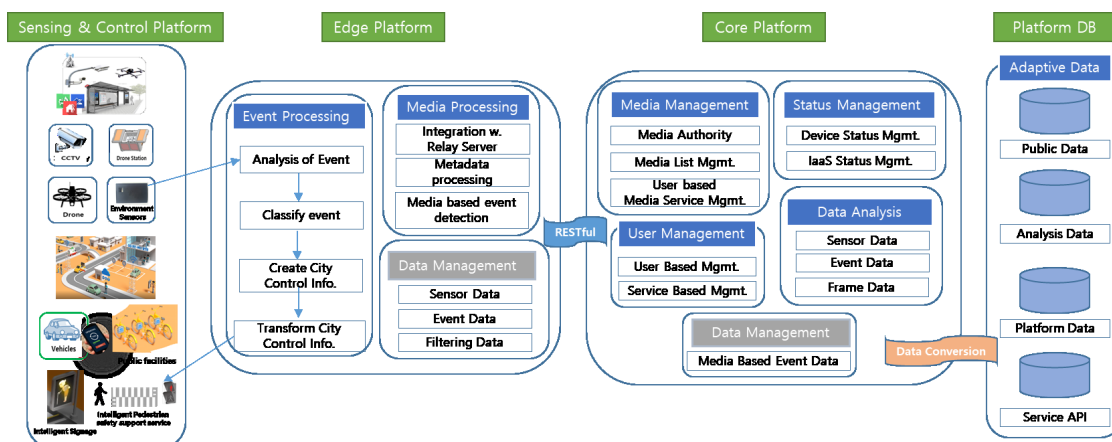


Fig. 1. 5G-SCSP function structure

II. 5G- SMARTCITY CONVERGENCE SERVICE PLATFORM

The integration of Cloud computing and IoT (CloudIoT) is considered as complementary technology, i.e. IoT can compensate for technical burdens by utilizing virtually unlimited capacity and resources in the cloud such as storage space, processing and communications. In the aspect of the cloud, the scope of service can be enlarged by processing real world data from IoT [5]. The CloudIoT concept was applied to 5G-SCSP using Infrastructure as a Service(IaaS) that allows unlimited use of storage, processing and network resources one of the cloud service models.

Fig. 1 shows function structure of our platform which consists broadly of four parts. First is the sensing & control platform part, the sensing part is input which collects images and sensed data using CCTV, environmental sensors, etc. and control part is output which receives control commands according to the urban situations. The second is the edge platform to rapidly process the collected data to correspond to emergency situations and creates its status events to notify the dangerous situation. The control commands are to notify the status and report the surrounding situation using unmanned aerial vehicle(UAV) or displays like signage. CCTV also can detect the situation by image processing but it has so many events in the real world and no way to alert it to somebody who concern, so the edge platform helps this one to select the specific dangerous situation and its post operations. The third is the core platform to handle the event metadata, it also handle the event driven results by decision control of edge platform, and include statistical analyzed data for predict or post management. It as well manages the sensing & control device information and the data driven urban events. Last one is the platform database(DB) to do the data sharing in 5G-SCSP, to measure the status comparison and to response results analysis, collected data analyzing, service authoring and platform status management. Data sharing is one of the most important purpose of this platform to classify the urban situation, enhance the urban environment information sharing, and predict the situation by analyzed statistical data. It additionally provides the open API, service API and control API to promote the data usage. The open API supports the data sharing, data query and statistical data query functions. We provide service API for application developers to utilize for expand services using collected sensor data. Depending on the application developer's use, it can be used in a variety of service areas. The control API is the specific usage interface to control the

UAV and display devices, etc. and to communicate with the integrated control system.

III. 5G-SCSP OPERATION MANAGEMENT

In this section, we will introduce one of the main functions of the core platform in the 5G-SCSP. It consists of user management, cloud infra information management, facility information management that includes status of the IoT sensors and devices and data management. In Fig. 2 shows the operation management scope and displayed content.

A. User Management

We classify as six users consisting of public institutions, industrial workers, researchers, citizens, developers and system administrators to govern access the 5G-SCSP. To provide different data usage category according to the user group we manage the user authority level. The developers and system administrators are permitted to access collected service data and media data. The collected service data can be used to create new applications with 3rd party system input data, and media based event analysis and urban status reporting will be able to access media data at user access levels for protect personal information. Other people can be acquire the facility information, urban event situations in the area of interest through the shared data and 5G-SCSP analysis data. User registration management is responsible for adding new users, deleting withdrawn accounts and allowing user permissions, and user history management handles the data access ratio per user category, access distribution of data categories and daily access proportion to analyze the system usage rate.

B. Cloud Infra Information Management

The IaaS which is one of the CloudIoT concepts is the base of the 5G-SCSP service platform and it has the key characteristics that improve resource usage and support multiple user access, etc. In Fig. 2 describes our system resources and server compositions which include edge and core server. The edge server processes the real-time data analysis to fast notify the dangerous situation according to event and the other handles data analysis, status management, data including media management, and so on.

C. Facility Information Management

The 5G-SCSP focused on four-service scenarios for

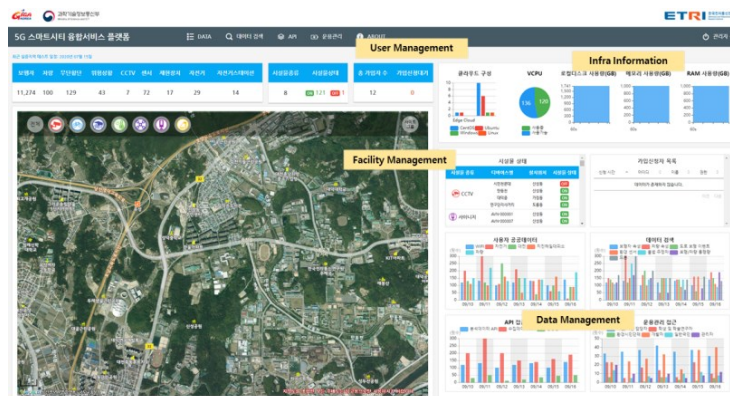


Fig. 2. 5G-SCSP operation management

demonstration, 1) Road Safety Support Services for the pedestrian and the social weak, 2) Control Service of public facilities for observation and control of hazardous facilities, 3) Mobile Shared Facility Management Service, in South Korea, it provides shared services of mobile appliances, such as 'the Tashu' of bike sharing and 'the Socar' for car sharing. 4) Shared Services for urban environment improvement, which encouraging citizen participation to enhance local environment, reduce illegal parking, prevent illegal trash dumping, etc. This service is designed to help the community improve its environment through citizen participation such as 'Living Labs'. Our system manages the devices which purposes data acquisition and data exposure and event driven control.

D. Data Management

The 5G-SCSP pursue the easy-to-collect, easy-to-use and easy-sharing aspect of the data side. To meet these requirements we provide three REST API categories which include open API, service API and control API. Those APIs are supporting data sharing not only our platform but also 3rd party system for increasing data extensibility. Fig. 3 shows our data sharing categories which includes mentioned APIs and various system concerned management data. The 5G SmartCity data include analyzed statistical event data to review defined urban status, collected service data based on the service scenarios. The public data provide five categories that encompass traffic, safety, life convenience information, facilities and environments of the demonstration area.

IV. 5G-SCSP OPEN APIs

The purpose of open API in smart city services is easily to access, to share and to use the data by anybody who want to know. The 5G-SCSP open APIs have the same motivation and also facilitate readability of shared data and enable continuous observation of the interested data. We provide the service scenario based open API and service APIs which includes IoT information, statistical analysis data and status event analysis data. In our system, we use the environmental sensors to monitor the air quality, gyro sensors to manage mobile facilities, CCTV to acquire the specific status, etc. In Fig. 4 shows the API types and usage example which contain service APIs and collected data APIs and the service scenario based Open APIs. Those APIs are available to query the data by key words, date, urban status events, etc. and it is possible to increase user friendly accessibility.

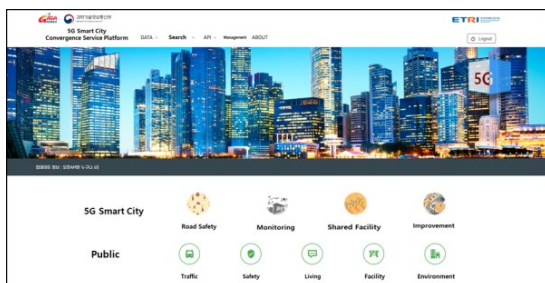


Fig. 3. 5G SmartCity Data Sharing

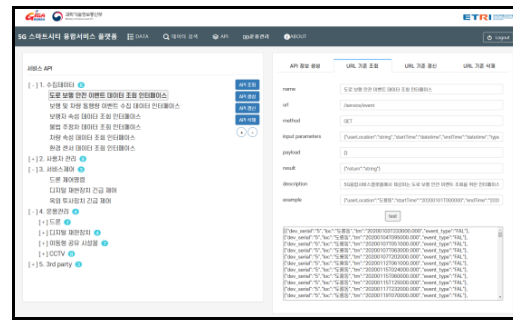


Fig. 4. 5G-SCSP based open APIs

V. CONCLUSIONS & FUTURE WORK

The 5G-SCSP based smart city abnormal situation processing and open API based data sharing can lead to city environment improvements and various service extensions. Those services are demonstrating in the Daejeon and Daegu in South Korea. We collect high quality 5G based CCTV media and analyze the situation using edge platform. The CloudIoT can relieve the storage shortage and easily deploy the platform where it needed places. A social network-based guidance service is assisted to inform a near emergency situation to registered users. In a situation like a fire for instance to pass emergency vehicles without a hitch, we can use the social network-based guidance service to inform owners of illegally parked vehicles. Drones with situation images transmit this information and the image is analyzed by edge platform. The work is being conducted around the two regions to verify the validity of service access according to the characteristics of each region and the collected data.

In future work, when 3rd party system developers want to create new services using our 5G-SCSP data, they can utilize service data using open APIs within the platform which provides openness of platform by providing interface registration function for 3rd party system data. We are developing to provide flexibility, extensibility and versatility

ACKNOWLEDGMENT

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