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Implementation of Digital Signage for Smart Facility System using IoT

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Abstract*: Recently, as wireless communication and smart phone spread and technology develop, there is an increasing demand for a system capable of real-time communication and business processing using online information anytime, anywhere in the offline field. In particular, changes in digital signage technology are developing in various ways due to the development of advanced convergence technologies. With the development of convergence technologies, digital signage has been constructed to provide information through a structured structure between each component in order to develop in a form that can deliver information in response to environmental changes rather than user input. This paper developed a system that outputs and services various contents together with industrial facility inspection and management by using wireless communication Bluetooth in a display device equipped with an operating system. This system is an Internet-of-Things-based system that simultaneously outputs various contents and a business management function that enables facility inspection.

Keywords: Video, Remote Education, Mpeg, Semantic, Image

I. INTRODUCTION

Advertising media have been evolving in new forms on the coattails of the development of both fixed-mobile network and display technologies. Combining such technologies helps off-line billboards, whose image is static, to have better visibility through bilateralness and to make consumers more immersed in their advertisements through digital signage, attracting more and more public attention. [1]. Digital signage is a service where a variety of information such as text messages and images are shown on a display screen. Digital signage is an indoor and outdoor digital medium by which various contents and messages are provided through digital information display (DID). It works as follows. Contents such as video clips and images are sent to a set-top box through a fixed-mobile network and shown on TVs, electronic displays, films, small-sized monitors and other screens. [2]. Not only does the digital signage provide dynamic advertisements, but also it gives consumers useful information. So the overall quality of advertisements improves. Based on such advantages, from a standing signboard established in a big building to a small-sized display device installed in an elevator or a subway, the form diversifies, and its effect is expanding. Accordingly, in this thesis, I would like to explain how an integrated management system using radio communication can be installed in a display device with OS installed, which makes industrial facility inspection management possible. In the second chapter of the thesis, I will touch upon digital signage-related studies and design a digital contents system for facility management in the third chapter. In the fourth chapter, I would like to show how to establish a system based on the design and then, present future challenges as well as my conclusion in the fifth chapter.

II. RELATED WORK

There is no business model for the same system. In this thesis, accordingly, I will introduce similar digital signage (DS) products. DS is a digital medium, which makes it possible to provide various information, entertainment services and advertisements through network by establishing remote-controllable digital displays in a public area or commercial space. Technologies used are contents format, contents management, contents transmission & distribution and device technology. [3].

Since the disaster information system can provide the information to DS systems established on roads in real time when any disaster occurs, it contributes to rapid information delivery and accident prevention. In addition, in case one's destination is registered in a mobile device, the closest DS system recognizes the destination and provides disaster and traffic information of the destination[4]. When it comes to the traffic information system, in case apublic transport such as bus or subway delays due to its breakdown or an accident, the current traffic condition and detour routes are transmitted to DS systems in real time. As both bus and subway running information is provided at bus stops as well as subway stations, travelers can compare the estimated travelling time by different vehicles to the destination and maximize the efficiency. It is also possible to check the detailed traffic information and find out detour routes by connecting DS with mobile device[5].

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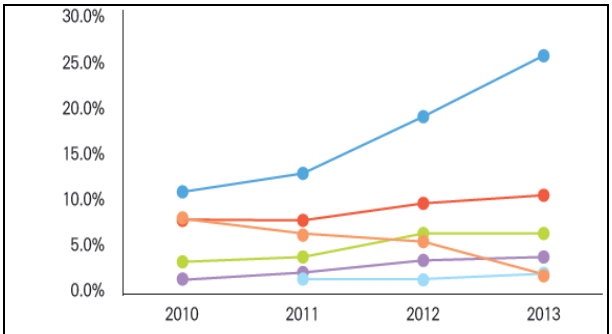

삼성전자	10.2%	12.0%	18.3%	26.3%
NEC	7.4%	7.4%	9.9%	10.4%
LG전자	3.0%	4.1%	5.7%	5.8%
샤프	1.6%	2.2%	3.5%	4.0%
필립스		1.6%	1.6%	2.5%
파나소닉	7.6%	6.1%	4.8%	2.4%

Fig. 1. Market share trend by global DS company

Fig. 1 shows the trend of global digital signage market share. Digital signage is a field where domestic companies are currently prominent along with TVs, and Samsung Electronics held 10.2% of the market share in 2010, followed by 26.3% of the market share, which is more than doubled in 2013. LG Electronics also occupied 5.8% of the market share in 2013 following Japan's NEC and is expected to continue to grow. The most active discussion on digital signage is in Japan. In Japan, digital signage is already being used in various fields, and research on activation plans and future applications is being conducted in-depth, centering on the "digital signage consortium" . Among these research contents, the following fields are expected to serve as mediators for domestic service activation

III. DESIGN OF FACILITY MANAGEMENT SYSTEM

3.1 System Analysis

This system transmits and receives facility inspection results using tablet computers and smart phones through a fixed-mobile network.

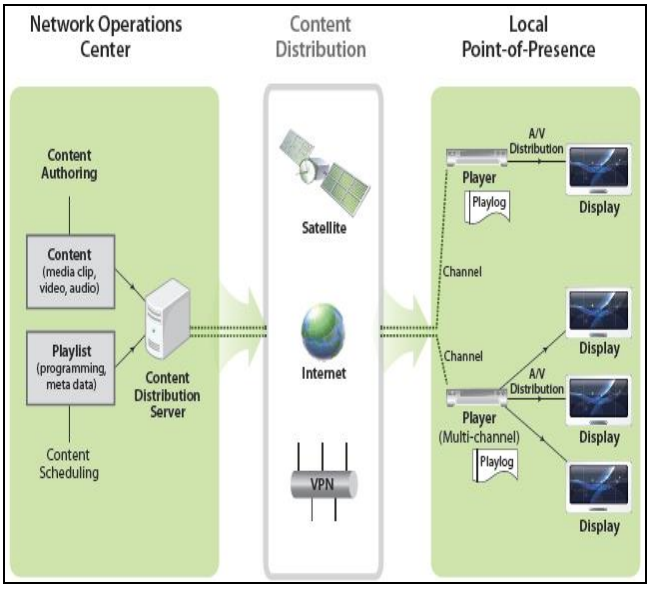

Fig. 2. Digital Signage Block Diagram

Fig. 2 is a DS block diagram. The DS system basically consists of contents, software solution, network and display device. Contents are provided to a web server as well as a display device through a software solution. A web server transmits the information requested by each display device. Inversely, it collects and processes the information transmitted from the display device[6].

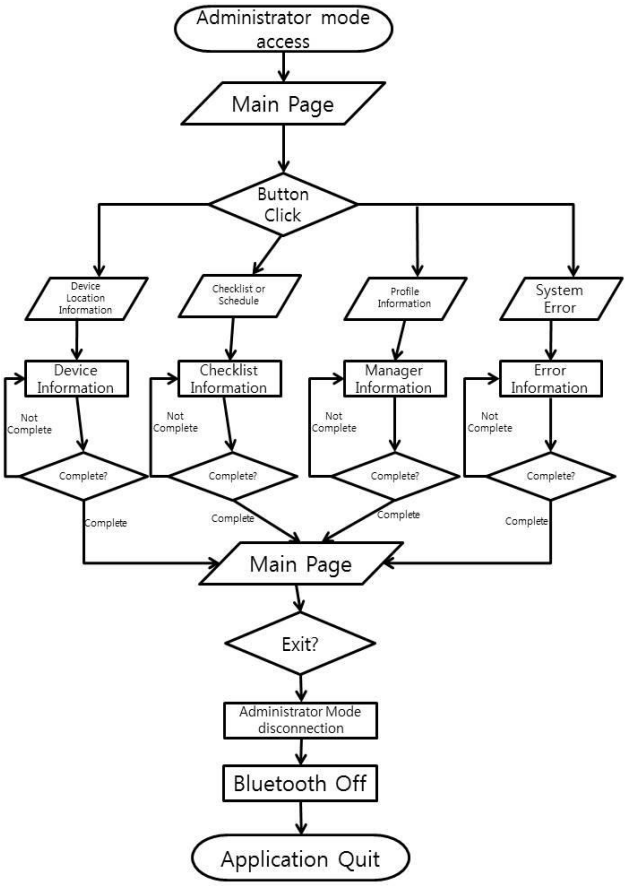

Fig. 3. Flow Diagram of Management System

Fig. 3 is a management system flow diagram. This diagram is the work flow of the top manager who can access all the data. A manager, first of all, accesses the Manager Mode in order to comprehensively manage device information, manager management and system error information[7]. After inspecting each and every function and its information, you can close the Manager Mode. Bluetooth is automatically closed in this case.

3.2 System Configuration

The system operating environment has an android-based mobile application version and a web-based general PC version. Information transmission happens between mobile application and web system. The best benefit of smart phone is its convenience to carry. By bringing out the best of such smart phone advantage, it makes possible to input necessary data in the system anytime and anywhere, and the results are transmitted through the 3G network to the server and then, to the PC of the person in charge[8].

Fig. 4 is a diagram of the overall system configuration.

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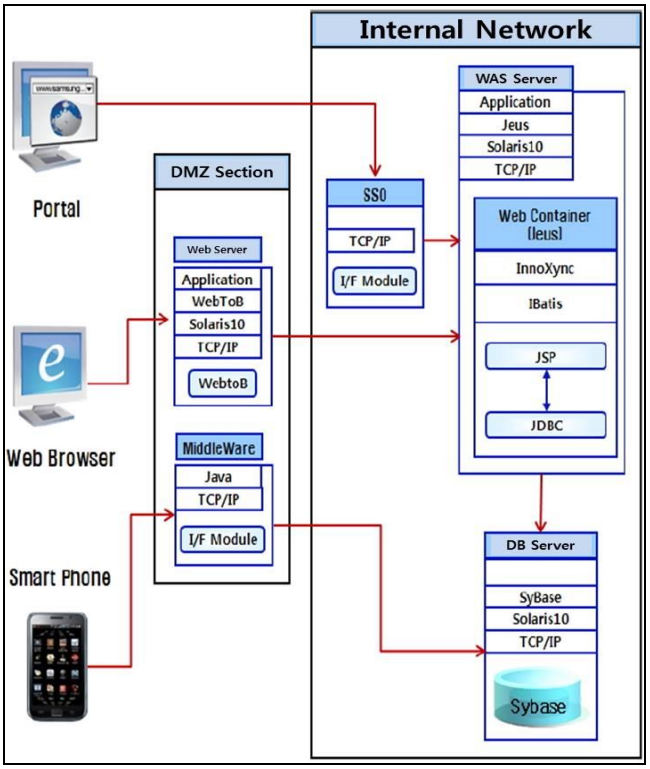

Fig. 4. Diagram of System Configuration

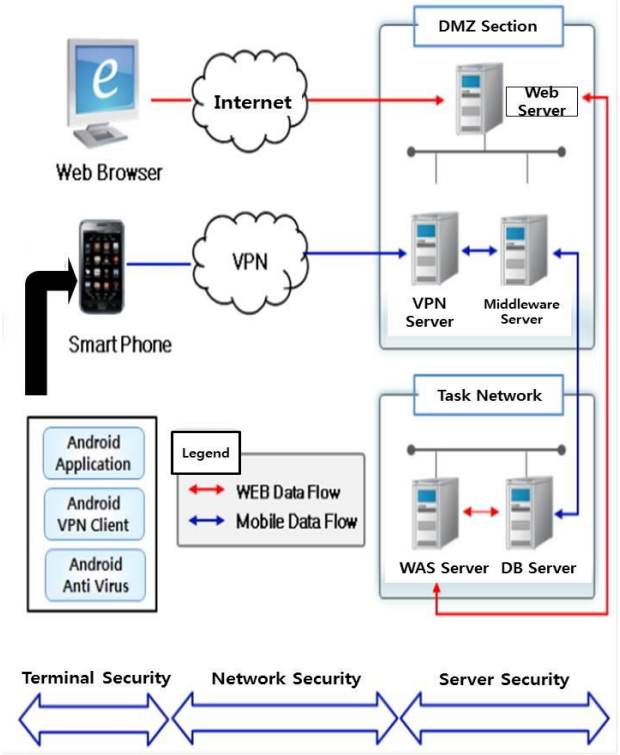

Fig. 5. security system for a mobile system

Fig. 4 consists of two servers. One is a web server for running a web system, and the other is a middle server for running a smart phone. Web system data is transmitted to a user and stored through communication between web application server (WAS) and web server, while mobile system data is transmitted to a device and stored through direct communication between middle are and DB server[9].

IV. ESTABLISHMENT OF FACILITY MANAGEMENT SYSTEM

4.1 System Security

Since there are no clear-cut national mobile security guidelines, unlike private enterprises, governmental offices and public institutions are facing difficulty in establishing a mobile system. Accordingly, any operating system which uses a smart phone application requires functions development and measures to prevent system intrusion which can be caused by data leakage and through network. In this thesis, therefore, the technical security system for mobile system development is recommended to have a web system separate from network. A manager page is created in the facility management digital contents system based onASP.NET and MVC5 while the tablet side is developed based on C#[10].

Fig. 5 shows security system for a mobile system. The basic secure zones are device, network and server. At the stage of device security, anti-virus is to be installed. The basic smart phone security guidelines should be applied and all the applications implemented must be shut off and DB files deleted when the phone is lost. Not only that, device as well as user authentication is to be implemented. At the phase of network security, web system network section and mobile system network section need to be disconnected and communication between mobile device and server can be done only though VPN (Virtual Private Network). Other communication channels except for VPN are to be blocked so that data encryption can be done only though SEED algorithm. In addition, at the stage of server (data center) security, data server access can be shut off by server duplication. Single communication through VPN is only to be allowed[11].

MDM(Mobile Device Management) client is to be additionally installed in the device. Through communication with MDM server, the device is to be more effectively managed and its security system can be further strengthened. It can be set to prevent any data from being stored in the device in principle, or to store the data only temporarily before the data is transmitted. However, the data must be immediately deleted after it is transmitted. In case of information transmission between device and server, all the data must be encrypted[12].

4.2 System Establishment

This is a facility management digital contents system connected to Bluetooth by using tablet and smart phone.

Fig. 6. System Interface

Fig. 6 is a start-up screen of the system. This system prints out and provides contents through wireless automatic authentication management. The system can be attached to facility inspection checklist or toilet entrance. Through a touch pad, the system can access a server. When information is required, the server transmits detailed information on the current situation as well as facility inspection results. In addition, various contents for specific areas can be transmitted from the server and printed out in real time.

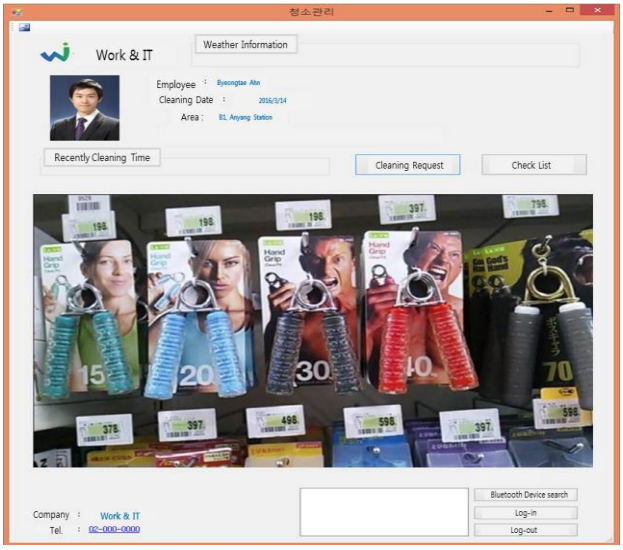

Fig. 7. User's start-up screen

Fig. 7 is a user's start-up screen displayed through smart phone and tablet. If a user makes a request for cleaning, such request is stored in a server and a manager sends the request for cleaning to staff. When the user makes a request and send it, Bluetooth device information can be used for smooth access.

V. CONCLUSION & FUTURE WORKS

This system helps managing facility inspection by installing a touch monitor with tablet PC or OS embedded in specific locations. Manager automatic authentication is possible by using wireless network. Not only can contents be replayed at specific display locations, but also the integrated software management system with a camera or a sensor embedded allows frequency of use to be managed. Last but not least, this is a "hardware and software in one system" solution. Various display devices equipped with OS provide functions such as video clips, images, weather forecast service, present time and emergency call service. Wireless network is used for interaction between this invented device and an end user's mobile device and the system provides various information about it [13].

Our future challenges are to add the Internet-of-Things (IoT)-based technologies for wireless interaction through various sensors and to develop cloud-based contents services.

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