

Implementation of Digital Contents System for Cleaning Facility management based on Bluetooth

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Abstract

There is a growing demand for a system that allows users to go online and work at anytime anywhere, as the smart phone is widely distributed and the technology is developing. In line with such a trend, this thesis has developed a system using a display with OS and bluetooth to help check and manage facilities of various industries as well as producing and delivering various contents. The system is based on the Internet of Things which supports the function of inspecting and maintaining facilities while providing various contents on display devices. This also receives from a service provider and displays advertisement contents real time. Therefore in short, the system manages facilities of a building including cleaning service management and displays various contents.

Keywords: *Digital Signage, Bluetooth, IOT, Cleaning Facility Management*

1. 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[3]. 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.

2. Related Studies

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. [4].



Figure 1. Disaster Information & Traffic Information System

It is Japan where DS is being most actively discussed. In Japan, not only has DS already been used for various areas, but also the Digital Signage Consortium is carrying on its in-depth research about DS activation plan and future application fields. The following areas are expected to be the media that activate domestic services. Figure 1 shows a disaster and traffic information system which is established based on DS [5]. 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. When it comes to the traffic information system, in case a public 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 [6].

3. 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.

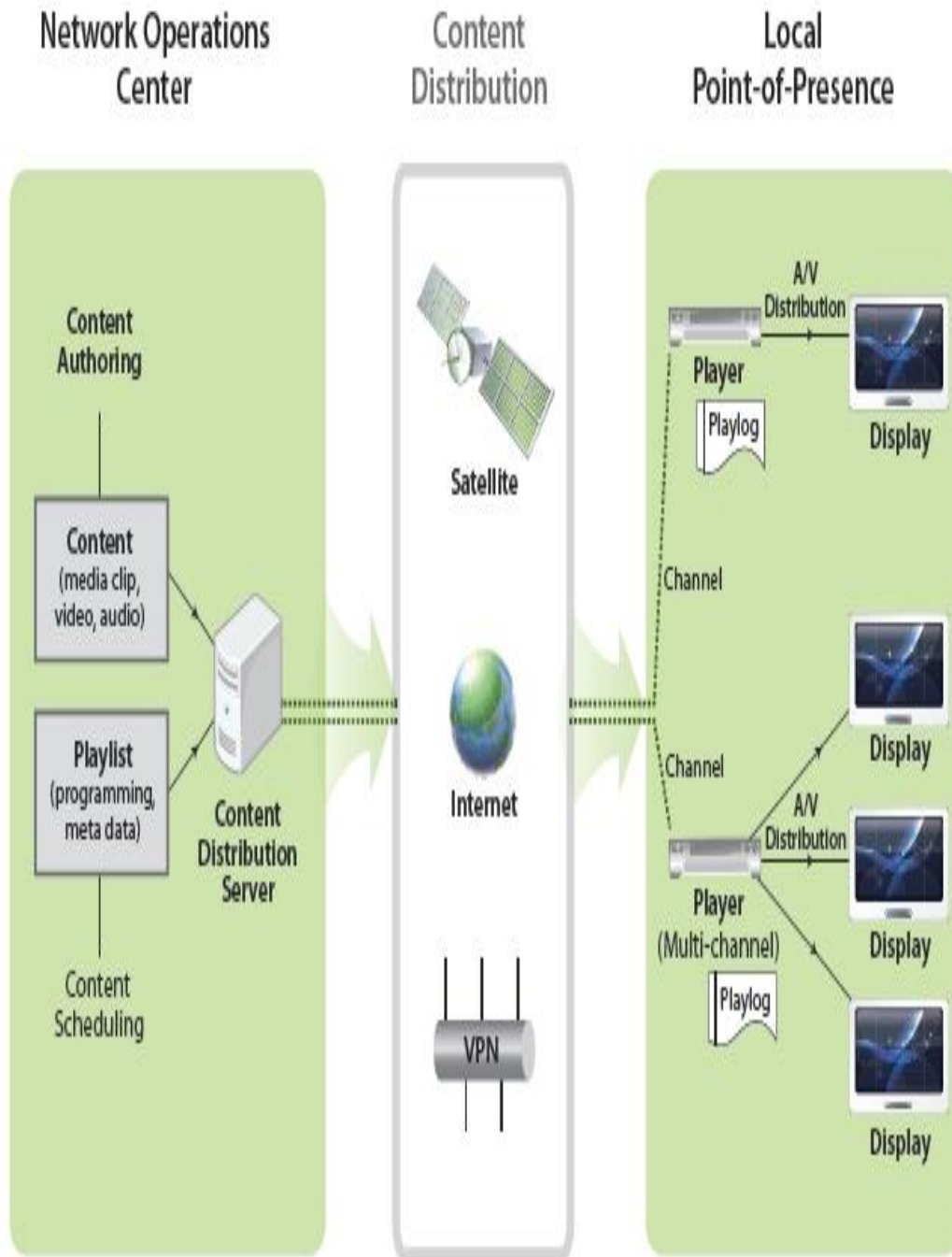


Figure 2. Digital Signage Block Diagram

Figure 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.

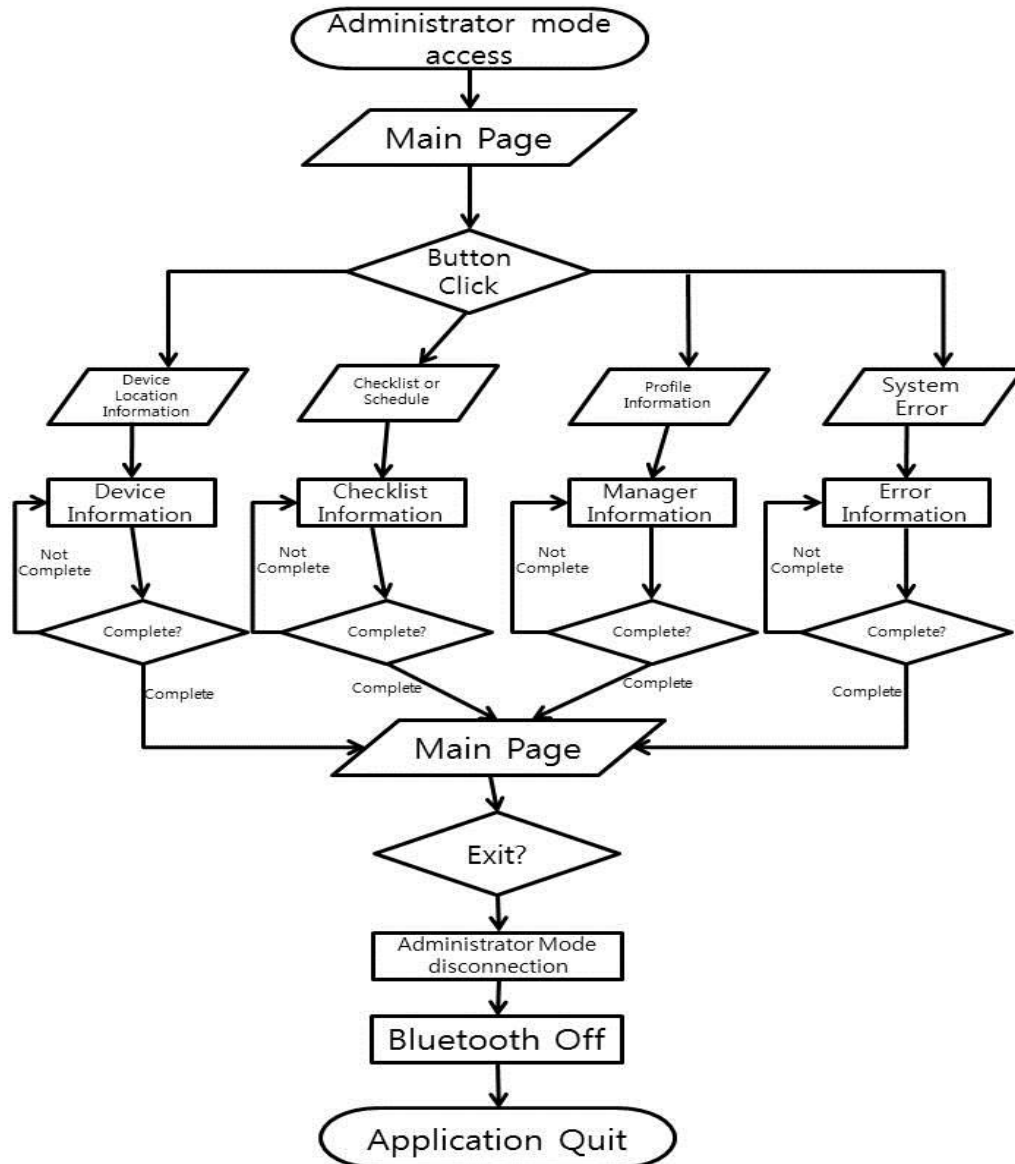


Figure 3. Flow Diagram of Management System

Figure 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. 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.

Figure 6 is a diagram of the overall system configuration.

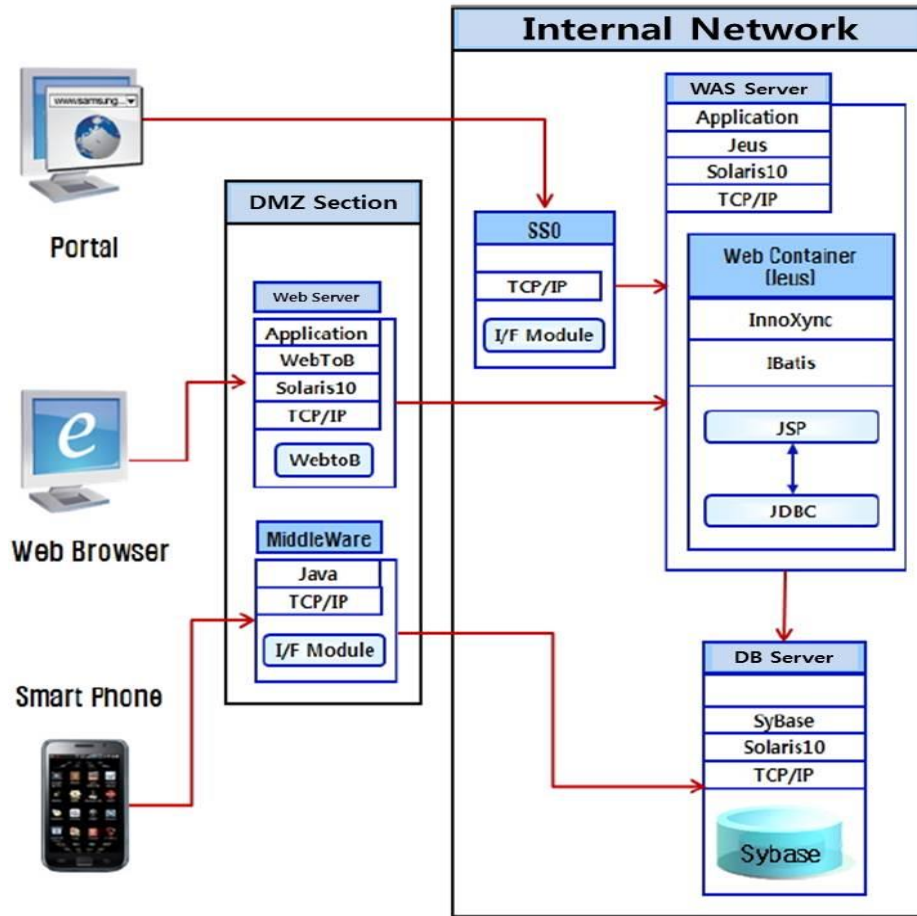


Figure 4. Diagram of System Configuration

Figure 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.

4. 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 System is developed based on ASP.NET and MVC5 while the tablet side is developed based on C#.

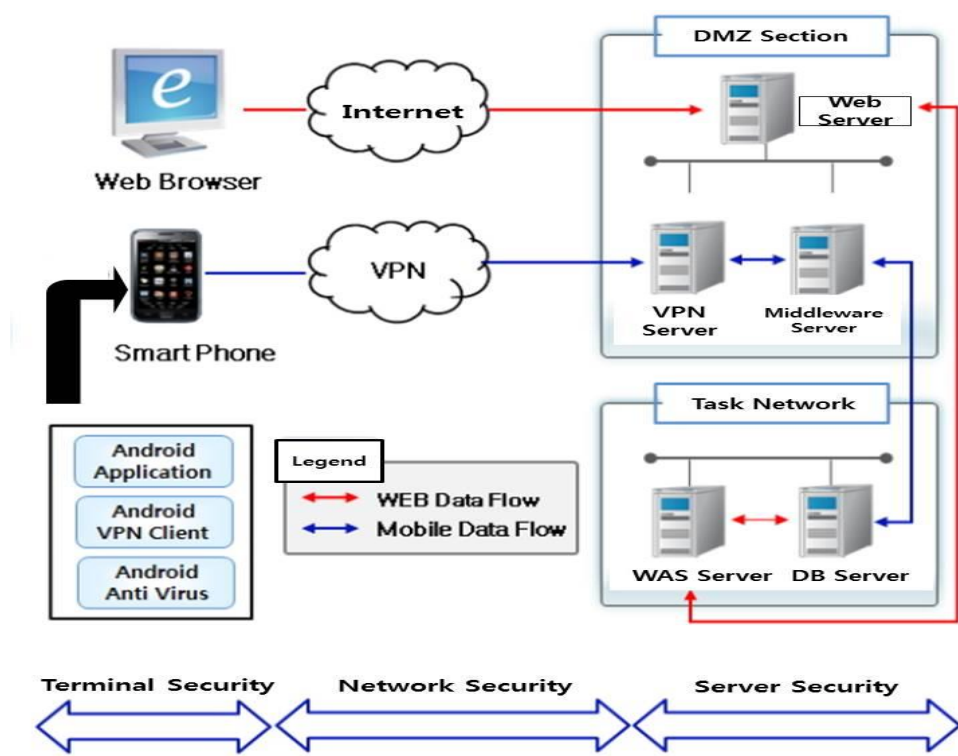


Figure 5. Security System based Mobile System

Figure 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 through VPN (Virtual Private Network). Other communication channels except for VPN are to be blocked so that data encryption can be done only through 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.

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.

4.2. System Establishment

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

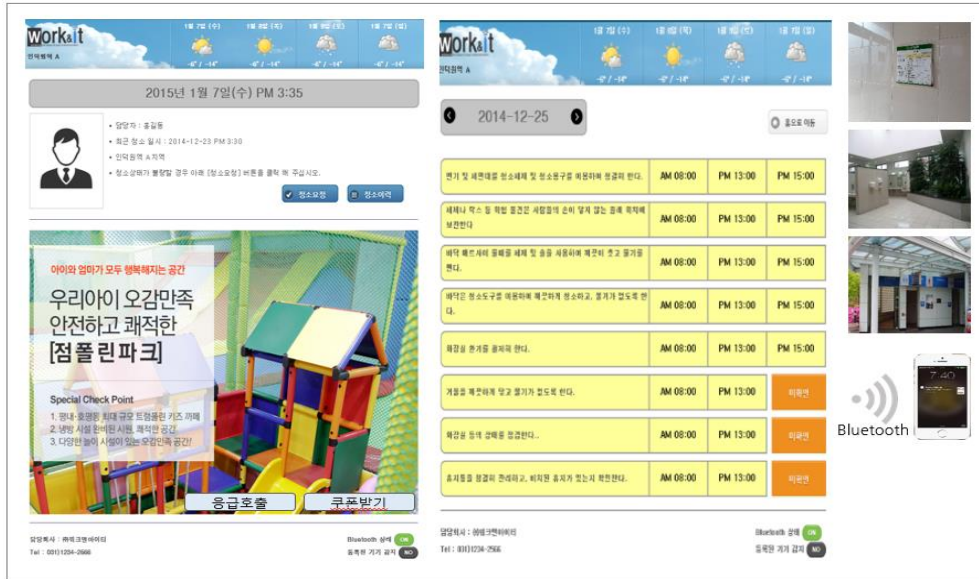


Figure 6. Start-up Screen of System

Figure 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.



Figure 7. Start-up Screen of Mobile System

Figure 7 is a start-up screen of the system connected to Bluetooth by using tablet and smart phone. When a user accesses the system for the first time, the user needs to create the top manager account in order to use the management system by clicking the button for registration as a new user.

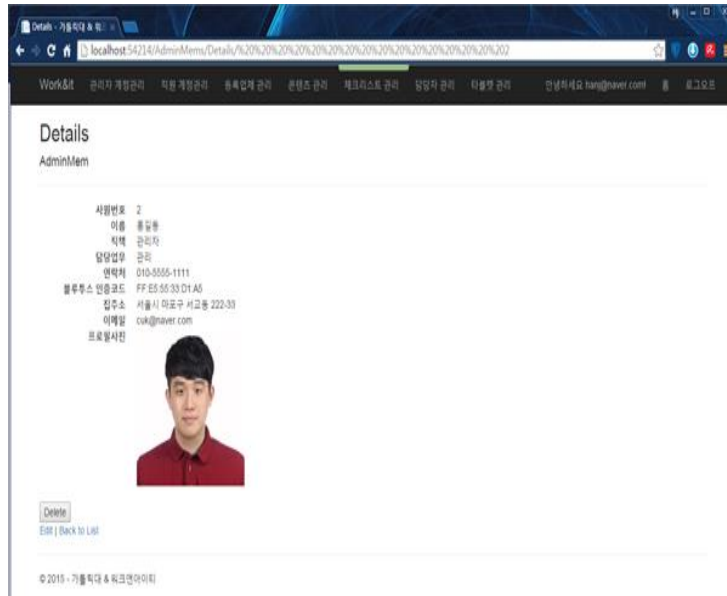


Figure 8. Manager Information Interface

Figure 8 is a detailed manager screen. There can be more than two managers. The user can delete managers by clicking the below deletion button. All manager accounts are controllable. Digital contents are created and managed at the Manager Mode.

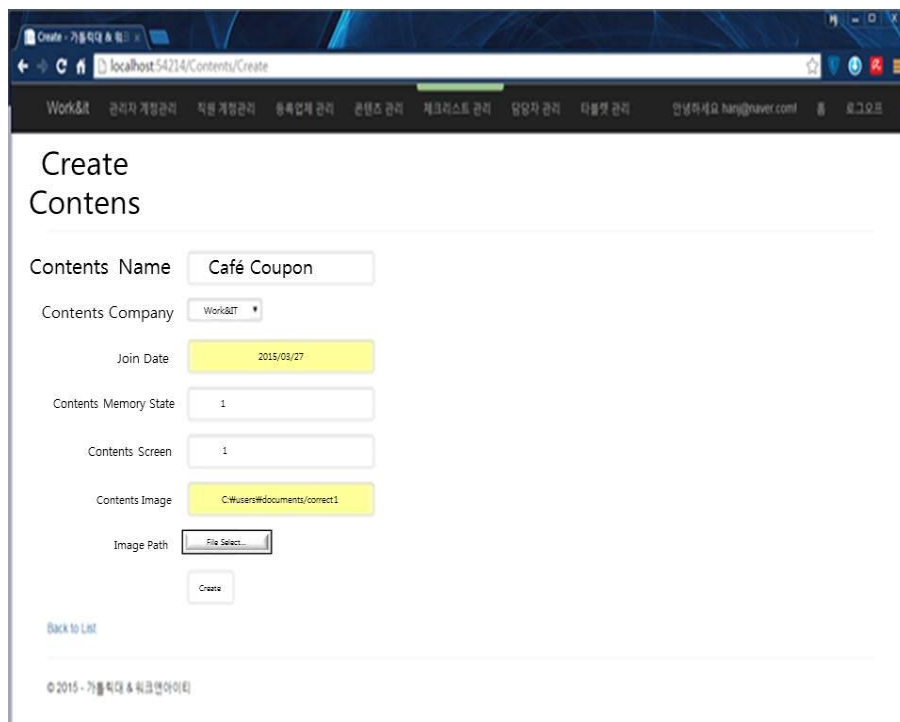


Figure 9. Interface for Contents Information creation

Figure 9 shows how to create new contents by clicking the Create button after inputting all the necessary information. When it comes to contents company names, only pre-registered company names can be displayed. Contents contract status is to be input in bool type such as 'Under Contract,' or 'Contract Suspended.' Contents screen is an item which shows the time how long contents are displayed [7].

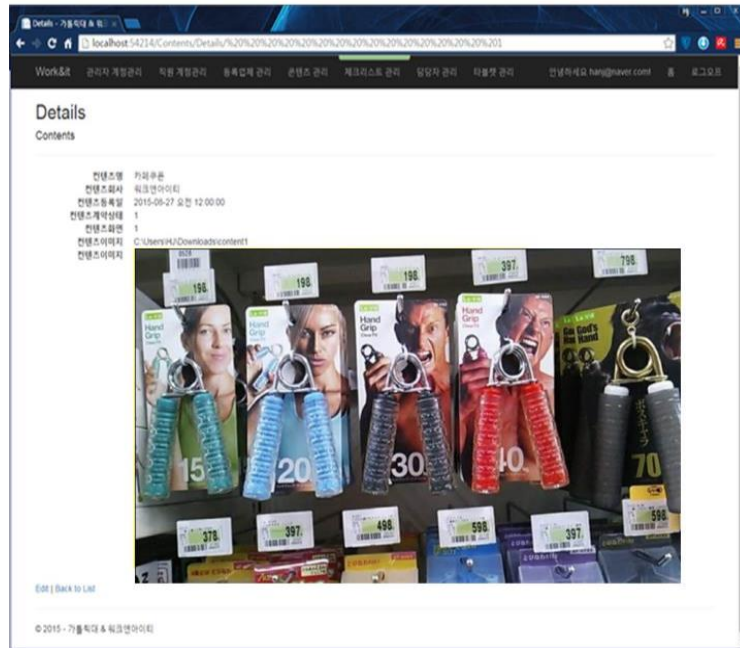


Figure 10. Output Interface of Detail Contents Information

Figure 10 shows one content. If you click on the content, the detailed screen is popping up. In the detailed screen, the information such as content name, content company, registration date, contract status and image is included.

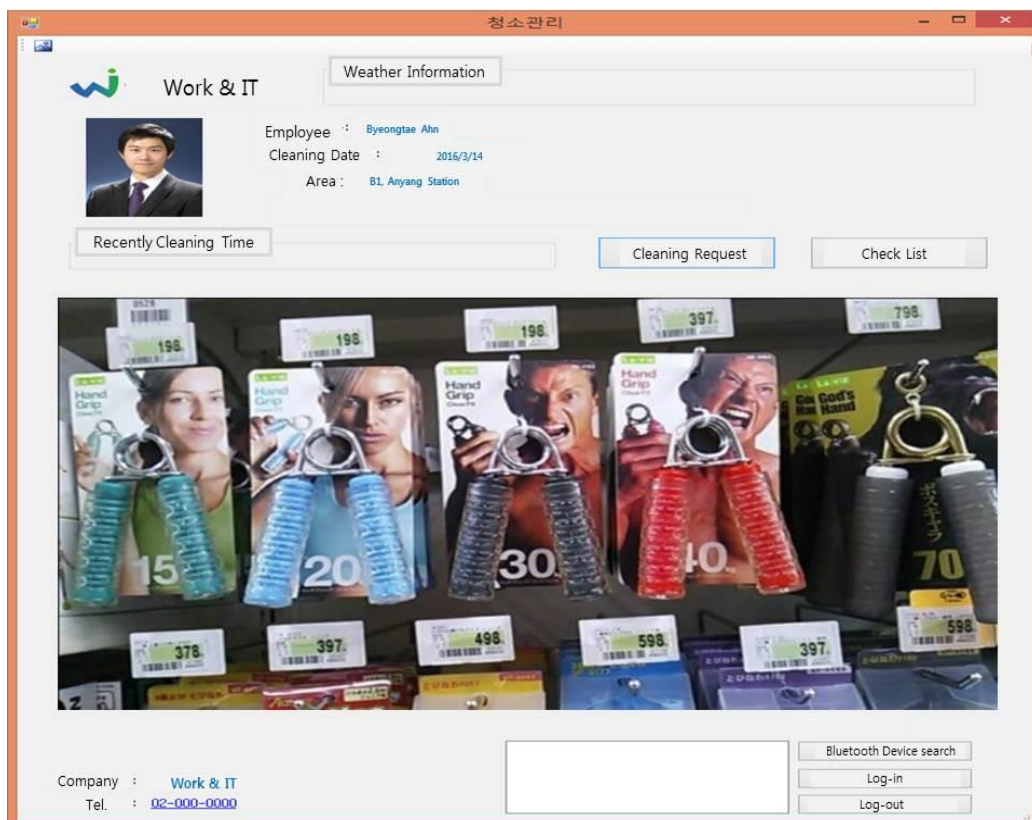


Figure 11. User Start-up Screen Interface Mobile System

Figure 11 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 [8].

5. Conclusion and Future Work

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 Bluetooth. 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. Bluetooth is used for interaction between this invented device and an end user's mobile device and the system provides various information about it [9]. 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[10].

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