

# A Study For Intelligent Campus Service using Zigbee Based on Wsn

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**Abstract:** We propose an integrated management system model for the establishment of a smart campus, such as a digital library system and a smart card system capable of providing various services using zigbee, which is currently prominent. The integrated management system can provide a higher quality education environment through transparent and efficient administrative management and one-stop service provision, away from the labor-intensive system of educational institutions, and users can provide personalized and knowledgeable intelligent education services that meet their needs and environments.

**Keywords:** Intelligent Campus, Sensor, IoT, Zigbee, WSN

## I. INTRODUCTION

Recently, due to the rapid development of information and communication technology, network infrastructure has been widely distributed, and as various advanced digital equipments are becoming more common in everyday life, the ubiquitous era based on this is coming. Various attempts are made to incorporate the new paradigm into education, and there are factors that can evolve educational methods or efficiently support all activities related to education. Already, many advanced countries are trying to build a smart campus that applies ubiquitous computing technology to university campuses with this in mind. The aforementioned smart campus refers to a campus that supports convenient and safe activities of campus members with ubiquitous computing technology using small computer technology and wired/wireless network technology. Currently, smart campus-related research is actively underway, and technology is being developed accordingly[1].

In this paper, according to this trend, we propose a smart campus design suitable for junior colleges using zigbee wireless communication technology. Chapter 2 examines the current status of smart campuses at home and abroad and in Chapter 3, Smart campus's service is designed considering the characteristics of junior colleges, and in Chapter 5, service design for each field is proposed. Chapter 6 compares the efficiency through sensor networks with universities that have built a smart campus, and Chapter 7 presents conclusions and future tasks. Cases

## II. DESIGN

### 2.1 Internal Smart Campus

The smart campus needs four core technologies. Terminal technology, network technology, platform technology, and service technology. Each field continues to develop along with the development of u-learning in universities, of which the sensor network field is the most active[2].

Looking at the development of smart campuses in Korea, in 1999, Sookmyung Women's University has built a "u-bi Sookmyung service" using mobile computing[3]. The u-bi Sookmyung service supported electronic attendance, 2D barcodes and wireless network environments using mobile student IDs. Afterwards, the utopia research team at Yonsei University built a smart campus through mobile wireless network access such as color code-based u-profile, u-messaging, and u-campus tourguide services[4]. And based on Konkuk University's X Internet, which began in 2004, a comprehensive information system was implemented that applied the J2EE&EJB platform and CBD architecture development methodology, and Kyunghee University implemented the u-class by introducing the world's first "two-way lecture system". In addition, Ewha Womans University is in the completion stage of ECC (Ewha Campus Center). After signing a memorandum of understanding (MOU) with SK Telecom on the construction of a smart campus, the USN system using u-library, laptop rental and information devices, and other parking systems, safety systems, and interactive lecture systems were expanded and implemented. The direction of u-campus in domestic universities is developing into platform development through intelligent mobile, multifunctional phone, sub-notebook PC, wearable PC, and information service through USN. However, these smart campuses are large universities and are not suitable for vocational colleges. Therefore, in this paper, smart campus is designed in consideration of the characteristics of junior colleges[5].

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### III. SMART CAMPUS SERVICE CONCEPT

#### 3.1 Base Design for Realization of Smart Campus Zigbee Network

The universities that built each smart campus implemented an efficient ubiquitous environment through information transmission and retrieval through various network infrastructures. In this paper, we construct a smart campus using zigbee wireless communication suitable for low-cost, low-power, and low-speed sensor network environments considering the characteristics of junior colleges[9].

The design of this paper processes information by attaching and embedding a zigbee sensor module to an object or place necessary to implement a zigbee-based network to recognize the object and sense the surrounding environment of the installed place and transmit the data to the wireless network. For efficient sensing of the module, zigbee RF transceiver is installed by selecting a suitable location considering the communication efficiency according to the location of the building and the location of indoor/outdoor building structures and equipment, and the OS is the OS for sensor network node suitable for large-scale network implementation. Suggest TinyOS. In order to speed up the sensor device response according to network initialization and to efficiently drive the zigbee stack, a kernel based on the Round Robin method is used rather than the Event Driven method. The chip is low-power, low-cost, supports 128-bit AES encryption method, uses JN5121 developed by Jennic, suitable for smart campus construction, and supports networking using CDMA network using CDMA module. Also, we propose efficient support by using korwin's KW-ZP-DUA1-JN3 for controlling the surrounding zigbee device through application programs such as PC or PDA[10].

#### 3.2 Concept of Smart Campus Using Zigbee Network

Figure 3 is the overall system design of the smart campus using zigbee network.

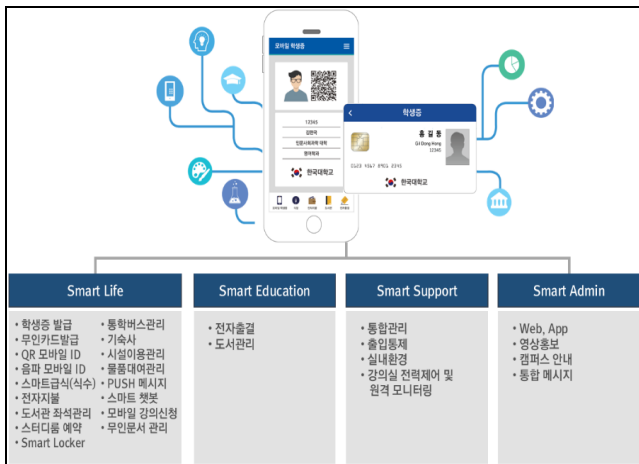


Figure 1. Yonsei University Smart Campus

Figure 1 shows the structure of the entire smart campus of Yonsei University. In addition to general functions, Yonsei University's smart campus provides various services such as electronic document-based administrative services[6].

#### 2.2 International Smart Campus

Research and development of ubiquitous computing environment is making a lot of progress in foreign companies and related fields as well. In Japan, Tokushima University has developed a system (tango) that recognizes information of objects by attaching RFID tags to each object, and implemented a manner education system (JAPELAS) based on infrared data communication IrDA (Infrared Data Association) [7].

The University of Hannover (Germany) implemented a so-called "laptop university project" using notebook computers, mobiles and other information devices. The Georgia Institute of Technology (USA), called Georgia Tech, is promoting an e-class project called 'classroom 2000'. e-Class implements a software infrastructure system environment that automatically saves and re-searches lecture contents using wireless LAN through an intelligent electronic board (Live Board) [8].

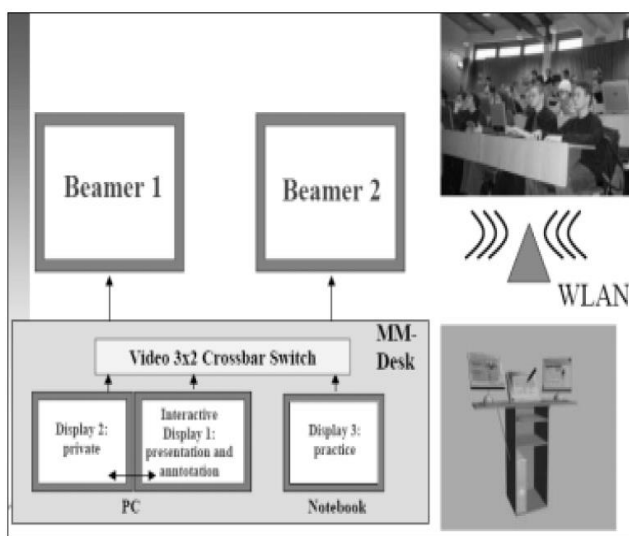


Figure 2. Structure of Hannover University

Figure 2 shows the system structure diagram of Hannover University, which has a well-established smart campus among overseas universities.

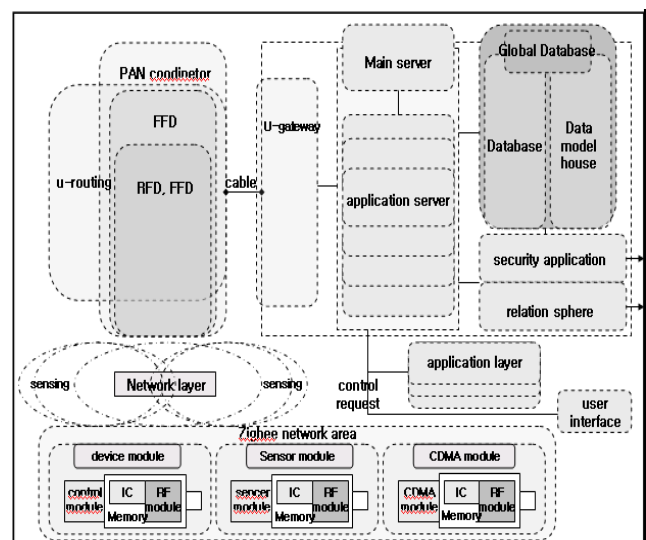


Figure 3. Entire system of smart campus using zigbee

Smart campus service based on USN infrastructure provides intelligent information service based on sensor network using zigbee chip in consideration of the characteristics of junior colleges[11].

Intelligent libraries, remote controls, and electronic bulletin boards provide authentication through user identification and information access using zigbee networking using electronic student IDs and zigbee modules attached to mobiles. In addition, through the sensing of the AP through the zigbee module, the electronic attendance function and the location search service of people and public facilities are supported, and a safe and efficient educational environment through environmental monitoring is provided through continuous environmental monitoring through an interface with a built-in S/W tool. Provided through appropriate control of the server. In addition, it provides a wireless network service that is complemented by zigbee's 128-bit AES for the security vulnerability of the wireless network in u-campus construction[12].

It recognizes the biometric information of students, professors, and faculty accumulated in real time from the sensing point, stores the activity amount in the database, and provides a health management service through the stored information. By transmitting continuous biometric information such as electrocardiogram and blood sugar to the server through mobile and electronic student ID with zigbee module attached and embedded by an individual, the transmitted information is stored and charted health records are provided through the user interface. In addition, hospital-like health checkup tables can be provided from the server through the model house, and efficient health care services are provided to members by adding health abnormal warnings or regular checkup dates to the notification function[13].

The electronic library currently manages books by bar code recognition and manages the entry and exit, and has disadvantages such as non-contact or low recognition rate, and inability to track the location of books in real time. However, the zigbee network built using the zigbee module can search for major book locations using a real-time sensing system, and book reservations, specific pages, and downloads of relevant files using mobile. In the case of relatively large files, information can be provided using e-mail or personal web folder, and SMS text is provided for the completion of file transfer and additional book information[14].

Remote control services are provided for public equipment and major equipment in the school that are permitted to be used through the approval of the use of the server. Using the PC and mobile to which the control module is connected, it requests approval from the server through the zigbee network, and provides a remote control interface through the user interface when the server's approval is completed. The remote control service provides a level of control so that there is no disadvantage in the provision of convenience to the members, and supports the convenient activities of the members through the efficient remote control service[15].

The real-time electronic bulletin board using the zigbee network is used as a space for useful information such as message transmission through the network between students and faculty and student notifications on the electronic board, advertisements, and publicity anywhere in the school, and

free transmission of frequently used document files and picture files. To support an efficient communication space.

In addition, through personal authentication through the member's mobile module and electronic student ID module, and access to the server and database using the zigbee network, a service that can be paid anywhere in the school is supported[16].

#### IV. CONCLUSION AND FUTURE WORKS

In this paper, the sensor network environment of the smart campus was designed in consideration of the characteristics of junior colleges using zigbee wireless communication suitable for the construction of the USN environment. The smart campus service through the zigbee network provides a campus support system suitable for the introduction of a smart campus and efficient services in related fields. In addition, by comparing and analyzing the wireless network-based technology between universities that built a smart campus, it was shown that the smart campus construction of a sensor network environment using zigbee is the most suitable communication technology for the smart campus of a junior college. The future task obtained by writing this paper is: First, a study on the efficient coexistence of other wireless communication technologies in a smart campus environment that requires a variety of services. Second, it is necessary to find a plan for additional cost reduction in service implementation and application. Third, it is a complementary problem according to the network configuration of members. There is a 128-bit AES encryption process provided by the 802.15.4 standard, but a software complementary system must be implemented to supplement additional information.

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