Study of Smart Campus Development Using Internet of Things Technology

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Study of Smart Campus Development Using Internet of Things Technology

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Abstract. This paper describes the development of smart campus using Internet of Things (IoT) technology. Through smart campus, it is possible that a campus is connected via online by the outside entity, so that the teaching approach based on technology can be conducted in real time. This research was conducted in smart education, smart parking and smart room. Observation and literature studies were applied as the research method with the related theme for the sake of system design of smart campus. The result of this research is the design of smart campus system that includes smart education development, smart parking and smart room with the sake of Universitas PGRI Yogyakarta as the case study.

1. Introduction

In the developed countries, Information and Communication Technology (ICT) has been used as the unseparated parts to increase the quality of higher education. ICT can be used to fix and increase the quality of learning process, research, library, information services and university management. One of the ICT implementations is the using of internet technology that is integrated to all of things of daily life, that is called as Internet of Things (IoT). IoT is a structure in which objects, people are provided with exclusive identity and the ability to relocate data over a network without requiring two-way handshaking between human-to-human or human-to-computer interaction [1]. IoT technology has been widely used for the development of smart home, smart campus, smart building and smart city. The concept of smart campus already being developed in developed countries several years ago. Smart campus is a trendy application in the paradigm of the IoT. The concept of constructing a smart campus implies that the institution will adopt advanced ICTs to automatically monitor and control every facility on campus [2]. The design and the implementation of smart campus is different with others, depends on the campus needs. The infrastructures to build a smart campus is costly. However, when it is implemented, all the campus activities will be effective and efficient. To build a smart campus, it needs to build the digital infrastructure inside campus that can give services so that it will be beneficial for surrounding citizens. IoT which bases on the internet, uses a variety of information sensing identification device and information processing equipment, such as RFID, GPS, GIS, JIT, EDI and other devices to combine with the internet to form an extensive network in order to achieve information and intelligence for entity [3]. In this research, the study of smart campus development with the discussion of smart education, smart parking and smart room that are located in Universitas PGRI Yogyakarta (UPY).

2. Literature Review

The research by [4] proposes the solution of RFID design structure integrated by using modern technology from cloud computation, supported by good quality technology and economy. This technology supports things to increase the campus security, asset track record, valuable things, student record, security of paper exam and original certificate. The future class appears to increase pedagogy, in which the students can participate more in the learning process through interaction and collaboration. To make environment that supports future classroom, it needs integrated mechanism of any related things being needed. In this research, the design of structure of Internet of Things was built, in which application domain is being made as system unity related to the internet [5]. To fasten and develop Intelligent Campus Internet of Things (ICIoT) more efficiently, the approach based on the runtime model to manage campus was applied as the result of the use of Wireless Sensor Network (WSN). It is hoped that all of management job description can be conducted by executing program that the model has been made appropriate. In the learning part, experiment was conducted and compared by using the traditional method. This method can increase the management effectiveness of campus facilities, save energy as much as 16,7% [6]. In the study conducted by [7], the concept of internet based parking guide by using QR code was introduced. This system runs on cellular platform by visualizing the available parking lot for the customers so that they can make order.

3. Smart Campus Infrastructure

Smart Campus is one of the innovations that will be developed in UPY. Adopted from the existing smart city system, one of aspects that being considered in developing smart campus is the infrastructure. The infrastructure is the main key of the campus smart program. If the infrastructure has been well developed, the information related to the campus can be accessed from mobile phone or others gadgets. Some parameters of the smart campus that being adaptated from smart city are:

a. Smart education consists of: eLearning, Personalized Learning, Virtual Classroom.
b. Smart parking, a parking system that provides the information about available parking lot and the information that the parking lot has been full.
c. Smart room, system that provides information related to the classroom that is being used or vacant.

4. Proposed Work

4.1. Existing Condition

The existing condition has not covered a smart campus. Between spaces, there is no connection that provides information regarding the total amount of present students or vacant classrooms. The system of parking lot is still manual, no information regarding the available parking lot. In UPY there are three parking lot, those are in unit 1, 2 and 3.

4.2. Proposed Method

The communication in smart campus consists on IoT unit that uses radio with the capability of receiving and sending wireless connection. Besides wireless, bluetooth is possible to be used as the connection. The component of IoT consists of hardware, software, cloud service. The design of hardware platform is built based on the needed. The hardware consists of microcontroller board that equipped by many sensor module, wireless, and other connection. The sensor module that being used is based on the needed. Generally, sensor module connected by microcontroller board through wireless. Sensor module being used is RFID, PIR sensor, IR sensor, camera, ultrasonic. Information being sent from the sensor, then being processed and saved in cloud that transmitted to android application. The application provides information to the users about condition and spatial condition, parking lot.

4.3. System Design

The system design of smart campus which described in Figure 1 below limited on (1) Smart education that consists on: eLearning, Virtual classroom, (2) Smart parking, a parking system that provides information related to the available parking lot, and also provides information when the parking lot is full. There are 3 parking lot. (3) Smart room: system that provides information related to the vacant room.

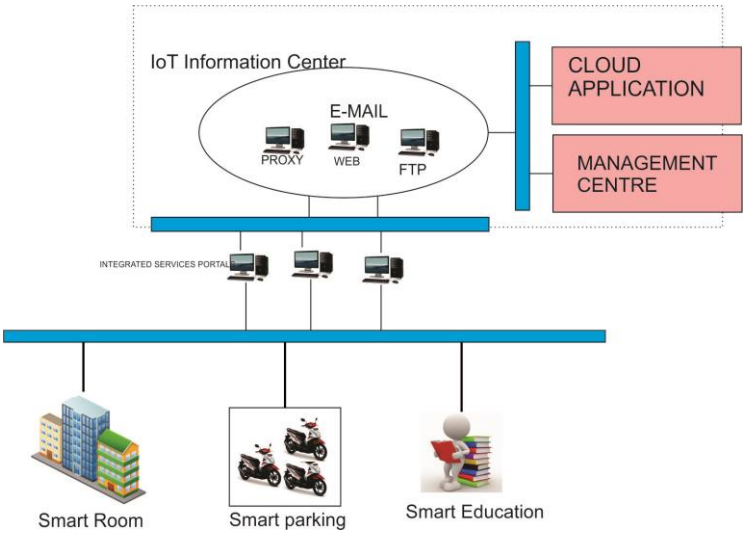

Figure 1. General scheme of system design

4.3.1. *Smart education.*

In smart campus sector, the learning process is conducted through e-Learning system, that makes it possible for students to be able to join learning from anywhere, anytime with the internet connection. E-learning eqquips with video conference facility so that it is possible for students to face the teacher from different place. Besides, virtual class feature can help simulation for students to solve problem in learning. Virtual class can be used for practicum lessons.

4.3.2. Smart parking.

A parking system that provides information related to the available parking lot, and also provides information when the parking lot is full. There are 3 parking lot. Sensor is put in the parking lot to scan the vehicle that enters the parking lot. The total amount of the vehicles that in the parking lot are revealed on the board. Next, the information will be processed by the system that provides information to the users about the available parking lot. The scheme is as described in Figure 2 below.

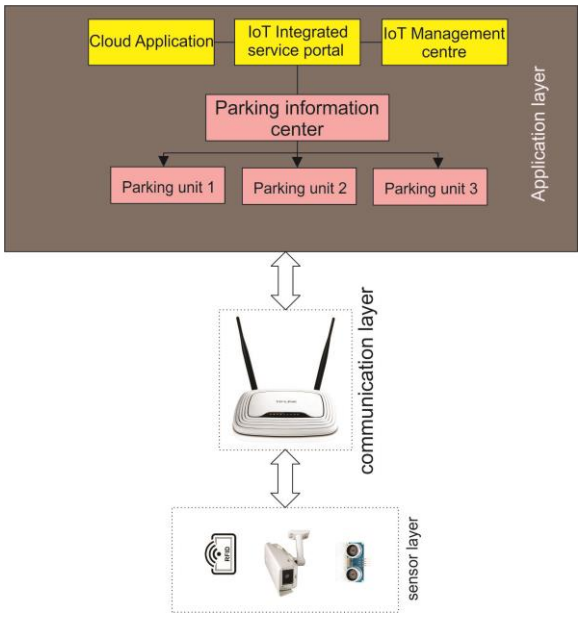

Figure 2. The scheme of smart parking

4.3.3. Smart Room

It uses the sensor of PIR, RFID, and camera. The concept of smart room is giving information about the vacant room, and the amount of the students being present on it. The data about amount and the name of the students are saved on the database. In this system, the students use RFID, so that the data of the students are in database. Smart system is being used in smart room. By using the sensor of PIR, the lights will be off automatically if there is no human in the room. On the other hand, the lights will be automatically on if there is or there are people in it.

5. Conclusion

IoT technology can be developed in any field. One of which is in the development of smart campus. Smart campus is an emerging and challenging concept for the technology to bring it in reality. The design of the system has created a scheme for implementation of smart campus limited on smart education, smart parking and smart room. This paper described the study of the concept that can be helpful in building the smart campus. The result of this research is the design of smart campus system that includes smart education development, smart parking and smart room with the sake of Universitas PGRI Yogyakarta as the case study.

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