Constructing Smart Campus Based on the Cloud Computing Platform and the Internet of Things

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Abstract —With the development and application of the cloud computing and Internet of Things, constructing smart campus as the key components of education information has been a focus of research. In this article we first introduce the application of the internet of things and the cloud computing in education. Then we discuss the current status of smart campus and indicate the difference between digital campus and smart campus. By the means of raising the model and application framework of smart campus base on the cloud computing and the internet of things, we analysis its function apply. Finally we discuss the issues of smart campus to be widely applied.

Keywords-smart campus; the internet of things; cloud computings

I. INTRODUCTION

In recent years, cloud computing and Internet of Things have attracted the attention of the researchers at home and abroad, the application of them is becoming increasingly wider and deeper. Smart campus is the outcome of the application of intergrading the cloud computing and the internet of things. In practice traditional data center is converted into cloud computing relying on many advances technology such as sensor devices and mobile internet. The software systems were separated before in campus, smart campus make them work together as a whole now, and smart campus provide smart support for campus management, teaching and researches.

In this paper, we will first introduce the application of the internet of things and the cloud computing in education in section Ⅱ, then we discuss the current state of smart campus in section Ⅲ. In section Ⅳ we raise the model of smart campus based on the IOT and the cloud computing, and discuss the application of smart campus, we will analyze the issues of smart campus in section Ⅴ.

II. THE APPLICATION OF THE INTERNET OF THINGS AND CLOUD COMPUTING

A. The internet of things in education

The internet of things (IOT) is the import part of the new information technology, and it connects everything through RFID, sensor, QR code and real-time positioning technology and realizes the intelligent identification, location and management for goods. IOT of education fully perceives the workers, resources and equipment of school in perceptual layer. Then network layer is responsible for the reliable transmission of information from perceptual layer. Eventually the IOT realizes the intelligent analysis, early warning and intelligent scheduling in application layer.
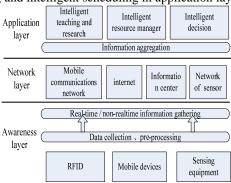

Figure 1. the system framework under the environment of IOT

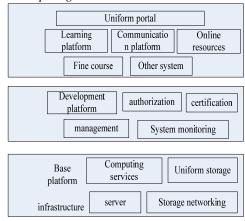### B. Cloud computing and education cloud

Figure 2. education cloud system platform

Education cloud is an information system applied to education base on the cloud computing. It integrates cloud computing and software platform. Through deploying the education cloud the school realizes the conversion from traditional data center to server virtualization, teaching management, and communications services. So school need

not to buy expensive servers and build complex IDC. Figure 2 shows the education cloud system platform.

III.   CURRENT STATUS OF SMART CAMPUS

Smart campus has experienced three phases: traditional campus, e-campus and digital campus. Smart campus is the higher stage of education information system, and the evolution of smart campus is based on the construction and development of digital campus. Smart campus emphasizes On-demand, react quickly. In fact, smart school reflects more features about intelligence. The contrast between the smart campus and the digital campus is shown in TableⅠ.

TABLE I.   THE CONTRAST BETWEEN THE DIGITAL CAMPUS AND THE SMART CAMPUS

	Digital campus	Smart campus
Technical environment	Local area network Internet	IOT Cloud computing wireless network mobile terminal RFID
Application	Digital teaching resources Distance education Digital library Administrator of networks	The smart system of sensory ability, interoperability, control capabilities
Management systems	Isolated system	System sharing Intelligent Push

At this stage, the application system's intelligence and connectivity increases significantly. We will discuss the model and application of smart campus in the following section.

IV.   MODEL AND APPLICATION OF SMART CAMPUS

A.   The model of smart campus

Smart campus includes portal architecture, management and service, smart management, infrastructure, etc. Smart campus system integrates hardware device of digital school, and   cloud storage as the means of data storage is applied. The model of smart campus is shown as Figure 3.
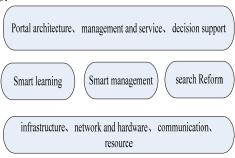

Figure3. Smart campus model

B.   Application of Smart campus

Smart school is a combination of IOT technology and cloud computing platform. We can integrate isolated system such as educational management system, finance management system, office system by IOT technology.
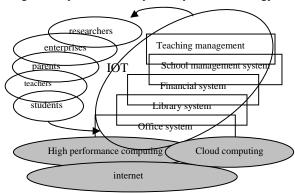

Figure4. Smart campus application framework

1)   application framework

The application framework of smart campus is a combination of IOT and cloud computing based on the high performance computing and internet. By the means of integrating the systems(such as teaching management system, financial system, office system, library management system) as a unified platform, smart campus can make teachers, students, parents, enterprises and researchers able to communicate and study.

The application of smart campus is composed of teaching management, logistics management, library management, etc. school realizes the card management including attendance access control card, library card etc. The application framework is shown as Figure 4.

2)   Teaching management

In smart campus, we no longer arrange a person specialist to carry on the checking attendance statistics and the management. Students can check in using card and mobile telephone that have the RFID label, the information data of the students are written to the database, the teachers and parents can master the real-time information of students by database system. The RFID technology is also used in the laboratory. We can extract the testing result by remote service use experimental equipment information store in the RFID label.

3)   Logistics management

We can have intelligent management in logistics, such as school consumer, intelligent light, intelligent parking. Teachers and students use one-card consumer in school anywhere. All the light and parking spot in school become a part of the IOT, smart campus system controls the lights under these circumstances, for example, system can auto close the lights when no one is around. The intelligent parking assists to help guide the car into parking spaces.

4)   Library management

We can have the new management mode in the library by IOT. Library takes the information feed into electronic

tag. These tags combine the mobile phone, library card and other physical objects. User can get the resources required at anywhere through GPS technology. The new mode can realize the communication between user and library, user and resource.

V. ISSUES OF SMART CAMPUS

Constructing smart campus based on the IOT and cloud computing technology is an inevitable trend. But there are many issues have to be perfect.

One of the questions is that the top-level design is not perfect. The designer ignores to dig deeply the value of information resources, so that the resources are difficult to be shared. Moreover, the solution of education cloud is not perfect, and schools attach more importance to office management than teaching and research. Anyway smart campus is the higher stage. We should pay more attention on design in this stage.

The other problem is the data standard. At present, there are many manufactures of RFID label and sensor, the standards are various and not compatible caused by this phenomenon. Cloud computing technology is difficult to get a complete unified control and effective management, so we should create a set of standards for data format and make the sensory data be shared and managed easily. In the future, smart campus needs the big breakthrough on information collection, chip research and programmed algorithm.

VI. CONCLUSION

We should vigorously develop smart campus, because smart campus is a new form of campus information, and it is the support circumstances of the education development. Smart campus can satisfy the demand of education user, and can supply the best service for mobile office, mobile teaching and life. We can construct a network teaching everywhere, in short, we should construct a safe, stable, green, efficient campus, and make smart campus as integral part of the smart earth.

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