Towards an Optimized Smart Campus Framework with three Layers (OSCF-L3)

نحو هيكلية مجمع جامعي ذكي بتقنية تعدد الطبقات

(OSC‒L3)

Dr.Nada M. Alhakkak
Ban Salman

Computer Science Department
Baghdad College for Economic Science University

الملخص

ان استخدام الاجهزة الالكترونية الحديثة و تعدد استعمالاتها في العصر الحديث ادى بالتالي الى التغيير بالطرق التي يتعامل بها المستخدمون مع المحيط الجامعي بشكل عام.

و تختلف المجمعات الجامعية الذكية عن سواها من المجمعات الجامعية التقليدية بكونها تعتمد في اساس عملها على الحوسبة السحابية و انترنت الاشياء لأغراض التعامل و التفاعل مع الخدمات المقدمة للمستخدمين.

في هذا البحث نقدم مقترحا لأطار عمل يخص مجمع جامعي ذكي يكون فيه التعامل و الاستفادة من الخدمات المتاحة الكترونيا لعدة انواع من المستفيدين ، ضمن الاطار الجامعي (الطلبة، الاساتذة ، الموظفين و غيرهم).

ان اطار العمل المقترح OSCF–L3 هو في اساسه يعتمد على تقنية الانظمة متعددة الطبقات والذي تم اعتماد تصميمه على اهم العناصر الاساسية للمجمعات الجامعية الذكية المعتمدة في الوقت الحالي.

Abstract

The use of modern technological devices has changed the way users interact with their university environment. Smart campus differ from traditional campus it depends on cloud computing and internet of things to connect its parts, this paper proposes an optimized smart campus framework for all types of individuals or users that enables the users of the campus to interact with each other using its main services. The proposed framework OSCF-L3 is a layered structure work. The proposed framework is interacted with the some of the main factors that affect smart campus performance.

Keywords: smart campus, internet of things, OSCF-L3.

1.Introduction

In the last few years, there was a noticeable interest about the concept of Internet-of-Things (IoT) from researchers and general public as well. The term become popular and acquire high publicity due to the fact that different application areas could get the benefit by using and employing IoT in one way or another[1]-[4].

The tremendous improvement in the technology field which has led to the foundation of the IOT results in the foundation of smart things like smart environments [5], smart home [6], smart hospital [7] and smart college/university.

New smart solutions has become available to be adopted in colleges/universities environments to improve such environments from every aspect.

The main interest in the era of smart college/university is the education; still there are other management and environmental aspects related to this concept which are influenced by, effected with, affected of and combined with this territory.

2.Literature Review

Coccoli et al. [8] Defined the smart university as a place where knowledge is sharable among teachers, students, employees and other staff in a unified smooth way [8].

Doulai [9] Proposed a smart campus system which consists of a dynamic web-based instruction technology and a real-time streaming technology, combines many tools specialized for educational purposes to ease and enable the cooperation and communication between students beside management of classroom [9].

Smart campus are founded to be a beneficial approach for faculties and students in a way that improves the user's experiences and manages the available resources with practical services [10].

Rehman et al. [11] Suggested a smart university sensing using the technology of RFID (Radio frequency identification) to serve the faculty as well as the students in fields of smart labs, smart lecture room, room security and smart student's and staff's attendance. It also gives benefits for identifying and tracking among other facilities [11].

Al Shimmar et al. [12] Developed a prototype to show the advantages of using WSN (Wireless Sensor Network) and RFID for Smart University for students' attendance. The researchers argued that these two technologies can improve the student attendance method and control management [12]. Figure 1 shows the Network block diagram for the system.
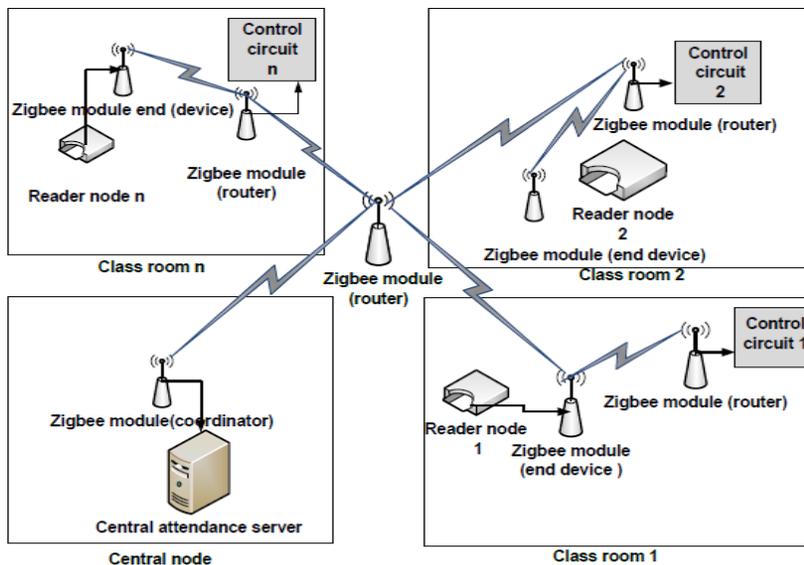

Figure 1 :The Network block diagram [12]

IOT, RFID and WSN plays an important role in smart college/university system and support the required characteristics from it.

Smarter universities/colleges can take the advantages of the big movement towards big data to be built in an innovative ways [13]. The researchers argue that if the generated data by smart universities could be used effectively, then the students' learning experience, support the outreach of community effectiveness and gives the research enterprise the enhancement it needs [13].

Maria et al. [14] Developed a system which could be useful in smart college area to supports users in recognizing the occurrence activities. It is an assessment tool for teachers and students in classrooms with smart facilities, this is to stay focus on teaching process and avoid time waist over minor subjects [14].

Weichun [15] Proposed a smart card system for college which could be used by the college's teachers , students and other employees at the same time. It is a unified campus card which includes all desired functions within the college's campus, like identity card for students, teachers and other employees. Also it may contain library card, key card and medical card [15].

Using this card, users could go to all places, do all activities and business inside the college's campus. Figure 2 shows the smart card applications.
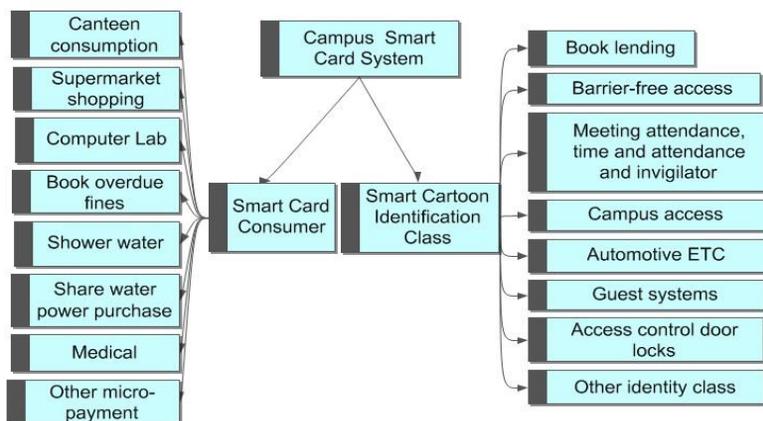

Figure 2: Smart Card application deployment[15]

3.Smart Campus Main Factors

Smart campus environment is affected by some of the main factors, as shown in figure 3, those factors are related to general types of services, Fast WiFi, classroom, lighting, security, learning registration, and managements [17].
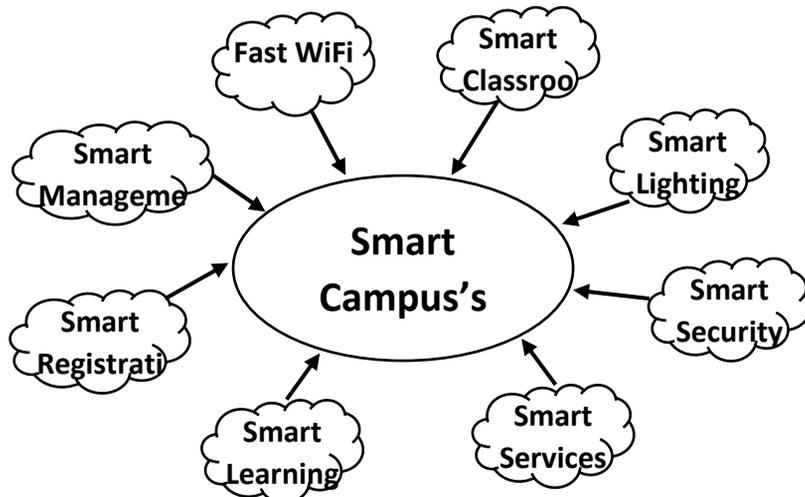

Figure 3: The Main Factors that Affects Smart Campus

4.Proposed Framework

Many works has been done in the area layered construction [16]. The proposed framework that we present in this work; Optimized Smart Campus Framework with three Layers (OSCF-L3), as in figure 4, contains three layers as follows:

A.Layer1: Infrastructure Layer, this layer is related to all kinds of hardware resources related IOT environment; those resources are WSN (Wireless Sensor Network), RFID (Radio Frequency Identification), Routers, Server, and Mobil. The same layer contains Virtual Machine Environment; which is related to creating virtual environment with specific features to be used by individuals with special features. Mainly virtualization helps in integrating multiple types of resources that improve resource utilization.

B.Layer2: Communication Layer, this layer deals with three main models; campus service model that deals with the main services offered by the campus; the second model is interconnection service model which is related to the network tools to be used for data transmission. The final model is cloud service model that contains cloud services.

C.Layer3: Application Layer, this layer treated as a user interface layer, it contains multiple types of software's deals with all kinds of individuals like students, teachers, and officers, together with learning software for future use.
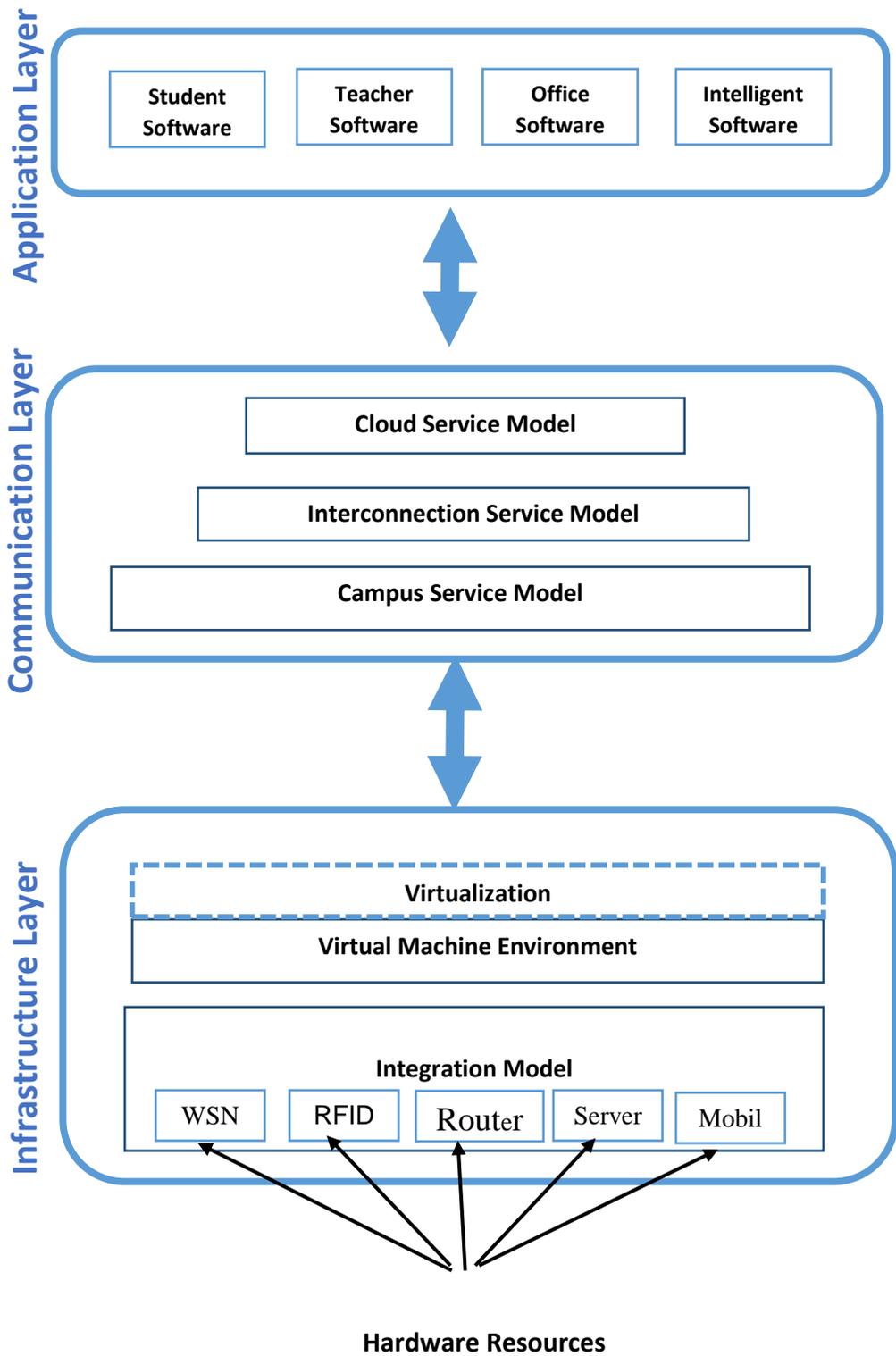
Figure 4: The Proposed Smart Campus Framework

5.Conclusion and Future Work

The construction of smart campus depending on cloud computing environment with a multilayer design should helps in; improving the resource utilization, information security, with sharing ability and real time monitoring, with ability to deal with big data generated from daily use of internet devices and applications, this work was the first step for designing a smart campus in developing countries, the second step should be designing a survey for requirements validation together with the factors that affect the performance of the smart campus. Finally, we intend to implement the proposed framework to be integrated with the cloud.

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