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Internet Of Things Applications In Academic Libraries

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Abstract

We are up to a new era of computing technology that many are calling the internet of things (IoT). IoT is emerging as the wave in the development of the internet. IoT has the potential to deliver solution that improves service efficiency and security of the academic library. This paper discusses the possible usage of the IoT. In particular, we consider cloud computing, magic mirror and pressure pad sensor using wireless sensor network (WSN). Considering these, we proposed an approach to improve library facilities and providing patron friendly system. This system is a step towards a smart library.

Keywords: Internet of things, cloud computing, magic mirror, pressure pad sensor, wireless sensor network.

1. INTRODUCTION

Libraries are essential in our life to improve our knowledge [1]. A concept of "Internet of Thing" (IoT), which forms a network by sharing information of each sensing object, has recently been spotlighted over the world [2]. IoT refers to the use of intelligently connected devices and system to obtain data gathered by embedded sensors, actuators in machines and other physical objects. IoT uses connecting media such as wireless sensor network and physical objects to connect devices to each other and the internet, with minimal direct human intervention to deliver service that meet the needs of wide range of academic libraries [3]. As libraries explore and develop their next generation library catalogue, cloud computing has emerged as a critical component of these new system. Cloud computing improves the service efficiency and visibility of libraries collection and management services [4]. Magic mirror is a application based technology could be added throughout library that will be able to sense what title the patron is holding and recommend other like material, mention

related events, give a sneak peak into the books[5]. Using Pressure pad sensors in the aisle under the floor is yet another innovative technology gives the library a count of people browsing aisles in the library, helping with collection development and possible area where improved signage might be required and automatic turn ON/OFF light bulbs which indeed save energy and making a smart library[5]. Wireless sensor network enabled with Wi-Fi provides communication node to transfer and gather information and data by the sensing nodes [6]. Above mentioned technologies inter linked to improve service efficiency and making academic library a smart library.

2. HISTORY OF INTERNET OF THINGS

Dewy (1983) posited that, "libraries are schools and the librarian in the highest sense a teacher." Oyedeji (1980) describes a library as having "a machinery" for the use of the collection. In the modem world, a wide range of information is disseminated through the printed word, yet it is impossible to have access to all forms of information and knowledge through wide reading alone. Other facilities and agencies thus exist that emphasize audio-visual learning. They include electronic media such as radio, television, cable satellite, the Internet. These media give wide publicity to events, objects, discoveries, scientific findings, new products, and new services [7]. In the 1990s, Internet connectivity began to proliferate in enterprise and consumer markets, but was still limited in its use because of the low performance of the network interconnects. In the 2000s Internet connectivity became the norm for many applications and today is expected as part of many enterprise, industrial and consumer products to provide access to information. However, these devices are still primarily things on the Internet that require more human interaction and monitoring through apps and interfaces. The true promise of the IoT is just starting to be realized – when invisible technology operates behind the scenes dynamically responding to how we want "things" to act [8]. As early as 1995, Louis Rosenfeld, founder of the clearinghouse for subject-oriented internet resource guide at the University of Michigan, edited a monographic series covering the area of health and science, humanities, social science, business, and law. There are also numerous wed sites devoted to the "best of the wed" in given subject area [9]. The term "Internet of Things" was popularized by the work of the Auto-ID Centre at the Massachusetts Institute of Technology (MIT), which in 1999 started to design and propagate a cross-company Radio frequency identification infrastructure. In 2002, its co-founder and former head Kevin Ashton was quoted in Forbes Magazine as saying, "We need an internet for things, a standardized way for computers to understand the real world" [10]. To date, the world has deployed about 5 billion "smart" connected things. Predictions say there will be 50 billion connected devices by 2020 and in our lifetime we will experience life with a trillion-node network which provides strong connection nodes [11].

3. CLOUD COMPUTING

Cloud Computing is nothing more than the collection of computing software and

services that can be accessed via the Internet rather than residing on a desktop or internal server. Cloud computing is independent of location network connectivity. The term cloud computing describes the software applications or other resources that exist online and are available to multiple users via the Internet, rather than being installed on a particular user's local computer. Cloud learning occurs on the basis of cloud technology as it supports the use of software in the cloud to learn by providing data, storage & software that can be accessed in an online environment". Traditional computing is completely different from cloud computing.

Libraries were loaded with various expenses. On the other hand, "with cloud computing there is little or nothing to finance". "Pay-as-you-go" & "Subscription" methods are two modes of payment in cloud computing. "91% of the organizations in US & Europe agree that the reduction of cost is a major reason for them to migrate to cloud environment" [12]. Therefore it is time for libraries think seriously before clubbing libraries services with cloud based technologies and provide reliable and rapid services to their users [13].

4. MAGIC MIRROR

Mirrors have more and more applications as technology advances. Magic mirror consisting of camera, sensor with Wi-Fi enabled provides interaction between people and computers. This technology can be applied to diverse information, such as location recognition, review of the contents, similar like material [14]. Also the information of the users review stored in the database [15]. This system will find their way into daily use very fast and advanced methods to provide intuitive user interfaces will be of high importance [16].

5. PRESSURE PAD SENSOR

Even though in the digital world, the traditional way of approach is still alive. The users come to the library by default [17]. Pressure pad sensor consisting of a thin sheet sensor pad enabled with Wi-Fi technology is connected to processing unit which records and controls the system. Frequent movement of the user in particular aisle is to be recorded so that the collection of books of recorded section can be increased to provide sufficient information. Pressure pad sensor can also be linked to energy system to minimize energy loss in academic library.

6. WIRELESS SENSOR NETWORK (WSN)

Recent technological advances in low power integrated circuits and wireless communications have made available efficient, low cost, low power miniature devices for use in remote sensing applications. The combination of these factors has improved the viability of utilizing a sensor network consisting of a large number of intelligent sensors, enabling the collection, processing, analysis and dissemination of valuable information, gathered in a variety of environments [18].

7. DESIGN AND IMPLEMENTATION

In our work we are planning to give patron a hassle free, user friendly atmosphere in academic library.

7.1 CLOUD COMPUTING

In figure 1 we can see, Cloud computing system that are divided it into two parts: the user part and the cloud part. They connect to each other through a network, usually the Internet through Wireless sensor network (WSN). The user part is the side the computer user. The cloud part is the "cloud" section of the system. On the cloud part there are various Computers, servers and data storage systems that create the "cloud" of computing services. Main characteristics of cloud computing are:

1. Self Healing, Multi-tenancy and Service-oriented.
2. SLA Driven: SLA driven such that when the system experiences peaks of load, it will automatically adjust itself so as to comply with the service-level agreements.
3. Virtualized: The cloud computing environment is a fully virtualized environment.
4. Flexible: They can be used to serve a large variety of workload types-varying from small loads of a small consumer application to very heavy loads of a commercial application

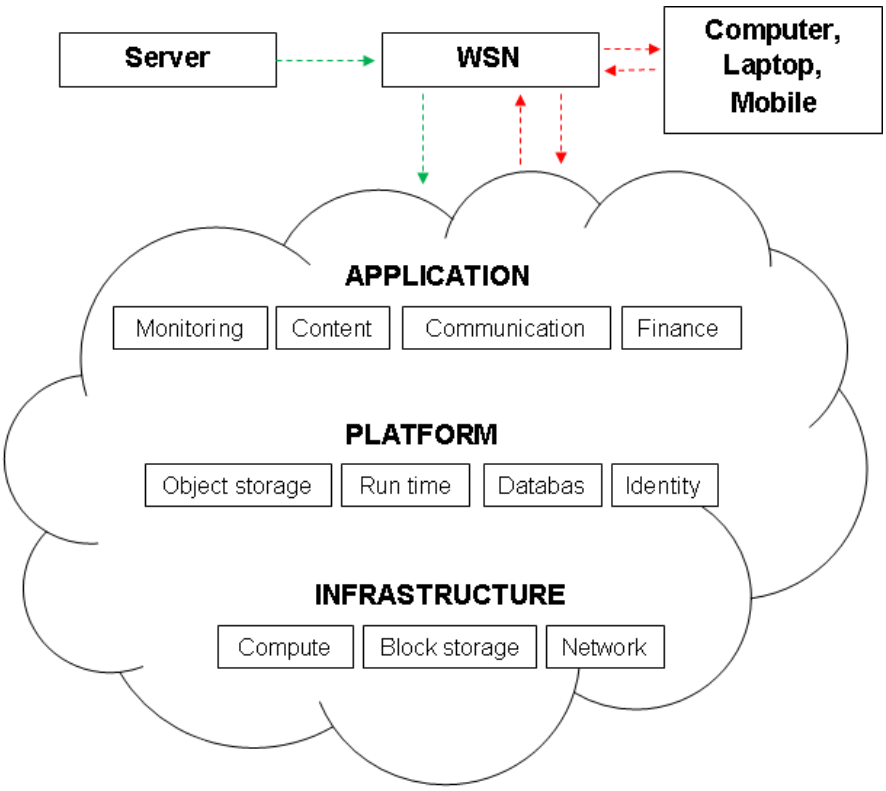

Figure 1

7.2 Magic Mirror

The system consists of a display device, camera are connected to server, processing unit through wireless sensor network as shown in the figure 2. Magic Mirror made up by a digital screen like a computer monitor, a sensory device like a webcam. The system will work in the following way: When a person holding a book enters the field of view of the camera, the camera will start capturing the image and the algorithm of the system will start tracking the information regarding the title of the books along with additional information like related books, reviews etc...And the result will be shown in the monitor. Figure 3 represent the implementation of magic mirrors in the academic library.

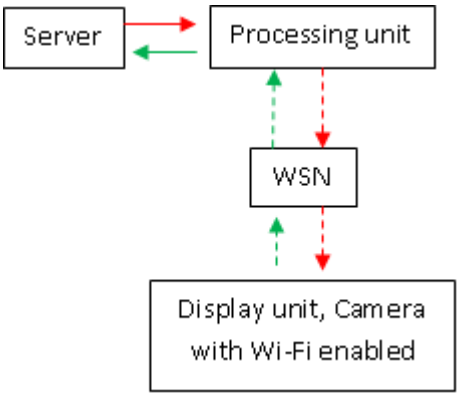

Figure 2

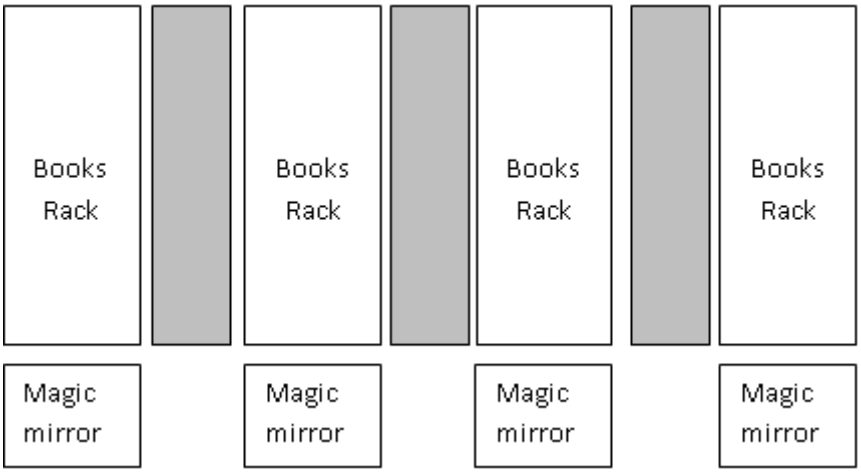

Figure 3

7.3 Pressure sensor pad

Figure 4 shows the block representation of pressure sensor pad system. A thin sheet of sensor pads are placed under the floor in the aisles. The sensors, in thin sheeted pads records the movement of the users through Wireless sensor network, recorded

information is monitored. As, we not only approaching towards digital library but also a smart academic library so, If no movement occurs the light bulbs, fans and energy related devices remains OFF, ensuring the saving of energy efficiently. Figure 5 shows the implementation of pressure sensor pads in the academic libraries.

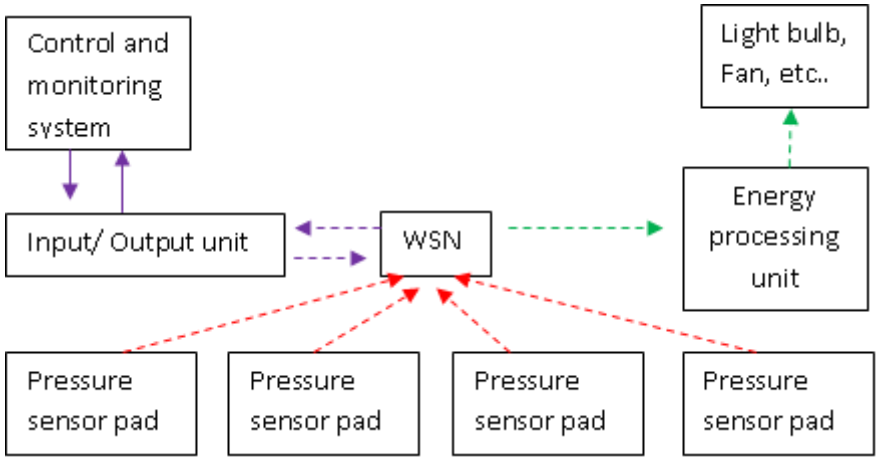

Figure 4

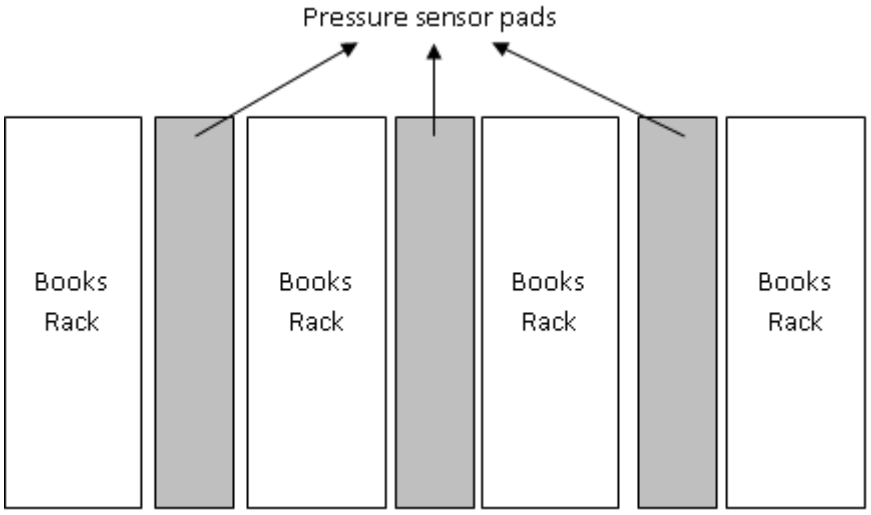

Figure 5

8. CONCLUSION

This study provides internet of things concepts in academic libraries in order to enhance their services in a more efficient manner. Internet of things is an ideal emerging technology to influence the patrons by providing new evolving and efficient services faster and more convenient.

The proposed technologies, cloud computing, Magic Mirror, Pressure sensor pads through wireless sensor networks can increase profitability by improving resources

utilization and development of management services in the academic libraries.
The proposed system is expected to enhance user convenience, and will be utilized effectively in the near future.

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