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**AWARENESS OF INTERNET OF THINGS AND ITS POTENTIAL IN ENHANCING
ACADEMIC LIBRARY SERVICE DELIVERY IN A DEVELOPING COUNTRY**

Abstract

The potential benefits of Internet of Things (IoT) to academic library service delivery have been identified as enormous. Through sensing devices such as radio frequency identification (RFID) devices, infrared sensors, global positioning systems, laser scanners and various other devices, objects are enabled to “think”, “feel” and “talk” thereby facilitating interconnection of all objects and humans, objects and objects leading to ease of communication, monitoring and control. It is however not certain if academic librarians in Nigeria would be able to explore these benefits due to their level of skills in relation to information and communication technology and availability of enabling infrastructure that could facilitate maximum use of new and emerging technologies that are consequential to Internet of Things. The broad objective of the paper was to ascertain the level of awareness of IoT among librarians as well as perceived benefits it holds for enhanced library service delivery in academic libraries in Nigeria. Future pathways for librarians in Nigeria were also discussed.

Introduction

There have been rapid developments in information and communication technologies (ICTs) in the 21st century. These developments have impacted on human endeavors, operations and services of industries and institutions including libraries (Aharony, 2014). Arguably, the advent of the internet is the most important and influential development in ICT. The internet now has a distinctive influence in various aspects of human life including relationships, interactions, manufacturing and services. Apart from providing a veritable platform for the effective and efficient promotion of workflow and services, the rapid growth of the internet globally lies in its ability to foster and shape human relationships and communication. In this regard, the advent of mobile devices and social media has made internet use a part of life for a good number of the world's population. The availability of broadband internet connection, more devices with Wi-Fi capabilities, affordability at lower cost and proliferation of smart phones have also contributed to the growth of the internet. For libraries, the internet now makes it possible for electronic packaging and virtual acquisition of information resources, online reference services, electronic cataloguing, as well as online dissemination of required information resources among others.

However, Pujar and Satyanarayana (2015) observed that in recent times 'the internet has taken a leap forward from "internet of communication" to "internet of things", making it possible to connect objects and transfer data with or without human intervention'. The 'internet of communication' promoted better communication and improved services, but with some form of human interventions. Herein lies the distinctiveness of the 'internet of things' – connecting objects using sensors and networking capabilities with very minimal or no human intervention. The concept first came into public sphere in the late 1990s and early 2000s (Wojcik, 2016). The idea promotes a convergence of a variety of objects including Radio-Frequency Identification (RFID) tags, sensors, actuators, networked devices and others, which through unique addressing systems are able to interact with one another to achieve common goals (Atzori et al, 2010). Wojcik (2016) considered the concept as a part of the so - called 'Future Internet' which is described as "a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual 'things' have identities, physical attributes, virtual personalities, use intelligent interfaces, and are seamlessly integrated into the information network"(Vermesan et al, 2011). The internet of things (IoT) has a great potential for improved and efficient services in industries and institutions

including libraries. Scientists and professionals believe that this new technology would definitely impact business and economic models, human experiences and everyday life.

Issues around the potentials of IoT for library operations and services have been raised in conferences and meetings (Obodovski, 2014). It has also become a subject of discussion among librarian associations (ALA, 2015). While studies on the awareness and potentials of IoT for library services have been carried out in some countries, it is difficult to find studies on this topic especially with regard to awareness among librarians in Nigeria. This forms the rationale for this study. It is hoped that the findings and discussions of this study will stimulate further and wider discussions on the subject in the country.

Objective of the study

The main objective of the study is to ascertain the level of awareness of IoT among librarians as well as perceived benefits it holds for enhanced library service delivery in academic libraries in Nigeria.

Literature Review

As with many concepts in ICT, there is no one definition for IoT; it means different things to different people. However, one major convergence of all descriptions of IoT is that it requires very minimal or no human intervention. Whatis (2015) describes it as “a scenario in which objects, animals or people are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-computer interaction; it is an evolvment of the convergence of wireless technologies, micro-electromechanical systems (MEMS) and the internet”. Pujar and Satyanarayana (2015) considers IoT as a system that enables any natural or man-made object to communicate with each other and transfer data using assigned internet protocol (IP) address with or without human intervention. Sharma (2015) observed that IoT requires a set of technologies to promote connectivity and interaction among objects. Each object requires a unique identification, sensors, internet and central server among others. Other authors posit that the basic set of technologies needed for IoT to happen include Radio Frequency Identification Device (RFID), wireless communication devices (such as Beacons), sensors, energy harvesting technologies, cloud computing and advanced internet protocol (IPv6) (Pujar and Satyanarayana, 2015).

According to Ashton (2009), IoT as an applicable concept in industries was first raised in early 2000s while working on a project that required linking RFID data to the internet. Consequently, the

International Telecommunication Union took note of the development of IoT in a report in 2005. The launch of Internet Protocol version 6 (IPV6) in 2012 further enhanced the potentials and possibilities of IoT. The growth rate of IoT has been very rapid as the number of objects connected to the internet keeps increasing annually. Greenough (2015) predicted that by 2019, IoT will be the largest devices market in the world. Current developments in industries tend towards a probable realization of Greenough's prediction. Numerous IoT applications are now available in various spheres of human endeavors – health sector, insurance, manufacturing, home appliances and others (Glova, Sabol and Vadjia, 2014). For example, it is now possible for medical personnel to remotely monitor the health status of their patients through smart devices attachable to human bodies.

Benefits of IoT to library service delivery

The applicability of IoT to libraries has become a subject of discussion among professionals. Libraries cannot afford to be left behind in the provision of improved services to patrons. Potter (2014) posited that though IoT is still in a stage of infancy, it holds a great potential for libraries. Pujar and Satyanarayana (2015) enumerated potential areas for implementation of IoT in libraries to include – improved access to the library and its resources, collection management, information literacy, recommendation service, location based service, appliances management and usage statistics. Wojcik (2016) opined that 'IoT has the potential to improve library services by providing users with tools that allow easy use of libraries, constant contextual help, and personalization processes'. Wojcik further noted that IoT can also be useful for sharing information, consultation and training, provision of access to spaces and equipment, gathering, description, storage, analysis and selection of collections, marketing and promotion. A survey carried out by OCLC (2015) indicated that practitioners opined that IoT is an emerging technology that can be used in such library operations as inventory control, access and authentication and monitoring of collection storage. There are very few known IoT applications in libraries currently. The first known initiative of IoT application in libraries is the BluuBeam application implemented by the Orlando Public library in the United States of America (USA). Sarmah (2015) explained that the BluuBeam application is based on the iBeacon technology. The application sends location-triggered information to mobile devices which helps users search for resources as well as expands their interests with contextual hints. Sarmah further describes the application as 'a virtual tap on the shoulder'. Swedberg (2014) noted that the BluuBeam technology is also used by about 30 other libraries in the USA. One of the libraries is using the technology to send user reminders about overdue

books and items available for pick up. Apart from the benefits and opportunities they offer, Wojcik (2016) observed that new technologies like IoT bring along with them some potential challenges. Questions often arise about privacy, data security, ethical and legal issues. Other challenges revolve around long term financial and technical sustainability of such projects.

Level of Awareness of IoT among librarians in Nigeria

A review of literature and developments in libraries have shown some levels of awareness of IoT among librarians in the United States and a few other countries (Swedberg, 2014; Wojcik, 2016); however, nothing in literature has provided any clue about the IoT awareness levels of librarians in Nigeria. Awareness is the first phase in technology acquisition and application. Generally, Nigeria like most developing countries, is far behind in terms of ICT application in industries, institutions and libraries. Ifijeh (2014) observed that in an era when libraries in developed countries are adopting more advanced technologies in their operations and service delivery, Nigerian libraries are still battling with automation and internet access. Adeleke and Habila (2012) in their study on internet awareness and usage in Nigeria reported a very low level awareness of internet facilities and services among Nigerian librarians; they concluded that internet application to library services is still at its formative stage in the country. Akpan-Atata (2014) attributed librarians' low level awareness and adoption of ICT to a diverse mix of technological (lack of facilities, computer and internet phobia, and digital illiteracy) and sociological (time, funding and human attributes) factors.

However, the idea of IoT has been discussed as a probable future solution to city housing and high population challenges in Nigeria. Kolade (2016) opined that IoT technology can be adopted to build smart cities that will improve services and quality of life for their inhabitants. It is hoped that librarians and libraries in Nigeria would dare to dream the adoption of IoT in the nearest future.

Future Pathways for Librarians in Nigeria

Even though literature has established low level of ICT adoption and awareness of IoT among librarians in Nigeria (Adeleke & Habila, 2012; Ifijeh, 2014; Akpan-Atata, 2014), the onus rests on librarians in Nigeria to devise means of equipping themselves with relevant knowledge in order to maximize the use of ICT for effective and efficient library service delivery in an ever changing information environment. This can be achieved through the following:

Regular conference/workshop attendance

One of the platforms for the refinement of professionals and academics are workshops and conferences. According to the International Congress and Convention Association (ICCA), a conference is seen as a “participatory meeting designed for discussion, fact-finding, problem solving and consultation” (ICCA, 2014). Best practices, innovations and general discussions in specific disciplines are usually focused at conferences and workshops. Although there are some dissimilarities between conferences and workshops, the major points of this study is to harness the benefits of the two for professional development for librarians. Idiegbeyan-Ose, Ohaegbulam & Osayande (2014) found that several benefits are embedded in attendance of conferences by librarians and emphasized that conference attendance is compulsory for professional relevance in the information age. Some of the benefits itemized as revealed in their study include networking, new skills acquisition and development of presentation skills amongst others.

There are emerging technologies in the field of librarianship which may not be circulated on time except they are made known through presentations at conferences and workshops. If librarians will make it a point of duty to ensure they attend conferences related to their field to acquire more knowledge and be abreast of best practices, it will be easier for them to maintain future dominance in the field of information resources management. Librarians will no longer be termed as reactive learners of technology but proactive learners. Internet of Things has come to stay, however, its adoption for library services may be delayed if librarians do not brace up to invest into conference and workshop attendance.

Commitment to personal development

The onus lies on librarians to shift focus from depending solely on organizations for personal development. Discretionary effort requires that individuals take responsibility for self-development to forestall human resources depreciation. Anyangwe (2012) noted that redundancy may set in if librarians do not advance in knowledge through training and retraining as jobs are being redesigned due to new approaches being discovered for improvement of services to library clientele. There had been fears that technology will take jobs, rather the truth is that technology creates more jobs, however acquisition of relevant skills remains sacrosanct.

Conclusion

The potentials of Internet of Things as it relates to library services cannot be underestimated. Based on review of literature, librarians in Nigeria need to take conscious steps at ensuring understanding of the concept and application of 'Internet of Things' to effective library service delivery. This will enhance maximization of the embedded benefits. Users will obviously gravitate towards smart libraries when they experience quality service resulting from technology adoption.

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