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Technology Driven Challenges Information Professionals and Academic Librarians Face: Internet of Things (IoT) as a Solution

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Abstract

Technological advancements continue to inspire librarians to transform the services they provide in order to stay relevant in the digital age. Contemporary libraries strive to deliver services to all community members because literacy is open to all members of society. In the past, literacy has been restricted to those members of society who could afford an education. Modernly, great strides continue to be made in order to provide access to books and to teach reading skills and language skills. The modern library is at the center of these changes. The library serves its community using tools to help community members with job searches and to stay current on industry trends by reading books and magazines. Resources continue to be limited as budgets continue to shrink across the nation at public and private universities. Small and large towns also face fiscal issues that impact community libraries. Academic library and other information science professionals' ability to deliver service has been impacted by changes in technology called the Internet of Things (hereinafter, IoT). Academic library professionals share a common goal to adopt IoT technologies including internet, sensors, and RFID to innovate services. It is worth examining what the implementation of IoT is polled to be now, what initiatives and programs are offered and what success they have shown.

Keywords

IoT, Magic Mirror, IoT Use, IoT Benefits, Radio Frequency Identification Technology

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1. Introduction

The purpose of this review of the literature is to determine if IoT ameliorates challenges academic library professionals face where the adoption and use of technology is concerned. This article provides a literature review to understand what IoT is, what is being done to implement it, and how academic library professionals may use IoT initiatives to deliver reference library services to off-campus constituents.

1.1. Research Aspect

Most research specifically related to IoT within the library context is relatively new. Most of the articles are published in scholarly journals namely: *Journal of Advancements in Library Science,* and the *International Journal of Information Technology and Library Science.* Interestingly, the most surprising place to find information is the *International Journal of Scientific Research in Computer Science, Engineering, and Information Technology* which feature articles about mechanical engineering. The impetus for IoT research connected to libraries appears to take the form of international conferences rather than a series of studies mapping librarian's impressions of IoT.

In fact, according to Bansal, Arora, and Suri [1], (IoT) is the network that links devices and the research plan is to exchange data facilitating communications between

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mechanical objects. The researchers' key strength is they track the emergence of IoT and delivery tools that are used by librarians. In this manner, the researchers address the problem that this technology is still emerging and has not been widely adopted. The research goal is to understand how librarians will increasingly use embedded identifier technology to track circulation for the purpose of inventory control.

The study provides an outline of IoT's technical components from the librarian's perspective. The authors skillfully explain all technical language as they describe object identification to be of primary importance since it allows for theft management and real time tracking of library holdings. The main weakness is the descriptive research method is used with no quantitative data profiled. This research is important to my project because it directly relates to how librarians utilize IoT to increase efficiency.

1.2. Radio Frequency Identification (RFID)

Ultimately, as the proliferation and dissemination of IoT continues, it will lead to the increase in smart libraries nationwide. The goal is to demonstrate how smart libraries fully integrate and use smart technologies that are linked with radio frequency technology (RFID). Here, the scholars use a historical analysis research method to advise that this technology uses responders and began in 1952. For Tarique et al., the decision to use RFID applications depends on cost but it can be easily integrated into library systems using barcodes. The researchers explain the architecture of IoT using wireless sensor networks (WSN) in easy to understand terms [2]. The article uses a descriptive or qualitative research method as it explains in detail the challenges that libraries face by not using an automated library management system. The researchers' strength is the discussion of RFID tags and readers as a solution to the lack of efficiency that many libraries face.

Most libraries are trying to reduce operating costs in the wake of shrinking budgets. RFID involves converting to a smart library to protect highly-skilled Reference Librarian jobs. Libraries could save money on facility operating costs by controlling temperature using motion detection. In this high-tech environment, RFID eliminates the need for assistants to check-out books, for example. The self-checkout process for the patron user is accomplished using RFID tags and scanners. More books could be digitized and stored electronically to free up physical space. Physical spaces can be re-allocated to accommodate larger chairs and more study space for groups. The work is important to my topic because it provides information about RFID that uses IoT to efficiently control all electronics.

1.2.1. Smart Libraries

The Reference Librarian's job continues to change to incorporate technology. The research goal is to show that the average librarian faces pressure to learn computer languages and applications since information is becoming digitized. Kaladhar and Rao refer to this as IoT which they define as a form of artificial intelligence used for library housekeeping. The researchers highlight the history and background of IoT and assert that IoT libraries are the future [3]. A qualitative research method is used as the authors explore the history of the internet. One important idea that they mention is library patrons are ready to use mobile apps and cloud computing to access collections from remote locations. This article is relevant to my work since it mentions how librarians will have to be skilled in RFID, cloud computing, and analyzing and classifying content so it can be retrieved digitally.

1.2.2. Magic Mirror

Another study by Nag and Nikam describes a new era called IoT which strives to deliver security solutions for academic libraries. Using a qualitative approach, the authors describe what a smart library looks like and the research goal is to urge librarians to prepare for the future [4]. The strongest aspect of the article is the discussion of magic mirror. Magic mirror is a computer application that is added throughout a library to sense what book a patron is holding and recommend suggestions for further reading. For me, this article demonstrates how technology is used to improve services by increasing utilization of library holdings.

1.2.3. Communication Intelligence

Researchers move forward with a few main goals in mind. The main research goal is to show that advanced internet communication is part of IoT personalized service leading to a more intelligent communication system [5]. Here, the researchers employ a qualitative research method to describe the unquantifiable elements which are part of communication. The scholar dubs it intelligent custom services for patrons using information resources sharing technology. The qualitative research method is used to describe a networking library that combines self-service with customer service on-demand. This article relates to my research because it describes the ways to balance using IoT with other types of customer service.

1.2.4. Scientific Information Exchange

According to Najafi, Asemi, Sohrabi, & Shabani, this source uses an exploratory approach as scholars focus on library users in Delphi. The purpose of the research is to describe how libraries can be more efficient through automated services without sacrificing data security [6]. The scholars use quantitative methods to develop their own scientific

model using data modeling methods. The discussion on data protection is strong and shows that there are two levels available for user and server. This research relates to my project since it provides readers with a proposal to use to begin automated library services.

2. Paradigm

Researchers strive to follow a paradigm or world view that emerges from a specific discipline. This research relates to the intersection between library science and information science. In the study, the goal of this research is to demonstrate how the internet continues to expand and intrude into our lives because of sensors. Using a qualitative research method, the scholars describe and infer that this phenomenon is a new paradigm which impacts libraries [7]. Librarians experience problems when items are misplaced and cannot be loaned out and sensors solve the problem. The physical library becomes virtual and patrons are given a virtual library card using an app to find sources. The strongest section of the research involves the discussion about privacy which is handled through increased training. The article helps me to promote IoT's potential for libraries while gaining expert insight into IoT's impact on how libraries connect with patrons.

2.1. Privacy Vulnerabilities

This study focuses on communication devices that interconnect everyone as IoT renders people vulnerable to privacy invasions [8]. The research purpose is to prevent others from giving in to fear regarding privacy concerns that prevent progress using IoT. The strongest aspect of the study involves how libraries could use patron data to provide patrons with suggestions for further reading. The tracking aspect of IoT may not be welcomed by all patrons. Further, Massis advises the IT community can address security issues but there must first be security awareness. A descriptive research method provides details about what Massis terms as proper security management in libraries. The article is relevant to my work because it raises awareness about security. Massis suggests the proper infrastructure for linking the systems the library is currently which allows patrons to safely link their mobile devices.

2.2. Digital Era

Here, library patrons want quick access to information and this is called the digital era [9]. The use of mobile technology impacts library services and helps librarians with outreach efforts. The problem is patrons may find information on the web without going to the library and outreach efforts are necessary. The purpose of this research is to raise awareness about how mobile applications are used for outreach to the surrounding community. According to Singh and Nikandia, library professionals have to be creative using mobile technology to meet a modern patron's needs. A qualitative research method is used to describe ways mobile technology is utilized as a database search tool. This article relates to my topic because text navigation and other mobile pathways are forms of IoT.

2.2.1. Infrastructure as a Service (IaaS)/Platform as a Service (PaaS)/Software as a Service (SaaS)

In Wada, there is concern among library professionals about how to entice patrons back into the library [10]. According to Wada, the research problem is the web provides access to information as libraries face crippling budget constraints. The Library Without Walls (LWW) along with Library 2.0 are designed to counteract these problems promoting interaction between librarian and patron user. Wada's research goal is to raise awareness about the benefits of cloud computing which include Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS), which are remote driven technologies. Wada employs a qualitative research method to describe the intricate benefits of cloud computing. This research is relevant to my project because it explores how libraries save energy, reduce maintenance costs, and provide patrons with varied information resources.

2.2.2. Information and Communication Technology (ICTs)

The library is not the only place that faces disruption because of internet applications. Leu, Kinzer, Coiro, Castek, and Henry advise that the nature of literacy is changing due to the internet [11]. The research goal is raise awareness about information and communication technologies (ICTs) shaped by social contexts impact the form and function of literate practices. The scholars employ a qualitative research method describing theory and application. The article's strength is that it suggests proficiency with internet technologies will be required for all professionals. This research is important to my work because it documents the internet's disruptions to our personal and professional lives.

2.2.3. Ground Theory Methodology (GTM)

Researchers seek guidance as they attempt to develop a model or theory. Wiesche, Jurisch, Yetton, & Kromar advise grounded theory methodology (GTM) is increasingly being used in information systems research [12]. The goal of the research is to raise awareness about GTM because it allows for even greater inductive theory. These scholars argue the problem is GTM has not been used to its full potential in Information Systems (IS) research. This research is useful for me because GTM is a framework for developing theory.

2.2.4. Grounded Theory Approach

Scholars may utilize a grounded theory approach as an effective research tool. Here, Shehata, Ellis, and Foster investigate scholars' attitudes regarding self-publishing within the digital age [13]. This qualitative study involves forty participants from four universities to determine if scholars are less interested in self-publishing forums. This study relates to my project about disruption s to librarians and the grounded theory approach is used to track how the internet disrupts traditional publishers

2.2.5. Mixed-design Grounded Theory Studies

The research goal is to raise awareness about new developments regarding the use of grounded theory in Information Systems (IS) studies [14]. According to Walsh, it is important to leverage qualitative and quantitative data to enhance research findings and avoid a paradigm war. The problem is that grounded theory continues to be applied in restrictive ways in prior IS studies. This research is relevant to my project since it is addresses types of research designs.

2.2.6. Use of Grounded Theory to Identifying User Experience

It is vital to understand a user's experiences so that improvements can be addressed as needed. Grounded theory is a flexible method to observe the user's experience while using search engines to locate needed information [15]. The researchers studied multilingual patterns within an image retrieval system in order to gain insight about a user's experience while conducting research. This research is useful for my project since my topic relates to improvements for patron users using technology.

3. Conclusion

The research shows that embracing IoT leads to smart building technology and some libraries received grants to build new structures that integrate or retrofit their buildings. IoT allows administrators to adjust the temperature or the lights using an app. The research demonstrates that the building can also be monitoring using security systems controlled by a mobile app. We explored how RFID technology sensors are placed in books. The research demonstrates that open-hardware based sensors reflect building utilization and this helps to control costs. The technology helps library administrators make strategic decisions that enhance patron services. Technology continues to be embraced by library administrators and IoT technology classes are also offered to patrons who seek information on the use of technology.

The future of IoT and its use in public and private libraries will continue to expand as more librarians become aware of IoT and its application. It is expected that there should be an indicator of some success to meet goals. There is an expected increase in the student patron user's evaluation of the library services from previous years. The expected increase should be large enough to reflect how IoT can increase efficiency in the delivery of reference services to off-campus constituents.

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