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Smart E-library Management System Based on User Behaviour in Ibrahim Babangida Library, Modibbo Adama University Yola, Nigeria

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ABSTRACT

This study is designed to explore user behaviour and overall user's usage behaviour based on use of electronic information resources. The purpose of the study is to evaluate and develop user friendly smart e-library management system and to ascertain the extent to which users will increase their use of smart e-library management system based on usage of e-resources by user per time. Rapid Application Development methodology and Matomo data analytics was used to present results in graphical charts and curves. The results obtained as overall users' behaviour analytic shows that the whole registered users behaviour accessed the e-resources and used the smart e-library Management System to their satisfaction. After examining the characteristics of the existing systems and their bottleneck. It was established that such system need improvement in the future especially in the area of data processing. It was recommended that management of Modibbo Adama University Yola in future research should include and expand the existing framework to enable it evaluate data, it was also recommended that Microsoft silver light software be used in the next upgrade because of its improved functionalities and flexibility and finally, it was strongly recommended that oracle should be used in the next upgrade so as to improve data security.

Keywords: Smart E-Library, Management System, E-library, User behaviour, Intellectual framework, E-resources, Modibbo Adama University, Library.

Introduction

Library is an indispensable source of information as they will have at their command a vast array of private, college, university, national, public, school, and special libraries (Chu & Duan, 2018). The reduction of costly ignorance by libraries is achieved through the assistance they provide in formal and informal education and direct assistance they give to scholars and scientists in the extension of the frontiers of knowledge. In the past decades, access to information was usually in the library room, and as technology advances, access is now made online. In recent times, the library has undergone many advancements from the traditional library to the modern library, where contents are in digital form (Edem & Egbe, 2018; Igbo & Imo, 2017). Library has been a home of knowledge for decades; policies have been formulated many times due to increased volume of physical books and Journals that occupy space even when these are moved to the archives. Knowledge is sometimes kept away in the name of archives. Storage of these books is often done in bad shape (Agyekum & Ossom, 2015). The library is capital intensive, and much fund is needed to preserve it. Both Students and staff often mishandle physical books and journals; sometimes others result in mutilation and book lost. Indeed, without information, there cannot be communication. The emergence of technology has led to the proliferation of electronically available information resources. These e-resources includes CD ROMs, databases, electronic mails, Online Public Access (OPAC), and internet browsing (Agyekum & Ossom, 2015). The Internet, which is prominent in this source, has made possible access to electronic books and journals in various databases and search engines.

In this age of globalization, the importance of Information and Communication Technology (ICT) in an academic environment cannot be overemphasized because ICT facilitate quick access to information resources worldwide, through the Internet and other devices. It is now difficult to imagine the world without information technology.

In this digital age, tertiary institutions strive to keep up to date in their curriculum and e-resources. The provision and use of e-resources is part and parcel of the entire system, the student, faculty, and the institution. It is one thing to recognize the importance of e-resources and know if students effectively utilize them. If e-resources are put to effective use, the essence of acquiring them is, to a large extent, justified vice-versa (Dolo-Ndlwana, 2013). Therefore, these e-resources acquired must be managed to achieve the goals and objectives of the research.

E-library management system is an application which refers to library systems which are generally small or medium in size. Librarian uses it to manage the library and it resources using a computerized system, videos and page sources. Books and student maintenance modules are also included in this system the system also keep track of the students using the library and a detailed description of the e-resources. There will be no booking record or member record loss with this computerized system, which generally happens when a non-computerized system is used.

Similarly, Loerke, Wyatt and McGuire (2018) noted the advantage of electronic resources overprinted which includes speed, ease of use and ability to access the document from outside the library. According to Dadzie (2005), electronic resources are invaluable research tools that complement traditional libraries' printed ones. These advantages include access to information restricted to the user due to the geographical location, finances, and extensive links to additional resources or related content. However, knowledge of computers and retrieval techniques is needed to effectively search these resources, which has a bearing attitude towards e-resources (Wang, 2017; Joshua 2014, 2-4).

Ajayi, Shorunke and Aboyade (2014) noted that e-resources are mainly made accessible for educational purposes. Students and academics who have security access codes can use some of the services in closed access mode because the university has paid for the subscription and are made available to them. The authors further noted that factors that impede the successful use of e-resources in higher institutions of learning in Nigeria include, lack of strategic planning, competent workforce, Internet connectivity, inconsistent preparation, insufficient support, inadequate computers, and unreliable electricity supply. Librarians are also encouraged to collaborate with electronic resource providers and publishers to reduce the complexities of licensing agreements to provide available e-resources for the overall development of libraries and meet the needs of end-users and National policies on acquisition and distribution of e-resources for academic usage in higher Institutions of learning. Particularly academic libraries.

Objectives of the Study

The main objective of the research is to develop a conceptual framework for smart e-library management system based on user behaviour, specifically the study is to:

i. Evaluate and develop user friendly smart e-library management system in I.B.

Library

ii. Ascertain the extent to which users will increase their use of smart e-library management system in I.B. Library.

Scope

The smart library system is a broad concept that can focus on security, access, management, services and ease of access via the browser-based platform. This study is confined to the use of the server and web-based application in Ibrahim Babangida Library, Modibbo Adama University Yola. The present work is limited to provide user access to the e-resources to various subjects in different formats to meet the user's needs.

Statement of the Problem

Despite the increasing use of smart library services, there is a scarcity of framework of the smart library system that provides analytical decision based on the user's behaviour on e-resources utilization and providing an understanding of how user's usage of the e-resources can enhance and support strategic planning for the development of smart library system to meet the needs of users in remote and isolated learners in the face of a global pandemic base on the usage behaviour. There is also inadequate use of library management system to take statistics of e-resources usage by the users. This could be attributed to lack of seriousness by the university management. It's against this background the researchers developed smart e-library management system.

Literature Review

The electronic resources have pose human, social and technology problems, such as discomfort in reading on the screen, problems in internet access and speed, poor infrastructure, lack of sufficient skill to use the electronic resources and exceptional change resulting from right to use rather than physical possession (Igbo & Imo, 2017; Macondo Sithole & Chasity, 2017) from a survey conducted by Okafor (Dresselhaus, 2012; Srujana, Murthy, TanveerAlam, Sunitha & Thimmaiah, 2013) on the topic "can e-book replaced paperwork" the study reveals that e-books require power, e-reader, to a computer or laptop, electricity remains a serious problem not to mention internet access to download them. Unlike print, electronic documents are not immediately readable by the naked human eye. The ability to access them is dependent on equipment and technology. Both of which become important considerations when

examining the acquisition of information stored in electronic form (Quadri, Adetimirin & Idowu, 2014; Chimah & Udo, 2015; Edem & Egbe, 2018, Joshua & King 2020).

To utilize the growing range of electronic information sources, users must acquire and practice the skills necessary to exploit them. Ben-Daya, Hassini and Bahroun (2019) suggests that the skills required to maximize electronic information sources' potential are much greater than those required for searching printed sources. These skills include knowledge of the structure of databases and the instruction that must be input into the computer by the searcher and how the instructions are linked with one another to this end. Tanuja, Tanushree, Vindhya and Gopinath (2018) state that users do not often appreciate the skills required to search these sources stating they are deceptively easy to use. The ability to find and retrieve information effectively is a transferable skill useful for future life which has enabled the positive and successful use of electronic information sources. Tanuja, Tanushree, Vindhya & Gopinath (2018) argue that libraries must reach a position where acquiring information skills is acknowledged as one of the key learning objectives for every student entering university who have been fully equipped to cope with the information-intensive world. Vaidya, Kulthe, Khaire, and Kela (2017) noted that digital libraries, e-journal platforms, portals, e-prints and web-based information systems provide services supporting users with intense work tasks that require complex interaction activities. This concept implies that library users cannot access e-resources without adequate computer skills. These skills and e-resources can be hosted on a server-based database.

User behaviour

Behaviour as defined by the Regional Training Seminar on Guidance and Counselling Module 4 Behaviour Modification, UNESCO (2000) could be seen as the way in which an individual behaves or acts. It is the way an individual conducts herself/himself. It could be seen in reference to social norms, or the way in which one treats others or handles objects. Behaviour, therefore, is the manner at which an individual acts towards another, society or objects. It can be either bad or good. It can be normal or abnormal according to social norms. As noted by Bandura (2006), most behaviour is learned by observing others. One forms a concept of how new behaviours are performed, and on later occasions, this coded information is a guide for action, it is a continuous reciprocal interaction between psychological and environmental (social) influences. People behave differently by learning observationally, or consciously when they seek for electronic information resources, especially when they are

working on a specific task. User behaviour may, therefore, be seen as how people use and interact with information resources rather than simply accommodating existing needs. In a behaviour change context, postgraduates could be seen as thoughtful people who think about what they are doing, and why, analytically they are able to set and modify their own goals and are open to central route persuasion through reasoned arguments about why some behaviours are better than others, perhaps motivating them to change their attitude about a subject as a precursor to changing their behaviour heedfully. These are users who can learn from their mistakes and change their behaviour accordingly (Lockton, Harrison & Stanton, 2012).

Cheung, Chan and Limayem (2005) argued that the factors that influence user behaviour are individual characteristics, structural, degree of knowledge, ease of usage as well as factors concerning the characteristics of web pages and the speed of the network. Users of electronic information resources are exposed to various heterogeneous factors represented not only by exogenous variables but also endogenous ones. Therefore, in order to succeed in any venture, and especially in today's dynamic and rapidly evolving information explosion, Librarians, as professionals need to know everything they can about users - what they want, what they think, how they work, how they spend their leisure time. They need to understand personal and group influences that affect users' decisions and how these decisions are made. In the virtual space, users' choices are largely influenced by the virtual groups they are part of and their trust in the online environment (Cetina, Munthin & Radulescu, 2012). User behaviour is the means for systematic examination of the characteristics and behaviour of users linked with the effectiveness (performance) of library and information services provided as they aimed at the satisfaction of user needs. Therefore, these factors include psychological, social and cultural influences.

Stelmaszewska, Wong, Bhimani and Barn (2010) proposed a study on user behaviour: searching for scholarly materials using electronic resources discovery systems and focused on the differences between behaviour displayed by their study group and those presented in previous work on information seeking. Their results showed that, people use personal or social networks at the initial stage of information seeking in order to understand the concept to find information and develop the keywords. It further revealed that participants rarely apply only one search (e.g., simple search) but that their strategy changed during information seeking process in relation to the results obtained, users perform another search, refined or reformulate search, abandon a search or resource or they change resource. Most users tended to carry out combined searches.

Lockton, Harrison and Stanton's (2012) study on models of the users: designers' perspective on influencing sustainable behaviour. They made use of a wide variety of techniques and methods. It revealed simple models of user behaviour emerging from statements by designers taking part in a workshop on influencing behaviour through design.

Gradinaru (2006) surveyed searching behaviour in the digital age at the University of Lasi (Romana) and observed that users are searching for information horizontally and do not use a deep and vertical strategy and do not return to the same website or journal, rather bounce and search a panoramic (wide) view, and stated categorically that users navigate through the overwhelming quantity of information for picking up some small piece, the full-text download is perceived as an indicator of users' satisfaction. These may be as a result of their behaviour and efficacy level towards the use of electronic information resources. There are varying elements that are vulnerable to the use of electronic information resources by postgraduates in universities, some of which are user behaviour and self-efficacy. User behaviour refers to the process users go through in search of information and the reactions they have towards electronic information resources retrieved. According to Szwacka-Mokrzycka (2015), users recognize needs or wants and go through a process to satisfy these needs which include the type of information resources, amount spent, frequency of use and what influences them to make such decision. It examines how emotions, attitude and preferences affect the behaviour of users. Therefore, during information search and evaluation stages, users work through processes designed to arrive at a number of information resources that represent viable use alternatives. Hence, Dowhan (2013) asserted that behaviour is the range of actions and mannerism made by an individual in conjunction with themselves or their environment and that student with more complex or advance studies have a greater capacity to learn new responses and thus adjust their behaviour. In a study on Information security culture: behaviour compliance conceptual framework by Nelson, Alfawaz and Mohannak (2010), user behaviour holds the key to successful use of electronic information resources. The successful use of electronic information resources depends on user behaviour which is determined by his/her intention to perform such behaviour which is in turn influenced by the individual's attitude towards performing that behaviour. The problem of user behaviour towards the use of electronic information resources could be aligned with Majid and Kassim's (2000) findings which according to them, it seems as low level of self-efficacy may have impact on the use of electronic information resources, using a computer is a challenge to most students in developing countries like Nigeria, northern part in particular. Therefore, the use of electronic

information resources and their behaviour depends on their self-efficacy level, their domain knowledge and understanding of the task they were given.

According to Ozeer, Sungkur, and Nagowah, (2019) new information technologies and particularly the internet, is drastically transforming access to information and changing the learning and research process, how we search, discover, teach and learn. Adeleke and Nwalo (2017) noted that the most prominent ICT today is the Internet. It provides the largest reservoir of vital information in all kind of discipline all over the world. Hence, its universal acceptability in the world of research is synonymous with university education. Eisenhauer (2019), writing on the benefit of the Internet submits that, student offering corresponding courses all over Africa benefit from the use of e-mail and World Wide Web to advice and read material from their tutors. Other studies such as Adeleke and Nwalo (2017), Vaidya, Kulthe, Khaire, and Khale (2017) have also identified the use of electronic information resources for postgraduate students. Access to electronic information resources should be available and affordable to all, regardless of economic status and information literacy. Higher education is changing rapidly with the advent of technology.

Previous studies such as Ben-Daya, Hassini and Bahroun, (2019) and Tanuja, Tanushree, Vindhya and Gopinath (2018) argued that there are several obstructions to the use of electronic information resources such as lack of infrastructure, lack of skills are among the primary reasons for their underutilization, lack of knowledge about the resources, lack of publicity, insufficient time to use online resources and services were other reasons that contributed to the low usage. Electronic information resources usage depends on various factors such as information searching skills, training awareness; information retrieval skills of users are acquired in various ways. Academic environment, improved liaison between academic staff and library is likely to increase their knowledge of library resources, leading to high increase usage of electronic information resources (Tanuja, Tanushree, Vindhya & Gopinath, 2018).

Several studies have investigated the behavior of users towards electronic resources. Yang, He, Huang, Ororbia, Zhou, Kifer and Giles (2017), carried out a study on students' attitude towards electronic resources. The study reveals that many students leave university without the necessary skills to cope with information-based societies. Electronic information resources offer today's student new opportunities that were not available to the previous generalization. Agyekum and Ossom (2015) argue that while reading an e-journal is not the

same as reading a printed issue, many students now acknowledge that electronic document offers users advanced features and novel forms. Zack, McKeen and Singh (2009), argue that ICT has brought tremendous change in nature, boundaries and structure of information. It is generally agreed that many factors do influence attitudes.

User attitude towards Electronic Information Resources

Several studies have investigated the behavior of users towards electronic resources. Yang, He, Huang, Ororbia, Zhou, Kifer and Giles (2017), carried out a study on students' attitude towards electronic resources. The study reveals that many students leave university without the necessary skills to cope with information-based societies. Electronic information resources offer today's student new opportunities that were not available to the previous generalization. Agyekum and Ossom (2015) argue that while reading an e-journal is not the same as reading a printed issue, many students now acknowledge that electronic document offers users advanced features and novel forms. Zack, McKeen and Singh (2009), argue that ICT has brought tremendous change in nature, boundaries and structure of information. It is generally agreed that many factors do influence attitudes. Students' argument for using electronic information sources is compelling because adequate knowledge of computer and retrieval techniques is desirable to search these resources effectively. It is necessary to establish what computer skills student require to access electronic information sources in libraries.

Ozeer, Sungkur and Nagowah (2019) investigated that, the graduate's usage of e-resources and found out that students usually depend on library staff's help the desire information. The evolution of e-document has just begun, as is most evident for the struggling of e-book reader. Studies have shown in the previous study that technology has not replicated book reading ease (Aithal, 2016).

Accordingly, Agyekum and Ossom (2015) developed a user interface for accessing the catalogue for checking available resources. This request is passed to the system management tool, which finds the correct resources, and then calls the available services that retrieve the cloud resources. The search capability gives digital materials a huge advantage when a digital version is available. The smart library is different from the traditional library, with certain characteristics. It has an extensive and precise search system with large volumes of text, images, and sound resources. There is no need for physical space for collecting online libraries, and you can do it from anywhere (Chu, J. L., & Duan, M. Z. 2018).

Methodology

In the course of this research, Rapid Application Development (RAD) methodology was used. RAD refers to a development life cycle designed to give much faster development and higher quality systems than the traditional life cycle. The key objectives of RAD are: High Speed, High Quality and Low Cost. RAD is a people-centered and incremental development approach. Active user involvement, as well as collaboration and co-operation between all stakeholders are imperative. Testing is integrated throughout the development life cycle so that the system is tested and reviewed by both developers and users incrementally. RAD drastically raises the quality of finished systems while reducing the time it takes to build them." Online Knowledge 2000 defines Rapid Application Development as "a methodology that enables organizations to develop strategically important systems faster while reducing development costs and maintaining quality. This is achieved by using a series of proven application development techniques, within a well-defined methodology." In short, Rapid Application Development is exactly that. It is a process through which the development cycle of an application is expedited. Rapid Application Development thus enables quality products to be developed faster, saving valuable resources. While existing system allow access, in and out of resources for its client, the new model does it all, it has a dashboard, a profile of its users and administrators and produce analytics based on the user usage behaviour and the overall users' usage of e-Resources behaviour.

Algorithm for data analytics of smart e-library management system

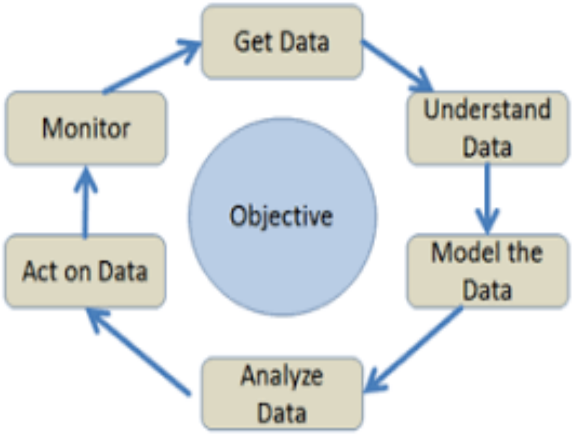


Figure 1: Algorithm. Source: Moses 2022

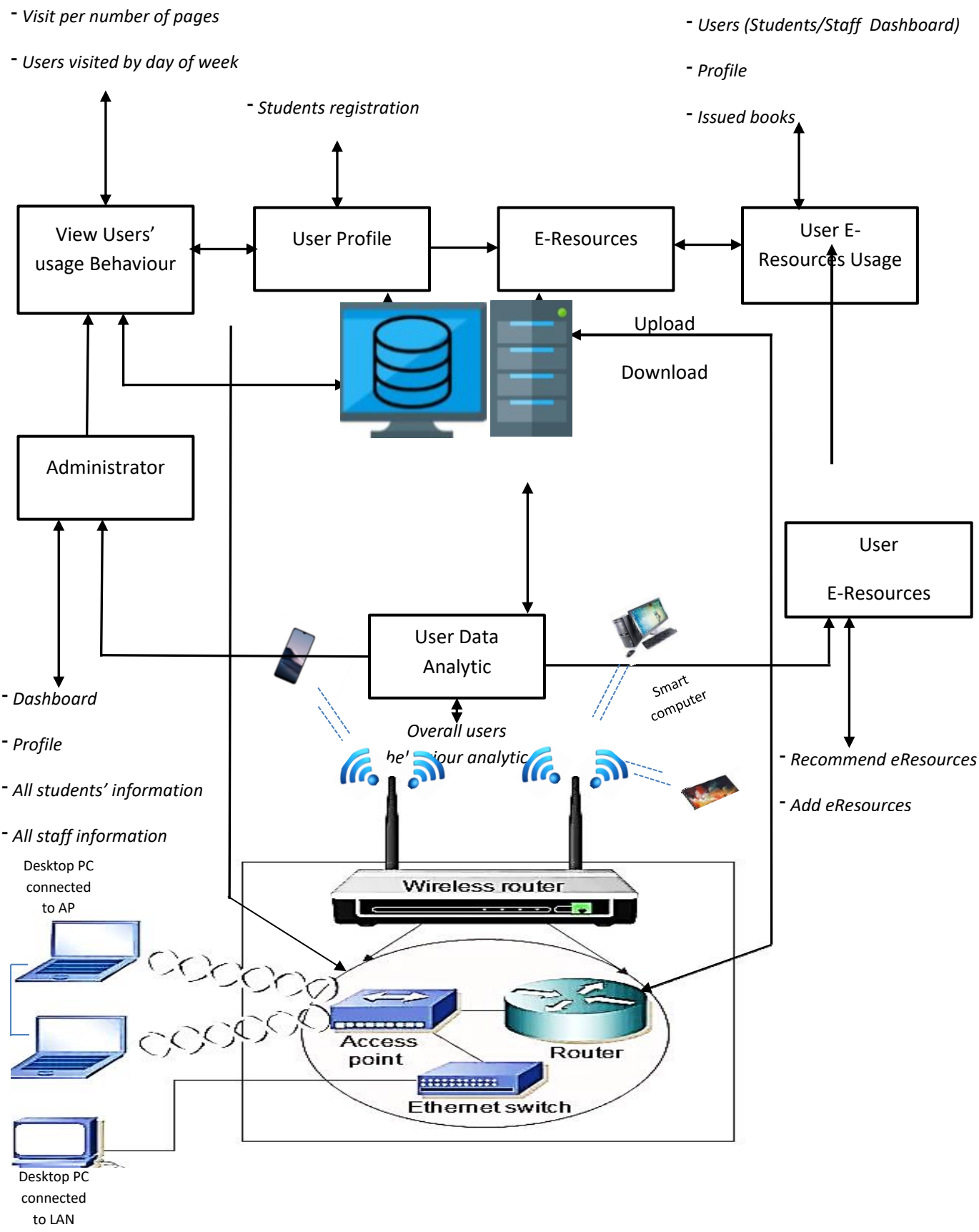
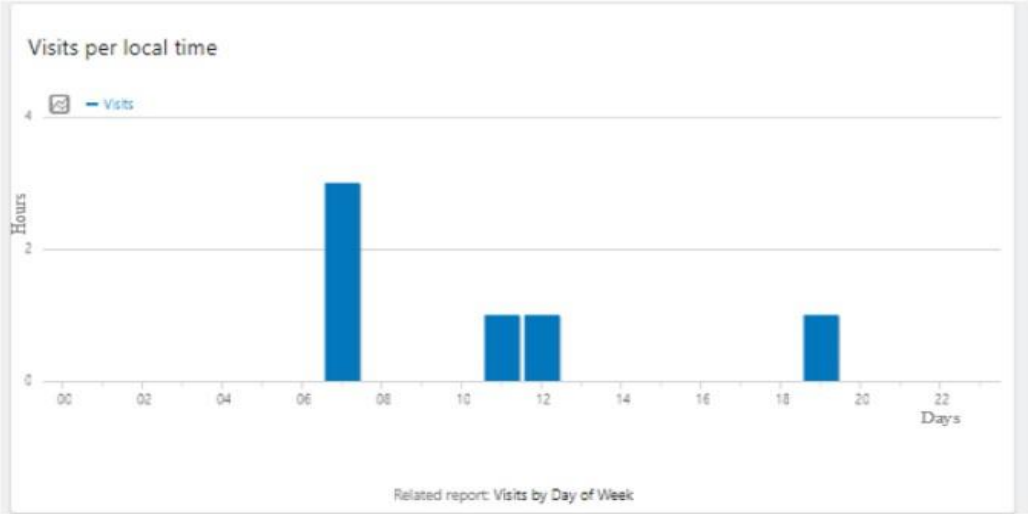


Figure 2: A Framework for Smart e-Library Management System. Source: Moses 2022

RESULTS AND DICUSSION

Figure 3 Number of Users Visited by Day of Week

The analytic below shows the number of users that visited the smart e-library management system for e-resources per day the week



From figure 3 above, shows that there was no visit to e-resources by users from the day 1 to 6. On the day 7 there was high number of visit to e-resources within 3 hours, on the day 8,9,10 there was no visit while day 11, 12 and 19 had some users visits within 1 hour. Day 13,14,15, 16,17,18, 20, 21, 22 had no visit to e-resources by users.

Number Page Visited

The analytic below shows the number of pages of e-resources visited by users of the smart e-library management system.

From figure 4 above, it shows that 40 users visited 1 page of e-resources while 20 users visited 25 to 30 pages.

Users overview graph

This is the graphical representation of the users' overview, from the graph below Mon Aug 23 to Mon Sep 19 there was no activity but from Mon Sep 20 there was a number of visits by users.

From figure 5 above, the graph shows that 40 users visited e-resources between September 20 and 21 September 2021 while 10 users downloaded e-resources within the same

duration. August 23 to September 19 there was no visit to e-resources by users except unique activities.

SUMMARY

Overall users' behaviour analytic

The overall user's behaviour analytic shows the whole registered users' behaviour that accessed and used the Smart e-library Management System for various e-resources. This e-resources include eBooks, eJournals and Multimedia. Below show 50 visits, 1 unique Visitor, average visit duration of 36 min 52s, 67 percentage of visit that has bounced, 36 actions which includes page views downloads, out links and internal searches per visit. These also include158 max actions in one visit, 208 page views, 39 unique page views, 0 total searches on websites, 10 downloads, 1 unique download, 7 outlinks and 3 unique outlinks.

Unique outlinks are links in anchor elements from a given URLs on the same subdomains that is being crawled, for each click Matomo will report the number of clicks and the number of unique clicks. Unique click is the number of unique visitors that clicked to a given domain and click represent the user behaviour.

From the analytic obtained from the Overall Users behaviour which is shown as visits overview, this agrees with Szwacka-Mokrzycka (2015), where users recognize needs or wants and go through a process to satisfy these needs which include the type of information resources, amount spent, frequency of use and what influences them to make such decision. It examines how emotions, attitude and preferences affect the behaviour of users. Therefore, during information search and evaluation stages, users work through processes designed to arrive at a number of information resources that represent viable use alternatives. It also agreed with Dowhan (2013) where he asserted that behaviour is the range of actions and mannerism made by an individual in conjunction with themselves or their environment and that student with more complex or advance studies have a greater capacity to learn new responses and thus adjust their behaviour. Bandura (2006), said most behaviour is learned by observing others, one forms a concept of how new behaviours are performed, and on later occasions, this coded information is a guide for action, it is a continuous reciprocal interaction between social influences. People behave differently by learning observationally, or consciously when they seek for electronic information resources, especially when they are working on a specific task. He went further to say, in a behaviour change context, users could be seen as thoughtful people who think about what they are doing, and why, analytically they are able to set and modify their own goals and are open to central route persuasion through reasoned arguments about why some behaviours are better than others, perhaps motivating them to change their attitude about a subject as a precursor to changing their behaviour heedfully.

In another study by Cheung, Chan and Limayem (2005), they argued that the factors that influence user behaviour are individual characteristics, structural, degree of knowledge, ease of usage as well as factors concerning the characteristics of web pages and the speed of the network. This study agreed with the points earlier mentioned that user behaviour to smart e-library management system is multidimensional in nature.

Conclusion

After examining the characteristics of the existing systems and their bottleneck. It was established that such system need improvement in the future especially in the area of processing data. The work is confined to the use of offline and webpage to perform tasks such as viewing e-resources, searching e-resources, requesting e-resources, sharing e-resources, viewing user

behaviour, and making recommendations. The said tasks access the database that keep and host e-resources for decision making obtained from the overall users' behaviour.

Recommendations

The following recommendations are made:

i. The management of MAU, Yola in a near future research should include and expand the existing framework to enable it evaluate data.

ii. PHP and JavaScript were utilized in the production of the system. Microsoft silver light software be used in the next upgrade because of its improved functionalities and flexibility.

iii. It is strongly recommended that oracle should be used in the next upgrade so as to improve data security.

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