MOBILE APPLICATION FOR LIBRARY SERVICES: CASE WITH UNISWA LIBRARY

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Abstract *The increasing advancements in the field of Information and Communication Technology, especially in the Mobile communication system has prompted many libraries to provide services which are predominantly mobile based. While there is no doubt that there are a number of initiatives in libraries to provide a number of mobile based services creating a complete application for the library is still at its infant stage. While most of the activities in the library can be integrated through the library this article looks at providing a complete mobile application as a comprehensive single mobile. This article looks at the basic approach needed to develop a mobile library application by taking the case of the University of Swaziland Library as a Case Study.*

Keywords: *Information and Communication Technologies (ICT), Library Services, Mobile Application*

INTRODUCTION

Influence of Information and Communication Technologies (ICT), especially the Internet and the World Wide Web has greatly changed the outlook of academic landscape. The use of internet platform and the use of emerging new technologies especially computers, network and telecommunication technologies has been accepted as part of the academic development. The main reason for the influence of ICTs in education is because the academic world is filled with digital natives and digital immigrants "who have grownup using technology and the internet, and therefore, feel more at home in the online world" (Hockley, 2011, p. 322).

Among the emerging technologies, mobile communication technology seems to be growing at a rapid speed. Mobile learning has been accepted as part of academic endeavor. Olatokun observed that "Mobile phones have become an inseparable part of everyday life" (Olatokun 2006: 530). The ECAR study on undergraduate students and information Technology observe that close to 76.7% of undergraduate students use smartphones for not only communication but also for accessing information (Educause Center for Applied Research, 2009). "Smartphones help turn teenagers into technologically savvy adults who have a better chance of becoming leaders and innovators in their fields" (Wilcox, 2015, p. 8). Scott McQuiggan et. al. (2015) argue that:

"Mobile learning is the experience and opportunity afforded by the evolution of educational technologies. It is anywhere, anytime learning enabled by instant, on-demand access to a personalized world filled with the tools and resources we prefer for creating our own knowledge, satisfying our curiosities, collaborating with others, and cultivating experiences otherwise unattainable. Mobile learning implies adapting and building upon the latest advances in mobile technology, redefining the responsibilities of teachers and students, and blurring the lines between formal and informal learning (McQuiggan et. al. 2015, p.8)*".*

Educational institutions have taken this latest advancements in their stride and have redefined the concept of learning.

They further point out that the "on-demand, perpetual connectivity of mobile devices changes the way we communicate with one another, gather and store data, and indulge our curiosity - all of which have great implications for education. Mobile devices enable users to not only be constantly connected to their data and resources, but also to always be connected to one another" (McQuiggan et. al. 2015, p.50). Another important factor in the influence of mobile technology in educational institutions is the convergence of teachers, students, classrooms, textbooks and information sources through a single mode of access which has provided an unenviable power in learning. This is an important context in the educational institutions since libraries are one such place which connect students, teachers as well as the wealth of information.

Libraries which facilitate information access to the academic world has always been in the forefront in making use of the emerging technologies to effectively provide information resources. Canuel and Crichton (2010) while analyzing the impact of mobile web on Canadian academic libraries point

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to the fact that among the Canadian Association of Research Libraries (CARL) the mobile penetration is around 34%. This figure is consistent with the 35% mobile penetration as reported by the Association of Research Libraries (ARL) which shows that the mobile application penetration amongst the libraries is on the increase. Cummings et. al. (2010) study on the use, impact and implications of handheld devices for libraries answers most of the questions researchers have on the application of mobile technology for library applications. Their study point, how close to 55% of the respondents were using mobile based internet services and close to 45.2% of respondents indicated that their desired search medium is mobile catalogues which clearly portrays that the choice of the users are mobile.

When compared to the rapid development of mobile based applications in other fields like e-commerce or e-tourism the hard truth is that the libraries have not completely captured the magic of this wonderful opportunity. It's worth observing that libraries are just starting to make their first step into the world of mobile learning especially learning through mobile phones (Walsh, 2009). In the mobile app market place the libraries have not started making any significant inroads. LaCounte (2012) observes that with computers and internet facilities libraries had the upper hand and provided state of art services to their clients but with regards to mobile applications out of the hundreds of thousands of mobile applications available for phones, the amount of apps that librarians have built for libraries can be counted on one hand! Though mobile interface to library websites are easily achieved by many libraries they lack their presence in native mobile applications. The main reason for this anomaly may be "the lack of technical expertise, limited budget, access to relevant data required to build native mobile applications" (Yang and Li, 2016, p.64). This article is an attempt to document the development of such an application for an academic library along with a prototype and flow diagram.

LITERATURE REVIEW

While looking at the wealth of literature written about mobile initiatives in different spheres of life, a general literature search shows that there is an increasing interest amongst the academic institutions in the use of mobile devices to support teaching and learning. There is no doubt that mobile usage is the trend in academic as well as institutions of higher learning. Jeff Wisniewski (2011) from the university of Pittsburgh predicted that "by 2014 mobile internet usage will surpass desktop web usage" (Wisniewski 2011, 54) which seems to be true. He further concludes that "the future is mobile and the future is now" and it's up to the libraries to choose which mobile path is right for their library which depends on different library factors: the environment, the budget the goals and the skill set of the library professionals.

Since library websites are considered to be the face of many libraries, the obvious choice for any library to initiate its mobile presence is through its library website. Bridges et. al. (2010) confess that if there is a question to be asked whether the library should develop a fully mobile website, the answer is an unequivocal yes. Their decision is based on the ECAR (Educause Center for Applied Research, 2009) study, which strongly suggests that a substantial number of traditional college-age students regularly use web-enabled mobile devices which augments the rationale behind creating mobile websites. Their study also highlights the need for mobile catalogues and the available mobile catalogues on the library horizon.

Høivik (2011) provides an illustrative interface flowchart model for creating mobile web display for libraries. His combination of push and pull content delivery model is promising to future mobile library website developments. He also provides insight into how with a simple java script which works on the server side, the devices can be identified and appropriate website design can be displayed. The major drawback with Høivik's script is that the system suggested is only for android users which leave out iOS and windows phones. Griffey (2010) feels that the mobile browsing, especially for library websites has become better because of the advancement of technology. With a little bit of tweaking of the existing library website coding or by using a conditional mobile CSS with a simple "command of max-device-width" an effective mobile based website can be created for libraries. This seems to have influenced lot of library website developers to combine their desktop as well as their mobile websites using a single web design with conditional style sheets.

The newer generation of designers are influenced by the Responsive Web Design techniques which provide the same design for any device. Baturary et. al. (2013, 2275-2279) provides a glimpse of the responsive web design for instructional content in their paper "Responsive Web Design: a new type of design for web based instructional content". The responsive web design aims to provide a "suite of techniques for building fluid, standards-based websites that adapt to user devices" Reidsma (2013). Using fluid grids and CSS media queries to change style according to devices it is possible to provide a single web design for multiple devices. Mairn (2013) concludes by saying the development of different websites for different gadgets will be the concept of the past as newer technologies and techniques are aimed at strengthening the mobile website presence as the prime source. Yang and Li (2016) asserts that "a mobile-friendly website has been achieved by almost all the academic libraries".

Parallel to the interest shown in the development of mobile based library websites there are various literatures on a number of mobile catalogues for libraries also. The earliest literature on mobile catalogue was referred by West et al. (2006) in a case study where Ball State University (BSU) attempted the development of the mobile website which had a catalogue and journal search option. Vielmetti (2008) in his blog lists close to a dozen library catalogues which are available as mobile enabled OPACs. Commercially Millennium's AirPAC (AirPAC, 2016), SirsiDynix'sBookmyne (BookMyne, 2016) and Open Source ILS Koha's mobile interface (Koha, 2016) are some of the notable Integrated Library System mobile OPAC interfaces.

Kroski's Library Technology Report in the year 2008, "On the move with the mobile web: libraries and mobile technologies", illustrates the need for the mobile website and mobile catalogues whereby she goes about giving examples of University of Richmond Library catalog search as well as University of Virginia Libraries mobile website and New York University Libraries Arch Mobile portal for searching resources. Murray's (2010) list of MOPACS (Mobile OPACS) in her study and Bridges et al. (2010), Griffey (2010) and Cummings et al. (2010) references to mobile catalogues are some of the prominent documentations of the development of library catalogues for mobile phones.

Texting has been an anonymous choice when it comes to ubiquitous and stable mobile computing especially when it comes to Short Message Service (SMS). Among the various applications, text messaging is still the only universal mobile platform for the masses. It does not require special downloads as it is already available on 98% of all cell phones (Pope et al., 2009). Although it is a widely used communication mechanism for cell phone users, SMS is far more than just a technology for teenage chat. One area where mobile technology especially the SMS technology has a good penetration and has been well documented in the literatures is mobile Referencing. Herman (2007) refers to the use of SMS referencing at Southbank Institute of Technology library in Brisbane as early as 2005. Pearce et. al. (2010) in their article "SMS reference: myths, markers, and modalities" try to create a framework to describe SMSservices. Anbu et. al. (2012), Jetty et. al. (2013) are some of the ground breaking studies on the use of SMS in libraries.

Availability of electronic resources for mobile devices is another area in which mobile penetration has been felt over the years. Mobile E-books and mobile access to Electronic Journals and reference materials are few examples of this access. Lippincott observes that some libraries have already experimenting with lending e-books through the e-book readers (Lippincott, 2010). Applications like Kindle (Amazon Kindle, 2016); iBooks (2016), Aldeko (2016) have revolutionized the concept of e-books. Jason Griffey (2010) also predicts that the future of mobile technology will point towards three main areas: location-based services, personally networked devices and ubiquitous connectivity. He also feels that the "reference services will increasingly move to the mobile interface" where most of the transactions will be completely virtual. With increasing emphasis on GPS related mobile applications it is possible for database vendors to provide geo-location standard for licensing of their content.

RESEARCH QUESTIONS

The broader picture which emerges out of the literature review is that there is no doubt there are experiments done on the use of mobile technology on different aspects of library activities. Most of the applications or mobile activities for libraries tend to address a single or an isolated activity of the library. The current mobile applications for libraries look similar to the origin of library automation days when circulation or serials management or OPAC were implemented as isolated computer applications for libraries until the framework for Integrated Library Systems (ILS) appeared. **The important question is to see if it is possible to bring all the different activities under an integrated mobile application for libraries.** This paper is an answer to that question whereby it can be taken as a case study on creating a mobile application for an academic library which comprises most of the activities in libraries and by doing so to create a flow diagram which can be used as a basis for creating such applications for libraries.

OBJECTIVES OF THE STUDY

The main objective of this study is to develop a mobile application for an academic library and by doing that it tends to document systematically how to plan and integrate the different activities of the library that can be integrated through the mobile technology. In that process the study also would like to present a flow diagram which can be used as a prototype in creating mobile library applications.

METHODOLOGY

As the study implies great majority of the study has been done through the experimental method where application or a computer output is attempted through coding and tested in the virtual space. Such a test involves running the application on a server with sample data to ascertain that it satisfies all the requirements. In the case of writing codes for mobile applications HTML5, PHP and other programming languages like C, C++, JAVA are used. In order to create a balanced programming approach the application was tested in all the three major platforms, Android, iOS and windows.

DESIGN AND DEVELOPMENT OF THE MOBILE APPLICATION

Keeping the objectives of this research work in mind an integrated mobile application for the University of Swaziland library was planned. In order to streamline the research process and to arrive at a meaningful integrated mobile application there was a need to survey the ground. For any experimental method before any work can be started there is a need to have a feel of the ground to make sure that all the issues are covered. In this case a general questionnaire was prepared having the University of Swaziland as the survey field. The sample was taken from the University of Swaziland where the researcher is currently practicing his library work.

University of Swaziland

University of Swaziland (UNISWA) was developed from the University of Botswana, Lesotho and Swaziland (UBLS) which had its headquarters in Lesotho between 1964 and 1975. First operated from 1975 as University College it gained university status in 1982. With 7 faculties and one institute of distance education which spans three sprawling campuses, UNISWA is the foremost institution of higher education in Swaziland. The total student enrollment in 2015 stands at 6305 and a teaching staff compliment of 271 (Vice-chancellor's report 2014-2015). The library services at UNISWA is provided as campus library services for each of the three campuses. The total monographs housed in the three libraries amount to 299759 with a current print journal subscription of 325 and a back issue collection of above 750 titles. Access to electronic resources are provided through the library website with access to close to 25 electronic databases. The university campus is connected through fiber optic and has a fairly good wifi coverage throughout the campus.

The Starting Point: Survey with UNISWA

The starting point for a library mobile application is to go to the basics and in this case to the users to find out what exactly they need in terms of content and service. In this survey a questionnaire was designed in Google drive and circulated through the library facebook page and by email. The questionnaire had a total of 14 different questions which were used extensively as a base in decision making. A return of 672 questionnaires were received out of which 24 questionnaires were found to be unusable since it lacked some basic data. Since the identity of the students were not captured in the questionnaire the 24 questions were withdrawn from the evaluation.

The following were the questions posed to the users:

- Types of mobile phone ownership:
- Purpose for which they use their mobile phones.
- Have they used their mobile phones to browse Internet.
- Frequency of access to Internet using mobile phones.
- From where they access Internet Access (personal data, campus wifi etc.).
- Have they ever accessed the University website using their mobile devices.
- Have they ever accessed the University Library website using their mobile devices.
- Their willingness to access the Library website if it is mobile complaint.
- What are the library services they would like to see in the Mobile website.
- Will they be comfortable to receive SMS/push alerts in their mobile devices.
- What are the library services for which they would like to receive SMS/Push alerts.
- Their preference of reading items in mobile phones (e-book, journal articles etc.).
- Their familiarity with mobile applications.
- Their view of developing a mobile application for the library.

Analysis of the Survey

The survey was answered by 648 users among which 494 (76.2%) were undergraduate students, 112 (17.3%) Post-graduate students and 38 (5.9%) of them were staff. The rest were Non-teaching staff. It was gathered from the survey that the majority (95.2%) of users use smartphones and that many of them are familiar with browsing (563 users, 86.9%) internet through their mobile devices. The survey also revealed that the campus wide wifi connection is widely used (88.5%) and the users are very eager to try accessing the library services through their mobile devices.

Table 1 illustrates the preference of the users when it comes to mobile based services. This question was vital to understand what type of content that the users would be willing to see in a mobile application or a mobile website. Among the various content the link to electronic resources stands as an important resource with 96.1%, closely followed by the Library Catalogue with 81.9% and the Library Notices as the third with 66.5%. The Reference resources forms last with 16.7%.

Table 1: Choice of Library Services in the Mobile Website / Applications

Content Preference	No of response	Percentage
Electronic Resources	623	96.1%
Library Catalogue (OPAC)	531	81.9%
Library Notices	431	66.5%
Others (Rules, Virtual tour)	134	20.7%
Reference Resources	108	16.7%

When it comes to receiving SMS and push notices in their mobile devices majority of the users (90.4%) wanted to receive alerts in their mobile phones. This question was intentionally asked to see if push notifications or specific SMS based services are to be initiated in the mobile application. The choice of alerts the users wanted as notices in their mobiles are illustrated in Table 2. Article alert notices (84.3%) similar to SDI services and the book overdue reminder notices (70.7%) are the popular alerts the users have opted for. Most of the users (85.7%) have also opted to have a native mobile application made for the university of Swaziland library so that all the services are accessible through that app.

Table 2: Choice of Library Services as SMS/Push Alerts

SMS /Push Notice Preference	No of response	Percentage
Article alerts of your field of study	546	84.3%
Book Overdue Notices	458	70.7%
New Arrival Notices	123	19%
Reserve/ Renew Notices	120	18.5%
General Library Notices	101	15.6%

Using the survey questions a detailed flow chart was drawn and a mobile application was designed for the University of Swaziland

Flow Chart for the Mobile Application

The first and foremost work was to gather as much information as possible regarding the various items that are needed in the mobile application. After going through the survey and also through the website usage statistics the following services were identified as key ingredients in the mobile application:

- Library Catalogue
- Electronic Resources
- New Arrivals
- Library Regulations
- Library Tour
- Past Exam papers
- Past Newspapers
- Library Social Network links
- Reference – Ask the librarian
- Communication to the library

The Flow Diagram

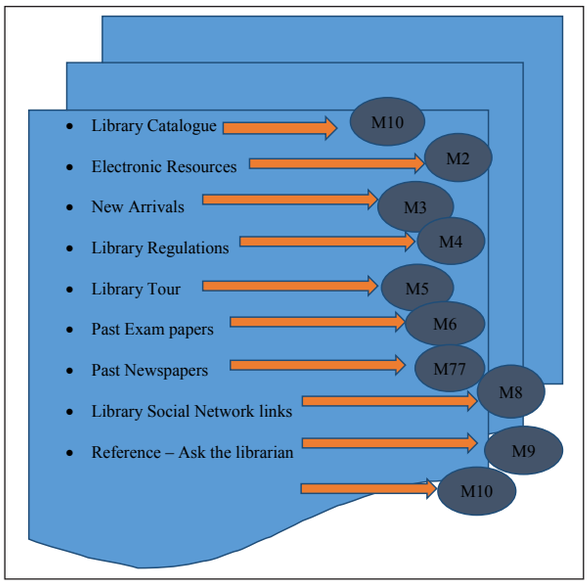

Fig. 1. Flow Diagram

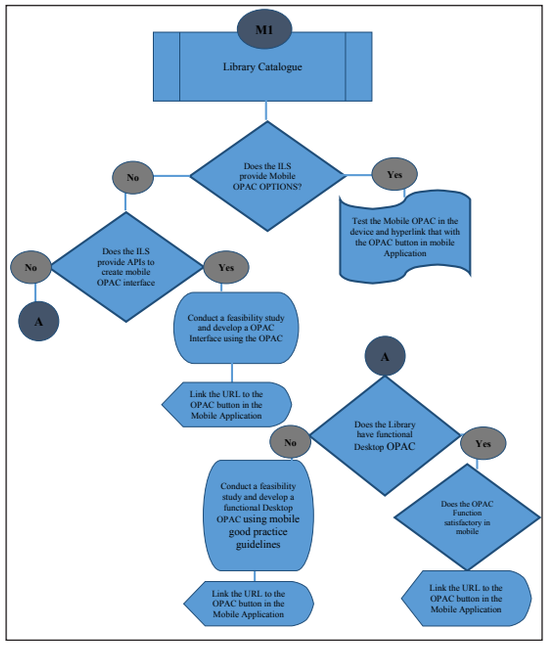

Fig. 2: Flow Diagram

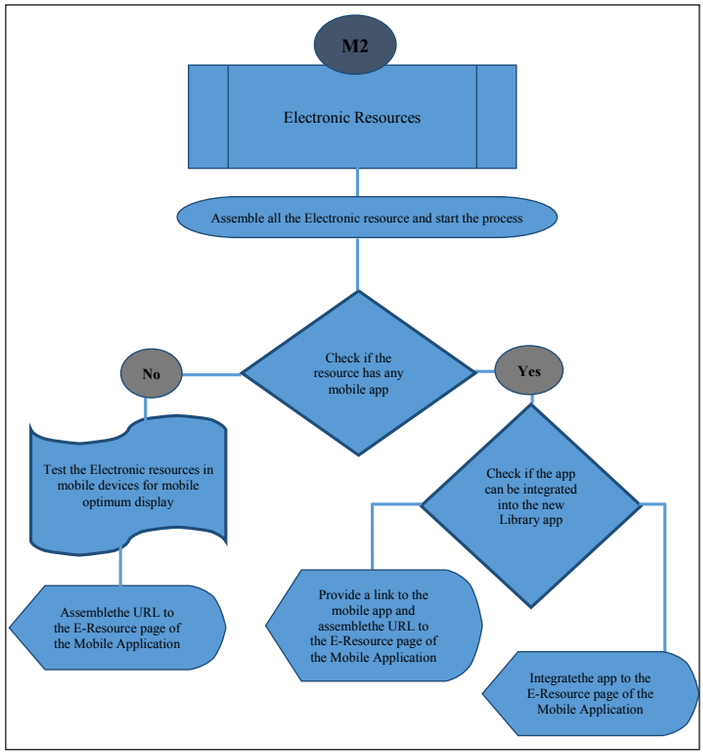

Fig. 3: Flow Diagram

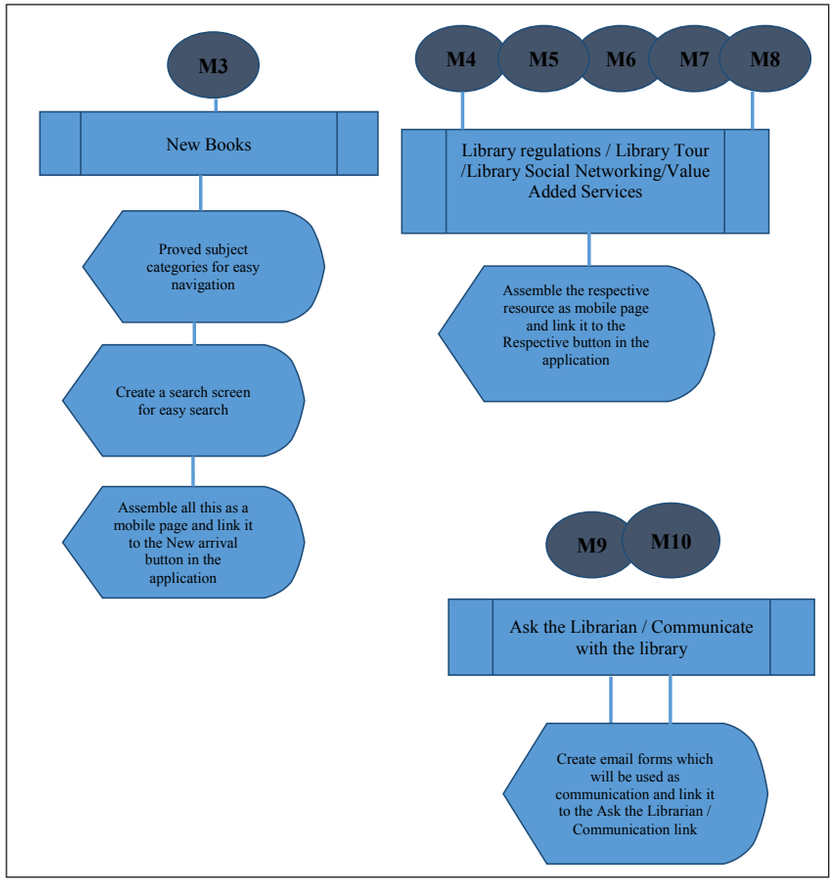

Fig. 4: Flow Diagram

THE MOBILE APPLICATION: UNISWA

Using the flow diagram a mobile application consisting the integrated library operations was designed.

Interface

Keeping the mobile device ownership statistics available through the questionnaire it was evident that majority of users use Android and a fraction of users use iOS. In order to cater for both the users applications on both platforms were attempted. The choice of making a mobile application rested with experimenting with a native application or trying to build a hybrid application. If all the mobile capabilities are to be captured there was a need to develop a native application which will enhance the mobile specific features such as push notices, location services and mobile specific inbuilt features such as camera, audio to name a few.

Testing

For testing and consolidating the result the app was placed as a web link and tested using the same link. Simulator mode of the application development for both platrforms were tried and on completion of the application it was compiled into specific application format and tried on mobile phones. For iOS devices the application was compiled as .ipa file format and loaded into the iphone as an enterprise app using the device management technique and tested. For android phones the app was compiled into a .apa file format and it was loaded into the mobiles as third party application and tested.

Features and Facilities of the Application

On invoking the application it will land on a landing page Figure 5 which acts as the home page screen or the landing page of the application. The landing page features the different menus (services) which are available in the application. As suggested in the flowchart there are 10 different services which are available through the application interface. The welcome screen has been incorporated to have the ipad and tablet viewers in mind as when they open in ipad the welcome screen will automatically open providing all the services as icons in the bottom of the screen as given in figure 6.

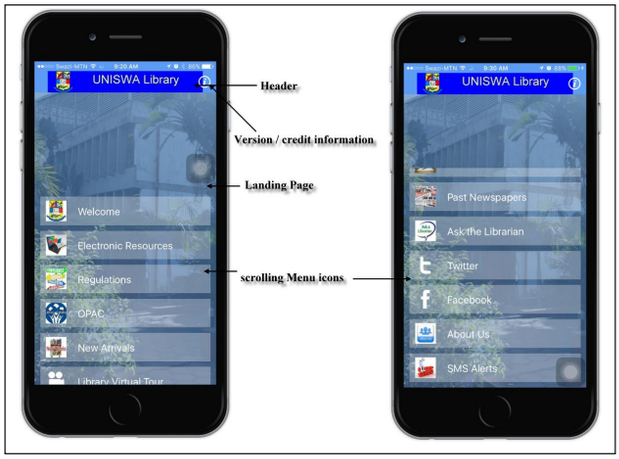

Fig. 5: The Landing Page of the Application

Fig. 6: The Landing Page of the Application in Tablets

Electronic Resources

The survey clearly showed that the users were much interested in having the electronic resources available for them as mobile links. In order to provide this as an option a button was created with a landing page with links to various electronic resources.

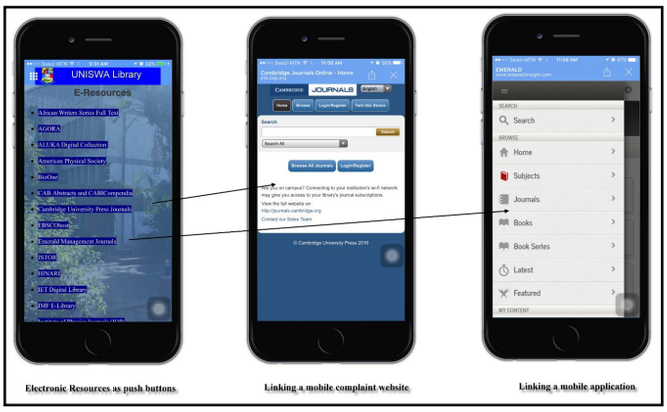

Fig. 7: Electronic Resources

The first and foremost work in this page is to check each and every electronic resource for corresponding mobile app or for mobile complaint page so that it can be correctly linked. Figure 7 illustrates the electronic resources lined alphabetically as push buttons. For illustration one link (Cambridge University Press) is shown which displays the correct mobile page and the next image depicts how a mobile app which is available as a mobile website is opened once the Emerald button is pressed.

Online Public Access Catalogue

Another service which the users have opted in their survey is to provide the Library Online Public Access Catalogue (OPAC) as a link. Before providing the link tests were conducted on the library OPAC. First and foremost it was tested in a number of mobile phones to see if searching is possible. As it was possible whether it follow mobile optimum standards especially while displaying was analysed. In the initial tests it showed that the OPAC is mobile complaint. At the current web services a separate link is provided for intranet (campus-wide) users and another link for remote users. An added spice is that the university use Symphony from SirsiDynix as the Integrated Library System (ILS) which has its own mobile application as a standalone library catalogue.In order to create a better catalogue option a landing page was created with options to select so that an easy search experience can be optimized. Figure 8 illustrates the landing page and the display of OPAC in mobile application with option to download the mobile OPAC app from the developer as well.

Fig. 8: Electronic Resources

Other Services

A number of other services were incorporated in the main menu. Notable among them are a colourful virtual library tour which the library users can use as an orientation tool. A page with videos of different sections of the library including how to access the catalogue, how to search and the different facilities available in the library were assembled as the library tour. The different videos were put together as a video channel in youtube for easy access. The youtube channel was sourced as a link in the landing page of the button to make a meaningful library tour.

A link on new arrivals was created to add more value to the user experience. There are two types of information, one is passive where the list of new arrivals are provided along with links and the next is to make an active push message so that the user can be notified as and when a new book arrives. In order to streamline the new book arrival the entire library is divided into 10 broad categories of subject material using the Dewey decimal broad subject classification and from that an elaborate new book arrival sections were designed. While doing that a dynamic search screen was also put in place so that the users can search for the book titles or author names.

Links to other value added services like past exam papers, past newspaper archive, Social networking are some of the important services which the users use and separate links to these services are also provided in the app which makes it a more complete application.

Mobile Specific Links to the Library

One of the important advantages of having a mobile application is to provide links to all the communication channels as well as all the relevant information in one place. This particular utility will be more useful if there are more than one library and there is a need to commute or to communicate with these branches. Keeping that in mind all the relevant information including the opening hours, telephone numbers and the emails of relevant authorities are coded in each page. Mobile phones are such wonderful gadgets it allows the users to make use of the inbuilt functions such as calling, emailing, geographical location etc. This app makes use of all the above mentioned functions to show how effectively they can be used for better utilization of the library services. Figure 9 is an illustration of such services inside the application.

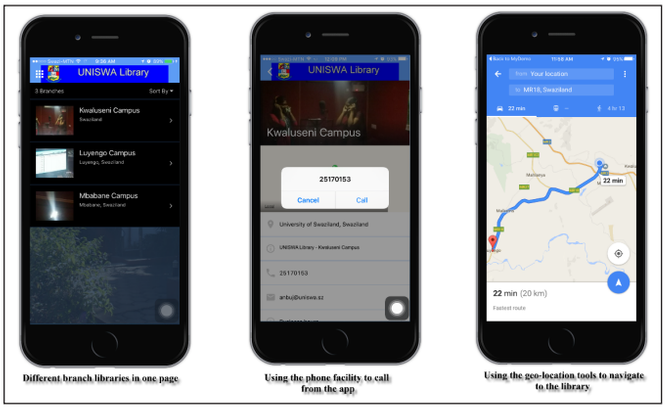

Fig. 9: Mobile Specific Links

Reference - Ask the Librarian

One of the important links for a library is its reference collection. In order to streamline the entire Reference process a mini application within the library application was attempted. Reference resources can be distinguished using their broad catagories such as Encyclopedia, Dictionaries, Travel guides, Maps, Atlas and so on. Keeping that in mind a menu with these broad categories were attempted. On selecting the Reference icon a Reference Suite screen will open as indicated in Figure 10.

Fig. 10: Link to Reference Resources

Apart from the major reference resources a number of other resources are also arranged in this suite which includes Travel Guides, chat utility and as the librarian which can directly communicate with the library. Most of the libraries have "ask the librarian" service right from their website and a similar attempt is made to provide a robust reference desk experience.

CONCLUSION

As technology evolve and the expectations of the users grow it is the duty of the libraries to keep pace with the advancements and the needs of the users to provide them with vibrant tools which will help and aid them in using the resources more fully. The availability of a number of mobile options for libraries and the possibilities to consolidate them with ease and assemble them to create a vibrant applications will add more value to service delivery. As technology keeps evolving rapidly there is a need to provide users with relevant and at the same time affordable services in line with their everyday practices. This application is such an attempt to keep the users in line with the technology and at the same time, more relevant.

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