IRC Mobile library Services

By

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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Information and Communication Technology Programme
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(INFORMATION AND COMMUNICATION TECHNOLOGY)

Approved by,

_____
Dr Anang Hudaya

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
MAY 2012

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

Gill Onesia Julio Simango

ABSTRACT

The evolution of mobile technology allowed the introduction of m-learning. Many institutions have been implementing Digital Library Systems and more specifically m-library (Mobile Library).

This report shows how libraries worldwide have been developing websites designed especially for mobile phones and PDA solutions, to enhance the accessibility range of their websites. It describes the Digital Library Systems available in the market, similarities among them and describes the proposed system to be implemented by UTP.

Readers will be able to identify the major problems with regards to the IRC PRECISE System and the areas in which following worldwide practices or UTP's needs the system can provide a more reliable link between IRC and students.

This report aims to clarify and emphasize the importance of the development of this project and how relevant it is to the UTP Students Community and also to the IRC Management. The background specifies the scope of work for this project, the purpose and significance. The literature review presents studies that have been conducted in this area, and similar projects developed around the globe.

Furthermore in this document, the methodology used to conduct research and the respective results and discussion are exposed; the timeline for the project completion, the tools identified for the project development will also be described in the methodology section.

The final part describes the prototype including the functional specifications and lastly the conclusion which includes the relevancy of the objectives and recommendations.

ACKNOWLEDGEMENT

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ABBREVIATIONS AND NOMENCLATURES

FYP	Final Year Project
IRC	Information Resource Centre
M-Library	Mobile Library
MSIS	Mobile Student Information System
UTP	Universiti Teknologi PETRONAS
SMSC	Short Message Service Centre
SoW	Scope of work

CHAPTER 1
INTRODUCTION

1.1   Background of Study

The Universiti Teknonogi PETRONAS   Information Resource Centre (library) is currently on the planning phase for the development of a new web portal using the concept of the Digital Library System.

According to Seadle and Greifeneder (2007) a digital library is based on documents in digital form that are handled like traditional library documents in standard processes (collecting, cataloging, and providing access) and that are made available online for users via catalog records. (p.171). Information that is physically stored in the library, such as books, journals, CDs and many more are available to the users through a website; users are able to browse through the library website, check the available books and other activities according to the website. IRC is currently using PRECISE system connected to the Library website. PRECISE is an online application that enables users to login, search for books, renew books return due date and others.

PRECISE alerts students through email when a book is overdue or when the return date is approaching. However, even though the system is available online students still face some problems, leading to the conclusion that the system needs to be improved and some new features need to be added.

1.2 Problem Statement

In UTP during results release period or examination slip collection, if students have any type of fines, their results are blocked and they are not allowed to collect their examination slips until all debts are settled. Most of the fines are related to books that are overdue, and to which students have not paid at the Library. A common fact among UTP students is that, most of them forget that they have books overdue, and only when the results are locked or they are not allowed to collect the examination slip, they return the books and pay the fines.

During those specific periods it is very common to see long queues at the IRC and Finance Department caused by students who forgot to return IRC books, accumulating fines. Students can easily forget that a book due date is already expired and the actual System fails to ensure that this problem is not verified.

This project is to be developed in conjunction with the IRC due to the fact that it has already been proposed to a 3rd party, and having a student working on it can ensure that the final result fulfils their expectations.

1.3 Objectives

- Create a mobile website connected to PRECISE web portal to enhance the Information System in IRC.

- Reduce queuing during at the Finance department examination slip period regarding IRC fines, enabling students to check their outstanding fines through the portal by sending reminders once a book due date approaches.

- Keep students updated on books available and provide book renewal services

1.4   Scope of Project

The list of requirement provided by the IRC for the implementation of this project with 3rd party company includes many aspects and features, which will not be covered in this study. The present project will be focusing specifically on mobile website connected to PRECISE that is to be developed.

The UTP Digital Library Services –Concept paper states that:

"Selective Dissemination of Information (SDI) can be offered online to all special interest group via PRECISE. The library will provide SDI services to update members regularly on the areas of interests indicated by members, including e-news, e-documents and any information appropriate for dissemination to members.

SDI Service features:

- The selected information resources such as thesis, project papers, research proposal and etc, can be indexed and the abstract can be provided for special group of patron.

- The summary of material will be send to the library patron using their personalized portal.

- Library patron also can receive their content alert via email (Millennium internal mail or personal mail).

- The full text and full version of content can be retrieved by authenticated patron

- Library patron can customized their own subject interest via PRECISE "

Those are some of the features to be implemented by IRC fro PRECISE portal, since this study is conducted in collaboration with IRC and fulfills these specific part of the requirements, the mobile website will include some of the requirements. The

requirements which will be implemented for mobile website are limited to meet the timeline. So the scope for this project will include:

1. Enable users to access to the library system through their smartphones, to check books and journals availability
2. Enable students to check using their smartphones the items that they have requested, the due date and fines for possible overdue books and book renewal
3. Update personal information such as email address, password and phone number
4. Send SMS notification when a book overdue date is approaching

1.5 Relevance of the project

Due to the fact that m-library has not been implemented in UTP, the development of this project is important and relevant. As the Literature review will show, some countries are already using it, and including some Universities around Malaysia. Though UTP has a similar portal, PRECISE, the mobile extension for the application has not been developed.

1.6 Project Feasibility

For any IT project, it is important to ensure that the project is complete within the time, scope and budget. This project is expected to be concluded by September 2012, which provides appropriate time for integration of all important modules. To ensure that this project is successfully completed, its development has been divided in 4 phases: Planning, Analysis, Design and Implementation (Please refer to Methodology section for more details). The scope of work has been defined as it is presented in section 1.4, which includes all the modules that the project will cover

until its completion. The implementation of this project has been divided into 2 parts: Final Year Project I and II. Further in this document the Gantt chart with FYP I and II activities are presented.

CHAPTER 2
LITERATURE REVIEW

Throughout the past decades mobile devices technology has developed extraordinarily, being currently one of the biggest trends in the technology market. Mobile devices include laptops, iPads, Mobile Phones and more.

This report focuses on mobile phones development and the impact that it is continuously bringing to the world, in specific to educational sector. A smartphone such as Blueberry, iPhone, provide to its users almost all the basic features that can be found on a computer. Its functions go beyond messaging, voice and video calling and others, to internet browsing, online chatting and the overall social networking. Mobile is a fast-growing medium in terms of penetration and usage. (Jenkins, 2006, p. 63)

According to Smura, Kivi and Toyli (2009)

> "In most developed countries, mobile phones have become an inseparable part of everyday life and a majority of people carry them all the time. In addition to complementing and expanding the use of various internet-based services, the evolution of mobile devices also enables entirely new types of services to be introduced. "(p. 53)

Furthermore Suki (2007) claims that in Malaysian society, heavy mobile users have become increasingly reliant on mobile phones, to the point where many of them no longer have a traditional home phone line and have elected to have just a mobile phone with a great plan. This is because mobile phones are small, reliable, and

convenient devices that can provide the full spectrum of information and entertainment options to users.(p.363)

University students are proven to be following the evolution of technology being clear to see nowadays that almost all university students own a mobile phone and a good percentage is going for or already has a Smartphone. From her study Suki (2007) concluded that the majority of the respondents were students with a bachelor's degree (94.3 per cent). … It was noted that this age group prefers to buy new mobile phones and also exchange old mobile phones for new mobile phones due to new phones offering a wide range of items that are of interest to a variety of ages and demographics, providing an engaging means to be entertained and interact among a circle of friends.(p 359). From her research it was proven that about 98 per cent of the respondents own a mobile phone and the rest own a PDA/pocket PC/palmtop or smart phone.(p 359)

All mobile operators offer internet connection to its subscribers, increasing users' interest on internet services due to the mobility offered by smartphones and other type of mobile devices. Smura et al. (2009) stated that "Web browsing on mobile devices has attracted the interest of many academics". (p. 62). With new technologies arising daily the educational system is embracing the opportunity to improve its learning methods by introducing e-learning Systems and solutions and m-learning which can be accessed through smartphones.

Many researchers have been working in the past years trying to identify students' behavior and response to mobile web based application a good example is the mobile student information system (MSIS) a system for providing relevant information to students on a mobile platform. (Asif and Krogstie, 2010 . p 5). This

study concludes that students respond positively to mobile based application, which can help them keep track of their studies;

Asif et al. (2010) affirm that

> "For the learning resource service, the majority 89 percent users were agreed that this service would make it easier for them to keep track of their study related resources and tasks. By using this service, 85 percent students found it interesting to have their learning resource on their mobile devices and showed interest to use it; 78 percent respondents found it easy to use. " (p 14)

At this stage we can easily identify the influence that mobile phones have in learning process, and how it can improve educational systems available in the market. However the major objective of this study is the digital library service in specific mobile based.

We can use as example the digital library developed by a research team at The University of Iowa City in conjunction to Iowa City's designation as UNESCO "City of Literature,". Hsieh, Draxler, Dudley, Cremer, Haldeman, Nguyen, Likarish and Winet (2011) in charge of this study believed that the project encourages undergraduate and graduate research, with an emphasis on interdisciplinary and collaborative practice, while recognizing the unique potential of mobile devices for public scholarship and civic engagement. (p.145).The development of the web based application received positive feedback from the users and through the pilot they were able to identify the strengths and weakness of their System.

On their effort to improve their system Hsieh et al (2011) plan to develop the mobile app on other mobile platforms and create an online version of the digital library.(p 148)

Another research was conducted at University of Edinburgh, Edinburgh, UK; The project seeks to develop contemporary user experience (UX) of digital libraries through a technological development and usability evaluation framework. It aims to

enhance an existing digital library with state-of-the art technologies and investigate new contexts in which digital library services can be diffused.(Paterson and Low, 2011, p 413).

According to Paterson et al (2011) California Digital Library (CDL) embarked on a mobile user research project more recently which culminated in a new mobile version of California Digital Library's website… They found that mobile users use the library services to find known materials or quick pieces of information and they are normally already using online databases and catalogues on their mobile devices.(p 414) This proves that users' interest in mobile library has been improving and since the among of students turning to smartphones is increasing, so will the access to this internet services.

Jones ,Edwards, and Reid (2008) on regards to SMS reminders used for educational purposes concluded that many students particularly valued reminders in support of their time management, an important self regulating strategy known to be a component of successful transition (p. 162).

A research conducted at University of Huddersfield, to study students feedback and behavior on regards to mobile digital services, proved that the use of SMS "reminders" is also creeping into education in general, with schools, colleges, and universities experimenting with text messages to remind students about deadlines and more.(Walsh ,2010, p 24). This proves that the messaging alert System which is to be implemented in IRC is currently on trend in the market, and that students around the world are getting familiarized and comfortable with the use of m-learning. Findings for that research have shown that Attitudes towards text messaging from the library are overwhelmingly positive. There were some concerns with the library using text messaging services, but these were based around whether the messages would be "useful" or promotional.(Walsh ,2010, p. 26).

In Ryerson University-Library, Toronto, Canada, a research on mobile library convenience concluded that the next two most popular library services desired for mobile devices were the catalogue and borrower record options. (Wilson and McCarthy, 2010, p. 217).

Cao et al.(2006) defend that a key benefit of m-learning is its potential for increasing productivity by making learning available anywhere, anytime.(p.1289). However a concern that arises when it comes to m-library is how to fit all the information in the screen, for that Murray (2010) says that to provide the best information on one's mobile site, librarians should review their library's mission and the various services they want to highlight.(p. 237)

A similar application to what UTP needs is the Mobile Digital Library in the National Library of Norway. According to Høivik (2011) "The National Library has a varied and extensive collection of Norway's documentary heritage dating back to the fourteenth century." (p.1).Known as a "memory bank", the National Library of Norway's Management is introducing a new system to digitalize all the information within the library, which users will be able to access through website.

This project aims to develop a visual web site prototype – m.nb.no. It will be accessible and designed for mobile phone and PDA users and will be based on the www.nb.no web site.(Høivik,2011, p.3). It will make use of the technology available in the market to improve the services provided by the library and reach their goal to be the pioneer as multimedia knowledge base in within Europe. This application shall enable the user to pull information from the portal database and also push their data into the database. The website designed for mobile devices will include special layout and content to sustain PDAs and mobiles specifications.

As stated earlier in this document, UTP has implemented PRECISE System, which a web portal is linked to the IRC website, which enables the users to register, and from which registered users can access to the IRC database to check books available

and renew book availability online. This system is also responsible for alerting users through email when the book is overdue when the due date is approaching. According to the specifications defined by IRC management the system should provide a mobile extension of the website, to enable the users to access to the website through their smartphones.

Through the review presented above, it is certain to affirm that mobile library services are one of the trends in technology on regards to m-learning and that its implementation in UTP is a need that can improve IRC services delivery and interaction with students.

CHAPTER 3
METHODOLOGY

3.1   Research Methodology

For this project the research was done using both quantitative and qualitative methods. In order to understand students' behavior towards IRC PRECISE System and m-library services an online questionnaire was distributed to a total of ninety five (95) students; an interview was conducted with one librarian, which identified the most common issues raised by UTP students when it comes to IRC services and efficiency.

The interview followed a semi-structured format, whereby certain questions were already pre-defined, while others were formulated at the time of the interview. The interview was recorded for better study of the content, and to avoid any type of information loss.

Apart from interview that have been specified above, an online survey was answered by students, independently of their academic level in UTP, meaning this questionnaire was available for foundation, undergraduate, masters students. It is important to state that although the implementation of this System is to benefit all students, it was not distributed to the IRC staff, because it was exclusively to gather students' feedback, and to understand in which area they think the IRC PRECISE portal can be improved.

This study uses both qualitative and quantitative approach, to level out the data that was gathered in survey with the detailed information collected during the Interview.

3.2 Software Development Life Cycle

The development of this system follows Waterfall model. To ensure that all the requirements are gathered and that the proposed system follows the customer's needs, the requirement phase is very important, it also defines the scope of work and time for the implementation. This phase also defines the functional and technical specifications of the final product, and it is used for the development stage.

The design phase follows, where based on the requirements, a prototype is created and the whole System layout is designed and once agreed upon, it passes to the next stage.

Once the development and implementation is complete, the next step is testing to ensure that there is no hidden error, which was left unsolved by the developers. This stage is also important for maintenance which is the next stage of the process that ensures that the system still works according to the specifications.
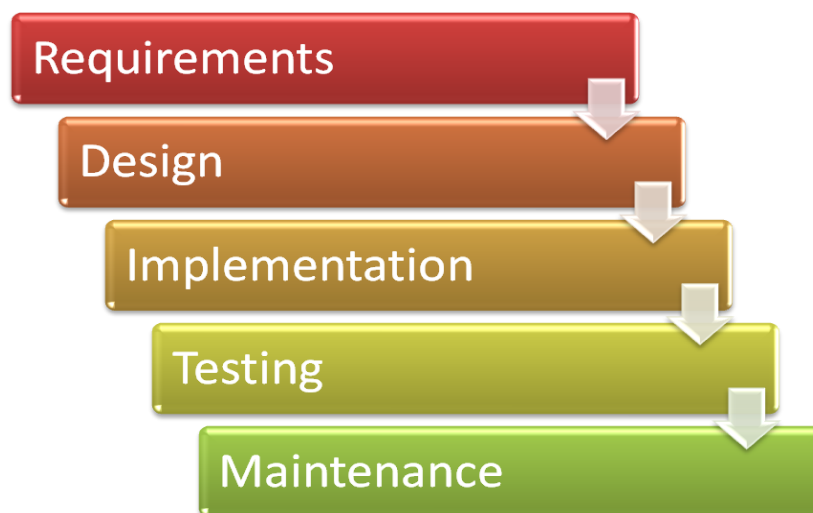
Figure 1 Waterfall Model

3.3   Project phases and activities

The project is mainly divided into 2 phases: FYP I and FYP II. FYP II is the continuity of FYP I, although certain activities will be done again, only to refine and finalize the Gantt chart.

Project activities are divided into 4 main phases:

- Planning: This phase is characterized by requirements gathering, through interview sessions with IRC representatives and survey questionnaires for students. It also includes the literature review. It is the most critical phase of the project, because it helps defining the project scope of work and timeline for milestones. If the requirements of the project are not correct consequently the final product will not fulfill users' expectation.

- Analysis: During this phase, results from surveys and interviews are analyzed. Activities for this phase include System modules definition.

- Design: In this phase the system features and flow is designed. All system's flow charts are design to help in the prototype development. Activities scheduled for this phase are flowchart and system layout definition and design, and prototype creation.

- Implementation: During this phase the actual system is developed, and all modules defined during the requirements gathering phase are integrated in the System.

- Testing: Every time a certain portion of the application is ready it goes automatically for testing, to ensure that there are no bugs that can affect the next phase; however the final testing shall be conducted once the system is ready, whereby other students will be asked to test the application and give feedback.

FYP I was more focused on Planning and Analysis Processes, Design will be initialized but completed in FYP II. FYP II is more focused on the development of the prototype and also testing.

3.4 Gantt chart

3.4.1 FYP I activities

The table below shows the timeline for the completion of FYP I. It also presents the Gantt chart for key milestones and project activities that will be completed throughout the project.

TABLE 1 FYP I Gantt chart

FYP 1 Activities	Weeks												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Project Proposal/ Planning	██	██	██	██									
Prepare Project Proposal		▓	▓										
Meeting with supervisor			▓	▓									
Topic approval				▓									
Extended Proposal				██	██	██							
Literature review				▓	▓	▓							
Write Abstract						▓							
Problem statement, objective and SoW				▓	▓	▓							
Methodology definition					▓	▓							
Submit Extended Proposal to SV						▓							
Proposal Defense							██	██	██				
Prepare Proposal Defense							▓	▓	▓				
Proposal Defense									▓				
Interim Report							██	██	██	██	██		
Prepare survey							▓	▓					
Interview Sessions							▓	▓	▓				
Organize results and								▓	▓	▓			

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Findings									▨	▨	▨			
Prepare Interim Report										▨	▨	▨		
Submit Interim report												▨		

■	Project Deliverables
▨	Project activities
▨	Milestones

3.4.2 FYP II activities

The following Gantt chart presents the activities planned for the implementation of FYP II. This phase of the project is dedicated to the development of the final product (functional prototype).

TABLE 2 FYP II Gantt chart

FYP II activities	Weeks													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Development	■	■	■	■	■	■	■	■						
User Interface and layout development		▨	▨	▨	▨	▨	▨							
Database connection				▨	▨	▨	▨							
Progress Report							▨							
SMS notification								■	■	■	■			
Connection to the SMS server								▨	▨	▨	▨	▨		
Final prototype											▨			
Testing									■	■	■	■		
Testing and bug fixing									▨	▨	▨	▨		

■	Project Development Phases
▨	Project activities
▨	Milestones

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3.5   Key Milestones

3.5.1   FYP I Key Milestones

The key milestones for FYP I were:

TABLE 3 FYP I milestones

Key Milestones	Timeline
Project Proposal	Week 4
Extended Proposal	Week 6
Proposal Defence	Week 9
Interim Report	Week 11

3.5.2   FYP II Key Milestones

The key milestones for FYP II are as follows:

TABLE 4 Key Milestones

Key Milestones	Timeline
Project Progress Report	Week 7
Pre-EDX	Week 10
Submission of Dissertation (soft bound)	Week 11
SEDEX	Week 12

Oral presentation (Viva)	Week 13
Submission of project dissertation (Hard Bound)	Week 15
Submission of technical paper	Week 15

3.6   Tools

Before discussing the tools used for the implementation of this project, it is important to state that website is specifically designed for iPhone mobile phones. Due to the fact that the tools used offer a proper user interface consistency for iPhone users. The development of the IRC m-mobile services was done using HTML concepts, and iWebKit was used to provide a suitable interface for the application since iWebKit is a web toolkit designed to create iPhone and iPod touch compatible websites and web application.

3.6.1   Software

To store the information on students, books, journals and SMS server; MySql is used as the database for this application, through a local web server: Xampp 1.8. In order to connect the HTML code and the database PHP was used. In terms of technology this application used the basic concepts of web programming, not to forget the software used to emulate the system: Electric Mobile Simulator.

3.6.2   Ozeki NG

This software was downloaded from Ozeki NG official website, and installed following the steps provided. It was used to connect to the database in order to gather the information users' information such as phone number, message to be sent and others. Two tables were created in the application database (in Xampp) in order to allow the Ozeki to pull the information and send the SMS to any mobile number.
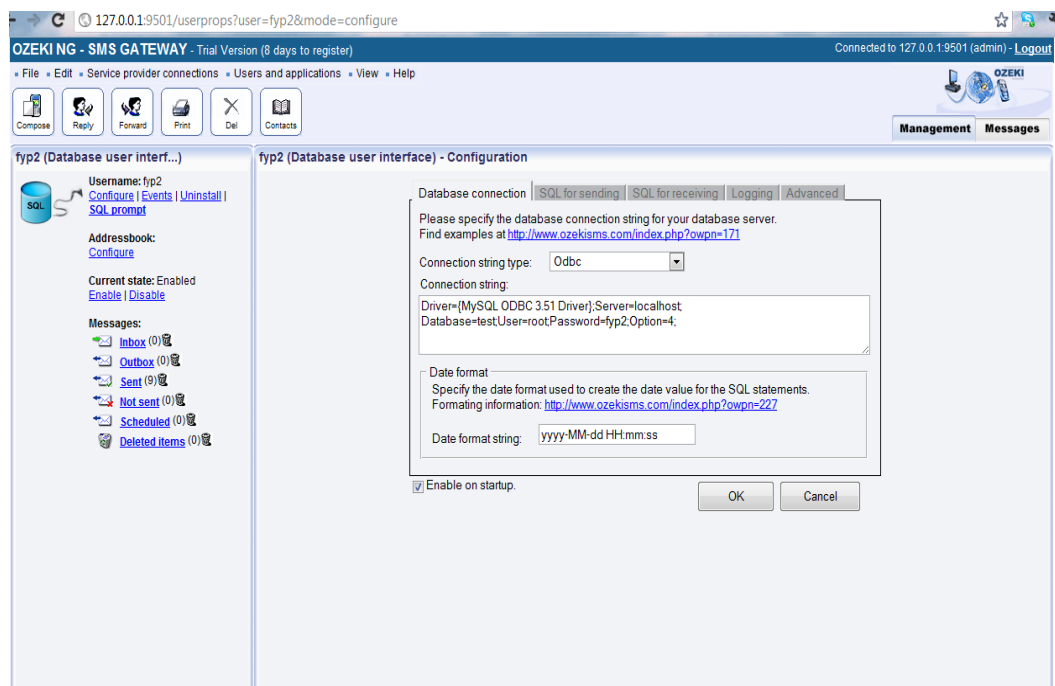

Figure 2 OZEKI NG- SMS gateway

3.6.3 Electric Mobile Simulator

This software was used to simulate the behavior of the system on an iPhone and also on an iPad. It is important to state that the same behavior was observed when it was tested on the real devices, including Android based mobile phone.

Figure 3 Electric Mobile Simulator.

3.7   Hardware

In order to test the SMS server a Samsung mobile phone was used, however it could have been any other type of mobile except Symbian based Operating System mobiles. The mobile phone was connected to the PC and configured in Ozeki NG SMS gateway. The SMS sending process includes, gathering the information from the database (in Xampp), connect to the Samsung SMSC and send it to the receiver phone number defined in the database.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Data gathering and Analysis

As stated in the methodology section, data gathering for this project was done using qualitative and quantitative approaches, and as such the findings are as follows:

4.1.1 Interview

An interview was conducted with Ms Rohil Amani Ismal in charge of Customer Services Department in the IRC. When asked about problems regarding the return process, she agreed that during examination slip collection and Results announcement, the number of students approaching the IRC normally increases considerable. She went further stating that, they use the option to block students' results and examination slips, because otherwise students would not return books.

When asked about the idea to implement m-library for the IRC and notification services for the students she stated that this procedure is not only implemented in UTP but also in other universities around Malaysia and around the world. In her interview, Ms Rohil emphasized how important such types of systems are for students and also for the library itself, whereby students feel more comfortable using library's services and resources through their mobile.

The idea of the implementation of the system in UTP was greatly appreciated and some suggestions were made, those shall be presented on the recommendation section of this document.

4.1.2 Survey

An online survey was conducted with the sole objective to know the satisfaction levels of UTP students on regards to library notification system and also to study their readiness for m-library system more specifically with regards to mobile notification. This helped understanding students' behavior and response to this system, and the overall interaction that they have so far with the library, by identifying their level of exposure with the current system it gave a solid base to predict their readiness to the proposed system.

Respondents were asked to reply a total of 10 questions, which aimed to first identify their level of study in UTP due to the fact that some students might have more necessity to rely on the library more than others; and others were related to the services available in the IRC and the problems faced on regards to fines, and also how this system can help improve that.

Due to the fact that this system is to be opened to all UTP students, and also staff, this survey was extended to all students levels in UTP, namely Foundation, Undergraduate and Postgraduate students. A total number of 95 students completed the survey; from the total sample 19 were foundation, 51 undergraduate and the other 25 Postgraduate students from all faculties.
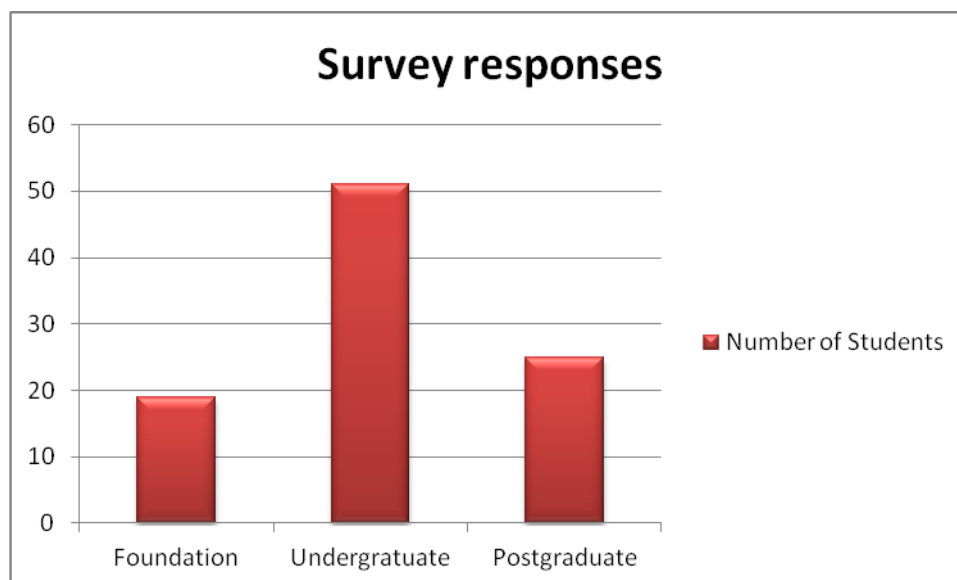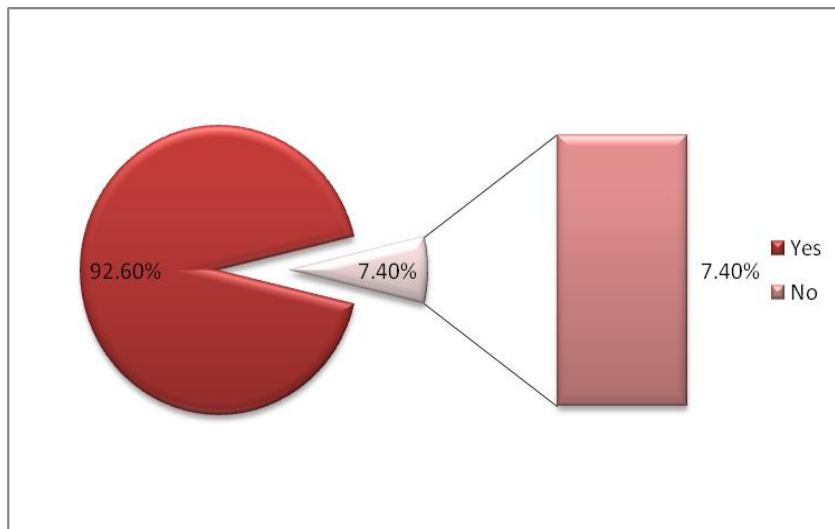
Figure 4 Survey respondents

When asked about the frequency in which respondents request books from the IRC, 24.2% answered that they request books on a regular basis, 42.2% sometimes against 31.6% which seldom requests books from the IRC. If we analyze the results we can conclude that out of the overall population sample used in the survey all have at least once used IRC's books, and majority use them on a regular basis .

Further in the survey majority of the students would like to access the library from their smartphones, and be able to see the students' profile, books which they have requested and the possible fines.

Eighty eight students which correspond to 92.6% of the total survey respondents believe that mobile notification would help return books to the IRC within the established time, while 7 respondents which correspond to 7.4% of the total sample, do not believe that the problem behind the late books submission is regarding notifications, they believe that email notification is enough to remind students to return books to the IRC.

Figure 5 Notification influence

This proves that although majority of the respondents accept the importance of the SMS notification in order to return the books on time, this is measure is not enough.

As the chart below shows, from the respondents of the survey 16% does not want to receive SMS notification from the library, while 84% agree that receiving SMS notification will help them interact with IRC, and possible ensure that the books are delivered within the time constrain.
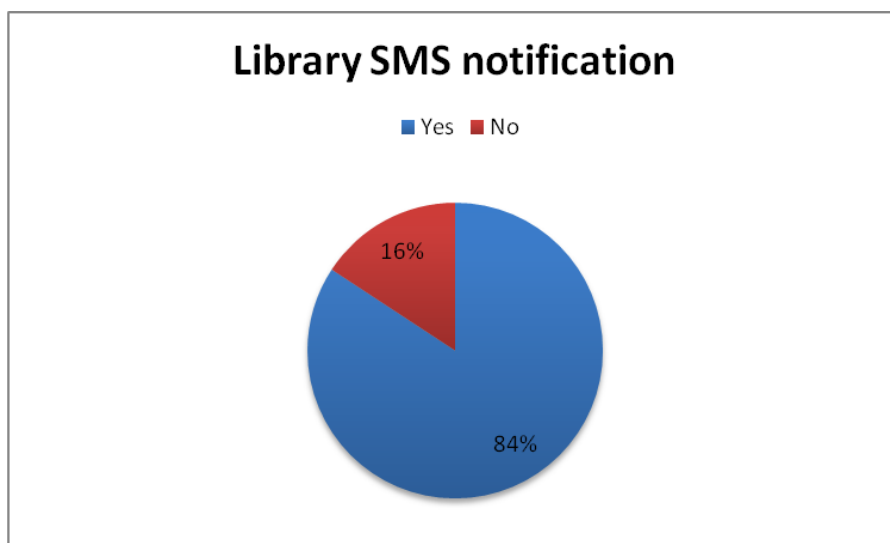
Figure 6 Library SMS notification

4.1.3   Discussion

From the survey replies presented above, we can concluded that UTP students believe that the m-library concept should be implemented in UTP, and also that the integration of SMS notification does not cause problems with regards to their availability, which leads to the conclusion that SMS from the library system are welcomed to our users. It is important to state, that settings with regards to the SMS notification can be adjusted according to the students needs.

This survey helped identifying the readiness of the students for this type of system, which was positive; from their responses we can conclude that the overall idea of m-library is greatly appreciated, not to mention that with the current mobile internet availability students will not have to rely on their computers to see all information that this system shall provide through mobile

Few aspects are to consider, especially on the services to be implemented and the settings that users shall be offered, although the mobile website has the objective of enhancing students' relationship with the IRC, not all things available on the PC website can be displayed on mobile, not to forget the size of the devices.

4.2   Prototype

The following figures illustrate the prototype of the system and the work that has been completed. Before further discussions on the prototype function specifications of the system shall be presented. Some features were introduced into the system after a demo with the IRC representative in charge of the Digital library.

4.2.1 Functional specifications

- **Library Catalog-** This function enables the user to search for available items in the library; the options in this system are for books and journals. It provides the location of the books/ journals, the availability and also the availability of an e-book. If the e-book is available, the user can read it though their mobile devices.

- **New arrivals-** This option enables the user to identify new arrivals, organized in descending order of the date in which it was uploaded in the system. This option is available for books and also journals.

- **Announcements –**users are enabled to view announcements posted by the IRC in descending order.

- **Login –** Only UTP students or staff have access to this part, in order to view personal information and information regarding items they have requested; after successful login in the system, this option is substituted by Student Profile. A more comprehensive description of this function shall be provided under Student profile section.

- **Opening hours-** Provides information on regards to the library opening hours, or any updates that might affect the library functionality though out the year, specific seasons such as study weeks, holidays are specified in this section.

- **Contact –** Provides basic information contact to enable students/users to contact UTP IRC, such as phone number, email address and physical address.

- **Student Profile-** as stated in the login option, only UTP students or staff are enabled to access this part of the website, through their login details. If the login details are not correctly entered, the access will be denied to them. If

the login details are accurate the user is then redirected to the Student Prolife page. From this page the user can browse through:
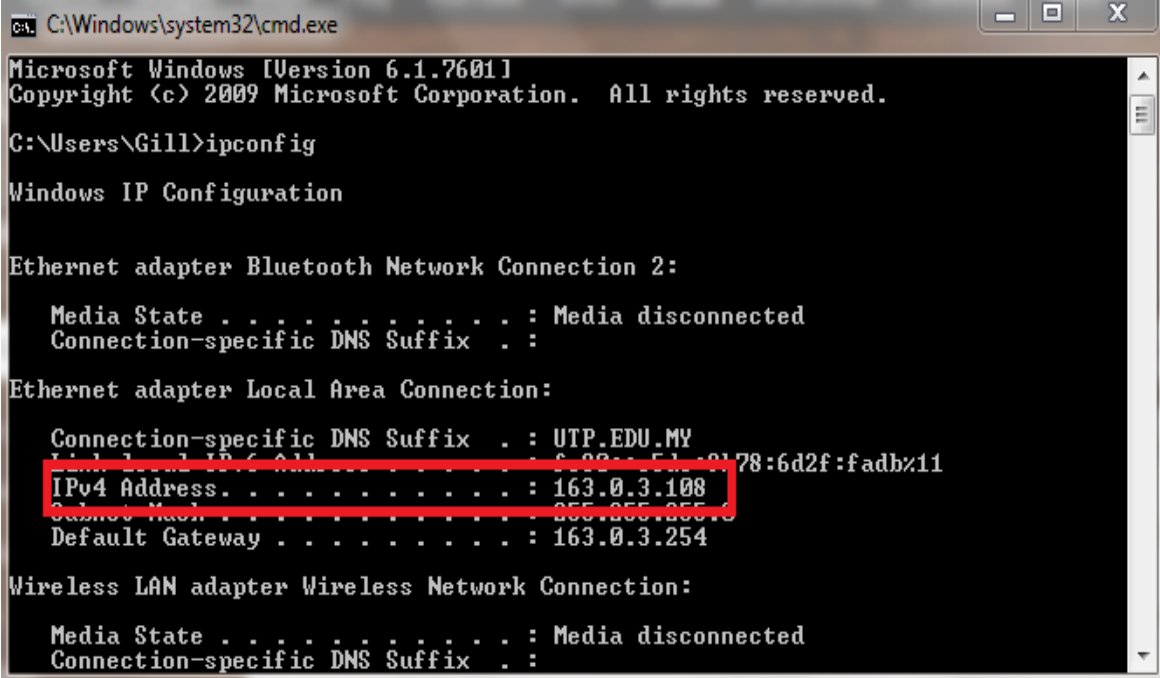
- o **Student details:** Provides all students personal information, such as name, matric number, email address and phone number. This also provides the option to change certain information which is no longer accurate.

- o **Books:** This shows the items that the user has requested, the particular information such as request date, overdue date, and whether it is overdue or still within the time; if the book is not overdue, the user has the option to extend the overdue date, through renewal services available in the page, this option provides extra 30days to the user overdue date; however the renewal services can only be used once. If the books is already overdue, the total fines accumulated for the book are displayed and if the user has more than one book it also shows the information for the other books.

- o **Change of information:** This option enables the user to change the email address, phone number and password.

- o **SMS notification:** Using OzekiNG SMS server, if the difference between the current date and the overdue date is equal to 7days, the user shall be notified through SMS, which the overdue date is approaching.

4.2.2 Experimentation

Apart from the mobile simulator used to test the website, devices such as iPad and iPhone were also used for testing. Android based phones were used throughout the testing phase. Since the development was used using a local web server, in order to connect the devices with the server, certain steps were followed:

Step 1: Connect both the PC and the device (mobile phone or tablet) to the same Network, through wireless connection.

Step 2: Get the PC network IP address, as showed in the figure above:

Figure 7 IP address

Step 3: Type the PC IP address in the URL section of the web browser, with the specific files directory:
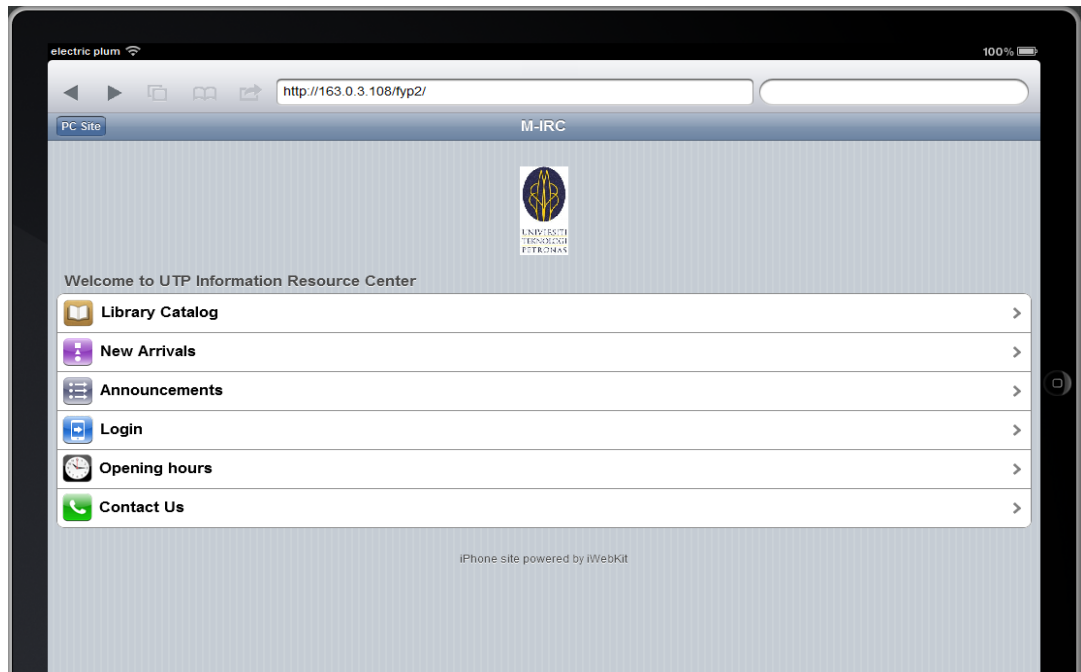
Figure 8 iPad connection
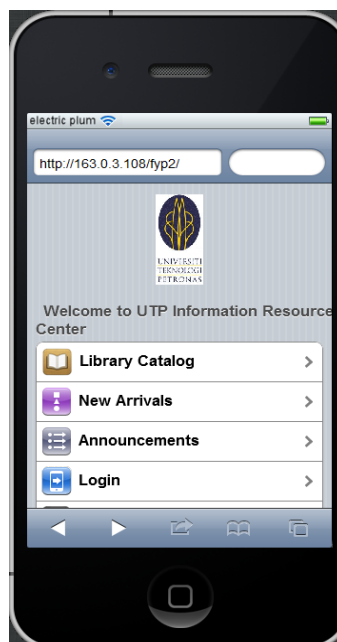
Figure 9 iPhone connection

Once users type the website URL they are redirected to the website home page; from there six different options are presented, the following figures illustrate how the users can check for book/journals availability at the IRC and also is specific location.

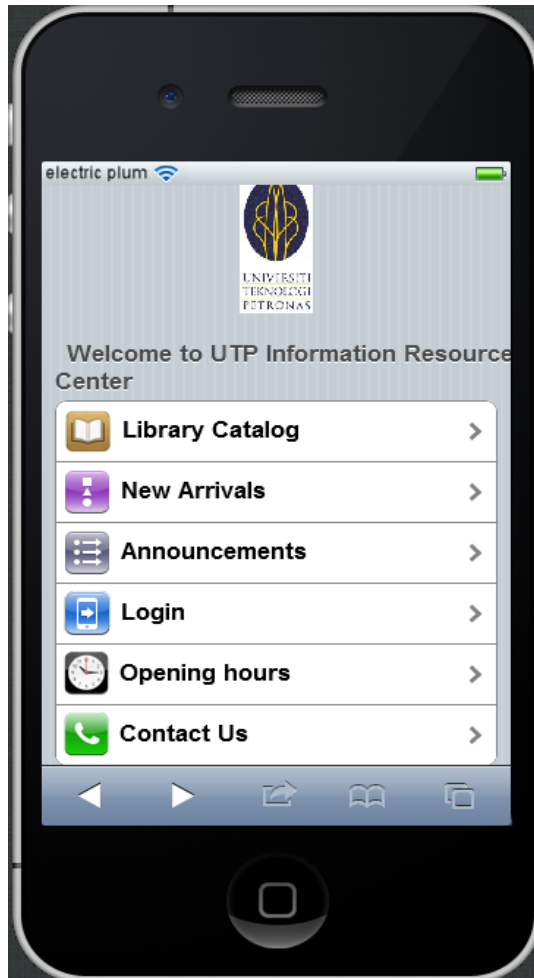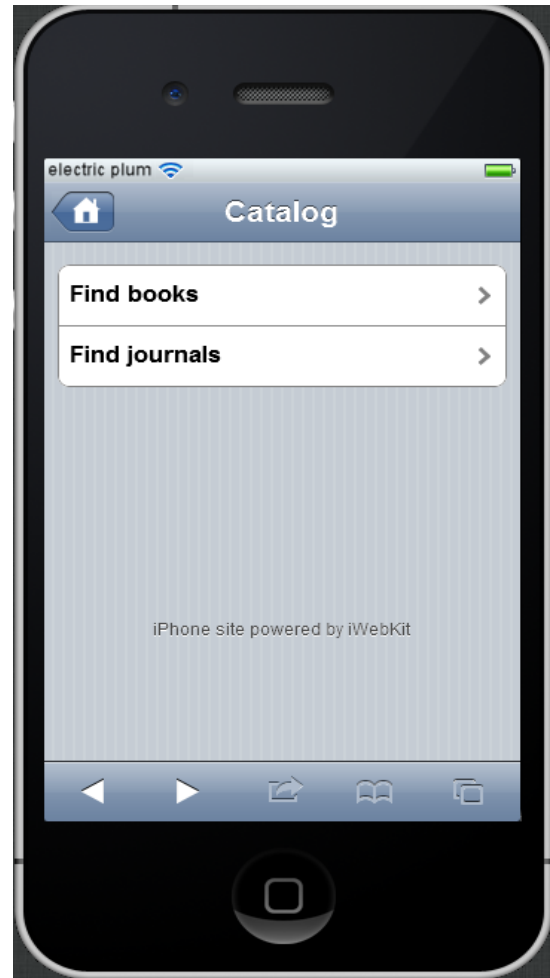
Figure 10 Home   **Figure 11 Library Catalog**

From the catalog page, users can choose whether to see books or journals, and through both of the following options are the same. If the book is available online

the user will be able to read it through the mobile device. As the following images will show books can be checked using author or/and titles:
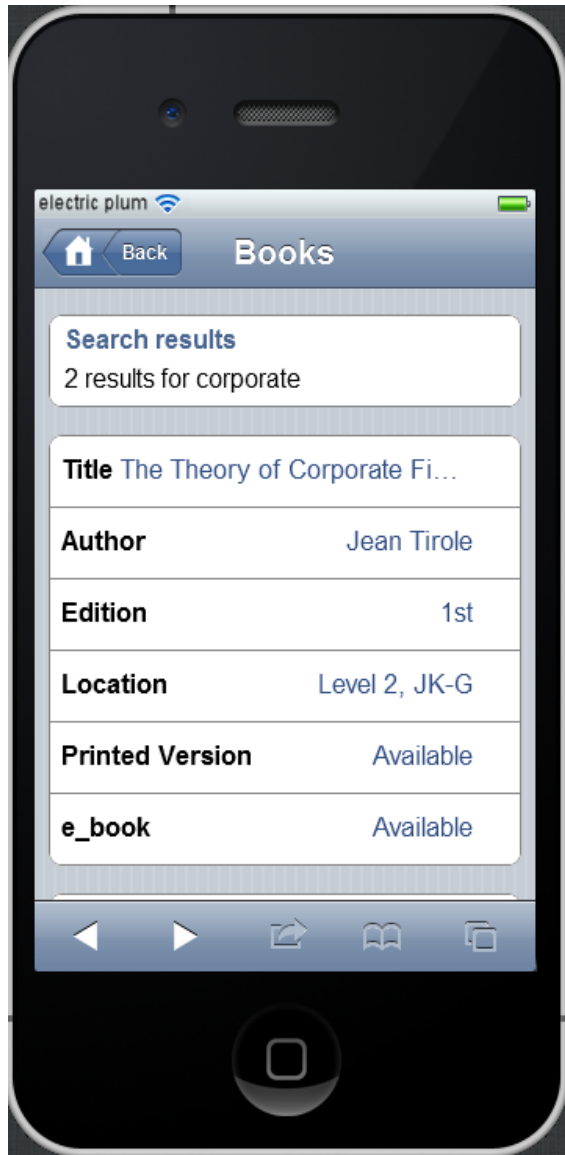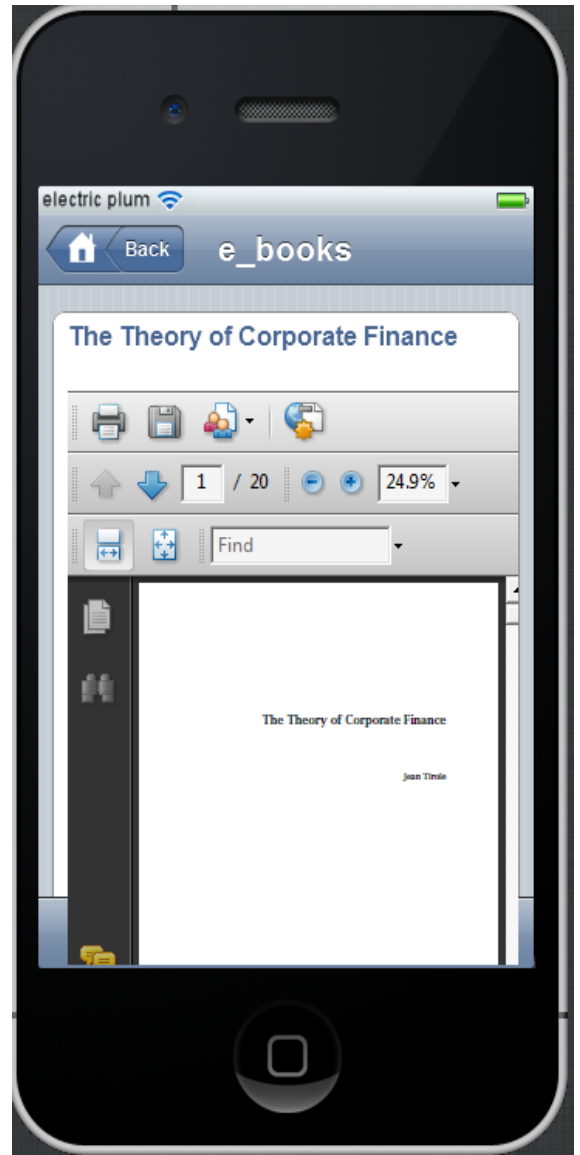

Figure 12 Book

Figure 13 e-book

From the home page the user can check the new arrivals and also new announcements from the IRC. Figure 14 shows the new arrivals displayed in

descendent order, and figure 15 shows announcements also organized from the most recent to the oldest.

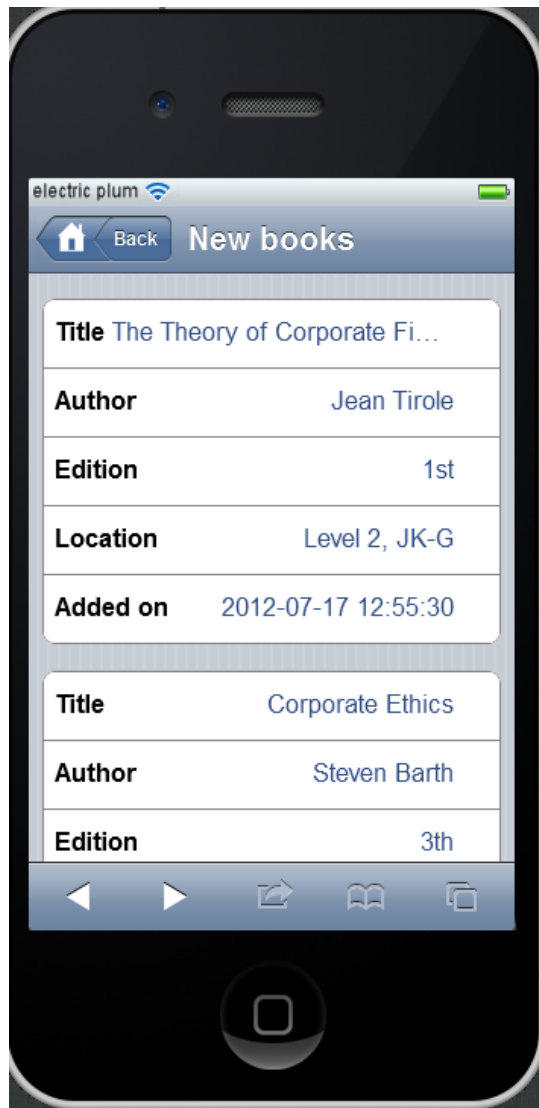**Figure 14 New arrivals**
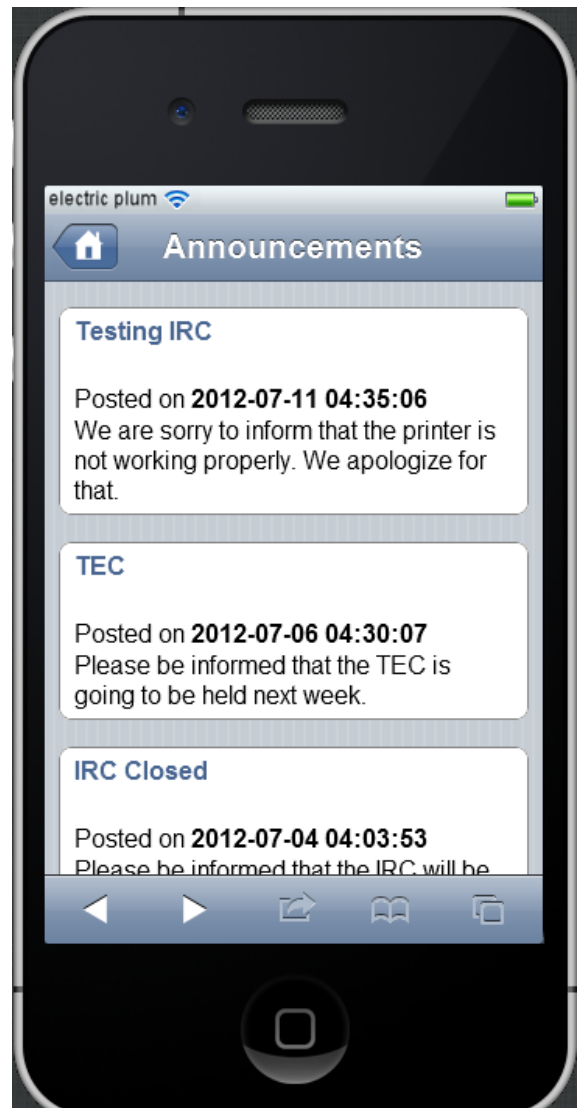
Figure 15 Announcements

If for instance the users click on opening hours they are redirected to the page displaying the operating hours of the IRC, the same goes for contacts where there the email address and phone number of the IRC are displayed followed by the physical address; please refer to figures 16 and 17.
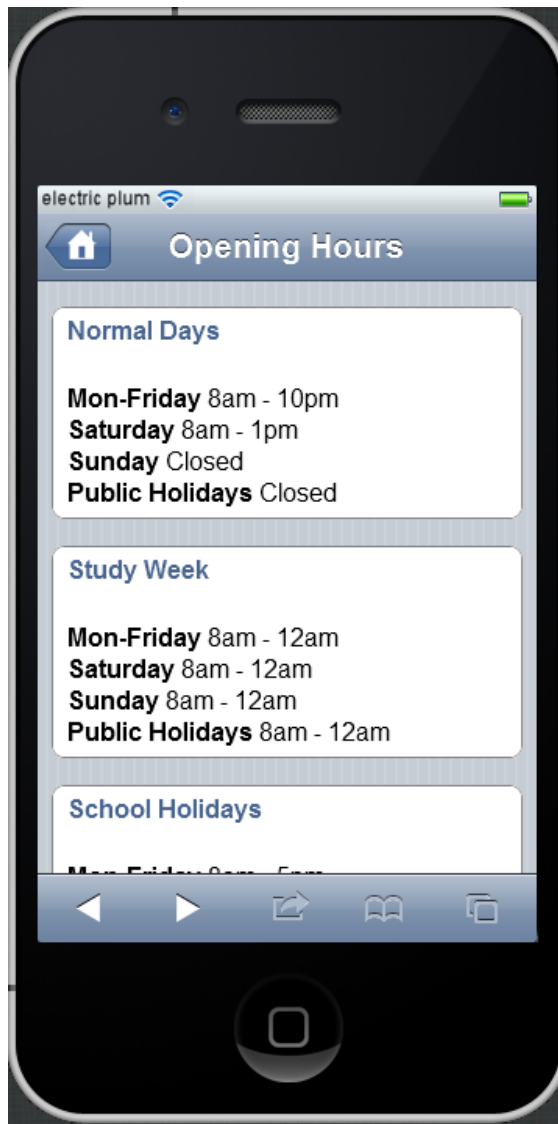
Figure 16 Operating hours
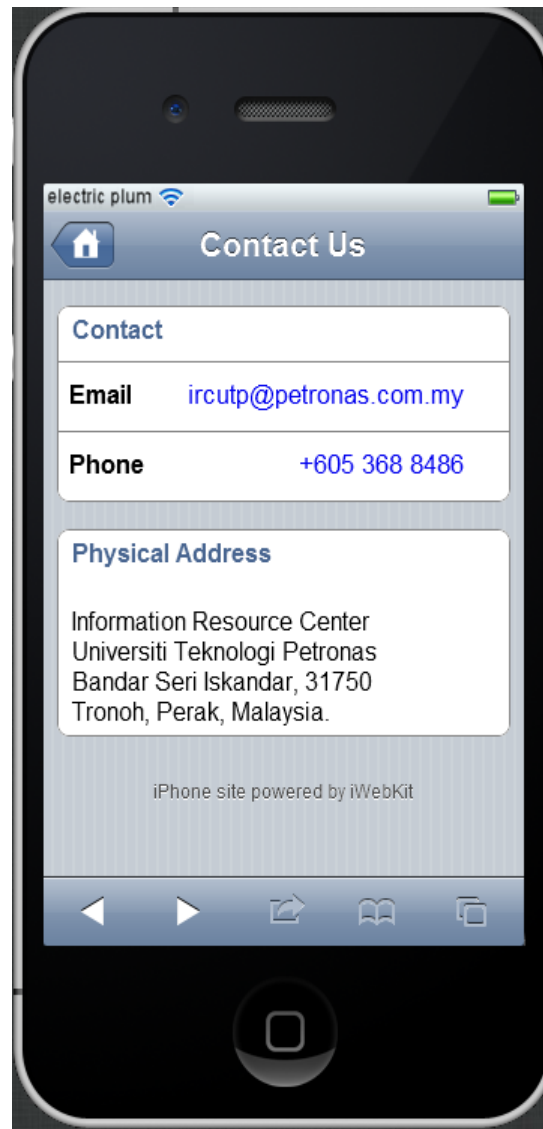
Figure 17 Contact Us

From the home page the users can access their personal information, as stated before in the document, that is only allowed to UTP current students or staff members. It is important to state that before the login the main page displays Login option, however once the user has gone through the login process; he/she is enabled to go through the student profile.

Figure 18 Login

Figure 19 Student Profile

Once the login is validated the students have the opportunity to browse through their personal information.

Apart from the personal information, users can see the books are still to be returned and whether or not they are overdue; if the latter is true the fines are displayed and at

the bottom of the page the total accumulated fine per user is displayed. If the overdue that has not been reached yet, the user has the option to renew the book, which can only be done once. The renewal service adds 30 days to the overdue date.

Figure 21 Book information
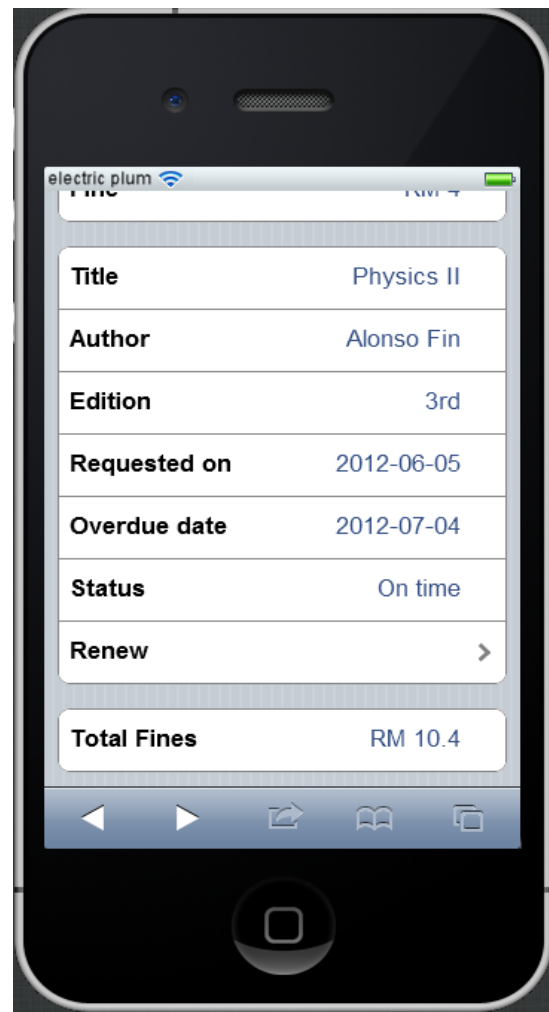
Figure 22 Fines

Apart from books details, students have access to their private information, and through the settings option they can change their password, email or phone number; which is very practical if for any reason one of this info is either missing or wrong.

Figure 23 Settings

The following images illustrate how users can change their password.

Figure 24 Change password
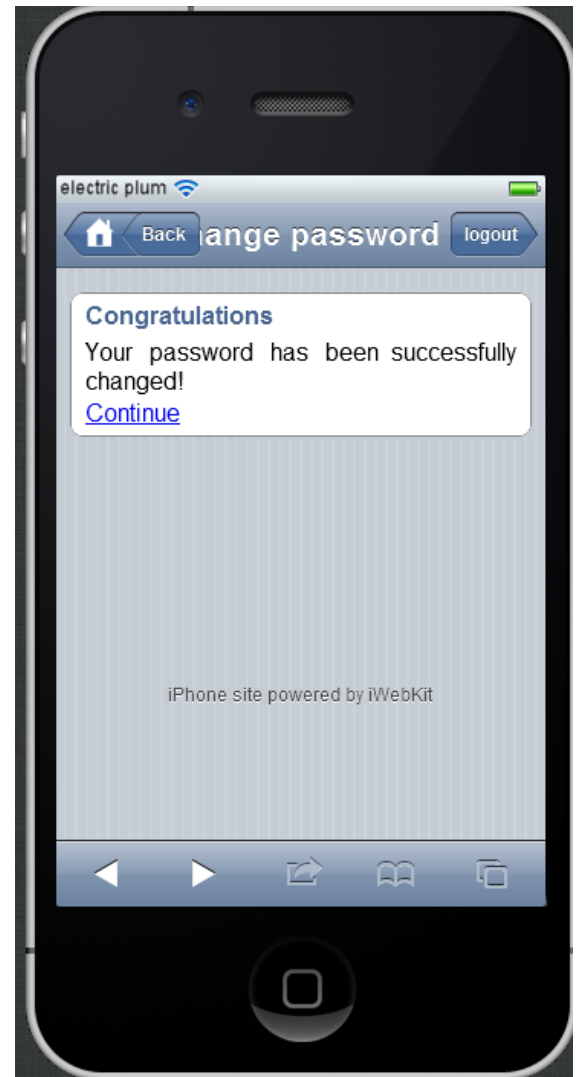
Figure 25 Successful password change

The same process is used to change the email and phone number. It is important to keep accurate information, because notifications will be sent through email and SMS.

CHAPTER 5
CONCLUSION

5.1 Relevance to the objectives

Education Systems are moving forward alongside with new technologies; mobile web based applications have been increasing for the past decade, improving communication channels through the internet between libraries and students.

We can conclude that m-library creates a platform for interaction between libraries and students. Mobile library services are one of the trends in technology on regards to m-learning and that its implementation in UTP is a need that can improve IRC services delivery and interaction with students.

The main contribution of this project is the platform which it will provide that UTP needs to improve their information service.

5.2 Recommendation

As stated earlier in this document, the scope of study defined for this project is relatively small in order to fulfill the time constrains, but there are some features, that should be implemented in future such as:

- Enable students to reserve book. Accessing to the IRC through their mobiles, students should be enabled to reserve books, in case they have been requested by another user, in this order of ideas, once the books has been returned to the IRC students would receive a mobile notification, in order to go and get the book.
- Enable students to access to Thesis through their mobile phones, subjected to certain charges. This would enable students preparing their dissertation for

bachelor degree to identify projects that have already been implemented in UTP, for postgraduates, it would work as a platform that would provide basic background work for their Thesis. This feature would only enable students to ready the information through their mobile, not to download to avoid possible plagiarism.

- Since this project was done using OzekiNG SMS server to test the function; it would be appropriate to connect to a SMS provider to enable automatic SMS notification; this function is the same used for banks and other systems that require SMS notification.

From the points presented above, it can be concluded that the implementation of m-library still have a vast room for improvement, not only on regards to the points that have been mentioned in this document, but also with the advance technology that is daily being implemented, greater things can still be done, to use technology on education systems' improvement.

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APPENDIX

Technical Paper

IRC Mobile Library Services

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Abstract—**The evolution of mobile technology had allowed the introduction of mobile leaning (m-learning). Based on this technology, many institutions have been implementing digital library systems and more specifically mobile library, better known as m-library. The paper discusses and compares the digital library systems available in the market, and present a proposed system to be implemented by UTP. The study was conducted through an interview with a UTP's IRC executive and a survey answered by ninety-five (95) students which gather feedback of the level of satisfaction on IRC services and issues faced with regards to books return and how SMS reminders can help eradicating those issues.**

Keywords— **IRC, Mobile library, SMS notifications, UTP**

1. INTRODUCTION

According to Seadle and Greifeneder (2007) a digital library consists of documents in digital form that are handled like traditional library documents in standard processes (collecting, cataloging, and providing access) and that are made available online for users via catalog records. Information that is physically stored in the library, such as books, journals and CDs are available to the users through a website. Users are able to browse through the library website, check the available books and other activities according to the website. The Information Resource Centre (IRC) of Universiti Teknolgi PETRONAS (UTP) is currently using the Petroleum Resource Centre and Information Service (PRECISE) online system connected to the library website. Through PRECISE, users are able to login, search for books; renew books, return due date and others.

1.1. Problem statement

Based on the feedback from the interview and the survey, it found the following points constituted the problem faced by the both stakeholders (librarians and students) of the IRC:

- Lack of reliable mobile communication channel between the IRC and its customers;
- Excessive fines accumulated by students;
- Long queues at the IRC during examination slip collection days resulting from the fines accumulated by students.

1.2. Objectives

The main objective of this study address the problem faced by the students and librarians, through a development of an mobile website, connected to the current PRECISE web portal to enhance the accessibility of the Information System of the UTP IRC. The mobile accessibility of the PRECISE will yield to the following advantages:

- Reduced queuing during at the Finance department examination slip period regarding IRC fines, as the students will be enable to check their outstanding fines through the portal by sending SMS reminders once a book due date approaches.
- Keep students updated on books available and provide book renewal services.

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1.3. Scope of study

The scope of this study comprises of this points:

- Enable users to access to the library system through their smartphones, to check availability of books and journals
- Enable students to check using their smartphones the items that they have requested, the due date and fines for possible overdue books and book renewal
- Update personal information such as email address, password and phone number
- Send SMS notification when a book overdue date is approaching

1.4. Relevance of the study

Despite having a portal, that PRECISE, UTP students still face problems, such as overdue of books, which results in fines. That is because the students rarely visit this portal and it is only accessible with the university's network. Therefore, it is relevant to propose an implementation of the m-library system as it would help resolve the difficulties faced by the students. As shown in the literature review, other universities have also implemented similar systems, therefore UTP should follow suite.

2. LITERATURE REVIEW

Throughout the past decades mobile devices technology has developed extraordinarily, being currently one of the biggest trends in the technology market. Mobile devices include laptops, tablets such as iPads, and mobile phones, such as iPhones, Blackberry and other range of smartphones.

This study focuses on mobile phones development and the impact that it is continuously bringing to the world, specifically to educational sector. A smartphone such as Blueberry or iPhone, provide to its users almost all the basic features that can be found on a computer. Its functions go beyond messaging, voice and video calling and others, to internet browsing, online chatting and social networking. Mobile communication is a fast-growing medium in terms of penetration and usage. (Jenkins, 2006)

According to Smura, Kivi and Toyli (2009) mobiles phones have become an inseparable part of daily file and majority of the people carry them all the time. Furthermore, new features are introduced into the mobile phones to complement and expand the use of various internet services.

Suki (2007) claims that in Malaysian society, heavy mobile users have become increasingly reliant on mobile phones, to a point where many of them no longer have a traditional home landline and have elected to have just a mobile phone with a great plan. This is because mobile phones are small, reliable, and convenient devices that can provide the full spectrum of information and entertainment options to users.

University students are are known to be avid followers of the evolution of technology, fact being that almost all university students own a mobile phone and a good percentage is going for or already has a smartphone. From Suki's (2007) study, it is seen found that the majority of students with a bachelor's degree, that is 94.3 per cent, of the study's respondents, preferred to buy new mobile phones or exchange old mobile phones for new mobile phones. The purchase of new phones or exchange of old to new phones is driven by the fact that new phones offer wide range of items that are of interest to a variety of ages and demographics, providing an engaging means to be entertained and interact among a circle of friends. Suki's research showed that about 98 per cent of the respondents owned a mobile phone and the rest own a PDA/pocket PC/palmtop or smartphone.The mobile operators offer internet connection to its subscribers, increasing users' interest on internet services due to the mobility offered by smartphones and other type of mobile devices. Smura et al. (2009) stated that "Web browsing on mobile devices has attracted the interest of many academics". With new technologies arising daily the educational system is embracing the opportunity to improve its learning methods by introducing e-learning Systems and solutions and m-learning which can be accessed through smartphones.

Many researchers have been working, in the past years, to identify students' behavior and response to mobile web based application a good example is the Mobile Student

Information System (MSIS) for providing relevant information to students on a mobile platform (Asif and Krogstie, 2010). This study concludes that students respond positively to mobile-based application, which can help them keep track of their studies.

It is now obvious to identify the influence that mobile phones have in learning process, and how it can improve educational systems available in the market. However, the major objective of this study is the implementation of a mobile-based digital library service. Therefore, the next paragraphs present and discuss the implementation of digital libraries in other universities around the world.

The University of Iowa City in conjunction with the Iowa City's designation as UNESCO "City of Literature", developed a digital library, in a research project by Hsieh et al (2011). The project was developed with the belief that it will encourages undergraduate and graduate research, with an emphasis on interdisciplinary and collaborative practice, while recognizing the unique potential of mobile devices for public scholarship and civic engagement. The development of the web-based application received positive feedback from the users and through the pilot, the research team was able to identify the strengths and weakness of their system. Furthermore, to improve the system interaction with the users, a mobile application for various mobiles platforms was suggested (Hsieh et al, 2011)

The University of Edinburgh, Edinburgh in UK initiated a project to develop a contemporary User Experience (UX) of digital libraries through the technological development and evaluation framework. The project aims to enhance an existing digital library with state-of-the art technologies and investigate new contexts in which digital library services can be diffused (Paterson and Low, 2011).

According to Paterson et al (2011), California Digital Library (CDL) embarked on a mobile user research project that culminated in a mobile version of California Digital Library's website . CDL research team found that mobile users accessed the library services to find already known materials or quick pieces of information, using online databases and catalogues on their mobile

devices. This proves that increased interest in mobile library, which is associated with the increasing ownership of smartphones among the students. Jones et al (2008) highlighted on the use of Short Message Services (SMS) for educational purposes, such as sending reminders to students on academic activities. Jones et al study also showed that students valued the SMS reminders as it served as support in their time management. This was also found by a research conducted at University of Huddersfield, to study students feedback and behavior on regards to mobile digital services, showed that the use of SMS reminders are also creeping into education in general. Moreover, schools, colleges, and universities experimenting with text messages to remind students about deadlines and more. (Walsh ,2010).

In Ryerson University-Library, Toronto, Canada, a research on mobile library convenience concluded that the next two most popular library services desired for mobile devices were the catalogue and borrower record options. (Wilson and McCarthy, 2010).

Cao et al (2006) defend that a key benefit of m - learning is its potential for increasing productivity by making learning available anywhere, anytime. However, a concern arises when it comes to m - library is how to fit all the information in the screen. For that, Murray (2010) says that to provide the best information on one's mobile site, librarians should review their library's mission and the various services they want to highlight

Through, the review presented above, it is certain to affirm that mobile library services are one of the trends in technology on regards to m - learning, and coupled with the SMS alert system, its implementation in UTP is a need and hence improve IRC services delivery and interaction with students.

3. METHODOLOGY

3.1. Research methodology

This research was done using both quantitative and qualitative methods. In order to understand students' behavior towards IRC PRECISE system and m - library services an online questionnaire was distributed to a total of ninety five (95) students; an interview was conducted with one librarian, which identified the most common issues raised by UTP

students when it comes to IRC services and efficiency.

The interview followed a semi-structured format, whereby certain questions were already pre-defined, while others were formulated at the time of the interview. The interview was recorded for better study of the content, and to avoid any type of information loss.

3.2. Tools

The development of the IRC m - mobile services was done using HTML concepts. A developer's toolkit, iWebKit was used to create mobile application that provides a suitable graphical user interface. Note that the created application was limited to iPhone and iPod touch compatible website, because the iWebKit is a web toolkit designed to create iPhone and iPod applications.

To store the information on students, books, journals and SMS server; MySql is used as the database for this application, through a local web server: Xampp 1.8. PHP was used to connected the HTML code and the database.. The development of the application used basic concepts of web programming and easily available software, such the Electronic Mobile Simulator. This Electronic Mobile Simulator software was downloaded from Ozeki NG official website and installed following the steps provided. It is connect to the database in order to gather the users' information such as phone number, messages and others, which are stored in database consisting of two (2) tables created using in Xampp. The Ozeki to pulls information from the tables and sends the SMS to any mobile number.

The SMS server was tested using Samsung mobile phone, however, it could have been any other type of mobile except Symbian based operating system mobiles. The mobile phone was connected to the personal computer and configured using the Ozeki NG SMS gateway. The SMS sending process includes, gathering the information from the database (in Xampp), connect to the Samsung SMSC and send it to the receiver phone number defined in the database.

4. RESULTS AND DISCUSSION

4.1. Data gathering and Analysis

As stated in the methodology section, data gathering for this project was done using qualitative and quantitative approaches, and as such, the findings are as follows:

4.1.1. Interview

The interview was conducted with Ms Rohil Amani Ismal, responsible for the Customer Services Department in the IRC. Concerning, the books return process, Ms Rohil, highlighted that students often missed the due dates, which leads to students incurring fines. However, there would be a considerable increase of returns as the exams approached, because the examination unit would withhold the examinations slips until the students have returned their books or settled their fines. When asked about problems regarding the return process, she agreed that during examination slip collection and Results announcement, the number of students approaching the IRC normally increases considerable. She went further stating that, they use the option to block students' results and examination slips, because otherwise students would not return books.

When asked about the idea to implement m-library for the IRC and notification services for the students she stated that this procedure is not only implemented in UTP but also in other universities around Malaysia and around the world. In her interview, Ms Rohil emphasized how important such types of systems are for students and also for the library itself, whereby students feel more comfortable using library's services and resources through their mobile.

4.1.2. Survey

An online survey was conducted with the sole objective to know the satisfaction levels of UTP students on regards to library notification system and also to study their readiness for m-library system more specifically with regards to mobile notification. This helped understanding students' behavior and response to this system, and the overall interaction that they have so far with the library, by identifying their level of exposure with the current system it gave a solid base to predict their readiness to the proposed system.

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When asked about the frequency in which respondents request books from the IRC, 24.2% answered that they request books on a regular basis, 42.2% sometimes against 31.6% which seldom requests books from the IRC. If we analyze the results we can conclude that out of the overall population sample used in the survey all have at least once used IRC's books, and majority use them on a regular basis .

Further in the survey majority of the students would like to access the library from their smartphones, and be able to see the students' profile, books which they have requested and the possible fines.

Eighty eight students which correspond to 92.6% of the total survey respondents believe that mobile notification would help return books to the IRC within the established time, while 7 respondents which correspond to 7.4% of the total sample, do not believe that the problem behind the late books submission is regarding notifications, they believe that email notification is enough to remind students to return books to the IRC.

As the chart below shows, from the respondents of the survey 16% does not want to receive SMS notification from the library, while 84% agree that receiving SMS notification will help them interact with IRC, and possible ensure that the books are delivered within the time constrain.
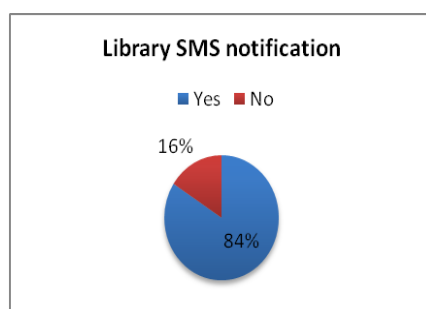
Fig. 26 Library SMS notification

4.2.   Discussion

From the survey replies presented above, we can concluded that UTP students believe that the m-library concept should be implemented in UTP, and also that the integration of SMS notification does not cause problems with regards to their availability, which leads to the conclusion that SMS from the library system are welcomed to our users. It is important to state, that settings with regards to the SMS notification can be adjusted according to the students needs.

This survey helped identifying the readiness of the students for this type of system, which was positive; from their responses we can conclude that the overall idea of m-library is greatly appreciated, not to mention that with the current mobile internet availability students will not have to rely on their computers to see all information that this system shall provide through mobile

4.3.   Prototype

a. Functional specifications

➢ **Library Catalog-** This function enables the user to search for available items in the library; the options in this system are for books and journals. It provides the location of the books/ journals, the availability and also the availability of an e-book. If the e-book is available, the user can read it though their mobile devices.

➢ **New arrivals-** This option enables the user to identify new arrivals.

➢ **Announcements –**users are enabled to view announcements posted by the IRC in descending order.

➢ **Login –** Only UTP students or staff have access to this part, in order to view personal information and information regarding items they have requested; after successful login in the system, this option is substituted by Student Profile.

➢ **Opening hours-** Provides information on regards to the library opening hours, or any updates that might affect the library functionality though out the year, specific seasons such as study weeks, holidays are specified in this section.

➢ **Contact –** Provides basic information contact to enable students/users to contact UTP IRC, such as phone number, email address and physical address.

➢ **Student Profile-** as stated in the login option, only UTP students or

staff are enabled to access this part of the website, through their login details. If the login details are not correctly entered, the access will be denied to them. If the login details are accurate the user is then redirected to the Student Prolife page. From this page the user can browse through:

➢ **Student details:** Provides all students personal information, such as name, matric number, email address and phone number.
➢ **Books:** This shows the items that the user has requested, the particular information such as request date, overdue date, and whether it is overdue or still within the time; if the book is not overdue, the user has the option to extend the overdue date, through renewal services available in the page, this option provides extra 30days to the user overdue date; however the renewal services can only be used once. If the books is already overdue, the total fines accumulated for the book are displayed and if the user has more than one book it also shows the information for the other books.
➢ **Change of information:** This option enables the user to change the email address, phone number and password.
➢ **SMS notification:** Using OzekiNG SMS server, if the difference between the current date and the overdue date is equal to 7days, the user shall be notified through SMS, which the overdue date is approaching.

b. Experimentation

Apart from the mobile simulator used to test the website, devices such as iPad and iPhone were also used for testing. Android based phones were used throughout the testing phase. Since the development was used using a local web server, in order to connect the devices with the server, certain steps were followed:

Step 1: Connect both the PC and the device (mobile phone or tablet) to the same Network, through wireless connection.

Step 2: Get the PC network IP address (Used command prompt , type ipconf)

Step 3: Type the PC IP address in the URL section of the web browser, with the specific files director.

Once users type the website URL they are redirected to the website home page; from there six different options are presented, the following figures illustrate how the users can check for book/journals availability at the IRC and also is specific location.

From the catalog page, users can choose whether to see books or journals, and through both of the following options are the same
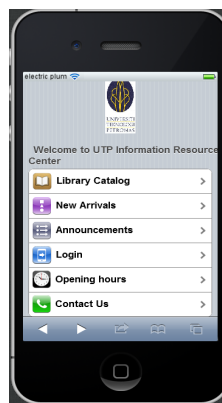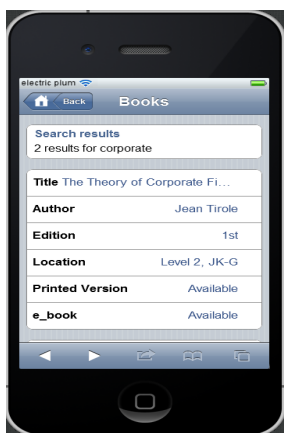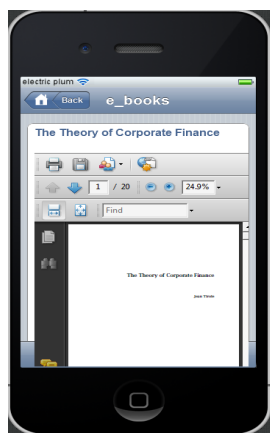

Fig. 1 Home   **Fig. 2 Catalog**

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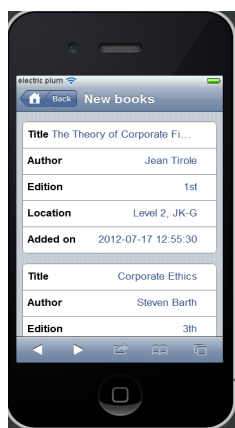If the book is available online the user will be able to read it through the mobile device.

Fig. 3 Book

Fig. 4 e Book

From the home page the user can check the new arrivals and also new announcements from the IRC. Fig. 5 shows the new arrivals displayed in descendent order, and Fig. 6 shows announcements also organized from the most recent to the oldest.


Fig. 5 New arrivals

Fig. 6 Announcement

From the home page the users can access their personal information, as stated before in the document, that is only allowed to UTP current students or staff members. Apart from the personal information, users can see the

books are still to be returned and whether or not they are overdue; if the latter is true the fines are displayed and at the bottom of the page the total accumulated fine per user is displayed. If the overdue that has not been reached yet, the user has the option to renew the book, which can only be done once. The renewal service adds 30 days to the overdue date.

Fig. 7 Book
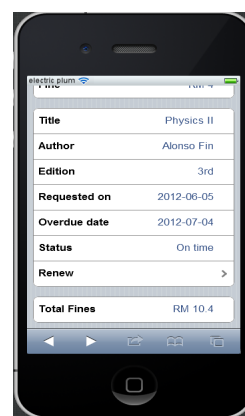
Fig. 8 Renew

5. CONCLUSION

5.1. *Relevance to the objectives*

Education Systems are moving forward alongside with new technologies; mobile web based applications have been increasing for the past decade, improving communication channels through the internet between libraries and students.

We can conclude that m-library creates a platform for interaction between libraries and students. Mobile library services are one of the trends in technology on regards to m-learning and that its implementation in UTP is a need that can improve IRC services delivery and interaction with students.

The main contribution of this project is the platform which it will provide that UTP needs to improve their information service.

5.2. *Recommendation*

As stated earlier in this document, the scope of study defined for this project is

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relatively small in order to fulfill the time constrains, but there are some features, that should be implemented in future such as:

- Enable students to reserve book. Accessing to the IRC through their mobiles, students should be enabled to reserve books.
- Enable students to access to Thesis through their mobile phones, subjected to certain charges.
- Since this project was done using OzekiNG SMS server to test the function; it would be appropriate to connect to a SMS provider to enable automatic SMS notification; this function is the same used for banks and other systems that require SMS notification.

From the points presented above, it can be concluded that the implementation of m-library still have a vast room for improvement, not only on regards to the points that have been mentioned in this document, but also with the advance technology that is daily being implemented, greater things can still be done, to use technology on education systems' improvement.

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