Library Interactive Directory

by

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Dissertation submitted in partial fulfillment of
The requirements for the
Bachelor of Technology (Hons)
(Information and Communication Technology)

SEPT 2013

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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.

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MOHAMAD GHAZALI BIN NADZARI

ABSTRACT

Technologies have driven the human being with more innovation and features that can benefits people in today live. Hence, technology plays a major role in our life. People demand for technology to assist in completing the task. There are many aspects in human lives that can be applied with technology. This project is about implementing the technology in resource center. With the abundance of material in library, users have a hard time to allocate the materials without the proper directory guide provided. Library Interactive Directory project has comes out into solution as this project will help user in locating the materials in library with the shelving map provided. User now can navigate the location of the material that user have search for based on the interactive shelving map displayed within the web application system. This map will show the direction and its will greatly help the user in locating the precise materials location in library. In the development process, programming language will be used such as HTML, PHP and JavaScript. The graphic design and map modeling development will be in Flash with the assistance of appropriate software application.

ACKNOWLEDGEMENTS

Alhamdulillah, all the praise and gratitude is only for Allah, by His blessing and guidance throughout these two semesters enabling me to complete my final year project successfully. Author would like to express his special gratitude to Universiti Teknologi PETRONAS for providing a chance to conduct author final year project for two semesters in partial fulfillment for Bachelor of Information and Communication Technology.

This project gives very valuable experiences and lesson to author to be exposed on the real working environment as author preparation after graduation. My special thanks to author supervisor, Mr. Khairul Shafee Kalid, who give strong commitment to guide and assist author all the way through this challenging final year project period. Not to forget, great appreciations also goes to the internal and external examiner of this project presentation during proposal defense, Pre-Sedex and Viva for all those brilliant comment and ideas towards this project. Sincere appreciation to the FYP's course coordinator for their dedication and never hesitated to clear any of the author's confusions and doubts.

Author would like to express gratitude to all lecturers of Computer Information Science (CIS) department of UTP for their kind support and guidance to all FYP students. Last but not least, thanks to everyone especially author's friends and family for their continuous support and assistance throughout the period of completing the author's final year project, whether directly or indirectly.

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ABBREVIATIONS AND NOMENCLATURES

HTML	Hyper Text Markup Language
PHP	PHP Hypertext Preprocessor
CSS	Cascading Style Sheets
OPAC	Online Public Access Catalog
UTP	Universiti Teknologi PETRONAS
IRC	Information Resources Centre
GUI	Graphic User Interface
UMP	Universiti Malaysia Pahang
UPSI	Universiti Pendidikan Sultan Idris
UNIMAS	Universiti Malaysia Sarawak
UMS	Universiti Malaysia Sabah
UKM	Universiti Kebangsaan Malaysia
UUM	Universiti Utara Malaysia
UTM	Universiti Teknologi Malaysia
UTHM	Universiti Tun Hussein Onn Malaysia
MMU	Multimedia University
UniKL	Universiti Kuala Lumpur
UiTM	Universiti Teknologi MARA
NUS	National University of Singapore
Pulse	PETRONAS Ubiquitous Library Search Engine
SQL	Structured Query Language
HTTP	HyperText Transfer Protocol
XAMPP	X ("cross"-platform), Apache HTTP Server, mySQL, PHP and Perl

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Nowadays technology have becomes one of key element in human being that facilitate human in daily life. Technologies that have been built mainly purposed in assisting and simplify the user in accomplishing the task in the specific time required. The interaction between human society and technology lies on the presentation of the technology to the end user. The presentation measurement can be described as the level of user understanding achievement in operating the technology. The design of the technology is an important aspect as well as the first impression by the user before using the technology. Interactive is one of criteria that will attract the user in term of user friendliness, usability, affordance, cost, user experience and constraint when using the system or application. Interactive can be demonstrated from the user interface as the graphic user interface (GUI) between the systems. On the other hand, directory can be described as a guide or navigation to the location, equipment or file location. In traditional practices, it's relatively difficulty for user to manual searching the files or location especially when user needs to find in the huge amount of data or location.

Library Interactive Directory is a web application that consists of the online database of resources held by a library with interactive graphical directory location presentation. Information regarding the book in the library will be displayed within the location of the book. By using this web application, user now can know the exact location based on graphical presentation navigation displayed in the web application. The basic practice is that user accesses the web application and search for book based on their desired criteria. After user retrieved the results from search option, the description of the book based on search results appeared. Hence, user can click the book needed and the full description will appear. Therefore, the status of the book should be referred before making a collection. User will be able to collect the book if the status of book is available

and user shall navigate to the book location based on the details location of book provided in the web page. The graphical mapping shall be displayed when user click on find the location in menu provided. This web application will be developed using a programming language such as HTML, PHP and JavaScript. Flash will be used for multimedia animation and graphical design construction.

1.2 PROBLEM STATEMENT

In current practice, library users need to identify the call number that located at the bottom of the book as a guide for user in locating the book location. Therefore, user can access the current Online Public Access Catalog (OPAC) system and retrieve the call number with the location provided. However, the drawback is that user itself needs to use the current method in locate for the exact book location based on the call number and location provided from the system depending only from signage board provided in the library. The system does not provide the user the sight of the material location. Hence, user possibly will face difficulty to search for the material that user want in the library. In addition, staffs also have to entertain question from patrons regarding problem occurs in locate the library materials.

1.3 OBJECTIVE

Library Interactive Directory is an online library web application that holds database of library materials with the navigation to the precise resources location. The objectives of this project as follows :

1. Understand the current user behavior, problem and challenges in locate the library materials.

   The investigations consist of interaction between user and the current library system to find the behavior of both parties. User behavior may include the method they had used in locate the materials and interaction that had been made from the user through the directory system provided in library. Problem and challenges occurs during the operational of the system from the patrons are identify including the current physical environment in library.

2. To analyze the requirement of the web directory application from the user.
   Analysis are made based on the user experience, analysis from the system or application in the current library environment, features that need to be included in the web directory application and expectation from the end user to retrieve the appropriate requirement needed for application.

3. To design the user interface of the architecture on the directory application.
   The design model needs were create accordance to the requirement and expectation from the user. Several of the suitable prototypes need to be design and evaluate to fulfill the requirement of the project. User interface can includes the graphical interface page, menus, animation and directory layout design. Several institutions that had implemented interactive directory also are observed to identify the potential directory design that can suit the user that will be using the web application.

4. To develop the book information location directory in the interactive way for library user.
   The display of the descriptive information needed for library material should be properly design and develop within the display of interactive map to assist the patron in library. Patron shall be able to identify the information of materials location within the interactive navigation map provided in the web directory application.

1.4 SCOPE OF STUDY

This scope of project is to develop user friendly and interactive directory location navigation in Library Interactive Directory web application. This web application targeted to Universiti Teknologi PETRONAS (UTP) Information Resources Centre and its will enhance the user experiences in locating library resources of materials and improve the current Online Public Access Catalog (OPAC). Therefore, patron shall able to see the shelving location that holds the library resources needed in the virtual map to assist patron in locating the materials in the library.

CHAPTER 2

LITERATURE REVIEW

2.1 Interactive Design in Computing Technology

Interactive design can be described as a user-oriented field of study that has interactive environment product design that embrace the relationship between users and technology (Graham, 1998). Designer need to investigate the user requirement toward the product design in order to achieve the maximum usability and effective of the product used by targeted people. The real understandings of the people that will be the end user are necessity to acquire their goals, experiences, and needs in order to match with the design conception of the product that suit the user. The end user is the people who use the product in the final stage of the product development and have been advertised in marketplace (Webopedia, n.d.). The development of the system or product is associated to the platforms that will used by user in interaction between the system and its users.

User experiences can be extend to the greater level as interactive design essentially can benefit the user in the way they interact, communicate and accomplishing their task in daily life. Interactive products behave accordance with the design creation defined based on the technology that we used to visualize and construct the product in order to make products desirable and greatly benefit to the end user. The design conceptual must be refined by studying the specific appropriate criteria to make the product notion are acceptable and any constrains can be identified before the development process of the product. General principle of interaction design can be used in associated with the conceptual interactive design to guide designer choice. Saffer defined that there are several law of interaction design can be deliberated such as direct and indirect manipulation, mental model, affordance, Fitt's Law, feedback and feedforward (2010).

Digital object can be handled in two ways according to the principle. Direct manipulation can be defined as an object that can be manipulated directly by using mouse and finger. Object imitations are done similar to the physical world to make sure that user can operate the object easily and fast learning. On the other hand, indirect manipulated consist of digital object part that cannot be altered or manipulate directly and user need to use tools provided to manipulate that object. Products that offer interactive functionality and features that easy to be discoverable and correctly used by user can be related to affordance. Feedback in general principles are used to indicate the event that will happened when user interact with the system. It is essential for designer to distinguish the latency between the product responses based on user action on the system. Feedforward, on the other hand to feedback, establish the expectation or perception of the user before executing the certain action desired in the system. Therefore, user can understand the information and operation needed in the system with more effectively with the assistance of the information or tutorial provided to let user know what will happen if they perform the respective action in the system. Fundamental of design law that introduced by Paul Fitt's in 1954 called as Fitt's Law defined that there are two factors that contribute to times user start using the system to the final target of the task accomplishment that user intend to do with the system (Saffer, 2010). The designs that need to take in consideration are the measurement and distance of the target. There are three implications that are clickable object, context menu and edge and corner as part of interactive design interface in the system that should be highly considered in system development and design.

Cultural context, form, process, user and the content of the subject are the aspects that need to be analyzed based on design research (Design Council, n.d.). The design research should focuses on the context of innovative way and meets the objective of the system development through interactive content presentation in order to grasp the user understanding in exploring the system. Besides that, user current understanding and expectation need to be identified in order to achieve high level of understanding between the audiences and interface. Blair-Early and Zender (2008) theorize that appropriate principal and fundamental of design can be identified and described based on the understanding acquired to guide interface design.

Human computer interaction (HCI) field also can be associated with the interface design (Blair-Early & Zender, 2008). Interface is mainly considered as tools in managing computer and software application in the current practice in HCI. However, computer interface nowadays are considered as a framework for exploring content inside the application or system. In the recent product for example, the iPod®, the media devices that have many features offered by its user. According to Blair-Early and Zender (2008), the main product featured offered is not just the construction of the devices nor the interface but the content in the devices that consist of music and videos are the highlighted features that attracted the buyers. In this perspective, HCI interface development will involve in developing the in device on graphic user interface that will interact with its content in the devices. Therefore, this is the design research that will propose the effective way in developing the attractive design interface that will benefit user on the effective content interface.

Ju and Leifer (2008) discovered that framework interaction between the systems can be separate into attentional and initiative demand. Attentional demand can be defined by a level of perceptive, awareness and cognizance required from the audience. The appearance on the foreground interaction can be higher attentional demand from the user in manipulating and operating the system while background interaction does not majorly actively demand by its user. According to Clark (2003) and Wroblewski (2003), visual organization technique in attentional demand manipulation on perception importance refinement toward the object can be done that consist of hierarchy, weight, contrast and also pointing and placing in more dynamics way. MIT Media Lab have used of such technique to engage user by presenting the ambient information to perform the task in the system (Brave, Dahley, Gorbet, Ishii, Ullmer, Wisneski, & Yarin, 1998). On the other hand, initiatives is a significant appearance in situation whereby the grouped of task working together in the background process to perform the main process in the system that intentionally more appeared to the user (N. Dholakia, R. R. Dholakia, Fortin & Zhao, 2000).

Dholakia et all. (2000) found that there are six critical components that need to take into consideration when constructing interactivity such as user control,

responsiveness, real time interaction, connectedness, customization and playfulness. User control can be defined as user can select desirable variable of timing, content and arrangement of communication provided in the system. Response or reaction to earlier message can be related to responsiveness. Besides that, real time interaction refers to the speed of the response time on the communication as the perception of interactivity will be much greater when the response speed is faster. The expectation of being linked to outside world is related to connectedness where there are medium or system that suitable to have connectivity on the internet and community to reach information. Customization can be described as the degree of information that will be represented to satisfy the user. The entertainment provided in conjunction to the presented media of information refers to playfulness. Interactive animation and games may be included in playfulness as a features to invoke user expressive and behavior reactions from the user. Interaction and interactive design can be related as both are the important aspect that need to be used in building and develop the system or product.

The research of design including the general principle can help the designer to understand the conceptual that will work best for the system interactive interface associated with the HCI to accommodate the user in interaction between user and the system. Hence, user can have a meaningful experience the system with the acceptable expectation behavior from the system that interacts with the user to achieve higher level of usability and user friendliness that also will meet system purpose and objective.

2.2 Interactive Directory and Implementation

In computer science and communication, directory can be described as a book which have been arranged and constructed with the exact sequences with the amount of information such as name, address and telephone number (Directory, 2003). On the other hand, it's also can be related to manual giving direction and also area of storage files that contain the specific location and names in the computer. Broadly speaking, directory refers as the guides or navigation for user to know the exact location for the desirable object needed.

FIGURE 2.1. Example of Interactive Directory Map

Interactive that refers to the interface design can be combined with the directory to have interactive display for displaying the information for individual entities, being persons and organizations. There may be a specific amount of information displayed to assist user in accessing the desire information or completing the task in the system. Pickering (1999) stated that various media presentation specifically multiple graphic design consist of underlining, shading, font choice and menus for example are used for interactive display. Appropriate videos, sound and animation also can be included to assist user in accessing the information in more interactive ways that meet the needs from the audiences. There are many organization have implement interactive directory and there are great amount of software directory have been developed for many purpose based on the objective of the directory. Interactive directory can consist of library book, building places, address, telephone numbers and country maps.

2.3 Related Works on Interactive Directory

2.3.1 Wichita State University

Library directory is related to the project that will be developed and there are many bookstores and library that have implemented this interactive directory. Wichita State University has implemented the interactive directory for holding locations in a library Online Public Access Catalog (OPAC) via dynamic mapping (Deng, Deyoe, & Mallory, 2008). The interactive directory hold the information of the book and presentation of the location of the book are displayed in the animated 3D map created using Google SketchUp and Antics.

In their library directory, user initiates search on OPAC and the result that appeared included the corresponding 3D shelving map location that can be viewed by user to find the location of books and journal. The directory shows in graphic presentation are more understandable and user can explore it in the most interactive ways within the information provided in the directory.

2.3.2 WESTMED Medical Group

WESTMED Medical Group is one of the company that have implement interactive digital signage directory at Westchester's Ridge Hill in Yonkers, New York to help the visitor to find the correct location in the building (Little, 2012). The interactive directory provided via a digital touchscreen and it's can display the exact location including the list of doctors and departments in the building. Furthermore, it also can show the desired advertisement for visitor. The digital signage project consist of 22 high definition video walls in the office's two main 300-foot-long corridors, and on the second floor entrance check-in lobby.

The signage interactive directory includes high-definition ambiance video clips, such as nature and landscape, pictures taken by employees and patients, information about selected WESTMED programs and services (YCDMultimedia, 2012). Therefore, interactive directory can simplify the user to access the information needed easily and provide the visitor to navigate the place with the correct and intuitive guidance.

2.3.3 National University of Singapore

Library directory that consists of 3D interactive mapping also have been developed in National University of Singapore that offer user the ability to view the library infrastructure and walkthrough the place in library. This virtual reality model of interactive mapping includes 6 libraries in National University of Singapore, namely Central Library, Chinese Library, C. J. Koh Law Library, Hon Sui Sen Memorial Library, Medical Library and Music Library. Hence, patron shall able to experience of exploring and discovering the interactive map in library with such advanced features offered with sufficient information and vivid media presentation in the system.

FIGURE 2.2. 3D Interactive Directory Mapping in Library

Several of key features in their library directory is patron able to navigate library infrastructure using peripheral devices, search based by landmark for each floor in the library, orientation tours are programmable for patron in visiting the library through the system, embedded videos are linked in the system to provide assistant for patron, 3D book search by call number and linked from OPAC ("National University of Singapore," 2013). This implementation also have been provided for iPads user through application developed that is available in Apple Apps Store.

2.3.4 University of Canterbury

Campus map have been developed to provide the user sight of the campus environment architecture. User can browse the building and facilities through the interactive directory map provided in the system. Image of the building also displayed in the interactive map directory to let user in recognizing the exact place in the campus. In addition, these interactive maps also provide the descriptive information about the building, facilities and services.

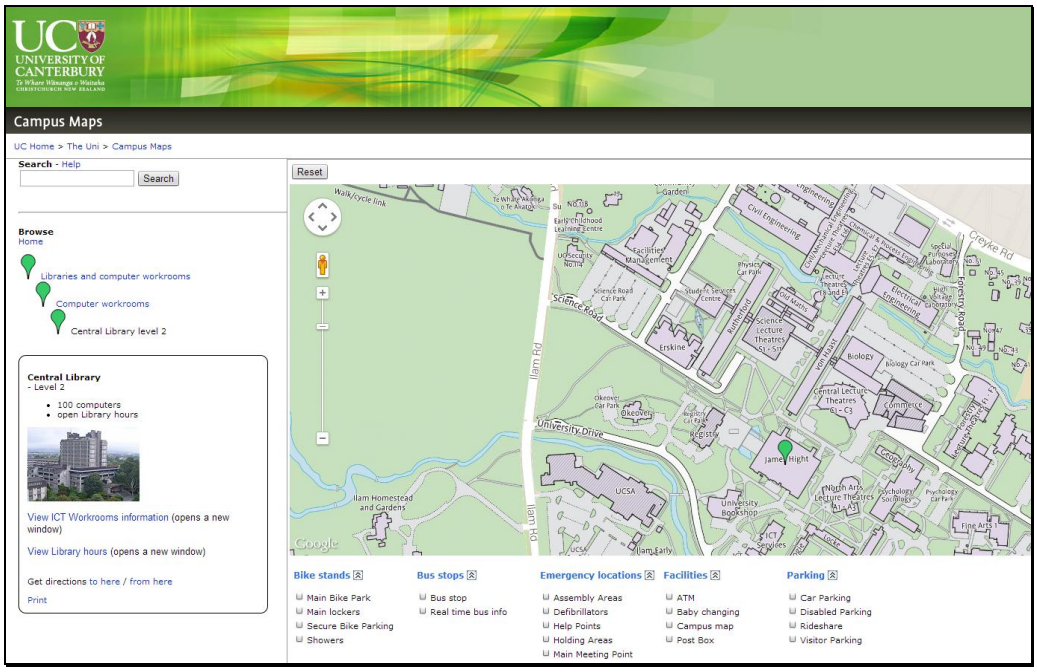


FIGURE 2.3. Interactive Campus Maps Directory

These interactive directories cover almost all the place in the campus including the specific building room in campus. User are able to select the choices of menu according to the preference of search in the system in order to assist the user in navigating the exact place that preferred in campus. Several place of the specific location that user can search in the interactive directory map such as bike stands, bus stops, facilities, parking and emergencies location. Online campus map that can be accessed are developed using Google technology ("University of Canterbury," 2013).

CHAPTER 3

METHODOLOGY

3.1 Research Methodology

The appropriate research methodology should be defined in order to achieve the concentrated information with the suitable action to gather the data collection and evaluate the data based on the research conducted. Methodology that preferred to be interrelated with this project is qualitative and quantitative method.

i. Qualitative Interview

Qualitative methods are usually conducted with the several elements that can assist with the project development. That element can consist of direct observation, qualitative interview and case studies. In this project, qualitative interview shall be conducted in the target user consist of library staff and patron. This element can involve of semi-constructed questionnaire to open-ended ad hoc conversation between the participants targeted.

Target audiences for this interview shall be the patron and staff in library. There will be appropriate questions that need to be constructed related to the user experiences in library. Question can include the level of frequent time user goes to library, user satisfaction, experiences and problem faced by user during using the OPAC system. Data collection that retrieved can be evaluated and the problem, expectation and requirement from user shall be discovered based on the interview conducted. Information gathered need to be analyzed in order to understand user requirement and other crucial information that will greatly contribute in project design and development.

ii. Quantitative Research

The combination of different method can be used to gather complete understanding of the specific field such as individual, community and organization. Quantitative method can help the researcher to have the precise or more accurate data based on the investigation on the situation targeted as its can produce more in-depth view of the current environment problem and comprehensive information shall be achieve towards the user behavior and experiences. For instance, participant shall be observed within the context and variable given to identify the problem that might be face by participant in library and valuable feedback from the participant shall be retrieved. This quantitative research shall support qualitative method to achieve the higher understanding of the current problem and verification can be made whether this project are feasible to conduct for library directory system.

Resource plan is the mechanisms that are needed to implement and develop library interactive directory web application project. Several types of resources are needed for this project. Among them are includes as follows :

i. Hardware

- Computer - Provide the platform for user to use the web application.
- Network Equipment - Internet connection access.

ii. Software

- Adobe Dreamweaver CS5 – Web page development.
- XAMPP protocol and server – Connection between the web and database.
- Database (PHP/MySQL) – Platform for storing the data or files.
- Adobe Photoshop CS6 – Graphic design.
- Internet Browser – Browser application in accessing the web application.
- Autodesk Maya and Swish Max – Map design, modeling and animation

3.2 Project Activities

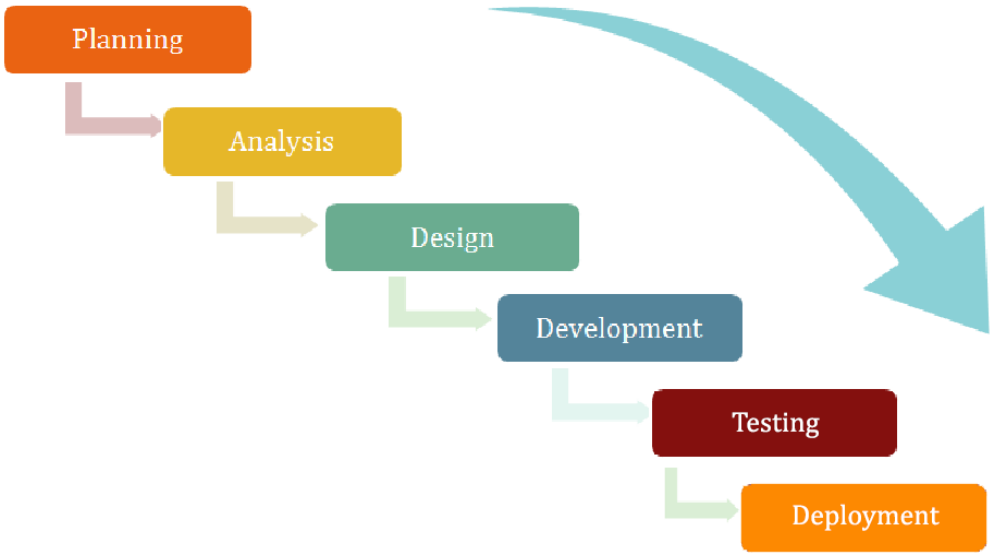


FIGURE 3.1. System Development Life Cycle Phase

i. Planning

Activities in planning phase consist of problem statement identification, design on data collection of the user requirement and selections of methods that will be used in analyze the user behavior, problem and challenges in the current target environment. In addition, several aspects that needs to be planned such as operational and technical of the project development that requires technical skill related to programming language and graphical animation development. The selection of tools and design implementation that will be used in project development also is crucial aligned with the user requirement.

Survey were conducted and targeted to staff and library patrons in UTP library. There are about 42 of people who participate in the survey and 5 people in assessment on quantitative analysis. Besides that, project discussion will be held with the staff in IRC to investigate and discuss about the project design, requirement and implementation that shall be made in library. A number of essential information such as library map layout and book information need to be

retrieved from the respective person in IRC in order to develop this project. Several respondents also will be selected to run certain assessment to investigate the problem, challenges and time needed in locating library material. This assessment is crucial to compare the result obtain from the assessment in current environment. In addition, interview also will be conduct through the student in various universities in Malaysia including the investigation of the current OPAC that university have implemented and currently used for their library material holding location.

ii. Analysis

Data collections were gathered and analysis will be made from the targeted user based on qualitative and quantitative research methodology. Questionnaire will be distributed to the library user and staff to gather their feedback that will contribute in data collection for project analysis. Hence, results that retrieved shall indicate the expectation from the user. Based on the expectation retrieved from user, user requirement can be discovered. User requirement is important as it will assist the project analysis in evaluating the effectiveness and usability of the project. In addition, problem and challenges are identified to analyze whether this proposed project can solve the current problem face by user.

Several of key point that necessity to investigate such as :

i. Project and user requirement

ii. Current Online Public Access Catalog (Pulse)

iii. Problem and challenges that occurs in current environment

iv. Project features that need to develop in web application

iii. Design

Result from the analysis on user requirement and proposed features were gathered to develop the user interface that aligned with the user expectation Design of the directory system may include the graphical interface for directory

location, directory information and layout of the library. The layout of the shelf in the library needs to be design and modeled based on the exact layout of library in UTP. Map layout will be constructed and designed in 3D perspective. Therefore, appropriate software will be used in designing the map layout. The design of the database also will be made for storing the necessity information on the directory system including user interface and directory output for user display.

iv. Development

The project were started to be developed based on the proposed designs that have been agreed accordance with the requirement. The layout of the library will be modeled and appropriate information will be include in the directory for user assistance in navigate the location of the library material. The graphical interface that will be display shall be in Flash with the image of map directory that consist of library layout. The interface of the web application shall be constructed using HTML, PHP and JavaScript programming language.

The design of the library layout that will be used for virtual map directory should be similar to the exact library infrastructure that consist of shelves, stairs, table, chair and other appropriate object to ease the user in locate the library material. Besides that, databases are constructed for the purposes in storing the data and files that consist of directory information, graphical design and layout displayed in web.

v. Testing

After development phase have been carried out, the completion of the project should be achieve within the timeline given. The project shall be tested to measure the feasibility and reliability based on the project deliverable. Library staff and patron also will be included in this project testing for verification and feedback will be gathered based on their user experience and expectation aligned with the objective of this project.

vi. Deployment

The last stage of this project is about deployment of the project. Result gathered from the testing stage will measure the potential, weakness and effectiveness on this project. This web application will be demonstrated through the library user after the completion of development process and feedback from user testing. Hence, it will include the preparation of complete web application that ready to be use in targeted environment at information resource centre.

3.3 General Flowchart

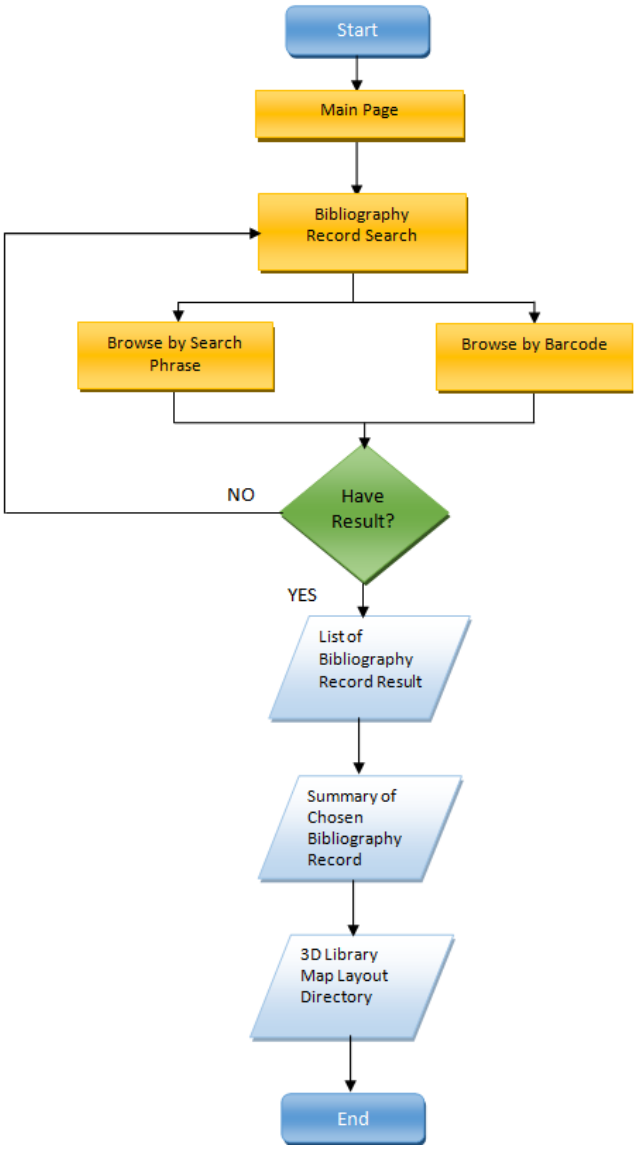


FIGURE 3.2. General flowchart for library user

3.4 Cataloging Directory Use Case Diagram

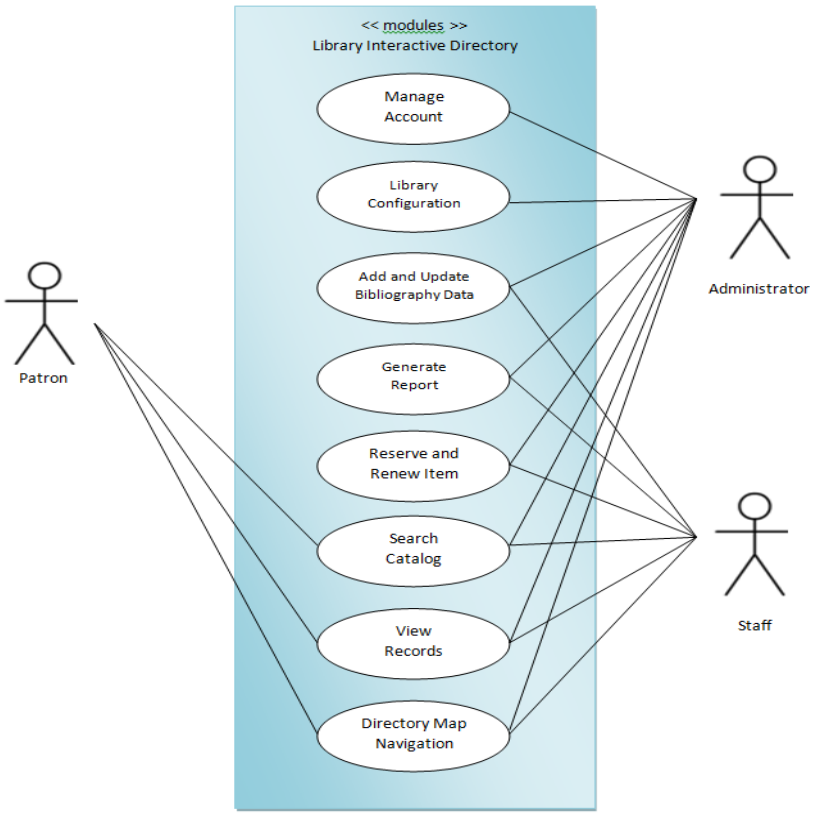


FIGURE 3.3. Use Case Diagram

3.5 Cataloging Directory Architecture

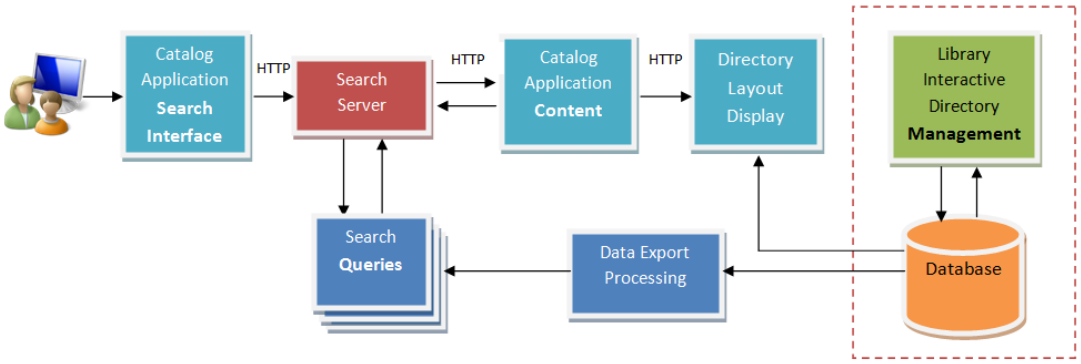


FIGURE 3.4. System Architecture

3.6 Key Milestones

1. Timeline for Final Year Project 1

Activities/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Search for Supervisor														
Selection of Project Topic														
Propose for Project Title														
Project Planning														
Data Analysis														
Project Design														
Project Testing														

TABLE 3.1. Key milestone for Final Year Project 1

2. Timeline for Final Year Project 2

Activities/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Project Development														
Web Application Testing														
Prototype Evaluation														
Prototype Deployment														

TABLE 3.2. Key milestone for Final Year Project 2

3.7 Gantt Chart

1. Gantt Chart for Final Year Project 1

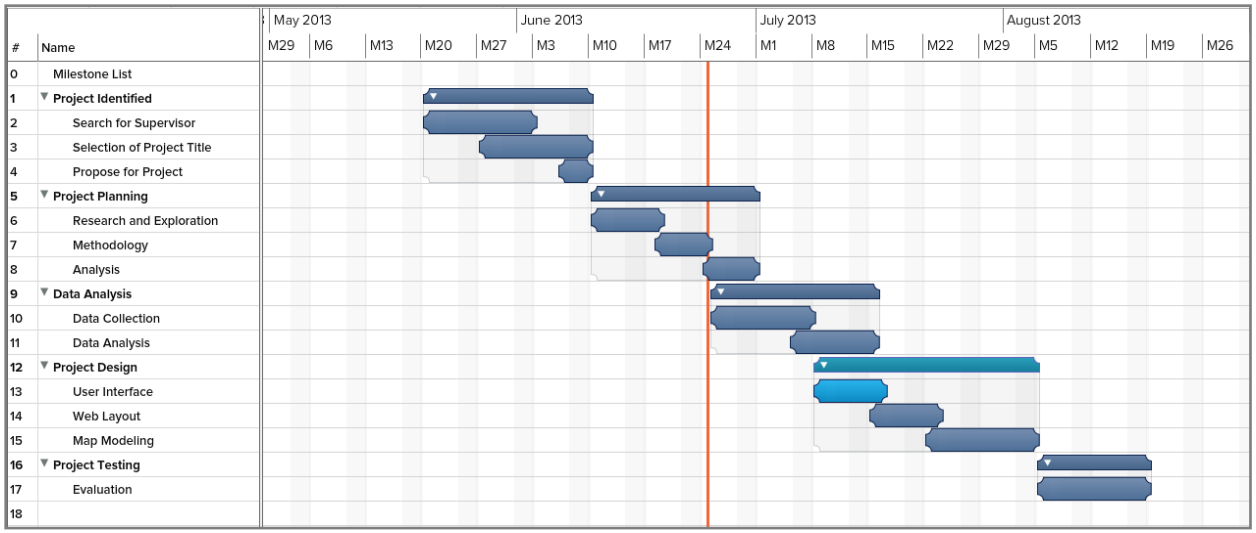


FIGURE 3.5. Gantt Chart for Final Year Project 1

2. Gantt Chart for Final Year Project 2

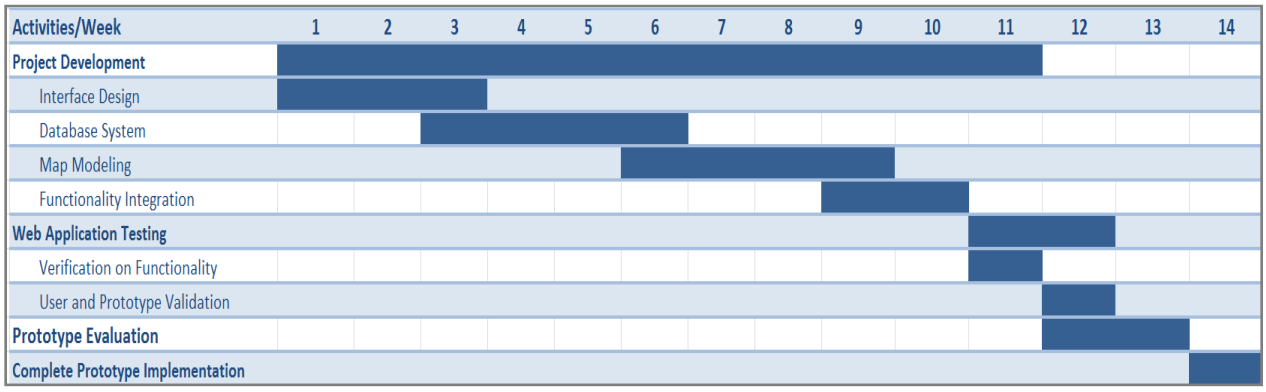


FIGURE 3.6. Gantt Chart for Final Year Project 2

CHAPTER 4

RESULT AND DISCUSSION

4.1 Analysis of Current Directory - PETRONAS Ubiquitous Library Search Engine

The current Online Public Analog Catalog (OPAC) that used in Universiti Teknologi PETRONAS (UTP) library directory is called as PETRONAS Ubiquitous Library Search Engine (Pulse). The Pulse can be accessed on internet via http://precise.petronas.com.my/search. In Pulse, user can select the choice of desired search criteria such as keyword, title, author, subject and the location of collection. The collection of the book and journal can be retrieved from various resources that have been integrated in Pulse.

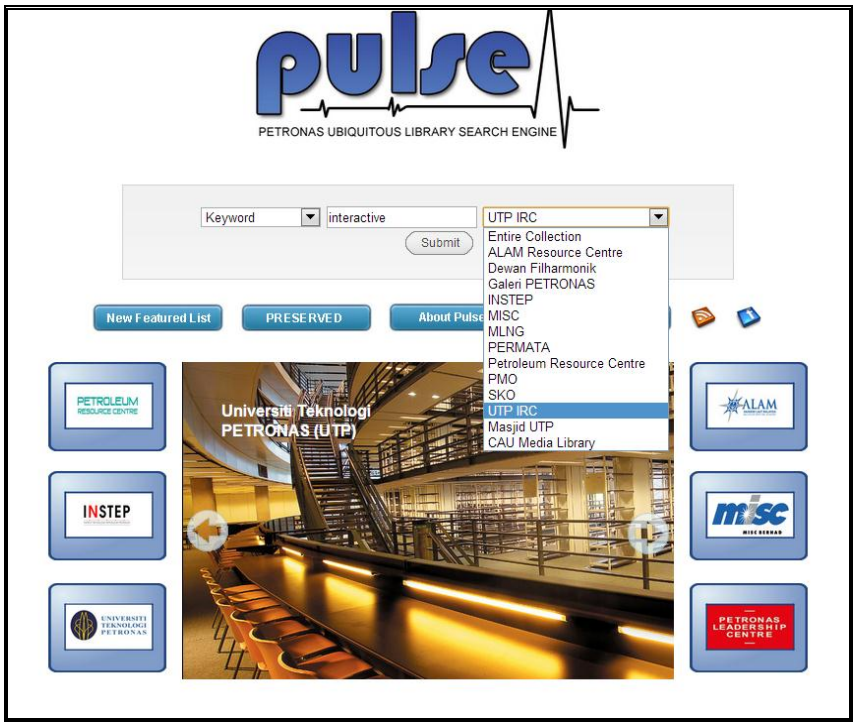


FIGURE 4.1. The library directory search interface in PETRONAS Ubiquitous Library Search Engine (Pulse)

Based on search results that have been retrieved, there are several results that show the location of the book and journal. In the image below for example, there is one book that shows the location of the book in UTP Information Resource Centre (IRC).

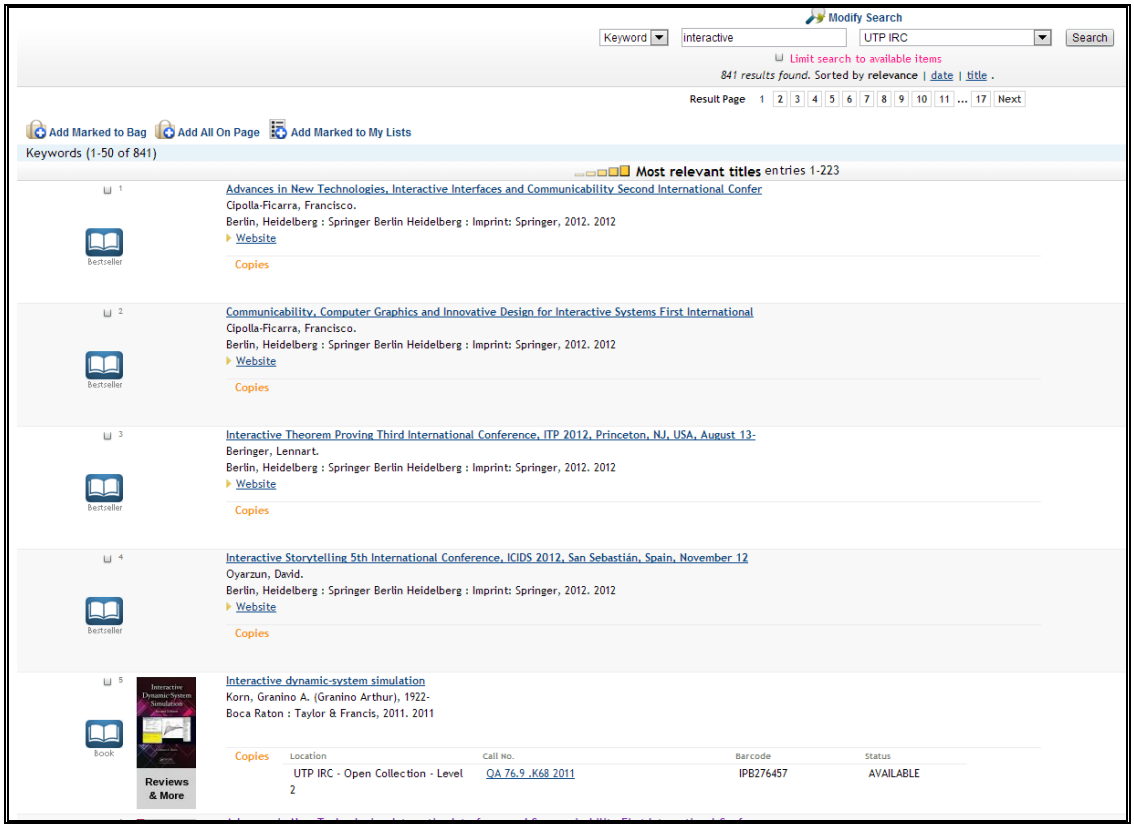


FIGURE 4.2. Result from search execution in PETRONAS Ubiquitous Library Search Engine (Pulse)

Thumbnail showed the front page of book in left position within the title of book, author, year of book published and location of books. This can be described as a short summary of book description to make sure that the user can know the description of book before user click to the book that desired for full details. Hence, the title of book should be clicked in order to view the full details of the book that user wants in the search results.

Description displayed more extends than short summary that included subject, content, bibliography series and International Standard Book Number (ISBN). In copies section, the details are provided such as location, call number, barcode and status of book. The status need to be referred before decided to collect the book. Example showed that the book status is available; hence user can collect the book by navigating to the location that provided in the section.

FIGURE 4.3. Example of book description with location provided in PETRONAS Ubiquitous Library Search Engine (Pulse)

The problem arises as users need to look for the sign of location according to the location information provided. User can get to the location of book based on sign of location in the end with appropriate search. However, the sign of book location will not provide the specific location rather than users need to find the shelf of the book based on the range of call number provided for each level in library. It will waste of time and there are possibilities for the new user should not be able to discover the book that desired.

4.2 Assessment Result on Quantitative Analysis

This assessment are conducted for the purpose in investigate the problem, challenges and time needed for one person to locate their desired library materials. 5 respondents have been selected to do the assessment with the scenario given. Respondents need to search for the book that mentioned below and try to locate the book based on the location information provided in OPAC. Time given for each respondent is 10 minutes.

Respondent	Time Consumed	Starting Point Location	Details and Location of Book	Status Finding
Respondent 1	6 minutes and 42 second	Level G	Study Guide for Islamic Studies : Ahmad Zainal Abidin - Level 1 (Call No. BP 42 .A286 2007)	Successful
Respondent 2	9 minutes and 52 second	Level 1	Building Interactive Systems : Principles for HCI : Dan R. Olsen Jr. – Level 2 (Call No. QA 76.9 .O47 2010)	Successful
Respondent 3	4 minutes and 59 second	Level 1	Communication and Multimedia Security : 11th IFIP TC 6/TC 11 international conference : Bart De Decker – Level 3 (Call No. TK 5105.59 .C66 2010)	Successful
Respondent 4	7 minutes and 20 second	Level 3	Knowledge Management and E-Learning : Jay Liebowitz – Level 1M (Call No. HD 30.2 .K636 2011)	Successful
Respondent 5	13 minutes	Level 2	.Net Framework Standard Library Annotated Reference : Brad Abrams – Level G (Call No. QA 76.76 M52 A27 2004)	Fail

TABLE 4.1. Result of the assessment

Based on the assessment conducted, respondent 5 didn't able to find the book that requested within the time given. Besides that, several respondent needs to guess the correct shelves because of shelf signage quite confusing although respondent already have the library material information location based on the call number and floor level provided in OPAC. Respondent sometimes need to search in every section of the shelves until they find the correct books.

4.3 Interview Result from Staff in Information Resource Centre (IRC)

Interview has been conducted with IRC staff and valuable feedback has been retrieved. The sample of staff feedback from interview question as shown in Appendix I. Based on the feedback gathered from staff, some of the patrons in library face a problem in using OPAC and locate the call number at the specific shelf. Problem that arises from patrons requires staffs to teach them how to use the OPAC system. Furthermore, to certain extent, staffs have to guide and direct them to the exact location of books.

In term of challenges among patrons, some of the staff agreed that it's quite challenging to locate library materials. Although there's call number and floor indicator provided in OPAC but the row of shelves might confuse them as they need to identify specific shelf they should go to collect their library materials. Staff also has given the opinion that OPAC alone as library material directory is not sufficient and would be better if accompanied by a visual directory or map. Some of the suggestions have been given from several staff that can be considerate such as a link displayed within the OPAC record itself to a visual directory system but this might involve a lot of work and restriction as this will associate with the PETRONAS system. Hence, an external visual directory system will do to improve library material location. Besides that, features that have been proposed by staff such as searchable call number, barcode number, graphic image of floor plan of shelf area or the whole floor of the library should be consider to have in the library directory.

4.4 Research on Library Directory in Institution

Student in several university in Malaysia are targeted as the respondent to get their feedback regarding the OPAC on their university currently used and have been implement in their library. In addition, several OPAC in university have been accessed to investigate the current OPAC implementation regarding their library directory. Based on investigation and interview with respondents, it appear that various university in Malaysia such as UMP, UPSI, UNIMAS, UMS, UKM, UUM, UniKL, UiTM, UTM, MMU and UTHM have been provided with the information of material location solely on text based rather than graphical image or navigation to the location of library material.

4.5 Analysis and Result Based on Library Patrons Responses

Survey targeted to people that consist of library patrons in IRC have been conducted and there are several of the essential information has been analysis based on the result retrieved from the respondents. Based on survey conducted, 42 of the respondent responses have been gathered to retrieve the result, analyze the problem and challenges in current environment.

FIGURE 4.4. Library material success finding by respondents

Based on the result analysis, more than half of respondents found that they sometimes find the material that they have searched for in the library. Current directory seem not providing adequate information regarding the location of the material in library. On the other hand, quite a number of respondents also agreed that they face difficulty in locating a book on the shelves in library.

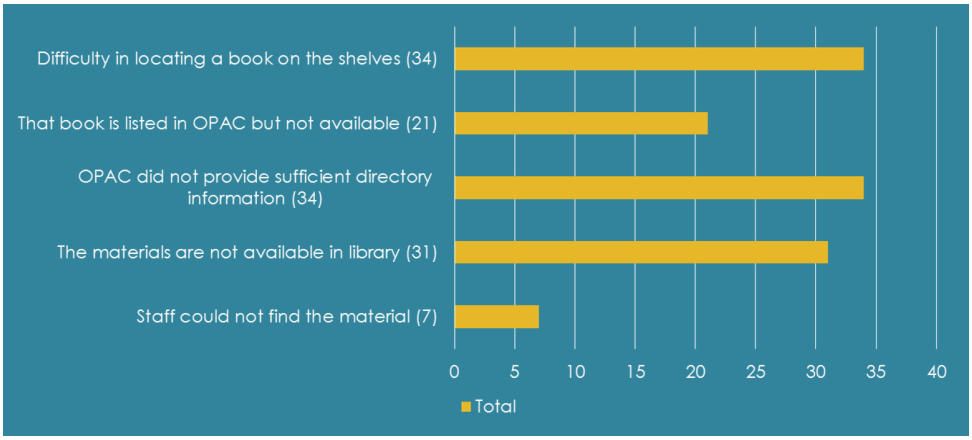


FIGURE 4.5. Problem to locate library material

Time consuming is one of the major problems that they have faced in locating material in library. The difficulty that they have tackled can be the current practices that require patrons to search through shelves in library in order to find the exact library material.

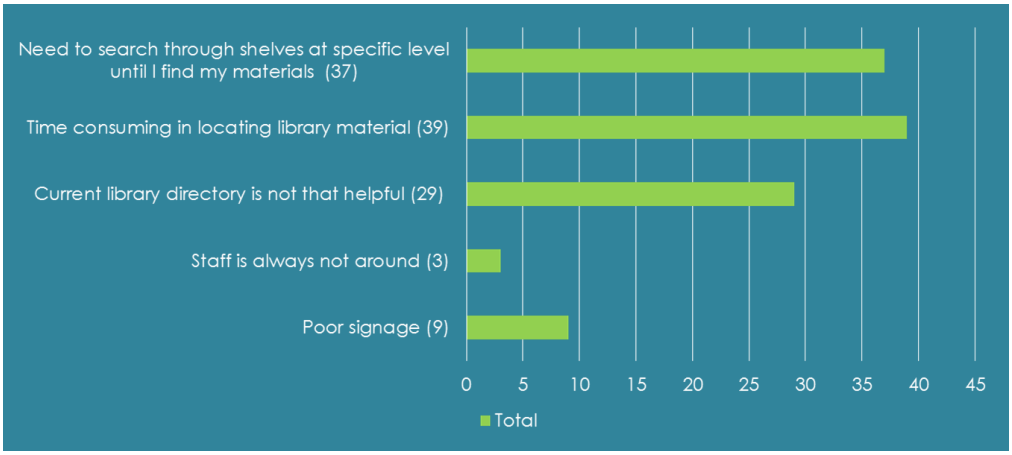
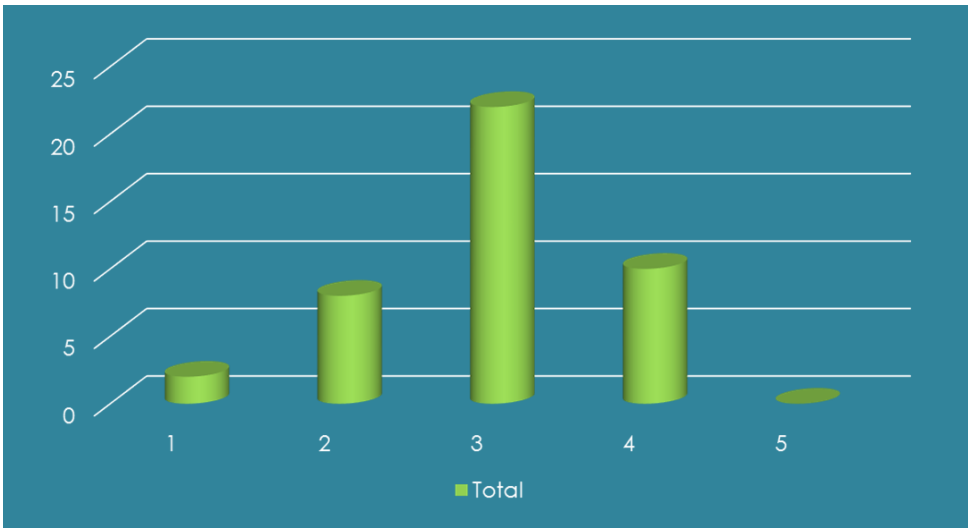


FIGURE 4.6. Challenges to locate library material

Hence, they found that the current library directory is not very assisted even though the current directory already provided the level of floor location and some effort needed by exploring the shelves until they find the desired library materials.



Value from a range of 1,Very Difficult, to 5,Very Easy

FIGURE 4.7. Respondents' difficulty rating to locate library material

There are about 26 of respondents' rate the interactive directory that will be implement shall greatly assisted patrons in locate the library material. Generally speaking, this interactive directory shall assisted patrons based on the result gathered on the level of assistance on new interactive directory implementation that will develop in current environment.

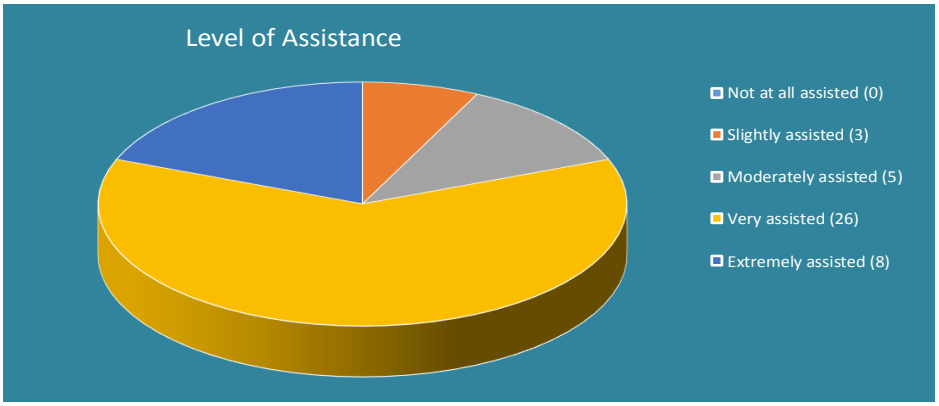


FIGURE 4.8. Rating on level of assistance for library interactive directory

Several of the key features that will be added in the interactive directory can be such as image of location of the library material, navigation to the exact shelves location and virtual map of library. Navigation to the material shelves should be provided based on the higher voting result retrieved from respondents and its can be included in conjunction with two other key features.

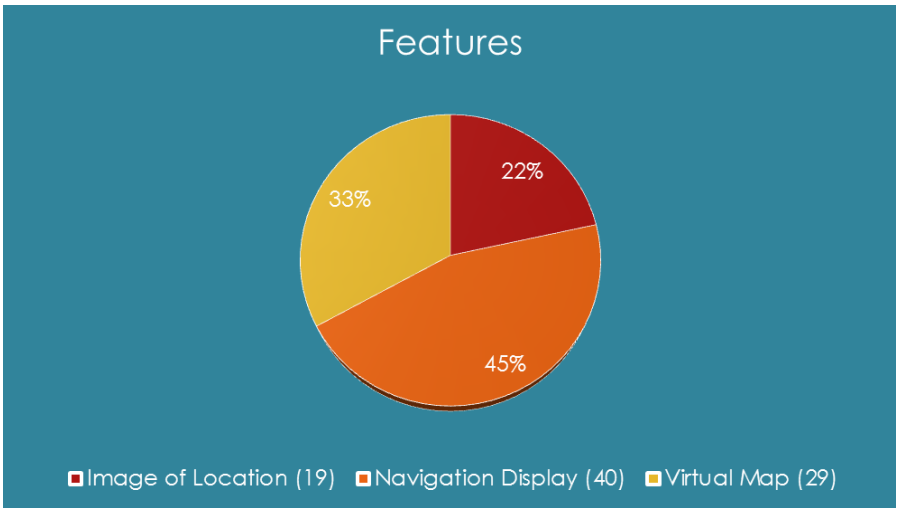


FIGURE 4.9. User expectation features for library interactive directory

4.6 Library Interactive Directory Prototypes

There are 2 suggestions of the prototypes that have been proposed and this virtual map of library is displayed using 3D perspective for user graphical interfaces. Patron will be displayed with the search box for the functionality to search the library materials when accessing the web application. Hence, patron can proceed with identifying the correct material need in the library based on the search results that have been executed. The result that showed consists of library materials description with the button provided that can direct patron to the visual graphical directory of material location.

Based on the 1st prototype, patron will be informed regarding their library material location by the notification provided in the virtual map. The current user location will be displayed and the object of red circle will be popup in the virtual map stated that the desired library material are located at the shelved accordance to the circle that displayed.

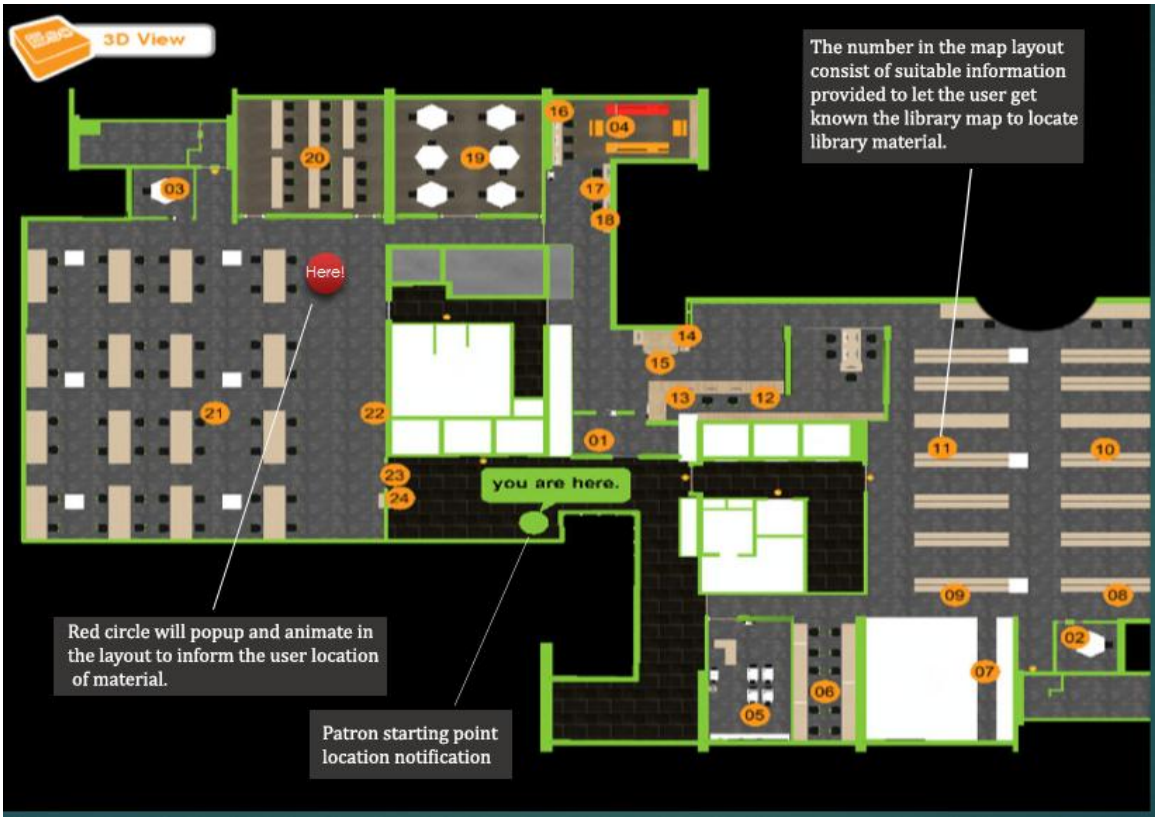


FIGURE 4.10. Virtual map of library displayed in 1st prototype

Patrons shall navigate to the red circle displayed to retrieve their library materials. The notification will animate through popup in the library virtual map to ease the patron in locate the material on the exact shelves without much effort made to explore random shelves to find the desired library material.

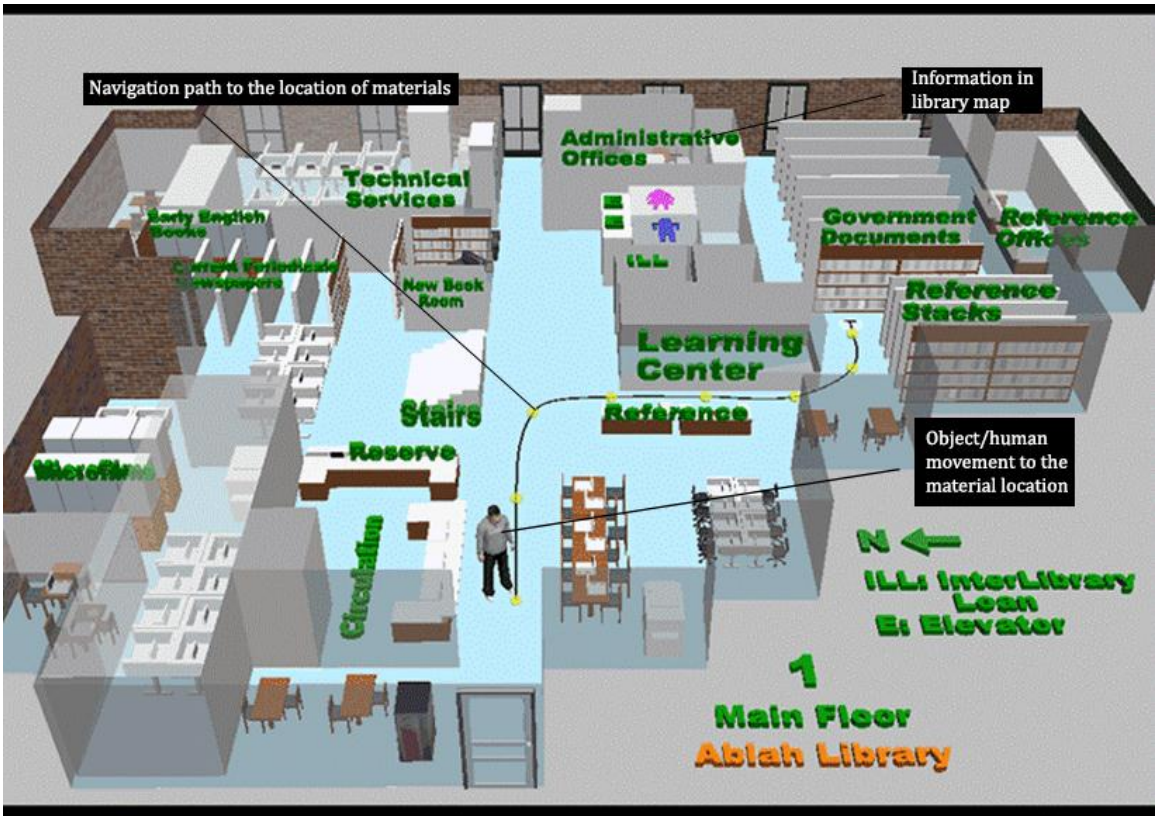


FIGURE 4.11. Virtual map of library on main floor in 2nd prototype

On the other hand, the implementation and ideas for the 2nd prototype is pretty similar with the 1st prototype that has been mentioned but in term of graphical interface displayed will be much different as the graphical design will be more realistic with the information provided in the virtual map.

Object will be designed at the appropriate location and it will move through the shelves in library until it finds the location of the library material. Patron shall navigate to their library material that they have search for based on the object demonstration on navigate the exact material location. For example, a person shall animate the movement in this virtual map to demonstrate how patron shall navigate from the current location of person that displayed to the location of shelves that contain the desired library material.

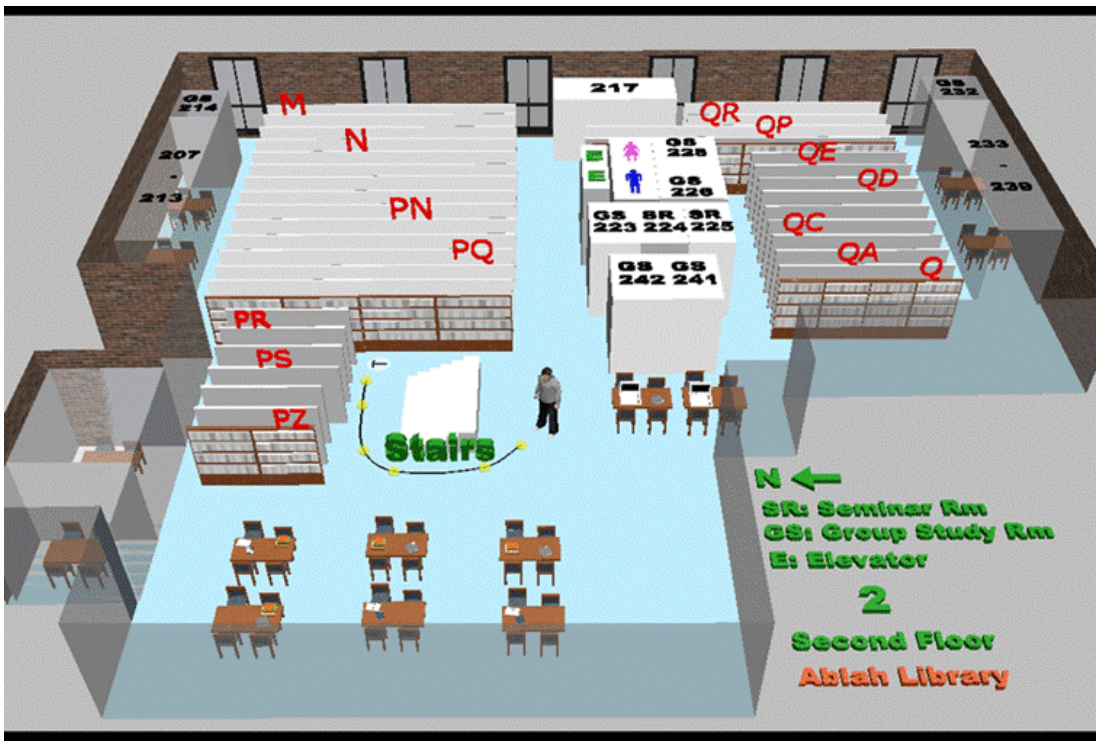


FIGURE 4.12. Virtual map of library on second floor in 2nd prototype

The development ideas will be similar based on the 1st floor that designed as the 2nd floor of the virtual library map will be displayed and object shall move until it finds the location of library material needed. Patron shall be displayed with the virtual map of exact library floor based on material location with the starting point of the object before it starts demonstrate on navigating the exact library location. The navigation path through the material location also will be displayed in this library virtual map. One of the prototypes that have been proposed shall be develop on this web application project.

4.7 Project Development on Library Interactive Directory

Project development will be separated into 3 different stages. The first stage shall develop is the administrative section that consist of setting and configuration for library interactive web application. This administrative section can only be access by authorized user that has been assigned in the web application by administrator. End user section that consists of library material search that can be access by patrons shall be the second stage of development. Graphical directory mapping within cataloging directory shall be the third stage of project development.

4.7.1 Tools, Equipment and Server Configuration

Several configurations for server need to be done in order to make a connection between web application and database system.

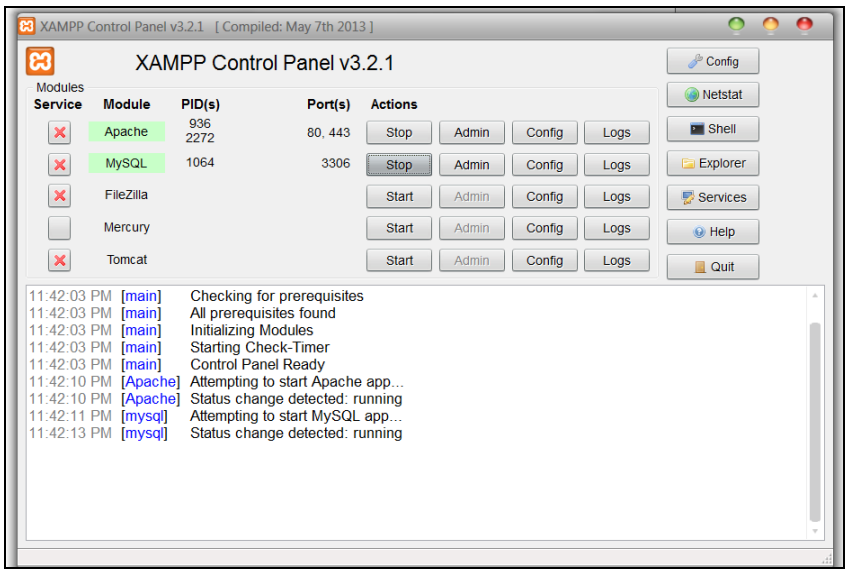


FIGURE 4.13. XAMPP service setup

XAMPP applications were installed and 2 essential service need to be executed such as Apache HTTP Server and MySQL from the application. MySQL is used to store the database needed with the proper configuration. On the other hand,

Apache HTTP Server is a service that able to make the connection between the databases that had been configured solely on the system or web application.

FIGURE 4.14. XAMPP for Windows on Localhost connection

The configurations for XAMPP in Windows have been made. This page can be accessed through Localhost. Databases were created for this web application in phpMyAdmin section through XAMPP control panel.

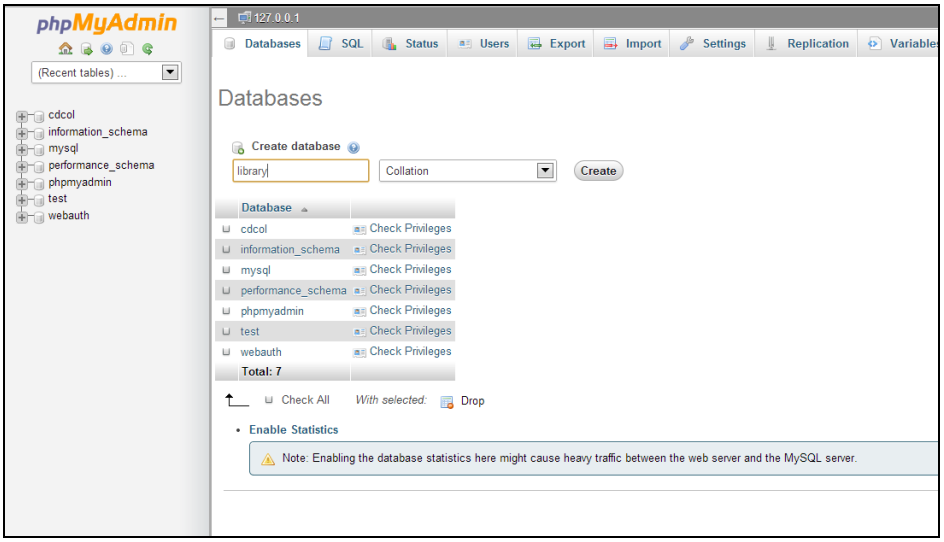


FIGURE 4.15. Database creation on phpMyAdmin

Database named library were created in phpMyAdmin as the database for this library interactive directory. This is the first database that created and there will be addition of data that will be stored inside the database. Databases that have been created shall grant all the privileges from the database user using the SQL queries that were executed inside database library.

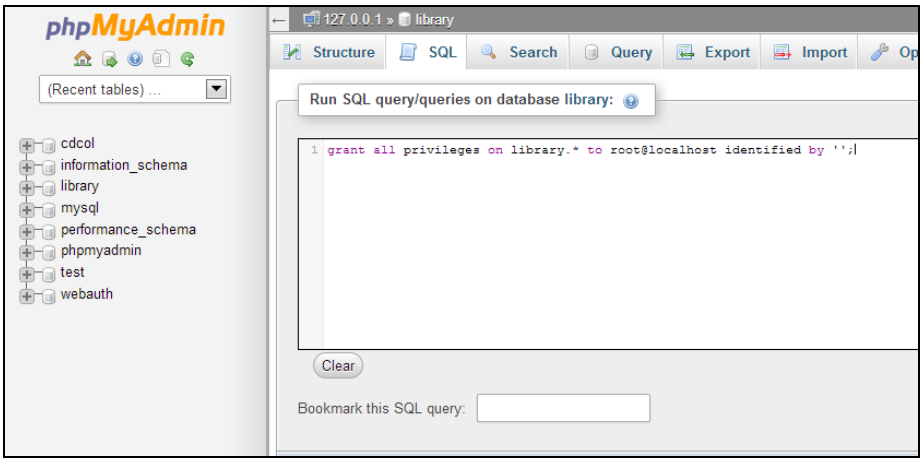


FIGURE 4.16. User grant privileges from database Library

Configuration that have been made shall serve and fulfill the library interactive directory project development and all files that related to this project development will be stored in the XAMPP folder that contains the webpage files consist of PHP, HTML, JavaScript and CSS language.

4.7.2 Library Mapping and Cataloging Directory

There are 4 main parts of the web application for library user section that consists of library material search records, search result, records view and directory mapping display. Web pages were developed using Adobe Dreamweaver. Programming language such as CSS, PHP, HTML, HTML and JavaScript were used during webpage developments.

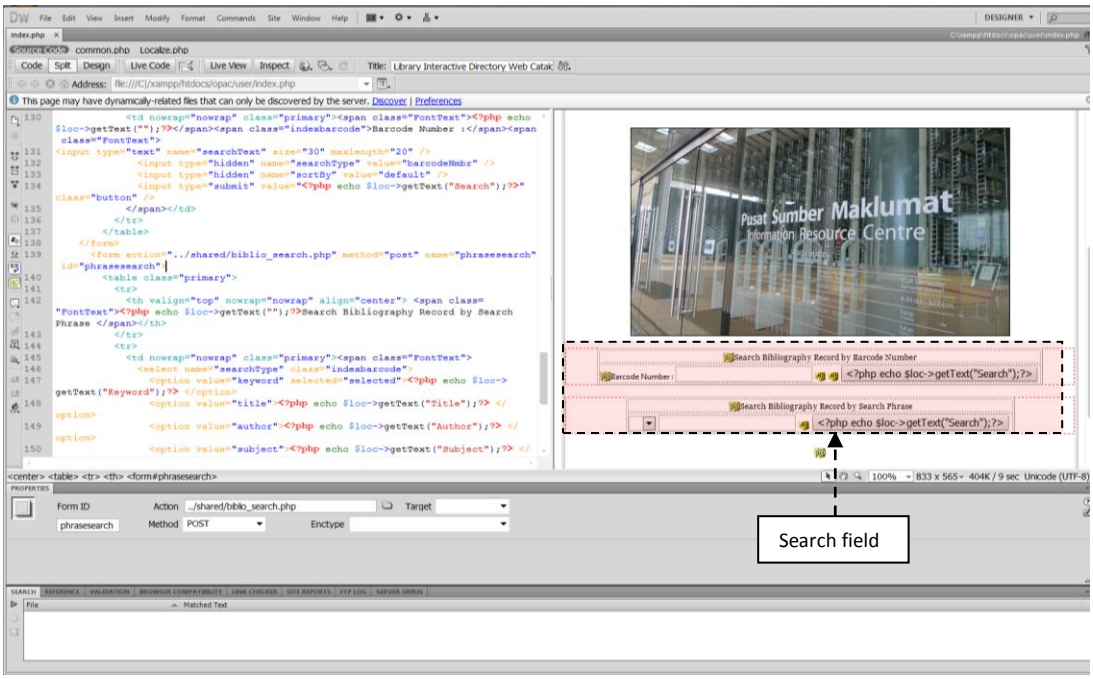


FIGURE 4.17. Library material search page

The first page will act as the main page that displays the search field for both barcode number and keyword. Besides that, there will be a Home, Admin and Contact link at the bottom of each page of web application. These links were provided for authorize user to access the administrative panel and regular user to access the homepage and contact via email.

Result page based on the search criteria that user have made were showed in the next page after search execution. The search field functionality added in the top of every page of web application to ease user without going back to main page. The records found based on the relevant keyword or barcode number will appear below the search field (Bibliography Record Search).

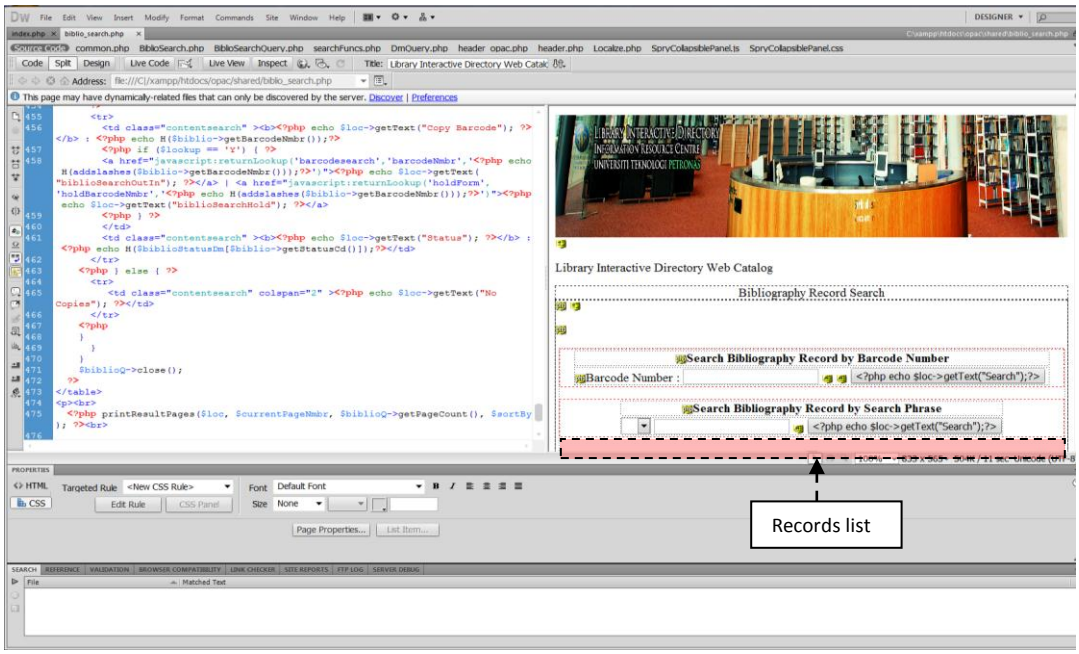


FIGURE 4.18. Library search result page

Library user can navigate through the records list found in the databases in webpage. For instance, if there are more than 10 records found in databases, the webpage will display the records on the next page accordingly until the end of records list. Therefore, user can navigate through link of page provided at the bottom of records list result in case the records found are much larger in cataloging databases.

Records view page will display the appropriate information regarding the book that user had chosen in previous search result page. This page will include the link provided solely for library layout directory mapping. The directory mapping link can be located within the call number.

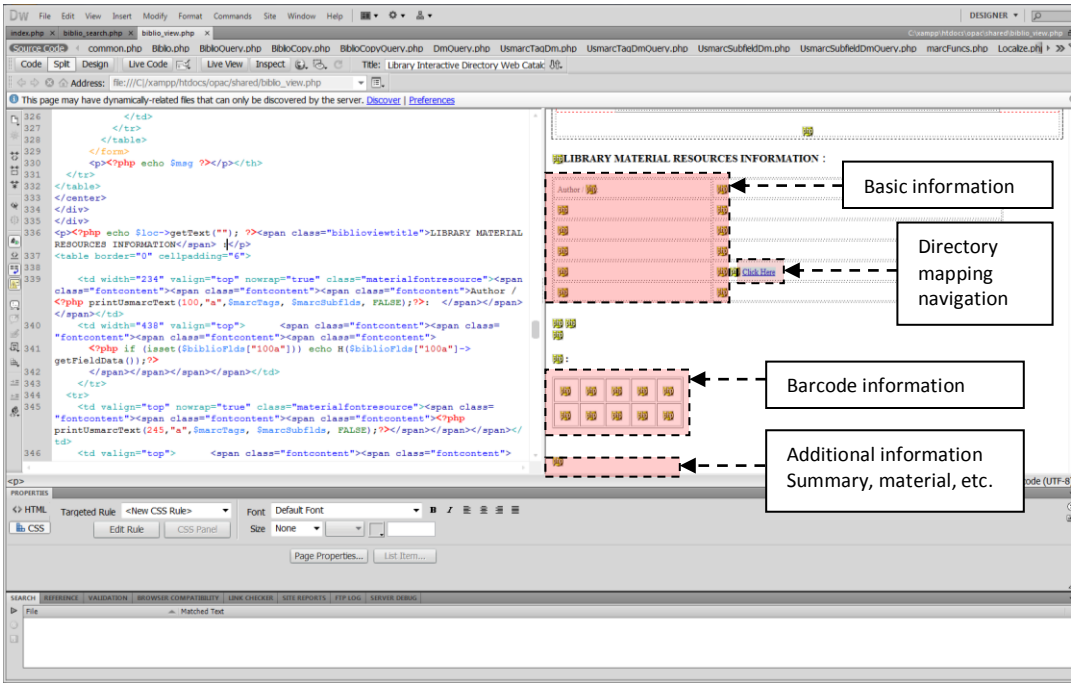


FIGURE 4.19. Library material records view page

Call number is the required information for library user to know the exact location on library materials. Hence, call number can be used to navigate to location with the assistance of signage in library. In this records view page, directory mapping will accompanying the call number information to give the accurate location of shelves assigned by administrator or staff in library.

Modeling the library is based on the map layout in the library. Several levels have a similar shelves structure. This will include level 1M and above. The content included inside the layout will be much similar with the structures have in library. For instance, level G included shelves on the left and right wings, helpdesk and circulation. These layouts modeled in 3D perspective to give user the realistic image of current library layout viewed in each library floor level.

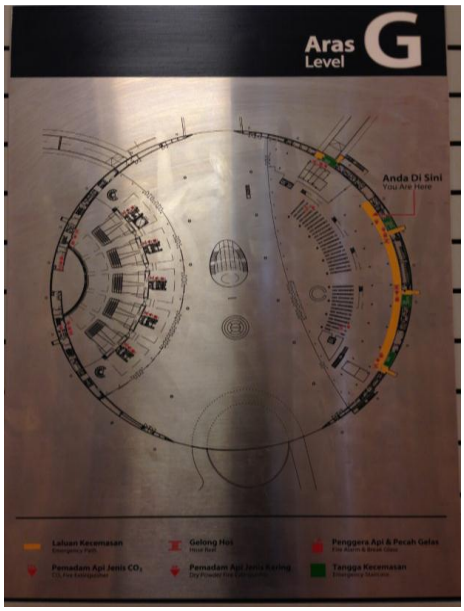


FIGURE 4.20. Level G Layout

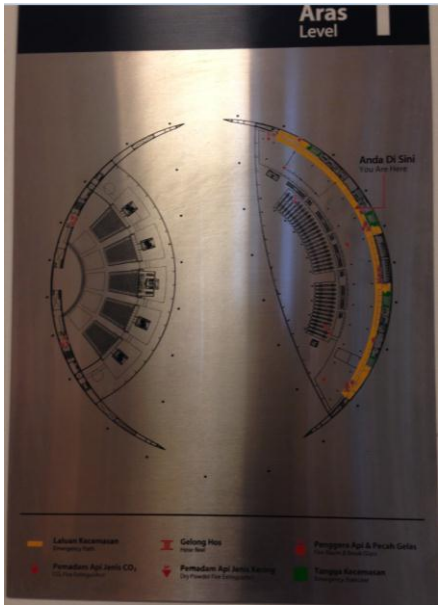


FIGURE 4.21. Level 1 Layout

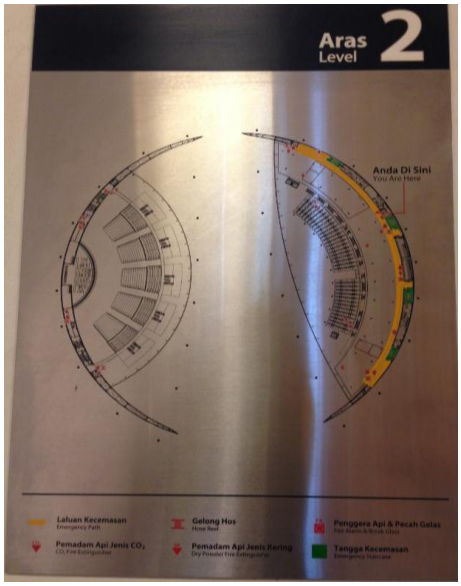


FIGURE 4.22. Level 2 Layout

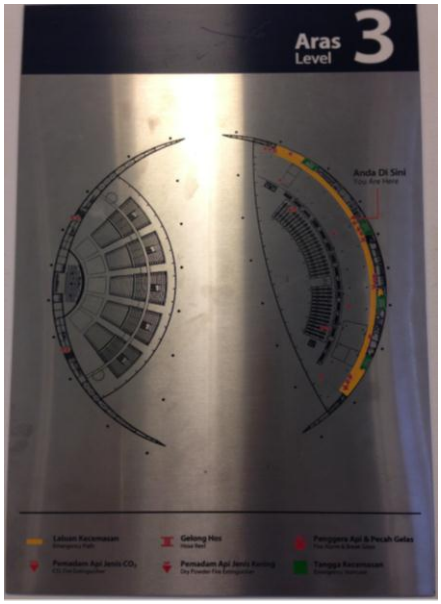


FIGURE 4.23. Level 3 Layout

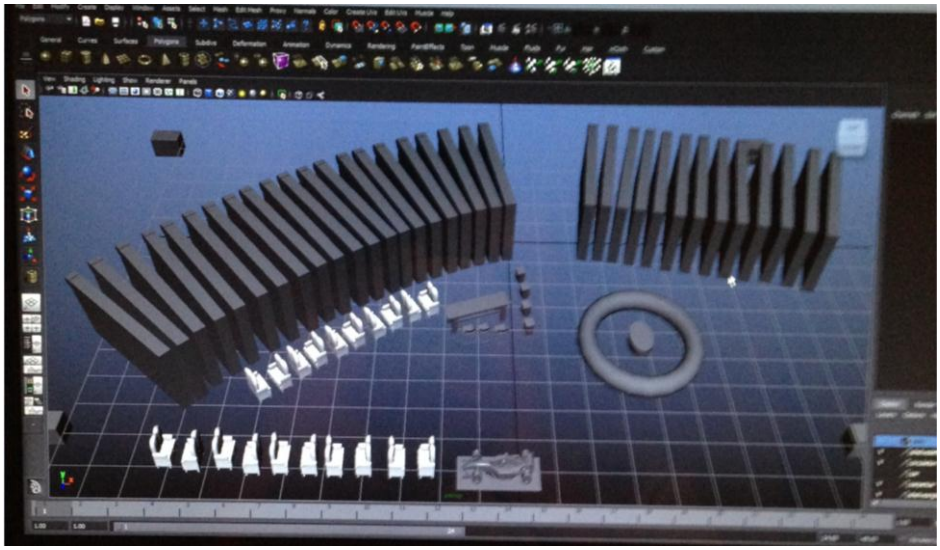


FIGURE 4.24. Library modeling layout

There are 3 stages in creating the directory mapping that consists of modeling the library layout using Autodesk Maya, structure painting and labeling information in Adobe Photoshop and animation movement through Swish Max application. Library layouts were imported to Adobe Photoshop to outline the structure with more details imaging including appropriate information for library user. An animated people are created inside the layout to give user the overview of the navigation that user can refer in order locate their book successfully in library.

FIGURE 4.25. Painting and labeling library layout

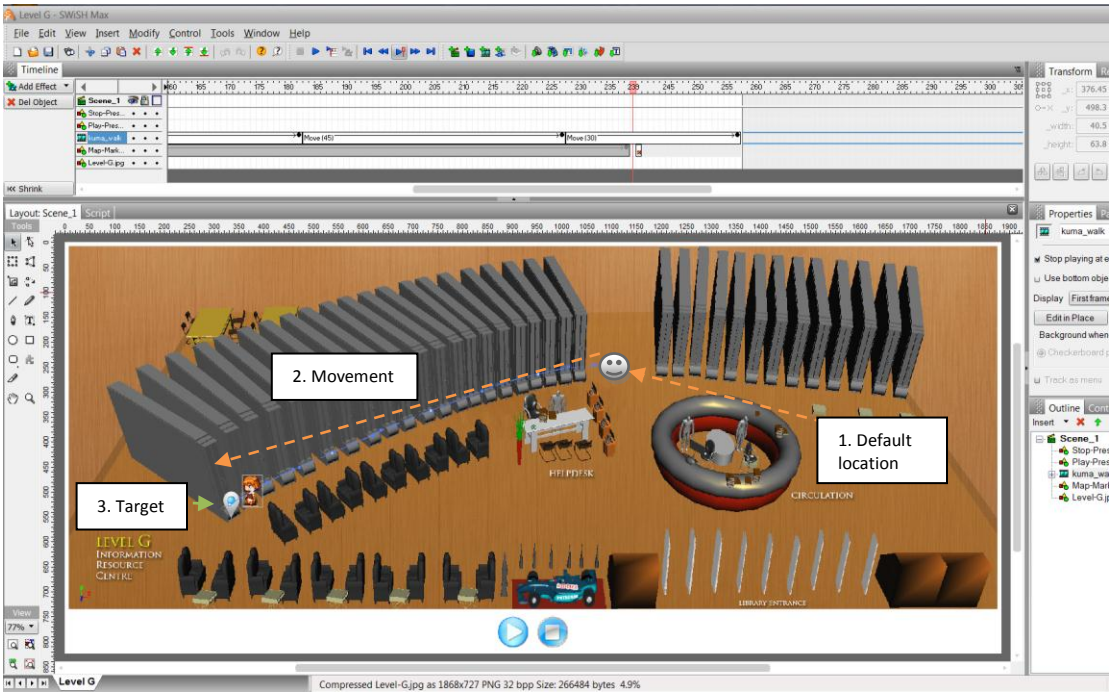


FIGURE 4.26. Animation design in library layout

Administrator or staff will need to assign the location code that will be provided aligned with the directory mapping. The cataloging directory will automatically allocate the correct directory mapping based on the location code provided in the book material information to each of the book information that had been assigned in cataloging basic information database.

Example of location code : **LG.S1.L** – Level G (**LG**), Shelves 1(**S1**), Left(**L**)

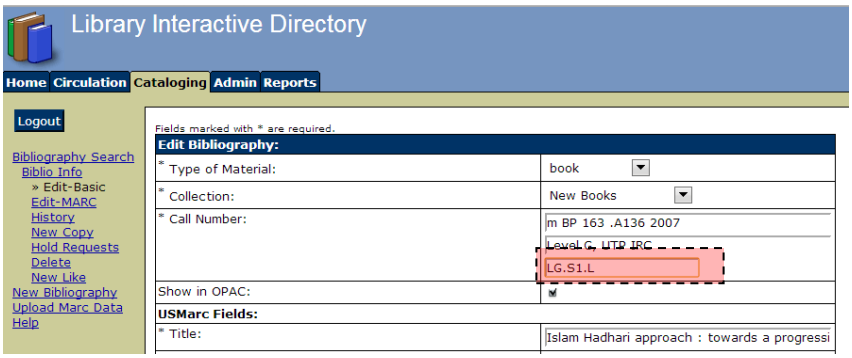


FIGURE 4.27. Directory mapping location code

4.7.3 Administrative Section

The administrative sections were developed that consists of circulation, cataloging, admin and reports. This different part of administrative section shall have the configuration and settings for different tasks in this interactive directory. This basic functionality in this section typically should have in the OPAC web application.

1. **A circulation is used to manage member records.**

i. Member administration (new, search, edit, delete)

ii. Member bibliography checkout, holds, account, and history

iii. Bibliography check in and shelving cart list

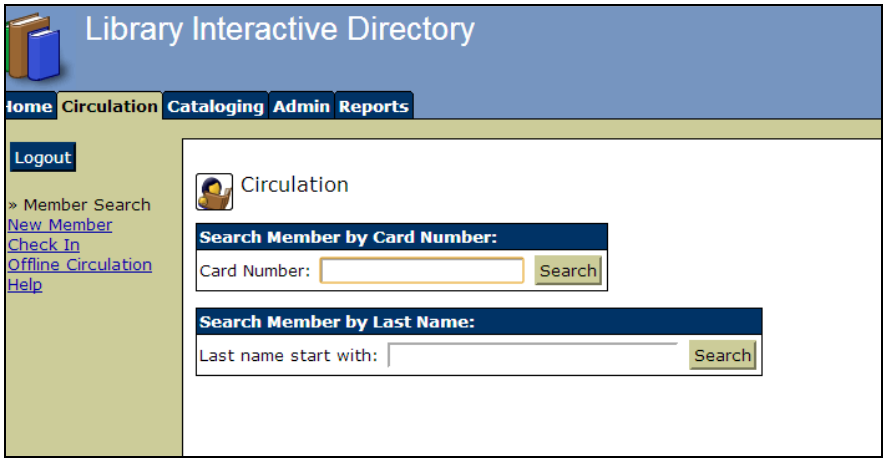


FIGURE 4.28. Circulation settings and configuration

2. **Cataloging is used to manage bibliography records in library.**

i. Bibliography administration (new, search, edit, delete)

In this cataloging tab, admin have ability to add for new library bibliography data records. In addition, admin can have functionality such as search, edit and delete bibliography data that had been stored in database. Besides that, admin can upload Marc data that contain imported record of bibliography from other library databases.

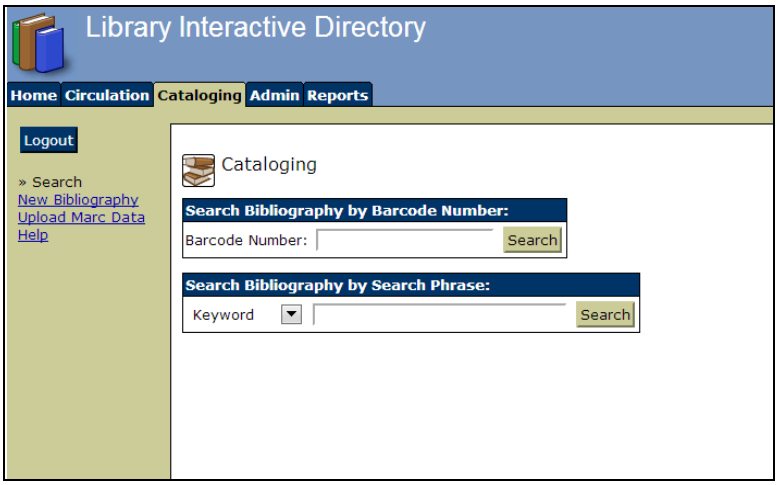


FIGURE 4.29. Cataloging settings and configuration

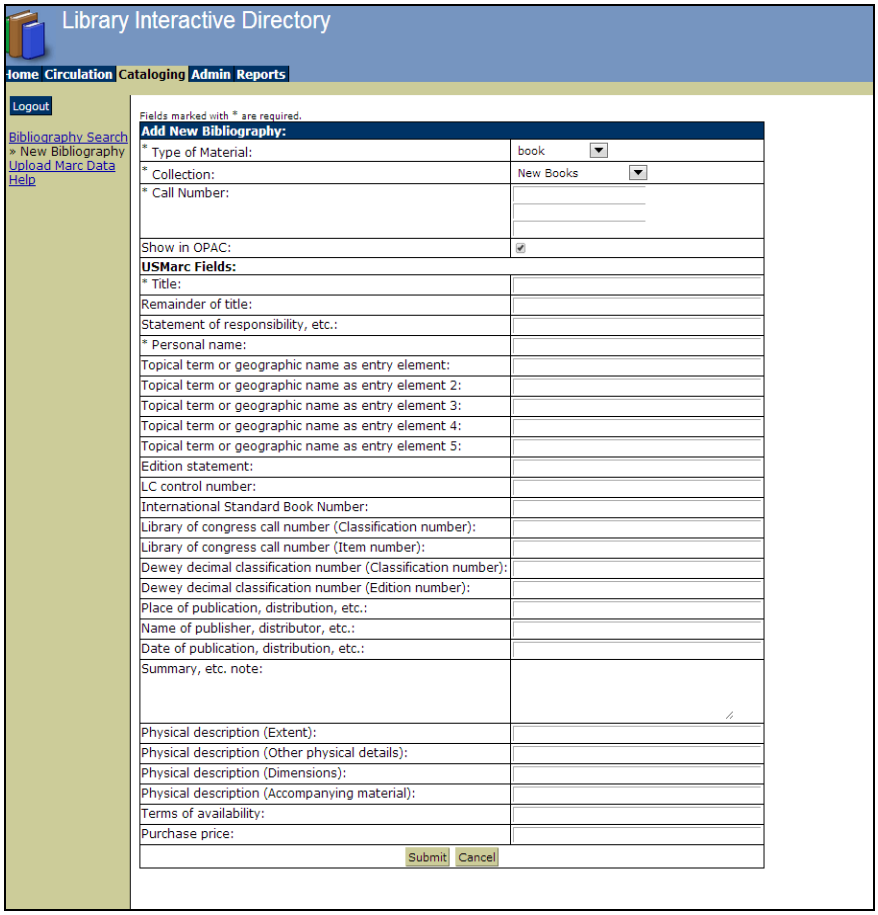


FIGURE 4.30. Bibliography records addition

3. **Admin tab sections were used to manage staff and administrative records.**

i. Staff administration (new, edit, password, delete)

ii. General library settings

iii. Library collection list

iv. Library material type list

In admin tab, there are several functionality had been added that enable administrator to configure member types, material types, collection, check out and library settings.

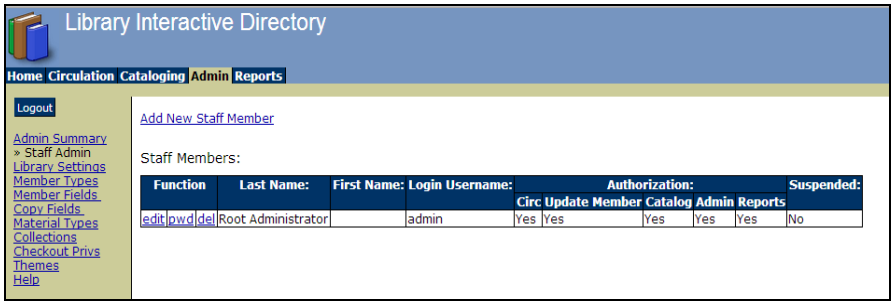


FIGURE 4.31. Staff administration

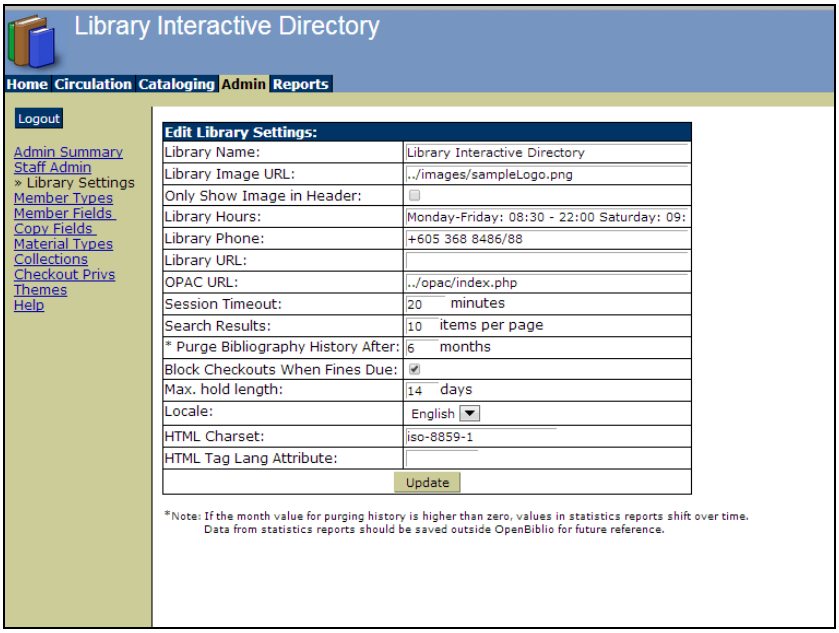


FIGURE 4.32. General library settings

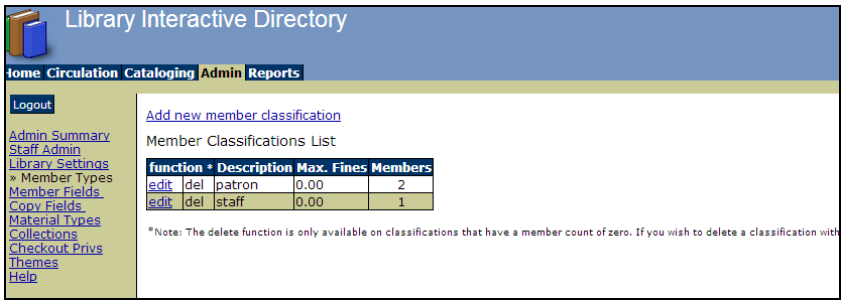


FIGURE 4.33. Member types

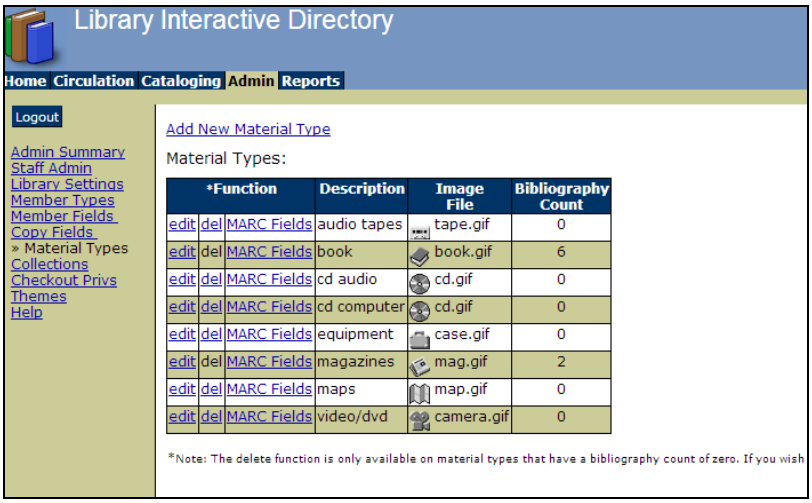


FIGURE 4.34. Material types

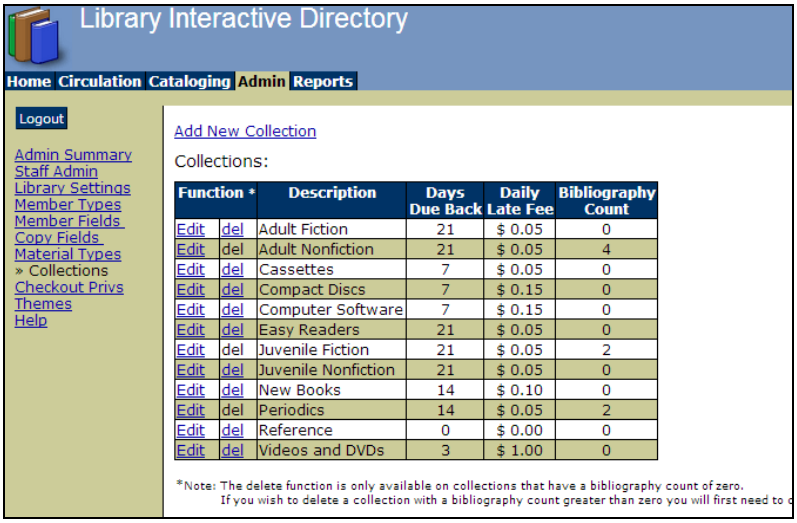


FIGURE 4.35. Collections on library materials

4. Report tab sections were used to run reports on your library data.

i. Report.

ii. Labels.

Reports tab provide the admin to generate the report based on the preference that had been offered in the web application. Hence, admin can know the statistic of the library materials, circulation and cataloging matters.

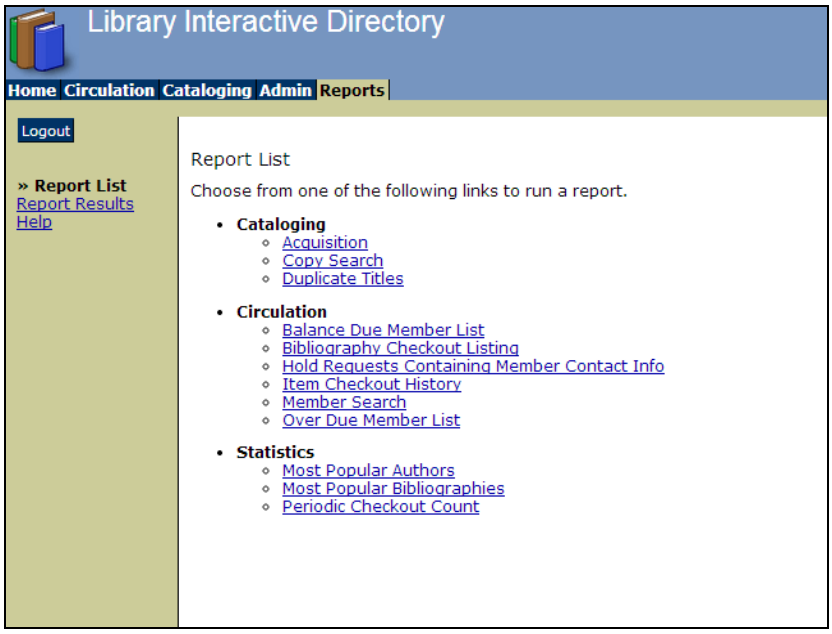


FIGURE 4.36. Functionality of generated reports

This project might require a large number of bibliography record data. In this project, data that consist of types of material, collection description and library materials information were added through cataloging administrative section to demonstrate the web application operation and functionality. Bibliography record will be based on the OPAC in UTP library.

In cataloging, records were added using New Bibliography menu at the sidebar. The new record fields were displayed and admin can input the appropriate record data inside the field that provided in the web application. Record that displayed is based on the OPAC in UTP library.

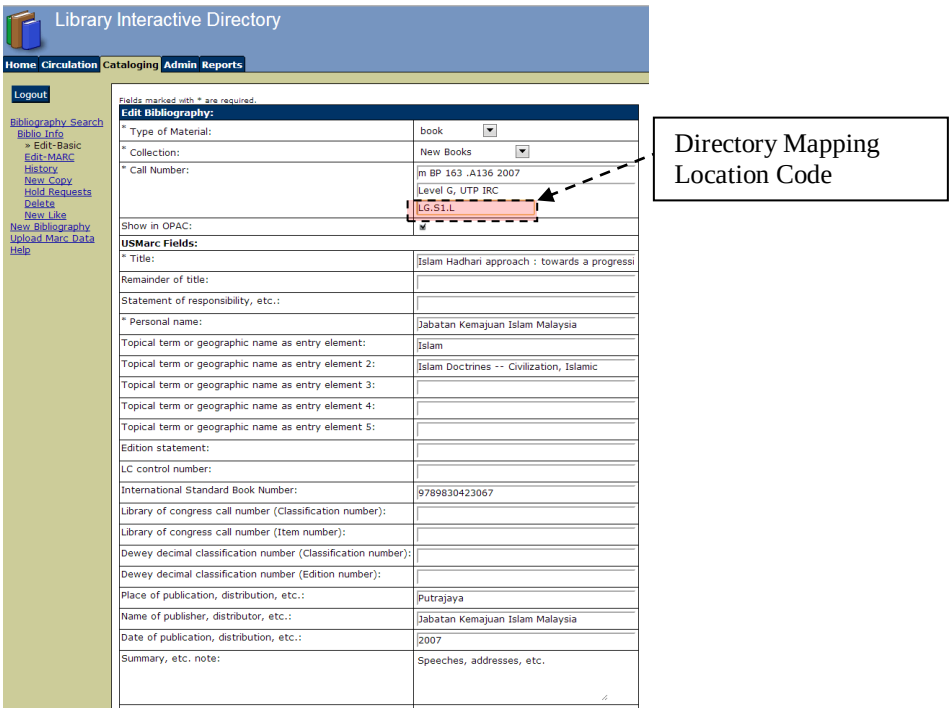


FIGURE 4.37. Demonstration of record added in the database

Administrator shall able to view the record that have been added through cataloging and several features such as administrator can edit and delete the previous bibliography record created in the web application.

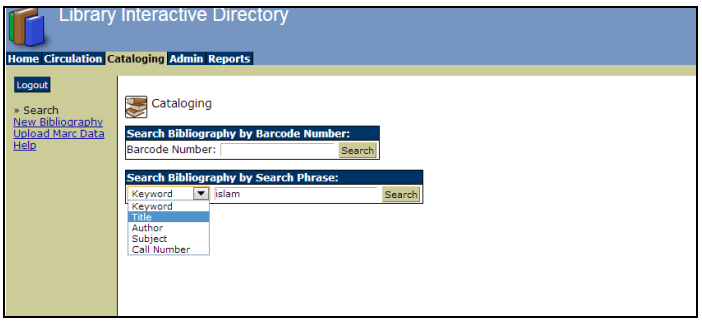


FIGURE 4.38. Search for bibliography records

In search functionality, administrator can input several keyword such as title, author, subject or call number inside the field provided before execute the bibliography record search. Full description of the bibliography record that consist of library material shall be displayed when administrator click on the results appear from the search execution.

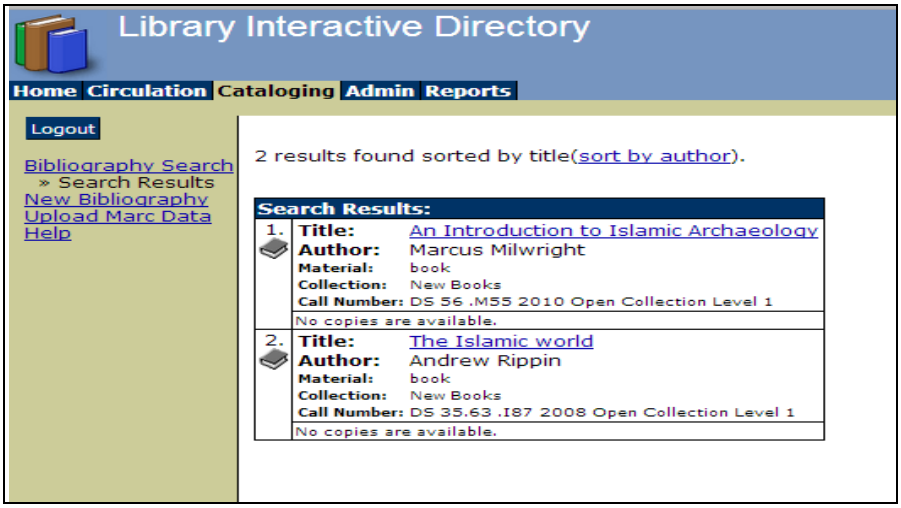


FIGURE 4.39. Result from bibliography records search

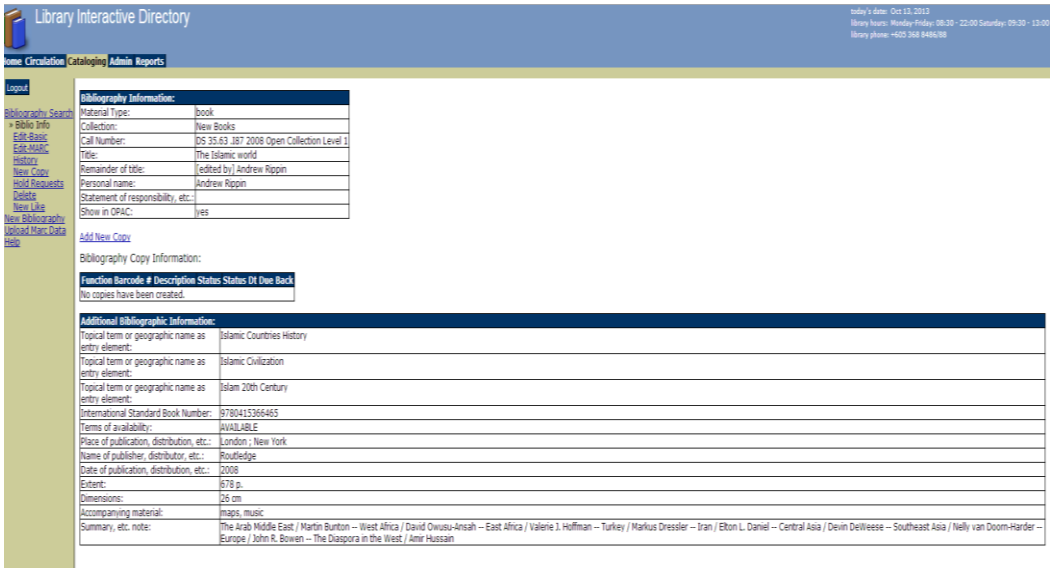


FIGURE 4.40. Bibliography record displayed

4.7.4 Cataloging Directory with Library Layout Mapping

Library user need to access the main page of the web application in order to locate the book desire in the library. Users were provided with two choice of search such as search books by barcode number or keyword that consists of title, author, subject and call number.

FIGURE 4.41. Main page of Library Interactive Directory

User will be directed to the result page of the search that had been executed in the search field provided in the main page. The list of records that have been found with relevant keyword search will be displayed in the search result page.

Therefore, user now can navigate through the search result provided in the page. On the other hand, if user not satisfies with the search result that had been retrieved in the page, user can make a new search on the top of the web section that provides the search field based on the barcode number or keyword.

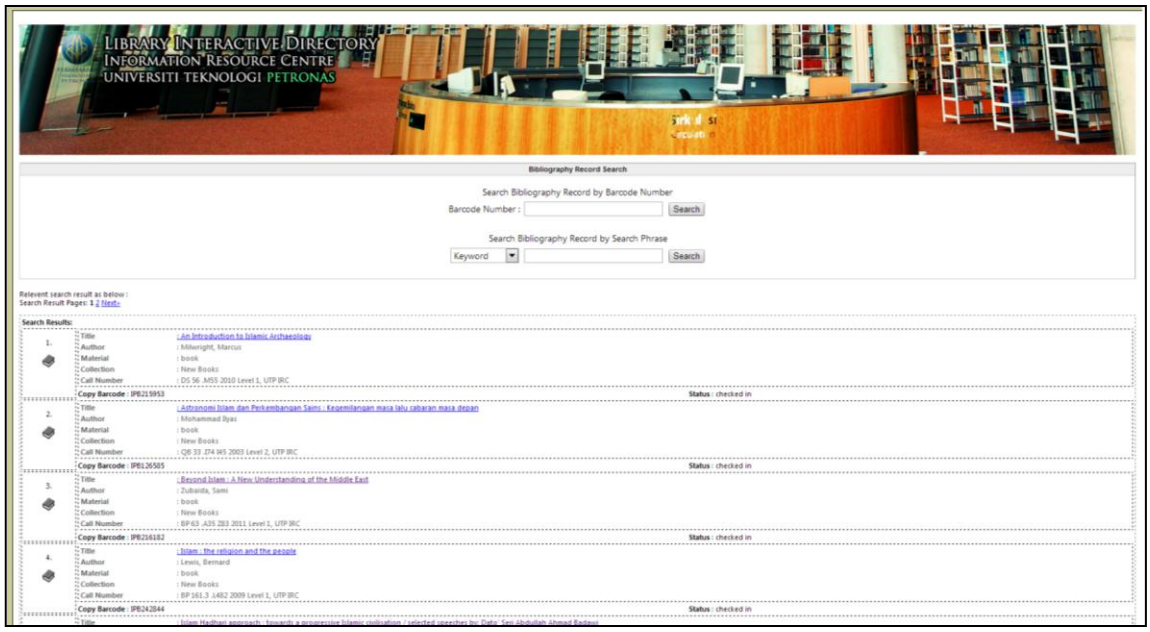


FIGURE 4.42. Search result on cataloging directory

For instance, if user has found the desired book in the search result, user can simply navigate to the list of records provided in the search result page to view the information of the book.

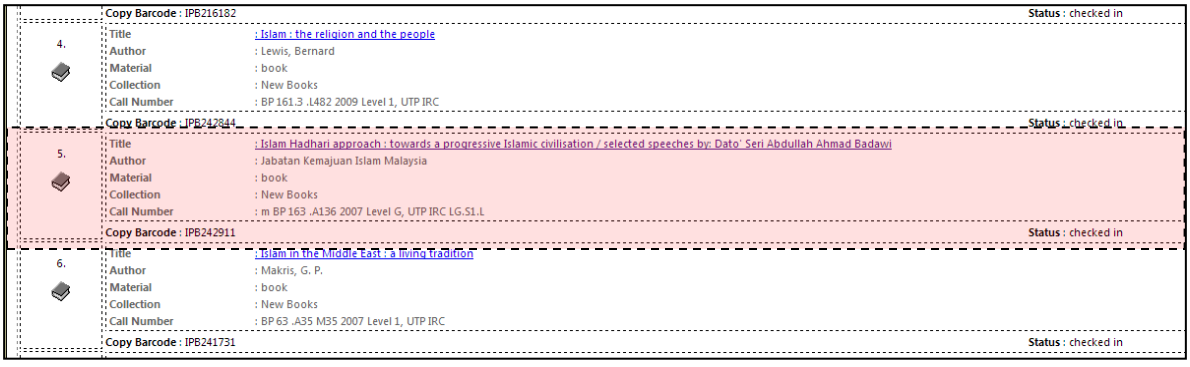
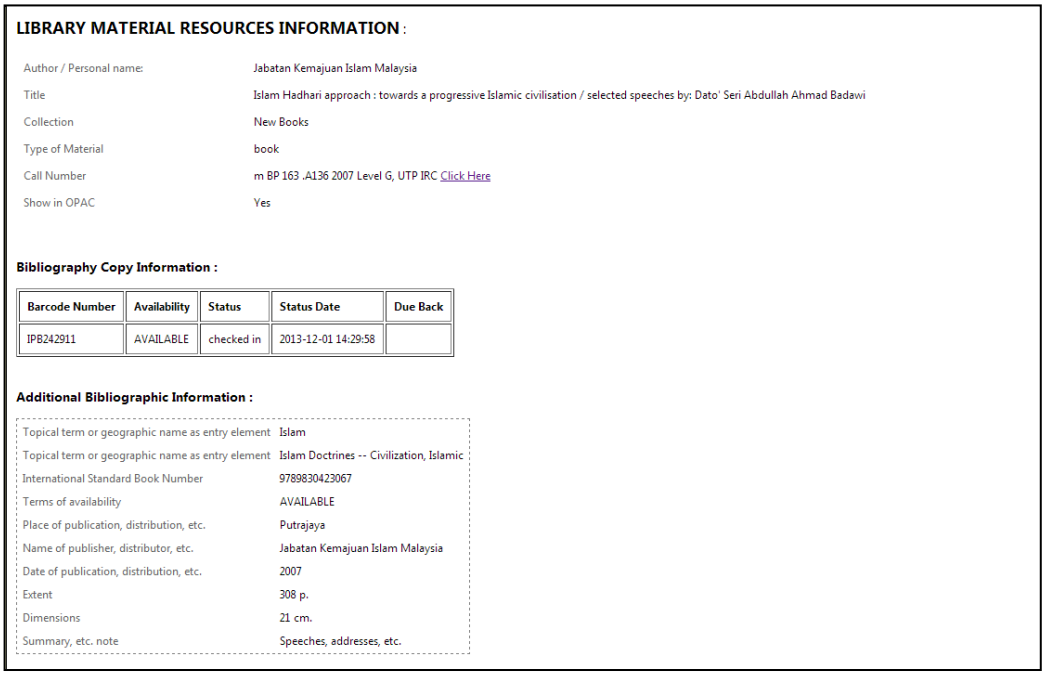


FIGURE 4.43. Navigation records on search result

Library material information will be displayed for references. User can view the information of the book such as the availability status, author, collection, call number, publication and summary. The information displayed in the records view of library material is much detailed compared to the list of records provided that only give the summary of the book information such as title, author, material, collection, call number, status and barcode.



LIBRARY MATERIAL RESOURCES INFORMATION :

Author / Personal name:	Jabatan Kemajuan Islam Malaysia
Title	Islam Hadhari approach : towards a progressive Islamic civilisation / selected speeches by: Dato' Seri Abdullah Ahmad Badawi
Collection	New Books
Type of Material	book
Call Number	m BP 163 .A136 2007 Level G, UTP IRC Click Here
Show in OPAC	Yes

Bibliography Copy Information :

Barcode Number	Availability	Status	Status Date	Due Back
IPB242911	AVAILABLE	checked in	2013-12-01 14:29:58	

Additional Bibliographic Information :

Topical term or geographic name as entry element	Islam
Topical term or geographic name as entry element	Islam Doctrines -- Civilization, Islamic
International Standard Book Number	9789830423067
Terms of availability	AVAILABLE
Place of publication, distribution, etc.	Putrajaya
Name of publisher, distributor, etc.	Jabatan Kemajuan Islam Malaysia
Date of publication, distribution, etc.	2007
Extent	308 p.
Dimensions	21 cm.
Summary, etc. note	Speeches, addresses, etc.

FIGURE 4.44. Records view based on search result

Records view will display all of the appropriate library book information for user references. Hence, after user had satisfied with the desired book, user need to look for status of availability whether the book is only for library use that solely on staff or available for regular library user. User can proceed with the location of the book based on the call number provided in the web application records view page.

Link will be provided within the call number in the records view page to ease the user in locate the books in library. User need to navigate through the link provided to display the interactive library layout mapping.

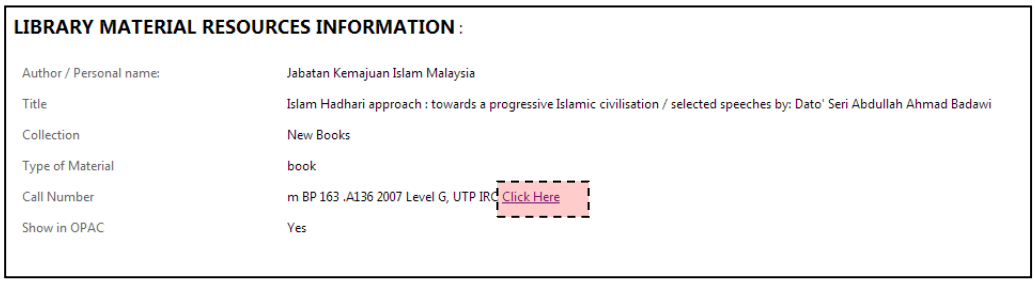


FIGURE 4.45. Navigation to interactive library layout mapping

Interactive library layout mapping will be displayed for user on the new page of web application. This library layout mapping consists of 3D graphical presentation of actual library layout. In addition, an animated people will be displayed in the layout to demonstrate the navigation through shelves based on the location of book in library. The book is located at Level G based on the information provided by call number. Hence, the directory mapping will display the Level G library layout.

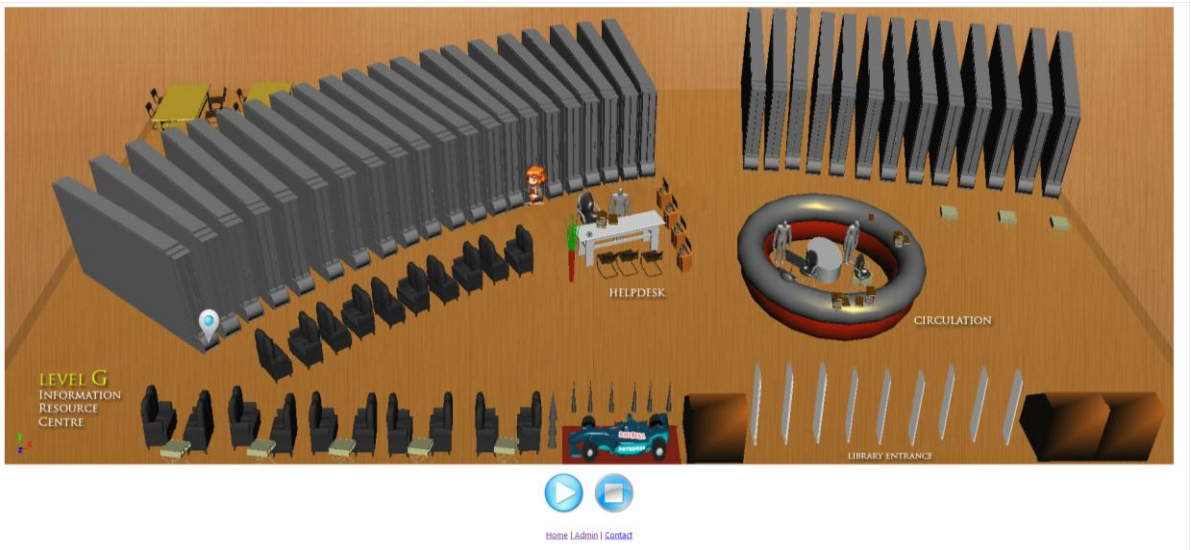


FIGURE 4.46. Interactive 3D library layout mapping

The person that appears in the library layout will walk to the pin point target of the shelves in library and stop after reach the target shelves. Therefore, user can know the location of exact shelves that hold the book in library.

FIGURE 4.47. Animated person walk to targeted shelves location

The architecture of library layout is modeled with the similar structures in library to ease the user in understanding the library layout while navigate and locate the book. These architecture are consists of shelves and furniture. Several of the appropriate information labeled in the library layout.

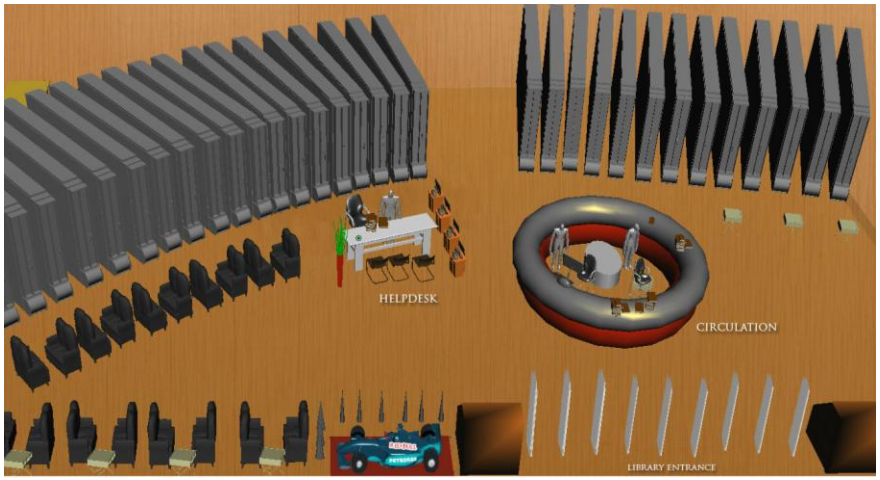


FIGURE 4.48. Architecture of library layout

In addition, users have a functionality to control the animated library navigation layout through the control features provided in the library directory mapping. The control button consists of play and stop (pause) can be used for animation movement in library.

FIGURE 4.49. Directory mapping control

Besides that, user can replay the animation using play control after animation end at the location targeted in library layout. These controls shall assist user to verify the location of book through animation movement through shelves in library.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

Library Interactive Directory is a web application that able to help library user in locating the book that they searched for in the accurate location. Hence, user can search for desirable book information including the correct location of the book.

The directory of book location can be displayed by user in the interactive graphical directory presentation from the interface of directory. Therefore, user should be able to find the location with the assistance from the interactive directory that has been provided in the web application.

Several recommendations that suggested such as the web application can be develop into various platforms on mobile application and the design of the mapping can be more defined with more detailed perspective to enhance the user experiences in viewing the graphical directory. In addition, live walkthrough navigation to library materials will be much better associated with cataloging directory. Hence, its can ease the users to navigate and manage to locate library material while walking and exploring materials in the library.

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APPENDICES

I. Sample of Staff Interview Question

INTRODUCTION

OPAC (Online Public Access Catalog) or Pulse is a current system in Universiti Teknologi PETRONAS library that help user in displaying the information about the materials user had search for within the location provided through the system. The purpose of my final year project is to develop an interactive directory application that could assist patrons in locating materials in library through interactive map displayed in the system.

This interview is intended to collection information regarding staff perception, user experiences and problem arises related to patrons in locating library materials on current library directory. The feedback from library staff shall be able to assist in project development that focused on library material directory enhancement that can assist patrons in current environment.

QUESTION

1. **Name** : Rabiatul Ahya Md Sharif
2. **Position** : Senior Executive, Reference & Consultancy Unit
3. **Gender** : Female

4. **What are the problems that patrons face in locating library material?**

   They don't know how to use OPAC
   They don't know how to locate the call no at the specific shelf

5. **How do you deal with the problem face by patrons in locating library materials?**

   Show or teach them how to use OPAC
   To certain extent have to direct them to the specific shelf

6. **In your opinion, is locating library materials is a challenge among patrons? If yes, please elaborate what do you think is the reason.**

   It is challenging for some. Although in OPAC there's call no. and floor indicator but maybe the row of shelves baffle them as to which specific shelf they should go

7. **What is your opinion on the current library material directory?**

   I think OPAC alone as library material directory is not enough and would be better if accompanied by a visual directory or map

8. **Do you have any suggestion or expectation in improving library material location provided through directory system?**

   I wish we can have a link from within the OPAC record itself to a visual directory system but this might involve a lot of work. An external visual directory system will do to improve library material location, something like NUS Library

9. **What features that you would like to have for the directory? (graphic image, animation, directory, etc.)**

   Searchable call no or barcode no and graphic image of floor plan of shelf area (or the whole floor or the whole library since there are other locations such as the Media Library and accompanying CD at level G).