LAB ASSET MANAGEMENT SYSTEM

WITH IMPLEMENTATION OF QR CODE

GAN SIONG HIN

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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JUDUL:

LAB ASSET MANAGEMENT SYSTEM WITH IMPLEMENTATION OF QR CODE

SESI PENGAJIAN:

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Saya

GAN SIONG HIN

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Catatan: * Tesis dimaksudkan sebagai Laporan Akhir Projek Sarjana Muda (PSM)

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LAB ASSET MANAGEMENT SYSTEM

WITH IMPLEMENTATION OF QR CODE

GAN SIONG HIN

This report is submitted in partial fulfillment of the requirements for the
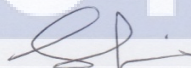Bachelor of Computer Science (Computer Networking)

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA
2016

DECLARATION

I hereby declare that this project report entitled

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is written by me and is my own effort and that no part has been plagiarized
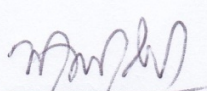without citations.

STUDENT   : _____   Date: 25 Aug 2016
             (GAN SIONG HIN)

I hereby declare that I have read this project report and found
this project report is sufficient in term of the scopre and quality for the award of
Bachelor of Computer Science (Computer Networking) With Honours.

SUPERVISOR : _____   Date: 25 Aug 2016
        (DR. WAHIDAH BINTI MD SHAH)

DEDICATION

The rise of Google, Facebook, and Apple are proof that there is a place for computer science as something that solves problems that people faces every day.

ACKNOWLEDGEMENTS

ABSTRACT

Lab asset management system is essential for every organization. The aim for this project is to build a prototype system which is able to allow the organization to keep track of their asset including recording, retrieving, lending and producing report. The Lab Asset Management System (LAMS) is a web-based system that is incorporated with a QR code for asset tagging. With QR code, process of identifying, tracking, lending and updating will be much easier. The advantages of LAMS are twofold; to the administrator and user. For the administrator, the system assists them to manage the asset by adding, editing, viewing the current status of the details of the asset. While for the user, they can scan the QR code to search the asset and track the asset status, and even for apply the asset application to lending the asset. Shortly, the system is able to reduce the problem of human mistake (manual record) and manage the asset more effective.

ABSTRAK

Sistem Pengurusan Aset Makmal (LAMS) adalah merupakan satu keperluan bagi setiap organisasi. Tujian projek ini dijalankan adalah untuk menghasilkan sebuah sistem prototaip yang membolehkan sesebuah organisasi memastikan keperluan aset makmal direkod, diperoleh, dipinjam dan juga dapat menghasilkan laporan. LAMS adalah berasaskan web yang menggabungkan kod QR untuk tujuan label aset. Dengan menggunakan kod QR, proses mengenali, mengesan, meminjam dan mengemaskini akan menjadi lebih mudah. Kebaikan LAMS ini terbahagi kepada dua bahagian, iaitu pentadbir dan pengguna. Untuk pentadbir, system ini membolehkan mereka mengendalikan aset dengan menambah, mengubah dan melihat status semasa tentang maklumat aset. Selain itu, untuk pengguna pula, mereka boleh mengimbas kod QR untuk mencari aset dan melihat status aset tersebut, dan boleh menggunakan aplikasi ini untuk meminjam aset tersebut. Secara ringkasnya, sistem ini dapat mengurangkan masalah kesilapan manusia iaitu membuat rekod secara manual dan membolehkan aset dikendalikan secara efektif.

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LIST OF ABBREVIATIONS

QR	-	Quick Respond
HTML	-	HyperText Markup Language
PHP	-	Personal Home Page
SQL	-	Structured Query Language
FTMK	-	Faculty of Information and Communication Technology
SKK	-	System and Computer Communication
SE	-	Software Engineering
MI	-	Interactive Media
KI	-	Industrial Computing
LAMS	-	Lab Asset Management System
DMS	-	Database Management System
AMS	-	Asset Management System
LMS	-	Library Management System
EB	-	EmployeeBook Employee Management System
FYP	-	Final Year Project
PK	-	Primary Key
FK	-	Foreign Key
AI	-	Auto Increment

CHAPTER I

INTRODUCTION

1.1 Introduction

Nowadays, the development of technology is very rapid and it is used to manage work effectively and efficiently. A lot of organization manages their asset and inventory by using a pen and paper recording. However, a huge company with large organization are required a management system to manage their asset. Assets are defined as an entity, item and things that have useful value to the organization such as inventory, equipment and accessories. Asset management is a system that used to manage and track the asset without using pen and paper recording. The development of asset management is systems are allowing the organization to managing their asset by using a systematic system. These asset management systems are focus on asset, database and other analytical tools. However, most of the web based management system is just allow the user to manage the asset by add and search for the asset but not for lend and return the asset. To solve the problem, an asset management system is implementing with tools which is barcode to make the work simple and easy to manage the organization's valuable assets. (Chu et al. 2012)

Barcodes is a one dimensional made up of lines and spaces to form a codes. It is read by using a readable optical machine to get the information and represent as data to identifying a product. Barcodes are used as industrial context and used on product such as supermarket checkout systems to identify the item details. For

example, inventory management system is a system that used to tracking and managing the product by scanning the barcode. Hence, scanning the barcodes to get the information was very fast instead of key in the serial number to get the information but it only holds the information with horizontal direction. A QR code can carry information with both horizontally and vertically because it is a 2 dimensional improve form of barcode that can store more information and it has quick response, fast readability and greater storage capacity.

As a practical application of the project, a lab asset management system will be developed by implementing the use of QR code due to the quick response, fast readability and greater storage capacity. The lab asset management system by using QR code tagging is easily to manage. The admin can generate the QR code by adding the information of the asset and store it into database. Besides that, it also allows the admin to manage it by editing the information of the asset and viewing the current status and the detail of the asset. The user can apply the application for lend the asset by scanning QR code. After the users scan the QR code, they are required to log in and verify their identity to apply the application and fill in the form before lending the asset. The system will send the application details to admin when users apply to lend the asset and after admin approve the application, it will update the status of the asset then store into the database. The system is developed to manage the lab asset easily and systematic. It also helps to solve the problem of human mistake on manually record and enhance the procedure of lending the lab asset.

1.2 Problem Statement

The QR code is widely used but mostly focused to several fields like check in and browsing a web page. In this project, the research is applied by development of a management system with the implementation of QR code to manage the lab asset easily and systematic. The system is cheap and affordable to manage the lab asset by using QR code.

The problem statement of this project is managing and lending lab asset manually is always complex than managing and lending by using a system. Currently the lab asset is managing and lending by manually with fill in the form and record on paper. The users are required to filling the form on application form and checking the lab asset details before lending the lab asset. The staffs also need to record it by manually. To ease the process of managing the asset, a management system is used to record the new asset by inserting the details and store into database. Hence, the details of the asset and the application of the asset can access by scanning the QR codes.

Table 1.1: Summary of Problem Statement

PS	Problem Statement
PS$_1$	Managing and lending lab asset manually is always complex than managing and lending by using a system.

1.3 Project Question

The project question of this project which is:

Table 1.2: Summary of Project Question

PS	PQ	Project Question
PS$_1$	PQ$_1$	How can the lab asset management system with the implementation of QR code help to overcome the current problem?

1.4 Project Objective

The project objective of this project which is:

Table 1.3: Summary of Project Objectives

PS	PQ	PO	Project Objective
PS$_1$	PQ$_1$	PO$_1$	To study the requirement of manage lab assets and usage of QR codes.
		PO$_2$	To develop a lab asset management system with implementation of QR code.
		PO$_3$	To test and verify the proposed lab asset management.

1.5 Project Scope

The project scope of this project which is:

1. **Web application**

   The language used to develop the system is HTML, PHP and JavaScript. The web application provides the interface and functionality to log in, register, manage asset by adding, editing and viewing the detail of the asset. Besides that, it also provides to apply asset lending by scanning the QR code.

2. **Database**

   MySQL will be used as a database management sytem to store the data information. All of the asset information will be saved into database as a record and used to manage the asset.

3. **Management System**

Management system is the system that used to manage the asset. The system record lab asset of FTMK. The system is providing the functionality to administrator and user. For administrator, the system assists them to manage the asset by adding, editing, viewing the current status of the asset. Meanwhile, the system is provides the user to scan the QR code to search the asset and track the asset status.

1.6 Project Contribution

The project contribution in this project is benefits to the staff and the user who involve on lending and managing the lab asset. The lab asset management system with implementation of QR code is developing to manage the lab assets easily and systematically. It is proposed suitable management system for manage the lab asset by QR code.

Table 1.4: Summary of Project Contribution

PS	PQ	PO	PC	Project Contribution
PS_1	PQ_1	PO_1	PC_1	Proposed a system to manage lab assets by using management system and tools with simplify the procedure of lab asset management manually and allow user manage asset easily by provides the reporting.
		PO_2	PC_2	
		PO_3	PC_3	

1.7 Thesis Organization

Thesis Organization will be discussed about the summary for each chapter that contains in the report.

Chapter 1: Introduction

This chapter discuss about the introduction of the project and the background of the project. In this chapter, the background of lab asset management system is defined as introduction. The problem statement of the project is identified and directly influences the motives of the projects. The project questions are arising from the problem statement of the project. The objective of the project are also describe are also described to achieve based on the problem statement and project questions. The scope of the project is list and summarize with explanations. Besides that, the project contribution are infer back to the objective of the projects. Hence, the conclusion are provides a summary of the chapter and discuss the next activities of the proposed system.

Chapter 2: Literature Review

This chapter discuss about the literature review of the project. In this chapter, it will provide a chapter outline to the project. This chapter will introduce to the lab asset management system and the literature reviews are collected from book and journals to provide the explanation of the project. The domain will be discussed as approach to the related research in the project. The related work to the proposed system will be defined and compare the between the existing system and proposed system. Therefore, the critical review of the current problem will be defined and proposed a solution to the proposed system. Hence, conclusion is summarizing the chapter and explains the next activities of the project.

Chapter 3: Project Methodology

This chapter discuss about the project methodology and how it would be carried out. In this chapter will select a methodology to carry out the activities of the project. The stages of the selected methodology will used to relate to the project. Besides that, the project milestones are used to plan and manage the activities of the project.

Chapter 4: Analysis and Design

This chapter discuss about the results of the analysis of the preliminary design and the result of the detailed design. All of the finding of analysis and design will be discuss in this chapter. In this chapter, the lab asset management are analysis and design with the problem and requirement. The data requirement and functional requirement are used to identify what type of data the system should used to store internally. In the high level design, the user interface design and database design are used to implement to the proposed system.

Chapter 5: Implementation

This chapter discuss about the activity involved in the implementation phase and the expected output of the phase. In this chapter, the software development environment setup and software configuration management are used to implement the proposed system. Besides that, the proposed project is implemented in this chapter by using selected programming languages.

Chapter 6: Testing

This chapter discuss about the testing phase and testing strategy of the project. In this chapter, the proposed system are test by using the plan, implementation and the test result will be analyzed to the proposed system.

Chapter 7: Project Conclusion

This chapter discuss about the conclusion for the project. All of the summarization and enhancement are discuss to conclude the project. In this chapter, the weaknesses and strengths of the proposed project are requiring to state and proposition for the improvement.

1.8 Conclusion

Development of lab asset management system with the implementation of QR code is a system that provides benefits to staff and user who involve on manage and applying for lending lab asset. The system will be developed to solve all of the problems that may occur. The next chapter will be focusing on the literature review and project methodology to develop the lab asset management system with implementation of QR code.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

In this chapter, the literature review is a study of searching, collecting, analyzing the related works, research and project to the system development process. The literature reviews are collected from books and journals. It is very important to provide the explanation for the project. Fact and finding will be reviewed and approach to the related research and other finding about the system. The domain will be discuss and used as the study.

The requirement of previous work such as the flowchart of system, function of system, programming language used, database used and more are analysed. All of the related work such as existing system will be identify to improve and make a comparison between the existing system and the proposed system. Hence, the proposed system can enhance in this project based on the previous work. The research of project requirement which is software and hardware require to develop lab asset management system (LAMS) also will discuss on this chapter.

Based on the references, the literature reviews are used as case study to the system development process. In the end of this chapter will conclude with the conclusion as chapter summary.

2.2 Fact and Finding

Fact and finding is a research of the documents from library and internet resources to develop the system with obtain the user requirements. The system is developing to solve the existing problems. The fact and finding is focused on the available system which related to the project and will be analysed to determine what the purpose of the system is. Therefore, the system can be developing by study and analysis from the resource on literature review.

2.2.1 Domain

Domain is a collection of the requirement and entities of the system. Therefore, the information of the Lab Asset Management System (LAMS) is required to collect and define before the system is developing. LAMS with implementation QR code is design for department of computer and communication. The system is being developed based on web based system that allows users to manage the lab asset by access through Internet. Hence, the system will improve the method to manage and lend an asset with effectively and manageable. These domains are required for determine and helps to develop the project system. The domains of the system which is LAMS, Database Management System (DMS) and QR code generator.

1. Lab Asset Management System (LAMS)

Lab asset management system (LAMS) is a system that used to manage the lab asset. It is a prototype system which is able to allow the organization to keep track of their asset including recording, retrieving, lending and producing report. It is a web-based system that is incorporated with a QR code for asset tagging. With QR code, process of identifying, tracking, lending and updating will be much easier.

It is helps to improve the techniques for management of the asset and may be overlooked using traditional criteria. The system is a systematic process of maintaining, upgrading and operating physical assets. It will link to the requirement of the organization and provides tools for organized.

A web based management system is an application used to manage the asset by using web application. Based on researches, a web based management system is developed by web-based application to track, manages and updates the latest data. This is because web based management system can access by any platform and browse on anywhere. The web-based application systems are being widely used in managing asset and enable the user to manage the asset by accessing through the web page (Udin et al., 2001). With the increasing of the number of students and the increasing of the asset in the lab, a web based management system is required to develop for manage the asset with effectively (Xiuli et al., 2009).

A web based management system need to consider the function, features and the content. It allows the user to manage the asset everywhere by accessing the Internet while compare to the management system only can allow the user manage the asset through the system. Therefore, the web based management system proposed in this work provides semantic support for combination of the management system and database management system (Gal & Mylopoulos, 2001). However, it is also required other assistive technologies to the system such as embedded tools like bar code, QR code, RFID and more to make the system easy to used.

The language used to develop the proposed system is PHP. It is a server-side scripting language for web development. PHP code can embedded into HTML code. It also can use in combination with several of web content management system and web frameworks (Chaudhary & Kumar, 2014). The web server combines the results of the executed PHP code with any type of data, images to generate the web page. PHP has been widely used and can be deployed on most of the web servers on almost every platform and operating system.

2. **Database Management System (DMS)**

A database management system is software that uses store the data information of the system. It is for users to read, create, update and delete the data in a database. The database management system essentially serves as an interface between the application programs and the database (Hababeh et al., 2015).

With the database management system, the application programs can provides an interface and perform the submitting, retrieving and sharing application data from the database through Internet. In particular, a database as a critical component of the system to store the data information and the web application enables the system perform the function (Hababeh et al., 2015).

Normally, the database management system used on management system is MySQL. MySQL is an open source relational database management system. It is widely used open-source client and server model in database management system. MySQL is a popular choice of database for use in web applications and it is a central component of the widely used open-source web application software stack which is Apache, Perl, PHP and Python. Hence, the information of can be stored into database to manage the data.

3. **QR code Generator**

QR code is 2D barcode which can store data information and decoded at high speed to perform into several task. It has become popular because of the quick response, fast readability and greater storage capacity and widely used to item identification, document management, product tracking and more. The QR code generator is creating QR codes by the user enter the text into the web page and get the QR code generated (Sutheebanjard, 2010).

Every different QR code represents different data information. Thus, the QR codes are used apply to several applications including management system. For

example, an application of hospital healthcare and data management using QR codes is a system to manage healthcare of a patient by using QR code (Mersini et al., 2013).

The uses of QR code to the proposed system are to provide convenience to the user for view the information of the asset and lend the asset. Besides that, QR code is used to store the information of the asset. Every different asset has different unique code. The user can get the information of the asset by scanning the QR codes before make decision to lend the asset.

2.2.2 Existing System

Existing system refers to the system which is current already used by user and already exists. A comparison between existing system and proposed system are plays the crucial part in identifying the features and the differences of the system such as the weakness of the function of existing system without embedded tools and reporting. This will assist to improve and enhance the strength factors for the proposed system. Next subsection discusses the details of existing system which is similar to the proposed system.

1. FTMK Asset Management

Currently FTMK asset management is managing the asset by using KEW PA form. KEW PA form which is a form that used to manage and record the asset with filling the detail of the asset by manually. The assets are required to filling KEW PA 2 and KEW PA 3 for the asset registration. Then the assets are required to list on KEW PA 4 and KEW PA 5 as a record for the responsible officer. For the asset lending, the user are required to filling the KEW PA 6 as a record. Then KEW PA 7 is for updated the location of the asset. For the yearly report of the asset, the responsible officers are requiring to filling the KEW PA 8.

The flowchart of the FTMK Asset Management with KEW PA form is show as below (Refer Figure 2.1).

```
        ┌─────────┐
        │  Start  │
        └─────────┘
             │
  ┌─────────────────────┐
  │ Asset registration  │
  │   KEW PA 2 and 3    │
  └─────────────────────┘
             │
  ┌─────────────────────┐
  │   Assign asset      │
  │ responsible officer │
  │   KEW PA 4 and 5    │
  └─────────────────────┘
             │
  ┌─────────────────────┐
  │   Lending asset     │
  │     KEW PA 6        │
  └─────────────────────┘
             │
  ┌─────────────────────┐
  │   Asset location    │
  │     KEW PA 7        │
  └─────────────────────┘
             │
  ┌─────────────────────┐
  │   Report of asset   │
  │     KEW PA 8        │
  └─────────────────────┘
             │
        ┌─────────┐
        │   End   │
        └─────────┘
```
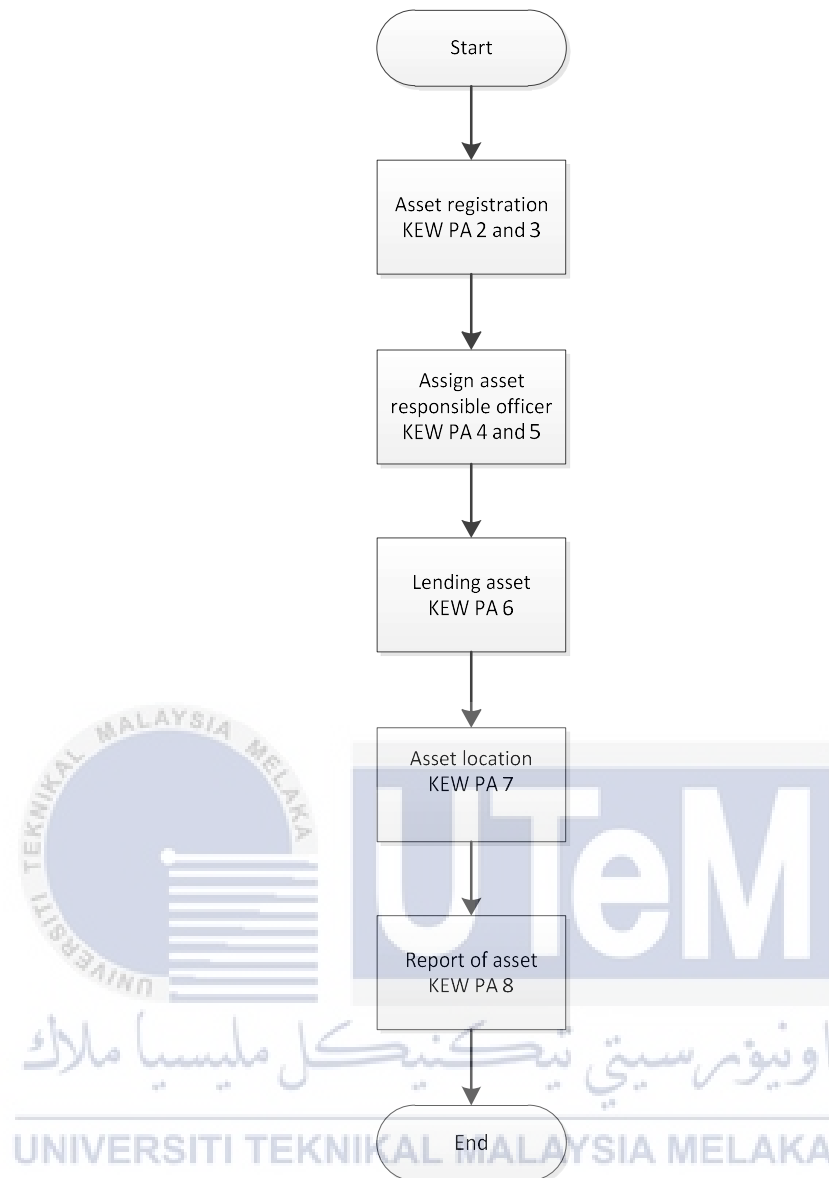
Figure 2.1 Flowchart of FTMK Asset Management with KEW PA form

2. Asset Management System (Khan, 2016)

Asset management system (AMS) is a online open source and available for user to used. It is a simple system that allows the organization to track and manage their asset. The system can be used by any organization to take an inventory of their existing hardware or software stocks. It can allow user to manage the vendors by categories and users.

The asset management system was developed with using PHP language. The database of the asset management system is using MySQL to store the information. AMS has two roles which is admin and user. Admin can add, update, delete stocks and assign any hardware or software while user only can view the vendor details.

To use the AMS, user is required to log in to the system (Refer Figure 2.2). After log in successfully, the dashboard will show hardware, software, user and vendor details (Refer Figure 2.3). Admin can use the system to add, update, and delete the stocks while user can search for the stocks.

Figure 2.2 Login page of Asset Management System

Figure 2.3 Dashboard of Asset Management System

The flowchart of the Asset Management System is show as below (Refer Figure 2.4).
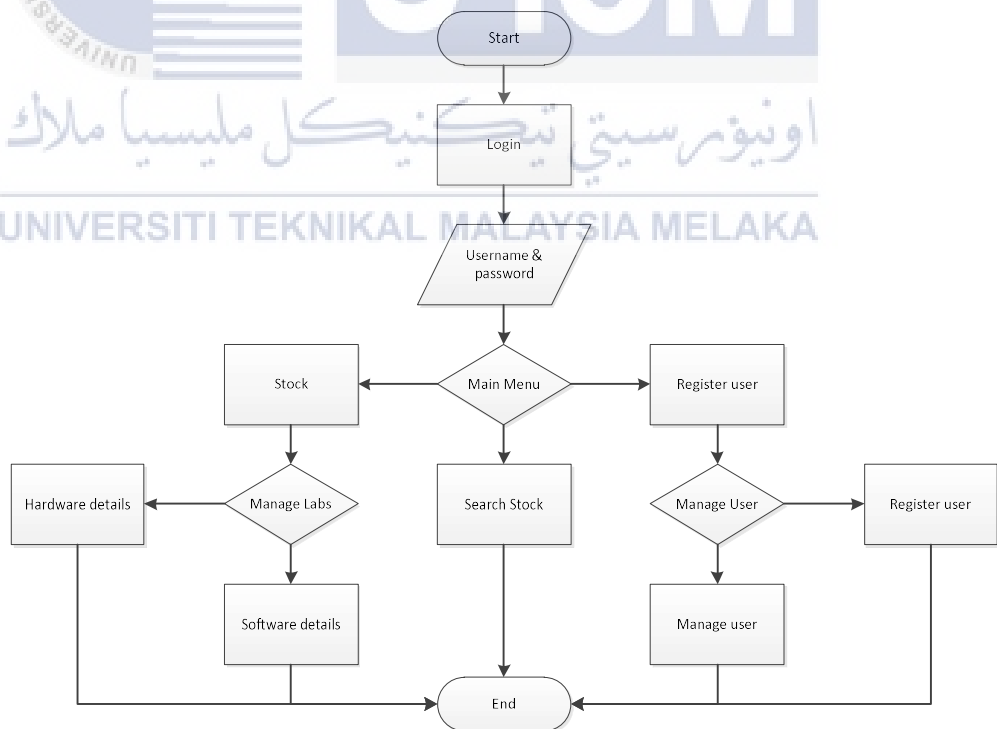
Figure 2.4 Flowchart of AMS

3. Library Management System (Xeroneitbd, 2016)

Library Management System (LMS) is a system developed for manage any type of library and accessing through internet. LMS is a web based management system where the admin can manage books of different categories, manage members and manage the issue or return of books easily.

LMS can be efficient on managing the library by providing the advanced features. The LMS was developed with using PHP language and the database system to store information is using MySQL. LMS are allowed the admin to manage the issue and return the books. It also can used to manage the member. The system also provided generates report features.

To use the LMS, the users are required log in to the system for lending the book or manage the book (Refer Figure 2.5). On the dashboard, it will display the report of the issue and return books (Refer Figure 2.6). LMS are allowed to manage the library by adding new books or editing the details of the books (Refer Figure 2.7). Besides that, LMS also can manage the member by adding new member and assign the member type (Refer Figure 2.8).
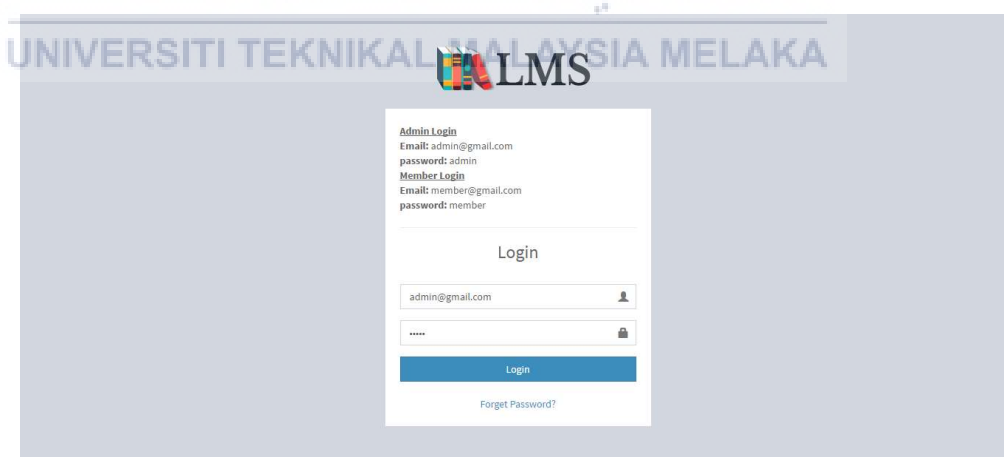
Figure 2.5 Login page of Library Management System
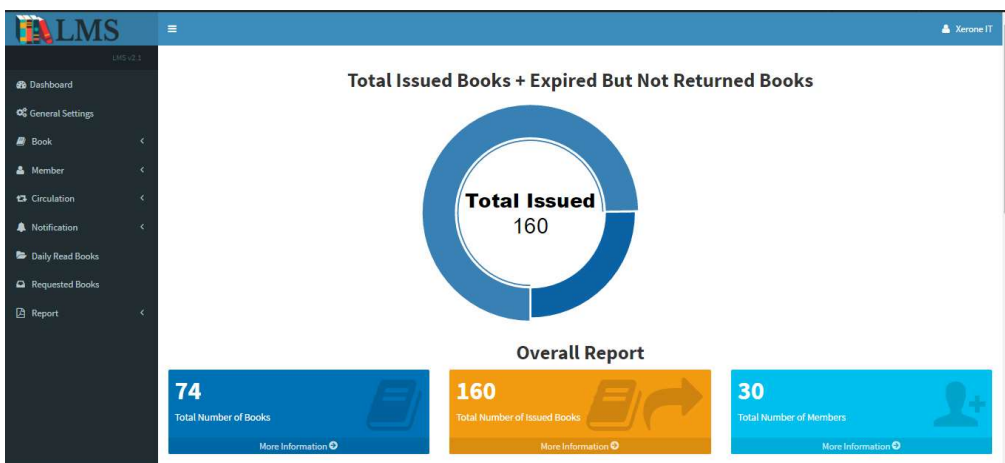
Figure 2.6 Dashboard of Library Management System
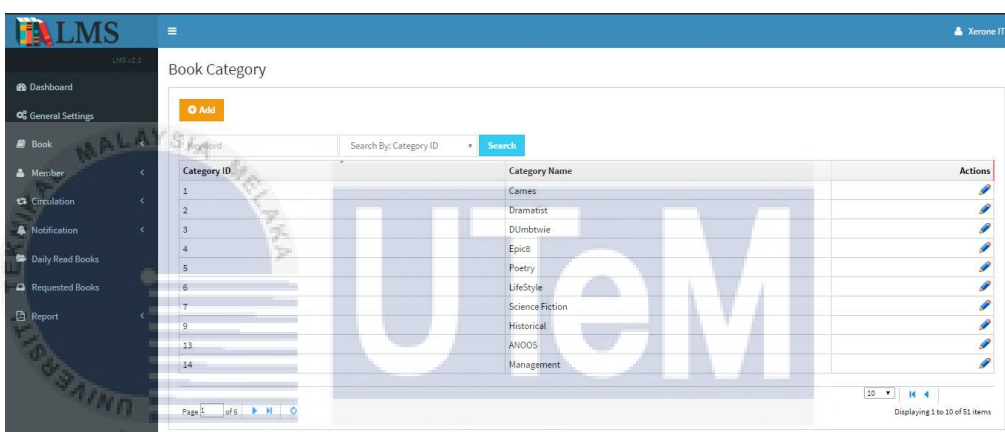
Figure 2.7 Book management page of Library Management System
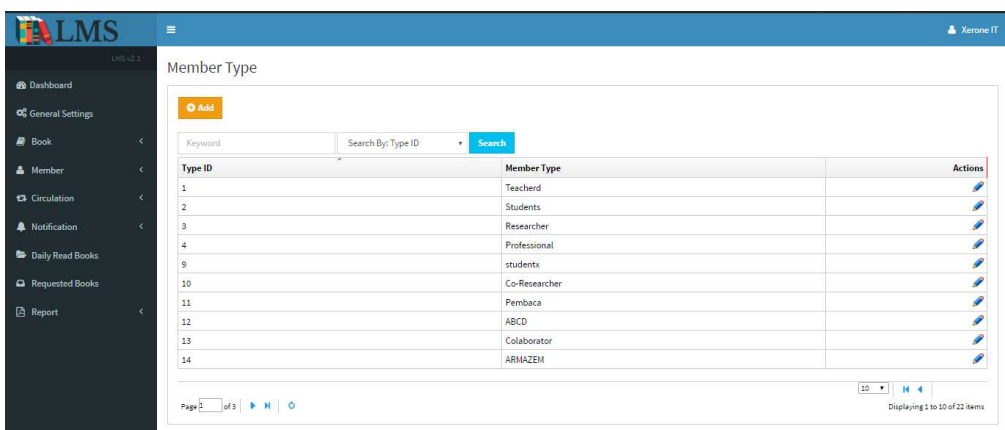
Figure 2.8 Member management page of Library Management System

The flowchart of the Library Management System is show as below (Refer Figure 2.9).
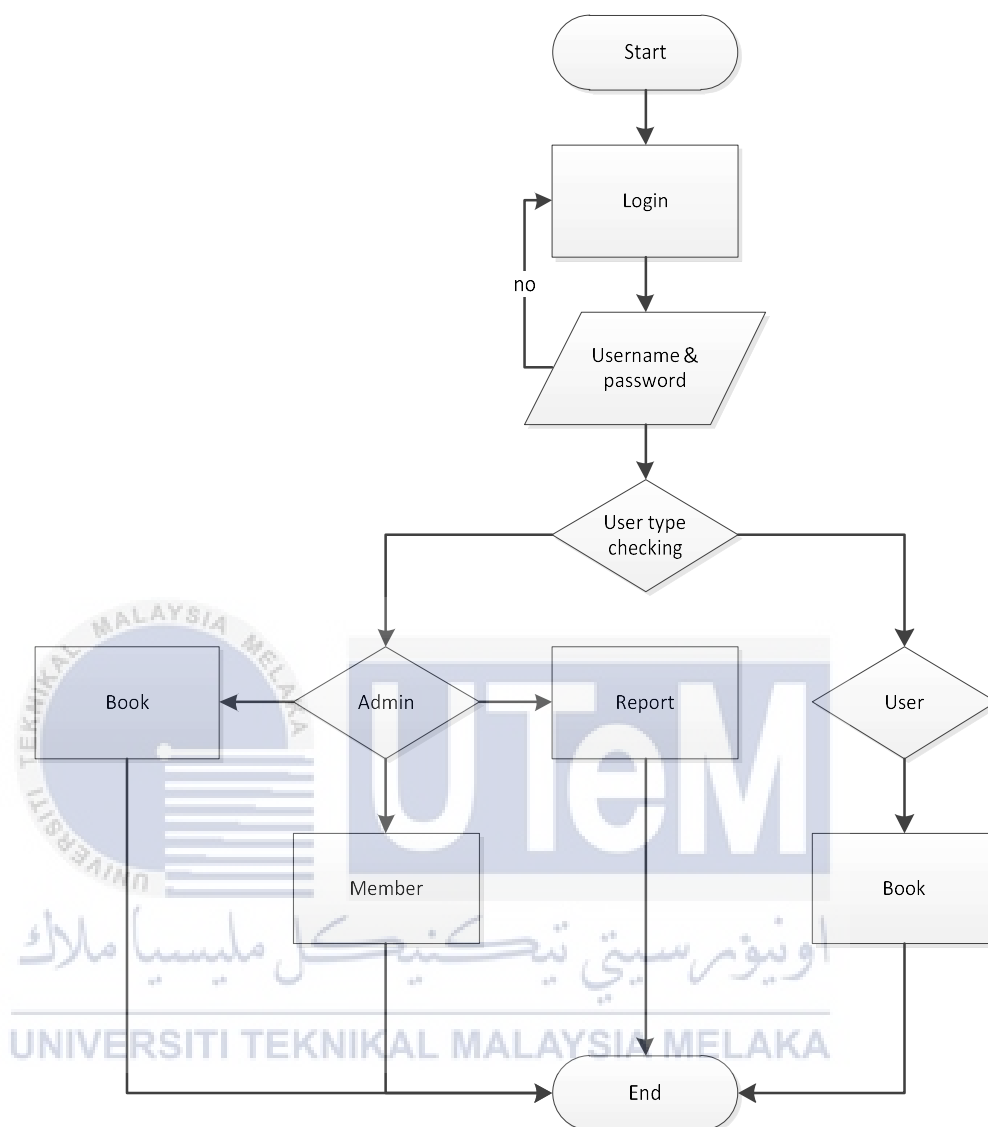
Figure 2.9 Flowchart of LMS

4. EmployeeBook Employee Management System (Codingexperts, 2013)

EmployeeBook Employee Management System (EB) is a system developed for helps organisations to manage employees easily. EmployeeBook is an efficient employee management system for organisations and can be used by all organizations.

EB was developed by using PHP language and the MySQL as database management system. The main features of the system are user management and leave management.

To use the EB, the admin are required to log in to the system for manage the employee (Refer Figure 2.10). Admin can add new employee (Refer Figure 2.11). Admin can view the user listing on the leave record of the employee (Refer Figure 2.12). Employee can apply for leave (Refer Figure 2.13).

Figure 2.10 Login page of EmployeeBook
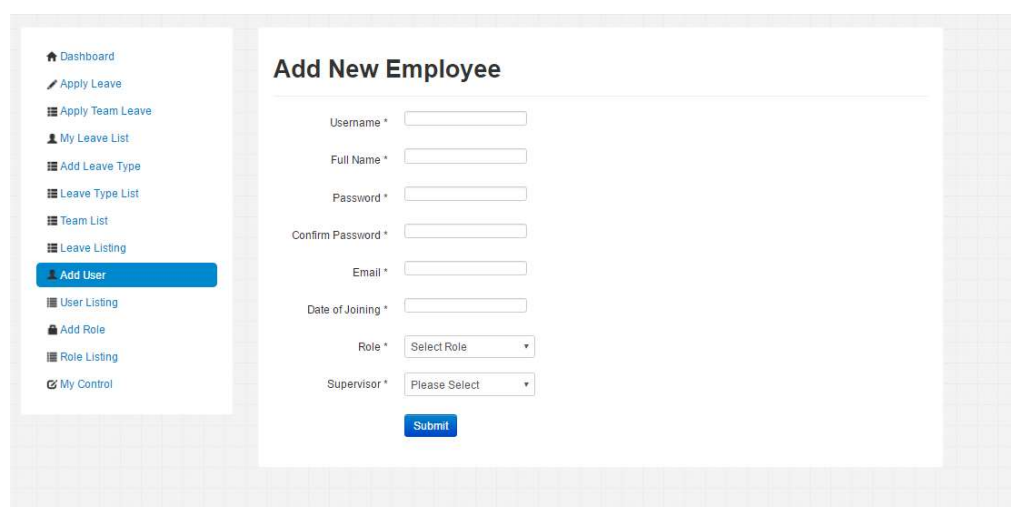
Figure 2.11 Add new employee of EmployeeBook

Figure 2.12 User Listing of EmployeeBook

Figure 2.13 Apply for leave of EmployeeBook

The flowchart of the Library Management System is show as below (Refer Figure 2.14).
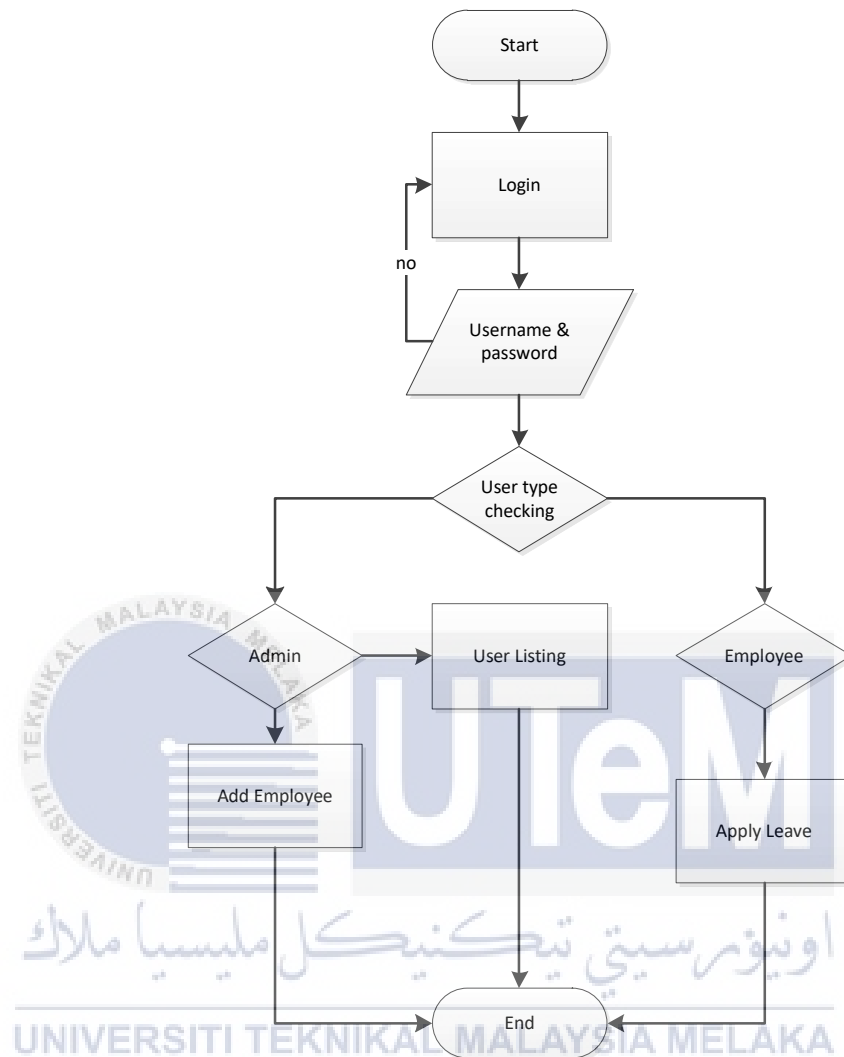
Figure 2.14 Flowchart of EB

2.3 Critical Review

Critical review is writing tasks that summarise and evaluate a text. Based on the previous research, the management system with manually will causes human error may occurs. The management is not effectively and difficultly manageable during the manually recording.

Hence, most of the developers are proposed and developed a management system to replace the manual management system. It will help to reduce the human error but the some of the existing system still not completely conveniences to use. This is because some of the system is lack of implement with the tools, assistive function, features and the content.

Therefore, a comparison between existing system and proposed system is required to compare and enhances with proposed the solution of the system. The comparison will show the differences between the existing system and the proposed system.

2.3.1   Comparison Existing System

The FTMK asset management system is manage by university asset management. Currently the asset is managed by using KEW PA forms. The assets are required to register and record manually by using the KEW PA forms. Therefore, the procedure to manage the asset is complex than using a system.

The asset management system is developed by TechZoo. The system is used to manage the asset by any organization (Khan, 2016).The system is used to discuss managing issues related to the project studies or work. The asset can be manage by admin with function add, update, and delete the stocks.

The library management system is developed by Xeroneitbd. The system is used to manage the book and the member in the library (Xeroneitbd, 2016). The book can be managed by admin by adding the new book or editing the details. Admin can also view the report and manage the member. Members are required to log in and search the book.

The employee management system is developed by CodingExperts. The system is used to manage the employee (Codingexperts, 2013). The admin can manage their employee by adding employee, assigning a task and view the employee listing. Employee can also apply for leave by using the system.

Based on the three existing systems, each of the management system has their own advantages and disadvantages. For asset management system (AMS), it can use by any organization, manage any type of asset and is an open source of management system but based on the flowchart of the system are defined some of the disadvantages. The disadvantage of AMS which is the system does not include notification, reporting and embedded tools to user. For library management system (LMS), it can only used by librarian and member which can only manage books and get the information from the website but not for lend and return the book. It also required RM108 to purchase the system. Based on the flowchart of LMS, it allow librarian to manage book, member and generate report, but it only allow user to search the book and does not include embedded tools and does not provides other functions to user. Meanwhile, for Employeebook employee management system (EB), it can helps employer used to manage employee details easily. Based on the flowchart, EB are allowing employee to apply leave but it does not provides search function, notification, reporting and embedded tools to the user. It also required RM76 to purchase the system.

Therefore, several features of the systems are used to comparison between the existing system and the proposed system as below:

Table 2.1 Comparison between existing system and proposed system

Name of system	Asset Management System (AMS)	Library Management System (LMS)	EmployeeBook Employee Management System (EB)	**Lab Asset Management System with implementation QR Codes (LAMS)**
Language	PHP, HTML, CSS, SQL	PHP, HTML, JavaScript, CSS, SQL	PHP, HTML, JavaScript, CSS, SQL	**PHP, HTML, JavaScript, CSS, SQL**
Database	MySQL	MySQL	MySQL	**MySQL**
User Type	Any organization	Librarian and Member	Admin and Employee	**Admin and Student**

Management Type	Any asset	Books	Employee	**Lab asset**
Login Requirement	Yes	Yes	Yes	**Yes**
Operation	Add, Update and Delete	Add, Update and Delete	Add, Update and Delete	**Add, Update and Delete**
Search	Yes	Yes	No	**Yes**
Notification	No	Yes	No	**Yes**
Email	No	Yes	No	**Yes**
Price	Open source	RM108	RM76	**None**
Reporting	No	Yes	No	**Yes**
Embedded tools	None	None	None	**QR code for asset tagging**

2.3.2 Project Requirement

The project requirements for the proposed system on Lab Asset Management System (LAMS) is required some of the software and hardware to develop the system.

2.3.2.1 Software Requirements

Software requirements are a description of a software system to be used on develops a system. The software requirements such as integrated development environment, local web server and embedded tools are required to develop the proposed system and will define and compare as below.

Integrated Development Environment (IDE) is an application that provides the environment to programmers to write the program as code editor. With this IDE, the system can be developing with efficiency and easier to reduce the mistakes. (Chow, 2006)

Table 2.2 Comparison of integrated development environment

Software	Eclipse for PHP	PHPStorm	Notepad++
Description	Eclipse for PHP is an tools to provides the environment to developer creating web application.	PHPStorm is a code editor to write the coding with code assist, navigation, on the fly error and more.	Notepad++ is a source code editor with supports several languages (DH 2016).
Language support	PHP, HTML, JavaScript, and more	PHP, HTML, JavaScript, and more	Any
Syntax highlighting	Yes	Yes	No
Code navigation	Yes	Yes	No
Debug & Testing	Yes	Yes	No
Price	Free	RM800	Free

Based on the comparison above, all of the software has the different features. Eclipse for PHP are chosen as IDE to the proposed system because of the price is free and the features.

Local web server is an environment that provides the delivery of web pages and database management system. Without the web server, the web pages are unable to interpret to the web pages. (Chaudhary et al., 2014)

Table 2.3 Comparison of local web server

Software	Xampp	MAMP	WAMP
Description	Xampp is an environment for PHP development with set up the web server and	MAMP is an environment for manage the database and accessing the web pages by web servers	WAMP is an environment for web application to manage the database and browse with web

	database.	without configuration (GmbH, 2004).	server easily.
Web server	Apache	Apache	Apache
Database	MySQL+ phpMyAdmin	MySQL+ phpMyAdmin	MySQL+ phpMyAdmin
Other features	PHP, OpenSSL, PostgreSQL PHP extension	PHP, Python, Perl, eAccelerator	PHP
Price	Free	RM237	Free

Based on the comparison above, the web server software chosen to develop the proposed system is Xampp. This is because based on the features and the research, Xampp is suitable for Windows environment because it has the configuration (Roy, 2015).

An embedded tool is a tool that used to provides the convenience and efficiency method to the user when using the software.

Table 2.4 Comparison of embedded tools

Software	Bar Code	QR Code
Description	A bar code is a linear form of pattern with containing number and line to store the information. Basically bar code is used to POS system to capture the information of the item.	A QR code is a 2D matrix form of pattern with containing text or other type or information such as URL and email. QR code is widely used to store the information and also can perform several tasks.
Type of barcode	Linear	Matrix
Density of information	Low	High
Capacity of information	Small	Large
Type of information	Numbers	URL, contact, SMS or text

Based on the comparison above, QR code can store many type of information such as URL link. The QR code can scan by using smart phone and used to perform several task like open url, text a SMS, save contact and more. QR code can also print and used as offer details, coupon, link and more (Lyne, 2009). Hence, QR code is chosen as the embedded tools to the proposed system.

2.3.2.2 Hardware Requirements

Hardware requirements are a system requirements and a guideline as opposed to an absolute rule of software to define between the minimum and recommended to the system requirements. The hardware used is to ensure the smoothness of the web server and processing of data. The hardware requirements for develop the proposed system with install the software requirement is defined as below.

Table 2.5 Hardware Requirements

Hardware Requirements	Minimum Requirements	Recommended Requirements
Operating System	Windows Vista or later	Windows 7 or later
Processor	Core i3 or equivalent processor	2nd-generation Core i5 (2GHz+), 3rd/4th-generation Core i5 processor
RAM	2GB or more	4GB or more
Disk space	Minimum free space of 10GB	Free space of 20GB or more

2.3.2.3 Other Requirements

Other requirement is the requirement other than software and hardware to develop the LAMS. The other requirement for develop the proposed system on LAMS which is network and internet connection. For accessing to the web based management system to manage the assets such as add asset, apply for the application of an asset and receiving an email, it must connect to internet connectivity.

2.4 Proposed Solution

Based on the previous research, a proposed solution to the manual management is using web based management system. It able to manage the asset effectively by using a web based management system compare using manually management (Xiuli et al., 2009). It also provides storage to store the data information to the database due to the large volume of data arriving continuously over time and add new complexity to the problems of storage.

Although, the problem of manual management can be solved by web based management system, but there are not efficient enough to manage the asset due to lack of some tools and features. Therefore, a proposed solution to the system is implementing with a tool which is QR code. By implementing with the tool, the system is convenience to use and more effectively with the fast respond to get the information from each of the unique QR code. The users can scan the QR codes by using a smart phone, tablets and handheld devices with network connection to get the information directly (Chu et al., 2012).

The lab asset management system (LAMS) is required previous finding to provide as references and to develop. The previous finding is summarized as the requirement on Table 2.6.

Table 2.6 Previous finding and justification

Finding	Justification
Lab Asset Management System	All of the asset management systems which related to proposed system are uses as a finding to develop LAMS. Based on the finding, most of the management systems are using web based management system. This is because it can browse by any platform and convenience to access through Internet. Meanwhile, to store the data information of the system, it is required database management system as a storage and retrieval. It also required embedded tools to enhance the system and provides convenience to user.
Database Management System	Database management system is a system that used to handle the storages, retrieval and update the data of the system. By using database management system, the LAMS can provide an interface and store the information into the database. Hence, the content of the system can get from database and display to the system.
QR code Generator	QR code generator is used to generate unique code of the asset. It is used to display content of the asset and apply the application of the asset.

2.5 Conclusion

As a conclusion, literature review plays an important role before the LAMS starts to develop. The purpose of the research in this chapter is not only collecting the data information, but is also important to develop a system with improvement from the existing system. The design and architecture of the system also required to improve based on the existing system. Hence, the purpose system is required the research before the system is develop.

In the end of this chapter, all of the references will be analyze and used to develop the system. In the next chapter it will discuss the methodology of the project.

CHAPTER III

PROJECT METHODOLOGY

3.1 Introduction

Project methodology defines as a systematic procedural with project management phases or processes. Therefore, project methodology helps to provide the structured set of activities for the development of a system. Hence, selecting a project's methodology is very important for the development of a system. To select a project methodology, it is according to the requirement of the users and the life cycle of the system (Bhatti et al., 2010).

Basically, a project methodology includes the elements such as people, roles, techniques, processes, tools, activities, milestones and quality measures. To select a project methodology, various processes and methodology are required to research and compare. However, the most suitable set of the methodology are required to selected and apply on the system development with manage the project (Kononenko et al., 2013).

Waterfall model is one of the methodologies that provide the sequential process for planning, analysis, design, implementation and testing. The waterfall model is flowing downwards through the phases. It can refer to the existing web

based management system and identify the deficiency of the existing systems. It is suitable to the proposed system to improve with the deficiency of existing systems and easy to understand by provides an identifiable milestone to the development process of the system compare to high learning curve of object oriented analysis and design (OOAD).

3.2 Waterfall Model

The phases of each stage and the activities involved in Waterfall model for the proposed system in Lab Asset Management System (LAMS) will be discussed below.

Phase 1: Planning

Planning phase is the phase that to determine the feasibility of the project and provides an overview documents of the project. In this stage, all of the project objective, project scope and project requirements of LAMS are defined. It also including past research or existing system as references in this planning phase such as the background, functions and other of the existing system. The systems architecture and the information are collected to the next phase.

Phase 2: Analysis

Analysis phase is the fundamental phase to understanding about the usage of the system and the user requirements. In this stage, all of the information related with the proposed system is gathered and collected from the research including the domain and existing system. Besides that, the requirement and the information about the asset management also gather from the asset admin. Based on the researches, the information is used to analyze and identify with the existing web based management system. The requirement such as the functionality and asset data are gather to develop the LAMS. Hence, analyze are provides a better declaration of the proposed system.

Phase 3: Design

Design phase is the description of how the proposed system to be built and the design is represent the interface and quality of the system with meet the user requirements before implement the proposed system. In this stage, the preliminary design and the detailed design of the proposed system are needed to define. The data table, data dictionary and the interface of the LAMS are defined and identify. Besides that, the entire requirement of the proposed system required to analysis.

Phase 4: Implementation

Implementation is the implement by using programming language to develop the proposed system. During this phase, the design of LAMS such as login page, register page and add asset page on the system should designed. The problem of the previous system required to identify and analyze which is without embedded tool. The database of the system also required to analysis by gather the data requirement and functional requirement. Hence, the database design can construct by entity relationship diagram in details to relate the data of the system with database table. Meanwhile, the interface of the proposed system required to meet the design of database and its function. The software development environment also required to setup with configuration of the network.

Phase 5: Testing

Testing is the phase to test the developed proposed system with the testing strategy. In this stage, the test plan, test strategy and test implementation are required to test and gather the testing results for analyze the problem of the proposed system. During this phase, the test user and the test environment which is user of FTMK and FTMK of UTeM.

Planning → Analysis → Design → Implementation → Testing

Figure 3.1 Diagram of Waterfall model

3.3 Project Milestones

Project milestones are the tools that used in project management to plan and actions from start to the end of the project. By using milestones, it is the way to identify the task being executed properly and achieve to develop the system successfully. Table 3.1 are the activities and duration for the project milestones.

Table 3.1 Table of project milestones

Start Date	End Date	Activities
22-Feb	6-Mar	• Submit and present the proposal approve by supervisor and agreed by PSM committee.
29-Feb	20-Mar	• Report on the project background, problem statement, objective and etc. • Phase 1: Planning the feasibility of the project.
14-Mar	17-Apr	• Report on finding references from article and journals for literature review. • Phase 2: Analysis the project by gather and collect related information from research.
11-Apr	8-May	• Report on planning the project milestone and timeline of project. • Phase 2: Analysis the project by analyzes the gather information from research.
25-Apr	29-May	• Report on analysis and design the proposed system. • Phase 3: Design the project by built and provides the interface with meet user requirements.
30-May	12-Jun	• Project demo and presentation for FYP1.
13-Jun	10-Jul	• Report on implementation the project with software development and configuration setup. • Phase 4: Implementation the project by

		using programming language to develop the proposed system.
4-Jul	31-Jul	• Report on testing the proposed system by testing plan and analysis the testing result. • Phase 5: Testing with analyze the problem.
25-Jul	14-Aug	• Report on concludes the weakness and strengths. • Phase 5: Testing with analyze the problem.
15-Aug	28-Aug	• Project demo and presentation for FYP2.
7-Mar	28-Aug	• System development from Phase 1 to Phase 5

The project timeline as show on Table 3.2.

Table 3.2 Table of project timeline

Activities	Start Date	End Date	Duration (Days)
Phase 1: Planning 1.1 Study and identify the requirement and usage of management system and the background of project. 1.2 Identify the problem that influence of the project to improving or solving the current system. 1.3 Identify the project question from the problem statement in the project. 1.4 Define and identify the objectives that want to achieve in the project. 1.5 Define the project scope of the LAMS system. 1.6 Identify the contribution to the project and infer from project objectives. 1.7 Define the summary of the project report	7-Mar	28-Mar	22

Phase 2: Analysis	4-Apr	2-May	29
2.1 Study the research of the project background and previous work of the project. 2.2 Determine the suitable technologies that to fetch the webpage and to retrieve the data of the asset. 2.3 Defined the current problem with critical review and make comparison of the differences of the system. 2.4 Provides a propose solution to the project. 2.5 Planning the flow of the project timeline based on methodology 2.6 Study the methodology and selected the methodology to the project. 2.7 Apply the methodology to the project.			
Phase 3: Design	9-May	30-May	22
3.1 Pre-processing the web pages by the preliminary design and detailed design of the LAMS. 3.2 Analyze the problem and extracted the data information of the system. 3.3 Identify the data requirement, functional requirement and other requirement of the system. 3.4 Define the high level design of the system structure with function of LAMS. 3.5 Construct the detailed design of LAMS.			
Phase 4: Implementation	6-Jun	27-Jun	22
4.1 Implement the system with expected output. 4.2 Define the development environment			

setup for the system. 4.3 Configure the environment setup to the system. 4.4 Implement the system with the module of the LAMS.			
Phase 5: Testing 5.1 Testing the system and validating the system. 5.2 Testing with the test plan with test user and test environment. 5.3 Producing the test strategy to the system. 5.4 Collect the testing data from the testing. 5.5 Analyze the testing data with the test cases. 5.6 Observe the weaknesses and strengths from the system testing. 5.7 Make recommendation based on the weaknesses and strengths of the system to propositions for improvement.	4-Jul	28-Jul	25

The Gantt Chart for the project as show on Figure 3.2.
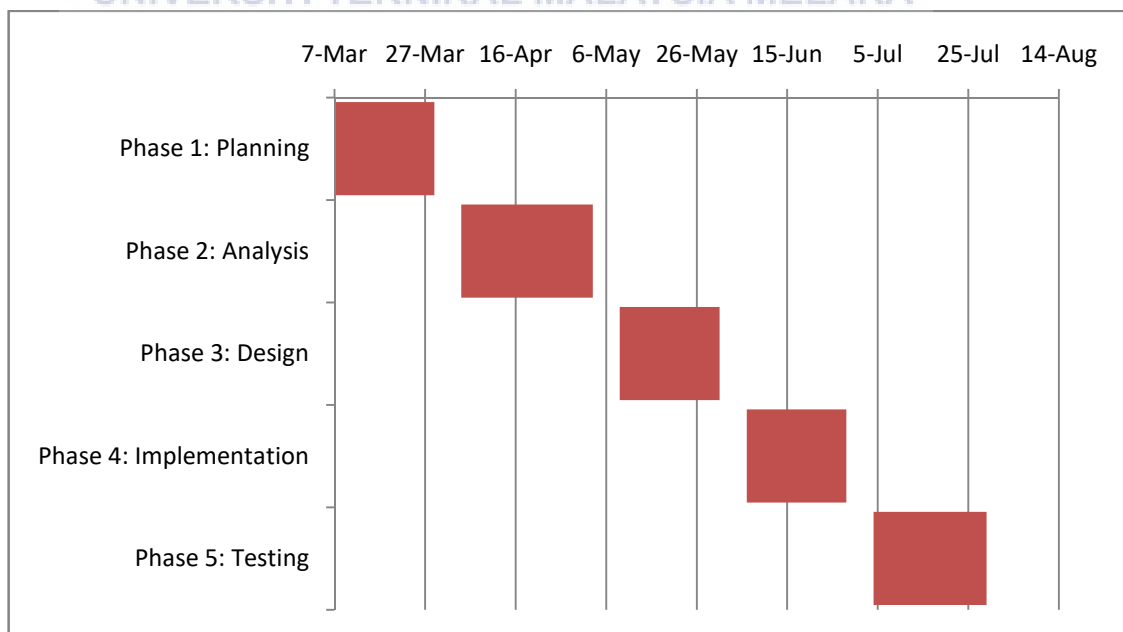
Figure 3.2 Project Gantt Chart of the project

3.4 Conclusion

As a conclusion, project methodology is a systematic procedural with project management phases or processes to help the systems develop successfully. The methodologies are defined and describe the activities of the system requirements. Besides that, project milestones are provides the planning and actions with timeline and identify the task being executed properly to achieve develop of the system successfully.

In the end of the chapter, all of the methodology and milestones will be apply to develop the proposed system. In the next chapter, it will discuss about analysis and design of the proposed system.

CHAPTER IV

ANALYSIS AND DESIGN

4.1 Introduction

Analysis and design defines as the results of the analysis of the preliminary design and the result of the detailed design. It is a set of detailed method and procedures to analyze and design the proposed system based on the current problem. It includes the process of planning, analysis, design, implementation and testing to the development of the system.

System analysis is a study of a system into its component and analyzes the component based on the planning and analysis from the previous research. Meanwhile system design is the process of defining the architecture, interfaces and data for a system to satisfy the user requirements.

Hence, analysis and design are required to having a proper planning on the proposed system before the system is developed. The architecture, interface and data of the system are also needed to analyze and design to improve a computerized of system. Therefore, the problem analysis, requirement analysis, high-level design and detailed design will be discussed on this chapter.

4.2 Problem Analysis

The problem statement is managing and lending lab asset manually is always complex than managing and lending by using a management system. Currently the lab asset is managed manually by filling in paper forms and record on paper manually. Human mistake by recording manually are always occurs during the complicated procedure of managing and lending an asset. The problem also more towards search the asset, report the asset and add the asset. To overcome the problem, a management system is proposed to develop to make the wok simple and easy to manage.

Based on the previous chapter, a comparison between the existing system and proposed system are defined and analyzed the problem. The FTMK asset management is using KEW PA form method to record the asset and apply application for the asset lending. Meanwhile, Asset Management System (AMS), Library Management System (LMS) and EmployeeBook Employee Management System (EB) are web based management system which are only allow the user log in to manage their asset, book or employee by search, add, update and delete but the management system does not provides the embedded tools to the users to get the information and to perform specific task. For example lend and return the asset by embedded a tool such as RFID, barcode and QR code tagging. The users are required to search the information by browsing the web page and only allow viewing the details.

Therefore, Lab Asset Management System (LAMS) are proposed to embed the tool with QR code tagging. With the QR code tagging, the users can get the information of the asset quickly by scanning the QR code to the web page for apply application to the asset lending. The system will save the details as record into the database. Besides that, the users also receive an email once the asset are apply and already approve by admin as a notice and references.

4.3 Requirement Analysis

Requirement analysis is a process to gather the requirement of the system and used to analysis and determine the data, functional and non-functional of the requirement of the system.

4.3.1 Data Requirement

Data requirement is to identify and determine the system input and output between the server and end user that data stored into the database. For the lab asset management system, there are five entity tables which are admin, user, asset, application asset and responsible officer tables. The admin and user table are used to store the information of the admin and user. The asset table is used to store the asset details such as asset id, name, category and more. Meanwhile the asset application is used to store the information of application of the asset lending such as references number and date. Responsible officer table is used to store the detail of officer.

1. **Admin table**

Table 4.1: Data dictionary of admin table

Table Name	Attribute Name	Content	Type	Required (yes / no)	PK or FK	FK Reference Table
Admin	ADMIN_ID	Admin ID	Varchar (10)	yes	PK	
	USERNAME	Username	Varchar (20)			
	PASSWORD	Password	Varchar (20)			
	NAME	Name	Varchar (100)			
	IC_NO	IC number	Varchar (16)			

	ADDRESS	Address	Varchar (255)			
	CONTACT_ NO	Contact number	Varchar (16)			
	EMAIL	Email	Varchar (60)			
	LEVEL	Admin level	Int			

2. User table

Table 4.2: Data dictionary of user table

Table Name	Attribute Name	Content	Type	Required (yes / no)	PK or FK	FK Reference Table
User	USER_ID	User ID	Varchar (10)	yes	PK	
	USERNAME	Username	Varchar (20)			
	PASSWORD	Password	Varchar (20)			
	NAME	Name	Varchar (100)			
	IC_NO	IC number	Varchar (16)			
	ADDRESS	Address	Varchar (255)			
	CONTACT_ NO	Contact number	Varchar (16)			
	EMAIL	Email	Varchar (60)			
	LEVEL	User level	Int			
	ADMIN_ID	Admin ID	Varchar (10)	yes	FK	Admin

3. **Asset table**

Table 4.3: Data dictionary of asset table

Table Name	Attribute Name	Content	Type	Required (yes / no)	PK or FK	FK Reference Table
Asset	ASSET_NO	Asset no	Int (AI)	yes	PK	
	ASSET_ID	Asset ID	Varchar (60)			
	NAME	Name	Varchar (100)			
	MANUFAC TURER	Manufactu rer	Varchar (100)			
	MODEL	Asset model	Varchar (100)			
	BLOCK_DPT	Block department	Varchar (255)			
	DPT_LEVEL	Department level	Varchar (60)			
	DPT_ROOM	Department room	Varchar (60)			
	ASSET_ DATE	Asset date	Datetim e			
	ASSET_ CONDITION	Asset condition	Varchar (255)			
	AVAILABIL ITY	Availability	Varchar (255)			
	IMAGE	Image	Varchar (255)			
	PRICE	Price	Varchar (255)			
	DESCRIPTION	Description	Varchar (255)			

	TYPE_OF_ASSET	Type of asset	Varchar (100)			
	CATEGORY	Category	Varchar (100)			
	SUB_CATEGORY	Sub category	Varchar (100)			
	TYPE_OF_EQUIPMENT	Type of equipment	Varchar (100)			
	ADMIN_ID	Admin ID	Varchar (10)	yes	FK	Admin

4. Application asset table

Table 4.4: Data dictionary of application asset table

Table Name	Attribute Name	Content	Type	Required (yes / no)	PK or FK	FK Reference Table
Asset_application	REFERENCES_NO	References number	Int (AI)	yes	PK	
	ASSET_NO	Asset ID	INT	yes	FK	Asset
	ASSET_ID	Asset ID	Varchar (60)			Asset
	USER_ID	User ID	Varchar (100)	yes	FK	User
	NAME	User name	Varchar (100)			
	PURPOSE	Purpose lending	Varchar (255)			
	LEND_DATE	Lend date	Datetime			
	DUE_DATE	Due date	Datetime			
	RETURN_DATE	Return date	Datetime			

	APPLICATION_DATE	Application date	Datetime			
	APPROVAL_DATE	Approval date	Datetime			
	COLLECT_DATE	Collect date	Datetime			
	REJECT_DATE	Reject date	Datetime			
	DURATION	Duration	Varchar (10)			
	BLOCK_DPT_LOCATE	Block department locate	Varchar (255)			
	DPT_LEVEL_LOCATE	Department level locate	Varchar (255)			
	DPT_ROOM_LOCATE	Department room locate	Varchar (255)			
	ASSET_STATUS	Asset status	Varchar (255)			

5. **Responsible Officer table**

Table 4.5: Data dictionary of asset owner table

Table Name	Attribute Name	Content	Type	Required (yes / no)	PK or FK	FK Reference Table
Responsible officer	ID	Officer id	Int (AI)	yes	PK	
	ADMIN_ID	Admin id	Varchar (10)			
	ASSET_ID	Asset id	Varchar (60)			
	BLOCK_DPT	Block department	Varchar (255)			

DPT_LEVEL	Department level	Varchar (60)			
DPT_ROOM	Department room	Varchar (60)			
ASSET_ DATE	Asset date	Datetime			

4.3.2 Functional Requirement

Functional requirement is the function of the system with how the system records, compute, transforms and transmit the data. There are two types of users which are admin and user involve in the system. Besides the types of user, it also manages the level of the user to determine the user's initial access to the system. In this system, it consist 3 levels to the user. Level 3 and level 2 is for admin type user, meanwhile level 1 is for normal user. Level 3 admin is able to assign an asset to responsible officer and manage the other admin user. Level 2 admin is only allows the permission to manage their own asset. All of the admin are able to manage the asset by adding, editing, viewing and generate the QR code of the asset. Admin are also able to approve, reject and notify the user on the asset application. Meanwhile level 1 user are only able to view the asset detail and apply the application of lend the asset by scanning the QR code. All of the information are stored into database and used by the user when they perform the action to the system. The following diagrams are shows to explain the data flow of the system.

Figure 4.1 shows the context level diagram of LAMS. The user type of the system which is admin and user are required to login to the system by using login details. After login to the system, the admin can get the asset details from the system. Meanwhile user can apply the application of asset by asset id to the system, then the system will pass the application asset to the admin and the system will provides the reference no to the user as a references.
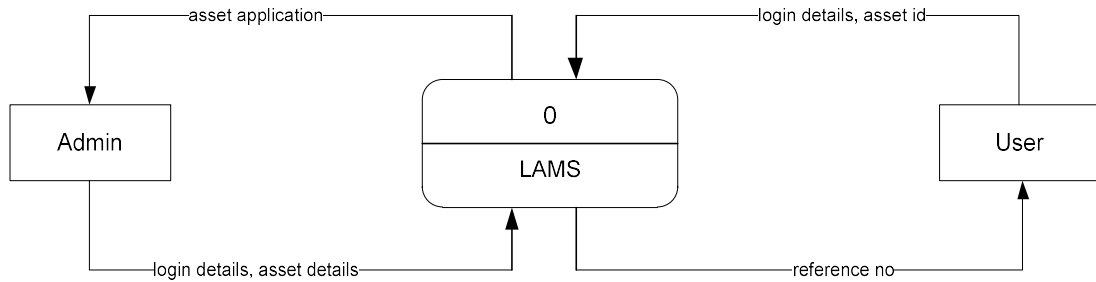
Figure 4.1: Context Level Diagram of LAMS

Figure 4.2 shows the data flow diagram level 0 for process 1.0 of LAMS. After admin login to the system, admin can manage the asset by using asset id and manage user by using user id. Then the details of the asset and user will stored and update on the database. Meanwhile user can apply for the asset application by using asset id and get the reference number from the system.

Figure 4.2: Data Flow Diagram Level 0 for process 1.0 of LAMS

Figure 4.3 shows the data flow diagram level 1 for process 2.0 of LAMS. Admin can manage the asset by add asset, view asset and edit the asset. By add the asset, admin required to insert the detail of the asset, then it will stored into database. Meanwhile admin can perform action for view asset, edit asset and generate QR code. The asset which are in status pending approve from admin for lending are using by asset id and reference number.

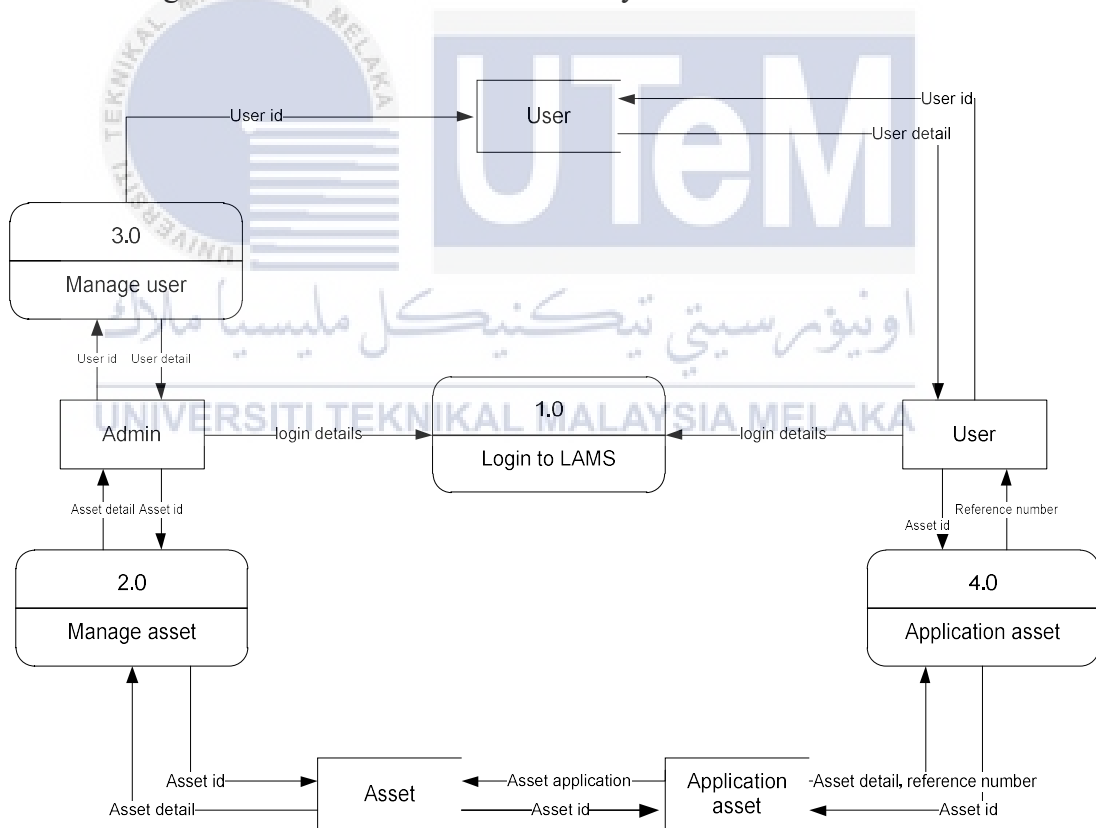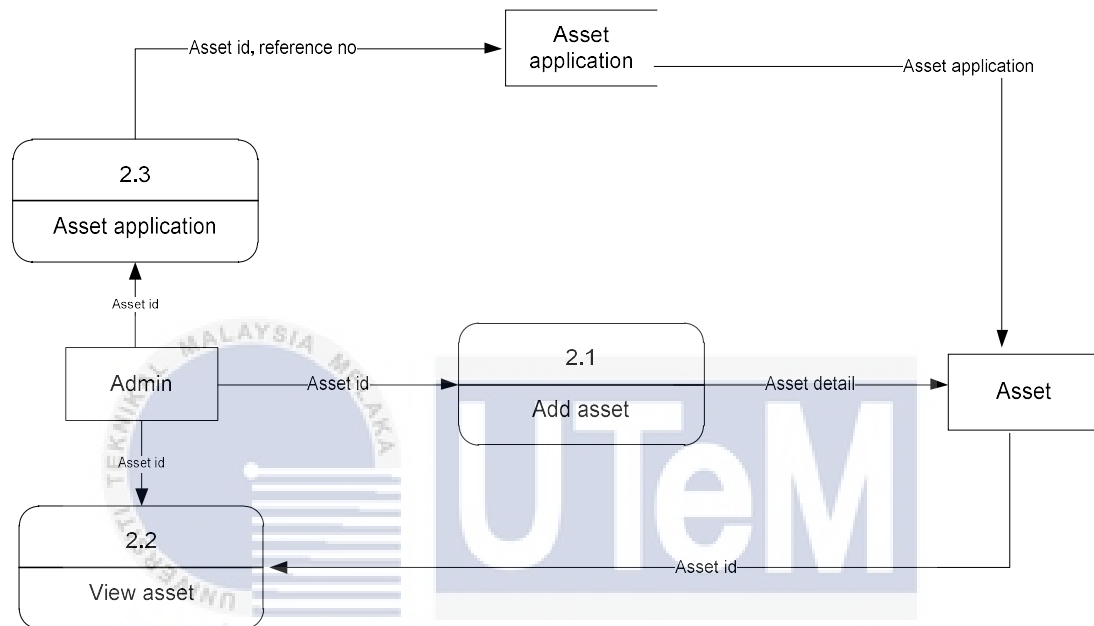Figure 4.3: Data Flow Diagram Level 1 for process 2.0 of LAMS

Figure 4.4 Data Flow Diagram Level 2 for process 3.0 of LAMS. Admin also can manage the user by add user and view the user details from the database.
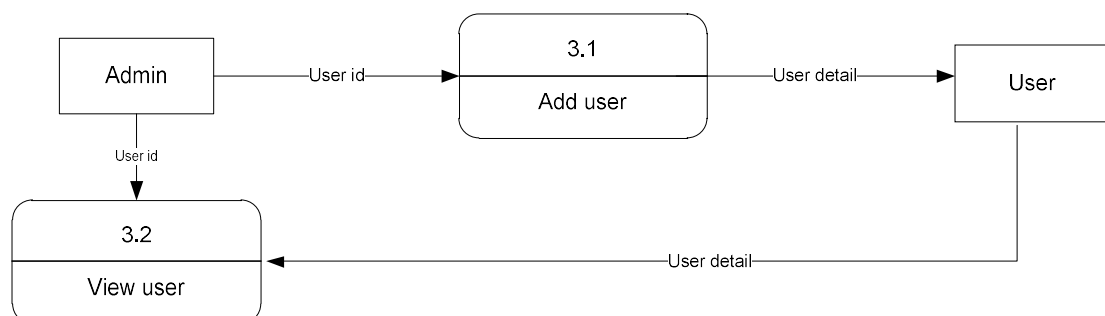

Figure 4.4: Data Flow Diagram Level 2 for process 3.0 of LAMS

Figure 4.5 Data Flow Diagram Level 3 for process 4.0 of LAMS. Users are view asset by using user id to identify identity and asset id to search the asset information. Therefore, user are allow to apply the application of asset by using asset id and it will provides a reference number as reference to user.
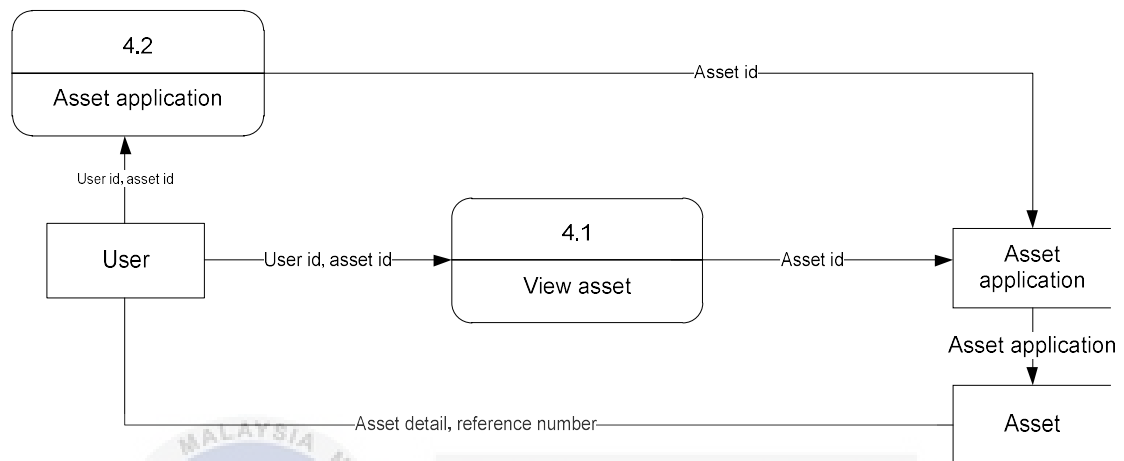
Figure 4.5: Data Flow Diagram Level 3 for process 4.0 of LAMS

4.3.3 Non-functional Requirement

Non-functional requirement is the requirement of the system performs its intended functions. For the requirement of the system is the computer required web browser to browse and view the web pages. The users are required web browser and QR code scanner to scan the QR code and browse the web content on their smart phone to view the detail of asset and apply for the asset application. To ensure the quality and performance of the system, different type of user are only able to view different data information and perform different actions.

4.3.4 Other Requirement

The other requirement is software, hardware and requirements that will be used on the system. The other requirement to develop the system will be defined as below.

4.3.4.1 Software Requirements

Software requirements are a description of a software system to be used on develops a system. The software requirements for develop the proposed system on LAMS will define and listed as below.

Table 4.6 Software Requirements

Software	Description
Eclipse for PHP	Tools for PHP developers for creating web applications. Language used to develop the system which are:
	1. PHP
	PHP is a server side scripting language designed for web development and it is embedded with HTML execution. It also used to extract the data from database and display on web page.
	2. HTML
	HTML (HyperText Markup Language) is the document format used to build the web pages. The web browsers are able to communicate with web servers through TCP/IP protocol by sends HTTP request to the server and get the responds with HTML pages.
	3. JavaScript
	JavaScript is a language used for web development with first class functions. It can used to access all of the objects, methods and create a dynamic content or perform to the other task.
QR code Generator	QR code generator is a open source library for generating QR Code with implemented in PHP.
Xampp server	Xampp server as a free open source cross platform between web server and database. Xampp server contains the following platform which are:
	1. Apache
	Used as web server. It is an open source HTTP server for modern operating system.
	2. MySQL

	Used as database management system to store the data information. MySQL is an open source relational database management system.

4.3.4.2 Hardware Requirements

Hardware requirements are system requirements with the minimum and recommended requirement used to install the software to support the performance of the software. The hardware requirements for develop the proposed system on LAMS are based on each of the software used will define and listed as below.

Table 4.7: Hardware Requirements

Operating System	Minimum Requirements	Recommended Requirements
Windows	Core i3 or equivalent Windows Vista or later	2nd-generation Core i5 (2GHz+), 3rd/4th-generation Core i5 processor, or equivalent Windows 7 or later

4.4 High-Level Design

High-level design is the view of the system's structure or system's interior. It will describe the architecture, user interface design and database design.

4.4.1 System Architecture

The architecture of the Lab Asset Management System is required an internet connect to web server and database server to the end user which is admin and user. The system contains five database tables (refer to Table 4.1, Table 4.2, Table, 4.3, Table 4.4 and Table 4.5) which are used to store the information of admin, user and

asset. The user can register and login to the web page by accessing to the web server to perform a task. Then, the task performed such as view asset, add asset, lend asset and more will be read from database or stored into the database. Figure 4.8 shows the system architecture of LAMS.
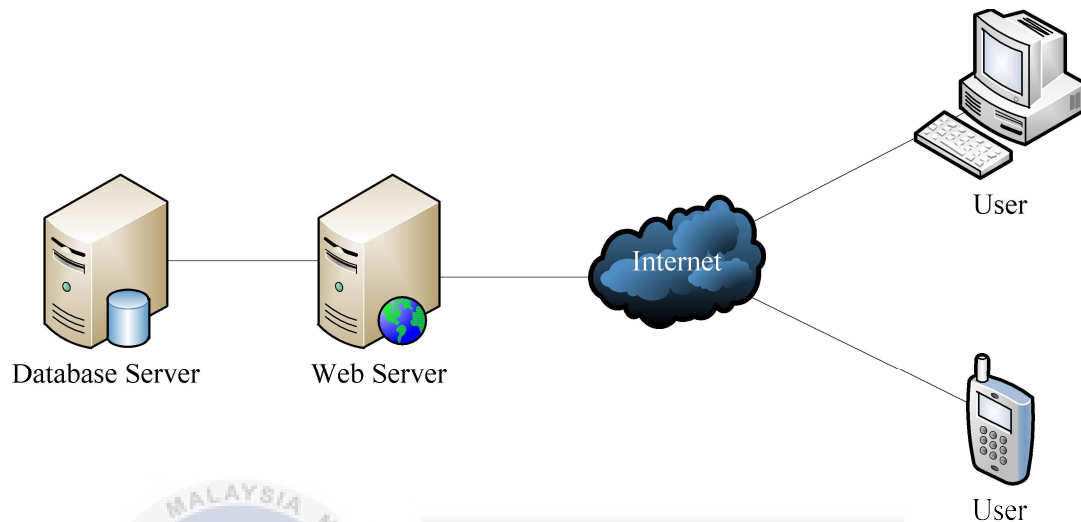
Figure 4.6: System Architecture of the LAMS

4.4.2   User Interface Design

User interface design will describe the design of the web pages. The interface design should be simple and easy to use by the user. The navigation design, input design and output design are shows as below.

1.   Navigation Design

Figure 4.7 shows the navigation design of the system and the type of navigation controls.
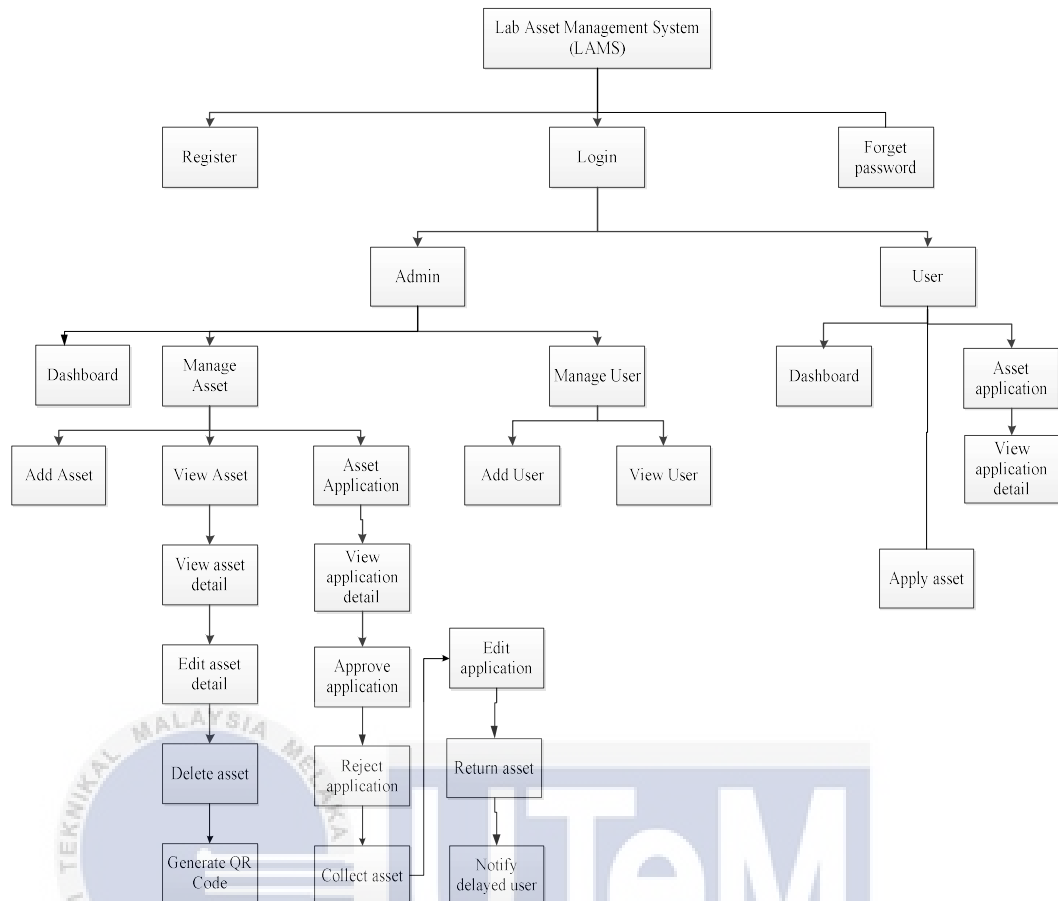
Figure 4.7: Navigation design of the LAMS

2. Input Design

Input design will defined and refine the type of data input used to enter the information such as text, number, selection box and etc. The table below will shows the type of input used on the system.

Table 4.8 Types of input used on the LAMS

Interface	Input	Type	Validation Rule
Login form	Username, password	Text box	Not null
Register form	ID (admin id/user id), username, password, name, IC no, address, contact no, email	Text box	Not null

Forget password	Username, password	Text box	Not null
Add asset	Asset id, name, manufacturer, model, type of asset, category, sub category, type of equipment, description, condition, availability, location, date, image, price	Text box, selection box	Not null
Generate QR code	Asset id	Text box	Not null
Edit asset	Asset id, name, manufacturer, model, type of asset, category, sub category, type of equipment, description, condition, availability, location, date, image, price	Text box, selection box	Not null
Delete asset	Asset id	Text box	Not null
Add user	Admin id, username, password, name, IC no, address, contact no, email	Text box	Not null
View asset	Asset id	Text box	Not null

3. Output Design

The output design is defined and refines the types of output of the system design. The expected outputs of the system are shows as the figure below.
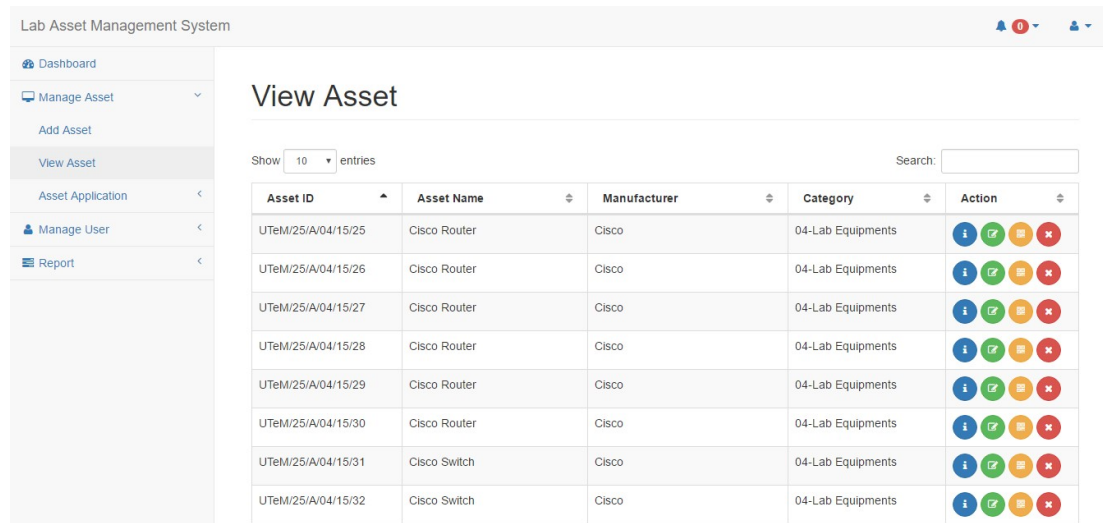
Figure 4.8 shows the login page which are allowed user to login by using username and password.

Figure 4.8: Login interface of LAMS

Figure 4.9 shows the add asset page which are allow admin to add asset by insert details.

Figure 4.9: Add asset interface of LAMS

Figure 4.10 shows the all of the added asset from database and admin can take action to view specific asset detail, edit detail, delete asset and also generate QR code.

Figure 4.10: View asset interface of LAMS

Figure 4.11 shows the all of the asset QR generate from asset id.

Figure 4.11: Asset QR code generator interface of LAMS

4.4.3   Database Design

Database design is a process to produce a conceptual and logical database design to make sure the system functionality.

4.4.3.1 Conceptual and Logical Database Design

Conceptual and logical database design are helps to defined, refine and construct the entity relationship diagram in details with explanation in text on business rules for the system.

Figure 4.12 shows the Entity Relationship Diagram (ERD) used on the system.
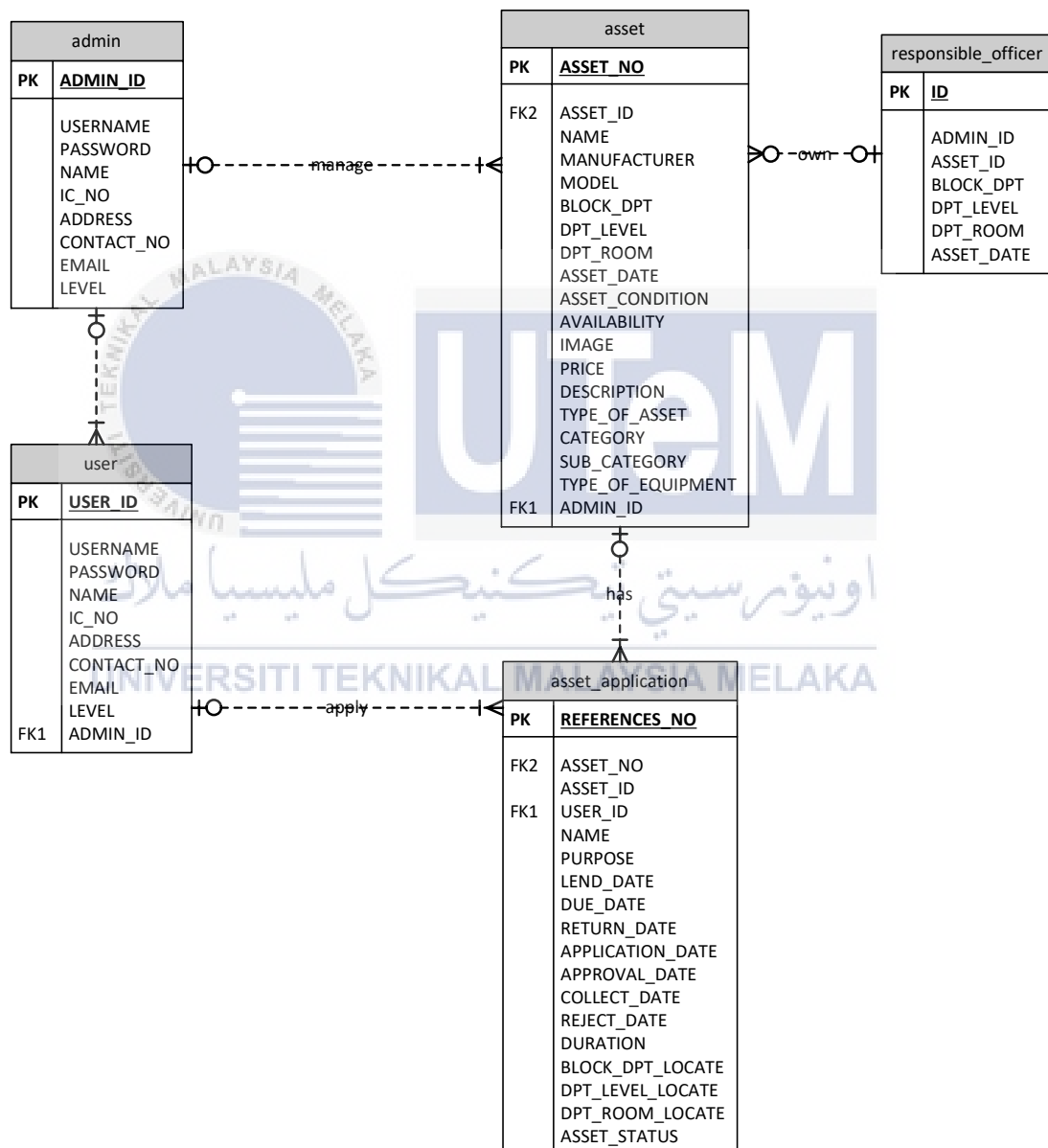
Figure 4.12: Entity Relationship Diagram of LAMS

Business rule of the system are:

1. Each admin can manage zero or more asset.

2. Each admin are managing zero or more user.

3. Each user can apply zero or more asset application.

4. Each asset has zero or more asset application.

5. Each asset owner are own zero or more asset.

4.5 Detailed Design

Detailed design will discuss about the detail of the software design and physical database design. This is the detailed design activity for implementation on next chapter. The software design will discuss about the flowchart and pseudo code of the system. Meanwhile physical database design will discuss about logical to target database management system.

4.5.1 Software Design

Software design will describe of every functions of the system according the DFD and the program specification. The flowchart and the pseudo code are used to describe the functionality of the program.

Figure 4.13 shows the flowchart of the system.
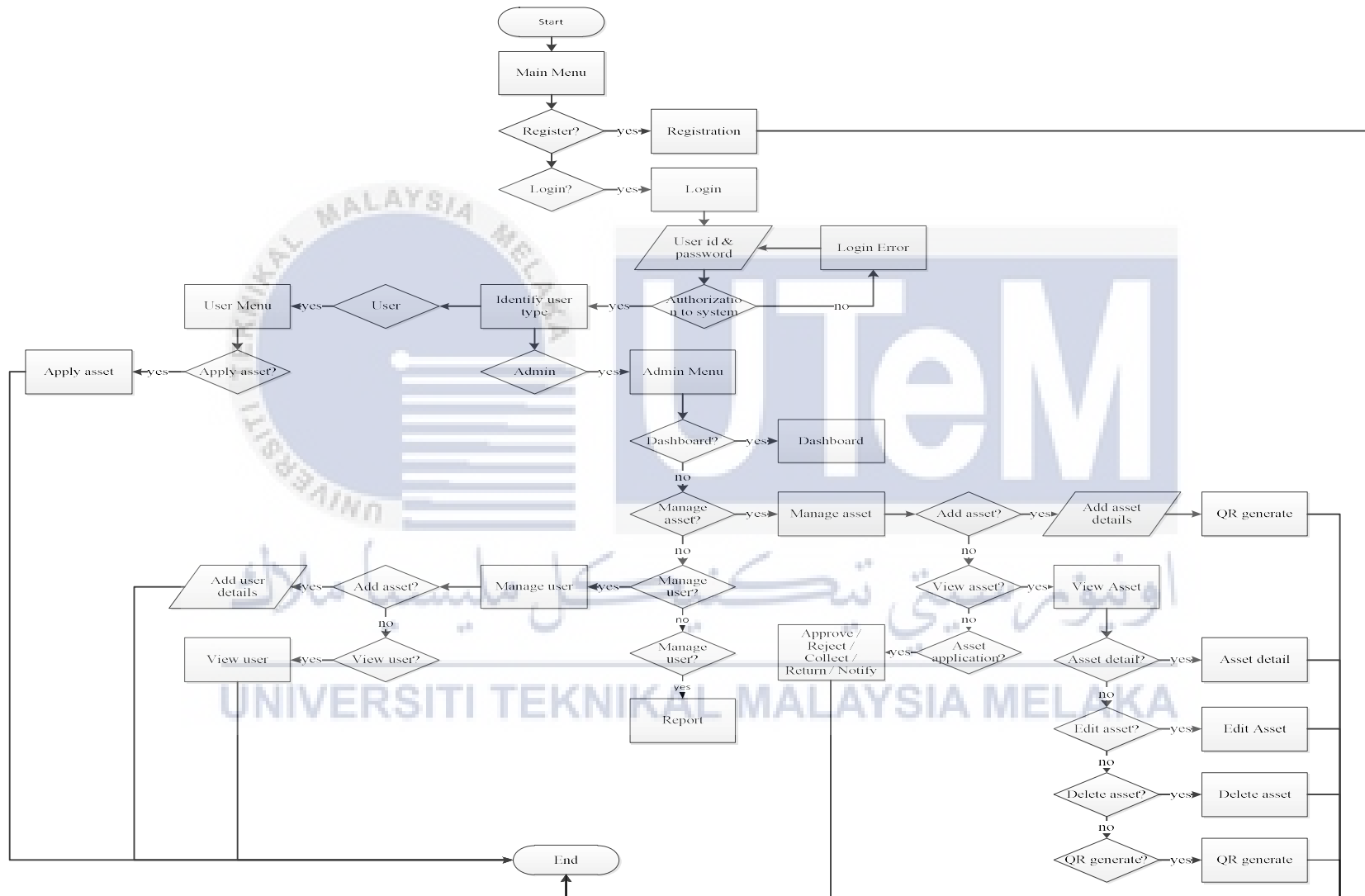
Figure 4.13 Flowchart of LAMS

The pseudo codes of the system are describe as below.

Main Menu

1.0 Start

2.0 Display main menu

3.0 Read user input

      3.1 If select Register

            Display registration page

      3.2 Else if select Login

            Display login page

4.0 End

Login

1.0 Start

2.0 Display login page

3.0 Read user input

      3.1 If username and password correct

          Identify user type by authorization to the system

             If identify is admin

                Display admin page

             Else if identify is user

                Display user page

      3.2 Else username and password incorrect

            Login fails by authorization to the system

4.0 End

User

1.0 Start

2.0 Display user menu page

3.0 Read user input

      3.1 If asset application

            Display asset application page

4.0 End

Admin

1.0 Start

2.0 Display admin menu page

3.0 Read user input

    3.1 If dashboard

        Display report page

    3.2 Else if manage asset

        Display manage asset page

    3.3 Else if manage user

        Display manage user page

4.0 End

Manage asset

1.0 Start

2.0 Read user input

    2.1 If add asset

        Add asset details and display generated QR code

    2.2 Else if view asset

        Display view asset page

    2.3 Else if asset application

        Display asset application page

3.0 End

View asset

1.0 Start

2.0 Read user input

    2.1 If add user

        Display asset detail page

    2.2 Else if edit asset

        Display edit asset page

    2.3 Else if delete asset

    2.4 Else if QR generate

        Display QR generate page

3.0 End

Manage user

1.0 Start

2.0 Read user input

      2.1 If add user

          Add user details

      2.2 Else if view user

          Display view user page

3.0 End

4.5.2 Physical Database Design

Physical database design is to translate the logical to target database management system by using SQL statement based on the tables created. The following session will discuss about the physical database design by connect to database management system and create table of database.

1. Connection to database management system

The database management system of the system is using MySQL. To connect the web application with the database management system, xampp web server is chosen as the web server application. The database of the web server is named as phpMyAdmin MySQL database. To connect the LAMS with database management system, the database host name is name as 'localhost', database user name as 'bitu3973' and password set as 'bitu3973' and the system should include a php file named as 'connect.php' with the connection coding as below.

```php
<?php
    $host = 'localhost';
    $user = 'bitu3973';
    $pswd = 'bitu3973';
    $dbname = "fyp_lams";

    $conn = new mysqli($host, $user, $pswd, $dbname) or
```

```
        die ('Error connecting to MySQL');
?>
```

2. Create table into database management system

The table are created by using SQL statement as show below.

a. Create table admin

```
CREATE TABLE ADMIN
(
ADMIN_ID                VARCHAR(10),
USERNAME                VARCHAR(20),
PASSWORD                VARCHAR(20),
NAME                    VARCHAR(100),
IC_NO                   VARCHAR(16),
ADDRESS                 VARCHAR(255),
CONTACT_NO              VARCHAR(16),
EMAIL                   VARCHAR(60),
LEVEL                   INT,

CONSTRAINT pk_adminid PRIMARY KEY (ADMIN_ID),
);
```

b. Create table user

```
CREATE TABLE USER
(
USER_ID                 VARCHAR(10),
USERNAME                VARCHAR(20),
PASSWORD                VARCHAR(20),
NAME                    VARCHAR(100),
IC_NO                   VARCHAR(16),
ADDRESS                 VARCHAR(255),
```

```
CONTACT_NO              VARCHAR(16),
EMAIL                   VARCHAR(60),
LEVEL                   INT,
ADMIN_ID                VARCHAR(10),


CONSTRAINT pk_userid PRIMARY KEY (USER_ID),
CONSTRAINT fk_adminid FOREIGN KEY (ADMIN_ID) REFERENCES
ADMIN(ADMIN_ID)
);
```

c. **Create table asset**

```
CREATE TABLE ASSET
(
ASSET_NO                INT (AUTO INCREMENT),
ASSET_ID                VARCHAR(50),
NAME                    VARCHAR(100),
MANUFACTURER            VARCHAR(100),
MODEL                   VARCHAR(100),
BLOCK_DPT               VARCHAR(255),
DPT_LEVEL               VARCHAR(60),
DPT_ROOM                VARCHAR(60),
ASSET_DATE              DATETIME,
ASSET_CONDITION         VARCHAR(255),
AVAILABILITY            VARCHAR(255),
IMAGE                   VARCHAR(255),
PRICE                   VARCHER(255),
DESCRIPTION             VARCHAR(255),
TYPE_OF_ASSET           VARCHAR(100),
CATEGORY                VARCHAR(100),
SUB_CATEGORY            VARCHAR(100),
TYPE_OF_EQUIPMENT       VARCHAR(100),
ADMIN_ID                VARCHAR(10),
```

CONSTRAINT pk_assetid PRIMARY KEY (ASSET_ID),

CONSTRAINT fk_adminid2 FOREIGN KEY (ADMIN_ID) REFERENCES ADMIN(ADMIN_ID)

);

d. Create table asset_application

CREATE TABLE ASSET_APPLICATION

(

REFERENCES_NO	INT (AUTO INCREMENT),
ASSET_NO	INT,
ASSET_ID	VARCHAR(50),
USER_ID	VARCHAR(10),
NAME	VARCHAR(100),
PURPOSE	VARCHAR(255),
LEND_DATE	DATETIME,
DUE_DATE	DATETIME,
RETURN_DATE	DATETIME,
APPLICATION_DATE	DATETIME,
APPROVAL_DATE	DATETIME,
COLLECT_DATE	DATETIME,
REJECT_DATE	DATETIME,
DURATION	VARCHAR(10);
BLOCK_DPT_LOCATE	VARCHAR(255),
DPT_LEVEL_LOCATE	VARCHAR(60),
DPT_ROOM _LOCATE	VARCHAR(60),
ASSET_STATUS	VARCHAR(255),

CONSTRAINT pk_referencesno PRIMARY KEY (REFERENCES_NO),

CONSTRAINT fk_assetid FOREIGN KEY (ASSET_NO) REFERENCES ASSET(ASSET_NO),

CONSTRAINT fk_userid FOREIGN KEY (USER_ID) REFERENCES USER(USER_ID)
);

e. Create table responsible_officer

CREATE TABLE RESPONSIBLE_OFFICER
(
ID   INT (AUTO INCREMENT),
ADMIN_ID   VARCHAR(100),
ASSET_ID   VARCHAR(100),
BLOCK_DPT   VARCHAR(255),
DPT_LEVEL   VARCHAR(255),
DPT_ROOM   VARCHAR(255),
ASSET_DATE   DATETIME,

CONSTRAINT pk_staffid PRIMARY KEY (ID),
CONSTRAINT fk_assetid2 FOREIGN KEY (ASSET_ID) REFERENCES ASSET(ASSET_ID),
);

4.6 Conclusion

In this chapter, the analysis and design about the proposed system has been discussed and all of the table and diagram are provided to explain the process of the design of the system. With the analysis and design, it provides an idea for the high level design and database design to develop the system. In the next chapter, it will concentrate on the implementation of the proposed system based on the previous research.

CHAPTER V

IMPLEMENTATION

5.1 Introduction

Implementation is the construction of a system and the production to deliver the system. In this chapter, the implementation of the system will be discusses with the software development environment setup, configuration management and the implementation status.

Software development environment setup is used to setup the environment to provide an environment to develop the system. In this part, all of the software used which on client software or server software will be setup. The server configuration required to setup and configure such as port number, IP address, database and network setup.

Software configuration management is used to keep track to the different version of software component in a configuration management system during the development process. Implementation status is used to show the process of the development status to each of the component of the system.

Hence, in this chapter will provide an implementation phase to develop the system by correctly and efficiently.

5.2 Software Development Environment Setup

Lab Asset Management System (LAMS) is a web based application system. Therefore, there are three components in the software development environment setup.

Figure 5.1 had shown the software development environment of LAMS with the PHP Eclipse as a PHP development tools for the PHP scripting development environment, Xampp is a software that combination of Apache, PHP and MySQL. Therefore, MySQL will be used the database of the management system for data management.
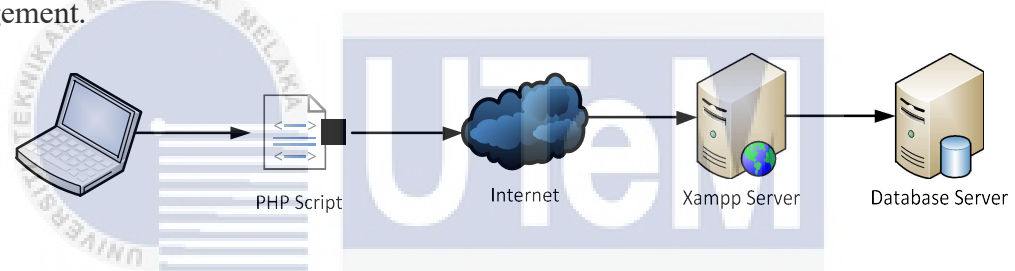
Figure 5.1 : System environment of LAMS

5.3 Software Configuration Management

The setup of the configuration management will be setup to operate the Lab Asset Management System with web based system.

5.3.1   Configuration Environment Setup

The configuration environment setup for LAMS is to configure the Xampp server and database server to ensure the LAMS can be run with web based application. LAMS is developed by using PHP Eclipse software development as the

PHP scripting environment. The software environment is easy to develop a PHP based web application and facilitated extensibility.

Besides that, the Xampp is used as web server by using Apache Server, and MySQL database management system. Hence, the configuration environment is required to configure and setup.

Once the PHP Eclipse and Xampp is successfully installed, run the Xampp as administrator and configure the Apache server on Xampp Control Panel by choose Config then select Apache (httpd.conf) as shown on Figure 5.2.
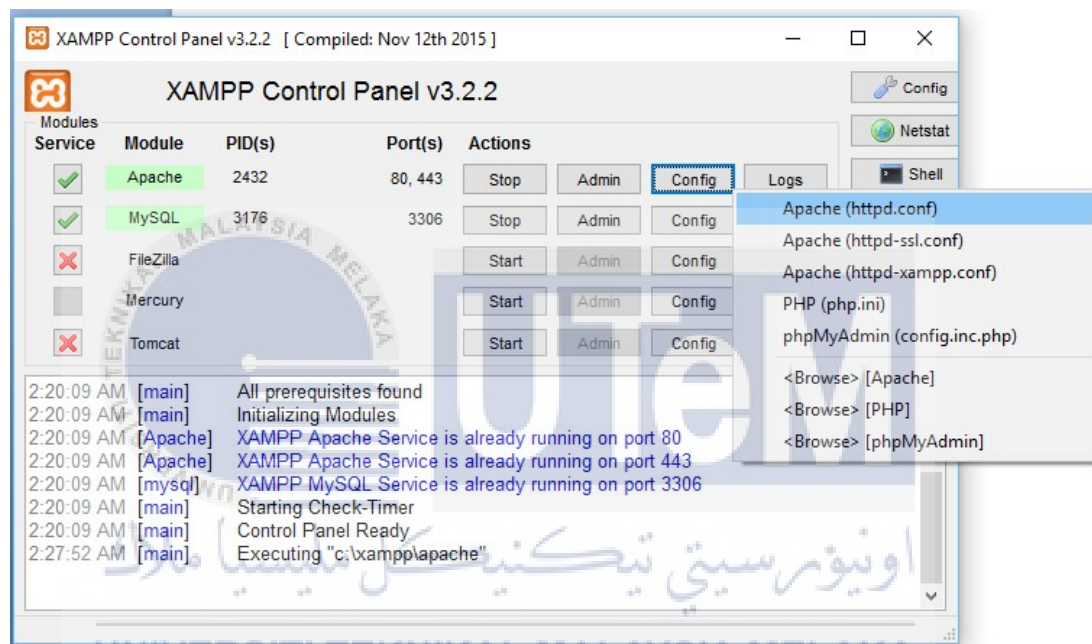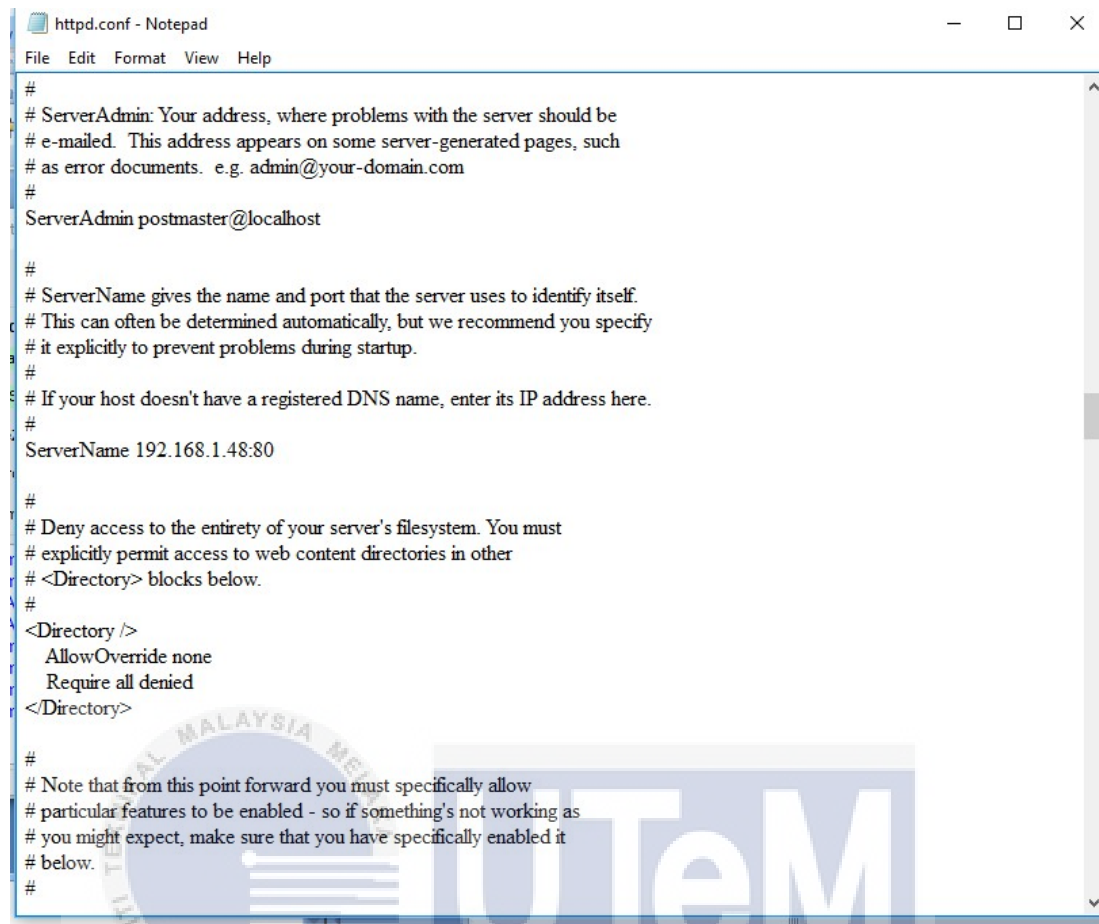
Figure 5.2 : Configure the Apache server with Xampp Control Panel

After that, find the server name part and insert the unused port number and IP address server name to the server. Figure 5.3 show the httpd.conf file with the configuration of server name and port number. Server name is the name and port that used to identify the server. If the host without a registered DNS, then enter its IP address as the server name. In the example, the configured values with server IP address is 192.168.1.48 and with port number of 80.

Figure 5.3 : Server name and port number of the server

Then find the document root part to check the directory for save the web application documents which is with directory C:/xampp/htdocs as show on Figure 5.4.

Figure 5.4 : Directory to save the web application documents

Finally check with the modules service on Apache and MySQL with the port and make sure it is ready to running on server with tick symbol to ensure the web server and database services can be run on browser.
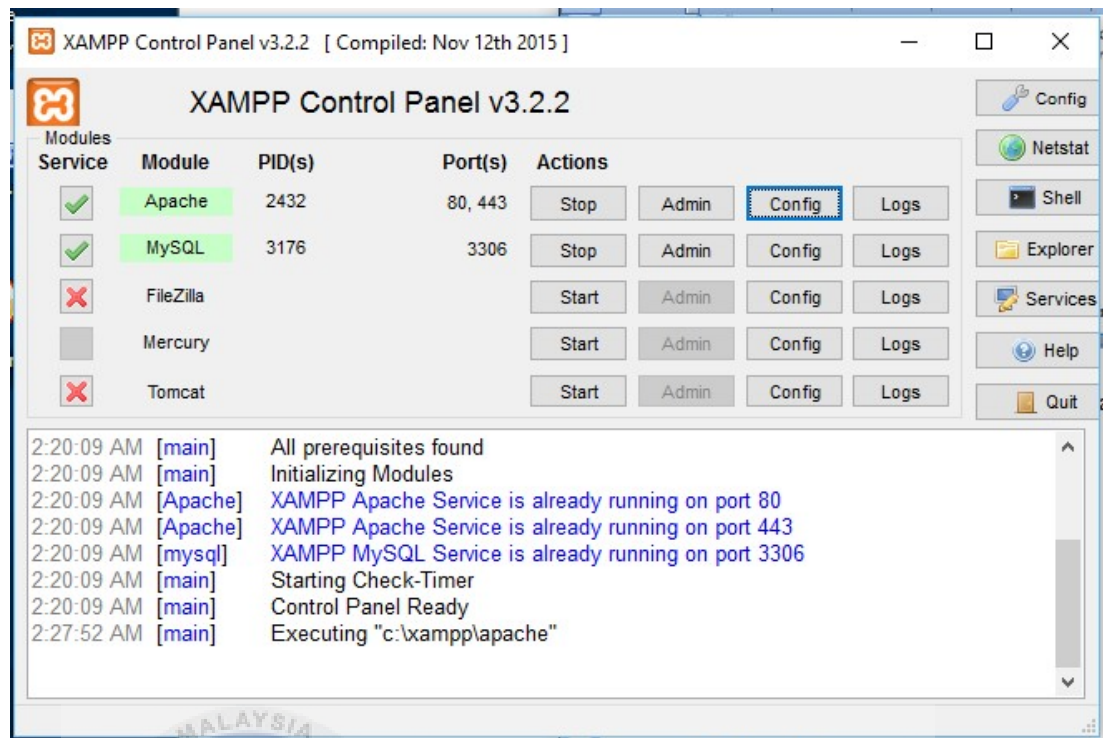
Figure 5.5 : Status of modules services with port number

After successfully configure the Xampp, open a browser with address http://localhost. A Xampp interface will be opened, then choose to the phpMyAdmin as show on Figure 5.6.

Figure 5.6 : Xampp interface

All of the details with database server and web server will be displayed on phpMyAdmin as show on Figure 5.7.
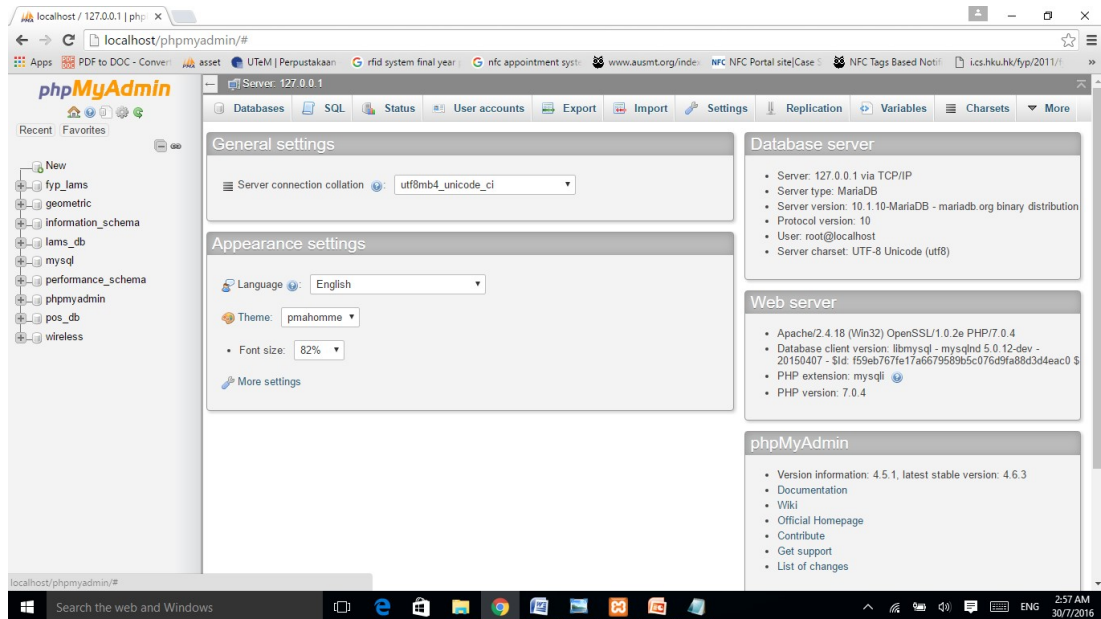
Figure 5.7 : phpMyAdmin interface with information of database server and web

server

Now choose the User accounts tab and add a new user account with username, hostname, password and the privileges for the LAMS system as show on Figure 5.8.
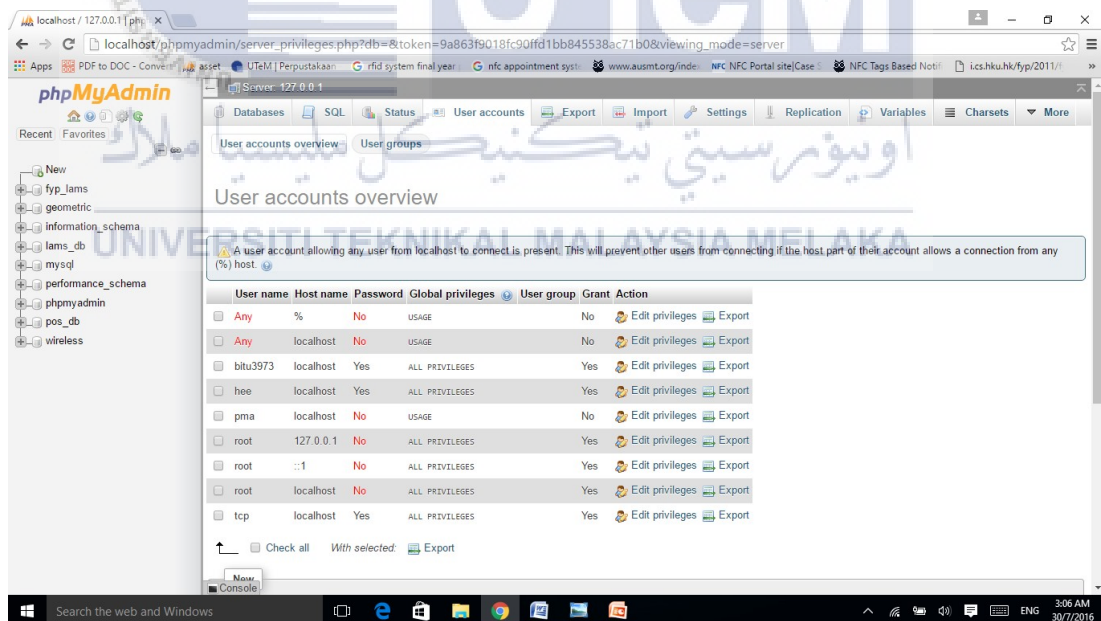
Figure 5.8 : User accounts for the LAMS system

Then create a new database with the database name for the LAMS system as a database management system is show on Figure 5.9.
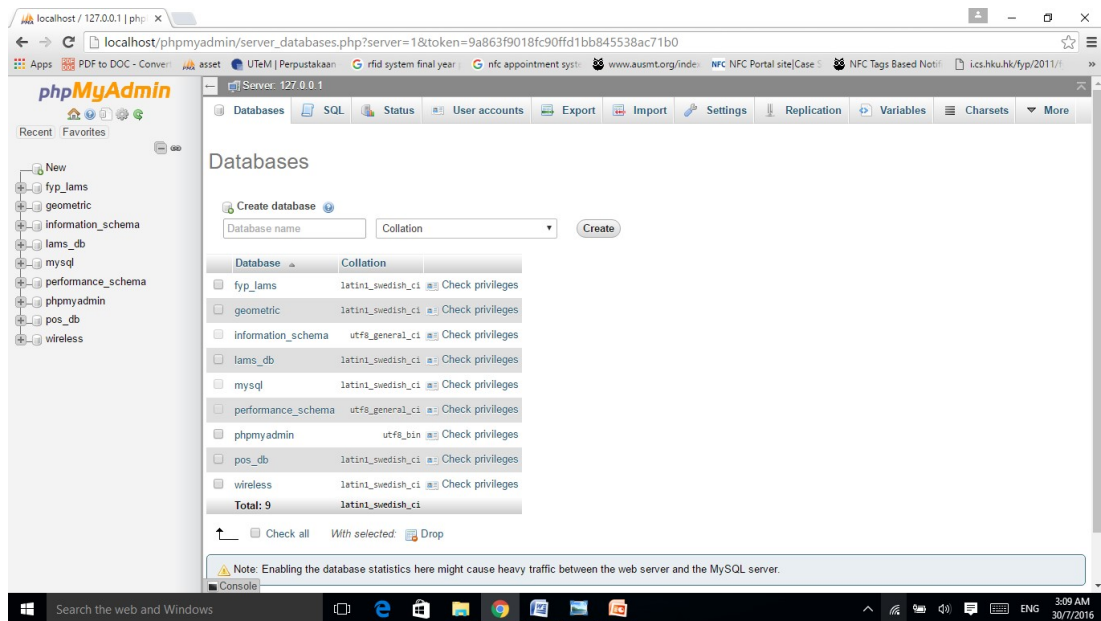
Figure 5.9 : Create a new database to LAMS

After create the database, open the PHP Eclipse and it will request to change the workspace launcher. Change the workspace path to C:\xampp\htdocs\ as the directory to save the web application document as show on Figure 5.10.
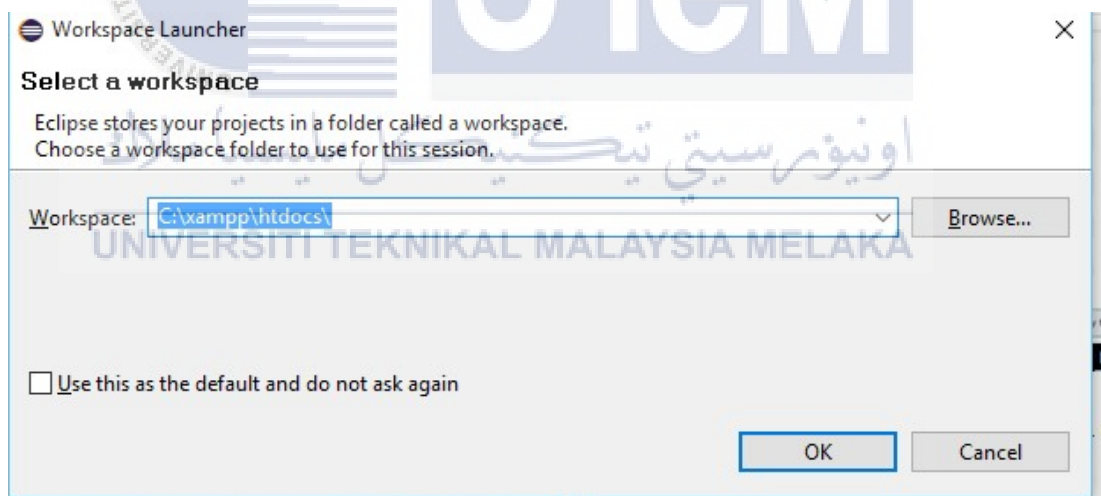
Figure 5.10 : Workspace of PHP documents

Then, create a new project by filling the project name as LAMS to save the project documents as show on Figure 5.11.
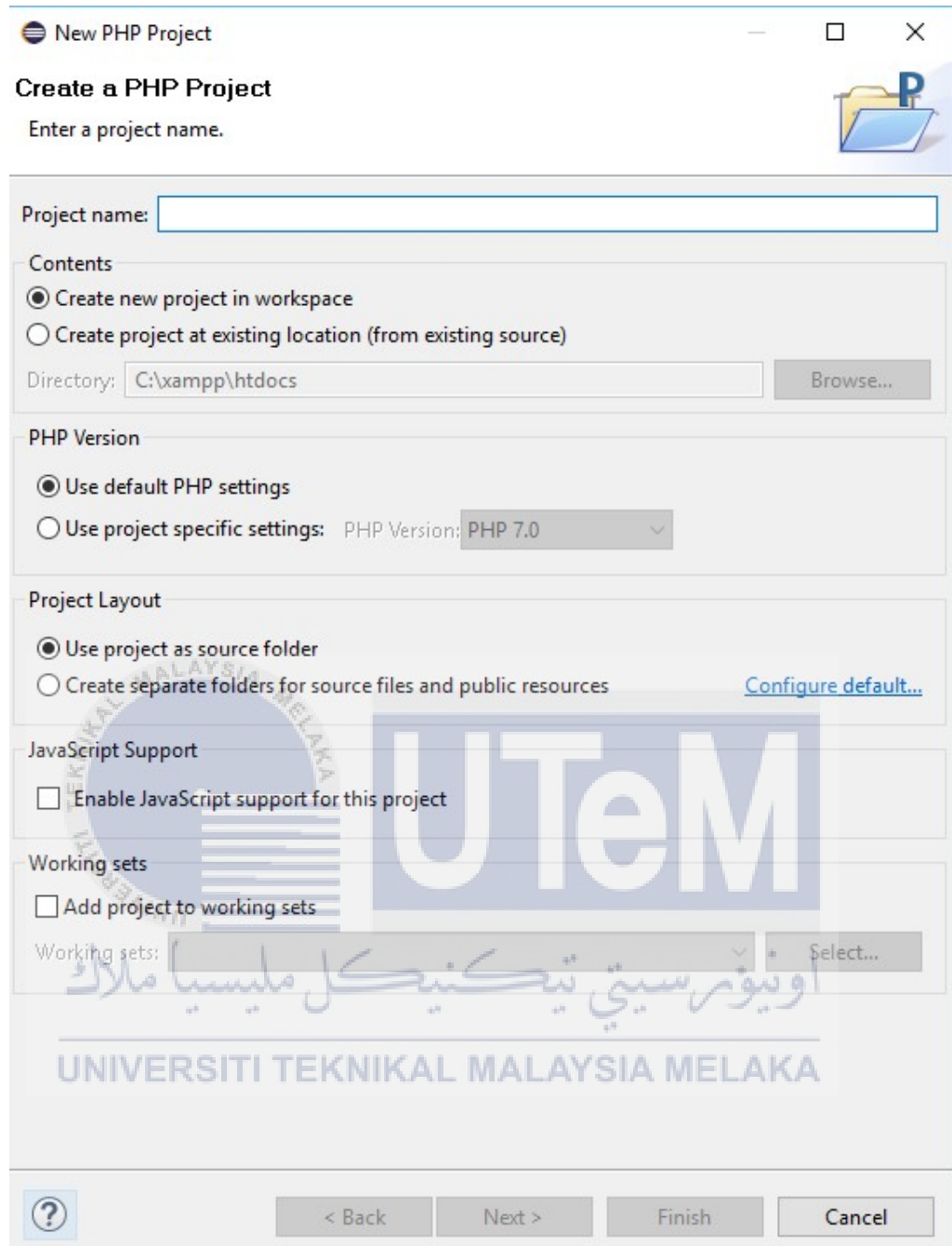
Figure 5.11 : Create a new PHP project

5.3.2 Version Control Procedure

Version control procedure is the procedure and control in managing with changes the source code version. It is used to fix the problem of the initial version of the LAMS and added new features to the system. Previous version will kept as backup to prevent the error or bugs that might occur during changing on the next

version. Table 5.1 shows the version control of LAMS with the descriptions of functions.

Table 5.1 Version Control Procedure of LAMS

Version of system	Description of functions
LAMS v1.0	In this version of LAMS is consists the interfaces with the navigation of each pages. Each of the pages is link together and consist the login features to user login into the system. Different type of user is navigated to different pages.
LAMS v1.1	In this version of LAMS, several features are added into the system which is add asset into the database, view asset, edit asset and delete asset from the database. Meanwhile, upload image of asset and generate QR code are also added into the system on this version.
LAMS v1.2	Some minor changes are done on the add asset by batch to the system to fulfil the user requirement in this version. The asset application with view the application status, edit the application status from the user are also added.
LAMS v1.3	Manage user are added into the system to allow the admin to manage user by add user in this version.
LAMS v1.4	In this version, the report features are added into the system and the details on dashboard are added.
LAMS v1.5	In this version is the last and complete version of LAMS with the complete work flow features. Some of the bugs and error with input validation are test and fixed.

The source code of the LAMS are managed and organized in several separated folder with different name of folder. This is because the source code can be manage easily and fixed easily by different folder. Each of the folder are consists different path to save the web pages of the system as show on Figure 5.12.

Figure 5.12 : LAMS source code on different folder

5.4 Implementation Status

Implementation status is the progress of development status of each features of the system. It is used to provide the components of the system by name, description, duration and date to complete the system. The problem that faces on implementation status is to develop the module with testing the function of each of the module. Table 5.2 shows the implementation status of the LAMS by the module.

Table 5.2 Implementation status of LAMS

Module	Module Name	Description	Duration to complete	Date completed
1	Login	A login page to user to login into the system by username and password to determines their level and navigate to different pages. It also provides a register pages to register the account.	2 days	12/6/2016

2	Manage asset	In this module, the LAMS can add asset into database, view asset, edit asset and delete asset from the database. Besides that, upload image and generate QR code is also added into the system. Asset application with application status, edit the application status from the user are also added.	15 days	8/7/2016
3	Manage user	The admin can manage the user by adding the user information and view to edit the user from the system in this module.	5 days	15/7/2016
4	Report	The report of the asset is added into the system.	5 days	22/7/2016
5	Dashboard	The detail and the summary of report detail is add into the dashboard.	5 days	29/7/2016

5.5 Conclusion

In this chapter, each of the implementation phases of the system has been discussed and all of the activities with software development environment setup, software configuration management and implementation are defined and completed to LAMS. As a conclusion, LAMS is develop by the implementation phase and needed to enhance with some of the other features. The next chapter which is testing will be discussing about the testing of the system by using the test plan, test strategy, test implementation and test result and analysis.

CHAPTER VI

TESTING

6.1 Introduction

System testing is the process of testing the prime objective of the system. It is conducted of testing technique with evaluate the system features by testing plan, strategy, implementation and results and analysis to the system. To test the system, each of the features and validation functionality is required to test by designing, executing, identifying the problems. After that, the problem only can fix by the testing phase. It also helps to ensure the system develops meet the user requirements while testing.

Therefore, testing phase is very important to a system to determine the objective and function of the system. It also helps to identify the problem of the system and helps to enhance the system. This phase also deliver a quality to ensure the system meets the system requirement specification.

6.2 Test Plan

Test plan is a plan that document all the testing and describing the testing scope and activities which is test user and test environment. In this test plan, test user is used to describe the people involved to testing. Meanwhile, test environment is used to describe the location to be test. Then test schedule is to conduct the duration of testing date by schedule.

6.2.1   Test User

Test user is the personnel who are involve in the testing phase and play the main role of the testing user. All the personnel in the test user will be involved to verify the developed system is meeting the system requirement specification. Software developer plays the main role in developing and integrates the system to meet the requirement of user. Software developer also as a tester to observe the problem of the system and document the test cases to ensure the system is fulfilling the user requirement with the expected output. Meanwhile, user represent the end user and conduct the result of testing result to evaluate the by its features. Table 6.1 show the description of the test user with their role and personnel who are involve in the testing phase of LAMS.

Table 6.1 Test user of LAMS

Personnel	Personnel Name	Personnel Role
Software developer	Gan Siong Hin	- Fully in charge to develop the system and test the system. - Document the documentation of the system - Represent the end user
Supervisor	Dr. Wahidah binti Md Shah	- Provide the information and the functionality of the system

6.2.2   Test Environment

Test environment is the environment or location that the system being to test and perform the testing of the newly built software product. It also as a test on the environment of system where it should locate and configuration to be configure. The hardware, firmware configurations, preparations and training prior to testing the system is define on the test environment. The test environment of LAMS will be setup based on the system architecture discussed on previous chapter to provides the testing phase to the system. Table 6.2 show the description of test environment of LAMS.

Table 6.2 Test environment of LAMS

Test environment	Item	Quantity	Description
Location	FTMK, UTeM		The location of testing to be carried out to test the system with the network performance and the function of the system.
Hardware used	Laptop	3	The laptop used to develop the system and browse the browser to test the function of system.
	Smartphone	1	The smart phone used to scan the QR code and browser the system to use the system.
Software used	QR code scanner	1	QR code scanner used to scan the QR and perform the QR to launch the system by using URL and perform the task with is applying the application to the asset.
	Google chrome	4	Google chrome as web browser for all the devices to browse the web based application.

6.2.3   Test Schedule

Test schedule is the schedule of testing activities with the duration of the test conduct and the type of testing. Table 6.3 shows the test schedule of LAMS.

Table 6.3 Test schedule of LAMS

Type of testing	Description	Start Date to End Date	Duration (days)
Unit testing	Unit testing is the process that tests the part of an application with units and the functionality of the system. In this system, unit testing is used to test each of the functionality of the PHP scripting with server side web development and executed the PHP runtime to create a web page.	4/7/2016 to 17/7/2016	14
Integration testing	Integration testing is the testing that tests the combination of the system modules when it is combined. In this system, integration testing is used to test the PHP with the database before the unit testing and validation testing.	18/7/2016 to 31/7/2016	14
Web application testing	Web application testing is the testing that used to test the application which hosted on the web with the interfaces and functionality of the system. In this system, web application testing is used to test the interface, functionality and the usability.	1/8/2016 to 7/8/2016	7
Performance testing	Performance testing is used to verify the server response time and the performance of the system.	8/8/2016 to 14/8/2016	7

6.3 Test Strategy

Test strategy is the testing that used to test the system by functionality and interface of the system. The black box classes of tests are used as test strategy of LAMS. It can provide to test the system with the functionality and the usability based on the internal structure of the system. Meanwhile, the white box class of test is used to test the structure or implementation of the system while developing the system.

The interface with all of the labels and inputs of the system is used as the black box testing. It is used test the input and functionality of the input and output of the system. An example in the LAMS which is the add asset pages with the label and input text field to provides an output interfaces to the user.

6.4 Test Implementation

Test implementation is the test that executes the system and test for the scripts with the combination of functionality of the system. It is a process that executes the system with finding the bugs. This section describes the testing design for the black box testing of LAMS. Data of 196 assets and eight (8) users are inserted to the LAMS system.

6.4.1   Test Description

Test description is the test that used to test the test cases and the expected output for each of the modules in the system is designed. The test case is carried out by all of the functions on the modules of LAMS such as retrieve data and updating data. The random samples are taken to test each of the functions to verify the functionality of the system.

Table 6.4 Test description of modules of LAMS

Modules	Execution value	Execution steps	Expected results
Login	Username Password	User login by insert the username and password to login the system	The system will determine the level of user and redirect to different page for user type. Error message will display if login fail.
Dashboard	null	After user login, it will navigate to the dashboard page based on the user level.	The dashboard contains the notification and the number of status of the updated application list.
Add Asset	Type of asset Category Sub category Type of equipment Name Manufacturer Model Date Condition Availability Price Image Description Responsible officer Location Asset ID	Navigate to add asset and insert asset detail to store the data into database by save button.	The asset data insert into the system by input form and verify the data input. Error message will display if the details is not insert complete.

View Asset	null	Navigate to view asset page and view for the asset to perform task.	The asset detail will display to the view asset page and admin can perform an action to view asset detail, edit asset detail, generate QR code and delete the asset.
Asset Application	null	Navigate to asset application page and perform task to the application.	The asset application will display the updated asset application and admin can perform an action to view detail, approve, reject, collect, edit, and return the asset. Admin also able to notify the delayed user to return the asset by email.
Add User	Admin ID Name Identity number Address Contact number Email Admin level Username Password	Navigate to add user to add admin user by insert the detail of the admin.	The admin can add the other admin by insert the detail and choose for the admin level.
View User	null	Navigate to view user to view admin user information.	The information of admin such as contact number and email

			will display on the page.
Report	null	Navigate to report page and to generate the report.	The report of the asset such as cost spent, asset location, availability and condition will be generate automatically.

6.4.2 Test Data

Test data is the sample data that collected from FTMK, UTeM to use the system. All of the data from different modules will be store into different tables of database of the system.

6.5 Test Result and Analysis

Test result and analysis is the test case identification and the results with success or fail on the detailed documentation. In this phase, the test data used on LAMS is used the example data of 196 assets and eight (8) users insert into the system. Few random samples data are taken randomly to test as the asset application. Table 6.5 shows the test result and analysis of LAMS. The testing details are enclosed on appendices A and appendices B.

Table 6.5 Test result and analysis of LAMS for register user.

Test Case ID	Result	Remarks
LAMS_REGISTER_01	PASS	No remark
LAMS_REGISTER_02	PASS	No remark
LAMS_REGISTER_03	PASS	No remark

Table 6.6 Test result and analysis of LAMS for add user.

Test Case ID	Result	Remarks
LAMS_ADD_USER_01	PASS	No remark
LAMS_ADD_USER_02	PASS	No remark
LAMS_ADD_USER_03	PASS	No remark

Table 6.7 Test result and analysis of LAMS for add asset.

Test Case ID	Result	Remarks
LAMS_ADD_ASSET_01	PASS	No remark
LAMS_ADD_ASSET_02	FAIL	Data inserted but fail to display image because only png supported.
LAMS_ADD_ASSET_03	PASS	No remark
LAMS_ADD_ASSET_04	PASS	No remark

Table 6.8 Test result and analysis of LAMS for asset application.

Test Case ID	Result	Remarks
LAMS_ASSET_APPLICATION_01	PASS	No remark
LAMS_ASSET_APPLICATION_02	PASS	No remark
LAMS_ASSET_APPLICATION_03	PASS	No remark
LAMS_ASSET_APPLICATION_04	PASS	No remark
LAMS_ASSET_APPLICATION_05	PASS	No remark

6.6 Analysis Testing

Analysis testing is the data analyze from testing based on the system developed. The performance testing is used to test the performance on each of the web pages. Loading time is the time to load the web pages and scripting time is the time to complete the function of the system. Rendering is the graphics of computer to view the image of the web pages and painting is the process of filling in pixels of the system. To test and record the performance of the system, the Google Chrome DevTools Timeline panel is used to record and analyze all the activity when the

application as it runs. To test the performance of the system, the web pages of the system are required to browse by using Google Chrome. After the webpage are open, right click and inspect the web pages. Then, choose timeline and refresh the page. The activity in the system will start investigating perceived performance issues of the system by the chart. Figure 6.1 to Figure 6.9 shows the performance analysis testing of the web pages of LAMS.

1. Performance on login page
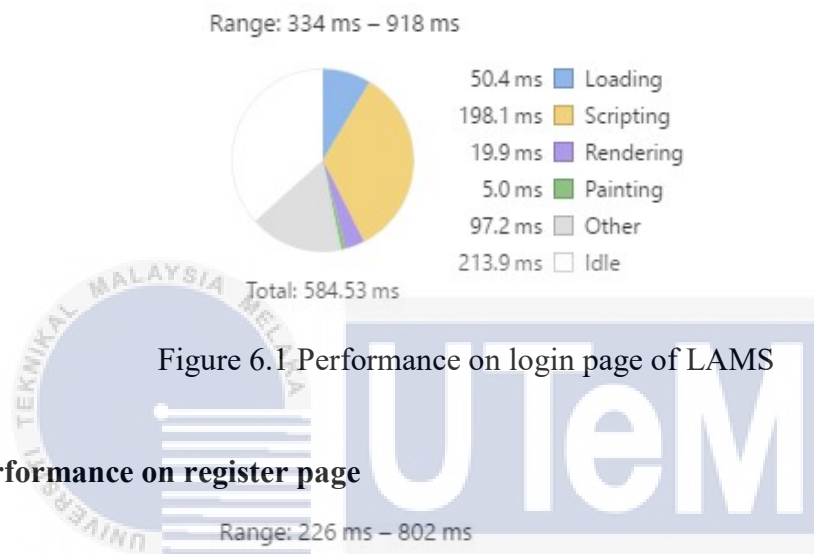
Figure 6.1 Performance on login page of LAMS

2. Performance on register page
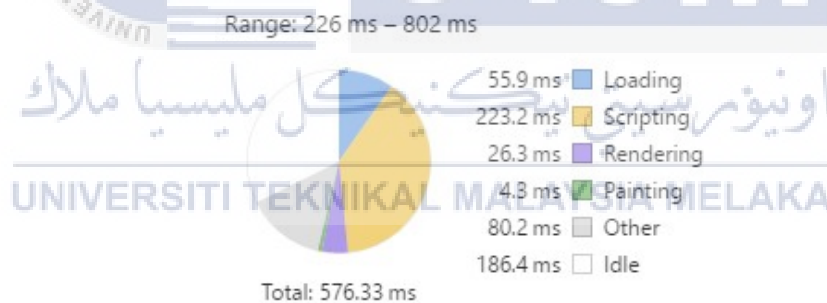
Figure 6.2 Performance on register page of LAMS

3. Performance on dashboard page
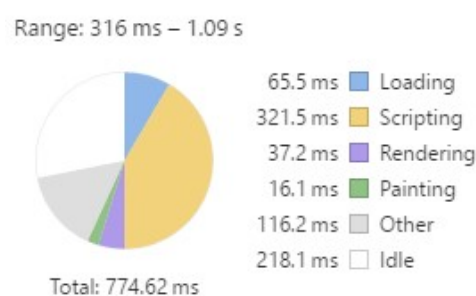
Figure 6.3 Performance on dashboard page of LAMS

4. Performance on add asset page

Range: 350 ms – 1.32 s

80.8 ms	Loading
383.3 ms	Scripting
114.7 ms	Rendering
8.9 ms	Painting
114.9 ms	Other
266.6 ms	Idle

Total: 969.14 ms
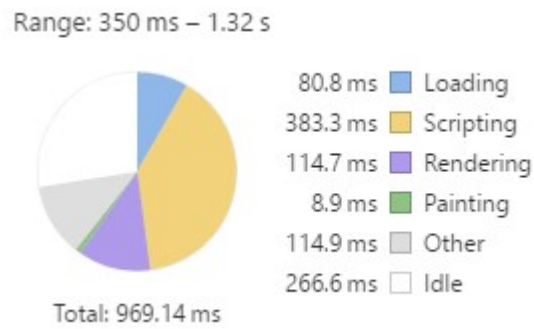
Figure 6.4 Performance on add asset page of LAMS

5. Performance on view asset page

Range: 1.07 s – 3.07 s

166.9 ms	Loading
794.8 ms	Scripting
89.0 ms	Rendering
12.5 ms	Painting
204.6 ms	Other
724.1 ms	Idle

Total: 1.99 s
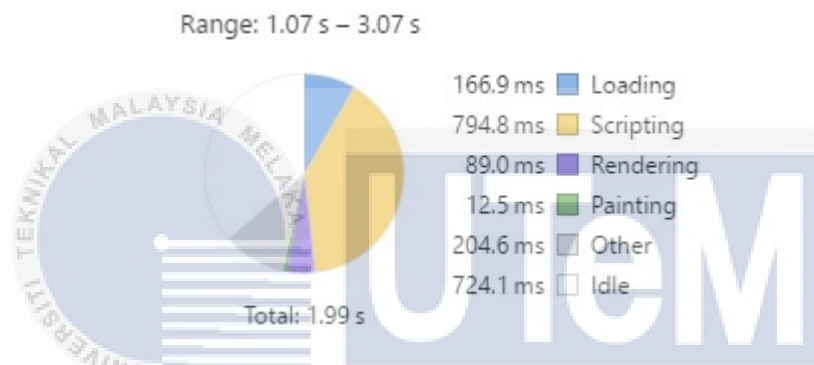
Figure 6.5 Performance on view asset page of LAMS

6. Performance on view asset application page

Range: 3.60 s – 6.36 s

71.1 ms	Loading
1371.6 ms	Scripting
169.0 ms	Rendering
6.2 ms	Painting
88.7 ms	Other
1056.2 ms	Idle

Total: 2.76 s
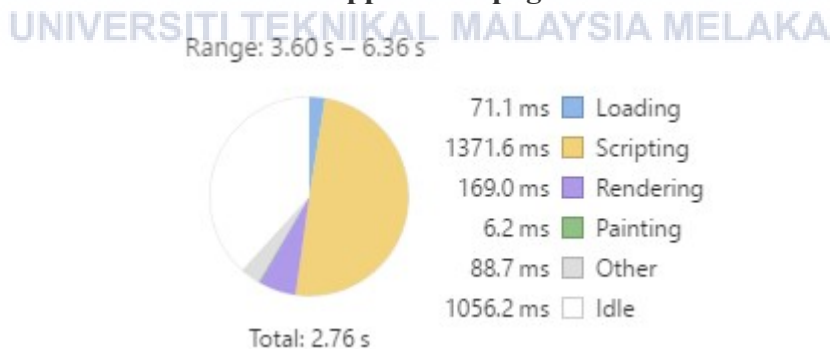
Figure 6.6 Performance on view asset application page of LAMS

7. Performance on add user page

Range: 669 ms – 1.49 s

71.6 ms	Loading
365.3 ms	Scripting
49.6 ms	Rendering
11.1 ms	Painting
103.2 ms	Other
220.7 ms	Idle

Total: 821.57 ms
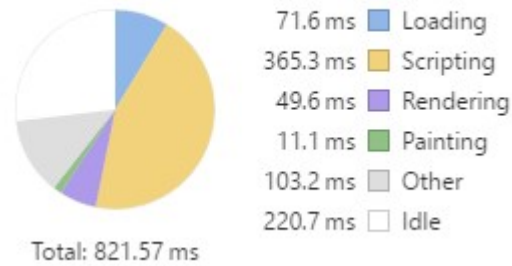
Figure 6.7 Performance on add user page of LAMS

8. Performance on view user page

Range: 1.16 s – 2.27 s

52.4 ms	Loading
455.3 ms	Scripting
42.1 ms	Rendering
13.0 ms	Painting
105.0 ms	Other
435.5 ms	Idle

Total: 1.10 s
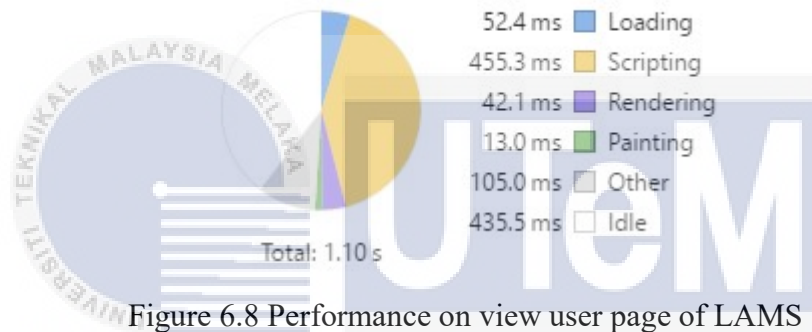
Figure 6.8 Performance on view user page of LAMS

9. Performance on report page

Range: 341 ms – 2.55 s

90.9 ms	Loading
685.9 ms	Scripting
85.0 ms	Rendering
9.0 ms	Painting
198.9 ms	Other
1143.1 ms	Idle

Total: 2.21 s
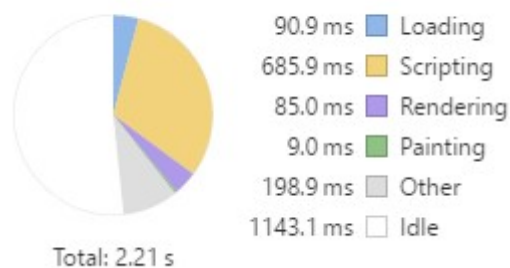
Figure 6.9 Performance on report page of LAMS

Based on results recorded on Figure 6.1 to Figure 6.9, the chart shows most of the time to load the pages is scripting, followed by loading and rendering, while painting the page consumes the least time.

6.7 Conclusion

In this chapter, each of the testing phases of the system has been test and discussed with the testing plan and testing implementation. The result from testing are analyze from the system by using real data.

The next chapter will be the project conclusion which is discuss about the weakness and strengths of the projects. It also will discuss about the improvement and contribution.

CHAPTER VII

CONCLUSION

7.1 Observation on Weaknesses and Strengths

Lab Asset Management System (LAMS) is developed to reduce the workload of the admin and user. LAMS with implement of QR code provide a solution to reduce and simplify the procedures of lending an asset manually. Moreover, the system also provides the notification and email features to notify the user with the asset lending.

However, there are few observation based on the weaknesses and strengths of the LAMS system. The current system is lack of few modules to make the system more efficient. The users are required to scan the QR code one by one to apply the application for lending the asset. Besides that, the system is not supported to notify the users who are delayed returning asset by automatically, the admin are required to notify the user by manually. Moreover, the system is also not supported to select multiple asset data to perform an action. The system is not supported with export the asset detail and report as document file. Lastly, the system also not supported to manage the asset within the warranty period and manage the process of disposal.

7.2 Propositions for Improvement

Based on the observation on weaknesses and strengths of the LAMS system that discuss from the previous section. There are few propositions for improvement the system on future work can be purpose to improve the system which is enhance and add few modules to the system to make the system more better than current system.

The system should add a module that allow user to manage and lend the asset by multiple selection. With the multiple selections, the user can manage and lend the asset by multiple and does not require managing and lending the asset one by one. The multiple selections can help to reduce the time on managing and lending the asset one by one.

Besides that, the system can add module that notify the user who are delayed returning asset by automatically. With the notification automatically, the admin does not require to notify the user by manually. Hence, the users who are delayed returning asset will remind to return the asset by receive the email automatically.

The system is also should be improve with the export asset detail and report with document file to provide a clearer view of the assets detail and report to the admin. Hence, the admin can export the asset detail and report with document file as documentation and print it as well. Furthermore, the interface of the system should be enhance and improve to be more user friendly. This will helps the user to use the system easily.

Lastly, the system is required to allow the admin to manage the warranty period of the asset. It can issue to the asset owner to repair or replace the asset within a specified period of time. Moreover, the process to disposal an asset also required to add as a module to improve the system. It can allow the admin to check the asset condition and disposal the asset by using a system.

With the propositions for improvement to the system, the LAMS will improve and enhance to overcome the weaknesses and strengths of the system and

improve to a better system which are more effectively and easily to manage the assets.

7.3 Project Contribution

The LAMS system is developed to organization of UTeM to managing and lending the asset by using a system with implement of QR code. The asset admin are able to manage the asset by using LAMS. Meanwhile, the users are able to lending the asset by scanning the QR code. Therefore, a system to manage lab asset by using QR code is provides a solution to simplify the procedure of managing with manually. All of the asset information can be stored and updated from the database of the system. Hence, it is provide the latest and more accurate information to the user.

7.4 Conclusion

In the end of this project, the objectives have been achieved with the researches which done previously. The objective to study the requirement of managing lab assets and usage of QR codes has been done by the previous research with managing lab asset by system and use the QR codes to lending an asset. The second objective to develop a lab asset management system with implementation of QR code has been achieved by the system developed with managing the asset by using the LAMS and view the detail and lending the asset by using QR tagging. Third objective to test and verify the proposed lab asset management has been achieved with the testing of the system. The system is tested based on the previous chapter.

As a conclusion of the project, all project objectives has been achieved and the system was developed to provide benefits to asset admin and user who involve on manage and lend lab asset. The LAMS is the potential system that can provide a better managing method to the faculty with the enhancement to improve the efficiency of the system.

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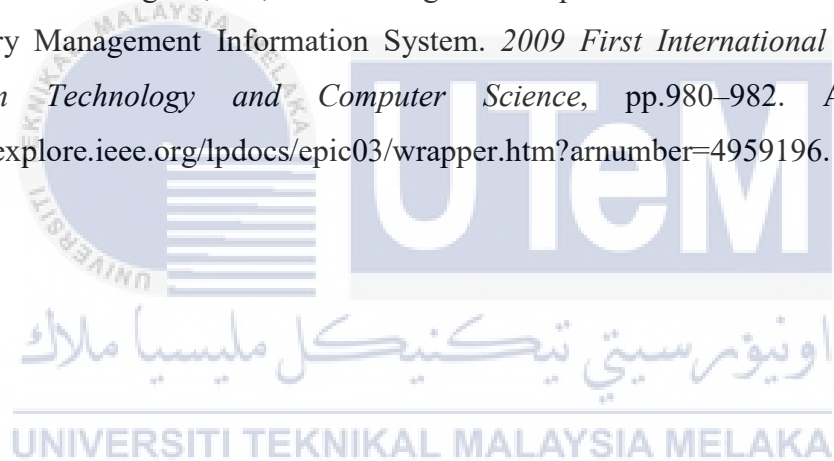
APPENDICES

Appendices A: Web application testing

a. Register user

Table 1 Test result and analysis of LAMS for register.

Test Case ID	Test Case	Test Procedure	Expected Results
LAMS_REGISTER_01	Empty text field	1. Click register button	The system display alert to request fills in the empty text field.
LAMS_REGISTER_02	Empty random text field	1. Insert detail to register but empty either text field 2. Click register button	The system display alert to request fills in the empty text field.
LAMS_REGISTER_03	Fully insert detail in text field	1. Insert detail to register 2. Click register button	The system display successfully registers.

b. Add user

Table 2 Test result and analysis of LAMS for add user.

Test Case ID	Test Case	Test Procedure	Expected Results
LAMS_ADD_USER_01	Empty text field	1. Click add button	The system display alert to request fills in the empty text field.
LAMS_ADD_USER_02	Empty random text field	1. Insert detail to register but empty either text field 2. Click add button	The system display alert to request fills in the empty text field.
LAMS_ADD_USER_03	Fully insert detail in text field	1. Insert detail to register 2. Click add button	The system displays add successfully.

c. Add asset

Table 3 Test result and analysis of LAMS for add asset.

Test Case ID	Test Case	Test Procedure	Expected Results
LAMS_ADD _ASSET_01	Empty text field	1. Click add button	The system display alert to request fills in the empty text field.
LAMS_ADD _ASSET_02	Fully insert detail in text field.	1. Insert detail and choose an image for the asset. 2. Click add button	The system display alert to request successfully added. Asset details added but image not display on the system because the picture upload not png format.
LAMS_ADD _ASSET_03	Fully insert detail with one asset in text field	1. Insert detail and choose an image with png for the asset. 2. Click add button	The system displays add successfully and the image displayed.
LAMS_ADD _ASSET_04	Fully insert detail with multiple asset in text field	1. Insert detail and choose an image with png for the asset. 2. Click add button	The system displays add successfully and the image displayed.

d. Asset application

Table 4 Test result and analysis of LAMS for asset application.

Test Case ID	Test Case	Test Procedure	Expected Results
LAMS_ASS ET_APPLIC ATION_01	Apply asset by scanning QR code with fill in the form.	1. Scan the asset QR code. 2. Click apply button. 3. Fill in the form and submit.	The assets successfully apply and receive an email from system.

LAMS_ASS ET_APPLIC ATION_02	Approve or reject asset by using system.	1. Receive an email from system with asset pending. 2. Open the system, and go to pending list. 3. Select approve or reject the asset application.	The status of asset changed after approve or reject the asset. The asset turns to not available to lend after approve. An email will be send to the user as references.
LAMS_ASS ET_APPLIC ATION_03	Collect or edit the detail of asset application.	1. Browse to approve list. 2. Select edit or collect asset button.	The status of asset will changed after click collect button. An email will be send to the user.
LAMS_ASS ET_APPLIC ATION_04	Return the asset.	1. Go the lend list. 2. Click return asset.	The asset return not display on the system and the asset turn to available for lend. An email will be send to user.
LAMS_ASS ET_APPLIC ATION_05	Notify the delayed returning asset user.	1. Go to the delayed list. 2. The delayed returning asset user will be list on the delayed list. 3. Click notify user.	An email will be send to the delayed user to notify them to return the asset.

Appendices B: Test Data

a. Register user

Table 5 Test data of LAMS for register.

Test Case ID	Field	Data
LAMS_REG ISTER_03	Matric Number	B031310140
	Username	gansionghin
	Password	sionghin
	Name	Gan Siong Hin
	Identification number	930308145689
	Address	684, Jalan SK 4/1, 43300 Seri Kembangan, Selangor.
	Contact Number	0166555384
	Email	sionghin0308@gmail.com
	Matric Number	B031310167
	Username	limboonhee
	Password	930616
	Name	Lim Boon Hee
	Identification number	930616016045
	Address	90, Jalan Sri Temiang, Taman Sri Temiang, 84000 Muar, Johor
	Contact Number	0147229331
	Email	boonheelim@gmail.com
	Matric Number	B031310269
	Username	khadijah
	Password	abcd1234
	Name	Khadijah binti Ismail
	Identification number	940225012346
	Address	No 11, Jalan SU41, Taman Saujana Indah, Bukit Katil, Melaka
	Contact Number	01110123456
	Email	sitidijaa@gmail.com
	Matric Number	B031310474
	Username	Hamieranordin

	Password	hamiera
	Name	Hamiera Nordin
	Identification number	941222013456
	Address	Kolej Kediaman UTeM Lestari, Durian Tunggal
	Contact Number	0142262967
	Email	norhamierabintinordin@gmail.com

b. Add user

Table 2 Test data of LAMS for add user.

Test Case ID	Field	Data
LAMS_ADD _USER_03	Admin ID	A0001
	Name	Administrator
	Identification number	160222160819
	Address	FTMK, UTeM
	Contact Number	0166555384
	Email	fyplams@gmail.com
	Admin Level	3
	Username	admin
	Password	admin
	Admin ID	A0002
	Name	Mohd Kamal
	Identification number	790819016789
	Address	FTMK, UTeM, Hang Tuah Jaya, Durian Tunggal, Malacca, Malaysia
	Contact Number	063316521
	Email	mohdkamal@utem.my
	Admin Level	2
	Username	mohdkamal
	Password	mohdkamal
	Admin ID	A0003
	Name	Mohd Nizam
	Identification number	780912019875

	Address	FTMK, UTeM, Hang Tuah Jaya, Durian Tunggal, Malacca,
	Contact Number	063316548
	Email	nizamsaid@utem.my
	Admin Level	2
	Username	mohdnizam
	Password	mohdnizam
	Admin ID	A0004
	Name	Zubaidah Abd
	Identification number	781012019856
	Address	FTMK, UTeM, Hang Tuah Jaya, Durian Tunggal, Malacca,
	Contact Number	063316618
	Email	zubaidah@utem.my
	Admin Level	2
	Username	zubaidah
	Password	zubaidah

c. Add asset

Table 3 Test result and analysis of LAMS for add asset.

Test Case ID	Field	Data
LAMS_ADD _ASSET_02	Type of Asset	Asset
	Category	05-Computer Equipments
	Sub Category	0404-Electronics
	Type of Equipment	4-Electronics
	Name	Dell Desktop
	Manufacturer	Dell
	Model	Dell Inspiron 3000 Series
	Date	2016-05-01 21:11:11
	Condition	Good
	Availability	Available
	Price	4500
	Image	dell_desktop.jpg

	Description	Dell Desktop Core i5 (3.2GHz) / 500GB/ 4GB / Windows 7 / LED 18.5 inch
	Responsible Officer	A0001
	Location	SKK-1-Lab CCNA
	Asset ID	UTeM/25/A/05/16/1
LAMS_ADD _ASSET_03	Type of Asset	Asset
	Category	05-Computer Equipments
	Sub Category	0404-Electronics
	Type of Equipment	4-Electronics
	Name	Dell Desktop
	Manufacturer	Dell
	Model	Dell Inspiron 3000 Series
	Date	2016-05-01 21:11:11
	Condition	Good
	Availability	Available
	Price	4500
	Image	dell_desktop.png
	Description	Dell Desktop Core i5 (3.2GHz) / 500GB/ 4GB / Windows 7 / LED 18.5 inch
	Responsible Officer	A0001
	Location	SKK-1-Lab CCNA
	Asset ID	UTeM/25/A/05/16/2
LAMS_ADD _ASSET_04	Type of Asset	Asset
	Category	05-Computer Equipments
	Sub Category	0404-Electronics
	Type of Equipment	4-Electronics
	Name	Dell Desktop
	Manufacturer	Dell
	Model	Dell Inspiron 3000 Series
	Date	2016-05-01 21:11:11
	Condition	Good
	Availability	Available
	Price	4500

	Image	dell_desktop.png
	Description	Dell Desktop Core i5 (3.2GHz) / 500GB/ 4GB / Windows 7 / LED 18.5 inch
	Responsible Officer	A0001
	Location	SKK-1-Lab CCNA
	Asset ID	UTeM/25/A/05/16/3
		UTeM/25/A/05/16/4
		UTeM/25/A/05/16/5
		UTeM/25/A/05/16/6
		UTeM/25/A/05/16/7
		UTeM/25/A/05/16/8
		UTeM/25/A/05/16/9
		UTeM/25/A/05/16/10
		UTeM/25/A/05/16/11
		UTeM/25/A/05/16/12
		UTeM/25/A/05/16/13
		UTeM/25/A/05/16/14
		UTeM/25/A/05/16/15
		UTeM/25/A/05/16/16
		UTeM/25/A/05/16/17
		UTeM/25/A/05/16/18
		UTeM/25/A/05/16/19
		UTeM/25/A/05/16/20
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		UTeM/25/A/05/16/24
		UTeM/25/A/05/16/25
		UTeM/25/A/05/16/26
		UTeM/25/A/05/16/27
		UTeM/25/A/05/16/28
		UTeM/25/A/05/16/29
		UTeM/25/A/05/16/30
	Image	dell_desktop.png
	Description	Dell Desktop Core i5 (3.2GHz) / 500GB/ 4GB / Windows 7 / LED 18.5 inch

		UTeM/25/A/05/16/31
		UTeM/25/A/05/16/32
		UTeM/25/A/05/16/33
		UTeM/25/A/05/16/34
		UTeM/25/A/05/16/35
		UTeM/25/A/05/16/36
		UTeM/25/A/05/16/37
	Type of Asset	Asset
	Category	05-Computer Equipments
	Sub Category	0404-Electronics
	Type of Equipment	4-Electronics
	Name	HP Desktop
	Manufacturer	HP
	Model	HP EliteDesk 800
	Date	2016-07-07 22:35:01
	Condition	Good
	Availability	Available
	Price	5000
	Image	hp_desktop.png
	Description	Core i5 / 4570 / 3.2 GHz / 500 GB / 4 GB / Windows 8
	Responsible Officer	A0002
	Location	SE-2-Lab System
	Asset ID	UTeM/25/A/05/16/38
		UTeM/25/A/05/16/39
		UTeM/25/A/05/16/40
		UTeM/25/A/05/16/41
		UTeM/25/A/05/16/42
		UTeM/25/A/05/16/43
		UTeM/25/A/05/16/44
		UTeM/25/A/05/16/45
		UTeM/25/A/05/16/46
		UTeM/25/A/05/16/47

		UTeM/25/A/05/16/48
		UTeM/25/A/05/16/49
		UTeM/25/A/05/16/50
		UTeM/25/A/05/16/51
		UTeM/25/A/05/16/52
		UTeM/25/A/05/16/53
		UTeM/25/A/05/16/54
		UTeM/25/A/05/16/55
		UTeM/25/A/05/16/56
		UTeM/25/A/05/16/57
		UTeM/25/A/05/16/58
		UTeM/25/A/05/16/59
		UTeM/25/A/05/16/60
		UTeM/25/A/05/16/61
		UTeM/25/A/05/16/62
		UTeM/25/A/05/16/63
		UTeM/25/A/05/16/64
		UTeM/25/A/05/16/65
		UTeM/25/A/05/16/66
		UTeM/25/A/05/16/67
		UTeM/25/A/05/16/68
		UTeM/25/A/05/16/69
		UTeM/25/A/05/16/70
		UTeM/25/A/05/16/71
		UTeM/25/A/05/16/72
		UTeM/25/A/05/16/73
		UTeM/25/A/05/16/74
	Type of Asset	Asset
	Category	05-Computer Equipments
	Sub Category	0404-Electronics
	Type of Equipment	4-Electronics
	Name	Asus Desktop
	Manufacturer	Asus

	Model	M32CD-MY013T M32 Series
	Date	2015-10-10 23:14:59
	Condition	Good
	Availability	Available
	Price	4800
	Image	asus_desktop.png
	Description	Core i5-6400 / 4GB / 1TB / 7200R SATA / Window 10
	Responsible Officer	A0003
	Location	MI-2-Lab Multimedia
	Asset ID	UTeM/25/A/05/15/75
		UTeM/25/A/05/15/76
		UTeM/25/A/05/15/77
		UTeM/25/A/05/15/78
		UTeM/25/A/05/15/79
		UTeM/25/A/05/15/80
		UTeM/25/A/05/15/81
		UTeM/25/A/05/15/82
		UTeM/25/A/05/15/83
		UTeM/25/A/05/15/84
		UTeM/25/A/05/15/85
		UTeM/25/A/05/15/86
		UTeM/25/A/05/15/87
		UTeM/25/A/05/15/88
		UTeM/25/A/05/15/89
		UTeM/25/A/05/15/90
		UTeM/25/A/05/15/91
		UTeM/25/A/05/15/92
		UTeM/25/A/05/15/93
		UTeM/25/A/05/15/94
		UTeM/25/A/05/15/95
		UTeM/25/A/05/15/96
		UTeM/25/A/05/15/97

		UTeM/25/A/05/15/98
		UTeM/25/A/05/15/99
		UTeM/25/A/05/15/100
		UTeM/25/A/05/15/101
		UTeM/25/A/05/15/102
		UTeM/25/A/05/15/103
		UTeM/25/A/05/15/104
		UTeM/25/A/05/15/105
		UTeM/25/A/05/15/106
		UTeM/25/A/05/15/107
		UTeM/25/A/05/15/108
		UTeM/25/A/05/15/109
		UTeM/25/A/05/15/110
		UTeM/25/A/05/15/111
	Type of Asset	Asset
	Category	05-Computer Equipments
	Sub Category	0404-Electronics
	Type of Equipment	4-Electronics
	Name	Acer Desktop
	Manufacturer	Acer
	Model	Aspire AXC780-6400W10 Desktop
	Date	2016-01-11 23:36:44
	Condition	Good
	Availability	Available
	Price	4000
	Image	acer_desktop.png
	Description	i5-Core / 2.7GHz / 4GB DDR4 RAM/ 1TB SATA HDD / HD Graphics 530 / Windows 10
	Responsible Officer	A0004
	Location	KI-2-Lab AI
	Asset ID	UTeM/25/A/05/16/112
		UTeM/25/A/05/16/113
		UTeM/25/A/05/16/114

		UTeM/25/A/05/16/115
		UTeM/25/A/05/16/116
		UTeM/25/A/05/16/117
		UTeM/25/A/05/16/118
		UTeM/25/A/05/16/119
		UTeM/25/A/05/16/120
		UTeM/25/A/05/16/121
		UTeM/25/A/05/16/122
		UTeM/25/A/05/16/123
		UTeM/25/A/05/16/124
		UTeM/25/A/05/16/125
		UTeM/25/A/05/16/126
		UTeM/25/A/05/16/127
		UTeM/25/A/05/16/128
		UTeM/25/A/05/16/129
		UTeM/25/A/05/16/130
		UTeM/25/A/05/16/131
		UTeM/25/A/05/16/132
		UTeM/25/A/05/16/133
		UTeM/25/A/05/16/134
		UTeM/25/A/05/16/135
		UTeM/25/A/05/16/136
		UTeM/25/A/05/16/137
		UTeM/25/A/05/16/138
		UTeM/25/A/05/16/139
		UTeM/25/A/05/16/140
		UTeM/25/A/05/16/141
		UTeM/25/A/05/16/142
		UTeM/25/A/05/16/143
		UTeM/25/A/05/16/144
		UTeM/25/A/05/16/145
		UTeM/25/A/05/16/146
		UTeM/25/A/05/16/147

		UTeM/25/A/05/16/148
	Type of Asset	Asset
	Category	04-Lab Equipments
	Sub Category	0404-Electronics
	Type of Equipment	4-Electronics
	Name	Cisco Router
	Manufacturer	Cisco
	Model	4451-X
	Date	2016-04-01 21:12:14
	Condition	Good
	Availability	Available
	Price	5700
	Image	cisco_router.png
	Description	Cisco integrated services router
	Responsible Officer	A0001
	Location	SKK-1-Lab CCNA
	Asset ID	UTeM/25/A/04/16/1
		UTeM/25/A/04/16/2
		UTeM/25/A/04/16/3
		UTeM/25/A/04/16/4
		UTeM/25/A/04/16/5
		UTeM/25/A/04/16/6
	Type of Asset	Asset
	Category	04-Lab Equipments
	Sub Category	0404-Electronics
	Type of Equipment	4-Electronics
	Name	Cisco Switch
	Manufacturer	Cisco
	Model	WS-C2960X-24PD-L
	Date	2016-04-14 21:25:51
	Condition	Good
	Availability	Available
	Price	6900

	Image	cisco_switch.png
	Description	Cisco Catalyst 2960-X Series Switches, LAN
	Responsible Officer	A0001
	Location	SKK-1-Lab CCNA
	Asset ID	UTeM/25/A/04/16/7
		UTeM/25/A/04/16/8
		UTeM/25/A/04/16/9
		UTeM/25/A/04/16/10
		UTeM/25/A/04/16/11
		UTeM/25/A/04/16/12
	Type of Asset	Asset
	Category	04-Lab Equipments
	Sub Category	0404-Electronics
	Type of Equipment	4-Electronics
	Name	Cisco Router
	Manufacturer	Cisco
	Model	4451-X
	Date	2016-07-08 22:52:08
	Condition	Good
	Availability	Available
	Price	5700
	Image	cisco_router.png
	Description	Cisco integrated services router
	Responsible Officer	A0002
	Location	SE-2-Lab System
	Asset ID	UTeM/25/A/04/16/13
		UTeM/25/A/04/16/14
		UTeM/25/A/04/16/15
		UTeM/25/A/04/16/16
		UTeM/25/A/04/16/17
		UTeM/25/A/04/16/18
	Type of Asset	Asset
	Category	04-Lab Equipments

	Sub Category	0404-Electronics
	Type of Equipment	4-Electronics
	Name	Cisco Switch
	Manufacturer	Cisco
	Model	WS-C2960X-24PD-L
	Date	2016-07-08 22:52:08
	Condition	Good
	Availability	Available
	Price	6900
	Image	cisco_switch.png
	Description	Cisco Catalyst 2960-X Series Switches, LAN
	Responsible Officer	A0002
	Location	SE-2-Lab System
	Asset ID	UTeM/25/A/04/16/19
		UTeM/25/A/04/16/20
		UTeM/25/A/04/16/21
		UTeM/25/A/04/16/22
		UTeM/25/A/04/16/23
		UTeM/25/A/04/16/24
	Type of Asset	Asset
	Category	04-Lab Equipments
	Sub Category	0404-Electronics
	Type of Equipment	4-Electronics
	Name	Cisco Router
	Manufacturer	Cisco
	Model	4451-X
	Date	2015-10-10 23:14:59
	Condition	Good
	Availability	Available
	Price	5700
	Image	cisco_router.png
	Description	Cisco integrated services router
	Responsible Officer	A0003

	Location	MI-2-Lab Multimedia
	Asset ID	UTeM/25/A/04/15/25
		UTeM/25/A/04/15/26
		UTeM/25/A/04/15/27
		UTeM/25/A/04/15/28
		UTeM/25/A/04/15/29
		UTeM/25/A/04/15/30
	Type of Asset	Asset
	Category	04-Lab Equipments
	Sub Category	0404-Electronics
	Type of Equipment	4-Electronics
	Name	Cisco Switch
	Manufacturer	Cisco
	Model	WS-C2960X-24PD-L
	Date	2015-10-12 23:24:27
	Condition	Good
	Availability	Available
	Price	6900
	Image	cisco_switch.png
	Description	Cisco Catalyst 2960-X Series Switches, LAN
	Responsible Officer	A0003
	Location	MI-2-Lab Multimedia
	Asset ID	UTeM/25/A/04/15/31
		UTeM/25/A/04/15/32
		UTeM/25/A/04/15/33
		UTeM/25/A/04/15/34
		UTeM/25/A/04/15/35
		UTeM/25/A/04/15/36
	Type of Asset	Asset
	Category	04-Lab Equipments
	Sub Category	0404-Electronics
	Type of Equipment	4-Electronics
	Name	Cisco Router

	Manufacturer	Cisco
	Model	4451-X
	Date	2016-01-12 23:46:21
	Condition	Good
	Availability	Available
	Price	5700
	Image	cisco_router.png
	Description	Cisco integrated services router
	Responsible Officer	A0004
	Location	KI-2-Lab AI
	Asset ID	UTeM/25/A/04/16/31
		UTeM/25/A/04/16/32
		UTeM/25/A/04/16/33
		UTeM/25/A/04/16/34
		UTeM/25/A/04/16/35
		UTeM/25/A/04/16/36
	Type of Asset	Asset
	Category	04-Lab Equipments
	Sub Category	0404-Electronics
	Type of Equipment	4-Electronics
	Name	Cisco Switch
	Manufacturer	Cisco
	Model	WS-C2960X-24PD-L
	Date	2016-01-13 23:48:05
	Condition	Good
	Availability	Available
	Price	6900
	Image	cisco_switch.png
	Description	Cisco Catalyst 2960-X Series Switches, LAN
	Responsible Officer	A0004
	Location	KI-2-Lab AI
	Asset ID	UTeM/25/A/04/16/37
		UTeM/25/A/04/16/38

		UTeM/25/A/04/16/39
		UTeM/25/A/04/16/40
		UTeM/25/A/04/16/41
		UTeM/25/A/04/16/42