University RFID-Enabled Event Management Information System (URFID-EEMIS)

by

Anis Afzan binti Ab Rahman

Dissertation submitted in partial fulfillment of
the requirements for the
Bachelor of Technology (Hons)
(Business Information System)

JANUARY 2009

Universiti Teknologi PETRONAS
Bandar Seri Iskandar
31750 Tronoh
Perak Darul Ridzuan.

CERTIFICATION OF APPROVAL

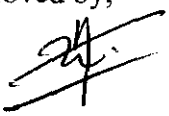
University RFID-Enabled Event Management Information System (URFID-EEMIS)

by

Anis Afzan binti Ab Rahman

A project dissertation submitted to the
Business Information System Programme
Universiti Teknologi PETRONAS
in partial fulfillment of the requirement for the
BACHELOR OF TECHNOLOGY (Hons)
(BUSINESS INFORMATION SYSTEM)

Approved by,

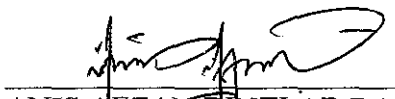


MOHD HILMI HASAN

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
January 2009

CERTIFICATION OF ORIGINALITY

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



ANIS AFZAN BINTI AB RAHMAN

ABSTRACT

This dissertation focuses on the research and development phase of University RFID (Radio Frequency Identification)-Enabled Event Management Information System, which aims to automate the current method of conveying information such as venue of class changed, class postponed/cancelled, date of quiz and tests, due date of assignment or project, and event update to the students of Universiti Teknologi PETRONAS (UTP).

The key objectives for this University RFID-Enabled Event Management Information System (URFID – EEMIS) includes capturing the unique ID stored in each RFID tags from the registered students, then validate the information with the database from back-end system and display information to the students. Based on the author research, RFID technology is suitable to be used in the system due to its unique characteristics compared to other available technology nowadays. It is hope that this system can be used as an alternative tool to convey the information or messages to the UTP students in future.

Methodology that will be used in developing University RFID-Enabled Event Management Information System is prototyping-based methodology. The author chooses this methodology because it can provides a system for the users to interact with very quickly, even if it is not ready for widespread yet. In addition to that, prototyping-based methodology helps to more quickly refine real requirements.

ACKNOWLEDGEMENT

First and foremost, I would like to send my almost gratitude to Allah for giving me the strength to complete my final year project. Not to forget, my heartiest appreciation to my supervisor, Mr Mohd Hilmi Hasan who had given me his fullest attention and guidance in both technical and non-technical area in order for me to complete my final year project. I am very thankful to be under his supervision that he had very committed to assure that this project is successful.

I would also like to express my appreciation to Mr. Mohd Fuad Nordin, Mr. Mohd Nadzaruddin Kahar and Mr. Mohd Affizan Ab Rahman who had given me their full cooperation throughout the project development. They have been dynamically involved by providing me with sufficient information on the coding as well as information on RFID which I found it very valuable to me. Special thanks to my parents who are really supportive and helped me to finish up this project.

Last but not least, I would like to take this opportunity to thank all my friends, Ms Noor Idayu binti Zainal, Ms Diyana Syamsiyah binti Rozali who had helped me a lot in finishing my final year project. Without their helps, I would not be able to debug some of the errors that occur during the system development phase.

Thank you so much to all who had been involved directly or indirectly for my final year project.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

RFID	Radio Frequency Identification
UTP	Universiti Teknologi PETRONAS
LF	Low Frequency
HF	High Frequency
UHF	Ultra High Frequency
ID	Identification
SDLC	Software Development Life Cycle
LCD	Liquid Crystal Display
URFID-EEMIS	University RFID-Enabled Event Management Information System

CHAPTER 1

INTRODUCTION

1.1 Background of Study

E-learning has been used in UTP for quite a while by the staff, lecturers and students. The main function of this website is to deliver the course information and materials to students. Apart from that, students can also get the information on any events information such as latest event held in UTP, seminars, adjunct lectures as well as any announcements from the managements through this website. In order to access this website, the users need to have network (internet/intranet) connection. Some students used other advertising tools like brochures, posters and flyers to convey the information to students which do not need any network connection. By having lots of brochures, posters and flyers, it will contribute to extra usage of papers and this can cause environmental problem.

Many problems arise with this current method of conveying the information. Most of the students are having problems to get the information that are related to their study such as class cancel, or venue of the class has been changed, etc as they cannot access the E-learning due to the connectivity problem as well as system maintenance. Besides that, there is a case whereby the lecturers want to make last minutes announcement like class is postponed probably an hour before actual class but the students are already gone to the class or they are having other class before that. As a result, students did not get the information.

Due to all these problems, the author has come out with an idea to use RFID technology in conveying the information to the students. All the students will be equipped with RFID tag where they have to register the information such as their

name, current semester, course registered, phone number, and semester intake in the system. All the information will be stored in a centralized database. RFID technology has the capabilities to store the unique identification (ID) in the RFID tag and read data stored in RFID tag using RFID reader. For this project, each student will be given a unique identification and it is differ from each other. Students that have the RFID tag can view the information that related to them once they enter the magnetic field generated by the reader. RFID reader will capture the unique ID stored in the tag and validate it with the database from the back-end system on which information to display.

There will be a LCD display unit that displays information of the students in the university. RFID readers will be placed near to the LCD display unit so that the reader will be able to capture the unique ID from the tag and then display the appropriate information such as events updates, changes in classes or venues, or important information on the display unit. The information displayed on the display unit will be tailored only to the registered students to avoid from spamming. The information displayed must tally with the information that related to the students.

1.2 Problem Statement

1.2.1 Problem Identification

Currently, information distribution medium in UTP is mostly done via E-learning, flyers, posters, brochures, etc. Due to the use of extra papers and unstable internet connection, it is inconvenience to students to have the internet access. Most of the UTP students and lecturers are having difficulties in accessing the E-learning as sometimes the network connection in this university is really slow. As students are not accessible to computer all the time, hence it is a problem when lecturers want to make last minutes announcement on class postpone probably on the day itself or an hour before actual class since some of the students are already gone to the class or they are having another class before that. Although they can access the computer, but they still need to log in into the E-learning in order for them to view the

information. For some students, this whole process is just a troublesome and they are too lazy to log in into the system. As the result, events updates, changes in classes or venues, and important information could not be conveyed to students in time. It is just a waste of time for the students walking to class when there is actually no class as they can use the time to do other stuff like study or finish up their assignments and projects.

1.2.2 Significant of the Project

By having the University RFID-Enabled Event Management Information System (URFID-EEMIS), it can act as alternative way to help with conveying information to students without having them to log in into E-learning and do not require any papers. It can also be used to analyze student's behaviour on the importance of communication medium. All students which have the RFID tag can view the information related to them once they pass the RFID reader near the LCD display. Apart from putting the information in the E-Learning or use the brochures and flyers as well as poster to deliver the event update, now lecturers and students will have another option to convey the information by using this system. This system is capable of reading specific unique identification from each tag, validates it with the stored database, and displays it accordingly to the registered students.

1.3 Objectives and Scope of Study

The key objective of this project is to develop a system called URFID-EEMIS, which provides the following functionalities:

- Store all the required data in the database and read the unique identification stored in RFID tags from registered students.
- Capable of displaying update information on large LCD display/information display unit based on the information registered by the students.
- Able to initiate tailored information to the students based on what they have registered earlier.

- To ensure and help students in getting update information that is related to them without having them to log in into E-learning as the information displayed is push-based information.

For this project, the author's scope of study will focus mainly on analyzing the communication medium to convey any updated information between lecturers and students using RFID technology. There are four types of RFID technology which include low frequency (LF), high frequency (HF), ultra high frequency (UHF), and microwave frequency. The author will only use HF RFID technology which is 13.56 MHz so that it has a shorter read range which is only 10 cm and able to read the tags within the frequency field. The system will implement inductive coupling which means tag is going to be in the magnetic field of the reader and is ready to respond appropriately. This method requires a single dipole tag which use single antenna and allows for only near-field communication and therefore read ranges usually, less than 1 meter. Kindly refer to Figure 1.1 for example of single dipole tag.

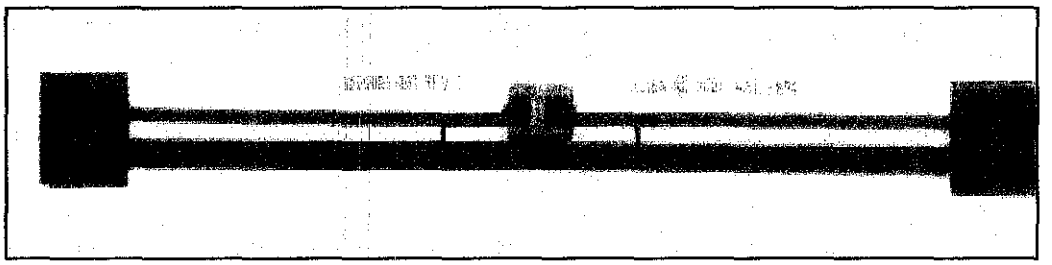


Figure 1.1: Single Dipole Tag (Single Antenna)

The system will focus on the users in the university, mostly the students and lecturers. It is a good opportunity for the author to find other alternative system that can be used to convey the information to students. The URFID-EEMIS is design such a way that students can use it without having them to log in into any system to view the information as the required information will be pushed to the students.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction of Technology Used

RFID is the main technology that will be used in development of this system to tag all the students and also to read the information stored in each RFID tag. RFID can track inventory in the supply chain more efficiently, provide real-time-in-transit visibility (ITV), and monitor the tagged objects or people. Hence, it is believed to give strategic advantages for business or organization. As quoted in [1], "RFID is an acronym for radio frequency identification, which is a wireless communication technology that is used to uniquely identify tagged objects or people. It has many applications. Some present-day examples include Supply chain crate and pallet tracking applications, such as those being used by Wal-Mart and the Department of Defense (DoD) and their suppliers, Access control systems, such as keyless entry and employee identification devices, Point-of-sale applications such as ExxonMobil's Speedpass, Automatic toll collection systems, such as those increasingly found at the entrances to bridges, tunnels, and turnpikes, Animal tracking devices, which have long been used in livestock management systems and are increasingly being used on pets, Vehicle tracking and immobilizers, Wrist and ankle bands for infant ID and security. The applications don't end there. In the coming years, new RFID applications will benefit a wide range of industries and government agencies in ways that no other technology has ever been able."

RFID system comprises of three main components in order to ensure the success of the system. These three components include hardware, middleware, and software. All the components will be integrated together before the system can actually be used and each of the components plays a different role in the RFID system. According to [2] "The Radio Frequency Identification (RFID) system comprises

several components; hardware, middleware, and software. The primary RFID hardware consists mainly of three parts: - An RFID tag that can be as small as a grain of sand, which is placed onto an object intended to be tracked or traced, an antenna or coil that can read/write data into the tag, a reader that can read tags up to a distance of 30 meters, and an RFID tag is attached to an object intended to be tracked or traced, and an RFID reader is a device that is used to interrogate an RFID tag. The reader has an antenna that emits radio waves and the tag responds by sending back its data. The reader communicates with other devices or servers, usually through some sort of network interface. A reader must also have a microcontroller or a microcomputer, and some readers even have built-in Bluetooth or wireless Ethernet communications. The antenna and the reader are often integrated into one product enclosure."

Passive RFID and active RFID system works differently. The author is focusing only on passive RFID in this report as the University RFID-Enabled Personalized Information System is using passive RFID technology. Passive RFID tags do not have any batteries as it will get the power supplied by the reader. How passive RFID works include - "The tag is activated when it passes through a radio frequency field, which has been generated by an antenna and reader. Then, the tag sends out a programmed response. The antenna that generated the field originally and is attached to the reader detects that response. The transceiver (or reader) sends the data to the middleware. The middleware sends the information contained in the tags to whatever systems need that information." [3]. Figure 2.1 shows the components of RFID system and how it works.

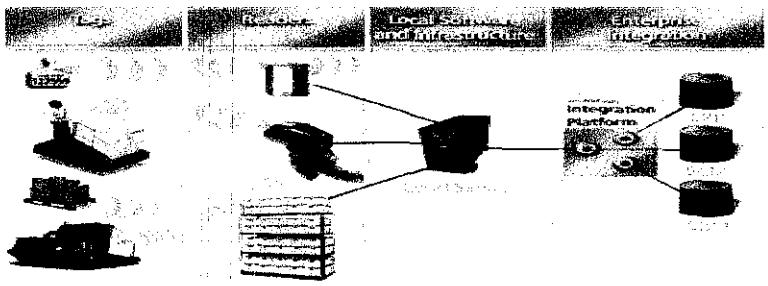


Figure 2.1: Components of RFID System

2.2 To Support the Problem Statement

Most of students here in the university are using papers to do the brochures, posters, flyers to convey the information to the students. Not to deny, there is only small percentage of students will keep the brochures or flyers. Others will just throw away all the papers after seeing the advertisement or information. Hence, it causes many problems to occur with the extra usage of these papers. According to [4], "Trees as a source of paper fiber have only been used for a little over a hundred years. It was the rapidly increasing demand for paper brought about by the printing press that necessitated huge amounts of a consistent fiber, the niche which a seemingly endless supply of trees could fill. As we know, the end may be in sight. Processing these trees requires the use of harsh chemicals. Papermaking is a dirty business. Paper mills are among the most polluting of industries. The paper industry is the greatest energy consumer in our country. The U.S. paper industry's reliance on chlorine-intensive bleaching places this industry as the worst water polluter in the world. Chlorine is not the only problem. One list of pulp mill contaminants identifies more than 40 items including cadmium, lead, mercury, phenols, PCB's, 2,3,7,8-TCDD (dioxin), and a variety of other harmful pollutants. Reduction of both the chemical input and output (pollution) must be our goal. Many of these substances cause cancer or genetic damage, are persistent, and accumulate in the environment. Toxic emissions from paper mills are concentrated in fish, and then are further concentrated when those fish are eaten, whether by a bird or a person. Studies indicate potential impacts to human reproductive and immune systems. All this so we can have all the paper we want."

As the author discussed in the earlier part of this report, internet connection plays important roles in determine success of E-learning or also know as online learning for some people. In order to access to internet or E-learning, first the students need to have computers. Although all students have their own computers and internet access but they are not accessible all the time. They need to put their user name and password in order to log in to E-learning and then only they can view the update information. Another limitation of E-learning is level of student readiness. Some students do not like to face problems or difficulties in getting any information and

some are usually too lazy or not so keen to read any announcement posted in E-learning. As [5] mentioned in the journal he wrote, "Online learning is any learning experience or environment that relies upon the Internet/World Wide Web (WWW or Web) as the primary delivery mode of communication and presentation. One of the limitations of online learning is student readiness. Student readiness poses great impact upon the success of an online course or program. Primarily, students must have the necessary technology available to them (suitable computer and internet access) before they can benefit from this type of program. Online students have the additional burden of dealing with technical delays and difficulties that may occur."

2.3 To Support the Idea

There are many factors that can support my idea of using RFID technology in developing the system. RFID technology provides lots of benefits to the users and also the organizations such as it contains unique ID which is difficult to forge, quick respond, high return on investment (ROI) and etc. According to [6], "Major driving forces for RFID adoption includes: Auto-ID Centre & EPCglobal Inc., common set of standards which are Generation 2 and Preliminary ISO Certification, diminishing costs of RFID tags and readers, significant advantages over barcodes, strong business case with potentially high ROI & ROE, adoption by the US DOD, Wal-mart, Airbus, Boeing, Tesco, BMW, P&G, and the list goes on and on, matured ICT infrastructure & enterprise systems (ERP systems), dwindling storage cost, renewed focus on security to counter terrorism acts and etc."

"As the ubiquitous society progresses, RFID tag are expected to spread widely. However, a tag still costs more than a barcode. To improve the cost-effectiveness of RFID tags, it is necessary to consider secondary uses for them. This paper focuses on a secondary use of applying RFID tags to a local area advertising system. It proposes an algorithm to determine what information is to be displayed on a series of display screens installed along a pedestrian path, based on information about the preferences of nearby pedestrians, collected from RFID tags which the pedestrians

are carrying. The algorithm is characterized by the use of several information items to determine the information to be displayed. These include the degree to which the preferences read in front of one display are used to influence the information to be shown in other displays, the weights given to the preferences of the all the pedestrians concerned, and the "word-of-mouth" information available from Web pages via the Internet. It has been confirmed that the proposed algorithm can successfully select display information according to the preferences of the pedestrians concerned."[7]. Based on these two references, it gives me the idea to come out with a similar system which used the same technology but for different purposes on which to help the lecturers to convey the information to students.

2.3 Related Works or Technology

There are a few related works or systems that are currently available which used RFID technology. The first one is "RFID-Enabled Billboards Talk to Mini Motorists". It has been done by the MINI USA. RFID key fobs are distributed to Cooper owners where interactive billboards will read the tags and flash personalized messages to drivers. Based on [8], "Mini, at the suggestion of its agency Butler, Shine, Stern and Partners, created a voluntary participation program in which select Mini Cooper owners attached an RFID fob to their keychain containing personal information such as occupation, birthday, etc. The agency purchased billboards with LCD displays that read the passing RFID signals and flash: "Mary, moving at the speed of justice," if Mary is a lawyer, or "Mike, the special of the day is speed," if Mike is a chef."

Apart from that, there is news on this technology as well. One the news coded that the system is an effort from them to know their customer's brand royalty and sense of community of others. Some of the news extracts; "The program is an effort to display Mini drivers' brand loyalty and sense of community with others—Mini Cooper motoring clubs and fan Web sites abound—while at the same time generating marketing buzz about the diminutive cars. When drivers carrying RFID-enabled key fobs drive past the billboards, readers housed in the signs read the

identification number encoded to the driver's fob. The interrogators can read the tags from as distant as 500 feet. Once an ID is captured, the interrogator sends it to a central server, which looks it up in a database and decides what message to display. It makes this decision based partly on how the driver answered a questionnaire before receiving the fob, and partly on other factors, such as the city it is in or the current day or season."[9]. Figure 2.2 shows a mini cooper billboard using RFID Technology to display their customer's information.

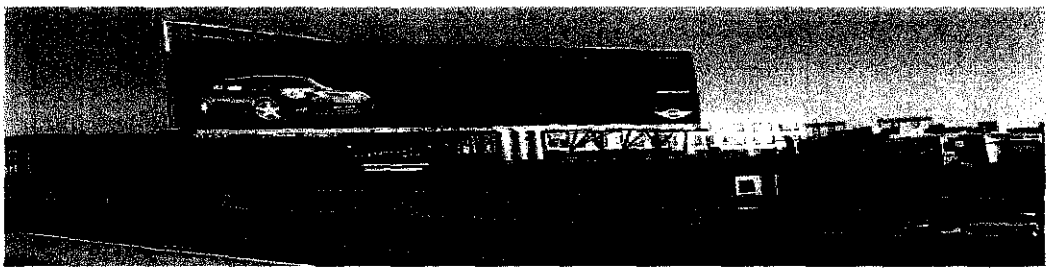


Figure 2.2: Mini Cooper Billboards using RFID Technology

Second related work that used the same technology is "Safety Driving Support System". The system is used to give information on pedestrian's position, direction of the road and car speed. According to [10] - "We study a new application system of RFID (Electronic Tag) technology for safety driving support in order to reduce traffic accidents involving pedestrians and bicycles occur near intersections. In this paper, we report an experimental system that senses the existence and position of pedestrians with active tag, send the data to an on-board device near that position and notifies it to the driver. The active tag is carried by a pedestrian or installed in a bicycle. When the tag enters the area of magnetic field generated by the LF-signal generator, it is excited and transmits the tag ID together with the position data to indicate the precise position of the object. When two LF-signal generators are embedded in a sidewalk with some appropriate interval, we can obtain the information of the direction and speed of the tag. It is important for this system to consider how to notify the information such as pedestrian's position, direction and speed to the driver. So we report our consideration about it, too."

Besides of the two related systems mentioned above, there is another related work which also used RFID technology in Japan. The system is mainly used to provide information about the time of train, streets, and entertainment such as movie show together with the time. Each Japan citizen will carry the RFID tag which is in a form of cards or in the phone and the RFID reader will respond to the tag once the person enters the area of magnetic signal. "Fujitsu developed a system that uses large plasma display integrated with eight RFID readers for delivering personalized information to citizens at public venues. The system is intended for places such as city streets, train stations, and airports. It responds to RFID tags (either RFID cards or RFID's phones) carried by users and display information that is tailored for individuals. Fujitsu plans to commercialize this system, which is currently called UbiWall) this year." [11]. Figure 2.3 shows the Fujitsu system using RFID technology.

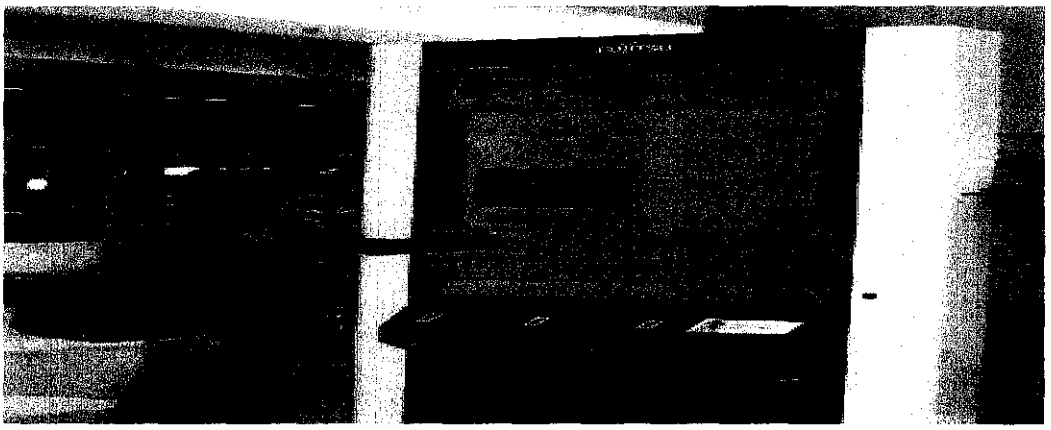


Figure 2.3: Fujitsu System using RFID Technology in Japan

Another related work that the author can found is Cascadia: A System for Specifying, Detecting, and Managing RFID Events. With regards to this system proposed by University of Washington, a new infrastructure that greatly simplifies the development of pervasive RFID applications such as those described above. Their focus is on large-scale, passive RFID deployments with fixed-location readers that exist within a single administrative domain such as a hospital, corporate or academic campus. Cascadia's data model comprises of a location model, an entity model, and an event model. The data model abstracts away the many technical details and difficulties of an RFID deployment to present applications with data in a form that is easier to work with. The location model hides the details of the RFID

infrastructure while capturing an abstract notion of tag location and movement. The entity model allows applications to work with meaningful entities (e.g. people, places, things). Finally, the event model defines how entity movements and relationships can map to high-level events and how these events are represented. [12]

CHAPTER 3

METHODOLOGY

3.1 Prototyping-based Methodology

There are several procedure need to be implemented in order to develop a complete system. Methodology is the essential ingredients in driving a successful development of the project to the right track. In developing URFID-EEMIS, the author had chosen the prototyping-based methodology which is one of the methodologies under Rapid Application Development (RAD). RAD falls in second category of system development methodology (SDM). With regards to this methodology, the system prototype which has minimal features will be built and showed to the user first. Any comments, feedbacks or corrections will be gathered and after that there will be another re-analysis, re-design, and re-implementation until the user satisfied with the features of the system. Then only, the real implementation will take place and the system will be constructed before it is ready to use. Refer to figure 3.1 for the methodology. [13]

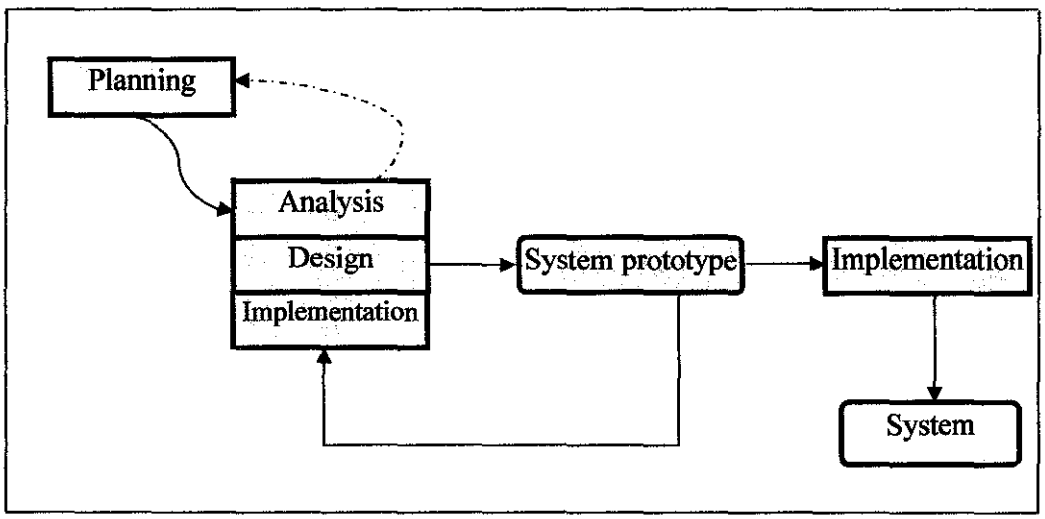


Figure 3.1: Prototyping-based Methodology

3.1.1 Planning

At planning phase, it is important to identify the business value in the system. Other than that, a feasibility analysis had been implemented in this phase. The major three key aspects of feasibility analysis include:

- Technical feasibility

Technical feasibility shows that the project is able to develop with the available technical skill.

- Economic feasibility

Economic feasibility in feasibility analysis shows that the project will be very beneficial to the university students as well as the staffs.

- Organizational feasibility

Organizational feasibility shows that the system will be used by the lecturers as well as students.

During the planning phase, Gantt chart is being developed to keep track on the project milestone. This is crucial as it help the author to plan on the development process.

3.1.2 Analysis

Methods or systems that are currently been used are being examined by the author during this analysis phase. Besides that, requirement gathering has also been conducted. The methods that had been used to gather the requirements include:

- Interviews: interviews with the RFID expert to discuss on the implementation whether the system is doable or not. Apart from that, the author had also interviewed a number of students to collect the information or requirement from them before proceed with the design phase.

- Survey: do some survey to collect information or requirement from the lecturers and students.

- Research: research is being done to investigate any current system and issues with the existing system as well as the improvement opportunities.

- Observation: observe the current system and how it works in order to make an improvement.

The author will analyze each requirement that had been collected, and then proceed with the design phase based on the gathered requirements.

3.1.3 Design

The "dirty-and-simple" prototype is developed. In this phase, it will focus on four main design which are architecture, interface, database, and system design. The back-end system's interface will be designed using Microsoft VB.Net, however, the author will use Microsoft C# for the middleware or reader's system and Microsoft Access for the database to store the required information. After that, the design will be shown to the user.

3.1.4 System Prototype

During the system prototype phase, the system prototype which has minimal features will be built which means integration of all the hardware with the back-end system and showed to the user for any comments and feedback. If there are any comments, feedback or corrections need to be done, then re-analysis, re-design, and re-implementation will take place until the user satisfied with the features of the system.

3.1.5 Implementation

At this phase, the system will be implemented after the user is satisfied with all the features.

3.1.6 System

The final system is thoroughly evaluated and tested. Routine maintenance is carried out on a continuing basis to prevent large-scale failures and to minimize downtime.

3.2 Tools and Hardware

3.2.1 Software Tools

[illegible]	[illegible]
Operating System	Microsoft Windows XP Professional Service Pack 2
Supporting Software	Microsoft Visual Studio 2008 • VB.net • C# Microsoft Access Adobe Photoshop CS3 Internet Explorer 6.0
Middleware	JUNO_900W_C#

Table 3.1: Software Tools

3.2.2 Hardware Tools

[illegible]	[illegible]	[illegible]
Central Processor Unit (CPU)	Genuine Intel ® CPU T2400 @ 1.83 GHz	Compatible and stable
Passive HF RFID Tag (Read/Write Tag)	UPMRaflatac DogBone	Need to use passive HF RFID tag as it can minimize the read distance between tags and reader.
Passive HF RFID Reader – 13.56Mhz (Passive Reader)	RFID Pocket Reader Juno7 – 10cm	To read the information stored in RFID tags.
LCD display unit	In this project, reader will be the LCD display unit.	Display the personalized information to students.

Table 3.2: Hardware Tools

3.3 Gantt Chart for FYP part 1

No	Detail / Work	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Selection of Proposed Project Topic											Mid-Semester Break				
2	Submission of Proposed Project Topic															
3	Preliminary Research/Design Work															
	- Study and understand the chosen topic															
	- Research on RFID technology : how it works?															
	- Choose the most suitable frequency															
	- Research on Literature Review															
4	Work on Preliminary Report															
5	Submission of Preliminary Report															
6	Seminar 1															
7	Attend Research Class															
8	Project Work															
9	Work on Progress Report															
10	Submission of Progress Report															
11	Seminar 2															
12	Submission of Interim Report															
13	Oral Presentation															

3.4 Gantt Chart for FYP part 2

No	Detail / Work	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Continuation of Development Phase - Interface										Mid-Semester Break					
2	Submission of Progress Report 1															
3	Continuation of Development Phase															
	- Database															
	- Back-end system's interface															
	- Middleware (coding)															
	- Back-end system (coding)															
	- Configuration															
4	Submission of Progress Report 2															
6	Poster Exhibition & Pre-EDX															
7	Work on Dissertation															
8	Submission of Dissertation (Soft Bound)															
9	Oral Presentation															
10	Finalize system															
11	Finalize Dissertation															
12	Submit Dissertation (Hard Bound)															

3.5 Key Milestone for FYP part 1

1.	Proposal	W2	Wed: 30th July 2008
2. *	Proposal Approval by RC	W3	Wed: 06th August 2008
3. *	List of Approved Topics	W3	Fri: 08th Aug 2008
4.	Research Class	W4 – W7	Fri: 15th Aug – 06th Sept 2008
5.	Preliminary Report	W4	Fri: 15th Aug 2008
6.	Seminar 1 – Preliminary Reporting	W9	Fri: 26th Sept 2008
7.	Progress Report	W13	Fri: 17th Oct 2008
8.	Seminar 2– Progress Reporting	W14	Fri: 24th Oct 2008
9.	Interim Report	W15	Fri: 31st Oct 2008
10.	Oral Presentation – Final Reporting	W16	Mon: 3rd Nov 2008

3.6 Key Milestone for FYP part 2

1.	Continuation of Project Work	W1 – W3	
2.	Submission of Progress Report 1	W3	Wed: 04.02. 2009
3.	Continuation of Project Work	W3 – W8	
4.	Submission of Progress Report 2 – FINAL DRAFT REPORTING	W8	Wed: 11.03.2009
5.	Seminar – FINAL DRAFT REPORTING	W9	Mon – Fri: (16.03 – 20.03) 2009
6.	Poster Exhibition & Pre- EDX	W10	Wed: 01.04.2009

CHAPTER 4

RESULT AND DISCUSSION

4.1 System Architecture for University RFID-Enabled Event Management Information System

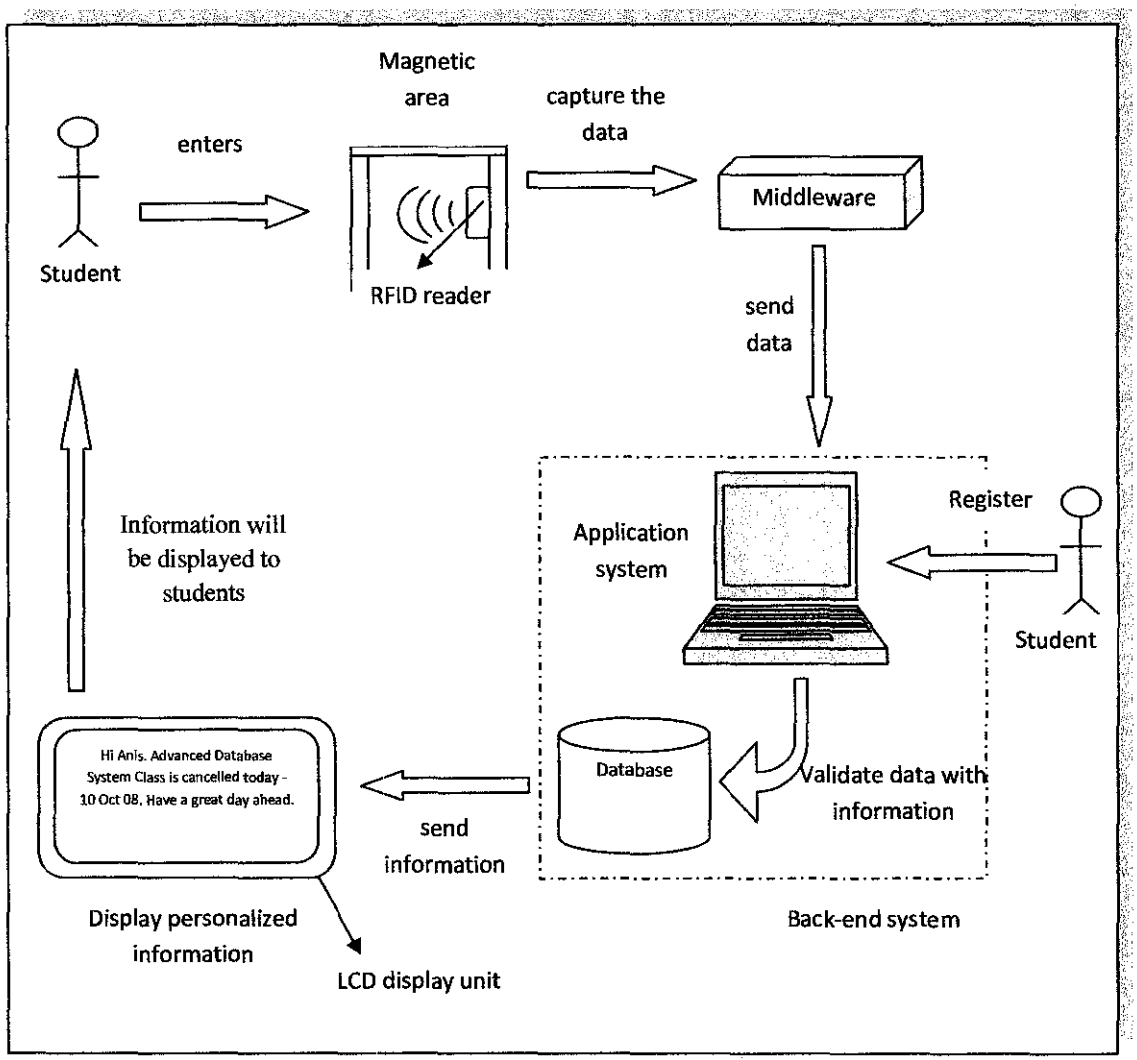


Figure 4.1: System Architecture of University RFID-Enabled Event Management Information System (Illustrate in a form of picture)

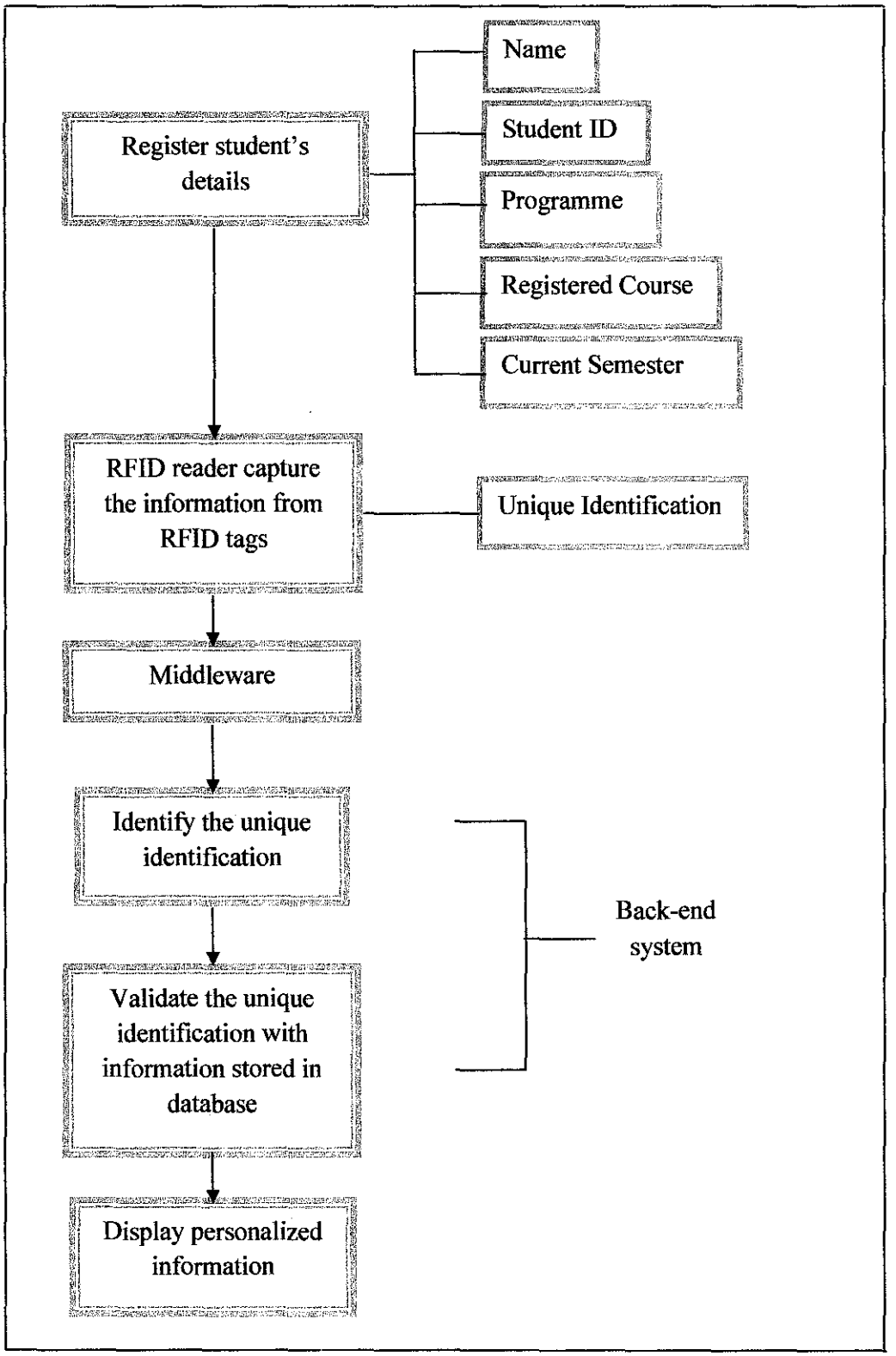


Figure 4.2: System Architecture for University RFID-Enabled Event Management Information System

Figure 4.1 and 4.2 shows the flow on how URFID-EEMIS is actually works. First, students need to register by given all the details such as name, student identification, programme taken, registered courses and current semester that are required. Those details will be stored in the database. During the registration process, students will be given a RFID tag that holds a unique identification in each tag. This unique identification is referred to student identification which varies for each student.

When students carrying RFID-enabled tag (student card is being placed with RFID label) enter the area of magnetic field generated by HF reader, this system that senses the existence of students with RFID passive tag, transmits the data to the reader. The reader is placed near the display unit read and captures the tags identification number which is encoded to the student's card. This RFID reader can only read the tags between a certain ranges that have been generated by LF reader only.

Once the unique identification is captured, reader will send it to a central server through a middleware, which later looks it up in the database and then validate the identification with the appropriate information to display. This system makes the decision based on the details given by the students during registration process. If there is any update messages regarding the students, personalized messages will be displayed on the LCD display unit to the specific student. This information will be updated automatically after 15 seconds as the reader automatically continue to read unique ID from the tags every 15 seconds.

For example, Anis has registered Advanced Database System as one of the registered courses for July 2008 semester and there is a message that the lecturer wants to convey to her like the class is cancelled for 10 October 2008. So when Anis walks past the area of magnetic field, the reader will capture Anis unique identification and transmits it to the reader. The reader will pass the unique identification to the back-end system and it will validate with the appropriate

messages stored in database. When the necessary message is found, it will be displayed to Anis on the LCD display unit as follows: "Hi Anis. Advanced Database System Class is cancelled today - 10 Oct 08. Have a great day ahead." Refer to Figure 4.1 for better understanding on how the system works.

4.2 Database Design for University RFID-Enabled Event Management Information System

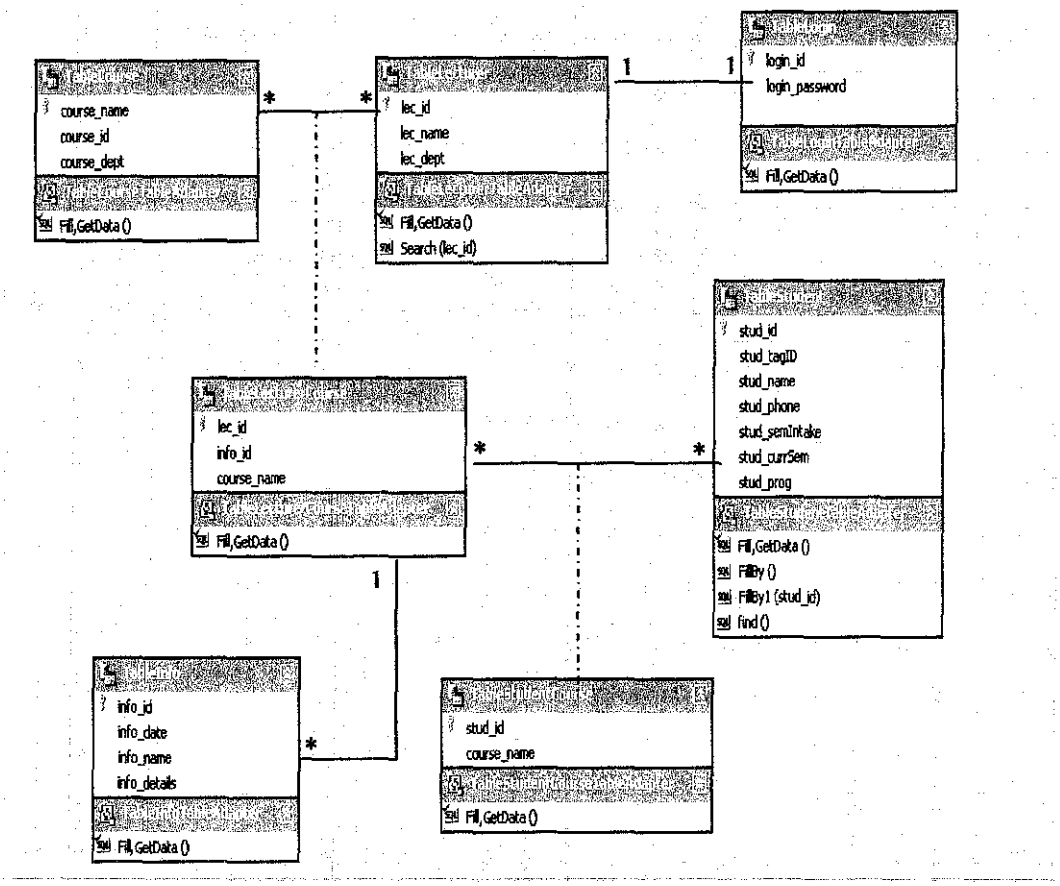


Figure 4.3: Database Design for University RFID-Enabled Event Management Information System

By referring to the Figure 4.3, URFID-EEMIS will have a database which consists of tables for lecturers, students, login, course, lecturerCourse, studentCourse, as well as info. Student's id, tag id, name, phone, semester intake, current semester, and programme will be stored under student's table. Under lecturer's table, lecturers can

provide their name, id and department. All the necessary information such as class cancel, class postpone, or change of venue will be stored under information's table. Login table will store the lecturer's login id and password. All the course name, id and department are stored under course table. LecturerCourse table hold details on lecturer id and what course that they are teaching for that particular semester. Student id, lecturer id and course name that the students are taken for that semester will be stored under studentCourse table. This database is crucial as all the necessary information is stored in it. The structure of the database might be changed in the future due to user requirement.

4.3 Use-case Diagram for University RFID-Enabled Personalized Information System

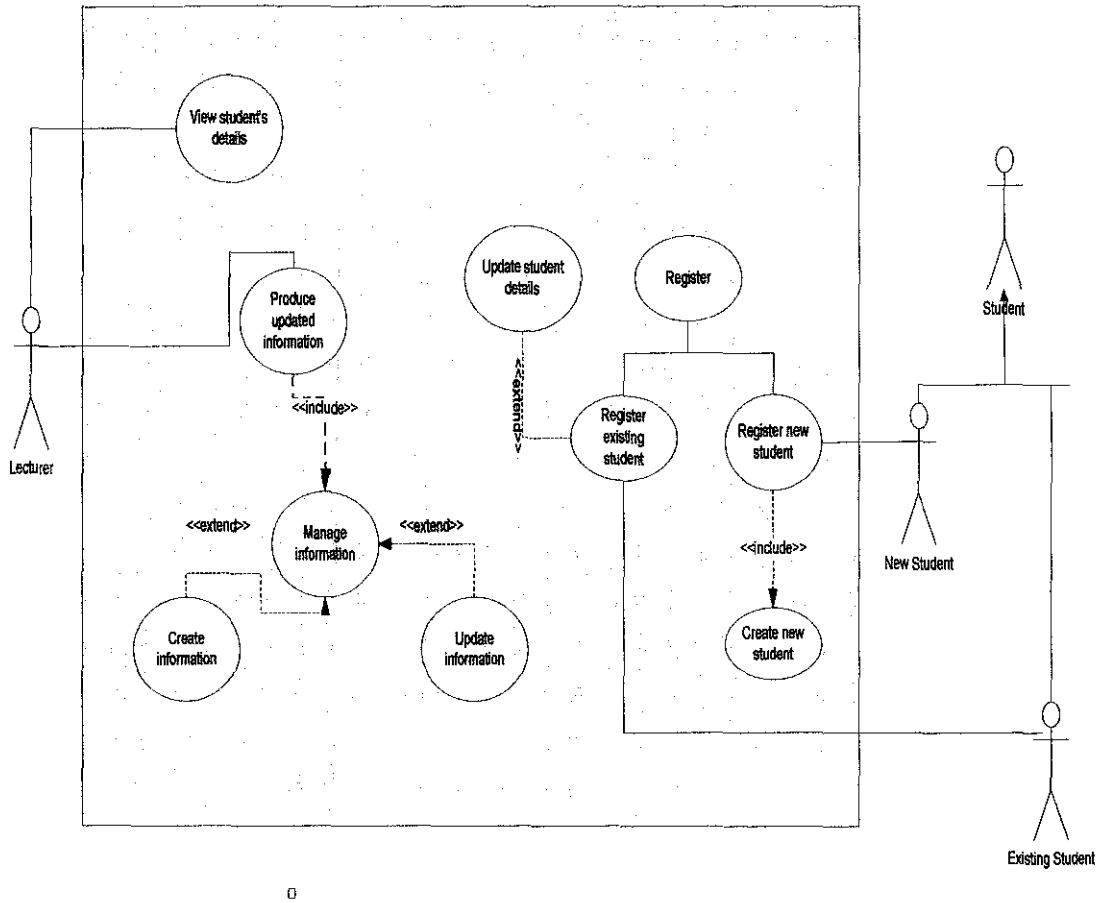


Figure 4.4: Use-Case Diagram for University RFID-Enabled Event Management Information System

As shown in the use case diagram in Figure 4.4 above, URIF-EEMIS is for the lecturers and the students. Students need to register their personal details first. There are two types of students which are new students and existing students. New students need to register their details and the system will create a new entry for them. For existing students, they still need to register their details every semester so that the system can update the current data in the database. Lecturers, as the administrators are responsible to produced and manage the information. They are able to create or update any information related to the students, view student's details together with the information that they want to convey to students. All the functions might be changed if there are any enhancements to make in future.

4.4 Comparison between E-Learning and University RFID-Enabled Event Management Information System

E-Learning	Criteria	URFID-EEMIS
• Network connection (Internet/Intranet)	[illegible]	• RFID
• Students need to log in to E-learning	[illegible]	• Push-based information which do not require any request or log in to view information
• Information is general to students (not personalized even though based on course taken)	[illegible]	• Information is push-based and personalized according to the students
• Need to log in to E-learning first before being able to view information.	[illegible]	• Just need to bring the tag and go near the reader to view information

Table 4.1: Comparison between E-Learning and University RFID-Enabled Event Management Information System

4.5 Comparison between RFID and Bluetooth Technology

RFID	Criteria	Bluetooth
• Yes	[illegible]	• Yes
• N/A	[illegible]	• 1 Mbps
• No	[illegible]	• Yes
• Good	[illegible]	• Very Good
• Low	[illegible]	• Low
• No	[illegible]	• No
• Range / (Triangulation)	[illegible]	• Range / (Triangulation)
• Good	[illegible]	• Very Good

Table 4.2: Comparison between E-Learning and University RFID-Enabled Event Management Information System

* Sources taken from [14]

Based on the comparison above, it is proved that Bluetooth have few advantages compared to RFID. However, RFID still have its own advantages. Prior to the capabilities provided by Bluetooth technology, the author have decided to improve the current URFID-EEMIS by integrate Bluetooth with RFID so that the information can be easily download through mobile phones in the future.

4.6 Data Analysis based on Questionnaire (Refer to Appendix A for the questionnaire)

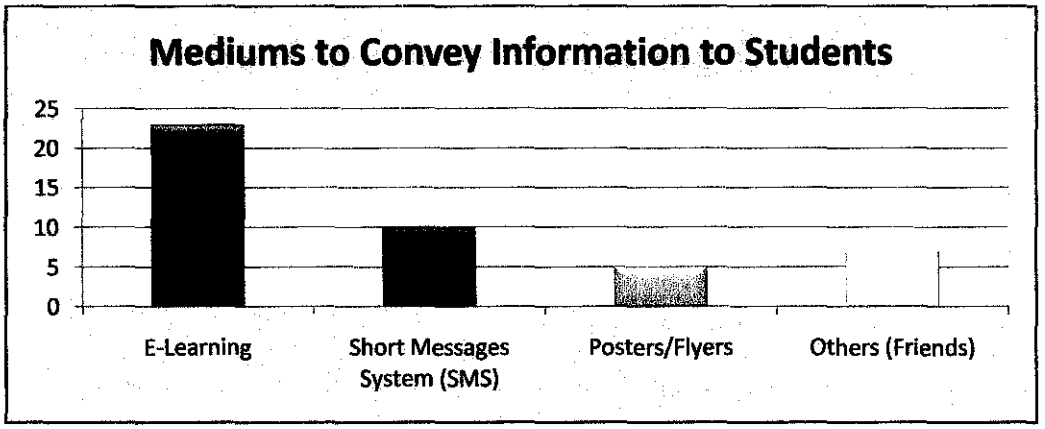


Figure 4.5: Mediums to Convey Information to Students

Mediums to Convey Information	Quantity
E-Learning	23
Short Messages System (SMS)	10
Posters/Flyers	5
Others (Friends)	7

Table 4.3: Data on Mediums to Convey Information to Students

*students are allowed to choose more than one answer

A survey to 50 UTP students has been conducted by the author in order to capture feedback from students on what are the mediums that they used to get updated information like class cancellation or postponement, etc. Students are allowed to choose more than one answer for this question. Based on the survey, 23 students use E-learning to get updated information from the lecturers which makes it the most popular medium to convey information, followed by short messages system (SMS) with 10 students as shown in Figure 4.5 and Table 4.3. Total of seven students get updated information from their friends. Posters or flyers are the least mediums that students use to get updated information. With regards to the respond from students, E-learning is the most important medium for them to get updated information. So, if there is a problem with E-learning, students might have difficulties to get the information.

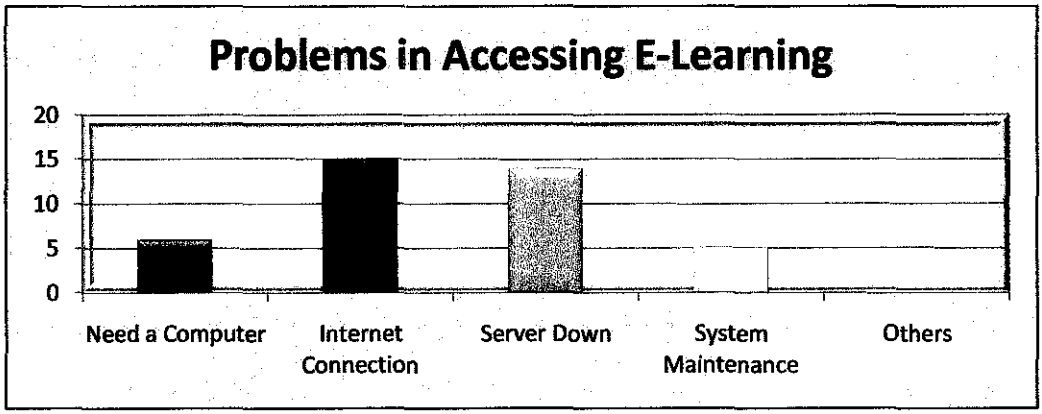


Figure 4.6: Problems in Accessing E-Learning

Problems to Access E-Learning	Quantity
Need to log in	6
Network connection	15
Server Down	14
System Maintenance	5
Others	0

Table 4.4: Data on Problems in Accessing E-Learning

*students are allowed to choose more than one answer

Second important question in the questionnaire is regarding the problems that students face when accessing E-learning. As shown in the Figure 4.6 above, most of the students have difficulties with network connection and server down when accessing E-learning which is 15 and 14 students. As discussed in the early part of this report, E-learning requires the students to access the internet or intranet and they need to log in to E-learning in order for them to get the information and it is not accessible all the time by the students. This factor leads to a major problem when they want to get any information. As a result, most of students will not get the information at the right time. Need to log in is the third highest problem when accessing E-learning based on the survey with six students. Students need a computer together with the network connection if they want to access E-learning. Only five students have difficulties with the system maintenance when accessing E-learning.

4.7 System Interface

4.7.1 Back-End System's Interface

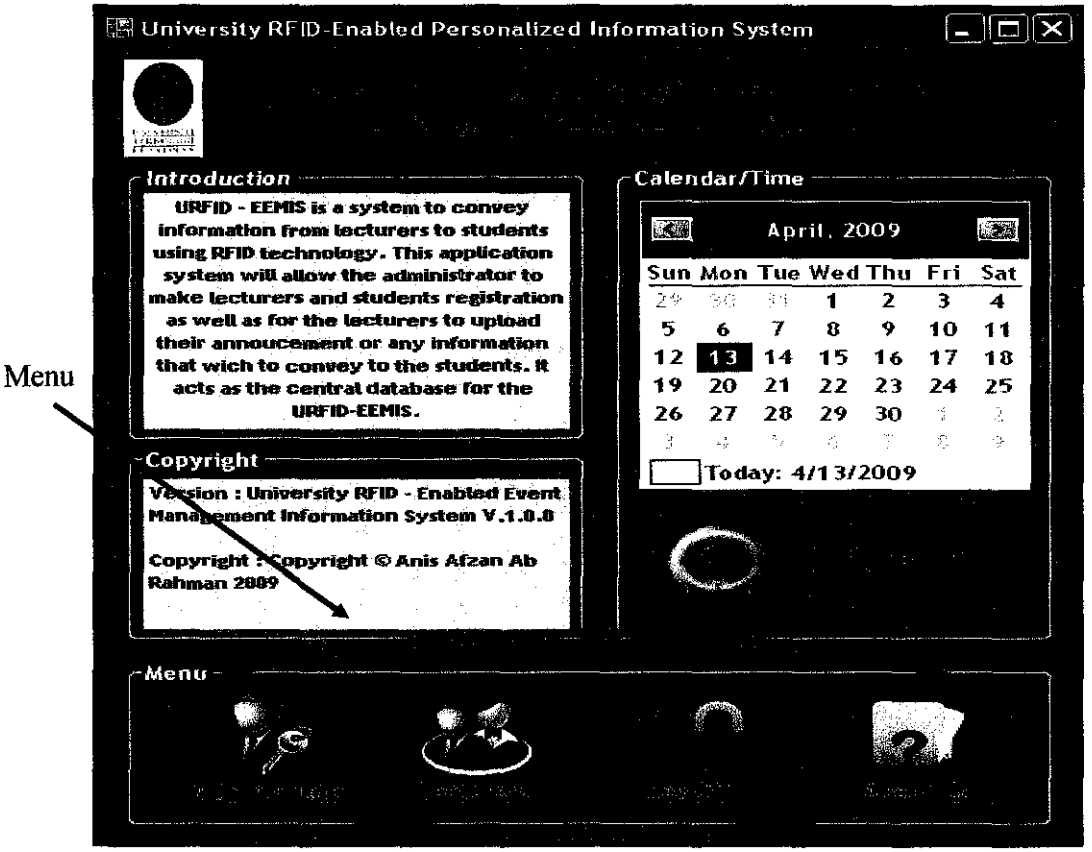


Figure 4.7: Main Page

Figure 4.7 shows the "Main Page" of URFID-EEMIS. This page contains four menus which are administrator, lecturer, about us and log off. If the user is the administrator, then he or she has to click on "Administrator" button in order to login into the system. Registration of new students and lecturers can only be done by the administrator. If the users are lecturers, then they have to click on "Lecturer" button to login into the system. Users can click on "Log Off" button once they want to leave the system. If the users want to know more about the system, they can just click on button "About Us" and all the details will appear.

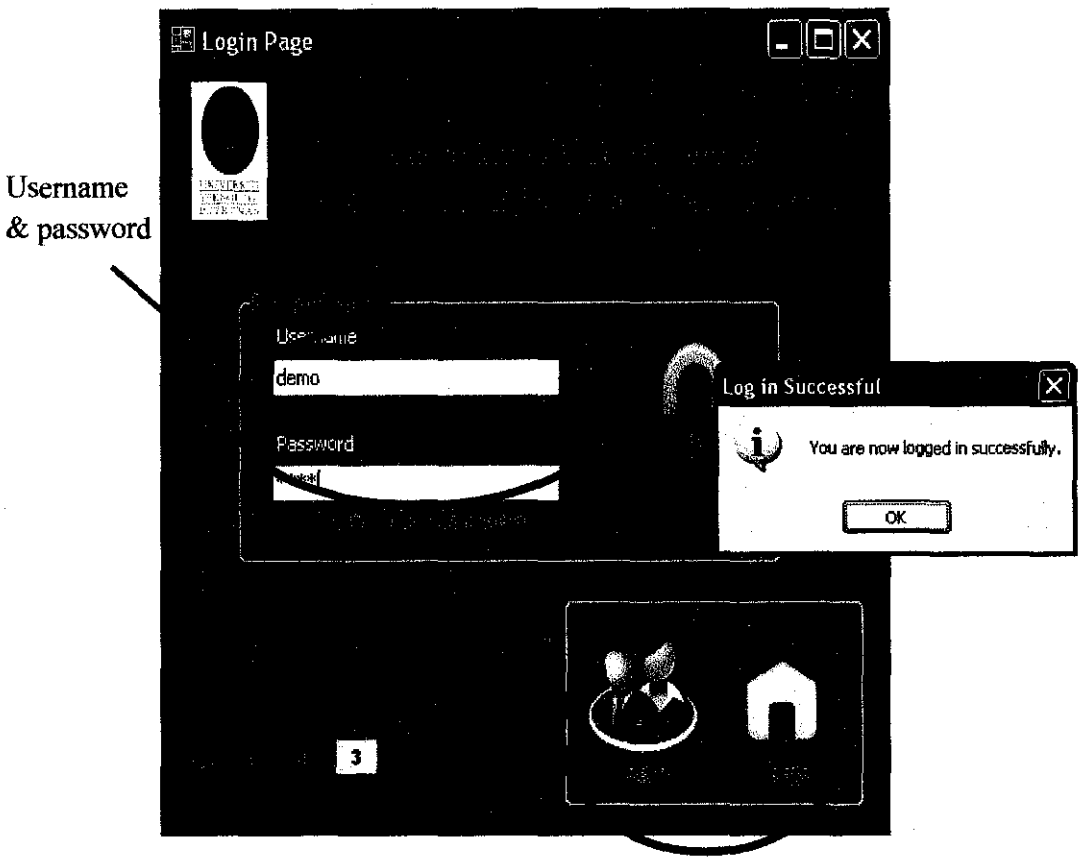


Figure 4.8: Admin Login Page

After the administrator click on "Administrator" button in "Main Page", the system will load the "Admin Login Page". Figure 4.8 illustrates the login page for administrator. Administrator need to put the username and password so that he or she will be able to view the data of existing students and lecturers or to register new students and lecturers in the registration page. There will be only three attempts for the administrator to login. If the username and password are valid, there will be a message box showing that log in is successful and then the "Registration Page" will be loaded. However, if username or password is invalid for three times, then all the textbox will be disabled and the administrator cannot login into the system anymore. He or she needs to log off from the system by clicking "Home" button and try to login again later.

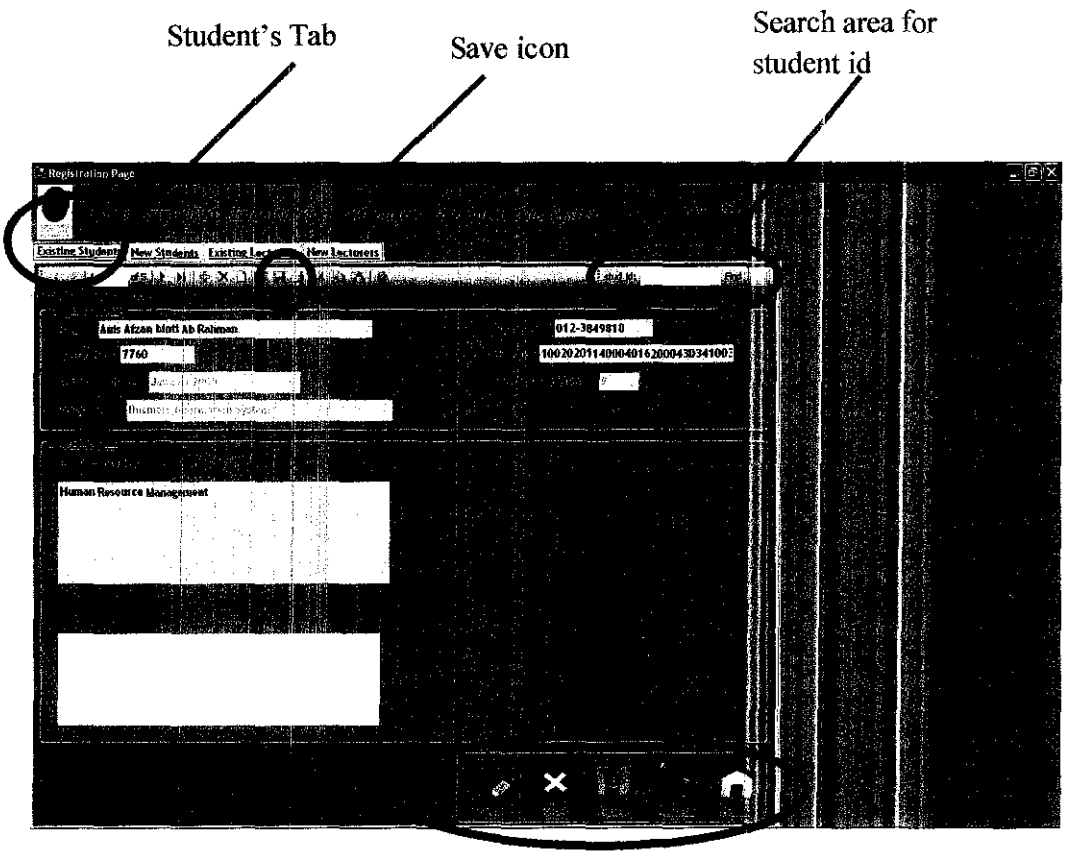


Figure 4.9: Registration Page (Existing Student's Form)

Once administrator has logged in successfully, "Registration Page" will be loaded. In this "Registration Page", there are four tabs which present different form such as students, new students, lecturers, and new lecturers. "Student" tab contains data on existing students as shown in Figure 4.9 above. Administrator is able to view the entire student's data such as name, phone number, matric number, tag identification that has been assigned automatically to the students upon registration, semester intake, current semester, programme, and course taken by the students for that particular semester. Since all these data need to be updated every semester, administrator can just click the "Update" button in order to make the departmental course and list course visible so that changes can be done to the current data. "Delete" button has a function to delete selected course taken from the list of course taken. When administrator check courses from list course, he or she need to click "Refresh" button so that all the checked courses will be added in list course taken. List course will be visible according to the selected departmental course. After finish updating the data, just click on save icon on top of the student's information form and all the data is save in the database. "Home" button is used when the administrator want to go back to the "Main Page".

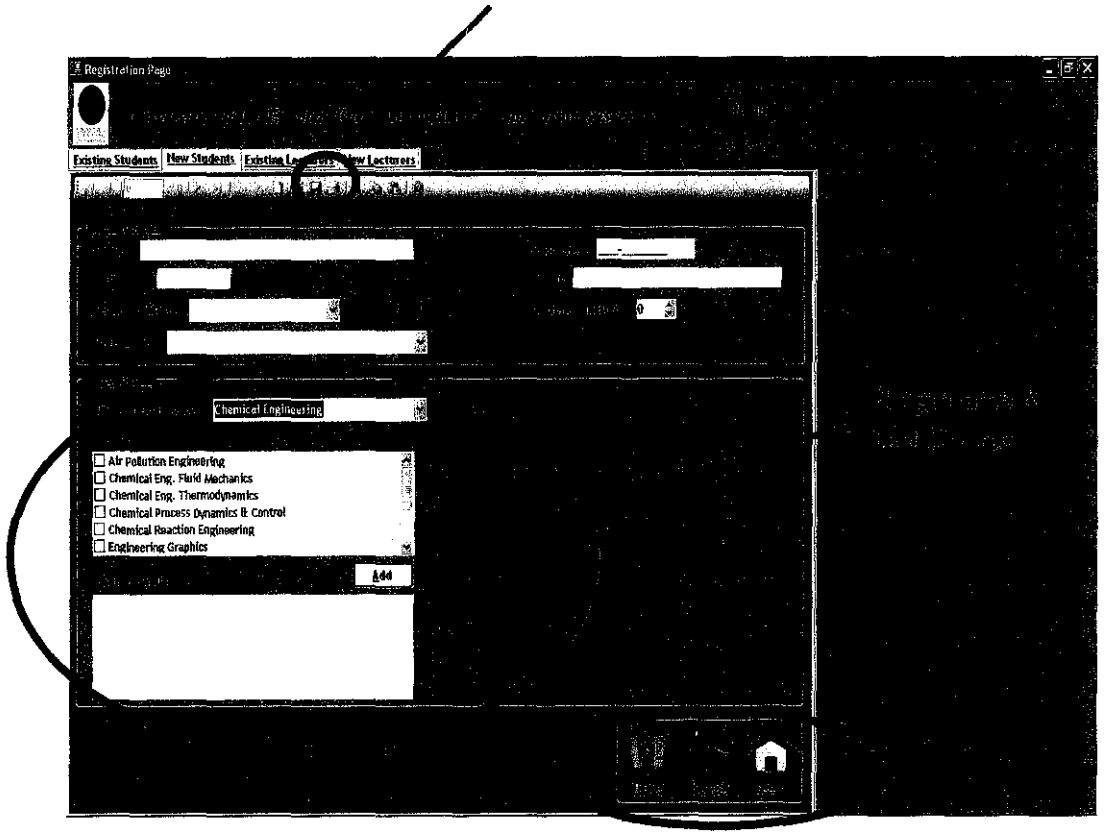


Figure 4.10: Registration Page (New Student's Form)

"New Students" tab contains a form to register new students as illustrated in Figure 4.10. Administrator needs to fill up the student's name, phone number, matric number, semester intake, current semester, and programme for personal details section. For tag identification, it is automatically filled up in the database so administrator does not have to fill it up with any number. For course taken, administrator has to check from the list course checklist box which courses that the students have enrolled for the current semester. The visible list course is based on selected departmental course from the combo box as shown in Figure 4.10. Once the administrator has checked on which courses taken by the student, he or she need to click "Refresh" button to add the courses into the list course enrolled. "Delete" button is used to delete selected courses in the list course enrolled. After finish filling up the new data, click on save icon on top of the student's information form and all the data is save in the database. "Home" button is used when the administrator want to go back to the "Main Page".

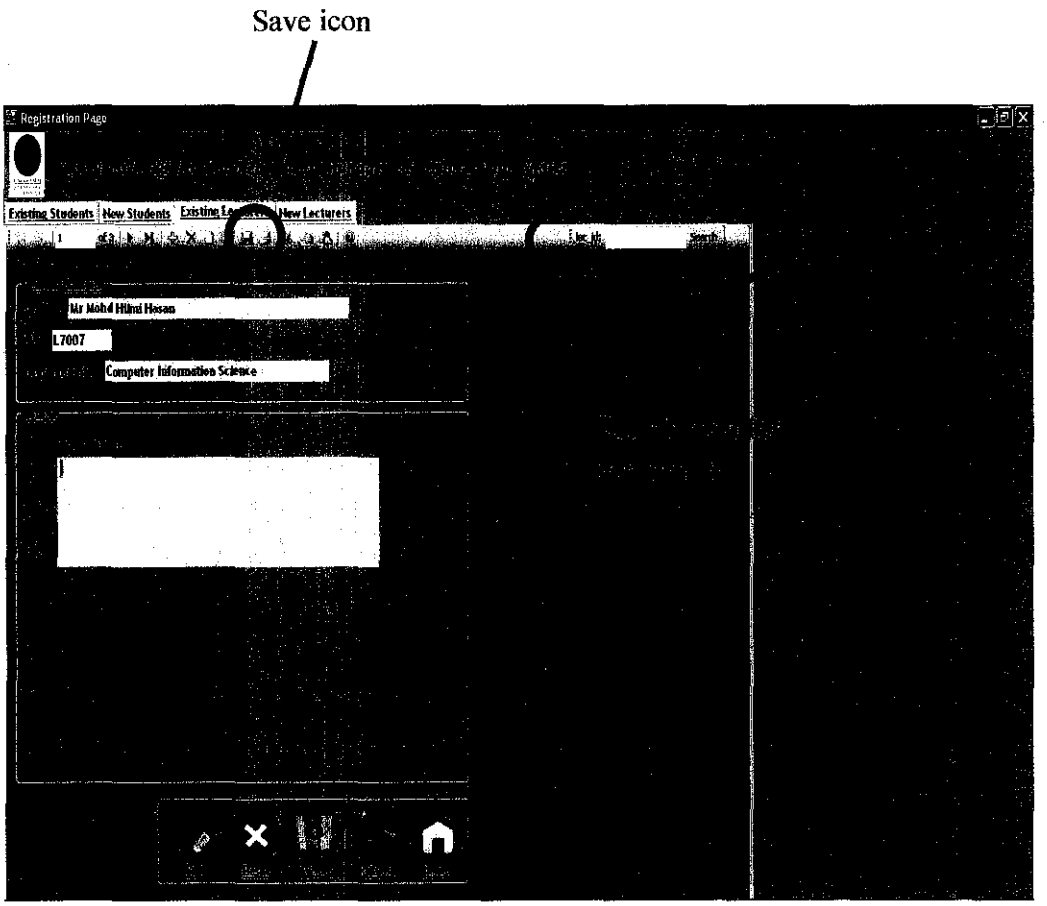


Figure 4.11: Registration Page (Existing Lecturer's Form)

"Lecturer" tab contains data on existing lecturers as shown in Figure 4.11. Administrator is able to view the entire lecturer's data such as name, identification which is the username for the lecturers to login into lecturer's page, and department. Course taken box will list out all the courses that the lecturer is teaching. Given that some data need to be updated if there are any changes to the current data such as changing of course taken, administrator can click the "Update" button in order to make the departmental course and list course visible so that changes can be done to the current data. "Delete" button has a function to delete selected course taken from the list of course taken. When administrator check courses from list course, he or she need to click "Refresh" button so that all the checked courses will be added in list of course taken. List course will be visible according to the selected departmental course. After finish updating the data, just click on save icon and all the data is saved in the database. "Home" button is used when the administrator want to go back to the "Main Page".

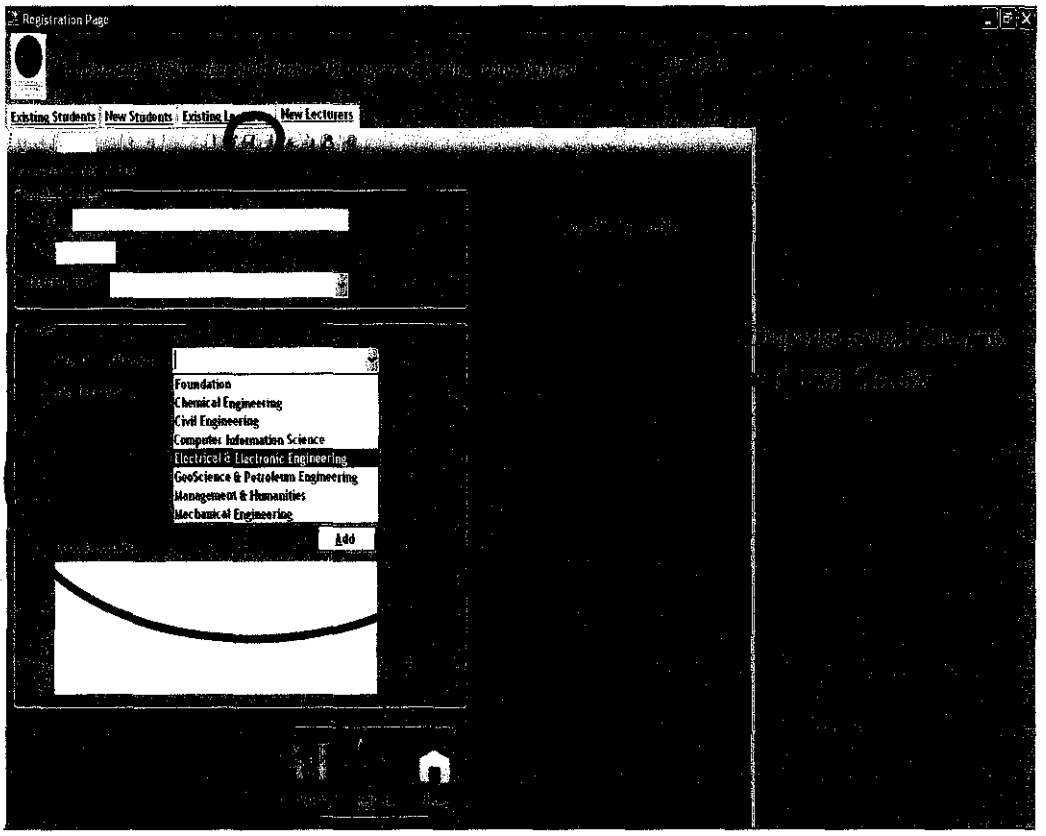


Figure 4.12: Registration Page (New Lecturer's Form)

Registration of new lecturers is done in "New Lecturers" tab which contains a form to register new lecturers as illustrates in Figure 4.12. Administrator has to fill up the lecturer's details like name, identification number which is the username for the lecturers to login into lecturer's page, department, and list of course. For the list of course, administrator has to check from the list course checklist box which courses that the lecturers have been assigned to teach. The visible list course is based on selected departmental from the combo box as shown in Figure 4.12. Once the administrator has checked on which courses assigned to the specific lecturer, he or she need to click "Refresh" button to add the courses into the list course enrolled. "Delete" button is used to delete selected courses in the list course enrolled. After finish filling up the new data, click on save icon on top of the lecturer's information form and all the data is save in the database. "Home" button is used when the administrator want to go back to the "Main Page".

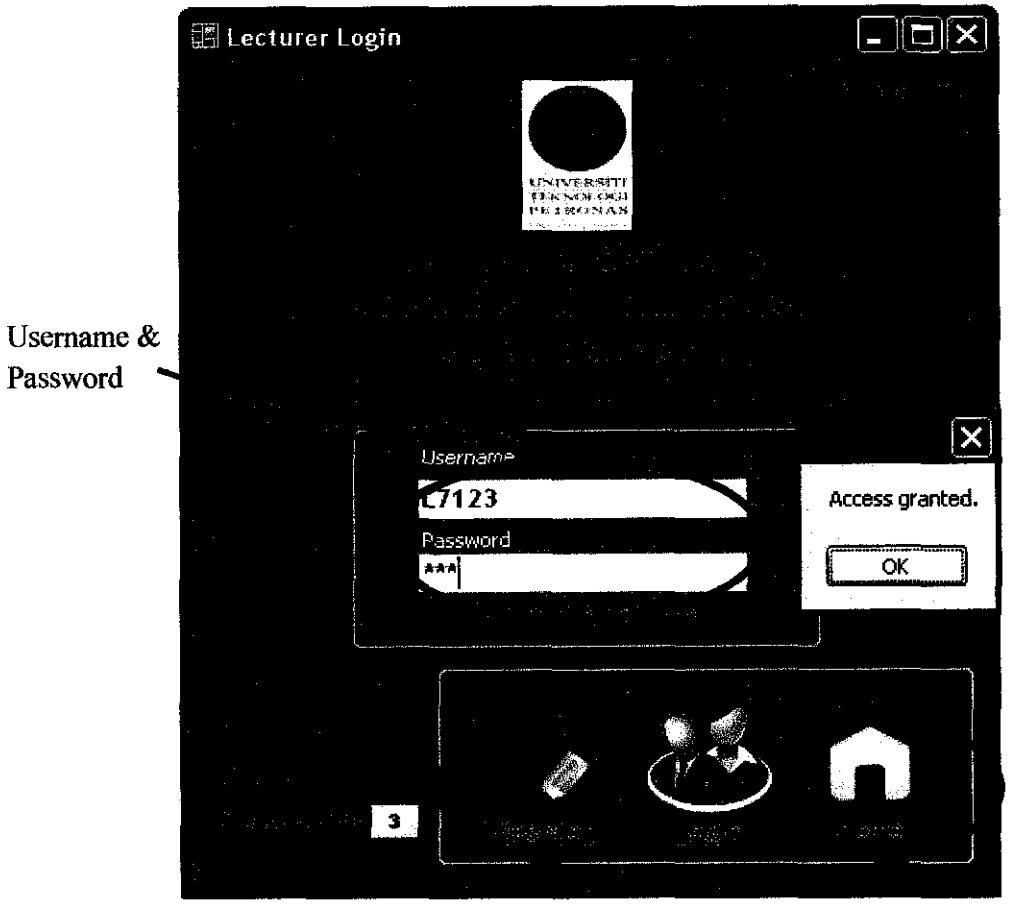


Figure 4.13: Lecturer's Login Page

"Lecturer's Login Page" is load when lecturers click on "Lecturer" button in the "Main Page". Lecturers need to put their username which the identification number as well as their password that they have registered earlier. This username and password are saved in the database. Once the "Login" button is clicked, the system will read each row of the database and validate whether the username and password are valid or invalid. If both username and password are valid, then message box showing access granted will appear. Lecturers just need to click the "OK" button to view the "Lecturer's Page". If either username or password is invalid, lecturers are not given the access to login into their page. So they need to put again their username and password not more than three attempts. If exceed three times, they need to consult the administrator. If the lecturers want to go back to the "Main Page", they can click the "Home" button.

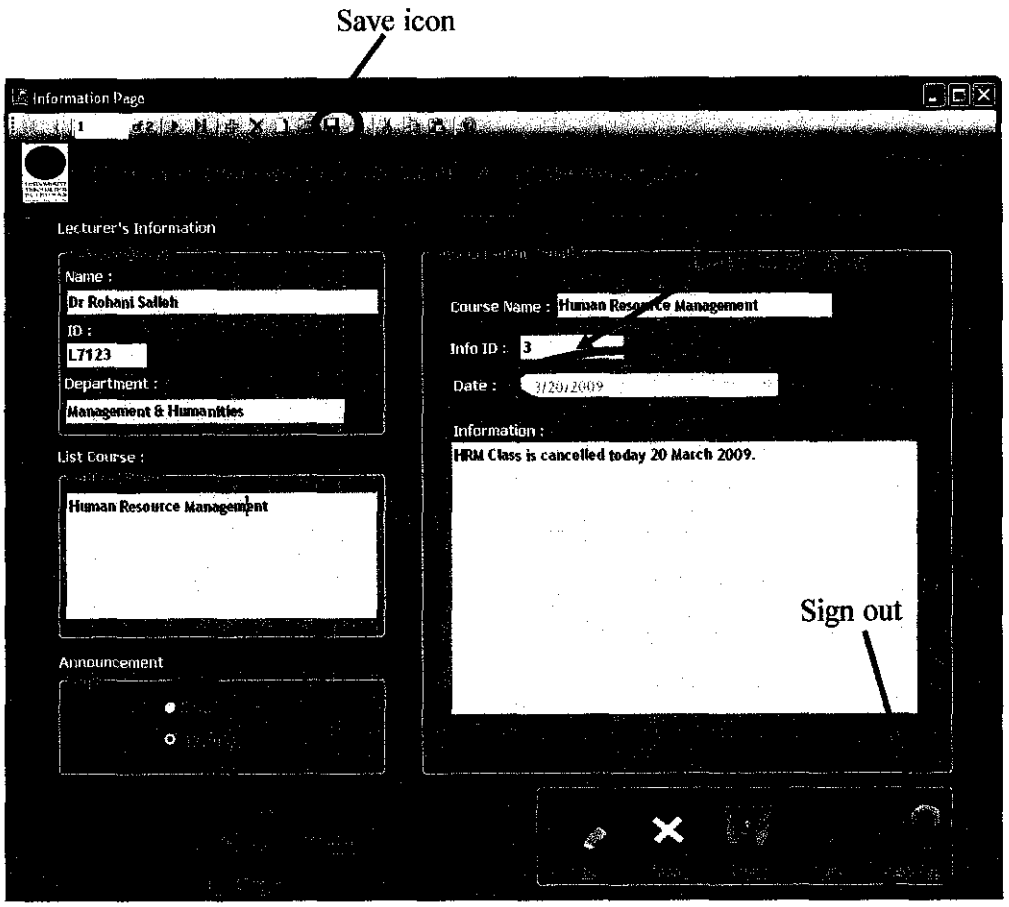


Figure 4.14: Information Page (New Announcement)

Figure 4.14 above illustrates the "Lecturer's Page" which contains four sections; personal details, course taken, type of announcement, and announcement details. For personal details and course taken section, all the data are called from the database according to the lecturer's username that has been used to login earlier and cannot be changed. There are two radio buttons with "New" and "Existing" under type of announcement section. "New" radio button is used when the lecturer want to post new announcement on the selected course taken. If "New" radio button is checked, then announcement details section will visible. Here, course name is the one that have been selected from the list of course taken. Lecturer can choose which date for the announcement from the calendar available in the page. All the information on the announcement can be written in the information text box. Once all the data is complete, then click the save icon on top of the page. All the data will be saved in the database to be used by the reader's system. "Sign out" button is used to log off from the system.

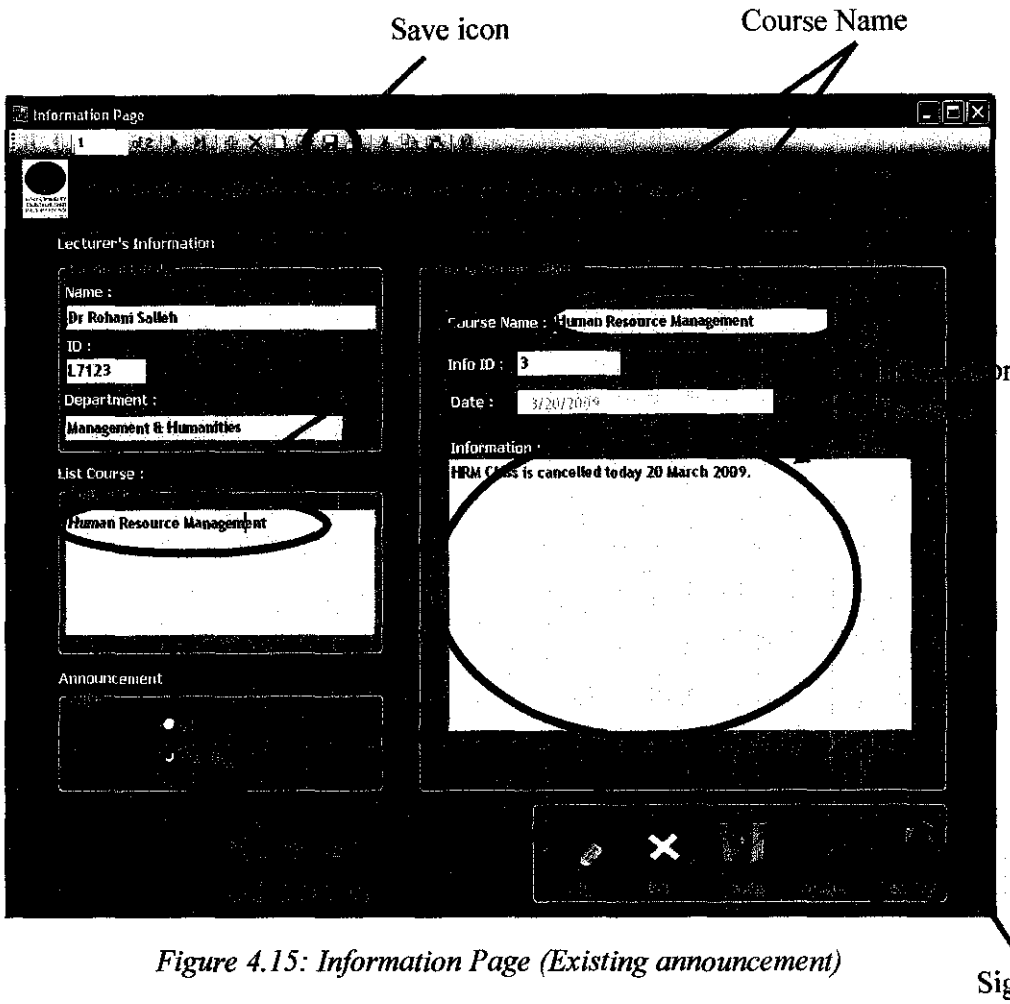


Figure 4.15: Information Page (Existing announcement)

If "Existing" radio button is checked, then existing announcement stored in the database based on the selected course taken will be called and displayed in announcement details section as shown in Figure 4.15 above. For personal details and course taken section, all the data are also called from the database according to the lecturer's username that has been used to login earlier and cannot be changed. Lecturer can update the existing announcement by clicking "Update" button and all the changes will be updated when the lecturer click on icon save on top of the page. All the data will be saved in the database to be used by the reader's system. Lecturer can view all the existing announcements stored previously by using the binding navigator as illustrates with red circle in Figure 4.15. "Sign out" button is used to log off from the system.

4.7.2 Middleware (Reader's System Interface)

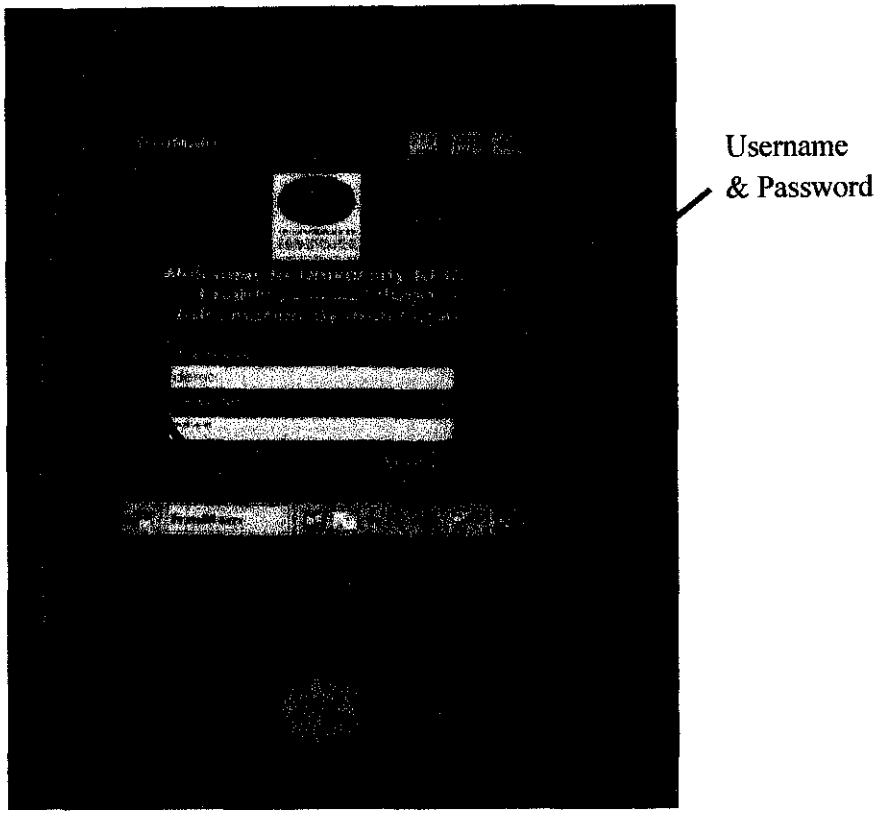


Figure 4.16: System Login Page for Reader's System

Reader's system is a simple but crucial system which needs to be uploaded in the RFID reader. Why it is crucial? It is because it holds the main function of this URFID-EEMIS which is to read the tags and it runs from the reader itself. Before the reader can read the available tags, administrator must login into the system first. Figure 4.16 illustrates the "System Login Page" for administrator. Administrator need to put the username and password to enable the system. Only the authorized administrator can login into the system. If the username and password are valid, then the "Start Page" will be loaded. However, if username or password is invalid, an error message will be displayed and the administrator cannot login into the system.

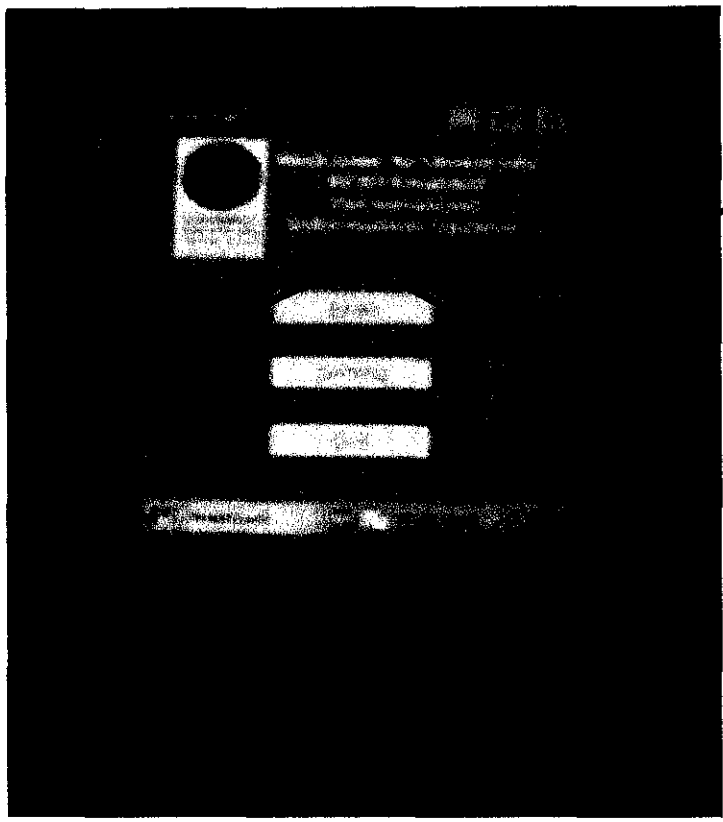


Figure 4.17: Start Page

"Start Page" is the page that is load after administrator has login successfully into the system. It has two buttons which are "Read" and "Exit" as shown in Figure 4.17. In order to read the tags, the administrator must click on "Read" button and the system will navigate to "Read Page". If the administrator wants to leave the system, he or she can just click on "Exit" button and it will log off automatically.

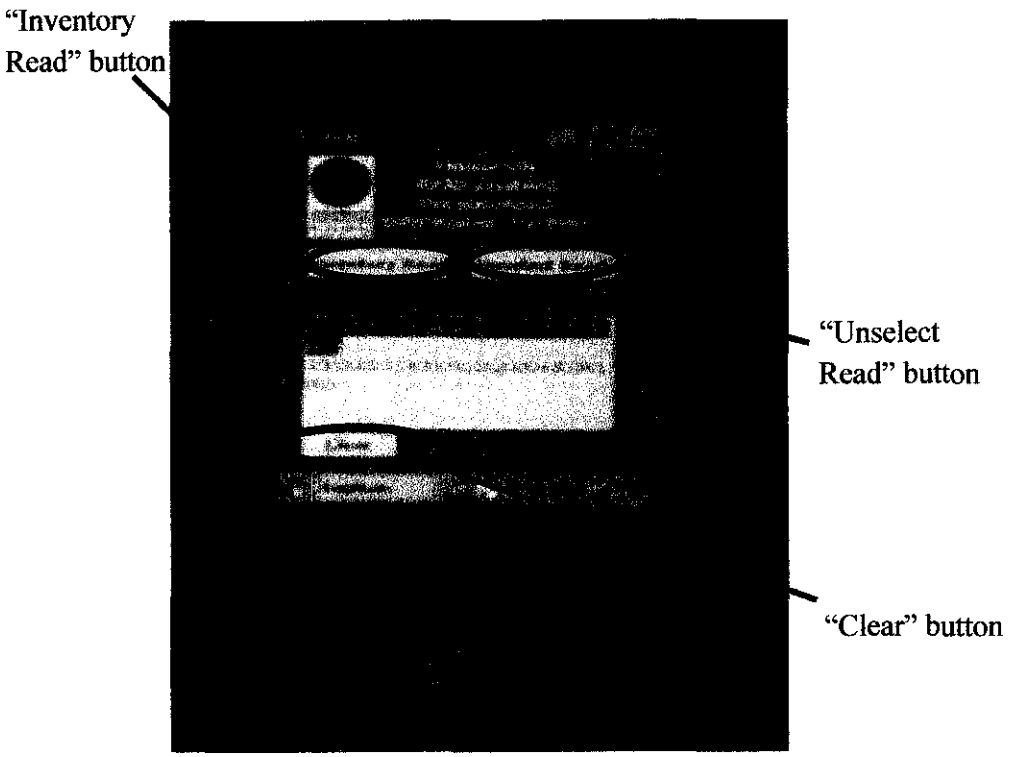


Figure 4.18: Read Page

"Read Page" is a page where it contains all the coding for the reader to read the tags. There are two buttons which have different functionalities in this page. The "Manual Read" button holds the function of reading the tags manually. It means that the administrator must press the read button on the reader itself or "Manual Read" button that available in the system every time want to capture the unique identification from the tags. Once the read button or "Manual Read" button is clicked, the reader will capture the unique identification, display it in the reading result area (circle in red) and send it to the back-end system for validation purposes. After the validating process, all the required information will be sent back to the reader to be displayed on the display unit. However, "Auto Read" button holds the function of reading the tags automatically. It means once the administrator click on the "Auto Read" button, the reader will capture the unique identification automatically without having anyone to press the read button on the reader or the "Auto Read" button. Same like manual reading, auto reading will also pass the unique identification to the back-end system for validation purposes. After validate the required information, the appropriate information will be sent to the reader to be

displayed on the display unit. The difference between auto read and manual read is that with auto read, the reader will automatically capture new identification every 15 seconds but for manual read, the administrator need to press read button on the reader or "Manual Read" button in the system to capture any new unique identification. "Clear" button is used to clear the reading result area.

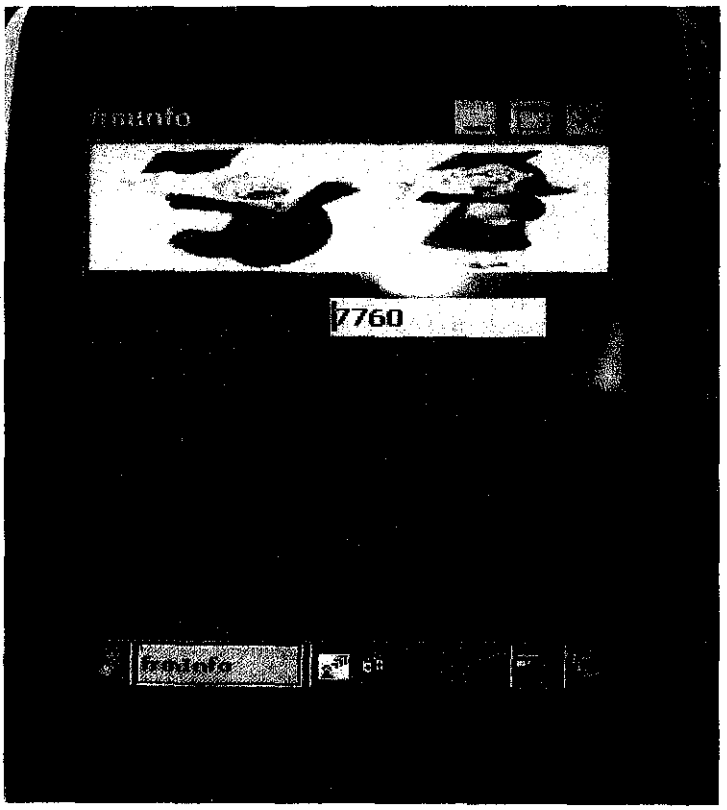


Figure 4.19: Information Display Page

After the reader had read the unique ID from the tag, then this information display page will appear and all the details that tailored with the particular unique ID will be displayed on this page as shown in Figure 4.19.

4.8 User Acceptance Testing

In user acceptance testing, users and system administrator are the one who conduct the test. Prior to URFID-EEMIS, the main users are the students. This test was given to 30 UTP's students. The main objective of this testing is to know the level of user acceptance on URFID-EEMIS. The complete user acceptance testing form is provided in Appendix B.

Over 30 tests that had been conducted, the system has faced some technical problems and errors. However, the percentage of technical problems and errors are minor, but the author is looking forward to eliminate the technical problems as well as errors to its minimum level. Figure 4.20 depict the complete result of the user acceptance testing.

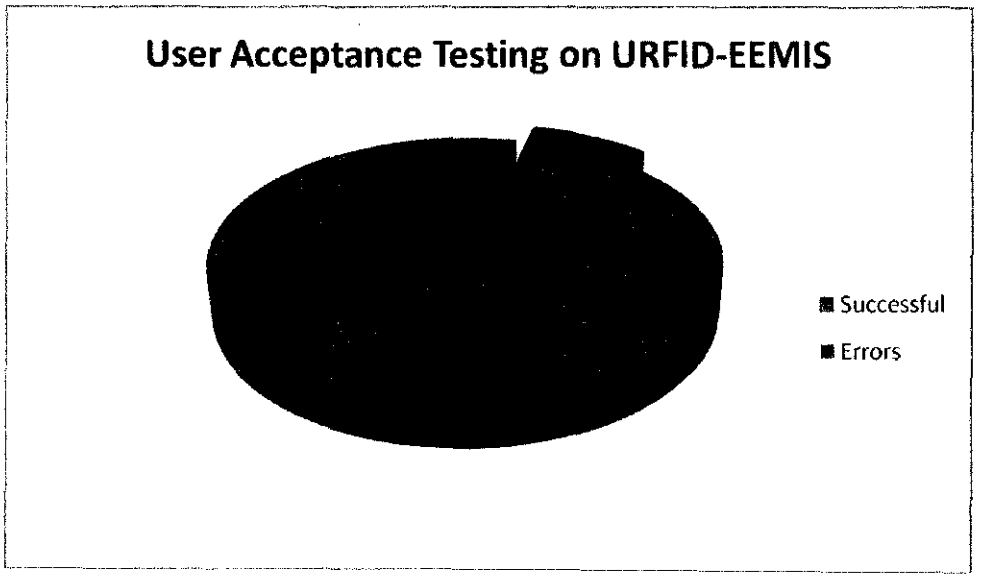


Figure 4.20: User Acceptance Testing Ratio

CHAPTER 5

CONCLUSION

As a conclusion, the author believed that URFID-EEMIS will be able to help student in getting the correct information at the right time without having them to access the internet. With regards to the system, it is not going to replace E-Learning but it is actually an alternative way to convey the personalized updated information to students and at the same time, students can also avoid from facing the problems when accessing E-learning as discussed previously. Information displayed by the system will be very beneficial to the students. It is hoped that lecturers can convey information effectively to the students by using the system.

There will be more enhancement to the system in future. Future enhancements include:

- To connect the reader with the database of students and lecturers from the Registration Unit. This is much easier because the administrator does not have to update different database every semester since Registration unit will update the student and lecturer's database upon registration period.
- To convert the system from windows form to web forms in order to make it web-based application rather than stand-alone application. The main purpose of having web-based application is to make the system accessible to all anytime and anywhere.
- Integrate the system with mobile device so that display information can be downloaded or send to the student's mobile phone. It can be done through collaboration with the telecommunication service providers.

- To make the system in multi language. For example, if the student is from Indonesia, then the information displayed will be in Indonesian language.

At the end of the development phase of URIF-EEMIS, the system had achieved its objectives which are it can store all the required data in the database and read the unique ID stored in RFID tags from registered students. It is also capable of initiate the update information based in what are the students has registered earlier. However, the information displayed is not on the LCD display unit yet but on the reader itself. The information displayed is pushed-based type of information which do not required any students to log in into any system in order to get the current information.

REFERENCES:

[1] V.Daniel Hunt, Albert Puglia, Mike Puglia, *RFID – A Guide to Radio Identification,* USA: A John Wiley and Sons, Inc., Publications, 2007.

[2] Richard Sebastian, "Asia Pacific RFID Supply Chain Markets", 2007: Frost & Sullivan.

[3] Patrick J.Sweeney II, *RFID for Dummies*, USA: Wiley Publishing, Inc., 2005.

[4] Rick Meis, "An Option for a Cleaner Environment – The Paper Issue: Alternatives and Solutions" http://www.frugalmarketing.com/dtb/paper-issue.shtml

[5] Subhashni Appana, "A Review of Benefits and Limitations of Online Learning in the Context of the Student, the Instructor, and the Tenured Faculty" *International Journal on E-Learning Corporate, Government, Healthcare & Higher Education,* Volume 7, No.1 : 2008, pp 5-22.

[6] Dr. Jeff Barker, Dr. Anand Mahaderan, Richard Sebastian, "A Brief Overview of Supply Chain & RFID", Frost & Sullivan.

[7] Kato Nobuo, Takami Kazumasa, "Information Selection based on Data Read from Multiple RFID Tags – An Information Display System for Local Area Advertising" *Journal on Technical Report (Institute of Electronics, Information and Communication Engineers),* Japan: 2006, pp 21 – 24.

[8] Mark Harrison, "RFID and Mini Cooper – "Tribal Marketing" or Agency Idea – Makers Run Amuck?", 2007 : http://www.opusresults.com/blog/2007/01/rfid-and-mini-cooper-tribal-ma.html

[9] Mary Catherine O'Connor, "RFID-Enabled Billboards Talk to Mini Motorists", 2007 http://www.rfidjournal.com/article/articleview/3005/

[10] Oda Hideo, Kubota Soichi, Okamoto Yoshiharu, "Study of how to notify the warning information such as pedestrian's position, direction and speed to the driver, in Safety Driving Support System using RFID", Japan, 2006, pp 31-36:

[11] Konomi, "Fujitsu to commercialize RFID Information Kiosk Terminals", 2005 http://ubiks.net/local/blog/jmt/archives3/003415.html

[12] Evan Welbourne, Nodira Khoussainova, Julie Letchner,Yang Li Magdalena Balazinska, Gaetano Borriello, Dan Suciu, "Cascadia: A System for Specifying, Detecting, and Managing RFID Events", Journal from Department of Computer Science and Engineering, University of Washington, Seattle.

[13] Alan Dennis, Barbara Haley Wixom and David Tegarden, *Systems Analysis and Design with UML Version 2.0 – An Object-Oriented Approach Secon Edition,* USA: A John Wiley and Sons, Inc., Publications

[14] Master's Thesis by Josef Hallberg and Marcus Nilsson from Lulea University of Technology – *"Positioning with Bluetooth, IrDA and RFID".*

APPENDIX A

(Questionnaire)

UNIVERSITI TEKNOLOGI PETRONAS

Final Year Project 1 - Questionnaire
University RFID-Enabled Personalized Information System

The questionnaire is intended to capture feedback from students regarding methods to convey updated information.

Section A: BACKGROUND INFORMATION

Please tick or write your answer in the appropriate box and blank space.

1. Gender:

☐ Male ☐ Female

2. Age: ..... years

3. Programme:

☐ CIS ☐ Petroleum

☐ Mechanical ☐ Civil

☐ Chemical ☐ Electrical & Electronic

4. Semester: .....

Section B: TECHNICAL QUESTIONS

Please tick or write your answer in the appropriate box and blank space

1. Is getting updated information at the fingertips of your hand important to you?

☐ Yes ☐ No

2. What are the medium that you used to get updated information?

☐ E-learning ☐ SMS

☐ Posters/Flyers ☐ Others (Please specify).....

3. How often you usually access E-Learning?

.....

4. When you usually access E-Learning?

☐ Morning ☐ Before go to class

☐ Night ☐ Others (Please Specify).....

5. What are the current problems that you face when accessing E-Learning?

☐	Need a computer	☐	Internet Connection
☐	Server Down	☐	System Maintenance
☐	Others (Please specify)		

6. Do you think that all the students will get the urgent information posted in E-Learning (class cancelled/ postponed, venue changed, etc) at the correct time?

☐	Yes	☐	No

7. If there is a student displayed information system at strategic places such as academic building and without having to access the internet, would it be useful and easier for the students to get the information?

☐	Yes	☐	No

8. What is the common information that you require as a student?

☐	Course Information	☐	Updates from lecturer (class cancelled/postponed, venue changed, etc)
☐	Announcements	☐	Others (Please specify).....

9. Where would you suggest to place the students displayed information system?

☐	Cafe	☐	Academic building
☐	Hostel	☐	Others (Please specify).....

10. In your opinion, by having students displayed information system, would it help to convey the information to students at the correct time? Please justify.

.....

Thank you for your effort and kind co-operation in completing this questionnaire.

APPENDIX B

(User Acceptance Testing Form)

UNIVERSITI
TEKNOLOGI
PETRONAS

To whom this may concern,

This is to confirm that the following student:

NAME: ANIS AFZAN BINTI AB RAHMAN

STUDENT ID: 7760

has conducted a testing for her FYP system prototype entitled **University RFID-Enabled Event Management Information System (URFID-EEMIS):**

DATE OF APPOINTMENT: _____

TIME: _____

LOCATION: _____

Element of comparison	Views using E-Learning	Views using URFID-EEMIS
System login		
Network connection		
Accessibility (level of ease)		
Automated information (personalized or general)		

User's Testimonial and Comments:

SIGNATURE: _____

* User's signature is required for confirmation and approval.

Name: