IMPLEMENTATION OF RFID AS AN ATTENDANCE RECORDING AND TRACKING SYSTEM IN UTP

(TimeTrack)

By

NURUL SHAIDATUL SHIMA BT MOHD DAUD

FINAL PROJECT REPORT

Submitted to the Electrical & Electronics Engineering Programme
in Partial Fulfillment of the Requirements
for the Degree
Bachelor of Engineering (Hons)
(Electrical & Electronics Engineering)

Universiti Teknologi Petronas
Bandar Seri Iskandar
31750 Tronoh
Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

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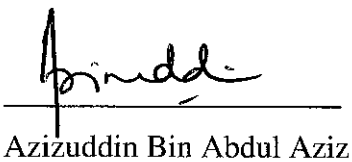


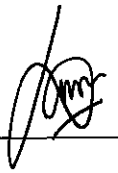
Azizuddin Bin Abdul Aziz
(Project Supervisor)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK

June 2008

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.



Nurul Shaidatul Shima bt Mohd Daud

ABSTRACT

In this project, RFID is applied as an Attendance Recording and Tracking System in Universiti Teknologi PETRONAS (UTP) specifically for staffs. The implementation will replace the old and ineffective attendance system and it will be able to monitor and print the staffs' attendance if needed through a computer. In addition, the system must also be able to provide security (door lock) to restricted areas such as lecturers' offices and labs. The report includes the theory, software and hardware used in order to execute the project. For the attendance and tracking system, it will display information such as names (may include pictures), current time, current date and current location of the staffs via graphical user interface (GUI) upon request. The database will enquire SQL as the database program and XAMPP as the hosting. An interface to the database system is developed using PHP language. The door locking system is controlled by Microcontroller Microchip PIC16F877.

ACKNOWLEDGEMENT

Above all, the utmost gratitude goes to the Most Gracious and Most Merciful God for giving me the guidance and blessings throughout the project.

I would like to take this opportunity to thank my FYP supervisor, Mr. Azizuddin bin Abd Aziz for the guidance and encouragement he had given me. I appreciate the opportunity given to learn and work under his supervision.

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ABBREVIATIONS AND NOMENCLATURES

UTP	Universiti Teknologi PETRONAS
FYP	Final Year Project
RFID	Radio Frequency Identification
GUI	Graphical User Interface
ID	Identification
LF	Low Frequency
HF	High Frequency
UHF	Ultra-high Frequency
DBMS	Database Management System
SQL	Structured Query Language
EPC	Electronic Product Code
XAMPP	X, Apache, MySQL, PHP and Perl
PHP	PHP: Hypertext Preprocessor
PIC	Programmable Intelligent Computer

CHAPTER 1
INTRODUCTION

1.1 Background of Study

Automatic identification, or auto ID for short, is the broad term given to a host of technologies that are used to help machines identify objects. These include bar codes, smart cards, voice recognition, some biometric technologies (retinal scans, for instance), optical character recognition (OCR) and radio frequency identification (RFID). RF technology is commonly used in attendance control, building access and tracking system. An RFID system that uses radio waves to automatically identify people or objects is a smarter way in order to replace the old system; which is based on paper and punch cards for attendance recording or bar codes for building access.

The focus of this study is to develop and implement an RFID System in Universiti Teknologi PETRONAS (UTP). The system is to be designed to record the attendance of staffs, replacing the self-written and punch cards system which is currently in place. In addition, the system is also able to track the status and the current location of the staffs.

In this approach, each staff will be given a unique smart card to allow entering restricted areas of the building (i.e lecturers' offices). Readers are typically mounted next to a door where access is controlled. The reader relays the cardholder information to a database and the database determines whether the cardholder has line access to that particular area. If access is allowed, an electronic door lock is disengaged, allowing access to the building or to a particular room. Meanwhile, his/her presence is registered in computer because the RFID system reads data from tag (smart card).

Through several RFID readers that have been install around the campus as a checkpoint (cafeteria, lab, offices, lecture halls and tutorial rooms), students or staffs may find the particular person easily. The system will display information such as names, current time, current date and current location of the staffs via graphical user interface (GUI) upon request.

1.2 Problem Statement

The existing attendance recording system for staffs in UTP still uses pens and papers as the information medium and bar code system for building access. This system is very inefficient in data management and may lead to lost data. Due to poor data management, it is very difficult for students or even for lecturers to track the exact location of the other lecturers. During emergencies or important purposes, the process of checking and tracking the particular person can be tiresome.

Bar codes are line-of-sight technology, thus a scanner has to "see" the bar code to read it, which means staffs usually have to orient the bar code card toward a scanner for it to be read. Bar codes system has other shortcoming as well. If a label is ripped or soiled or has fallen off, there is no way to scan the item.

1.3 Objective

In order to overcome all the drawbacks of the old attendance system as stated in section 1.2 earlier, the RFID-based attendance and tracking system (TimeTrack) is proposed. The main objectives of this project are:

- To develop and implement RFID-based attendance and tracking system for staffs in UTP.
- To replace the old and ineffective attendance system.
- To be able to monitor and print the staffs' attendance if needed through a computer.
- To easily track the exact location of the particular staffs when requested by students or lecturers and this will lead to time saving.
- To provide security (door lock) to restricted areas such as lecturers' offices and labs.

To successfully implement the whole system, several objectives are required to be achieved such as:

- To develop a working prototype of TimeTrack system.
- To fully understand the functions of the hardware (RFID reader and tag).
- To enable communication between the hardware and a computer via serial port RS232.
- To develop a software as an interface between the hardware and the database in a computer.
- To be able to read the unique ID of RFID tag and mapped into the database.
- To enable connection between PIC 16F877, MAX232 and RS232.

1.4 Scope of Study

The scope of this project includes the study of Radio Frequency Identification Device (RFID). The main concern is to make sure the signal transmitted are received at the reader and transmitted through serial communication port which consist the information signal to map the database. The project also includes the development of tracking algorithm and hence a strong programming knowledge is required to build a database and GUI.

The time frame given is feasible as the complete integration between RFID reader and database are successfully done and working properly. The system budget is still in affordable range as the only item need to be bought is the RFID reader and tags.

CHAPTER 2
LITERATURE REVIEW AND THEORY

2.1 RFID History

In the late 1940s, a scientist named Harry Stockman published a paper about Radio Frequency Identification (RFID), which is said to be related to the "Friend or Foe Transponder Identification System" used by the British Royal Air Force during World War II [1][2]. In the late 1960s to the early 1970s, RFID developed its first commercial application, the Electronic Article Surveillance (EAS) system, which uses a simple form of RFID with 1-bit tags to prevent shoplifting. Other RFID commercial uses followed in the 1980s and 1990s, including livestock tagging, toll road payment systems, and using RFID on shop floors to direct the assembly of automobiles [1]. By the end of the 20th century, RFID technology is embedded in a product or a device used by consumers (e.g., the Touch 'n Go System). Overall history of RFID is shown in Table 1 [2].

Table 1 History of RFID

Decade	Event
1940 – 1950	Radar refined and used major World War II development effort. RFID invented in 1948.
1950 –1960	Early explorations of RFID technology, laboratory experiments.
1960 – 1970	Development of the theory of RFID. Start of applications field trials.
1970 - 1980	Explosion of RFID development. Tests of RFID accelerate. Very early adopter implementations of RFID.
1980–1990	Commercial applications of RFID enter mainstream.
1990 - 2000	Emergence of standards. RFID widely deployed. RFID becomes a part of everyday life.

2.2 RFID Attendance Recording System

RFID is a tool for product identification, locating assets and people. The different between RFID and bar codes is that it uses Radio Waves instead of line of sight [2].

Basic RFID system is composed of three components:

- an antenna
- a transponder (RF tag)
- a transceiver (reader)

Figure 1 [2] shows the RFID system components.

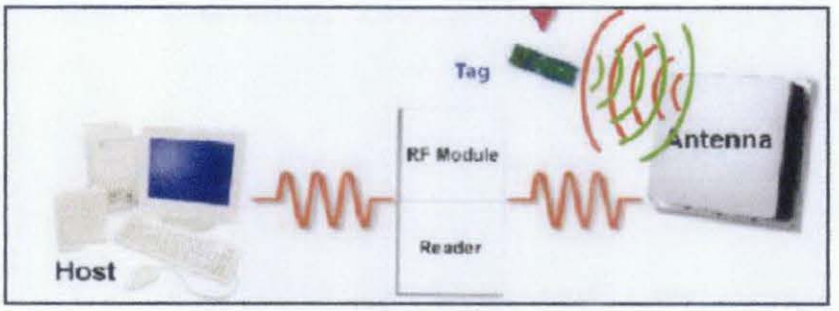

Figure 1 RFID System Components

The conceptual elements of the access control systems used by most of the organizations are illustrated in Figure 2. Each system comprises a number of antennas used to interrogate RFID tags embedded in access cards, electronics for data acquisition and control, the lock or some other physical security feature under the control of the system, network integration of the distributed electronics, and a centralized database that records the details of the use of access cards [3].

After scanning an access card, the system determines whether the card is authorized entry (or exit) and unlocks the barrier (if authorized to do so). A record of that transaction is captured in a database. Records stored in the database typically include the unique identifier of an access card, the location of the antenna and lock where it was read, and the time and date it was read.

By using a concordance that maps unique identifiers of access cards to the names of the individuals who were issued the cards, this data collection can provide a history of an individual's card use. These useful data can be used as the attendance of the particular individual.

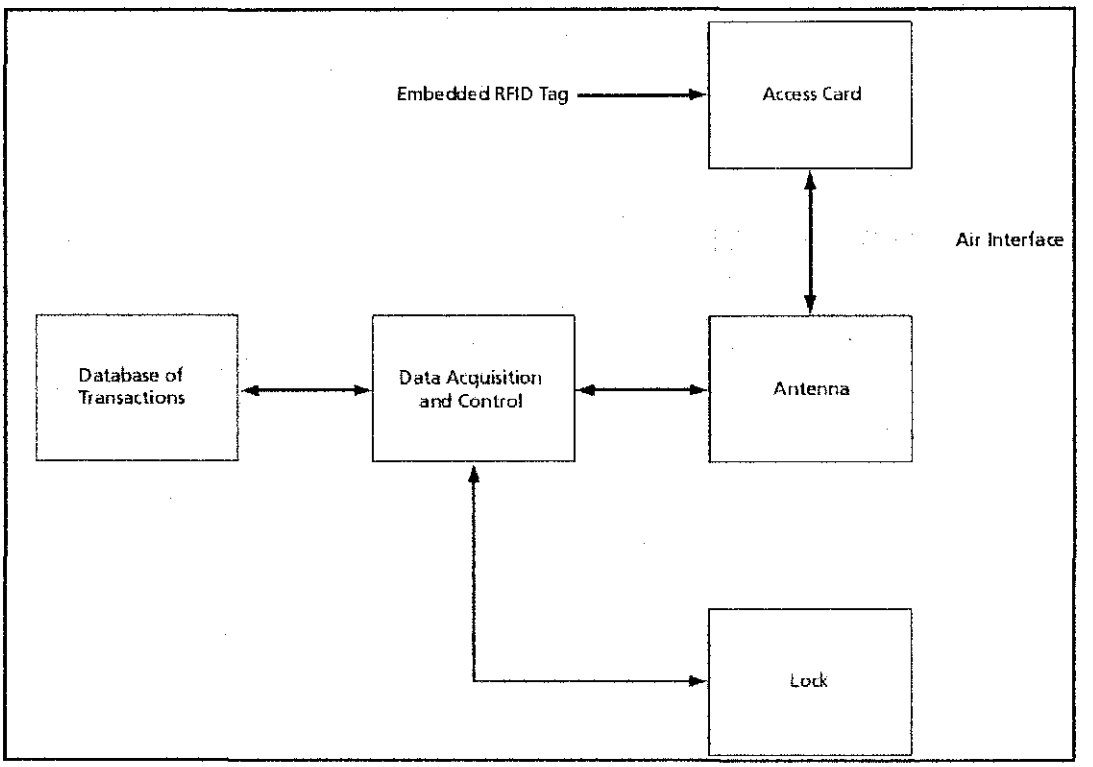

Figure 2 Elements of a Typical RFID Access Control System

2.3 RFID Tracking System – Privacy in Workplace

Privacy in the United States workplace has few protections. The Electronic Communications Privacy Act of 1986 (ECPA, 86) is a U.S. federal statute that establishes the privacy of employee communications in the workplace. It generally prohibits the interception of electronic communications but specifically allows employers to monitor their networks for business purposes and in particular to monitor communication networks with employee consent. These broad exceptions enable employers to monitor all forms of electronic communications in the workplace (e.g., e-mail, instant messaging, voice calls and voice mail). This constraint arises from the National Labor Relations Act (NRLA, 1935). Much of the advice available to employees and employers about workplace privacy concludes that there is very little workplace privacy in the United States [3].

Unlike in Malaysia, there are no specific laws regarding RFID since it is still new and not widely used. A few of big organizations have already implemented RFID based employees tracking system but most of organizations here especially educational institutions have not even considered to implement one.

2.4 RFID Security System

Physical access control (the ability to control when and where people go) is a big problem in the business world. The easiest solution is to have security guards at the doors to all sensitive areas. However, this solution has its drawbacks. Security guards are expensive, may make mistakes, and do not like to keep audit trails. Master key lock systems can also be a problem, because a dismissed employee may have a copy of the key, thereby forcing the employers to buy all new locks.

At some point, access cards in the form of magnetic strip cards are introduced. These systems had a computer-driven backend; cards could be revoked and removed from the system. The problem with these systems was the mechanical wear. Magnetic strip cards have to be physically swiped through the reader, which leads to the card becoming worn down.

RFID technology was applied in what is known as proximity cards. After passing the card over the reader, the reader quickly looks up the identifier from the card in the database, checks to see whether the user is allowed to pass the door, and automatically unlocks the door if the user is. Each time the user wave the card, the reader keeps an audit trail by entering the time, date, card ID, and location of the access [1].

2.5 RFID Tags

A common way of categorizing tags is by their source of power. This is also one of the main determining factors for the cost and longevity of a tag. Passive tags obtain all of their energy by some method of transmission from the reader. Whereas active tags use an on-board battery to power communications, a processor, memory, and possibly sensors [4].

Figure 3 Various RFID Tags

Figure 3 [2] shows various types of RFID Tags while the processes of passive and active tags are shown in Figure 4.

2.5.1 Active RFID Tag

Active RFID tags are usually powered by an internal battery. This battery-supplied power generally gives the tag a greater read range although the tag is usually larger in size and more expensive. A typical scenario for the use of active RF tags is the control of vehicles through a specified access point. As the tagged vehicle approaches the access point, receiver decodes the tag and the authorized vehicle is allowed access by means of a gate or boom [5].

2.5.2 *Passive RFID Tag*

A passive tag gains its power from the reader and has no internal power source. This type of tag is therefore less expensive and is smaller and lighter than the active tag. It also offers a virtually unlimited operational lifetime. Their read range is however shorter and they need to be activated by a higher-powered reader [5]. In order for passive tags to work, the antenna and the tag must be in close proximity to the reader. This is because the tags do not have an internal power source and derive their power to transmit from coupling to the near field of the antenna.

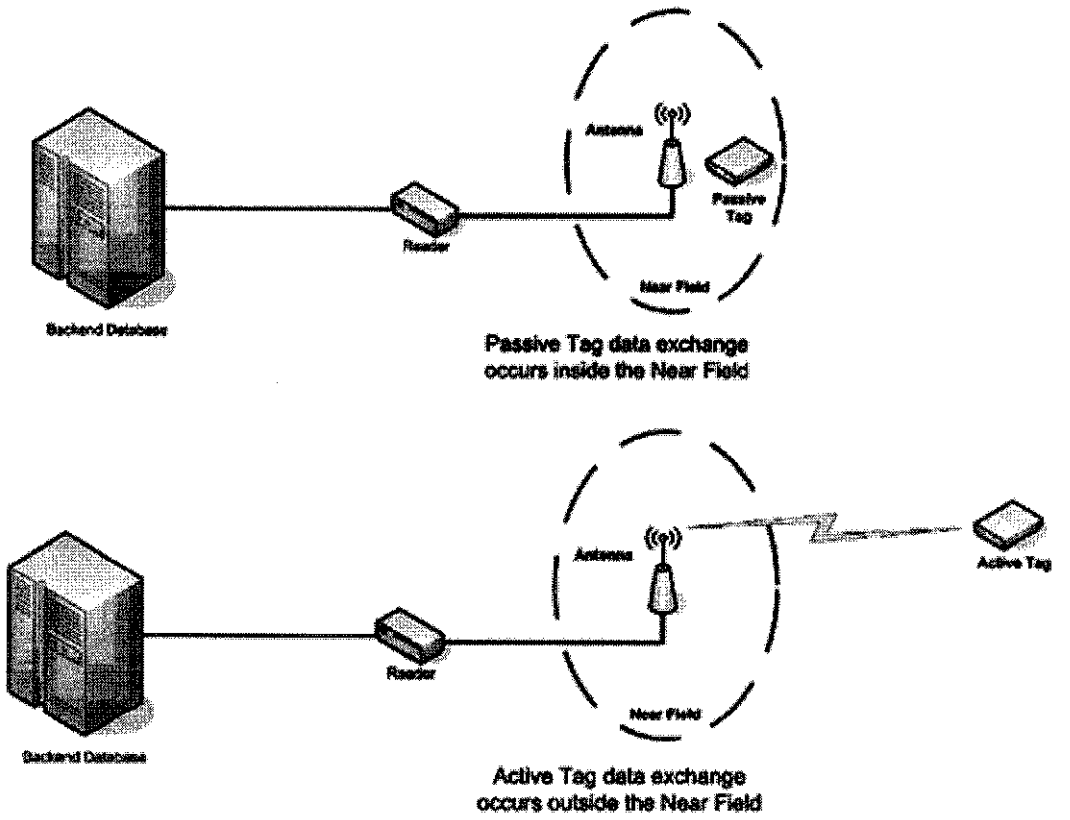

Figure 4 Passive and Active Tag Processes

2.6 RFID Operating Frequency

The RFID operating frequency is the frequency that the tag uses to communicate or to obtain power. The electromagnetic spectrum range in which RFID typically operates is usually broken up into low frequency (LF) , high frequency (HF), ultra-high frequency (UHF), and microwave.

Table 2 [2] shows the frequency range with its applications.

Because RFID systems broadcast electromagnetic waves, they are regulated as radio devices. RFID systems must not interfere with other protected applications, such as emergency service radios or television transmissions [4].

Table 2 Frequency Range and Application

Frequency Band	Characteristics	Typical Applications
Low 100-500 kHz	Short to medium read range Inexpensive low reading speed	Access control Animal identification Inventory control Car immobilizer
Intermediate 10-15 MHz	Short to medium read range potentially inexpensive medium reading speed	Access control Smart cards
High 850-950 MHz 2.4-5.8 GHz	Long read range High reading speed Line of sight required Expensive	Railroad car monitoring Toll collection systems

2.7 RFID versus Bar codes

Bar codes which have served the world for almost thirty years are one of the best automatic identification tools. The bar codes technology (UCC System) was started in the United States and it was established in 1973 by Uniform Code Council Inc. (UCC) [2].

Bar codes consist of characters that are displayed in the form of dark vertical bars and light spaces. When bar codes are scanned, a beam of light passes across the bar codes, the dark bars absorb the light and the light spaces reflect it. Then, a detector will translate the reflected light into electrical pulses which are recognized by a computer as characters. The characters represent the manufacturer and the product category of the item being scanned. Figure 5 shows a typical UPC bar code [4].

Figure 5 UPC Bar code

However, bar codes have a lot of drawbacks. The tags need to be seen individually or scanned from a very close distance compare to RFID. RFID tags need not to be scanned individually because of the usage of Radio Frequencies which make multiple reading possible at one time. Bar codes only identify products generically and not as unique product whereas RFID can identify a variety of products uniquely. Bar codes also have very poor tracking facilities and very slow in process [2].

2.8 Database Management System

A database is a collection of information organized in such a way that a computer program can quickly select desired pieces of data. Database can be described as an electronic filing system. Traditional databases are organized by fields, records, and files:

- A field is a single piece of information
- A record is one complete set of fields
- A file is a collection of records.

For example, a telephone book is analogous to a file which is shown in Figure 6 [6]. It contains a list of records, each of which consists of three fields: name, address, and telephone number.

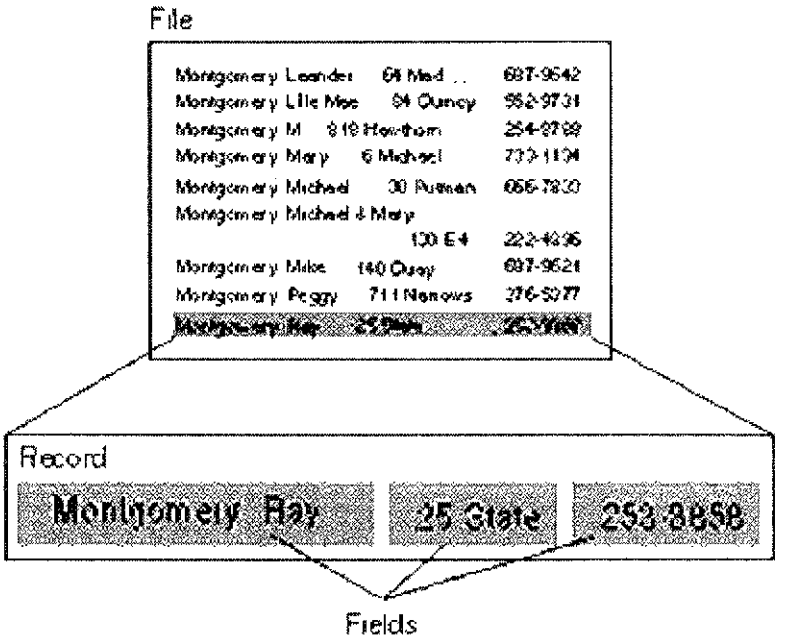

Figure 6 Concepts of Field, Record and File

To access information from a database, a database management system (DBMS) is needed. This is a collection of programs that enables the process of entering, organizing, and selecting data in a database. DBMS is a collection of programs that enables process such as to store, modify, and extract information from a database. There are many different types of DBMSs, ranging from small systems that run on personal computers to huge systems that run on mainframes [6].

The following are examples of database applications:

- computerized library systems
- automated teller machines
- flight reservation systems
- computerized parts inventory systems

From a technical standpoint, DBMSs can differ widely. The terms relational, network, flat, and hierarchical all refer to the way a DBMS organizes information internally. The internal organization can affect how quickly and flexibly the information can be extracted.

Requests for information from a database are made in the form of a query, which is a stylized question. For example, the query

```
SELECT ALL WHERE NAME = "SMITH" AND AGE > 35
```

requests all records in which the NAME field is SMITH and the AGE field is greater than 35.

The set of rules for constructing queries is known as a query language. Different DBMSs support different query languages, although there is a semi-standardized query language called SQL (structured query language). Sophisticated languages for managing database systems are called fourth-generation languages, or 4GLs for short.

The information from a database can be presented in a variety of formats. Most DBMSs include a report writer program that enables to output data in the form of a report. Many DBMSs also include a graphics component that enables to output information in the form of graphs and charts [7].

2.9 RFID Attendance Recording and Tracking System

2.9.1 RFID Takes Attendance

A small California startup called InCom has developed radio frequency identification (RFID) system called InClass to automate attendance-taking in elementary and secondary schools in Feb. 16, 2005. The system uses ultra-high frequency (UHF) readers mounted in classroom doorways and passive RFID tags attached to student ID card holders. InClass was being tested at Brittan Elementary School in Sutter, the small town northeast of Sacramento where InCom is based. However, after a number of parents of Brittan students protested the use of RFID in the school, InCom announced on Feb. 15 at a school board meeting that it had ended the pilot test [8].

2.9.2 Kindergarten RFID for Taking Attendance

Ryounan Kindergarten in Kanagawa, Japan prefecture is experimentally using active RFID tags for taking attendance. All of the 230 kids (as well as the teachers) in the kindergarten carry active RFID tags that operate in the 300MHz band. The active tags and the reader devices installed at the kindergarten's gates are used to automate the process of taking attendance. The director of the kindergarten says that no teachers raised voices against this because it makes the teachers' tasks efficient even though it may be possible that some kindergarten staffs are against making everyone always carry RFID tags [9].

2.9.3 RFID Passports

RFID tags are being used in passports issued by many countries. The first RFID passports ("E-passport") were issued by Malaysia in 1998. In addition to information also contained on the visual data page of the passport, Malaysian e-passports record the travel history (time, date, and place) of entries and exits from the country [10].

2.10 RFID in Supply Chain

2.10.1 EPC Information Service

An EPC Information Service (EPCIS) provides a standard interface for access and persistent storage of EPC-related data, for read and write access by authorized parties [11].

Because an Electronic Product Code (EPC) gives each object a unique serial number, each individual object can be tracked independently and fine-grained real-time information about each individual object can be collected, stored and acted upon.

EPC Information Services are a way for supply chain partners to share and exchange information efficiently, because a standard interface allows trading partners to use the same functions or methods for querying data across the supply chain, leading to reduced times integrating with partners if everyone uses the same interface, even though they may store the information in different types of underlying databases.

The EPC Information Service Specification will specify the standard interfaces for:

- Query (getting data from an EPCIS)
- Capture (putting data into an EPCIS)

2.10.2 GS1 System

GS1 is a leading global organization dedicated to the design and implementation of global standards and solutions to improve the efficiency and visibility of supply and demand chains globally and across sectors.

The GS1 System is an integrated system of global standards that provides for accurate identification and communication of information regarding products, assets, services and locations. It is the most implemented supply chain standards system in the world.

EPCglobal is leading the development of industry-driven standards for the Electronic Product Code™ (EPC) to support the use of Radio Frequency Identification (RFID) in today's fast-moving, information rich, trading networks.

GS1 EPCglobal is a new global standards system that combines RFID (radio frequency identification) technology, existing communications network infrastructure and the Electronic Product Code (a number for uniquely identifying an item) to enable immediate and automatic identification and tracking of an item through the whole supply chain globally, resulting in improved efficiency and visibility of the supply chain [12].

CHAPTER 3
METHODOLOGY

In completing the project, all required stages are illustrated in the flow chart in Figure 7. Each stage is carried out subsequently at all time. The project Gantt chart is shown in Appendix A.

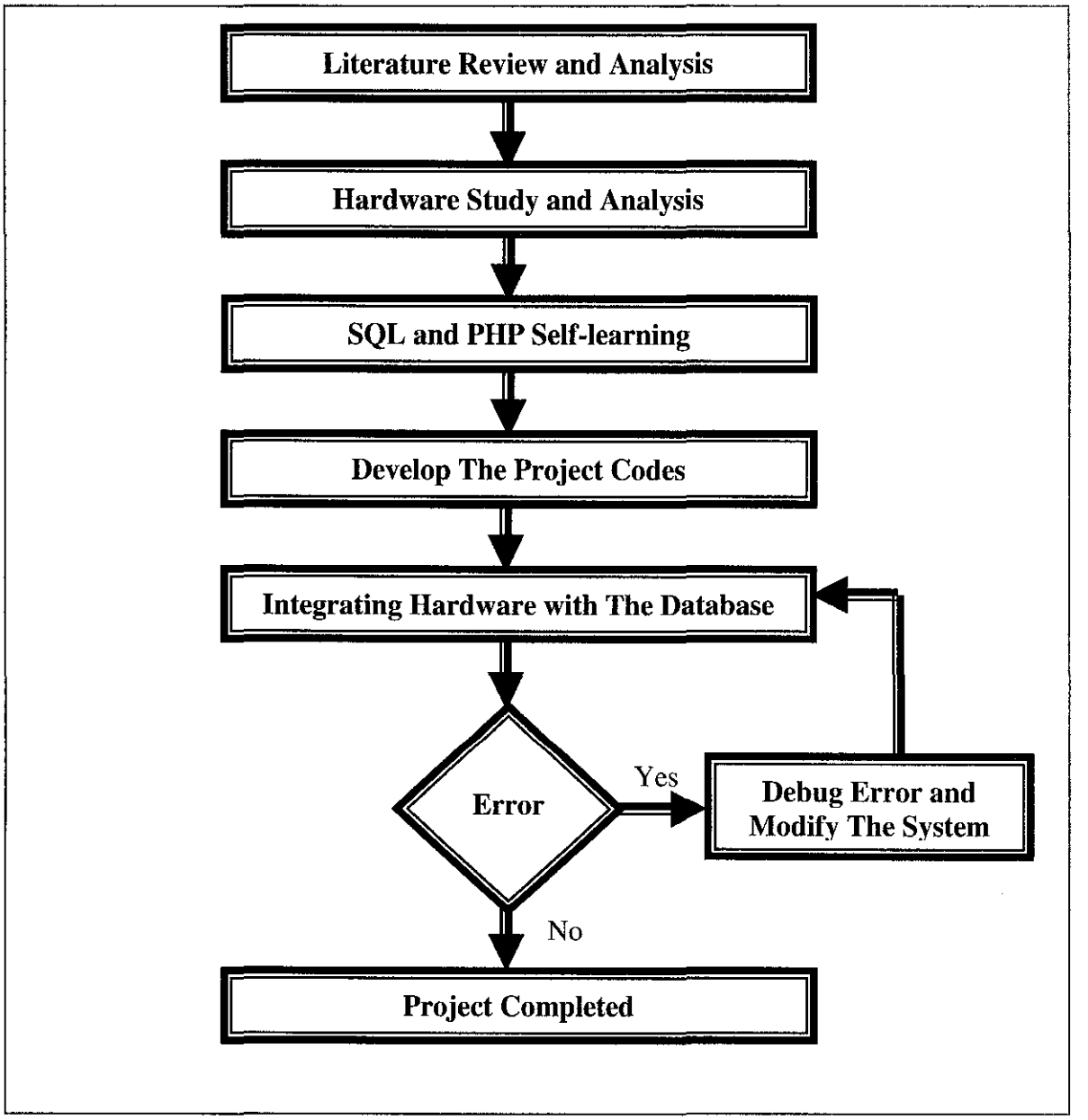

Figure 7 Project Flow chart

3.1 Literature Review and Analysis

Thorough research was carried out as it was the must in the early stage of the project before pursuing on to the next step. It was also done to develop better understanding on RFID and discover method on how to complete the tasks successfully. Literature review and analysis were done from Week 3 to Week 6 (FYP I) to build strong fundamental for the project including the RFID, Database, GUI as well as PIC research. A survey was planned to be carried out to the lecturers and staffs. The survey purpose was to investigate the needs of replacing the old system by implementing attendance recording and tracking system using RFID.

3.2 Hardware Study and Analysis

Hardware (RFID reader and tags) study and analysis were carried out once the literature review was completed which happened between Week 6 and Week 8 (FYP I). Various vendors were contacted to get information about the RFID readers and tags. Catalogues and technical papers were studied and analyzed to select the most suitable hardware before actually bought the product. One of the possible vendors was Cytron Technologies which offers a reasonable RFID Kit price.

3.3 SQL and PHP Self-learning

This task was performed right after the hardware analysis tasks were completed. The languages self-learning task was started from Week 8 to Week 10 (FYP I). During this time, books, practices and strong determination were needed as the language had never been studied before. A few experts had been consulted in order to increase understanding on the languages and to learn the right techniques to develop project codes as well as to enhance skills on programming.

3.4 Develop the Project Codes

Project codes were developed after all the languages had been mastered. According to the Gantt chart, this stage would be performed from Week 10 to 14 (FYP I). However, the progress was accelerated since the project was carried out efficiently and smoothly. A simple database system and a user-friendly interface have been built using SQL and PHP since Week 9, and were upgraded from time to time.

3.5 Integrating the Hardware with the Database

The final part of this project was to integrate the developed database with the hardware which was planned to start from Week 14 (FYP I). Since the progress had been speed up, the task had been started at Week 10. The system was tested whether the data transmission from the RFID tag would be displayed through the built GUI. Impressively, the system built was able to acquire the unique ID when the tag was sensed by RFID Reader. The unique ID then was successfully map to the database and displayed through the GUI. The TimeTrack system was fully developed throughout FYP II.

3.6 System Hardware and Software

In order to implement TimeTrack system, the study focused on how to integrate the hardware and software. Based on the research, the software and hardware used were:

i. RFID tag and reader (Cytron IDR-232)
ii. Microchip PIC16F877
iii. Magnetic Lock
iv. XAMPP
v. SQL
vi. PHP

3.7 Door Locking System

In order to build an efficient and successful door locking system, the flow chart as shown in Figure 8 is followed.

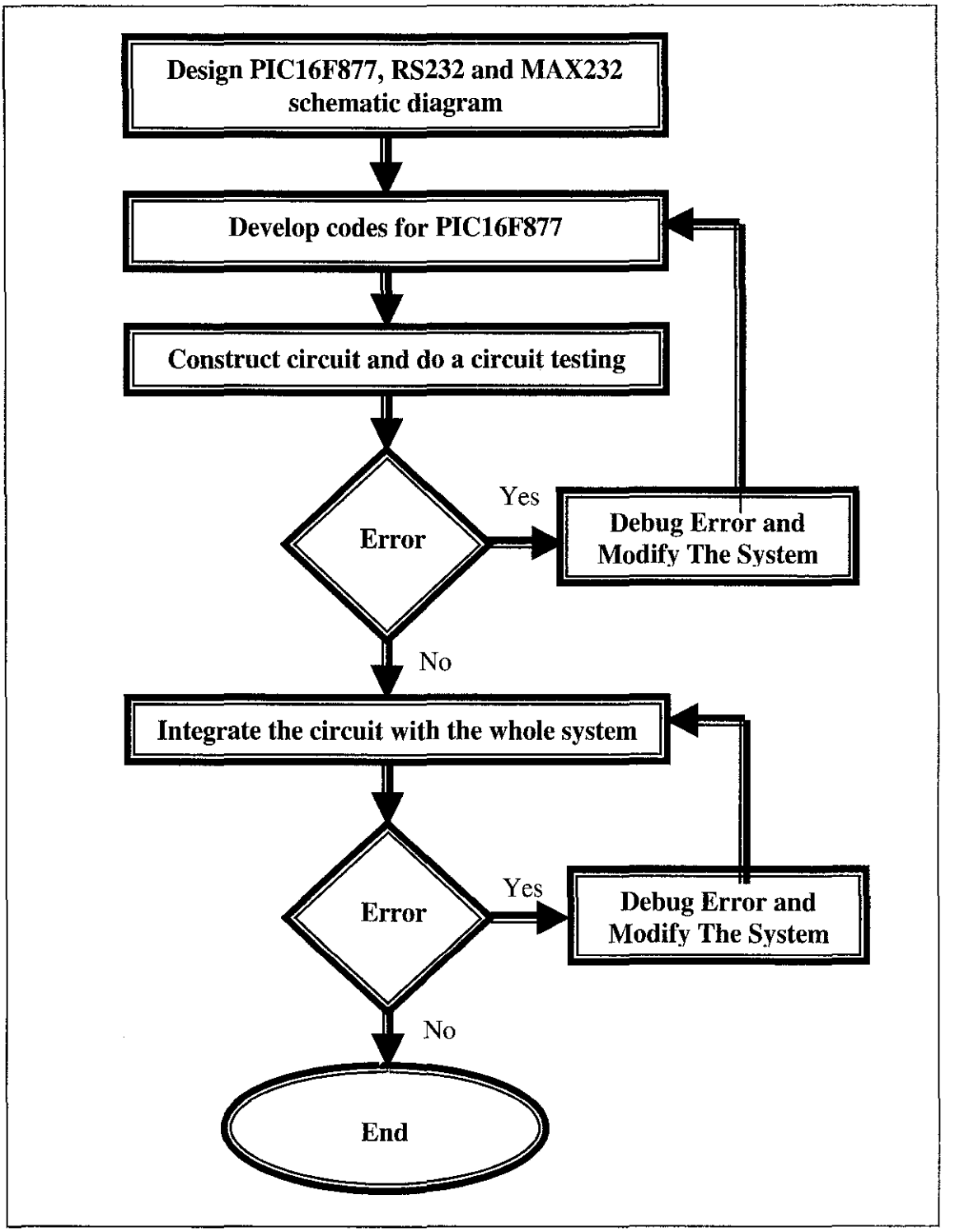

Figure 8 Door Locking System Flow chart

CHAPTER 4
RESULTS AND DISCUSSION

4.1 Hardware Analysis

RFID systems are new in Malaysia and there are only a few RFID vendors here; thus the cost of RFID Kit is still expensive. One of the vendors contacted was Cytron Technologies. Although the specification of Cytron RFID Reader, IDR-232 is below satisfaction (only 2cm reading range), the cost is reasonable. Therefore, Cytron RFID Reader, IDR-232 is used to execute the project.

4.1.1 IDR-232 Component

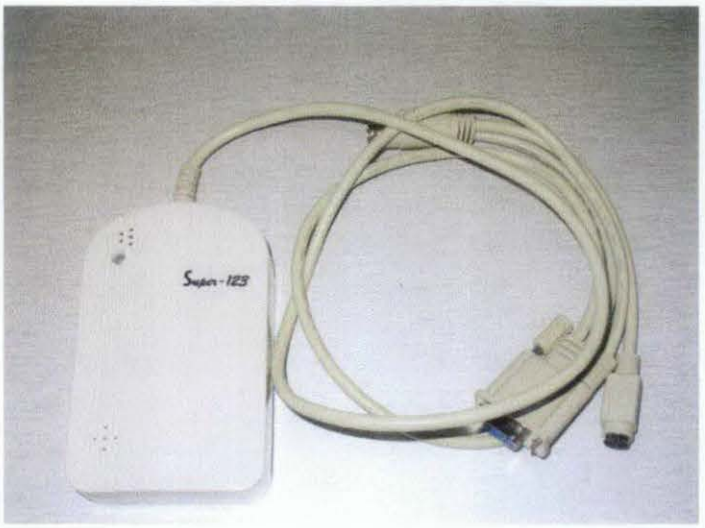

Figure 9 IDR-232 Reader

The Reader (shown in Figure 9) can be connected to a computer through its female RS232 cable and powered through PS2 connection (5V). The communication line is the RS232 cable (connected to a computer serial port).

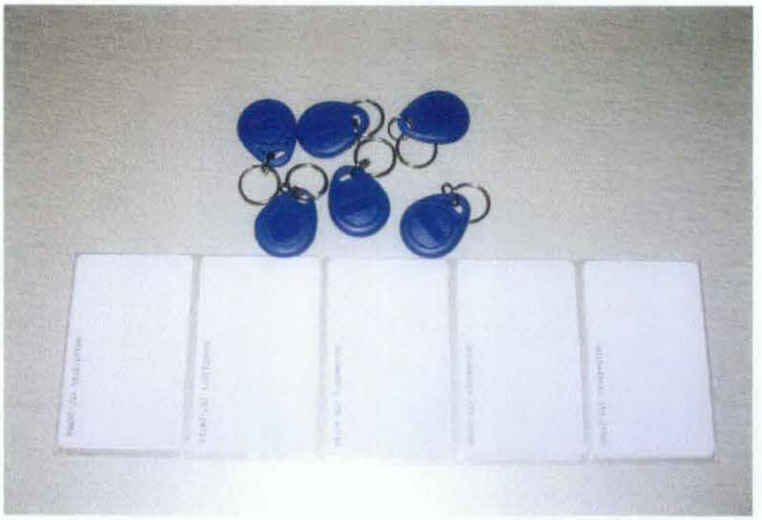

Figure 10 RFID Passive Tags and Key Chains

4.1.2 Data Acquisition

Figure 11 IDR-232 Reader and Tag

Figure 11 shows how a unique ID of RFID tag is transmitted to the reader while Figure 12 shows that it is being read by a computer using HyperTerminal (software). This unique ID is be mapped into the created database system as the staffs' ID through the GUI.

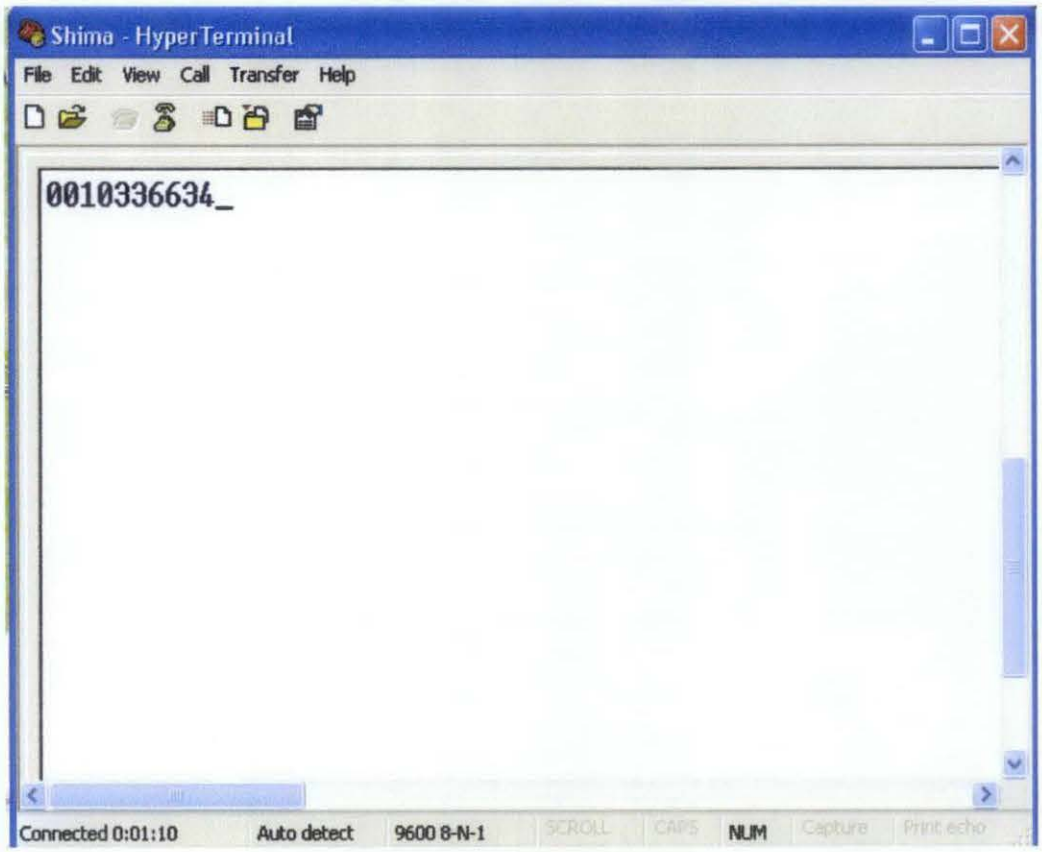

Figure 12 Unique ID Detected by HyperTerminal

4.2 Software Analysis

4.2.1 SQL and PHP

The database will enquire SQL as the database program and XAMPP as the hosting. XAMPP is a free, cross-platform web server, consisting mainly of the Apache HTTP Server, MySQL database, and interpreters for scripts written in the PHP and Perl programming languages.

XAMPP's name is an acronym for X (any of four), Apache, MySQL, PHP and Perl. The program is released under the GNU General Public License and acts as a free, easy-to-use web server capable of serving dynamic pages. Currently, XAMPP is available for Microsoft Windows, Linux, Sun Solaris and Mac OS X [13].

PHP (Hypertext Preprocessor) is a reflective programming language originally designed for producing dynamic web pages. PHP is used mainly in server-side scripting, but can be used from a command line interface or in standalone graphical applications [14].

4.2.2 *Software Implementation*

A simple preliminary and trial system known as TimeTrack has been implemented after thorough self learning on database, SQL and PHP.

As shown in Figure 13, XAMPP is chosen to be the host.

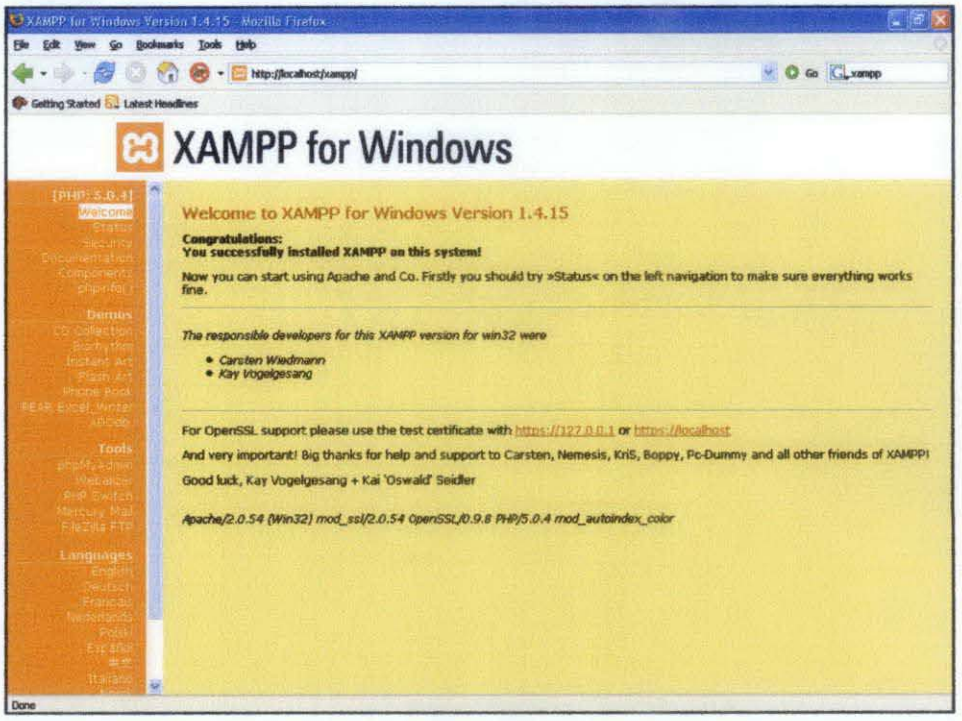

Figure 13 XAMPP for Windows

An interface to the database system has been developed using PHP language. The interface built can perform several functions such as:

- Add New User
- Edit Profile
- Remove User
- Refresh
- List User Current Location
- Print User Attendance

4.3 TimeTrack System

4.3.1 TimeTrack home.php page

The TimeTrack system has been fully developed and can be viewed by log on to *http://165.0.16.52/web* using any web browser in UTP. This TimeTrack system is uploaded to UTP server through LAN connection, thus it can be viewed by any computers in the campus that are connected to UTP server.

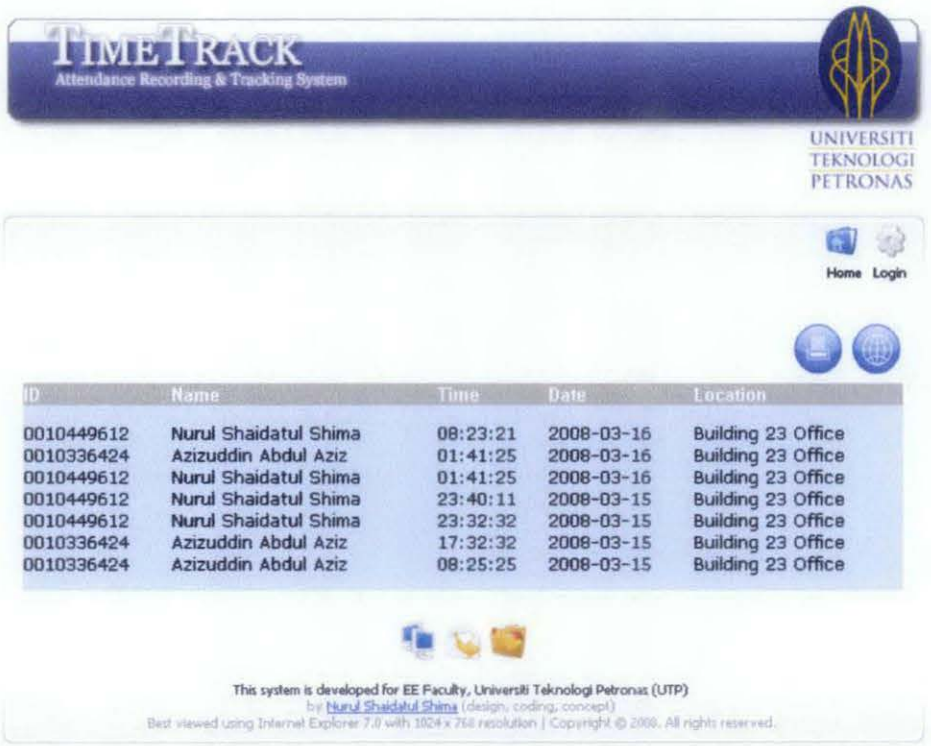

Figure 14 TimeTrack home.php Page

Figure 14 shows the *home.php* page which will be redirected automatically when users log on to *http://165.0.16.52/web*. As the first page of the system, the *home.php* page will have a quick display of time, date and current location of the staffs.

When any RFID tag is being detected by RFID Reader, the database as well as *home.php* will be updated and displayed the current time and location of the ID. The reader and the system integration will be discussed more in Section 4.4.

4.3.2 *TimeTrack login.php page*

The *login.php* will display a log in page for administrators for the TimeTrack system. Since the page inside is only for administration purposes, normal users are restricted from entering the site.

The php script used in *login.php* is shown below:

```
$admLogin    = $_POST['adm_login'];
$admPwd      = $_POST['adm_pwd'];

include('db.php');

$query = mysql_query("SELECT a_id FROM admin WHERE a_login =
'$admLogin' AND a_pwd='$admPwd'");
$record = mysql_fetch_array($query);

header("Location: controlpanel.php");
```

The output displayed of *login.php* is shown in Figure 15.

Figure 15 TimeTrack login.php Page

However, if any incorrect username or password is detected, the person will not be able to enter the site as shown in Figure 16.

Figure 16 Invalid Username or Password

Javascript shown below is used to develop the alert message:

```
<script language="javascript" type="text/javascript">
alert('Invalid user name/password. Please relogin again.');
history.go(-1);
</script>
```

4.3.3 *TimeTrack controlpanel.php page*

The *controlpanel.php* page is developed for administration purposes. In this page, administrator will be able to add a new user as well as the user's particular easily. The administrator will have a full access of the system including deleting a user.

When a user is added at the interface, the user description will be stored automatically into the database and the user profile will be displayed. The user profile can be edited or removed from the interface itself, thus the administrator of the system can easily maintained the system.

In order to add a new user with the description into the database, the php script used is save in *process.php* and linked to *contolpanel.php*. Figure 17 shows the output from *controlpanel.php* and *process.php* scripts if a new user is to be added by the administrator.

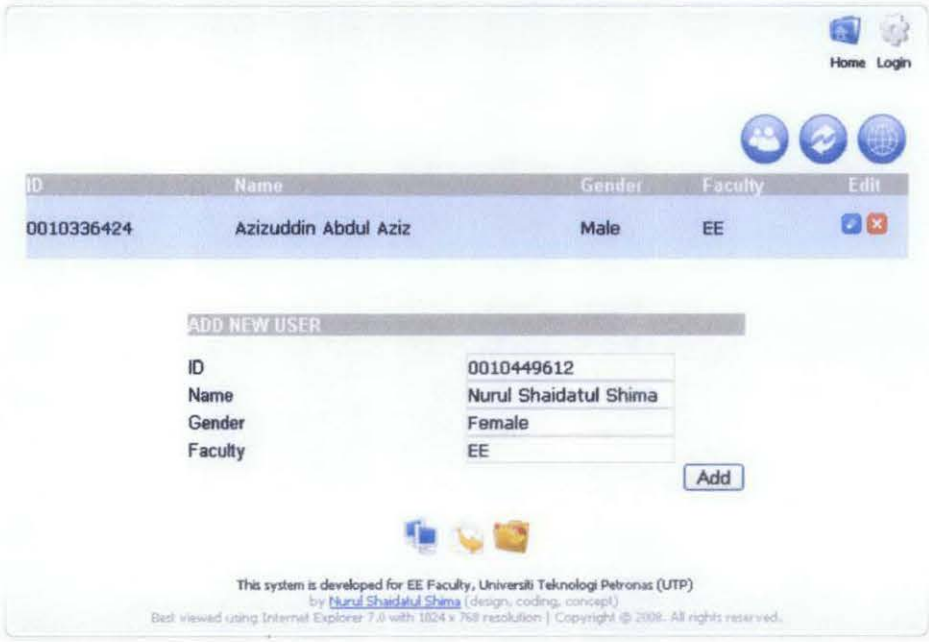

Figure 17 Add a New User

The php script used in *process.php* to a add new user is shown below:

```
$backPage = "controlpanel.php";
if ($state == "add")
{
$sqlstring = "INSERT INTO user (u_id, u_name, u_gender,
u_faculty) VALUES ('".$usrID."', '".$usrName."',
'".$usrGender."', '".$usrFaculty."')";

include('db.php');
$result = mysql_query($sqlstring);
      if (!$result) {
            echo "error occured: ".mysql_error();
            }
      else {
            header("Location:".$backPage."?state=added&uid=".$
            usrID);
            }
}
```

The database will be automatically updated when functions such as add, edit and delete are performed by the administrator through the interface. The system also is able to retrieve the data from the database and displayed at the interface. The following script is used in *controlpanel.php* to display data from table in database:

```
$sqlstring = "SELECT * FROM user";

include('db.php');

$result = mysql_query($sqlstring);

while ( $record = mysql_fetch_array($result) )
      <tr>
            <td><?=$record['u_id']?></td>
            <td><?=$record['u_name']?></td>
            <td><?=$record['u_gender']?></td>
            <td><?=$record['u_faculty']?></td>
      </tr>
```

Figure 18 shows the output from *controlpanel.php* after a new user is added. The output displays the new user profile.

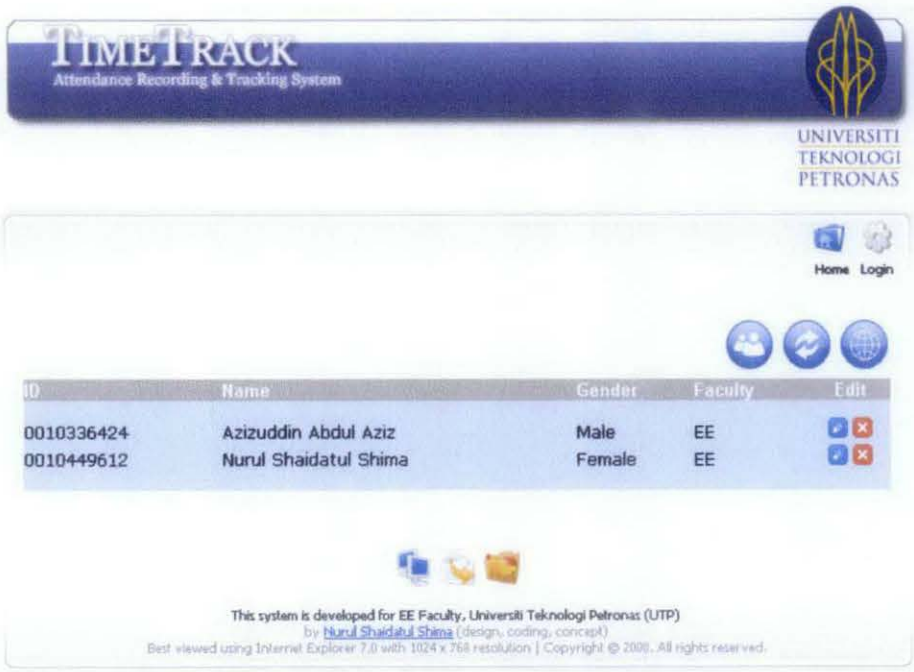

Figure 18 TimeTrack controlpanel.php Page

4.3.4 TimeTrack print.php page

The TimeTrack system is also able to print users' attendance when needed according to user ID and date selected as shown in Figure 19. Figure 20 shows a sample of a user's attendance that will be automatically produced based on ID and date selected.

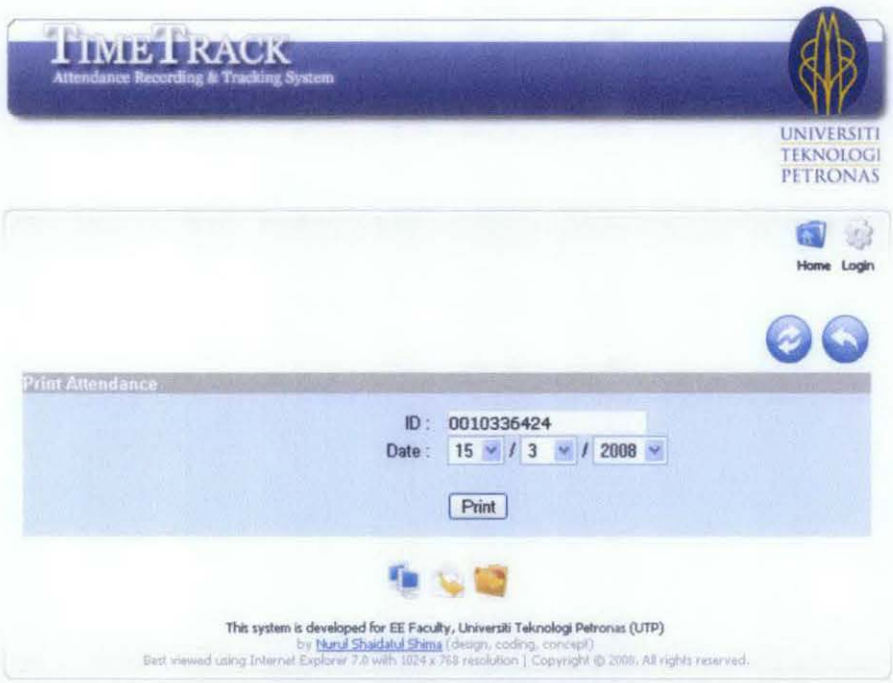

Figure 19 TimeTrack print.php Page

```
Date: 2008-3-15
Name: Azizuddin Abdul Aziz
ID:   0010336424

-----------------------------------------------
Time            Location
-----------------------------------------------
17:32:32        Building 23 Office
08:25:25        Building 23 Office
-----------------------------------------------

Sincerely,


-------------------
(Azizuddin Abdul Aziz)
```

Print Attendance

Figure 20 TimeTrack Attendance Record

4.4 Hardware and Database Integration

The final part of this project is the integration between the system software and the RFID hardware which is the reader itself. The whole system must be able to acquire the unique ID when the RFID tag is sensed by RFID Reader and the ID should be able to map to the database.

Using CYTRON IDR-232 RFID Reader, when reader scans an access card, the record of that transaction is captured in a file named *"idno.txt"* using HyperTerminal. Unique ID of the RFID tag will be stored into the *idno.txt* file.

In order to insert the unique ID, time and date of each transaction from *idno.txt* file into the system database, the following php script is used:

```
$filename = "idno.txt";
$fp = fopen($filename, "r") or die("Couldn't open $filename");

while (!feof($fp))
      {
            $line = fgets($fp, 1024);
      }

$sqlstring = "INSERT INTO log (USER_ID,LOG_TIME,LOG_DATE)
VALUES (".$line.", '".date('G:i:s')."', '".date('Y-m-d')."')";

$result = mysql_query($sqlstring);
```

To retrieve information stored in database regarding *idno.txt* through the interface, the following php script is used and saves as *timetrack.php*:

```
$query = mysql_query("SELECT * FROM timetrack");

while ( $log_record = mysql_fetch_array( $query ) )
<tr>
      <td><?= $log_record['u_id'] ?></td>
      <td><?= NAME_LOG("u_name", $log_record['u_id']) ?></td>
      <td><?= $log_record['tt_time'] ?></td>
      <td><?= $log_record['tt_date'] ?></td>
      <td><?= $log_record['tt_location'] ?></td>
</tr>
```

The output from *timetrack.php* is shown in Figure 21. The output display the unique ID from RFID Tag, the name of the RFID tag owner, the time and date when RFID tag is detected as well as the location.

Figure 21 RFID Tag is Detected by The System

4.5 Door Locking System Using Microcontroller PIC16F877

A microcontroller is a compact standalone computer, optimized for control applications. Entire processor, memory and the I/O interfaces are located on a single piece of silicon so, it takes less time to read and write to external devices. In this project, the door locking system is controlled using Microcontroller Microchip PIC16F877 and MAXIM MAX232.

4.5.1 Microchip PIC16F877

PIC16F877 is one of the most commonly used microcontrollers especially in automotive, industrial, appliances and consumer applications. This 8-bit microcontroller is powerful (200 nanosecond instruction execution) yet easy-to-program because it has only 35 single word instructions. The core features of PIC16F877 are 256 bytes of EEPROM data memory, self programming, an ICD, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 additional timers, 2 capture/compare/PWM functions and a Universal Asynchronous Receiver Transmitter (USART) [15].

Microchip PIC16F877 and its pin configuration are shown in Figure 22 [15].

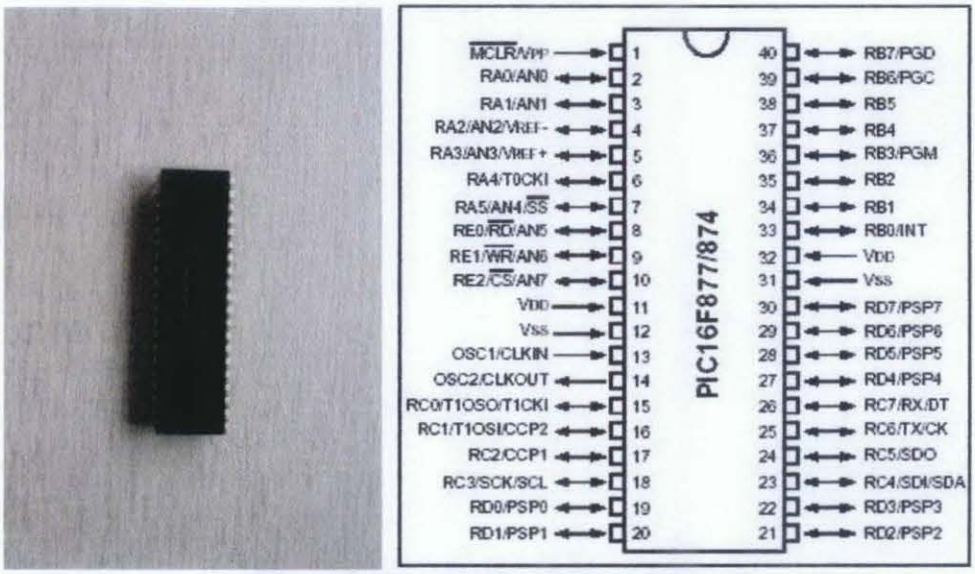

Figure 22 Microchip PIC16F877 Pin Diagram

4.5.2 *Door Locking System Flow Chart*

The flow chart of the door locking system is shown in Figure 23.

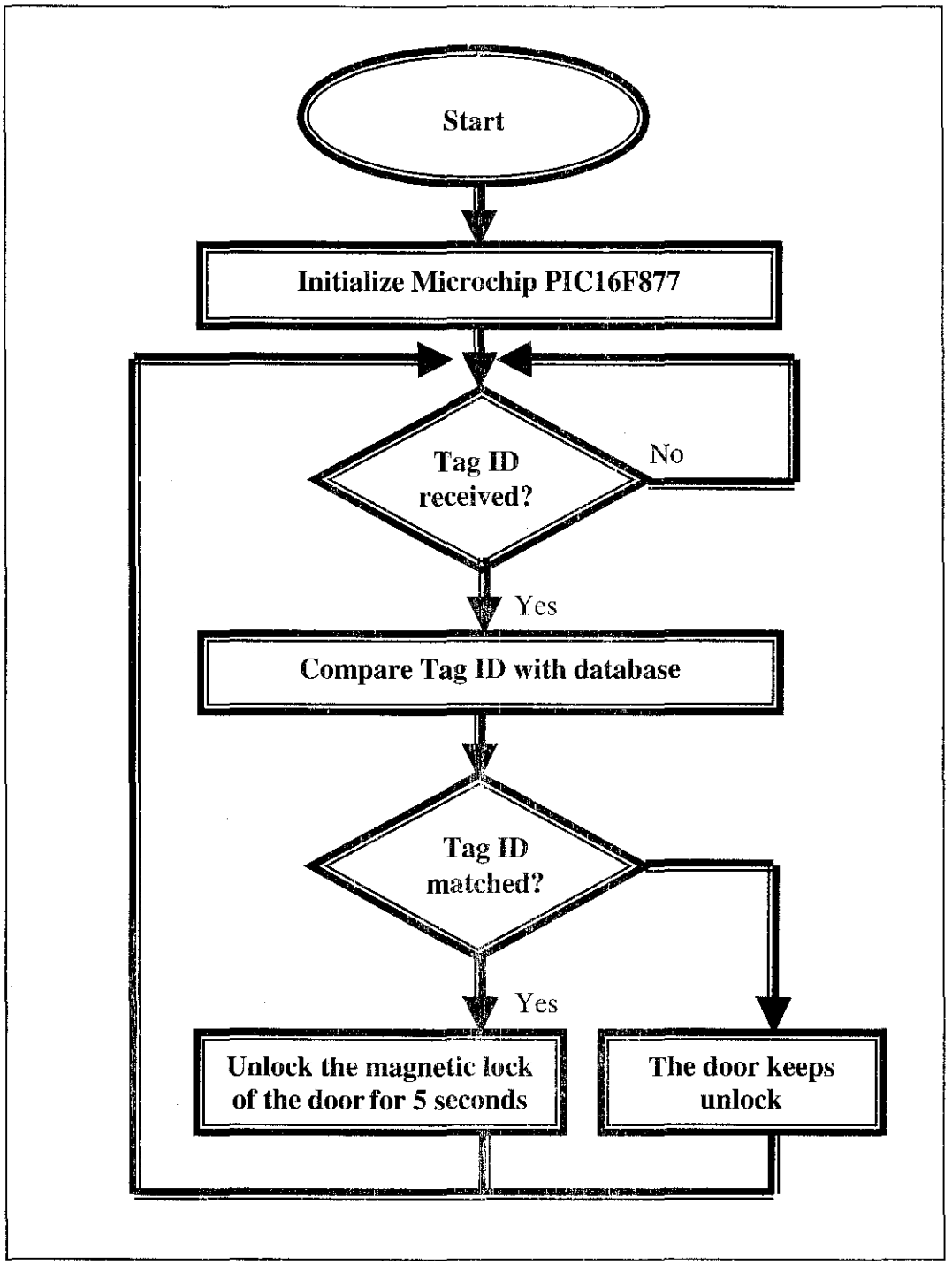

Figure 23 Flow Chart of Door Locking System

4.5.3 Schematic Diagram

Figure 24 shows the pin configuration of MAXIM MAX232. The schematic diagram in Figure 25 shows the connection between RS232 DB9 and MAXIM MAX232 [16].

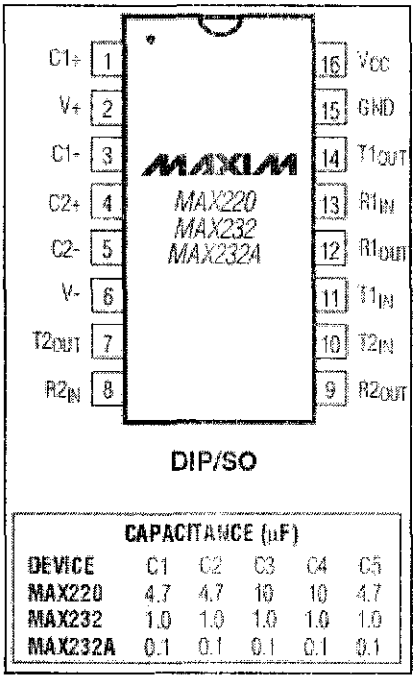

Figure 24 MAX232 Pin Configuration

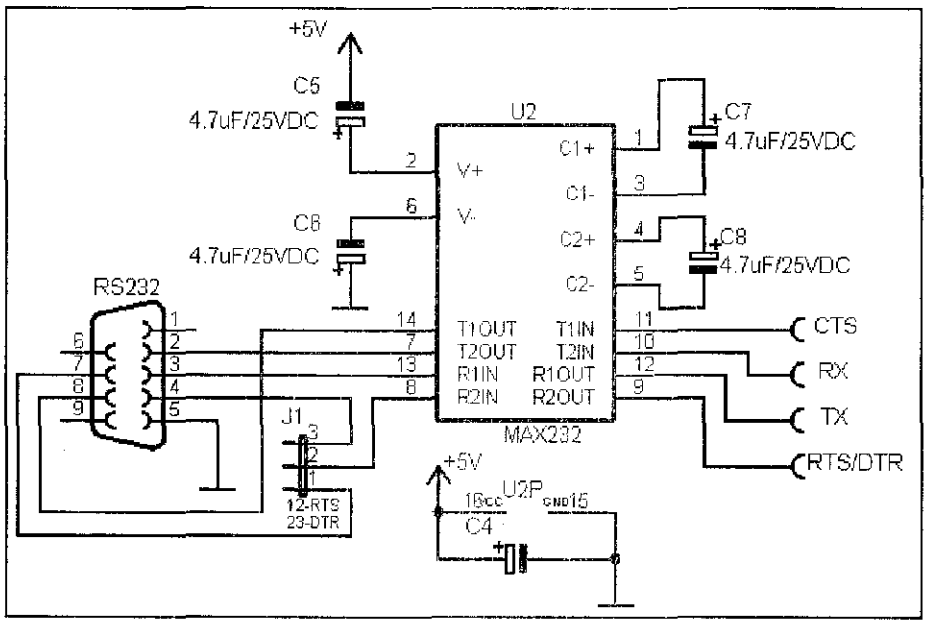

Figure 25 RS232 and MAX232 Schematic Diagram

4.5.4 Circuit Diagram

The circuit diagram in Figure 26 shows how the RFID Reader, RS232 DB9, MAX232 as well as PIC16F877 connected with each other.

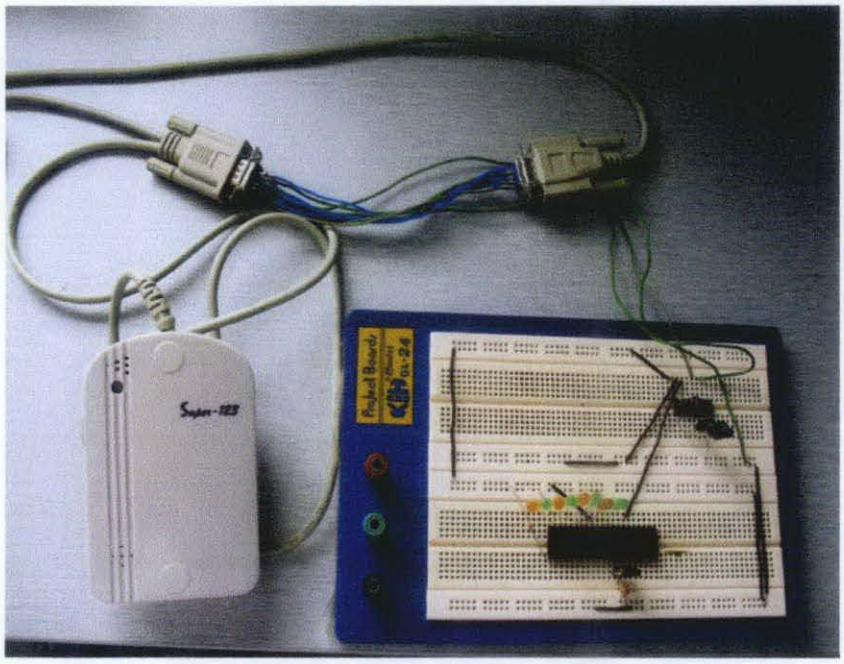

Figure 26 Circuit Diagram of Door Locking System

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The TimeTrack system utilizes RFID usage to develop attendance recording and tracking system for staffs in Universiti Teknologi PETRONAS (UTP). The main objective of this project is to implement RFID system that is able to record the attendance of the staffs, replacing the self-written and punch cards system which is currently in place. Thorough researches are made in order to achieve all the objectives in this project as well as to find the best way of transmitting data from the tag to the reader and display the output in the computer. Project flow has been planned efficiently to ensure the smoothness of the project until it is completed successfully within the proposed time frame of two semesters.

A working prototype of TimeTrack system is developed to show integration between RFID reader, microcontroller and a computer. The database of the system enquires SQL as the program and XAMPP as the hosting. An interface to the database system is developed using PHP language.

5.2 Recommendation

In the future, this project can be further enhanced and improved to make it more practical. The TimeTrack system can be implemented as a trial version in UTP for a certain period of time to determine the efficiency. Furthermore, the system can be improved by mapping the unique ID of RFID tag to the real lecturer's ID. New interesting functions may be created as addition to the existing functions.

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APPENDIX A – GANTT CHART

GANTT CHART FOR FYP I

No	Task	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Date	23/7	30/7	6/8	13/8	20/8	27/8	3/9	17/9	24/9	1/10	8/10	15/10	22/10	29/10	5/11
1	Research on FYP titles																
2	Submission of FYP proposed title (RFID)																
3	Research on RFID																
4	Research on methods to conduct a survey																
5	Preliminary Report Submission																
6	Research on database and GUI																
7	Serial communication and data transmission study																
8	Hardware study and analysis																
9	Progress Report Submission																
10	SQL and PHP self-learning																
11	Develop the project codes																
12	Draft Report Submission																
13	Develop a simple database system																
14	Interim Report Submission																
15	Integrate RFID reader with the database																
16	Oral Presentation																

GANTT CHART FOR FYP II

Io	Task	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	19	21
		Date	21/1	28/1	4/2	11/2	18/2	25/2	3/3	17/3	24/3	31/3	7/4	14/4	21/4	28/4	2/6	16/6
1	Research on RFID tracking system																	
2	Design PIC16F877, RS232 and MAX232 schematic																	
3	Progress Report 1 Submission																	
4	Develop codes for PIC using assembly language																	
5	Construct circuit and do a circuit testing																	
6	Progress Report 2 Submission																	
7	Integrate circuit with the whole system																	
8	Improve the GUI																	
9	Draft Report Submission																	
10	Final Report (soft cover) Submission																	
11	Technical Report																	
12	Oral Presentation																	
13	Final Report (hard cover) Submission																	