RADIO FREQUENCY IDENTIFICATION (RFID) BASED PLATE RECOGNITION FOR REGISTERED VEHICLE IN UMP

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RADIO FREQUENCY IDENTIFICATION (RFID) BASED PLATE RECOGNITION FOR REGISTERED VEHICLE IN UMP

NUR ALIAA BINTI MOHD EZANEE

A thesis submitted in fulfilment of the requirements

for the award of the

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JUNE, 2012

SUPERVISOR DECLARATION

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of the degree of Bachelor of Computer Science (Computer Systems & Networking).

Signature : .....

Name : RAHIWAN NAZAR BIN ROMLI

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DECLARATION

I declare that this thesis entitled " Radio Frequency Identification (Rfid) Based Plate Recognition For Registered Vehicle In Ump" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : NUR ALIAA BINTI MOHD EZANEE

Date : 11 JUNE 2012

DEDICATION

Special dedication to:

My beloved family,
Mohd Ezanee and family

My dedication supervisor,
Rahiwan Nazar bin Romli

All my supported friends,

UMPians

&

All parties involved directly or indrectly with this project

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Thank you.

ABSTRACT

Recent advances technology in world of computer resolve the difficulty of recognition. Based on technology of Radio-Frequency (RFID) has enhanced a project of plate recognition for registered vehicle specially proposed to Universiti Malaysia Pahang. The scopes of work is study and develop a passive tag RFID system in detection of RFID Reader from input to output composed of hardware, database development and software programming VisualBasic.Net. Method and implementation conducted by stages due to the system requirements needed. RFID Plate Recognition solves the problems of unauthorized vehicle entering campus of UMP without inspection and come out with a number of statistics vehicle check-in and check-out day-by-day.

Keywords: Knowledge Radio-Frequency Identification

ABSTRAK

Kemajuan teknologi terkini dalam dunia komputer menyelesaikan kesukaran pengiktirafan. Berdasarkan teknologi Frekuensi Radio (RFID) telah menghasilkan projek pengiktirafan nombor plat kenderaan yang berdaftar sebagai kenderaan sah di Univesiti Malaysia Pahang. Skp kerja merupakan kajian dan pembangunan sistem RFID beserta sistem tag pasif dalam pengesanan RFID Reader untuk input daripada perkakasan, pembangunan pangkalan data dan perisian perngaturcaraan VisualBasic.net.

Kaedah dan perlaksanaan yang dijalankan secara berperingkat mengikut proses-proses tertentu. Sistem ini menyelesaikan masalah kenderaan kampus yang dibenarkan memasuki kawasan Universiti Malaysia Pahang (UMP) tanpa pemeriksaan dan merangkumi statistik daftar kenderaan keluar dan masuk setiap hari.

Kata kunci: Pengetahuan Pengenalan Frekuensi Radio

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CHAPTER 1

1.0 INTRODUCTION

Radio-Frequency Identification (RFID) Based Plate Recognition for Registered Vehicle in UMP is one of project by the concept of RFID technology which is an automatic identification method, relying on storing and remotely retrieving data using its devices such as tags and responders.

1.1 Introduction

RFID for plate recognition is a system for process of check in and out of the main gate of Universiti Malaysia Pahang (UMP). It is design for only registered vehicle in UMP to make sure UMP staffs & students to get more secure and safety guarantees.

RFID basically is a Radio-Frequency Identification that use radio waves to transfer data from electronic tag, through some reader and attached to an object to be identified or to be tracked. It transmits the identity of an object wirelessly grouped under broad category of automatic identification technologies [1]. RFID contains three (3) main parts, firstly is the tag, second is the reader and last part is the antenna. An RFID tag has three (3) types such as passive, active and battery assisted passive. In this system, by using a passive RFID, a tag without battery can be read in long range to the RFID reader. It is because by using the radio wave, the reader is not necessary read the tag (plate number) in straight line and it also can be read hundreds at a time [1]. Most RFID contain at least two (2) parts, one is an integrated circuit for storing and processing information, modulating and demodulating a radio-frequency (RF) signal and the other part is the antenna for receiving and transmitting the signal [2]. The data transmitted by tag may provide identification or specified information. Other advantage of RFID is it's effective in any environment where tags can be sealed within plastics enclosure eliminating due to expose of chemicals, heat, abrasion, dirt and grease build-up, etc [3].

The system will allow identify registered vehicle in and out of the campus of UMP by recognition of the vehicle plate number. When the reader of RFID can recognize the tag of vehicle plate number, it directly show the vehicle owner details as it is been transmitted in the system and the vehicle barrier quickly open. Then, the registered vehicle of UMP staffs & students can check in and also check out from campus of UMP easily.

1.2 Problem Statement

The problem statements that have lead to this project are:

1) Unauthorized vehicle entering campus of UMP without inspection.
2) Time consuming when frequently check in for each vehicle that passes by the barrier.
3) Numbers of vehicle check in and out of UMP campus are unknown.

The first problem is about unauthorized vehicle entering campus without inspection causes security issue. The problem occur when sometimes vehicle just pass through the entrance of security without stopping by so no authorization process could be done.

Secondly is time consuming when vehicle have to stop for screening process at the entrance when security need to check for identification card of student and staff and also for unauthorized vehicle need to report manually so it consume time for other vehicle queue up at the line of entrance.

University campus always has many visitors so do the community itself. So as the third problem is numbers of vehicle check in and out of the campus are unknown. It is a problem as we cannot really estimate how many vehicle checks in and are the vehicle check out the same day or not for unauthorized vehicle. And also for authorized vehicle, they need to be in campus before 12p.m so the security will record any vehicle coming in late night.

So the objective of the system can help to develop solutions to solve the problem statement.

1.3 Objective

The objectives of this project are:

1) To develop a prototype of RFID systems for vehicle plate recognition.
2) To recognize the vehicle that only registered in UMP will be allowed to enter the campus of UMP.
3) To make statistics on the number of vehicles check in and out of the campus UMP.

1.4 Scope

There will be three (3) scopes that will discussed in details which is:

1) Administration
   - The system managed by administrator.
2) Security Guards
   - The system handled by security guards.
3) User
   - The user of the system is the staffs & students UMP who registered their vehicle in the system.

1.5 Thesis Organization

This thesis consists of six (6) chapters which I described chapter by chapter:

i. CHAPTER 1: Introduction

This chapter briefly contains the whole idea by introduction, problem statement, objective, scopes and thesis organization.

ii. CHAPTER 2: Literature Review

The purpose of this chapter is about the review for the chosen project, divided into two (2) sub-reviews that require a study to get complete information about the project.

iii. CHAPTER 3: Methodology

The content will included all the method, technique or any approach that will be used while designing and implementing the project.

iv. CHAPTER 4: Implementation

The purpose of this chapter is to explain about all the processes involve in the development project.

v. CHAPTER 5: Result and Discussion

This chapter will explain the result and data analysis that had been acquired.

vi. CHAPTER 6: Conclusion

This chapter explains about overall description about the project and its summarization.

CHAPTER 2

2.0 LITERATURE REVIEW

This chapter will review on the existing research based on article, journal or any kind of resources that can give guides on addition of knowledge and information to produce a good system based to the topic proposed before.

This will include on technically what is the system are about and the kind of methodology of the existing systems during the research.

2.1 Radio-Frequency Identification (RFID)

Radio-Frequency Identification that is also known as RFID in general term of Information & Communications Technology (ICT) world. RFID is all widely about a technology that uses radio waves to transfer data from an electronic tag or label to an object, through a reader for purpose of identifying and tracking the object [1]. According to Nemai Chandra Karmakar (2010) states that RFID is a wireless data capturing technique from a tagged item. The RFID tags or

transponders are high-frequency electronic circuits that allow the items to be remotely detected, identified and to be tracked by the position of the items itself [11]. From Patrick J. Sweeney II (2005), he claims that RFID is a very valuable in business and technology tools holds the promise of replacing existing identification technologies like the bar code.

2.1.1 The Arrival of RFID

Based on array technology innovation in 1940s, RFID roots in early military systems. A reflected radio signal identifies a remote object based on the reflection signature from the object from paper of journal "Communication by Means if Reflected Power" 1948.

In early of 196Os, the RFID explode with the theory related to RFID "Theory of Loaded Scatterers" in 1964. RFID related inventions such as "Remotely activated radio frequency powered devices" by Robert Richardson's and "Passive data transmission techniques utilizing radar echoes" by J. H. Vogelman until the first century opens with the smallest microwave tags built using at a minimum two components; a single custom CMOS integrated circuit and an antenna. Tag was creating as sticky labels, easy attached to windshields and for objects to be managed well. The use of electronic for collection toll had become popular systems to applied with RFID system especially in United States and had develop to other country as well.

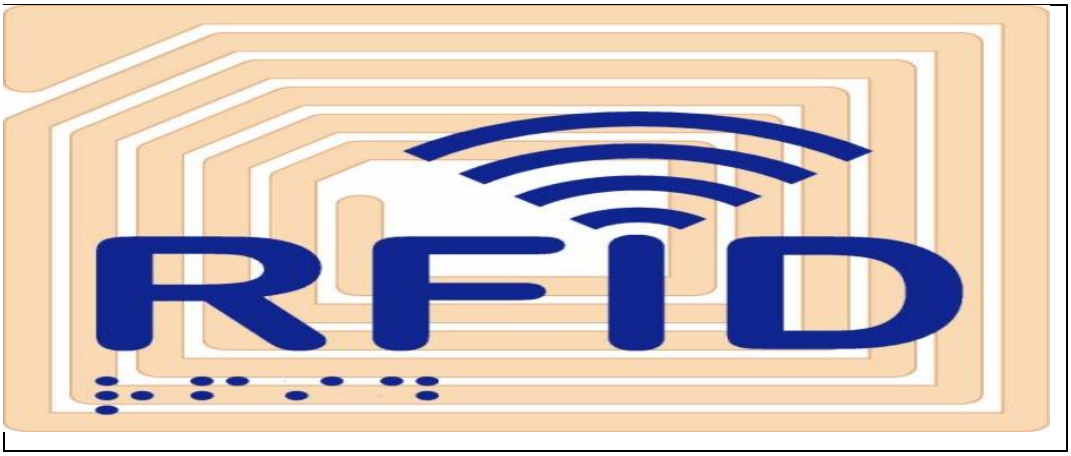


Figure 2.1a – Radio Frequency Identification (RFID)

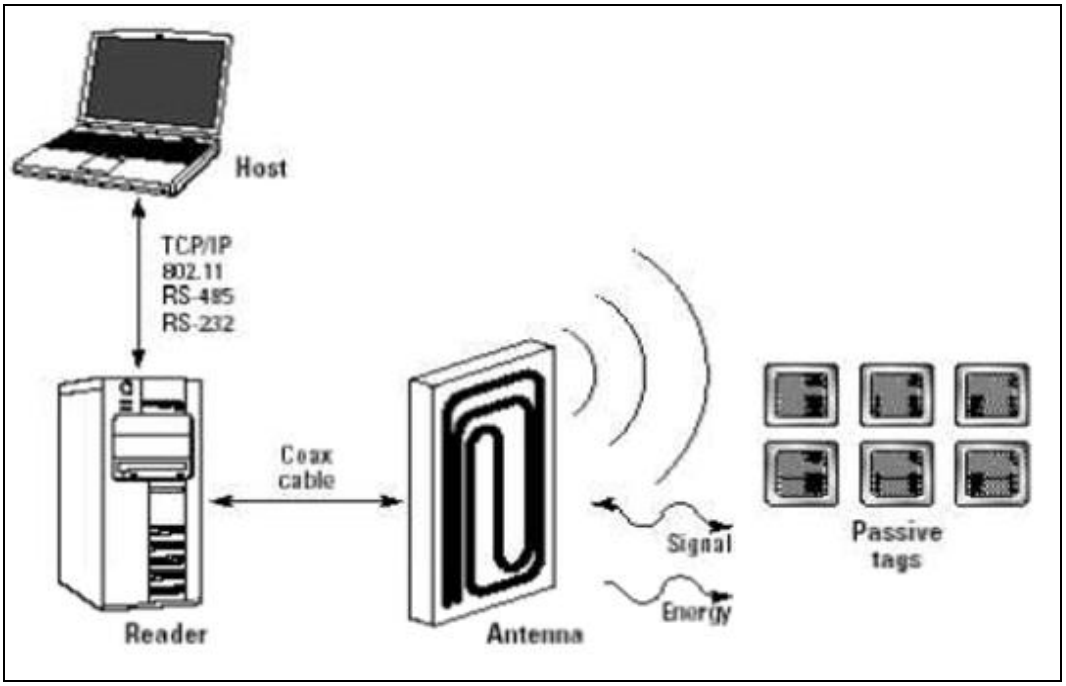


Figure 2.1b – Process of RFID

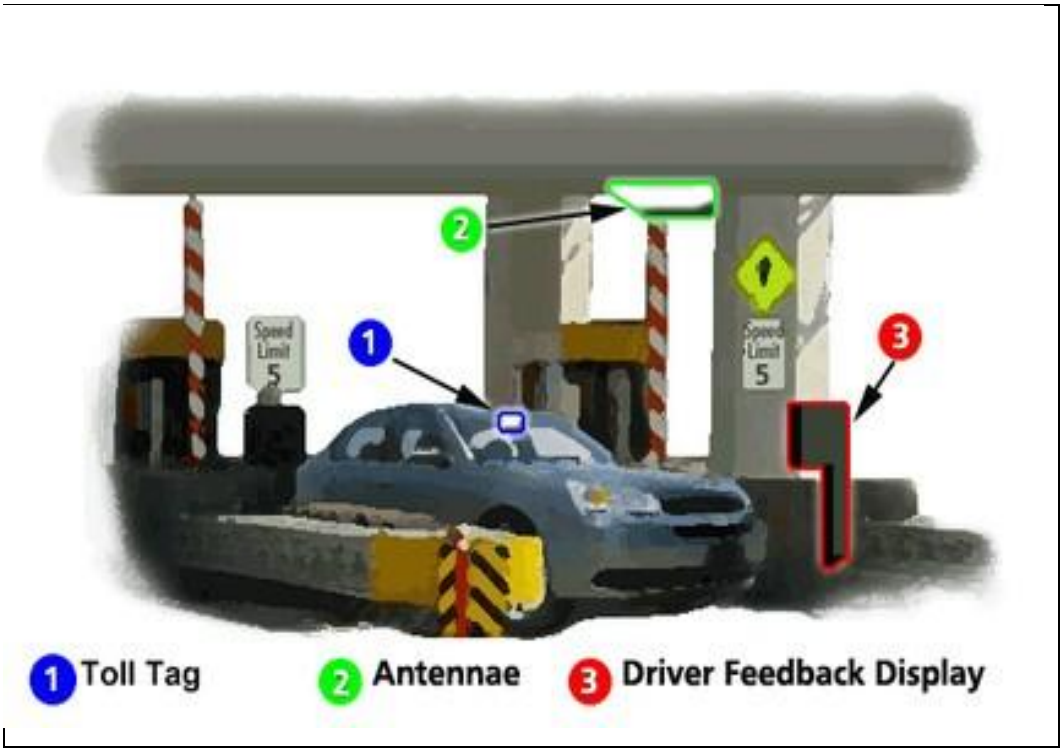


Figure 2.1c – RFID mostly applied for toll system

2.2 RFID Tag

There are 3 types of tag has been produced in name of RFID tag. Well-known tags are passive, active and battery assisted passive types. Most RFID tag contains at least two (2) parts that is integrated circuit and the antenna. The circuit is for storing and processing information, modulate and demodulate a radio-frequency (RF) signal while the antenna functions to receive and transmit the signal [1]. George Roussos (2008) issued that passive tag of RFID is a tag that carry no battery at all which is whole system is depends on the reader for its energy supply [10]. As agreed with Patrick J. Sweeney II (2005), passive tag read by the reader in the close presence. While active tag communicates powers by battery. The active tag will always broadcasts its signal and the battery supplies power to both the tags and the transmitter [11]. Also state in the research of Nemai Chandra Karmakar (2010), semi-passive tag are also called battery assisted tags (BATs). Generally the tag has on-board power supply to provide power to the tags to keep it alive but it doesn't carry any transmitter.

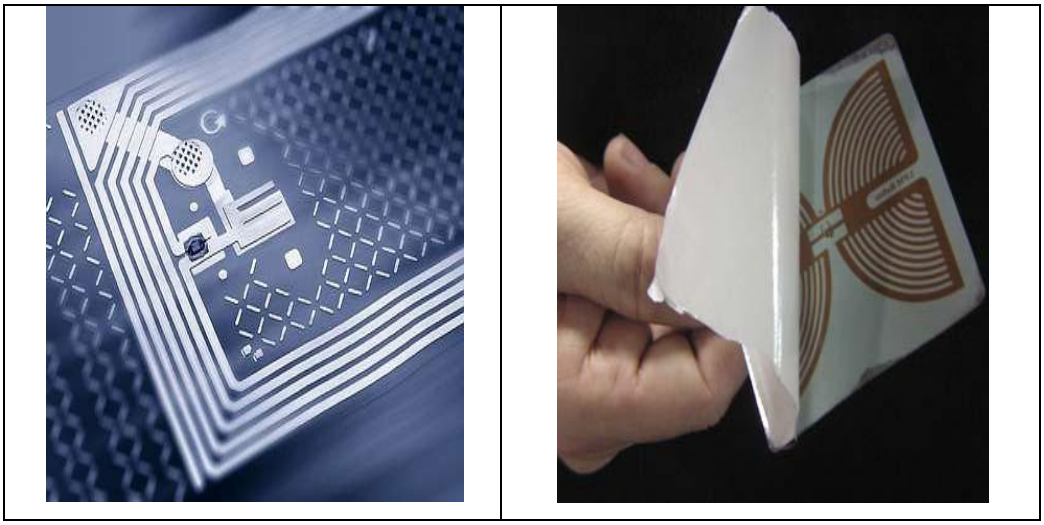


Figure 2.2a – RFID Tag

2.2.1 Passive Tag

A passive tag operates power from the reader, not contain a power itself. To conducts the circuitry, the tags relies on electromagnetic power obtained from the RFID antenna. The design of passive tag could be simpler and less expensive. Since passive tag depend power from the reader and antenna, the tag comes for downside as their range is extremely limited. The tag must be close proximity to the reader and antenna in order to have sufficient power to transmit signal for the data.

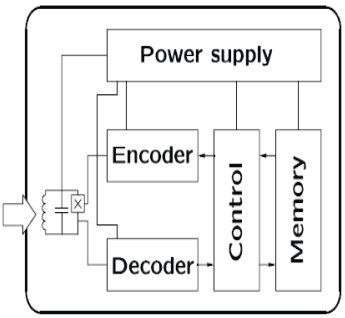
Classification	Performance Data
Passive Tag 	• Known as 'pure passive', 'reflective' or 'beam powered' that operates power from the reader • The reader sends electromagnetic waves that induce current in the tag's antenna, the tag reflects the RF signal transmitted and adds information by modulating the reflected signal

Table 2.2a – Passive Tag

2.2.2 Semi-active (Semi-passive) Tag

Semi-active tag uses an internal battery to support power for circuit that is internal to then tag itself. The circuit includes sensors monitoring environmental conditions such as temperature and humidity. The sensors are also powers to detect vibration and movement. The semi-active tag typically used to monitor the possibility of damage or unauthorized movement during transport or storage.

For semi-passive tag, it relies on electromagnetic field power received from the antenna. It conserved internal power for battery life. Power supply from the internal is the most important elements for semi active (semi-passive) tags.

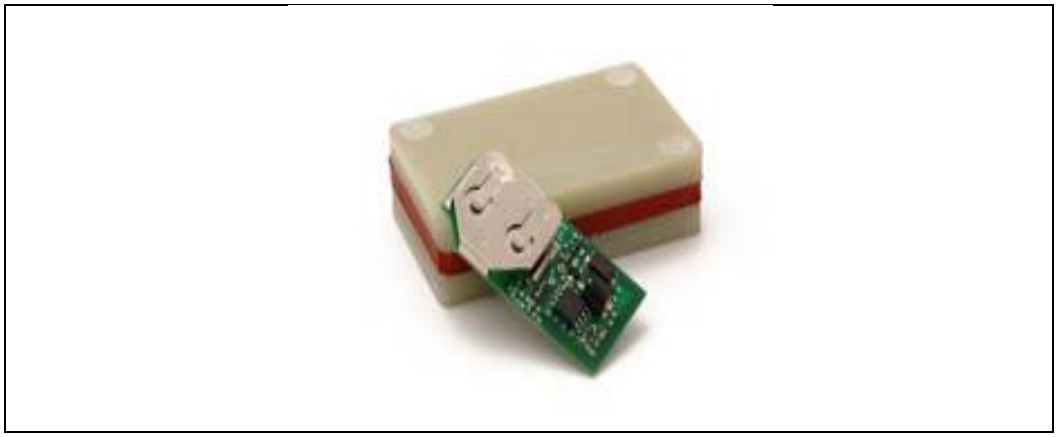


Figure 2.2b – Semi-active Tag

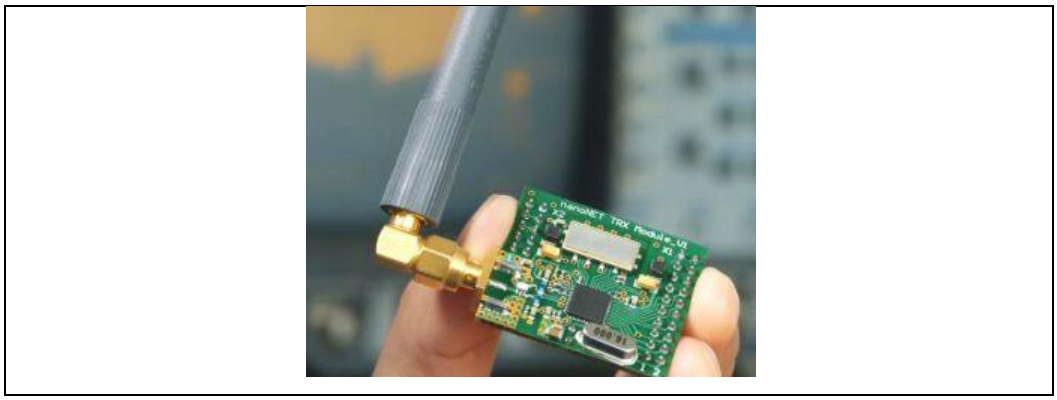


Figure 2.2c – Semi-passive Tag

2.2.3 Active Tag

Active tag differs from the passive tag as it contains its own power source. The power usually comes in the form of a small battery. The battery power both the tag internal circuit and also the antenna. Active tag are more larger and more costly than passive tag.

This type of tag is known as transmitter/receiver (or transponder) when the active transmitter are being read in long range by the reader.

Figure 2.2d – Active Tag

2.3 RFID Reader

RFID readers have evolved and are now frequently wireless handheld units that enable the user to roam through a warehouse, capturing RFID data wherever RFID tags are found. Some readers are adapters that add RFID reader capability to a PDA that can snap into a cradle. Readers are growing more radio frequencies sensitive, and more capable of processing, as well as just collecting, RFID data.

Reader generates the signal that goes out through the antenna into space and listens for the tag's response. Besides that the reader also receives analog waves and then turns them into bits of digital information. Each reader is connected to one or more antennas and its function practically as bridge between the application software and the antenna that radiates radio waves towards the tags.

In simple RFID systems, the energy of RFID reader functioned as an on-off switch. In more sophisticated systems, the reader's RF signal able to provide the tag, instructions to read or write memory that the tag contains, and even passwords.

Figure 2.3a – RFID Reader

Components	Description
Transmitter	• Used to transmit AC power and the clock cycle with the antenna and tags in its zone of circuit. • Reader send signal to environment and receiving tag will response back connect with the antenna.
Receiver	• Receive analog signals from the tag via the antenna. • Send the signal to reader to be converted to its equivalent digital.
Microprocessor	• Implement the reader protocol for communication with compatible tags. • Perform decoding and error checking of the analogue signal from the receiver.
Memory	• Store data stored in the tag to be read by reader and antenna.
Input/output channel	• External sensor for reader to read the tag.

Table 2.3a – RFID Reader Components

2.4 RFID Antenna

The RFID physical layer consist antennas used to couple the reader to the tag so that information can be transferred between the frequencies at which it oscillates and the strength or power of those oscillations.

Most RFID systems use unlicensed spectrum, which is a specific part of the spectrum set aside for use without a radio license. Popular bands are the low-frequency (LF) band at 125 - 134.2 KHz, the high-frequency (HF) band at 13.56MHz, the ultrahigh-frequency (UHF) band a 915MHz and the industrial, scientific, and medical (ISM) band at 2.4GHz.[2]

The energy that is radiated from an antenna is dividing into two parts:

a. the near field-part of radiation that is within a small number of wavelengths of the antenna
b. the far field- the energy that is radiated beyond the near field

The low-frequency (LF) and high-frequency (HF) RFID systems are operate in the near field while ultrahigh-frequency (UHF) and industrial, scientific, and medical (ISM) RFID systems operate in the far field.

The larger the antenna on the reader and the tag, the better an RFID system will work because large antennas are generally more efficient at transmitting and receiving radio power than are small antennas. Thus, a large antenna on the reader means that more power can be sent to the RFID tag and more of the tag's emitted energy can be collected and analysed. A large antenna on the tag means that more of the power can be collected and used to power the chip. Likewise, a large antenna on the chip means that more power can be transmitted back to the reader.

Figure 2.4a – RFID Antenna

Characteristics	Description
Impedance	• The resistance of an electrical component to alternating current. • Measured in ohms.
Polarization	• Move to wave. • Best power between two antenna.
Bandwidth	• Different bandwidth for different antenna size and configuration.
Appearance	• Antenna fit in the décor of surroundings.

Table 2.4a – RFID Antenna Charateristics

2.5 Radio Wave

From the author of Basic Concepts in RFID Technology by Richard Moscatiello states that the radio waves that function are a kind of electromagnetic waves so do with the light and x-rays. The number of waves that occur in one second is known as the frequency and it is measured in Hertz. One Hertz is equal to one wave oscillation per second.

The channel frequency over an RFID system communicates data called a carrier wave. It used to carry data RFID tag antennae tune to resonate only to the specified band carrier frequencies. RFID tag is able to absorb and reflect energy back to the source [4].

The reader generates a magnetic alternating field in the radio frequency range. If the circuit moved into the vicinity of the magnetic field, the energy from alternating field can be induced in the resonant circuit via its coils based on Faraday's Law. The current flows in the resonant circuit and it acts against the external magnetic alternating field. This effect of small change in voltage drop across the transmitter's generator coil and leads to a weakening of the measureable field strength.

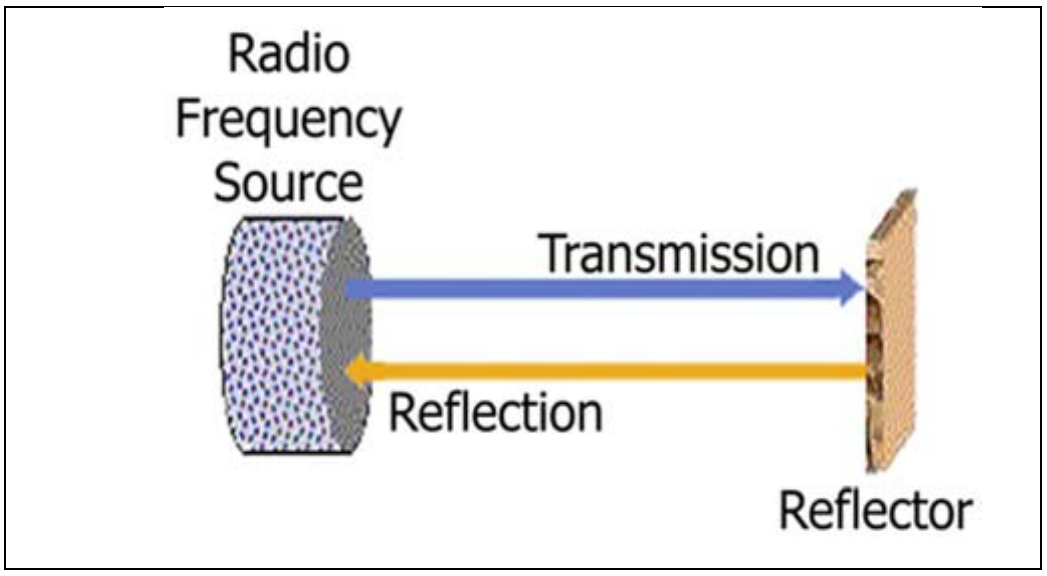


Figure 2.5a – Radio Frequency Transmission & Reflection

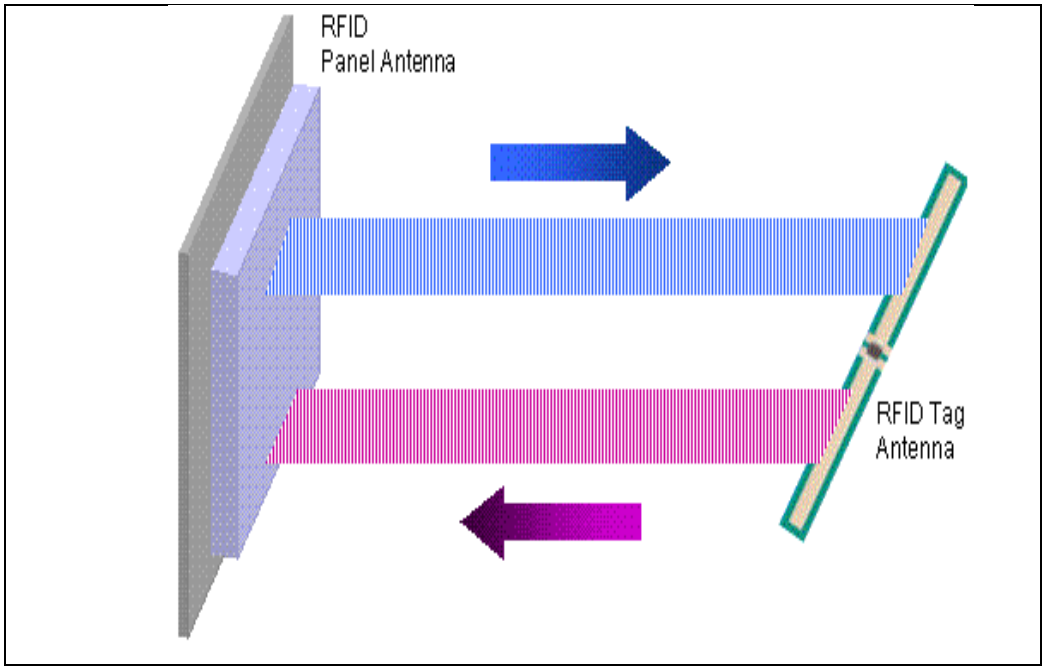


Figure 2.5b – Radio Frequency Reader & Tag Antenna

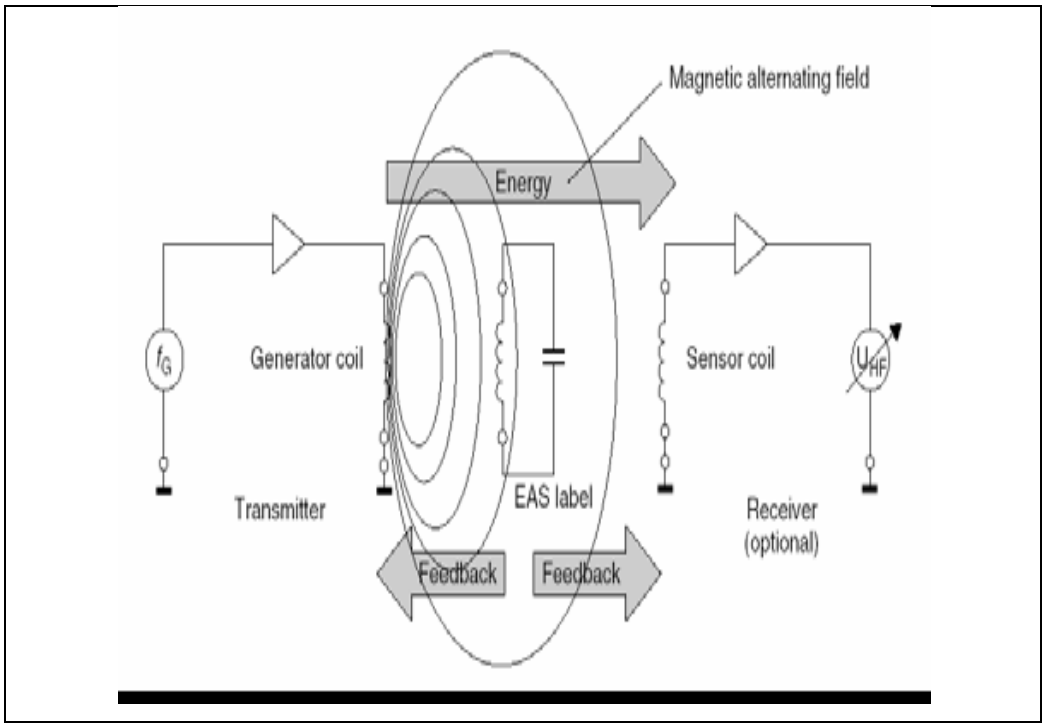


Figure 2.5c – Radio Frequency Energy

2.6 Advantages and Disadvantages of RFID & Comparison with Barcode

Richard Moscatiello (2007) issued the advantages of RFID over the barcode system. RFID tag has a longer read range compare to barcodes and also has the capability to have read/write memory while barcodes do not. More data can be stored in an RFID tag than stored in barcodes. Human intervention is required to scan the barcode whereas in most applications on RFID can be detected 'hands off' [4]. Moreover RFID technology does not require in line-of-side reading, the reader can read all the tags within palletized load without having physically moved. It also proved the tag still can be effective in harsh environments when bar code labels and reader must be clean, clear optics, free of abrasion and the label must be properly oriented with respect to each other [3, 12].

Although the RFID tag is a success than the barcode system, it also has disadvantage itself. The tag can fail with unique issue that automated nature of RFID optimized processes. In addition, the cost also has big issue here. Compare to the barcode that has the manufactured cost of low-cost consumer goods, the RFID tag has an additional cost thus make it as a higher-cost product.

Figure 2.6a – Barcode System

Factor	RFID	BARCODE
Sight of distance	• No line of sight requirement.	• Must be in straight line.
Environment	• The tag can stand a harsh environment.	• Must be in clean, clear optics, sensitive area.
Read Range	• Long read range. Passive RFID: Up t o 40 feet Active RFID: Up to 100's feet	• Sensor in very short distance. • Several inches up to several feet.
Read/Write	Multiple tag read/write.	Read only.
Read Rate	10's, 100's or 1000's simultaneously	One at a time.
Price Rate	Costly	Low-cost

Table 2.6a – Comparison of RFID & Barcode

2.7 Existing Related System of RIFD

2.7.1 Auto-checkout System for Retails using Radio Frequency Identification (RFID) Technology

As introduction about the system, it is a system of RFID by M. F. M. Busu, I. Ismail, M. F. Saaid, S. M. Norzeli (2011) that introduced Auto-Checkout System for Retails.

The system is developed with Graphical User Interface (GUI) using Visual Basic.Net (VB.Net) and a database was created in Microsoft Access with integrated RFID system. The system could read the simultaneously and retrieve corresponding detail information directly from the database. This project is more similar to the proposed project (RFID Based Plate Recognition for Registered Vehicle in UMP).

In this Auto-Checkout System by RFID is composed by three (3) basic components which are reader, tags and antenna. The project plan is about giving customer and cashier easy and faster ways in retails. The process shown in the flow chart integrated with GUI developed in the host PC.

All groceries placed in a trolley and place at the yellow line/checkout line to be read by RFID reader. If all the items have been detected, listed of items and total amount will be displayed in the system, wait for the receipt and pay the items easily.

The whole system is divided into three (3) stage of developement. By the Graphical User Interface (GUI), that is developed to act as Application Programming Interface (API) of communication between FRID system and computer will shows the development for Com Port which referred to USB port on the computer. Link to Database Development, it is store detail information of the item by identify the tag ID. In the database, each four (4) columns parameter represents ID, Product Name, Category and Price. Last stage is about Checkout System. The details about the items information from database displayed in listed with total amount, detected by RFID reader.

So the system concludes that the system tagged multiple items simultaneously. No battery is required, it is powered up by radio frequency signal, and the life time of tag is longer.

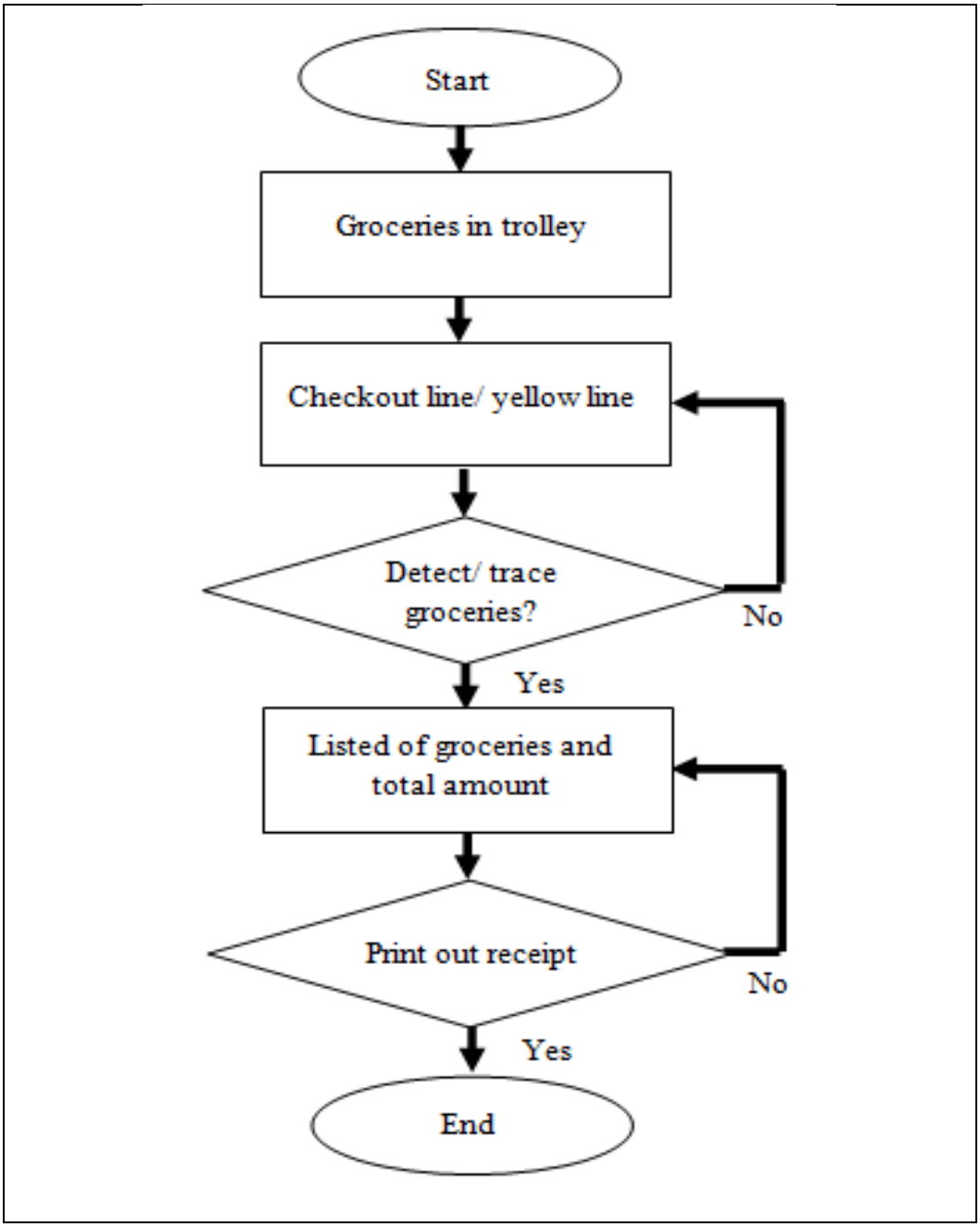


Figure 2.7a – Flowchart for Auto-checkout System for Retails

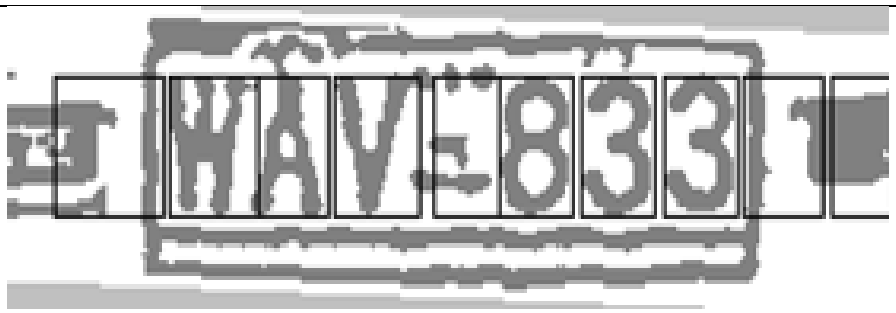
2.7.2 Automatic Number Plate Recognition for Australian Conditions

A research by Leonard G. C. Hamey in collaboration with Colin Priest (2005) for their national state of Australia produced 'A Automatic Number Plate Recognition for Australian Conditions'. The system is for a plate number of applications including law enforcement, services theft monitoring, access control and automated tolls. A successful services theft monitoring applications involves tracking vehicle registrations where the driver has not paid for petrol obtained from self-service petrol stations.

The research addresses four (4) key issues: (1) Vehicle presence: is the vehicle present? (2) Plate location: Position of the number plate image? (3) Glyph location: Where are the number plate glyphs within the plate? (4) OCR: Characters on the plate. According to a research by George Roussos (2008) it may be the simple process of retrieving an identifier stored in a tag. Reading a tag can be done straightforward first by transmit adequate energy to power up the tag and secondly by communicate with the tag to request and receive identifier.

In the research of by Leonard G. C. Hamey (2005) and Colin Priest (2005) they used Optical Character Recognition (OCR) to determine the plate number, despite of the proposed project, is about plate number recognition by RFID. OCR applied directly to plate region, scanning to locate positions of best match for each possible glyph plate [5].

Segmentation



Glyph rectangles

.03 .94 .95 .96 .02 .95 .95 .95 .03 .02
* W A V * 8 3 3 * *

OCR input and output

Figure 2.7b - Automatic Number Plate Recognition

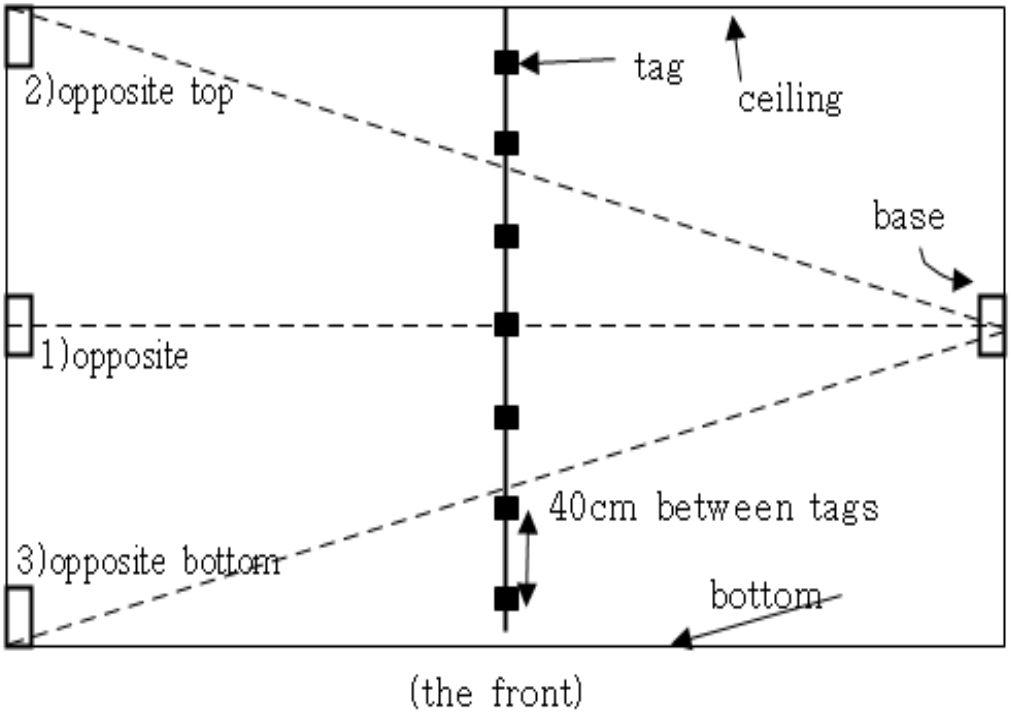
2.7.3 A RFID Configuration with an Enhanced Recognition Property for Indoor Positioning

A RFID system can be enhanced more its features by this research did. It is a system that enhanced property for indoor positioning to be more stable for seamless services. In the research shows RFID indoor positioning system which can recognize a lot of position information simultaneously as simple positioning tools for implementation to show comparison of performance enhanced. Full system developed by Sunghee Jeon & Joongoo Park (2009).

The accuracy of both RFID location-sensing systems is depends in signal strength such as reader's power and the number of tag referred. The system offered an optimal reader configuration without additional readers due to the lack of possibility of no signal area and cost limitation depends on reader number.

There are many parameter key exist for performance enhancement indoor positioning. They state that all the factors related (reader & tags, transmitting signal power of reader, sensing rate, number of reader and reference tag) with each other because no tag recognition zone has no use of RFID positioning method.

According to the location changes of target antenna, the receivers can be classified into three modes (opposite side, upper opposite side and lower opposite side) on straight line to the base antenna for measurement.



The location of target reader antenna on a straight line

Figure 2.7c – Figure of Enhanced Recognition Property

Result: on straight line, if the location of target antenna is higher than the base-antenna, sensing rates about tags under-side of the base antenna is lower than others in each position. This means tag sensing rate can be decided as the position of the reader. So they recommended the use of optimal reader configuration on the front burner in RFID indoor positioning system for performance enhancement.

CHAPTER 3

3.0 RESEARCH METHODOLOGY

In this chapter will discuss about the methodology that will be using in the development of Radio-Frequency Identification Based Plate Recognition for Register Vehicle in UMP.

For developing a radio-frequency based system, practical integration must be implemented due to specific characteristic needed in the system that is suitable for the project. There have four (4) section consists in this chapter. The first section explains about the introduction of development method that is method used to obtain and collect information regarding this project. The next section discuss about the architecture of design of the project. The third section will elaborate the hardware and software that was used in the development project and the last section will be the construction phase.

3.1 Introduction of Method

This method explains about the main part of development stages involved in the project. The main purpose of the method is to obtain the output of the tag by RFID. After detection process by the RFID reader, a number of statistics vehicles check-in and check-out can be obtain by the time in and time out day by day.

After analyzing details and all information has been gathered due to the requirements, the design phase manages to generate user diagram for the development. This will help to generate designing the interface of the system.

With the integrated of CASE (Computer Aided Software Engineering) tools, the design make the flowchart more practical to be develop. The use case shows the behavior of a functionality system that displays the relationship of the development. An actor will begin a process or an event by narrative description respond.

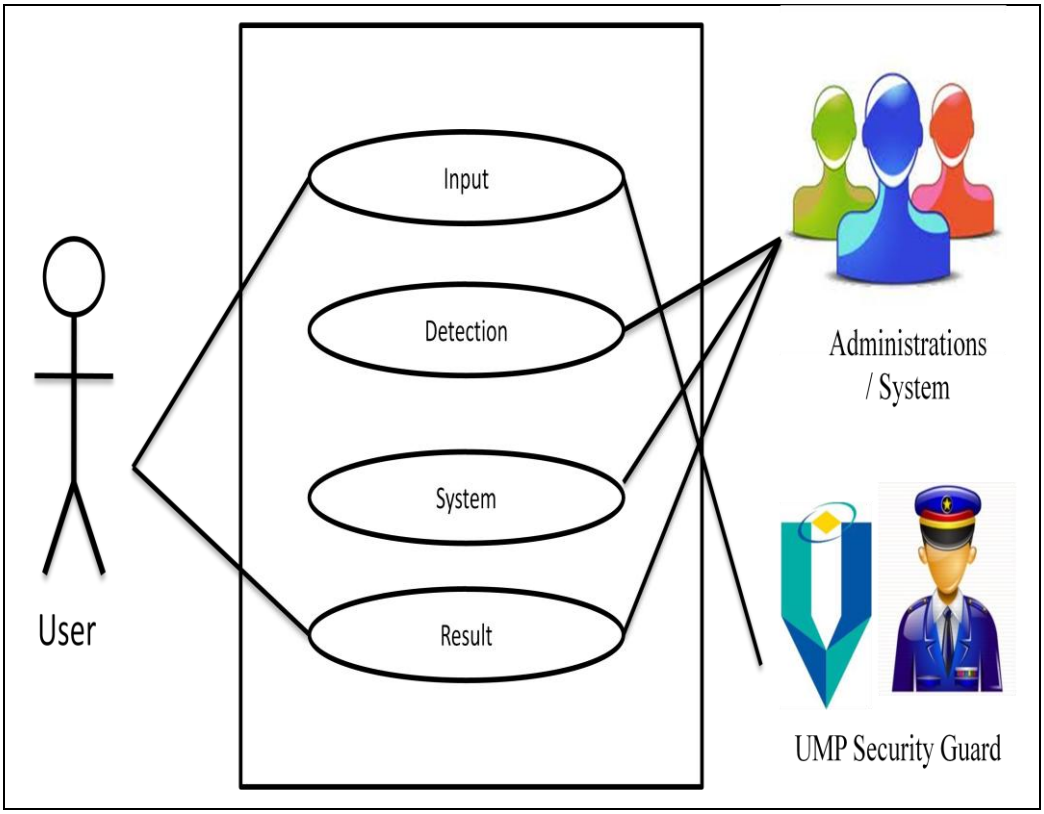


Figure 3.1a – Use case Diagram

3.2 RIFD Architecture

The RFID architecture consists of four (4) main modules to design based on system needed:

1) Input
2) Detection
3) System
4) Result

Structured based models chose to illustrate the flow of the system to make it more clearly for the system.

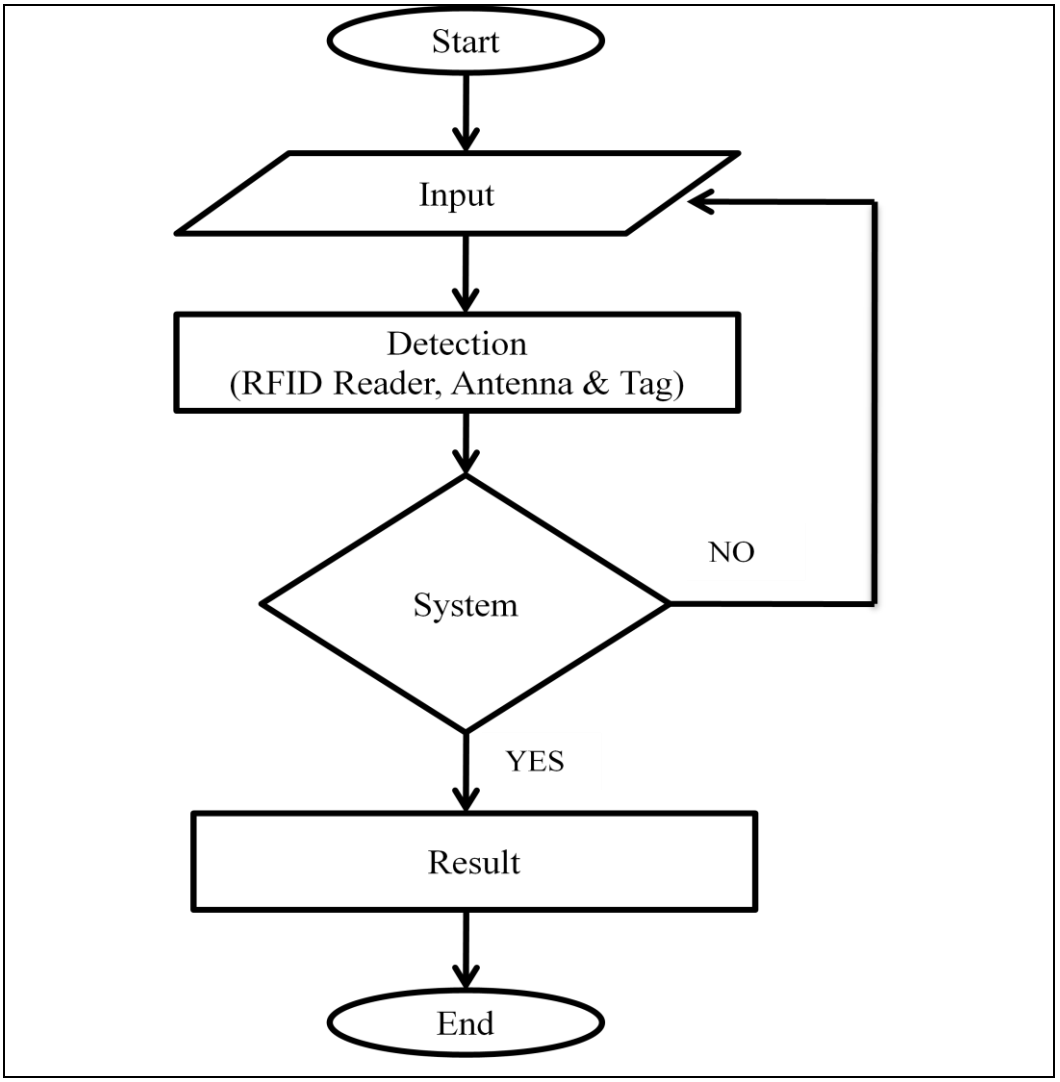


Figure 3.2a – Flow Chart Design of the System

3.2.1 Input Process

Input process is a phase that requires details to be delivered as input of the system.

The processes involved two parts that are registered and unregistered vehicle in UMP. This process is about key-in details information into RIFD tag. The process starts when the user registered the vehicle by online system of UMP and was process by Security Guard in Security Office. Security Guard will key in the user's data in the RFID tag. After the session complete, the tag will be attached to the vehicle plate number of the owner.

The tag will functioned as storage information and transmit the signal to RFID reader and antenna so that information in the tag will be processed.

For unregistered vehicle for student and staff, they still need to register anyhow unless for unregistered vehicle for outsiders, they need to report manually to Security Guard.

3.2.2 Detection

The process functioned when a registered vehicle with attached tag at plate vehicle enter the entrance of campus UMP. The RFID reader detect the radio waves that transmitted by the frequency of the tag at the plate vehicle. The reader generates a magnetic alternating field in the radio frequency range. The tag used is passive tags consist no internal battery power. This give advantage to the user for not required any battery in the tag. The reader also comes with antenna which functioned to sense transmitted modulated carrier wave. Frequency of tag communicates by carrier wave that carry data RFID tag antenna to resonate carrier frequency invoke.

Then process continues by 'reading' the tag by the antenna with fixed distance by administrations. Average distance about 100-200m was set between the tag at plate vehicle and RFID reader to make the system easy to detect in near and clear position by the tag. Also practical if any breakdowns happened, easy to fix by adjusting the position and also convenient to unregistered vehicle to manually report at security guard.

3.2.3 System

After the screening process by the reader, the information of the tag will appear in the system and verify the registered vehicle. Only registered vehicle with the tag can be verified by the system. Else, for vehicle with no tag must manually report to security guard and registered online in the system Vehicle Registrations in UMP E-Comm.

3.2.4 Result

As a result of registered vehicle with tag, the barrier will open and user can pass by the entrance and enter the campus of UMP. By the system, it will report the time in for check-in and time out for check-out of the user and will transform by statistics day-by-day.

3.2.5 Mechanism of Design

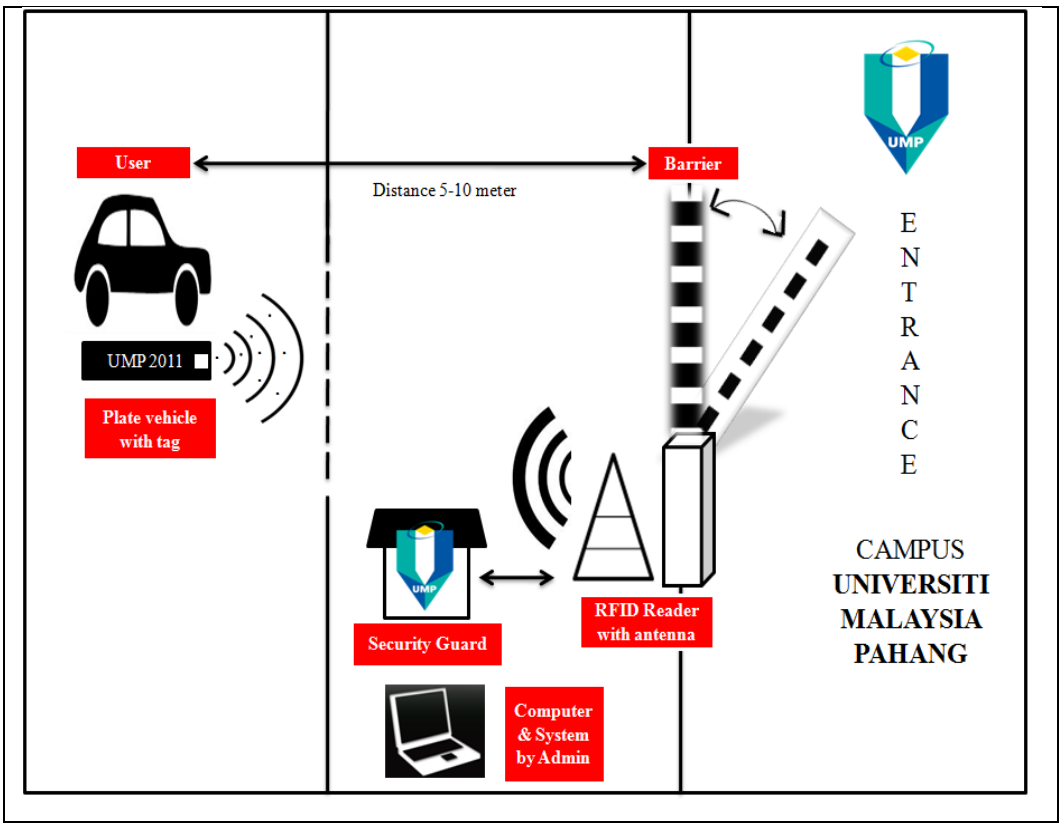


Figure 3.2b – The Mechanism of Design

3.3 Software and Hardware Tools

Effective and efficient requirements activities are absolutely essential when software systems meet the hardware and make the expectations of the project is successfully on the track.

Software, hardware and other resources need to be identifying before developing the project.

3.3.1 Hardware

The recommended hardware requirement for deploying the project:

Component	**Requirement**	**Purpose**
RFID Tag	**Passive** • UHF	• Programmed with unique information with based tracked system.
RFID Antenna	RFID Antenna 865-960 MHz	• Emits radio signals to activate the tag & write data to it.
RFID Reader	RFID Reader UHF 868/915 MHz	• Emits radio waves in ranges of 1 inch to 100 feet depend to the radio-frequency.

Computer/ Laptop	Any brand; Ex: HP, Sony, Asus, Lenovo, etc.	• Process the encoded data in the tag's integrated circuit that decodes by the reader.
CPU	32-bit / 64-bit	• Carries out the instructions of a computer program to perform input/output operations of the system.
RAM	2/3/4 GB	• Form of computer data storage
Processor	2.5 GHz - Dual processors/faster	• Translate and converts data more faster

Table 3.3a – Hardware Requirements

3.3.2 Software

The software needed to deals with specifications of requirement is:

Component	Requirement	Purpose
Microsoft Office	• Microsoft Word 2007	• For report and documentation

	• Microsoft PowerPoint 2007 • Microsoft Project 2007	• Presentation slides • Gantt-chart process
Windows	• Vista • XP • Windows 7	• Operating system that used in prepared documentation and system development.
RFID Software	• RFIDToolkit Software; Ex: Rifidi Toolkit, RFID Gazette	• Easy to encode radio-frequency
Microsoft Visual Basic.Net	• Visual basic programming or any similar software	• Develop interface with object-oriented computer programming language
Database Software	• Oracle / MySQL	• For storing group of data

Table 3.3b – Software Requirements

3.4 Construction

The construction phase focuses on the program and application development task such as a detail interface design for the project.

The system of project is programmed in Microsoft Visual Basic.Net which developed interfaces for the ongoing system. This tool also has multiple frameworks with multitasking button with implemented programming setting up to the system. A user-friendly platform is design for the administrations and security guards to handle.

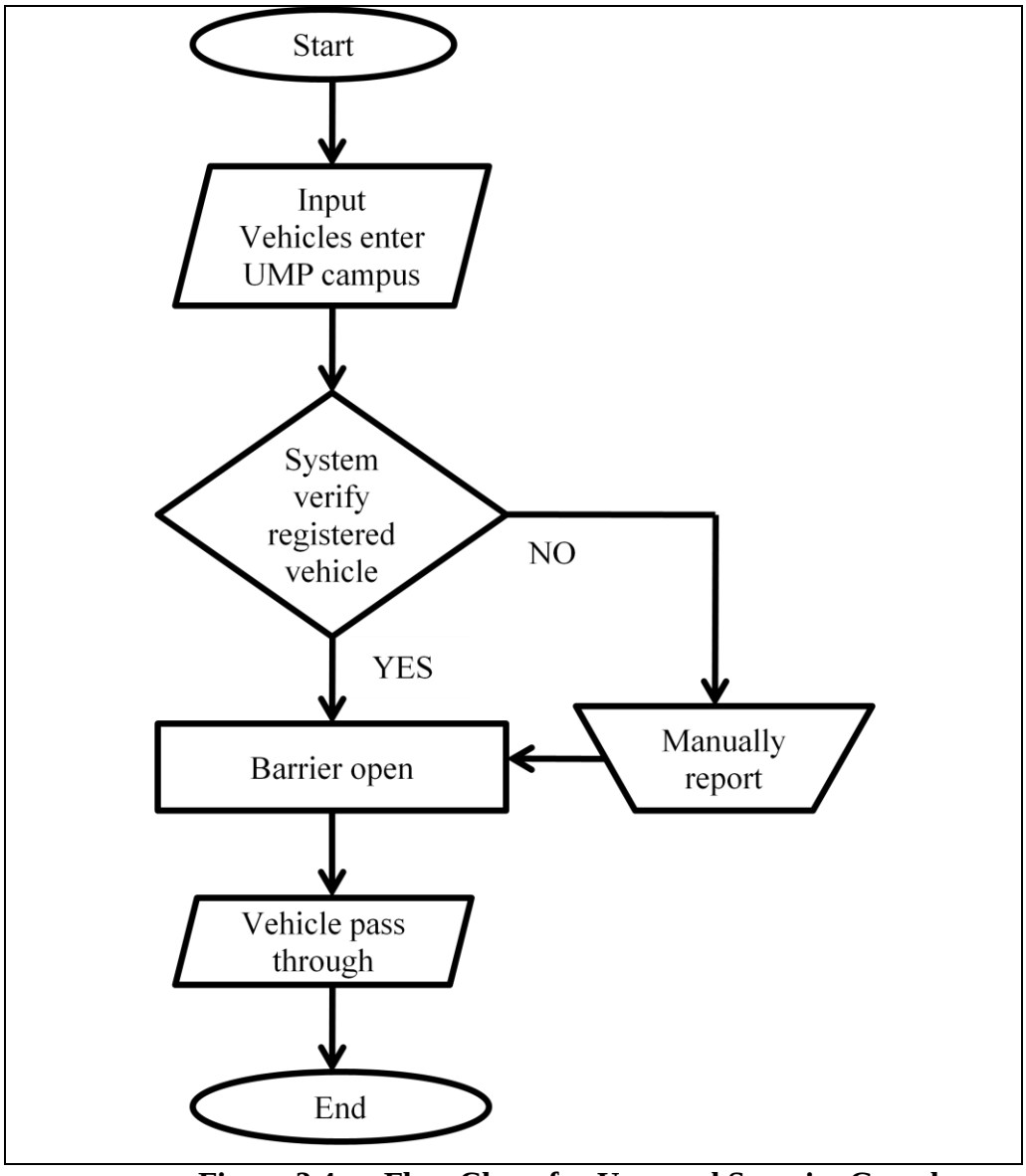


Figure 3.4a – Flow Chart for User and Security Guard

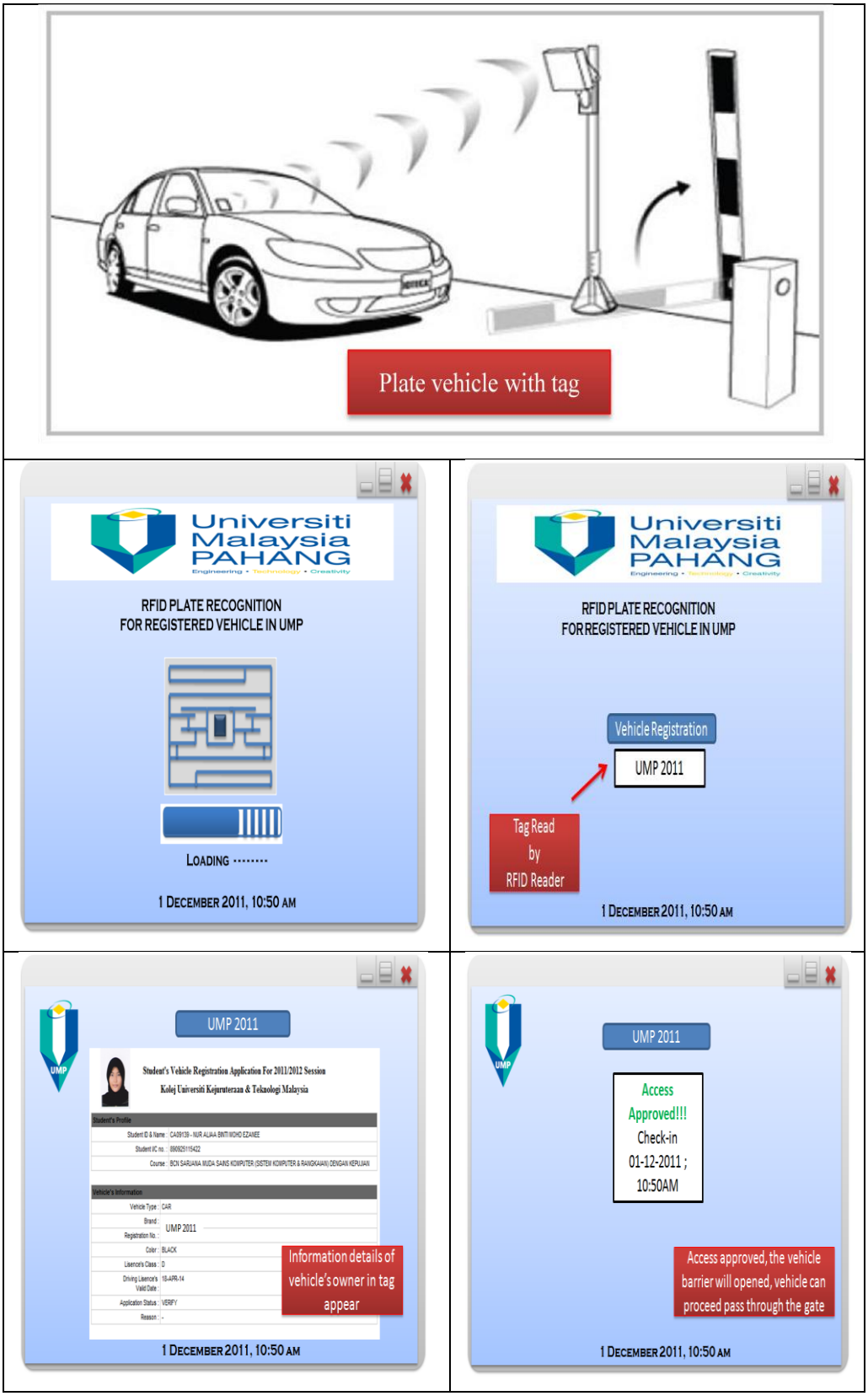


Figure 3.4b – Interface System for Registered Vehicle in UMP

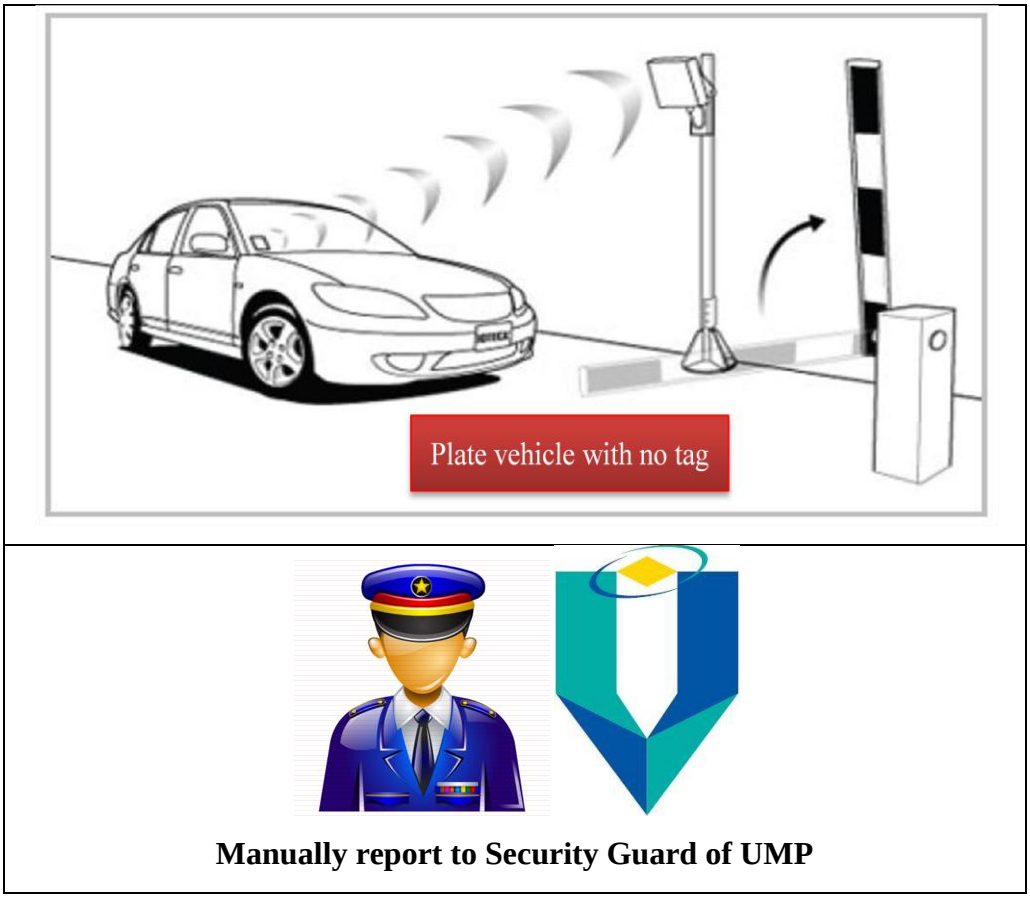


Figure 3.4c – Interface System for Unregistered Vehicle in UMP

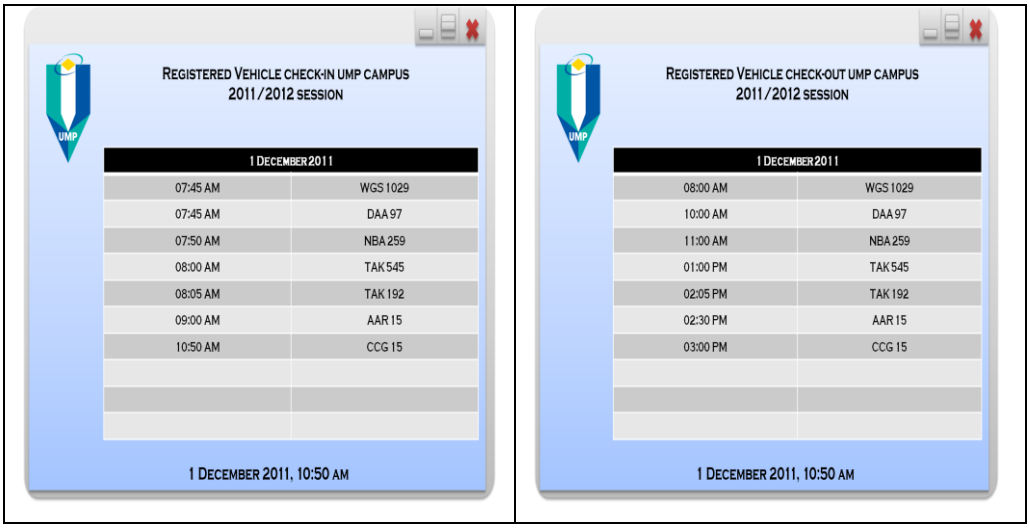


Figure 3.4d – Interface Statistics of Registered Vehicle

Check-in & Check-out with time

3.5 Context Diagram

Context diagram for RFID Plate Recognition system shows as figure below. The user (student/staff) firstly will apply for tag, to register legally as valid staff and student of UMP. After the operation of RFID, the user data saved in the passive tag and also in the system, key in by Security Guard. Then the user will attach the tag at plate number of the vehicle and when the user reaches the entrance, the RFID reader and antenna will detect and open the barrier gate. The system will check and update by Admin and manage report as well.

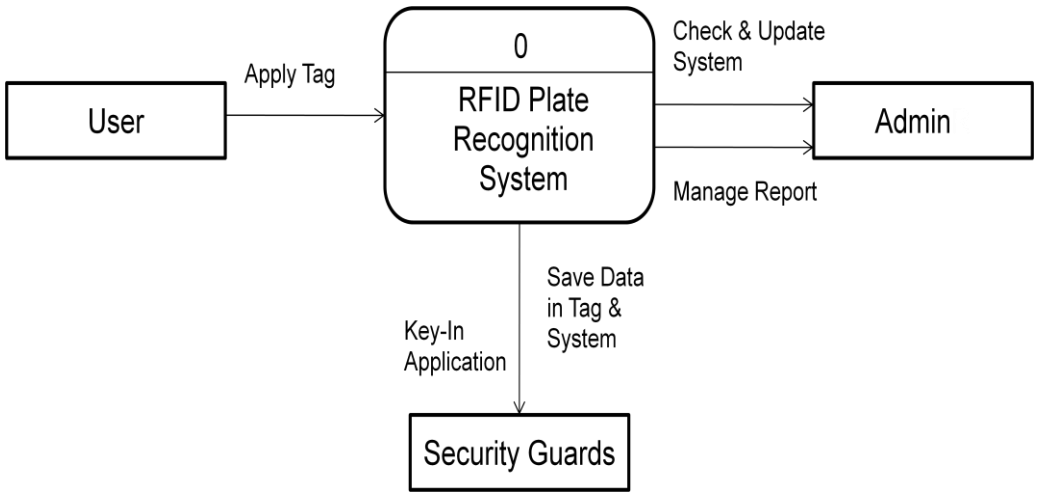


Figure 3.5a – Context Diagram for RFID Plate Recognition System

3.6 Data Flow Diagram Level 0

The figure below shows the flow for Admin and Security Guards to access system. They need to login first before proceed to next part. After operation, the reader will read data and send it to database. The data will update to the system. After data had been recorded, the barrier gate will open and vehicle can get access to UMP campus.

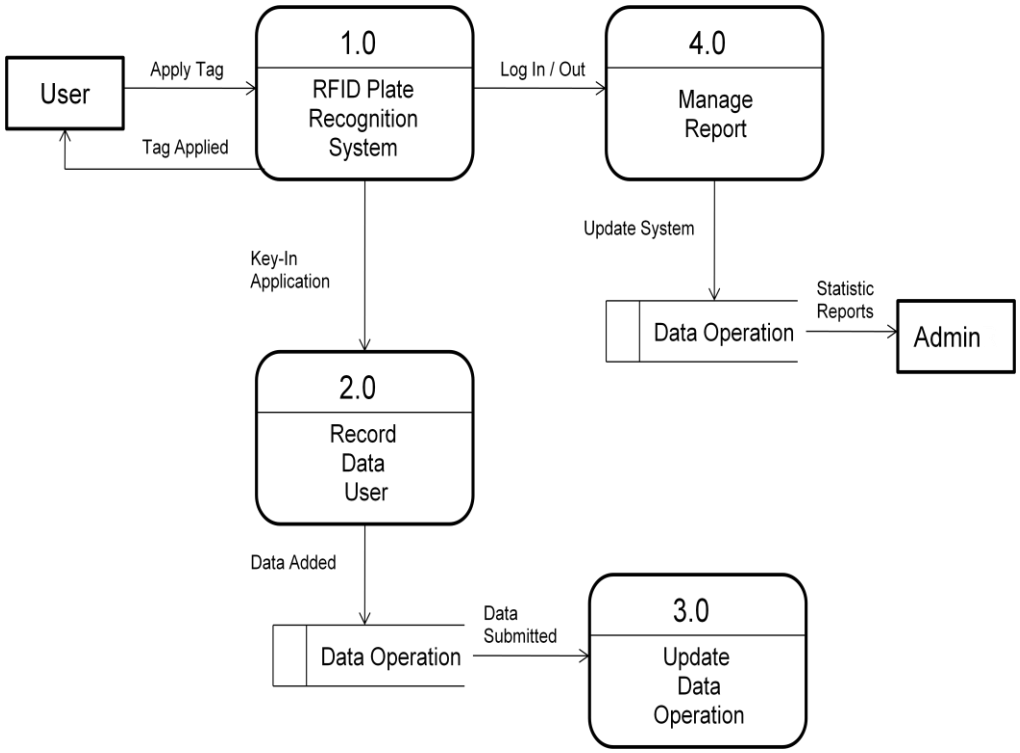


Figure 3.6a – DFD Level 0 for RFID Plate Recognition System

3.7 Data Flow Diagram Level 1

The diagram shows the next phase after the barrier gate open and vehicle pass by. The reader will read tag, and then the data recognize, and will be recorded in database.

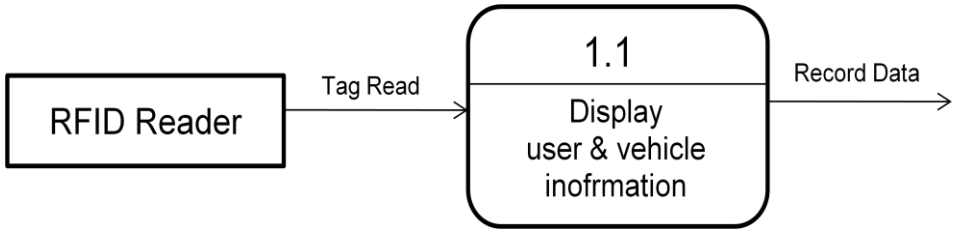


Figure 3.7a – DFD Level 1 for RFID Plate Recognition System

3.8 Process of Database Design

Database modelling and design in logical part, called normalization. It is a process of converting complex data structures into simple, stable structures. In process of design the logical database, there are steps required; the first key develop a logical data model using normalization principles, combine normalized into solidities logical database model (integration) and translate it to E-R data model and compare the consolidated logical database.

Admin Info

Field	Description	Type	Contraints
ID	The ID of Admin	Varchar (10)	PK
AD_NAME	The name of Admin	Varchar (10)	
AD_PASSWORD	The password of username Admin	Varchar (10)	
AD_CONFIRM	The confirmation password of username	Varchar (10)	
AD_STATUS	The status of Admin	Varchar (10)	

Table 3.8a – Admin Database Design

Staff/Student Info

Field	Description	Type	Contraints
REG_NO	The registration number of staff/student vehicle	Varchar (10)	PK
SERIAL_ID	The tag ID for staff/student vehicle	Varchar (10)	
S_ID	The ID of staff/student	Varchar (10)	
S_NAME	The name of staff/student	Varchar (10)	
S_IC_NO	The IC number of staff/student	Varchar (10)	
S_CATEGORY	The category of staff/student	Varchar (10)	
S_DEPARTMENT	The department of staff/student	Varchar (10)	
S_TEL_NO	The telephone number of staff/student	Varchar (10)	
S_ADDRESS	The address of staff/student	Varchar (10)	
S_DATE	The date registered	Varchar (10)	
S_ACADEMIC_YEAR	The academic year of staff/student	Varchar (10)	
S_VEHICLE_TYPE	The vehicle type of vehicle	Varchar (10)	
S_VEHICLE_BRAND	The vehicle brand of vehicle	Varchar (10)	
S_VEHICLE_COLOUR	The vehicle colour of vehicle	Varchar (10)	
S_LISENCE_NO	The licence number of staff/student	Varchar (10)	
S_LISENCE_VALID_ DATE	The licence valid date	Varchar (10)	

Table 3.8b – Staff/Student Database Design

CHAPTER 4

4.0 IMPLEMENTATION

This chapter discuss about the development and implementation process of the project. In this chapter, the objective is to record all phases od developing the system for future improvements and enhancements. The documentation for this process is important to give more understanding to the user.

4.1 Result of Radio-Frequency Identification (RFID) Based Plate Recognition for Registered Vehicle in UMP

Radio-Frequency Identification (RFID) Based Plate Recognition for Registered Vehicle in UMP with implementation and integration are functionally working when the barrier opened and all output of the details of vehicle is clearly pass through the system with function of RFID.

This system is expected to run with free error and should be capable to function every time there is a tag to read of plate number by RFID reader. The detection also will be expected to detect the time in and time out of every check-in and check-out of vehicle entering the entrance of UMP campus gate.

The end results of the development phase are categorized into three (3) parts; system interfaces, system database and RFID connection. The system output will demonstrate the functionalities of the system due to its requirements.

4.2 System Interfaces

To ensure the system works properly, it is required for testing implementation for user and administrator to get used of the system.

Thus, the interface design implemented to facilitate user.

i. Consistency and Standard

Easy standard user interface are developed for user and also administrator to monitor the system. All the interfaces are standardized according to layout size, providing with common known button directly can be understood. Same goes to the wordings, labels and forms are acknowledged to the user.

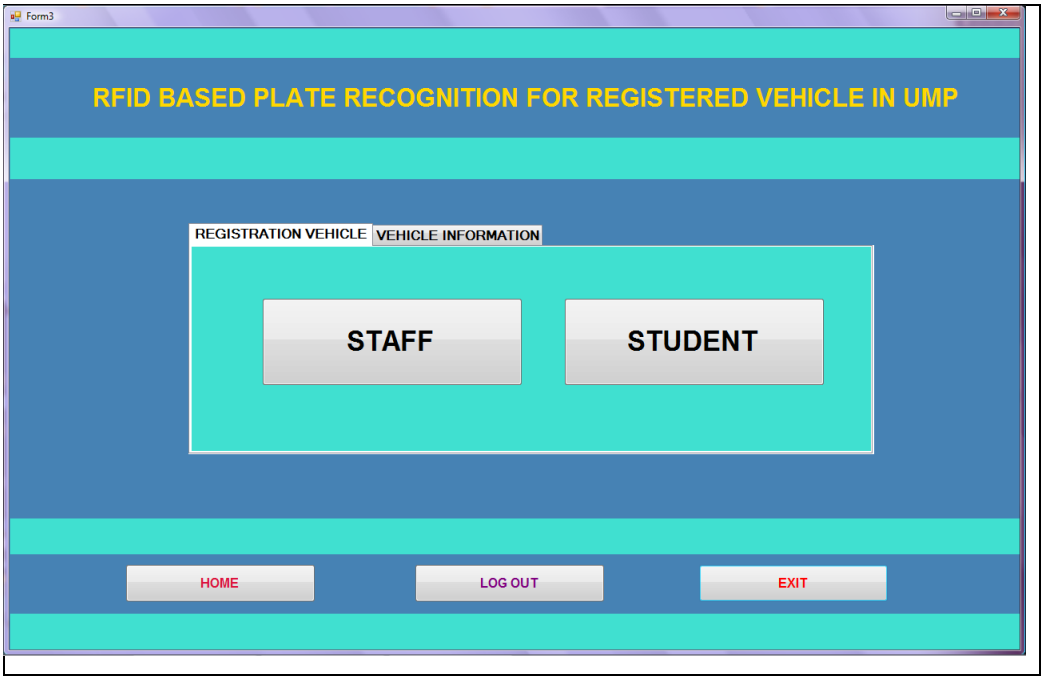


Figure 4.2a – Consistency and Standard Interface

ii. Error Prevention

Design to prevent problem at the first place. If the user key in the wrong data such as invalid username or password, the message box will appear to acknowledge user about the error.

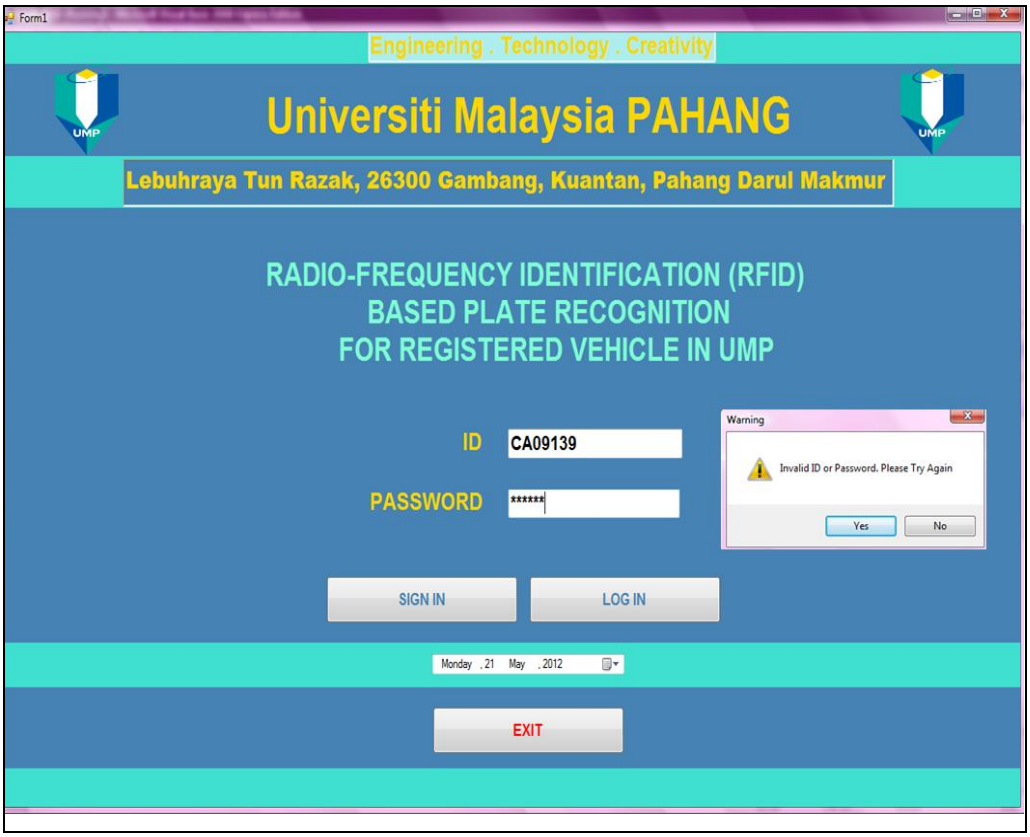


Figure 4.2b – Error Prevention Interface

iii. Recognize, Diagnose and Recover Error

This error message should pop up when some of the column or boxes are not filled in. From that the user will notify to complete the session before continue to the next page.

Figure 4.2c – Recover Interface

4.3 Database Constructions and Tables

For database, the system of RFID database is constructed by using Microsoft Access 2003. The tables are more easily created as well as the queries scripts in the system. There are three (3) tables for the system; ADMIN_INFO, STAFF_INFO, STUDENT_INFO, VEHICLE_INFO. Each table play their own roles.

i. ADMIN_INFO

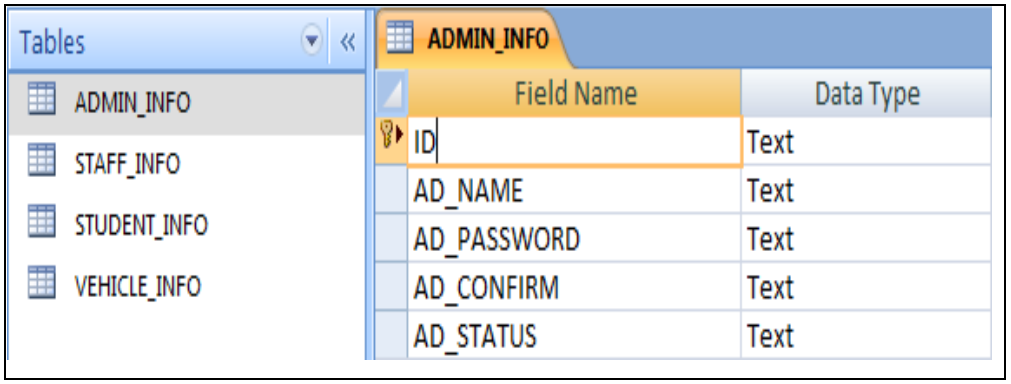


Figure 4.3a – ADMIN_INFO Database

ii. STAFF_INFO

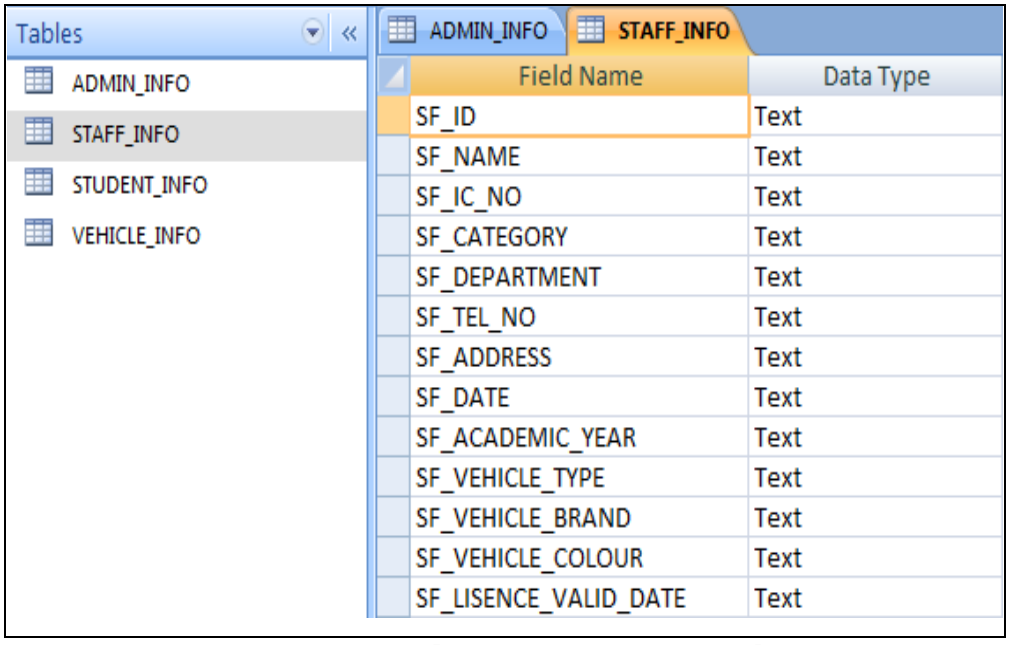


Figure 4.3b – STAFF_INFO Database

iii. STUDENT_INFO

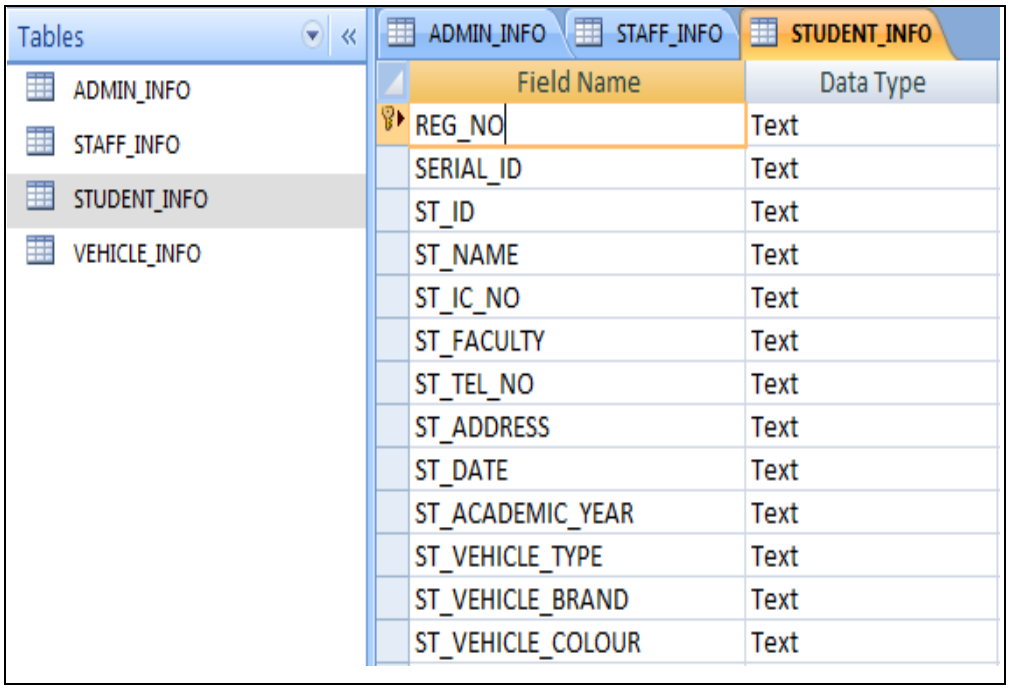


Figure 4.3c – STUDENT_INFO Database

iv. VEHICLE_INFO

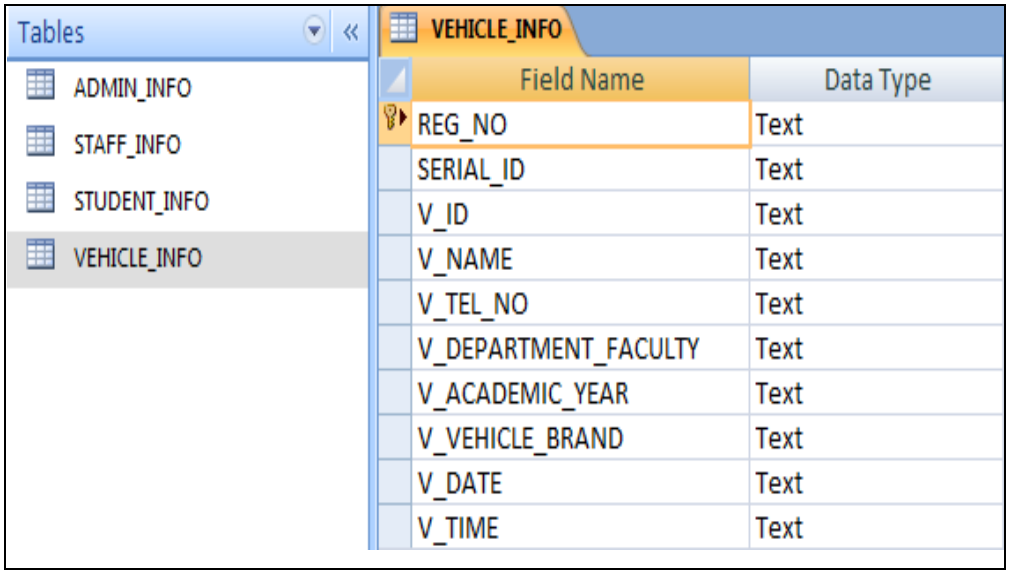


Figure 4.3d – VEHICLE_INFO Database

4.4 Interface Design

To log in the system, the administrator and security need to access by key in the ID and password first. If they not yet have an ID, so they need to sign in. Then the steps include from the first step until finish tagging the vehicle.

1. Welcome Log in Page

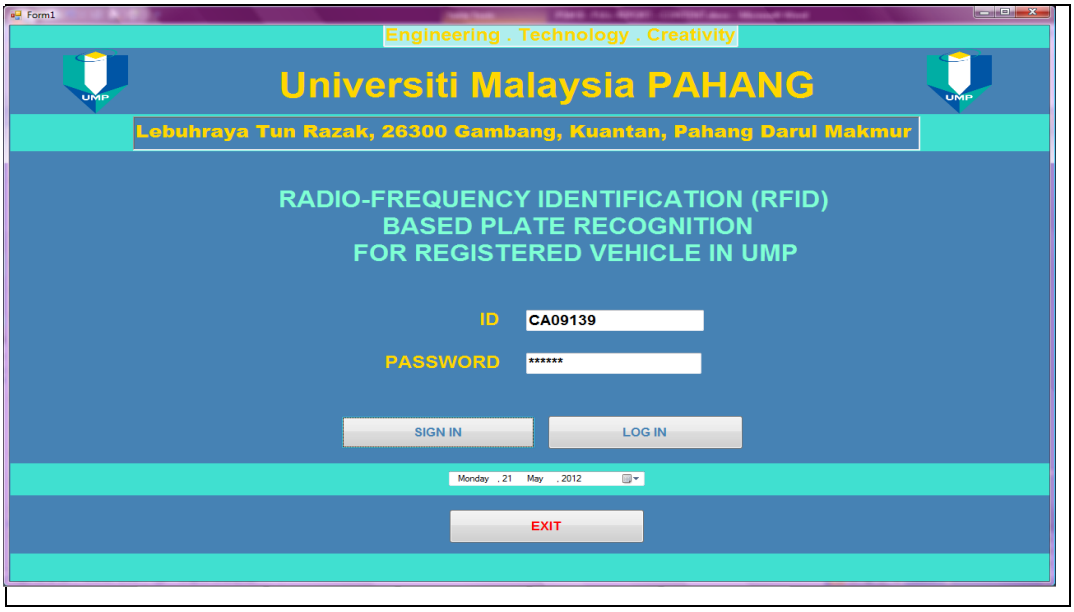


Figure 4.5a – Welcome Log in Page

2. Sign In

Figure 4.5b – Sign In

3. Home Page

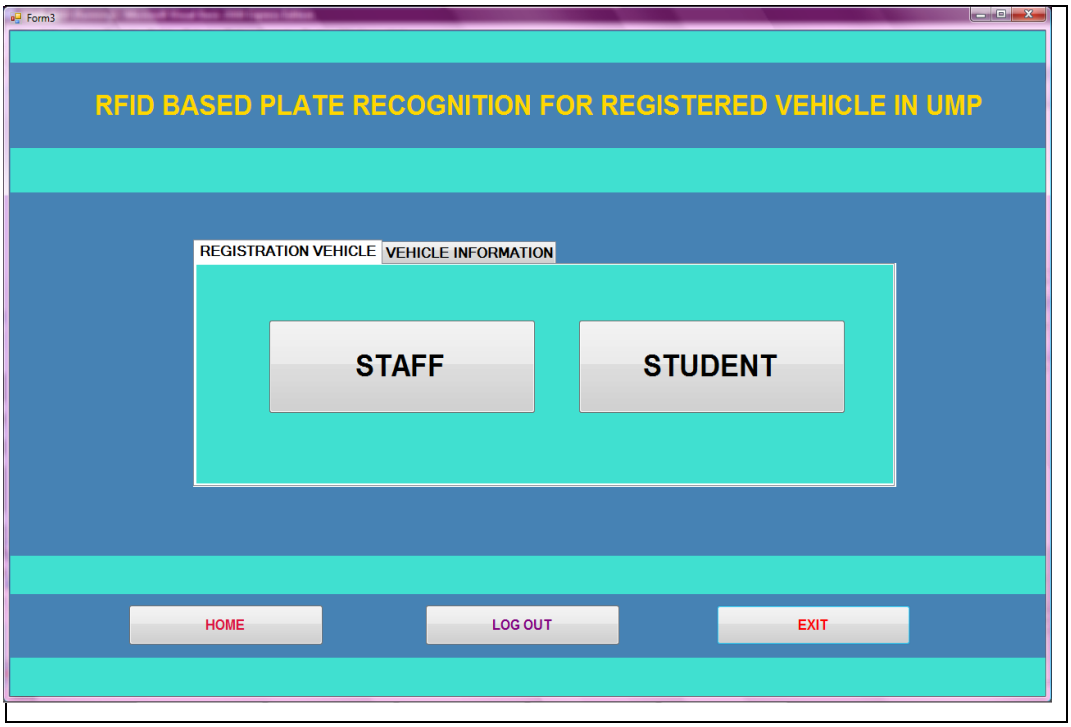


Figure 4.5c – Home Page

4. Staff Application

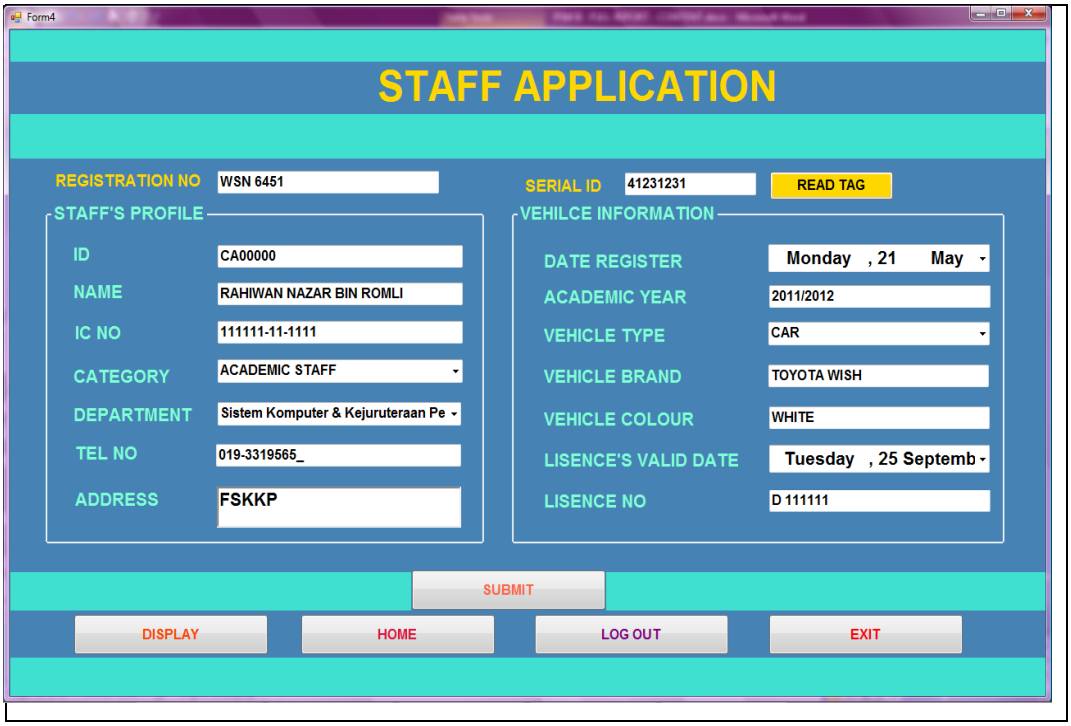


Figure 4.5d – Staff Application

5. Student Application

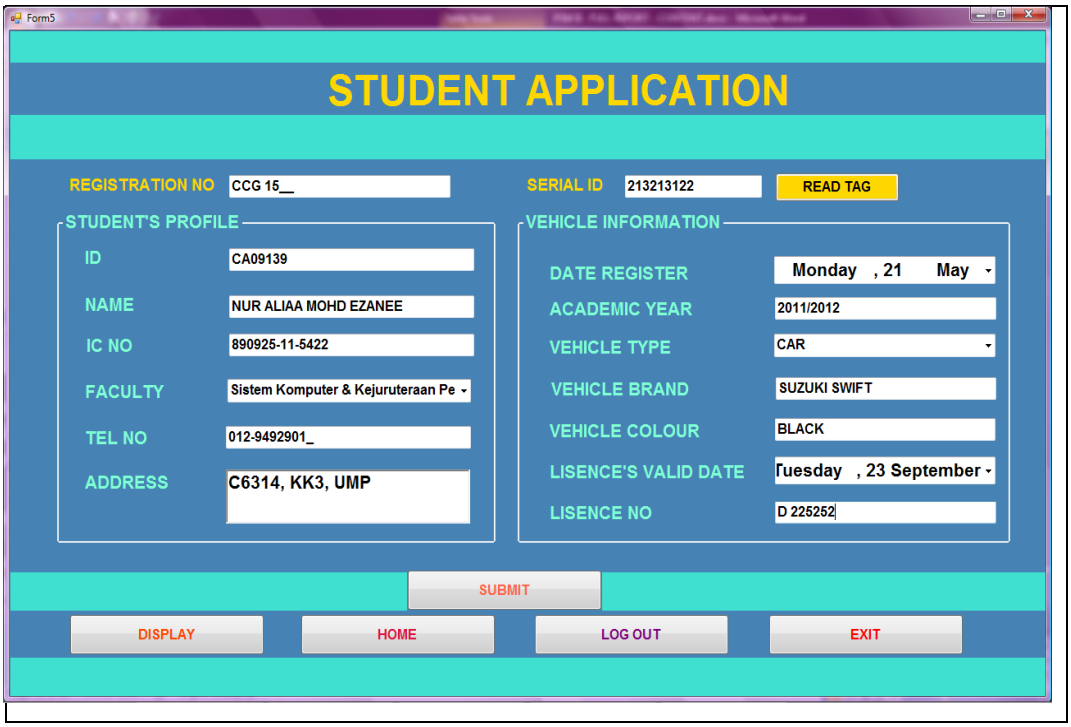


Figure 4.5e – Student Application

6. Staff Information

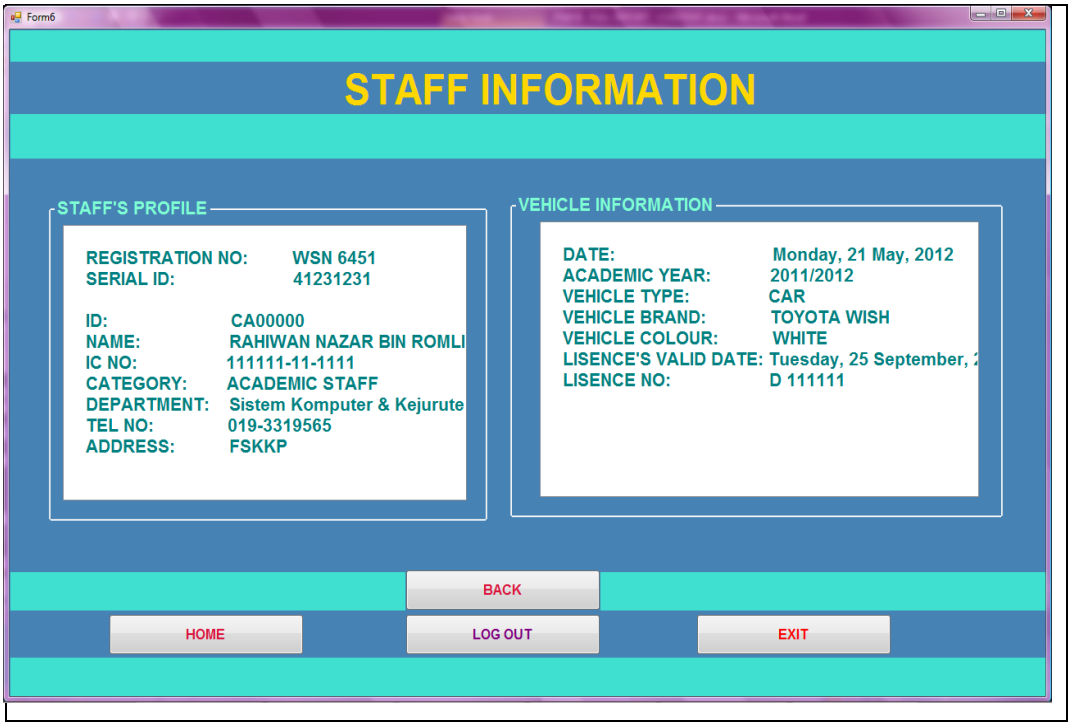


Figure 4.5f – Staff Information

7. Student Information

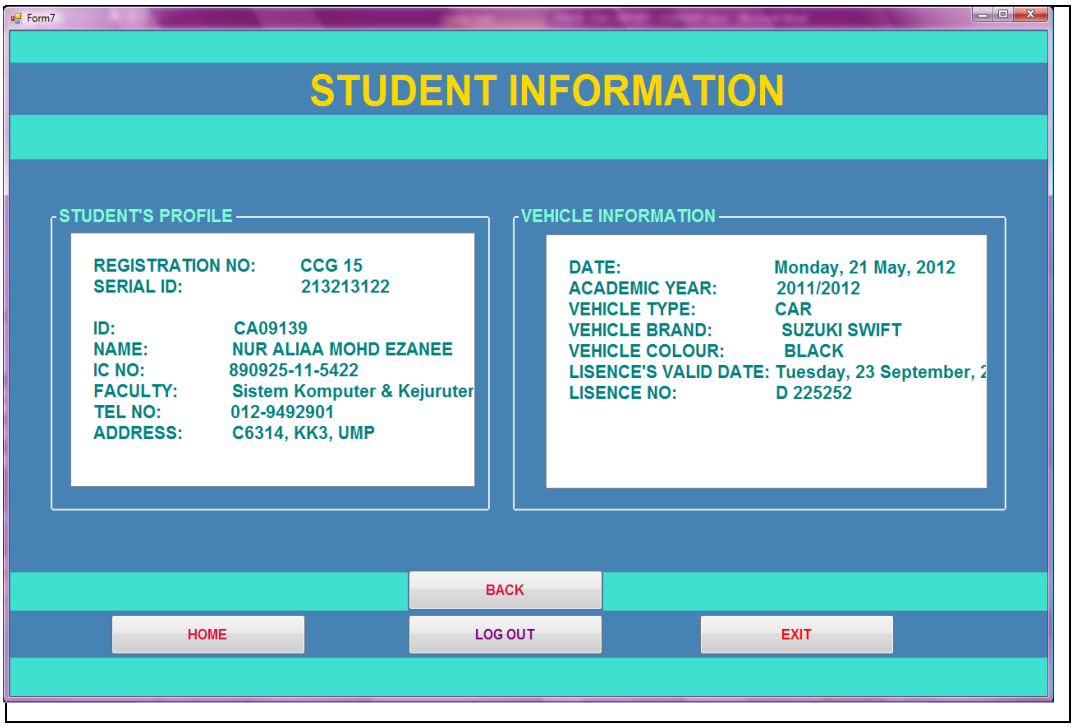


Figure 4.5g – Student Information

8. Check In Vehicle

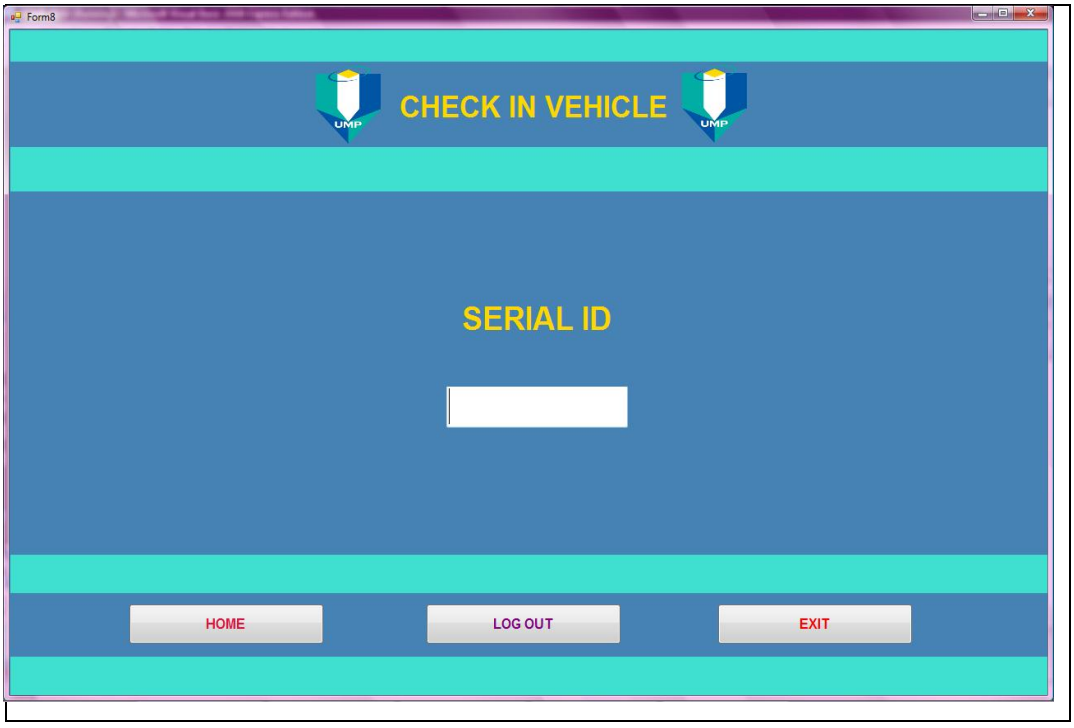


Figure 4.5h – Check In Vehicle

9. Vehicle Information

Figure 4.5i – Vehicle Information

CHAPTER 5

5.0 RESULTS AND DISCUSSION

This chapter mainly discussed about the result and discussion of Radio-Frequency Identification Based Plate Recognition for Registered Vehicle in UMP. This chapter also discuss about development, constraint and obtains data, clarifies the objective achieved.

5.1 Result Analysis

The system is declared achieved the objectives which are:

1) To develop a prototype of Radio Frequency Identification Technology (RFD) systems and technology for vehicle plate recognition.

2) To recognize the vehicle that only registered in UMP will be allowed to enter the campus of UMP.

    - The system can only be access by registered vehicle in UMP, managed by only Admin and Security Guards.

3) To make statistics on the number of vehicles check in and out of the campus UMP.

5.2 Constraints

i. Development Constraints

- Lack of programming skills

  Programming skill is the key of development constraint because any system needs programming to build. In order to develop the system in Visual.Net, I need to study more on programming part.

- Time consuming

  Time management in order to arrange the task as final year student quite a bit tough for me. To balance other assignment and to focus on final project is a challenge to complete all task.

ii. Hardware Constraints

- Lack of hardware knowledge

  RFID is a new technology to student especially to UMP student. To gain further information about RFID, I need to survey and explore myself about RFID. Based on guidance from supervisor, friend and all the research reading, I manage to get information for RFID.

iii. Physical Constraints

- Prototype scale of size

  Due to some technical problem, the prototype scale is generally scalable to the real version but need to improve the certain part of the model.

5.3 Future Research

For future research, it is encouraged for the system to detect RFID tag in some greater distance and it may be implemented in the server so that the data will save in secure condition.

More unique data might be added such as picture of the registered vehicle, statistics time for user and more database options can be developed.

The project is recommended for final year project.

CHAPTER 6

6.0 CONCLUSION

This project is aimed to develop a system of Radio-Frequency Identification Based Plate Recognition for Registered Vehicle in UMP. It is design for UMP staff & student to enter the entrance only with registered identification what will read by RFID reader and verify the check-in and check-out process.

The research on RFID for the system should be able to provide better conceptual in developing process as to run it due to the goals of achievement in objectives project. In hopes of solving the major problem statement that is unauthorized vehicle entering campus of UMP campus without inspection and the unknown statistics for vehicle check-in and check-out the campus would be the major goals to reveal.

The functions of RFID to detect the tag attached by the plate number vehicle and read the info in the tag to verify the vehicle owner so that only the plate with the tag can pass by the gate without manually inspection by security guard.

By the architecture of the project and the implementation of RFID, the system will come out with the prototype by plate recognition of registered vehicle in UMP.

6.1 Result Analysis

RFID Base Plate Recognition for Registered Vehicle in UMP: Practicalities in security session to enter the campus and exit from the UMP have achieved the objectives which are:

- To develop a prototype of Radio Frequency Identification Technology (RFD) systems and technology for vehicle plate recognition.

- To recognize the vehicle that only registered in UMP will be allowed to enter the campus of UMP.

- To make statistics on the number of vehicles check in and out of the campus UMP.

6.2 Lesson Learn

During developing process, there are lots of lesson that I had learn.

The lesson I acknowledge the most is ViusalBasic.Net language, helps me a lot trough all part of consequences of the system, the failure and success of running coding, improve my knowledge in the process.

Time organization helps me to be better person as student and also as human being. Appreciate the time to manage all task in order to finish it due to dateline had turn me to become organized person.

In addition, I had discovered overall knowledge about RFID technology and system; communicate with the hardware and software, the advantage and disadvantage of RFID itself.

I had so much time learning although it is quit challenge task as final year to complete this final year project, but I am manage to complete it done with all input I gain in the process of developing this project; Radio Frequency Identification (RFID) Base Plate Recognition for Registered Vehicle in UMP.

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APPENDIX

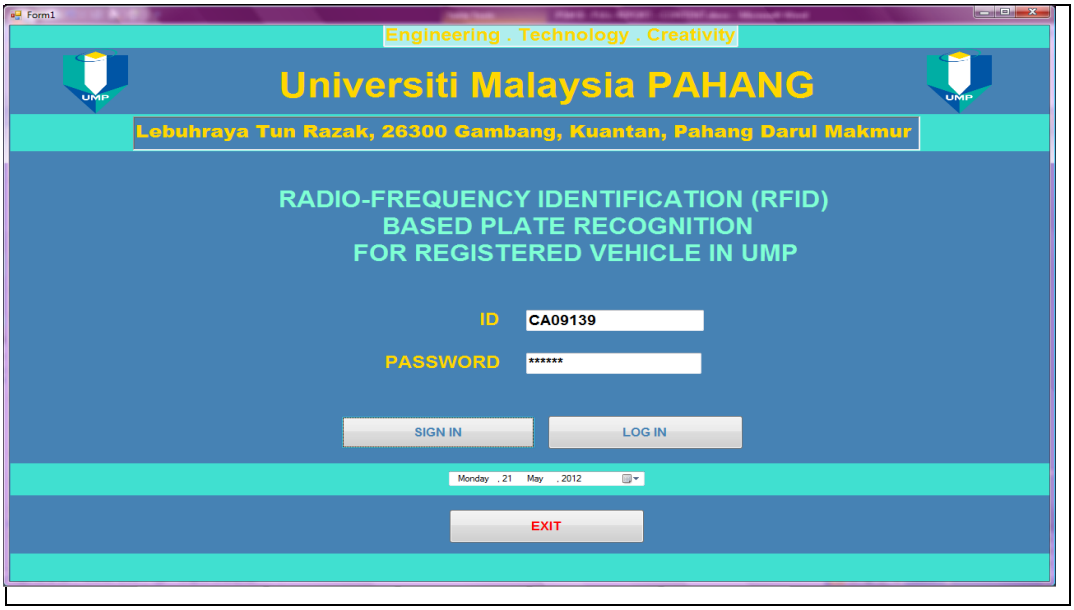
GANTT CHART

	Task	Start date	End date	SEPT 11	OCT 11	NOV 11	DEC 11	JAN 12	FEB 12	MAR 12	APR 12	MAY 12	JUNE 12
1	**Literature Study**	12/09/11	15/06/12										
2	**Planning**	13/09/11	15/01/12										
3	RFID system	13/09/11	15/11/11										
4	Development study	16/11/11	15/01/12										
5	**Analysis Requirement**	16/01/12	31/01/12										
6	-Software	16/01/12	18/01/12										
7	-Hardware	19/01/12	23/01/12										
8	-RFID functions	24/01/12	31/01/12										
9	**Design**	01/02/12	26/02/12										
10	-System interface	01/02/12	07/02/12										

11	-System design	08/02/12	17/02/12	
13	**Development**	27/02/12	30/03/12	
14	**Testing**	31/03/12	30/04/12	
15	-Interface Design	31/03/12	15/04/12	
16	-System	16/04/12	30/04/12	
17	**Implementation**	01/05/12	10/06/12	
18	-Coding	01/05/12	27/05/12	
19	-Installation	28/05/12	10/06/12	
20	**Operation and Maintenance**	11/06/12	15/06/12	

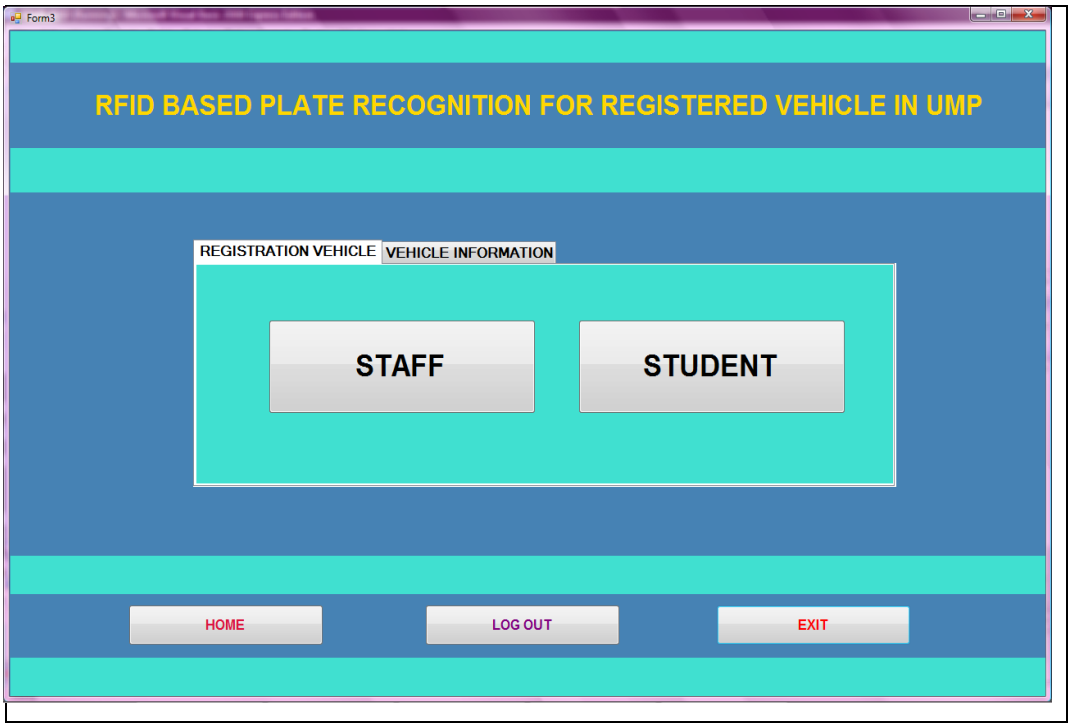
INTERFACE DESIGN

1. Welcome Log in Page

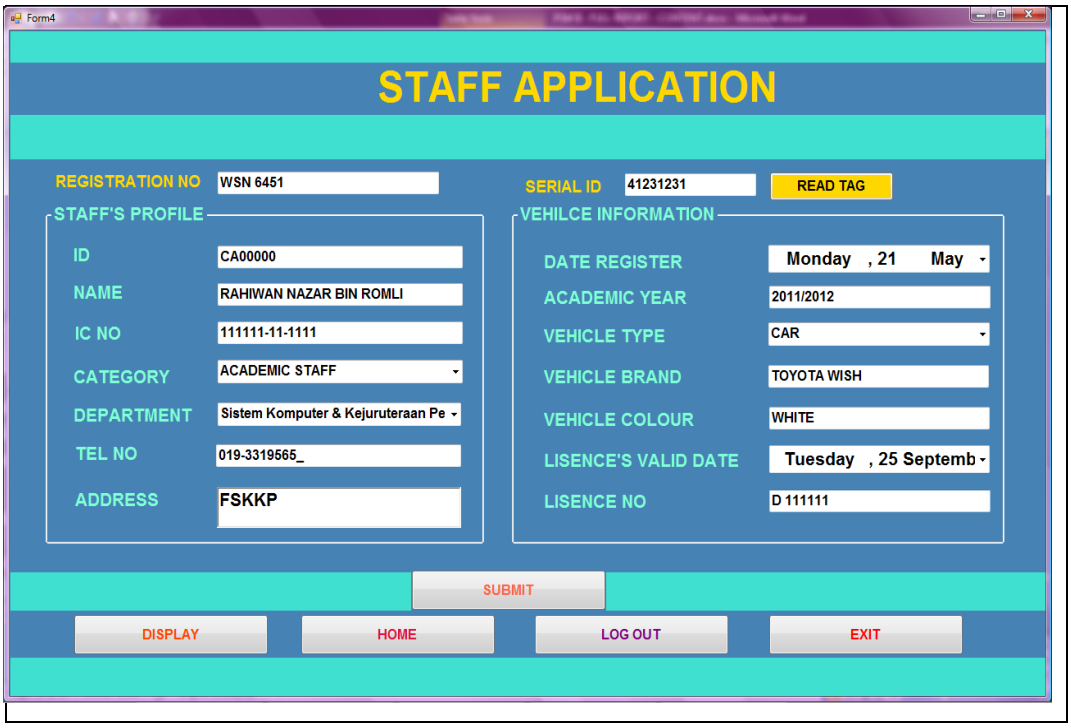


2. Sign In

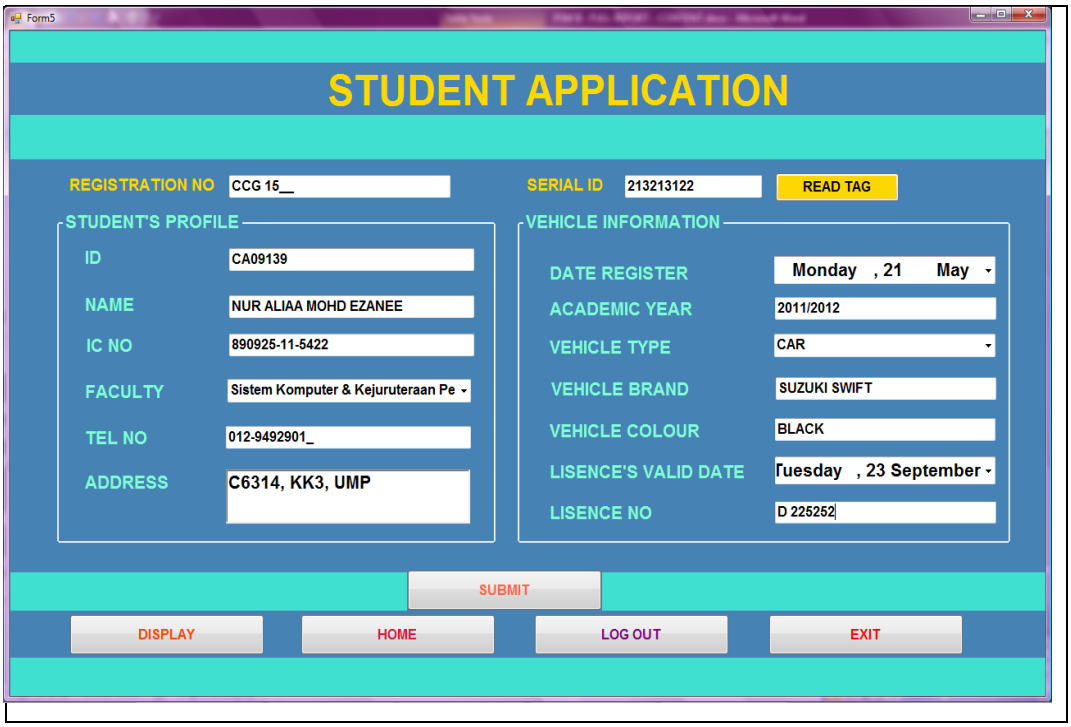
3. Home Page



4. Staff Application

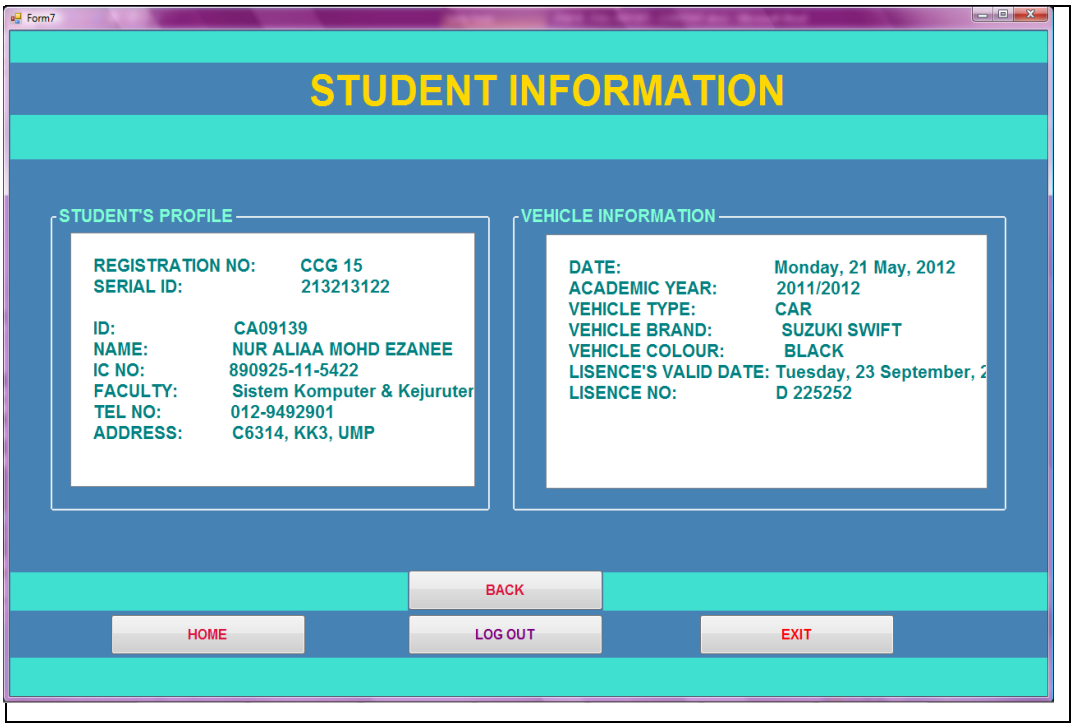


5. Student Application

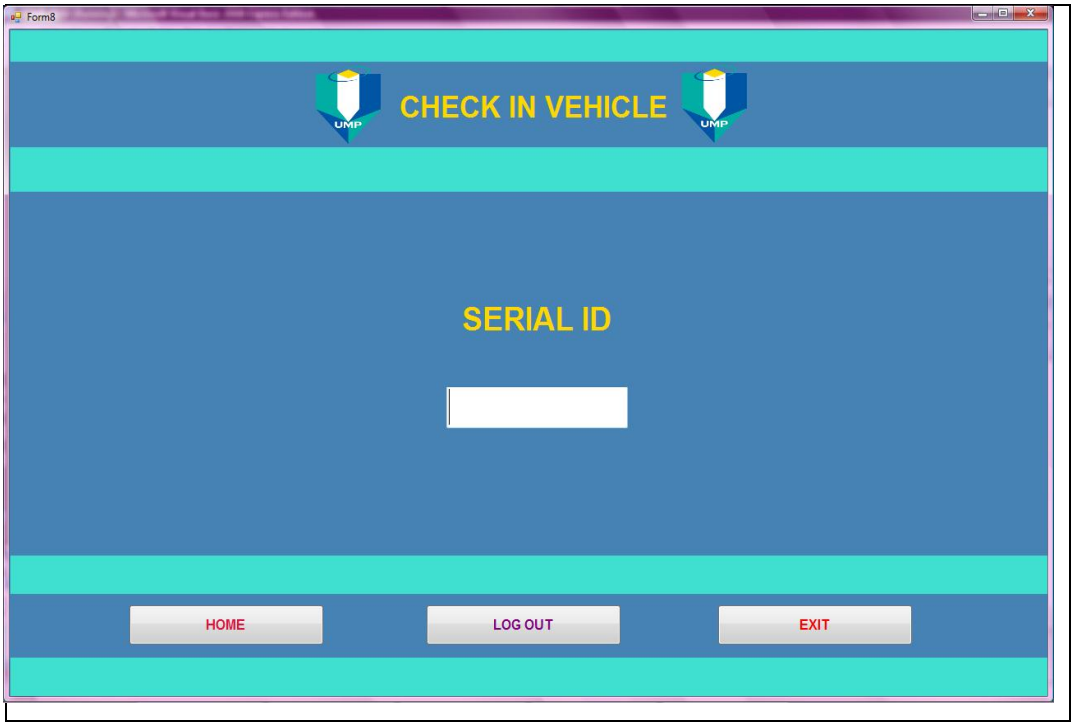


6. Staff Information

7. Student Information



8. Check In Vehicle

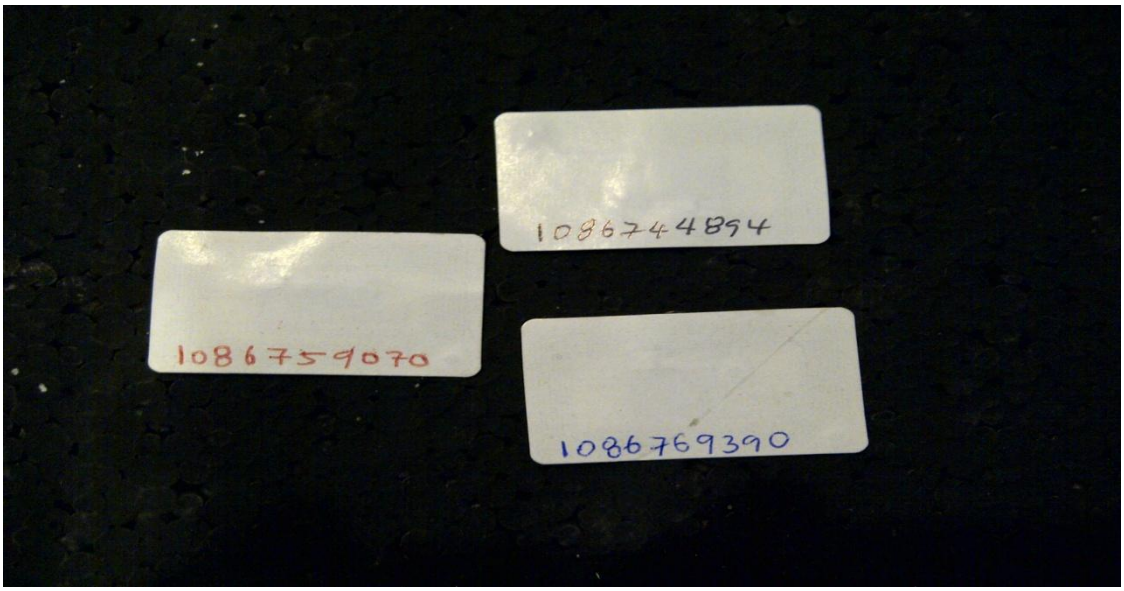


9. Vehicle Information

HARDWARE

RFID Reader

RFID Tag



PROTOTYPE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