DEVELOPMENT OF TRACKING SYSTEM USING RFID

HAZRULLIZAM BIN IDRIS

This report is submitted in partial fulfillment of requirement for the award of Bachelor of Electronic Engineering (Computer Engineering) with honours

Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka

APRIL 2008

UNIVERSTI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : **DEVELOPMENT OF TRACKING SYSTEM USING RFID**
Sesi Pengajian : **2007 / 2008**

Saya : HAZRULLIZAM BIN IDRIS

mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (√) :
5.

☐	**SULIT***	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)
☐	**TERHAD***	(Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☑	**TIDAK TERHAD**	

(TANDATANGAN PENULIS)

Alamat Tetap: **PO. BOX. 999**
89808, BEAUFORT
SABAH

Tarikh: 22 APRIL 2008.

Disahkan oleh:

(COP DAN TANDATANGAN PENYELIA)

MOHAMAD ZOINOL ABIDIN B ABD AZIZ
Penyarah
Fakulti Kej Elektronik dan Ke. Komputer (FKEKK)
Universiti Teknikal Malaysia Melaka (UTeM)
Karung Berkunci 1200,
Ayer Keroh 75450 Melaka

Tarikh: 22 APRIL 2008.

DECLARATION

"I hereby declare that this report is result of my own effort except for quotes that have been cited clearly in the references."

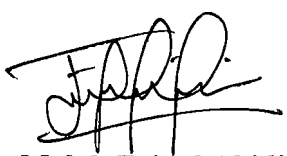
Signature : 

Name : **Hazrullizam Bin Idris**

Date : **22 April 2008**

SUPERVISOR APPROVAL

"I hereby declare that I have read this report and in my opinion this report is sufficient in terms of scope and quality for the award of Bachelor of Electronic Engineering (Computer Engineering) with honours."

Signature : 

Supervisor : **Mohd. Zoinol Abidin B. Abd Aziz**

Date : **22 April 2008**

For the almighty God, his messenger, my grand sheikhs and god's creations who was involved in this masterpiece

ABSTRACT

Radio Frequency Identification (RFID) is coming, and it's bringing a streamlined revolution. When dealing with the tracking device, Radio Frequency Identification (RFID) is the latest phase in the decades-old trend of the miniaturization of computers that can be used as an efficient tracker. The development of tracking system using the Radio Frequency Identification (RFID) technology is quite new but something that promising. The idea is to use the RFID reader as a check point to provide the coordinate reference as the RFID transponder will act a transmitter or traced object. The tracking system actually based on external database system that will provide the recorded information about the reader. Since the reader detected by the database, then the tracking system will process the data and will show the result of subject tracking. A synchronize combination between RFID reader, database and the tracking system will come out as an efficient tracker. The tracking system was developed using Microsoft Visual Basic (VB) that offered graphical user interface (GUI) application. The visual graphic interface provide the graphical mapping that show the result of tracking. The visual graphical interface development is more on software programming syntax coding. The another part of the system is the database. The database is handled by SQL database. MySQL database software was used to construct the database for the whole tracking system. The purpose of this database is to be the reference of any related stored data and information. The system is standalone which is communicated with external database handler. The tracking system only will interact directly to the database and show the result that had been received from the external database handler.

ABSTRAK

Radio Frequency Identification (RFID) telah muncul dan ianya telah membawa rovolusi jalur aliran. Apabila berbincang tentang peranti penjejak, Radio Frequency Identification (RFID) merupakan fasa terkini dalam gaya lama pengecilan saiz computer yang boleh digunakan sebagai peranti penjejak yang efisien. Pembangunan sistem penjejak menggunakan teknologi Radio Frequency Identification (RFID) adalah sedikit baru tetapi menjanjikan masa depan yang luas. Ideanya adalah dengan menggunakan pembaca RFID sebagai titik periksa untuk meneydiakan koordinat rujukan dan penghantar isyarat RFID akan bertindak sebagai pemancar atau objek jejakan. Sistem ini sebenarnya berdasarkan sistem pangkalan data luaran yang akan menyediakan informasi ynag dirakam tentang pemabaca. Apabila pembaca dikesan oleh pangkalan data, system penjejak akan memproses data tersebut dan menunjukkan hasil lokasi subjek jejakan. Kombinasi yang selaras antara Pembaca RFID, pangkalan data dan sistem penjejak akan menghasilkan penjejak yang efisien. Sistem ini bertindak sendirian yang mana akan berkomunikasi dengan pengendali pangkalan data luaran. Sistem penjejak ini akan berinteraksi kepada pangkalan data dan menunjukkan keputusan yang diterima daripada pengendali pangkalan data luaran. Sistem ini dibangunkan dengan menggunakan Microsoft Visual Basic (VB) yang menawarkan aplikasi antara muka pengguna grafik. Antaramuka visual grafik menyediakan pemetaan grafik yang memaparkan hasil jejakan. Pembangunan antaramuka visual grafik ini lebih kepada pengekodan sintaks perisian pengaturcaraan. Bahagian lain dalam sistem ini adalah pangkalan data. Pangkalan data ini dijalankan oleh pangkalan data SQL. Perisian pangkalan data MySQL digunakan untuk membina keseluruhan pangkalan data bagi keseluruhan sistem. Tujuan pangkalan data ini adalah untuk menjadi rujukan bagi setiap simpanan data dan informasi yang berkaitan.

TABLE OF CONTENT

LIST OF TABLE

LIST OF FIGURE

LIST OF ABREVIATION

ANSI		American National Standards Institute
API		Application Programming Interface
CODSYL		Conference on Data Systems Languages
DBMS		Database Management System
EPC		Electronic Product Code
HF		High Frequency
IBM	-	International Business Machines Corporation
ID	-	Identification
ISM band		Industrial, Scientific and Medical radio bands
ISO		International Organization for Standardization
JDBC		Java Database Connectivity
LF		Low Frequency
MHz		Megahertz
ODBC		Open Database Connectivity
ODMG	-	Object Data Management Group
PHP	-	Hypertext Preprocessor
RDBMS		Relational Database Management System
RFID		Radio Frequency Identification
SQL		Structured Query Language
UHF		Ultra High Frequency
UNIX		Computer operating system
VB.Net		Visual Basic .Net

LIST OF APPENDIX

CHAPTER I

INTRODUCTION

1.1 PROJECT BACKGROUND

Radio frequency (RF) technology is used in many different applications, such as television, radio, cellular phones, radar, and automatic identification systems. RFID stands for radio frequency identification and describes the use of radio frequency signals to provide automatic identification. Unlike the electronic article surveillance (EAS) Systems used for theft detection, RFID provides a unique serial number for identification of an object. RFID technology was invented in 1948, but it was not commercialized until the 1980s. One of its first known applications was during World War II, when it was used by the British radar system to differentiate between friendly and enemy aircraft with attached radio transponders.

Radio Frequency Identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. An RFID tag is an object that can be attached to or incorporated into a product, animal, or person for the purpose of identification using radio waves.

The main theme of this project is relying on the application of the Radio Frequency Identification (RFID) based on RFID tag as an identification medium. The project will provide a tracking system using a location mapping orientation. The result will be displayed on a map oriented interfaces which is communicate with the RFID reader as a checked point. The idea is using a RFID cards are also known as "proximity" or "proxy" cards and come in three general varieties: passive, semi-, or active. These

RFID cards will contain an identity (ID) reference number and data, which means each personal identity fixed with one identity (ID) to represent that person in the system for the purpose.

1.2 OBJECTIVES

The main objective of this project is to develop the tracking system using Radio Frequency Identification (RFID) application technology. The main idea is to develop application software on tracking system using Radio Frequency Identification (RFID) application technology. The system will be in the form of software and using the RFID technology as an external tracking hardware. The system will communicate to the hardware tracking component and manage the tracking activity. To provide a user friendly system, a graphical user interface (GUI) will be prepared to display the result of tracking activity in a graphical mapping format. Graphical user interface (GUI) will make the system can be manage easier and suitable for all level of literacy. Besides of easy handling the graphical mapping also create a systematic control and monitoring environment for the tracking system supervisor.

Finally, the internal database should be provided to make a complete dynamic system which can trace a real time condition and also keep the history of the previous activity that happened. The combination of these objectives will be fulfill and achieves with one perfectly organized system call 'The Tracking System Using RFID' as my project to be develop.

1.3 SCOPE OF WORKS

The purpose of an RFID system is to enable data to be transmitted by a mobile device, called a tag, which is read by an RFID reader and processed according to the needs of a particular application. Related to this project the application of a tracking system will be controlled by application software. The scope of this project is to develop the application software in a graphical user interface (GUI) form to control, manage and monitor the whole tracking system. The software is just an application of processing the

data transmitted by a RFID reader. Between reader and the software will be another database component. This software will process a data from the outside main database component. This system not only will visualize the real time result but the whole system activities will be recorded in an appropriate data form to represent the activities log. The software will do this task and application reading database, display location and storing data.

1.4 PROBLEM STATEMENT

In the matter of controlling and monitoring the most important aspect is how to trace the track of any activities that happened. For example in the high alert territory such as military area, prison or any kind of place in needs of privacy, every single activity should be aware and under supervised. This aspect of monitoring is important to prevent any undesirable activity and faulty. Nowadays the experts in the field of security come with a solution on how to monitor and control such activity by using a CCTV. So every single action will be captured by the camera and stored as an image. The problem is how the system will be supervised when dealing with a large area and capacity. It means the supervisor should recognize each and every single faces in the area involved and jotted down what they had done and where it was.

On this kind of difficulty and problem, a complete and efficient system should be provided which is considering all the matters occur compare to others method. So the answer to overcome this problem is to provide a tracking system that can trace the track of identity in the supervised territory. In term of tracking, the system will identify any movement and activity by tracing the track of every person such as a detail on where are they now, where they headed, where they had been. So no more lost trace phenomenon because you can freely moving but you have been watched and monitored.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

In order to execute this project, literature review must be done to comprehend the whole system and to decide the best inputs, outputs and used devices. From literature review, there will be an analysis regarding the advantages and disadvantages for each phase of this project. Equipment data sheets and manuals provided information such as dimension, operation and specification of the RFID reader also will discussed. There are two main parts which is review on RFID and review on Database that wrap up the main title 'Development of tracking system using RFID'.

2.2 LITERATURE REVIEW OF RFID

2.2.1 Radio Frequency Identification (RFID) Technology

Radio frequency (RF) technology is used in many different applications, such as television, radio, cellular phones, radar, and automatic identification systems. RFID stands for radio frequency identification and describes the use of radio frequency signals to provide automatic identification [1]. Unlike the electronic article surveillance (EAS) Systems used for theft detection, RFID provides a unique serial number for identification of an object [2]. RFID is used in the Mobil Speed pass system to pay for gas without going into the store, in automobile immobilizer systems to prevent theft by uniquely identifying a key with an embedded chip, in Fast Lane and E-Z Pass toll road systems to automatically pay tolls without stopping, in animal identification, in secure entry cards to secure access to buildings, and in the supply chain to manage the flow of

pallets, cases, and items. RFID technology was invented in 1948, but it was not commercialized until the 1980s. One of its first known applications was during World War II, when it was used by the British radar system to differentiate between friendly and enemy aircraft with attached radio transponders [3].

Most media accounts of RFID are actually about one form of RFID, the electronic product code (EPC) system [2]. Initially, RFID was being used to identify objects in the MIT robotics laboratory but was found to be useful for managing the supply chain. The electronic product code (EPC) was developed by the Auto-ID Center at MIT and is now being managed by EPCglobal Inc. EPCglobal Inc. is a global not-for-profit standards organization commercializing the Electronic Product Code™ (EPC) and RFID worldwide. It is one important form of RFID used by retailers to manage the supply chain. EPC has standardized chip designs and protocols to enable the mass production of low-cost passive RFID tags in the 860-960 MHz range. EPC is a technology similar to the uniform product code (UPC) barcode identification used to provide information about the product to which the EPC tag is attached except that it can be read at a distance and does not require line-of-sight aiming like the barcode system [2].

The advantage of RFID is that it does not require direct contact or line-of-sight scanning. An RFID system consists of three components: an antenna and transceiver which often combined into one reader and a transponder that usually the tag. The antenna uses RF waves to transmit a signal that activates the transponder. When activated, the tag transmits data back to the antenna. The data is used to notify a programmable logic controller that an action should occur. The action could be as simple as raising an access gate or as complicated as interfacing with a database to carry out a monetary transaction [3].

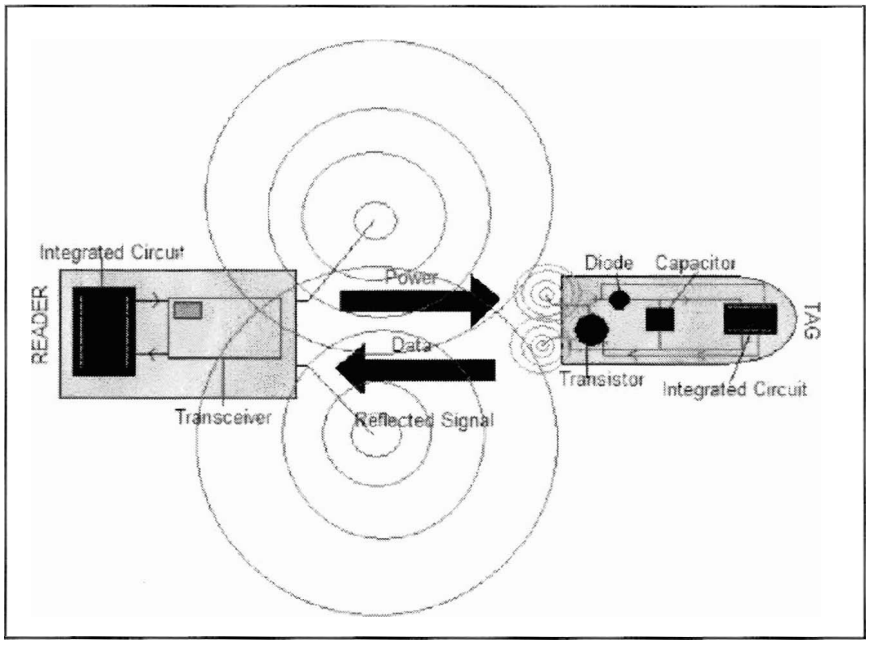


Figure 2.1: A Schematic of Power and Data Flow in a UHF RFID System.

The Figure 2.1 shows a typical RFID tag consists of a microchip attached to a radio antenna mounted on a substrate. The chip can store as much as 2 kilobytes of data [3]. For example, information about a product or shipment, date of manufacture, destination and sell by date can be written to a tag. In order to retrieve the data stored on an RFID tag, a reader is needed. A typical reader is a device that has one or more antennas that emit radio waves and receive signals back from the tag. The reader then passes the information in digital form to a computer system [4].

2.2.2 Radio Frequency Identification (RFID) System

An RFID system may consist of several components: tags, tag readers, edge servers, middleware, and application software. The purpose of an RFID system is to enable data to be transmitted by a mobile device, called a tag, which is read by an RFID reader and processed according to the needs of a particular application. The data transmitted by the tag may provide identification or location information, or specifics about the product tagged, such as price, color, date of purchase, etc [4]. The use of RFID in tracking and access applications first appeared in 1932, to identify aircraft as friendly

or unfriendly ("identify friend or foe" (IFF). RFID quickly gained attention because of its ability to track moving objects. As the technology is refined, more pervasive and possibly invasive uses for RFID tags are in the works [5].

In a typical RFID system, individual objects are equipped with a small, inexpensive tag. The tag contains a transponder with a digital memory chip that is given a unique electronic product code. The interrogator, an antenna packaged with a transceiver and decoder, emits a signal activating the RFID tag so it can read and write data to it. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation signal. The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer. The application software on the host processes the data, often employing Physical Markup Language (PML) [2].

Take the example of books in a library. Security gates can detect whether or not a book has been properly checked out of the library. When users return items, the security bit is re-set and the item record in the integrated library system is automatically updated. In some RFID solutions, a return receipt can be generated. At this point, materials can be roughly sorted into bins by the return equipment. Inventory wands provide a finer detail of sorting. This tool can be used to put books into shelf-ready order [3].

2.2.3 Types of Radio Frequency Identification (RFID)

The main component of RFID technology is the transponder/tag , which in most cases comprises of a chip and antenna mounted onto a substrate or an enclosure. The chip consists of a processor, memory and radio transmitter. These transponders communicate via radio frequency to a reader, which has its own antennas. The readers can interface through wired or wireless medium to a main computer. Transponders are also known as smart or radio tags. The memory will vary, depending on the manufacturer, from just a few characters to kilobytes [3].

Transponders can either be Read Only (R/O) which are pre-programmed with a unique identification or they can be Read Write (R/W) for applications that require data to be stored in the transponder and can be updated dynamically. Another form of transponder is Write Once Read Many times (WORM). This will allow for an identification number to be written to the transponder once. The information is stored in the memory, it cannot be changed but the transponder can be read many times.[1] The two most common types of RFID technologies are Active and Passive. Active RFID transponders are self powered and tend to be more expensive than Passive. Having power on board allows the tag to have greater communication distance and usually larger memory capacity [4].

(a) Active RFID Systems

Active tags are used on large assets, such as cargo containers, rail cars and large reusable containers, which need to be tracked over long distances such as in a distribution yard, for example [4]. They usually operate at 455 MHz, 2.45 GHz, or 5.8 GHz, and they typically have a read range of 60 feet to 300 feet (20 meters to 100 meters) [3].

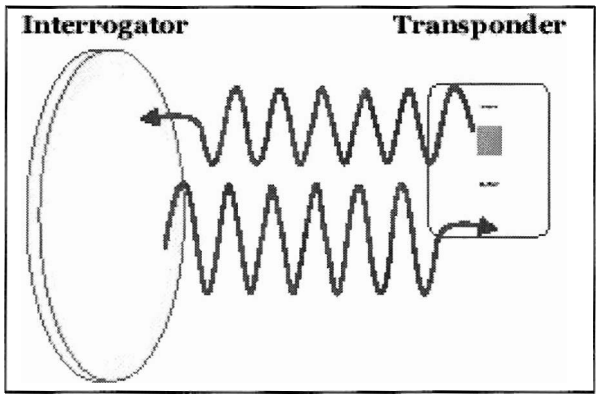


Figure 2.2: Active RFID System

There are two types of active tags which is a transponders and a beacons. Active transponders are woken up when they receive a signal from a reader. These are used in toll payment collection, checkpoint control and other systems. When a car with an active

transponder approaches a tollbooth, a reader at the booth sends out a signal that wakes up the transponder on the car windshield. The transponder then broadcasts its unique ID to the reader. Transponders conserved battery life by having the tag broadcast its signal only when it is within range of a reader [5].

Beacons are used in most real-time locating systems (RTLS), where the precise location of an asset needs to be tracked. In an RTLS, a beacon emits a signal with its unique identifier at pre-set intervals which it could be every three seconds or once a day, depending on how important it is to know the location of an asset at a particular moment in time. The beacon's signal is picked up by at least three reader antennas positioned around the perimeter of the area where assets are being tracked [5].

(b) Passive RFID Systems

Passive RFID tags have no power source and no transmitter. They are cheaper than active tag and require no maintenance, which is why retailers and manufacturers are looking to use passive tags in their supply chains [5]. They have a much shorter read range than active tags which is a few inches to 30 feet.

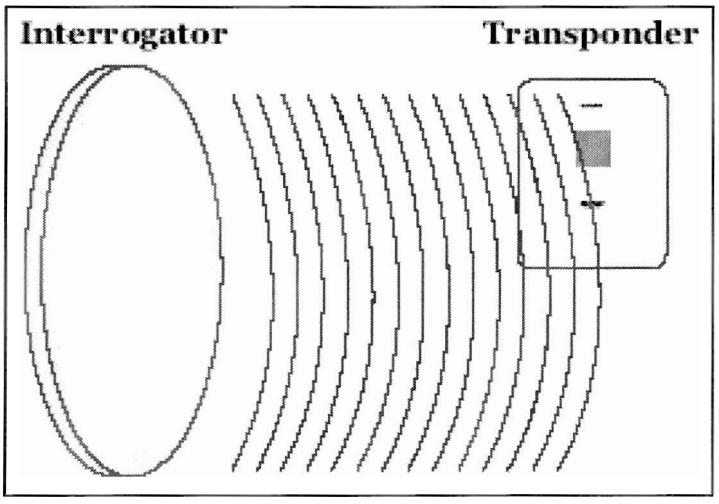


Figure 2.3: Passive RFID System