

GRID ANTI-THEFT SYSTEM

RHUBAN A/L NEER PANDI

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Faculty of Computer System & Software Engineering
University Malaysia Pahang (UMP)

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ABSTRACT

Global System for Mobile Communications (GSM) seems to be the best solution to develop outdoor alerting system, but performance of these systems is not good enough to local entities within indoor environments, mainly if accuracy and precision are required. With the technology of Radio frequency identification (RFID) and GSM, many researches are being carried out on monitoring entities as it does provide accuracy and precision. Plus, the technology is applicable to develop new variation of identification, and anti-theft system. Accordingly, in this project, we propose an anti-theft system combining GSM and RFID technology that is able to accurately monitor and alert various valuable entities. The proposed system can alert the user when the entities moved out of the define parameters and then the system can notify the owner by sending message when the entities moved out of the parameter.

ABSTRAK

Global System for Mobile Communications (GSM) merupakan salah satu teknologi yang mendorong kepada penyelesaian terbaik membangunkan system notifikasi luar tetapi prestasi sistem ini bukan cukup baik untuk entiti-entiti tempatan dalam persekitaran tertutup, terutamanya jika ketepatan dan ketepatan dikehendaki. Dengan teknologi pengenalpastian frekuensi Radio (RFID) dan GSM, kebanyakan penyelidikan dilaksanakan mengenai pemantauan entiti-entiti kerana ia dapat memberi ketepatan dan ketepatan. Tambahan lagi, pengabungan teknologi boleh digunakan untuk membangunkan variasi baru pengenalpastian , dan sistem anti kencingian. Oleh sebab itu, dalam projek ini, kami mencadangkan satu sistem anti kencingian bergabung teknologi GSM and RFID yang mampu memberitahu dengan tepat pelbagai entity bila dicuri. Sistem yang dicadangkan boleh memberitahu pengguna apabila entiti-entiti dialihkan daripada parameter yang ditakrifkan lalu system ini boleh memberi alarm dan terus menghantar pesanan kepada pemilik entiti dengan teknologi GSM..

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CHAPTER I

INTRODUCTION

This chapter briefly discusses on the overview of this research. It contains five clusters. The first cluster is the background of study followed by the problem statement. The next cluster is the objectives of the project, scopes of the system and lastly is the thesis organization which briefly describes the structure of this thesis.

1.1 Project Background

There are many new highly developed technologies being used nowadays that gives precise location data and accurate monitoring of assets regardless their physical location. The most commonly used technology for tracking is the Radio-frequency identification (RFID) technology whereby it is used by many industries for their very own purpose.

Radio-frequency identification (RFID) is one of the latest technologies that use radio waves to transfer data from an electronic tag which is called as a RFID tag or label that is attached on an object. This is done using a reader that has two purposes which id to identify and track the object.

RFID tags do not require battery and it is usually powered by the electromagnetic fields used to read them. Some other RFID tags uses limited power source that emits radio waves. These tags carry data that is electronically stored in it that can be detected by its reader from up to few metres away.



Figure 1.1: RFID tag

Source: http://en.wikipedia.org/wiki/Radio-frequency_identification

There are many industries that have been using RFID tags. Example of the usage of a RFID tag is in the car manufacturing industry whereby this tag is attached to a car during its production and it can be used to track its progress through the assembly line. Apart from that, one area where it can provide significant advantages is in vehicle access control. Cars, trucks, or other vehicles in warehouse environments can be tagged with passive RFID transmitters. When a restricted area, or a parking lot entrance, is approached, a reader at the site accesses the tag. If the vehicle is authorized, the gate opens and it is allowed to pass.

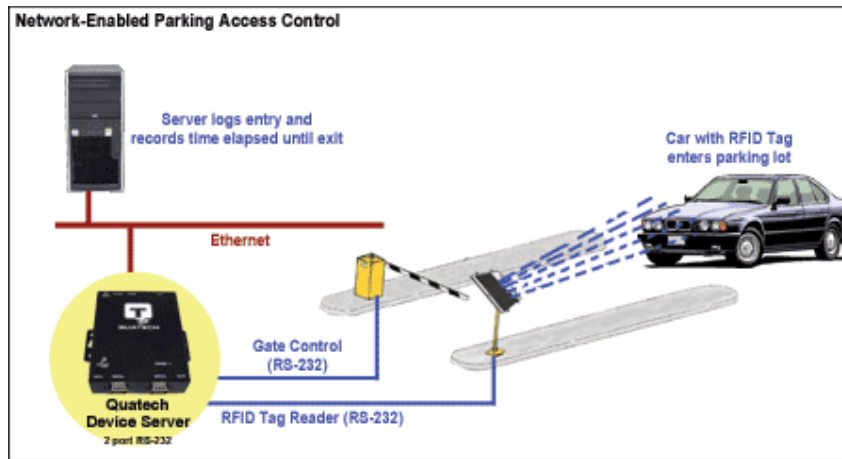


Figure 1.2: RFID Application in Parking Lot

Source: http://www.quatech.com/applications/rfid_ac_appex.php

RFID tags are also used in medical industry that enables medicine to be tracked through stores, agriculture industries that uses these RFID tags by injecting it to the animal or live stocks, allowing positive identification of the object and employees too can access to locked areas using their company identity card which contains RFID where the information of the employee electronically stored.

RFID tags are easy to be attached to objects and are used primarily to manage and track in many ways. For example, it can be attached to books, lab equipment, animals, clothes and others. There are many advantages of RFID compared to manual systems or bar codes whereby the reader can read the tag if it is passed, although it is covered by clothes and it is not visible to the reader. Apart from that tag can be read for more than once meanwhile the barcodes can only be read once.

A radio-frequency identification system together with the tag attached to an object is mainly used for identification. It works both ways as the reader will send a signal to the tag and able to detect it through the response from the tag. Once the reader detects the response, it will transfer the data to a computer that has the RFID software or middleware. Usually, the RFID reader has a non-volatile memory where it contains electronic information of the object. RFID tags can be classified into three types which are active, passive and battery assisted passive.

Active tags are built with on-board battery and it will transmit its signal in a periodic of time. A battery assisted passive RFID is also built with a small battery on board and the RFID reader will activate the battery. Lastly, a passive tag is built without any battery and it operates using the radio energy transmitted by the reader. Passive tags are cheaper and smaller in size due to this reason.

RFID can be dissected into two parts. The first part is the integrated circuit where it stores and processes information meanwhile the second part is the antenna for transmitting and receiving signals.



Figure 1.3: Antenna for Transmission and Receiving Signal

Source: <http://sg.digikey.com/1/2/indexb11.html>

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The RFID tags can be differentiated by the frequency bands as it transmits their signals in various frequencies. The table below will show the RFID frequency bands.

Table 1.1 RFID Frequency Band

Band	Regulations	Range	Data speed	Remarks	Approximate tag cost
120-150 kHz (LF)	Unregulated	10cm	Low	Animal identification, factory data collection	\$ 1 US
13.56 MHz (HF)	ISM band worldwide	1m	Low to moderate	Smart cards	\$0.50
433 MHz (UHF)	Short Range Devices	1-100m	Moderate	Defence application with active tags	\$5
868-870 MHz 902-928 MHz	ISM Band	1-2m	Moderate to high	EAN, various standards	\$0.15 (passive tags)
2450-5800 MHz	ISM Band	1-2m	High	802.11 WLAN, Bluetooth standards	\$25 (active tags)
3.1-10 GHz	Ultra Wide band	to 200m	High	Requires semi-active or active tags	\$5 projected

As the price of the RFID decreases, it becomes more prevalent. RFID plays its important role in commerce filed with various purposes such as payment by mobile phones, transportation payments, asset management, promotion tracking, inventory system, product tracking, access control, transportation and logistics, advertising, e-passports, and identification.

Many institutions have adopted RFID technology due to its effectiveness and accuracy. The widespread institutions include hospitals and healthcare followed by libraries, museums, school and universities and sports.

On the other hand, Global System for Mobile Communications (GSM) is a major standard developed by the European Telecommunications Standards Institute (ETSI) and it is in use in over 60 countries providing its service over one billion users worldwide. The three major GSM bands currently in use are 900MHz, 1800MHz and 1900MHz. These are the major technologies integrated together to form a new way of monitoring and also retrieving the precise location information of the lost item. GSM is a cellular network which means that mobile phone connected to it will search for the signal continually.

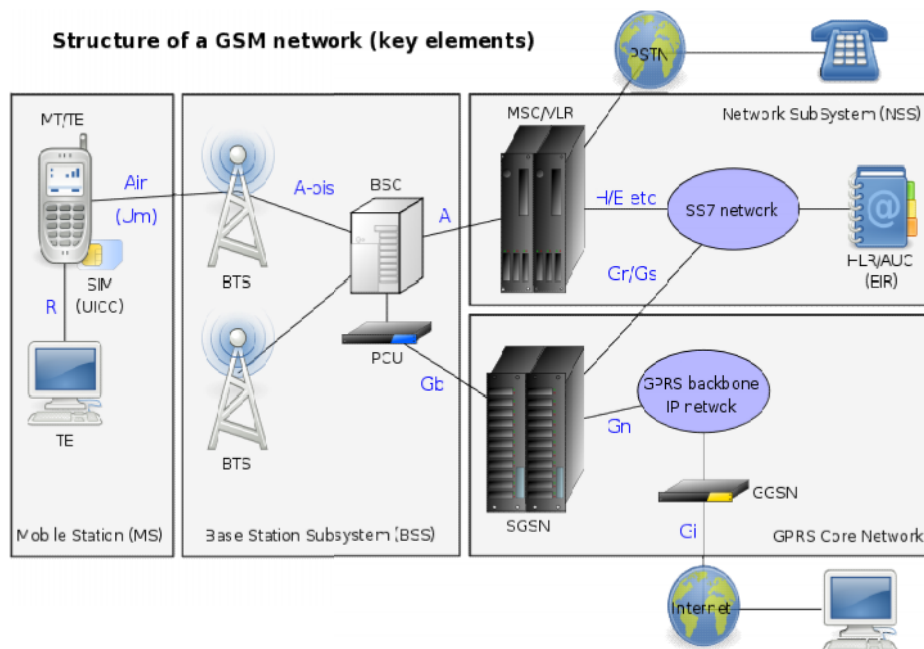


Figure 1.4: Structure of a GSM Network

Source: <http://en.wikipedia.org/wiki/GSM>

There are four main structures in GSM network which are Base Station Subsystem, Network and Switching Subsystem, GPRS Core Network and Operations support system. All these four components work together to provide the GSM service. GSM module is a specialized type of modem whereby it operates over a subscription to a mobile operator via SIM card. In this case, GSM module can be considered as mobile phone from mobile operator perspective.

GSM modules can be connected to the computer and play as a medium when the computer tries to communicate over the mobile network. Commonly, these GSM modules used to provide mobile internet services instead it also can be used for sending SMS and MMS messages. GSM modems can be a quick and efficient way to get started with SMS, because a special subscription to an SMS service provider is not required. In most parts of the world, GSM modems are a cost effective solution for receiving SMS messages, because the sender is paying for the message delivery.

Due to some compatibility issues that can exist with mobile phones, using a dedicated GSM modem is usually preferable to a GSM mobile phone. This is more of an issue with MMS messaging, where if you wish to be able to receive inbound MMS messages with the gateway, the modem interface on most GSM phones will only allow you to send MMS messages. This is because the mobile phone automatically processes received MMS message notifications without forwarding them via the modem interface.

It should also be noted that not all phones support the modem interface for sending and receiving SMS messages. In particular, most smart phones, including Blackberries, iPhone, and Windows Mobile devices, do not support this GSM modem interface for sending and receiving SMS messages at all. Additionally, Nokia phones that use the S60 (Series 60) interface, which is Symbian based, only support sending SMS messages via the modem interface, and do not support receiving SMS via the modem interface.

1.2 Problem Statement

With the on-going and rapidly increasing acts of crime and theft in our society, an ever growing need is seen to be arising to secure ourselves and our possessions. Theft has been the major concern of complaint in Universiti Malaysia Pahang (UMP) all the time.

The major parties affected by this criminal act in universities are mainly students, staffs, followed by valuable assets in laboratories such as computers, servers and so on.

This project addresses this problem and it will assist the user in managing his/her domestic assets in the university environment. This system can be easily integrated in any electronic device in a university environment. The envisioned system will consist mainly of the following three elements; firstly, a Radio-frequency enabled (RFID) tag that will be integrated in an electronic device, secondly, Global System for Mobile Communications (GSM) module, and finally a system to monitor the device in case if there is any unexpected event occur when the owner not around.

Since most of the anti-theft systems are expensive in the market, the theft problem can be solved using this method which uses RFID and GSM modules as it very cost effective. Apart from that, most of the stolen items are untraceable as the thief is able to flee away with valuable belongings very quickly however using the GSM module; it is able to track down the stolen item easily.

1.3 Objectives

The objectives of the project consist of:

- To monitor the valuable assets or items using RFID tag for every defined timer
- To alert owner by sounding the alarm when the object or asset moved out of the parameter
- To alert the owner by sending Short Message Service (SMS) to preferred mobile phone number with preset message right after the item moved out of the parameter.

1.4 Scope

The scopes of the system are listed below:

- i. This system development related to hardware and software integration and subjected to Faculty of Computer Systems & Software Engineering (FSKKP).
- ii. System can monitor the tagged item or assets for every set timer
- iii. System can help to alert the user by sending message to the defined mobile phone number in this case number of the owner
- iv. System can alert the owner by alarming the buzzer

This system is mainly targeted to the following parties;

i). Students

- They can secure their valuable belongings such as laptops, personnel gaming console, external hard disk, bicycle and so on.

ii). Staffs

- They can secure the office properties such as desktops, printers, scanners, photocopy machine and so on.

iii). Laboratory equipment

- Such as high-end performance desktops, servers, printers, routers, switches, wireless devices and so on.

1.5 Thesis Organization

i. Chapter 1: Introduction

The purpose of this chapter is to introduce to the readers about the project that will be developed later. This chapter contains introduction, problem statement, objective, and scope and thesis organization.

ii. Chapter 2: Literature review

This chapter explains about the reviews for the chosen project. This chapter is divided into two sub reviews that require students to study to get complete information about the project.

iii. Chapter 3: Methodology

This chapter discusses the approach and framework for the project. Method, technique or approach that will be and will be used while designing and implementing the project will be included in the content. Justification and of method on approach used and hardware and software necessary is stated here.

iv. Chapter 4: Implementation

This chapter acts to document all processes that involve in the development of the project. Designed project development is explained here. The content of this project depends on the system. It contains information of database and tools used.

v. Chapter 5: Results, Discussion and Conclusion

The purpose of this system is to explain about the results and data analysis that had been acquired. Result analysis, project limitation and suggestion and project enhancement are contents for the chapter.

CHAPTER II

LITERATURE REVIEW

This chapter briefly describes the review on existing technology and techniques related with “GRID Anti-Theft System” that will be developed later. This chapter comprises two sections: The first section describes the comprehensive review on existing related system. The second section describes the review on techniques and system requirement attributes previously used in the same domain.

2.1 Radio Frequency Identification (RFID)

Radio Frequency Identification (RFID) is a technology that incorporates the usage of electromagnetic or electrostatic coupling in the radio frequency (RF) portion of the electromagnetic spectrum to uniquely identify an object, animal, or person. RFID has become popular in recent years as it has been replacing bar code in many industries. The main reason for this transformation is RFID does not require direct contact or line-of-sight scanning.

Reddy (2011) stated that RFID has been implemented in few applications which are used to make business operation or life easier such as asset management, animal tracking, anti-theft systems, food safety, blood banks, baggage handling, car manufacturing, asset tracking, automated payment, food safety, mother baby pairing, waste management and supply chain management.

In specific regarding the anti-theft system, Reddy (2011) also mentioned that the usage of these systems is growing day by day. Many stores solely rely on these systems instead of surveillance cameras and security guards to protect their merchandise from being stolen. Even now surveillance cameras are used but only after the theft have taken place to identify any suspicious movements and suspected thieves by watching hours and hours of the store camera's footage.

The installation of RFID system aids in these situations whereby this device will alert any movement of products being taken without purchasing them at the very moment itself which is cost and time efficient for the many parties such as the shop owner and the police.

In a study conducted by Raghuwanshi and Kailash (2010), Real Time Location System (RTLS) is the system that is used to collect information of a moving object collectively. In a discussion regarding the Real Time System, there are a number of technologies used in real time tracking such as Active RFID, Passive RFID, Infrared, GPS (Global Positioning System), and others.

Passive RFID has a reading range from 20 feet for handheld readers to 40 feet if it is a fixed reader whereas an Active RFID can read up to 300 feet and above. Furthermore, Passive RFID does not require any power source and the tag life can be extended up to 10 years depending on the environment the tag is placed at. The usage of Passive RFID mainly is for inventorying assets using handheld RFID readers and it can also be used with fixed RFID in tracking movements. Active RFID on the other hand is battery powers and its lifetime is from 3 to 8 years based upon the tag broadcast rate. Its usage can be associated with fixed RFID readers to perform real-time asset monitoring at choke-points or within zones and its usage is necessary when security is a requirement. The reader for Passive RFID are usually costly than the Active RFID.

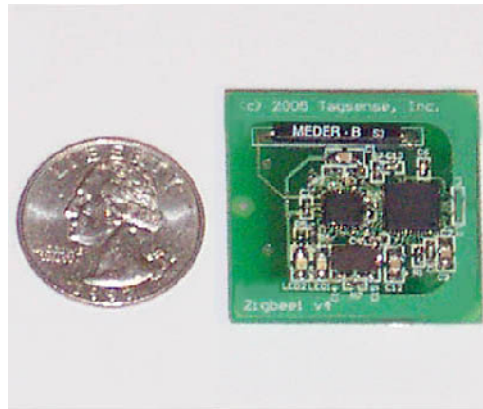


Figure 2.1: Active RFID

Source: http://www.tagsense.com/ingles/products/product_mw.html



Figure 2.2: Passive RFID

Source: http://www.systemid.com/barcode_learning_center/rfid/labels.asp

Daily (2007) stated that position tracking using RFID is an active area of research. There are several companies incorporating real-time monitoring in RFID applications such as active RFID tags are used to communicate with satellites to obtain precise location and movement have been developed and these tags also have GPS (Global Positioning System) capabilities that are able to read and write at 500 meter distances. Active tags also have been developed whereby it can be monitored in real

time at a range of 1,000 meters. However, passive tags are less used in real-time monitoring due to its limited read range compared to active types.

He also mentioned that continuing improvements in supply chain management systems are directed towards the ability to continuously estimate the location of products and goods throughout the transport process. This is motivated by just-in-time and lean manufacturing process in many industries. In addition, tracking of shipment with increasing resolution and accuracy is needed to support many worldwide shipments, both to ensure product quality in the case of perishable food and medical items as well as to improve security monitoring.

The application of RFID can be seen in military as it is used extensively in tracking and identifying military containers. A major use of RFID tags were seen in October 2003 when the U.S Department of Defence announced that its 43,000 suppliers will be required to use RFID tags at the pallet/case level by 2005 which pointed out Green 2003.

Wolfe et al. 2003 remarked that Gillette and Tesco too have been cooperating on item-level RFID in the United Kingdom. Gillette tagged razor blade cartridges and Tesco user a smart shelf system to monitor stock in retail stores. This system was primarily designed to prevent theft, and it was combined with an extensive camera surveillance system that was triggered by the removal of product from the smart shelf. Consumer privacy concerns have prompted the trial to be ended in 2003.

The usage of RFID is seen to be blooming especially in current technology. Association of RFID with anti-theft system is one of the many researches that can be done to improve the life style of mankind.