

**WIRELESS ASSET MANAGEMENT SYSTEM USING RADIO
FREQUENCY IDENTIFICATION (RFID)**

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**This report is submitted in partial fulfillment of the requirements for the award
of Bachelor of Electronic Engineering (Wireless Communication) with Honours**

**Faculty of Electronic and Computer Engineering
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UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

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PROJEK SARJANA MUDA II

Tajuk Projek : Wireless Asset Management System using Radio Frequency Identification (RFID)

Sesi Pengajian :

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Special thanks to my family, project supervisor and friends for the encouragement to complete this project

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ABSTRACT

Wireless Asset Management System using Radio Frequency Identification (RFID) enables asset to be monitored remotely using internet-connected devices. RFID is the technology that uses radio waves to automatically identify individual items. This system utilizes several RFID tags that are installed to the assets being stored. Each tag will contain information about the assets for example serial number, status and price. Every movement of the asset can be monitored by RFID reader installed in the building. The data will also be wirelessly transmitted using ZigBee to a server where software is used to record and log the reading into a database. The respective data can be read using a program developed by using Visual Basic. A website that can access the database periodically and displays the reading is created. Any internet-connected device can access the website, allowing constant monitoring of the asset status remotely. A user friendly web interface will be developed for easier utilization.

ABSTRAK

Sistem Pengurusan Aset tanpa wayar menggunakan Pengenalan Frekuensi Radio (RFID) membolehkan aset dipantau dari jarak jauh menggunakan peranti yang disambungkan ke internet. RFID ialah satu teknologi yang menggunakan gelombang radio untuk mengesan objek individu secara automatik. Sistem ini menggunakan beberapa tag RFID yang dipasang kepada aset yang disimpan. Setiap tag mengandungi maklumat mengenai aset contohnya nombor siri, status dan harga. Setiap pergerakan aset boleh dipantau oleh pembaca RFID (*reader*) yang dipasang di dalam bangunan. Data tersebut juga akan dihantar secara tanpa wayar menggunakan Zigbee kepada pelayan (*server*) dimana satu perisian akan digunakan untuk merekodkan bacaan kedalam pangkalan data. Data tersebut boleh dibaca menggunakan program yang dibangunkan menggunakan program Visual Basic. Sebuah laman sesawang yang membolehkan segala data dapat diperiksa dari semasa ke semasa dan juga untuk tujuan paparan bacaan telah direka. Sebarang peranti yang mempunyai sambungan ke Internet boleh mengakses laman sesawang tersebut dimana pemantauan pergerakan aset boleh dilaksanakan secara berterusan. Laman web mesra pengguna pula akan dibangunkan untuk penggunaan lebih mudah oleh para pengguna.

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LIST OF ABBREVIATION

PC	-	Personal Computer
ATC	-	Automatic Toll Collection
RFID	-	Radio Frequency Identification
ERP	-	Enterprise Resources Planning
ELP	-	Electronic License Plates
WWW	-	World Wide Web
WSN	-	Wireless Sensor Network
EAS	-	Electronic Article Surveillance
ID	-	Identification
LF	-	Low Frequency
HF	-	High Frequency
UHF	-	Ultra High Frequency
LOS	-	Line Of Sight
IEEE	-	Institute of Electrical and Electronics Engineers
USB	-	Universal Serial Bus
OLE	-	Object Linking and Embedding
MCU	-	Multipoint Control Unit
GUI	-	Graphical User Interface
PCB	-	Printed Circuit Board
WAN	-	Wide Area Network
USART	-	Universal Synchronous Asynchronous Receiver Transmitter
CPU	-	Central Processing Unit

CHAPTER 1

INTRODUCTION

1.0 Overview

This chapter is briefly discussing on the flow of this project. Five parts will be discussed on this chapter. The first part is the project background and then followed by the problem statement in the second part. Next is the listing of the objectives where the aim of this project is determined. Then, the scopes of this project are discussed and the last part to be discussed is the thesis organization. This part will briefly describe the structure of this thesis from Chapter 1 to Chapter 5.

1.1 Background

Asset management system possesses a systematic approach of maintaining, inspecting, and operating physical assets effectively. It has been widely used in other country as a current technology because traditionally maintenance staffs usually need to spend up to 50 percent of their time with paperwork or data entry. Previously, asset tracking and inventory management are mostly depending on barcode scanning that is printed on each item. This process is done manually and consuming longer time.

Therefore, asset management system by using Radio Frequency Identification (RFID) has been introduced. RFID is the technology that uses radio waves to automatically identify individual items. RFID technology is use to replace Scan Code technology for asset tracking and inventory management. RFID is a non-line of sight technology that make it more advantageous compared to barcode scanning. Therefore, every item can be handled automatically without the need of human power. RFID readers also can read the RFID tags even when they are not in sight, thus make it easier for asset monitoring.

RFID technology is a reliable technology in many applications for example in supply chains. However, an asset management system must have the necessity for data privacy, identity and non-refutability and also organizations. This is needed to ensure the RFID technology can supports for the security requirements. If this technology is going to be used in industry, the security risk such as profiling, eavesdropping, denial of service attacks and inventory jamming need to have proper solution before it can be commercialized.

In this project, several RFID tag will be installed to the assets being stored. Each tag will contain information about the assets for example picture, serial number, purchasing date and expired date. Every movement of the asset can be monitored by RFID reader installed in the building. The reader will be connected to access point or server to encrypt the data. Mobile devices such as PDA, laptop and smartphone can access to the data when it is connected to the server. A user friendly web interface will be developed for easier utilization.

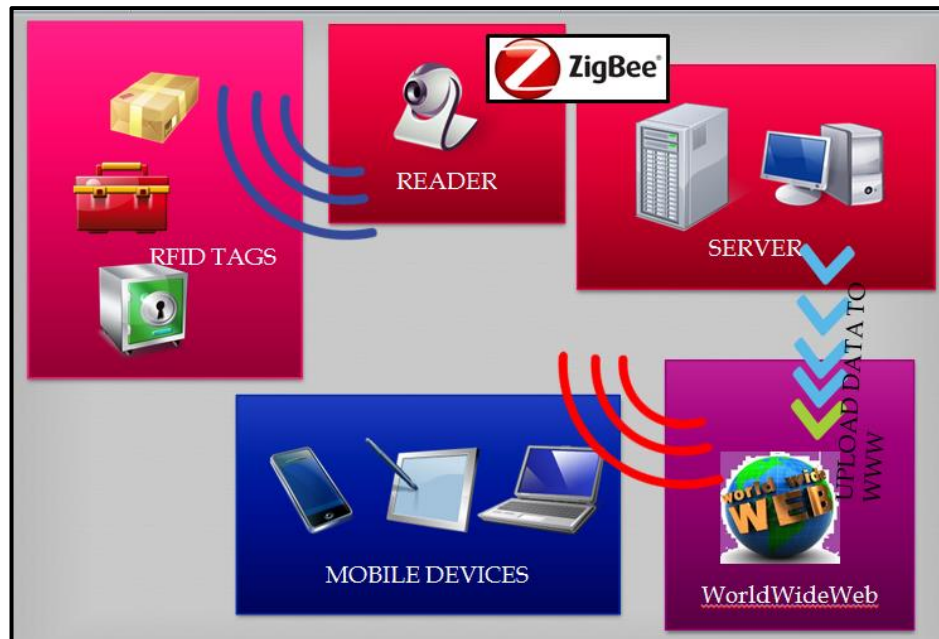


Figure 1.10: Project Illustrations

1.2 Problem Statement

Many warehouse or store in the factory usually encounter problem in handling their asset. The typical ways to monitor in and out of the assets is usually by using manual system which facing a great possibility of error. Asset normally is identified by using serial number as it is different for each asset. The traditional ways to get the serial number is by using bar code scanner, this will consume a lot of time if the asset comes in a big sum.

Other than that, if traditional ways is being used, the recorded data will be easily lost because the data is usually been save in Microsoft Office Software, there is much possibility that the data can be mistyped, misplaced or even unsaved. Therefore, this issue will create another big problem for the administrator and user.

Therefore, this project is done to upgrade the traditional ways by changing it to scanning the asset serial number by using RFID tags. Each asset will be equipped with RFID tags, RFID reader will be able to track down this asset through the tags. This will help to monitor the movement of the asset in the store.

This system also includes a database, which allows the storing and retrieve process of user information accomplished in a faster and easier way. The overall system is believed to be much more systematic and efficient as compared to the old system. Moreover, the interfaces are designed and developed oriented to be easier, to be understood and user friendly.

1.3 Objectives

This asset management system using RFID wirelessly is develop to help improving the asset management system that been used currently. The main aim of this project is:

- a) To develop an asset management system using RFID technology to monitor status and information of asset in the warehouse.
- b) To design a user friendly web-based interface for viewing information and data from the asset management system remotely on mobile devices.

1.4 Scope

Several scopes have been decided before this project is being built but still following the objective listed. The main aim of this project is to develop an asset management system using RFID that works wirelessly. It also includes the database, monitoring system and friendly web-based interface.

The interface is to connect the RFID with the database, manage the information about the asset, and helps to take monitor the number of asset automatically. Other scopes of this project are:

1. This wireless asset management system is done for small scale application.
2. Users of this system are administrator and person-in-charge of the store only.
3. Administrators can update, add or delete asset's data and view asset record.
4. Analyze number of asset going in and out of the warehouse frequently.

1.5 Thesis Organization

This thesis consists of five parts. In Chapter 1, the introduction of this project which contains background, problem statement, objectives and scope will be stated while the literature review is being discussed in Chapter 2. Literature review is the analytical study of other research have been done before through library and web sources, the comparison between technology chosen and why it is being choose. Chapter 3 will be discussing on research methodology that will be explaining on the method, technique or approach used to complete this project. Other than that, this chapter also will explain the project development. It includes the integration of hardware and software used in this project. Chapter 4 is explaining the analysis of the system including how it work and the interface. Conclusion and recommendation is covered is Chapter 5 where the summary of the whole project and suggestion to enhance this project in future is discussed.

CHAPTER 2

LITERATURE REVIEW

2.0 Overview

This chapter will review what Radio Frequency Identification (RFID), details on RFID, previous and current asset management system application using RFID. A comparison for RFID vs Barcode, types of RFID, advantage and disadvantage of RFID will also be discussed to determine the best technology to be chosen. Other than that, introduction of Wireless Sensor Network (WSN) is also included in this chapter where introduction to ZigBee and ZigBee topologies are discussed. A comparison between ZigBee and other wireless transmission device is comprised together with this topic. Finally, the information about software being used for interface between hardware and software is discussed.

2.1 Radio Frequency Identification (RFID)

2.1.1 History of RFID

During World War II, British Royal Air Force is using a technology called "Friend or Foe Transponder Identification System". In conjunction to that, a scientist named Harry Stockman has published a paper about Radio Frequency Identification (RFID) in the late of 1940. In the late 1960s to the early 1970s, RFID have been developing its first commercial application which is the Electronic Article Surveillance (EAS) system in the late 1960 to the early 1970. EAS system uses a simple form of RFID with to prevent stealing cases.

RFID technology is starting to be commercialized in the 1980 and 1990. Examples of the application are for livestock tagging system, toll road payment systems and RFID usage on shop floors to help in automobile assemble. By the end of the 20th century, RFID technology is used by embedding it in a product or a device used by users for example Touch 'n Go System. Brief history of RFID development is shown in Table 2.1 below:

Table 2.1: Brief history of RFID

Year	Events
1940 - 1950	-Radar technology is open and majorly used in World War II development effort. -RFID is invented in 1948.
1950 - 1960	-Early development of RFID technology through experiments.
1960 - 1970	-Development on theory of RFID. -Applications trial on the field work started.
1970 - 1980	-RFID technology is starting to develop. -Testing on RFID application increases. -Early adoption of implementation of RFID.
1980 - 1990	-Application of RFID is starting to commercialized.
1990 - 2000	-RFID standard is starting to develop. -RFID is widely deployed. -RFID is being used in everyday life.
2000 - present	-RFID is continued to be commercialized on.

2.1.2 Introduction to RFID

RFID is the technology that is grouped under the Automatic Identification (Auto ID) systems. Example of the technology in this system including barcode, magnetic inks, optical character recognition, voice recognition, touch memory, smart cards and biometrics. Auto ID technologies are a new technology in monitoring information and material flow such as asset management system. This technology is especially suitable for large production asset.

Radio frequency identification (RFID) technology has been widely used recently. This technology is providing an infrastructure to maximize real-time tracking and monitoring of assets information to improve current asset management systems. RFID can be used for identifying, tracking, sorting and detecting large types of objects.

The RFID technology working method is by gathering information about a specific item without the need of touching or seeing the data directly. This technology is using the inductive coupling or electromagnetic waves as a carrier to send the data.

Communication takes place between a RFID reader and a RFID tag where data is encoded in built-in embedded system in the tags. Tags that are integrated with an antenna can be either active which is powered by a battery or passive which is powered by the reader field. RFID does not require line-of-sight to identify an object. This technology is capable in recognizing various objects at once, thus many sectors have been implemented it as their system. Examples of the fastest growing application areas of RFID are in retail services, commercial services, and healthcare services.