WIRELESS LOCATOR SYSTEM

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Dedicated to family, especially to emak and ayah for the support, to all friends for helping this project and also all UTeM lecturers. Thank you!

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ABSTRACT

The purpose of this project is to create a system that can help people to locate their personal belongings by using RFID (*Radio Identification Identification)* technology. RFID is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags. An RFID tag is an object that can be applied to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader. Most RFID tags contain at least two parts. One is an integrated circuit for storing and processing information, modulating and demodulating a (RF) signal, and other specialized functions. The second is an antenna for receiving and transmitting the signal. There are two types of RFID tag which is active and passive RFID tag. Tag used in this project is passive tag. Passive RFID tags have no internal power supply. It obtains the power when there is electrical current induced in the antenna by the incoming radio frequency signal. It provides just enough power for the CMOS *(Complementary Metal Oxide Semiconductor)* integrated circuit in the tag to power up and transmits a response. Passive tags have practical read distances ranging from about 10cm. Once the item is detected, it will be display at the LCD *(Liquid Crystal Display)*. This LCD is program by microcontroller. RFID reader locate item with tag and routed it to the microcontroller. Microcontroller program the LCD based on receive signal from the reader.

TABLE OF CONTENTS

ABSTRAK

Tujuan projek ini dijalankan ialah untuk membina satu sistem untuk mambantu orang mencari barang-barang mereka dengan menggunakn RFID teknologi. RFID ialah satu cara pengesan automatic yang menyimpan dan mendapatkan kembali data menggunakan alat yg dipanggil RFID label. RFID label ini boleh digunakan terhadap sebarang barang, haiwan atau manusia dengan tujuan identifikasi yang menggunakan gelombang radio. Sesetengah label boleh dibaca daripada jarak beberapa meter dan jauh dari pandangan pembaca. Kebanyakan RFID label terdiri daripada dua bahagian. Satu bahagian adalah litar bersepadu untuk menyimpan maklumat dan untuk memproses informasi, mengubahsuai gelombang radio dan lain-lain fungsi tertentu. Satu lagi bahagian ialah antena yang berfungsi untuk memancar dan menerima isyarat. Jenis RFID label juga terbahagi kepada dua iaitu jenis pasif dan jenis aktif. Projek ini menggunakan label pasif. Ia memperoleh bekalan kuasa daripada arus elektrik yang dirangsang di bahagian antena oleh gelombang radio yang diterima. Bekalan kuasa ini cukup untuk dibekalkan kepada litar bersepadu CMOS di dalam label dan memancarkan semula isyarat tindakbalas. Label pasif mempunyai jarak bacaan yang praktikal iaitu dalam julat 10cm. Apabila barang sudah dikesan, status barang tersebut akan dipaparkan di paparan LCD. LCD ini diprogramkan oleh mikropengawal. Mikropengawal memprogramkan LCD ini berdasarkan isyarat yang diperoleh daripada pembaca.

LIST OF TABLE

LIST OF FIGURE

LIST OF ABBREVIATIONS

AV	-	Alternating Voltage
CMOS	-	Complementary Metal Oxide Semiconductor
CPU	-	Central Processing Unit
DIP	-	Dual in Line
EMC	-	Electromagnetic Corruption
ID	-	Identification
ISO	-	International Organization for Standardization
LED	-	Light Emitting Diode
LCD	-	Liquid Crystal Display
MCU	-	Microcontroller Unit
PC	-	Personal Computer
PCB	-	Printed Circuit Board
PDA	-	Personal Digital Assistant
PIC	-	Peripheral Interface Controller
RF	-	Radio Frequency
RFID	-	Radio Frequency Identification

LIST OF APPENDIXS

CHAPTER 1

INTRODUCTION

This chapter will provide brief explanation about the project done. Besides, it will cover the objective, scope of work, problem statement, methodology and report structure of the project.

1.1 Introduction

Nowadays, there are many locator systems available in the market by using various technologies which has growth rapidly days by days. Consequently, this project will use RFID (Radio Frequency Identification) technology in order to locate items. People always misplaced their small personal belongings such as keys, wallet, PDA and so on. When this situation happens, it will waste time by searching for them and worse, those things missing by a simple careless mistake. This system is wireless so it is portable to be use in any desired area. The reason of choosing RFID technology is because of its efficiency, security, and no line-of-sight requirements. Furthermore, RFID is expected to increase rapidly in the next few years.

Basically, this project is to design a portable wireless locator system by using RFID technology. The type of RFID chosen is passive RFID type. An RFID tag will be stick at the personal belongings to be located. A circuit will be design to produce a magnetic field which will excite the RFID chip on the personal belonging. The output signal will be filtered and routed to the PIC. The PIC will then, analyze the signal and output the status result of the item has been detected on the LCD panel.

1.2 Objectives

In order to complete this project, there are several objectives to be achieved. These objectives will lead to project success.

i. To design a power regulator circuit to provide supply to the whole circuit.
ii. To design a RFID detector circuit that can detect item with the RFID chip.
iii. To display status of item to be detect at LCD panel.

1.3 Scope of Work

This project has wide scope, however, in order to make sure that this project follow the dateline, some limitations have to be done. The limitations of this project are:

i. Tag used is passive tag.
ii. 125 kHz RFID microchip used.

1.4 Problem Statement

Recently there has been an explosion in the number and variety of products using wireless technology to track assets and personnel. Though, bar codes have been the primary means of identifying products. Major problem with this bar code is that it require line of sight for them to be read by a scanner. Moreover, if a bar code on an item is damaged, soiled or removed, it can not be scanned. Nevertheless, standard bar codes only identify the manufacturer and product and not the unique individual item. This is because, bar codes is one of font available in Microsoft Office Word also known as code 39, code alpha 39, code 3 of 9 or 3 of 9 code. The number 3 and 9 itself means that each character was design from 3 elements from 9 of all elements. To encode characters, simply surround any combination any supported characters with * character. As for example, to encode123, just simply type *123*. By using RFID technology, these outcomes can be solved where tags can be read even under an object or layer such as dust, under humidity, and heat and cold. Tags also does not require line of sight and can be read simultaneously. It has the capabilities of both reading and writes wirelessly. There is also available a finder system where use radio frequency to locate items but it is not practical where it use remote to find another. Plus, it requires high power consumption. This system does not require remote and it is low power consumption [1].

Thus, RFID solution has more four advantages compared to barcodes system which are;

i. Contactless and remote interrogation.
ii. No line of sight required.
iii. Multiple parallel reads possible.
iv. Individual items instead of an item class can be identified.

1.5 Report Structure

This thesis is divided into five chapters to provide clear understanding about this whole project.

Chapter 1: Covers the overview of the project. This chapter will be including the synopsis of the project, the project objective, and scope of the project and of problem statement.

Chapter 2: This part is the medium to get information in order to develop the project. The information will classify by a journal, articles, and books and some related interview.

Chapter 3: It will cover up all the methodology and a project implementation process to make the goal achieved. The hardware and software technical details also will be explained in this chapter.

Chapter 4: This is the important chapter for this project. This chapter will contain the development and implementation of the whole project and also the results gained.

Chapter 5: This chapter is the whole contents of this project and thesis. At the end of this chapter, some references, discussions and attachment will be includes for future references.

CHAPTER II

LITERATURE REVIEW

This chapter will focus based on the basic concepts and theories about the development and implementation of the project. The portable wireless locator system is a concept design based on helping people keep lives organized. Through this literature review, previous works and researches upon this system can be performed. The technical issue about this system reliability can also be evaluate and identify.

2.1 Wireless Locator System

Radio Frequency Identification is a generic term technologies that use radio waves to automatically identify individual items. There are several methods of identifying objects using RFID, but the most common is to store a serial number that identifies a product, and perhaps other information, on a microchip that is attached to an antenna. The chip and the antenna together are called an RFID transponder and RFID tag. The antenna enables the chip to transmit the identification information to a reader. The reader converts the radio waves returned from the RFID tag into a form that can then be passed on to computers that can make use of the sent information.

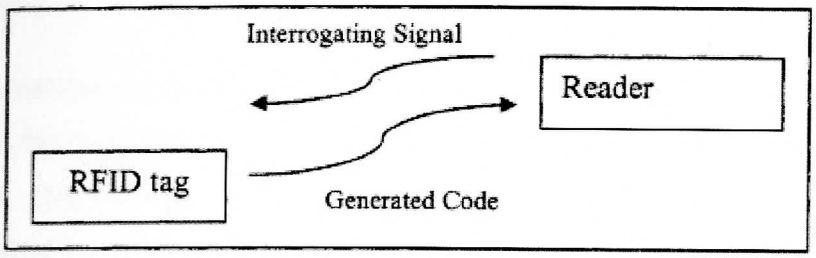

Figure 2.1: Schematic Diagram of Typical RFID System

Even though tags in the form of RF transponders have existed for the last fifty years, bar codes require line of sight for them to be read by a scanner. Moreover, if a bar code on an item is damaged, soiled, or removed, it can not be scanned. Standard bar codes identify only the manufacturer and product and not the unique individual item. Recent inventions in fabrication and design techniques solved some of these problems and lead to the aggressive application of the RFID technology, where tags can be read even under an object or layer, do not require line of sight, and can be read simultaneously. RFID's having read/write capabilities can be both read/written wirelessly, offering a lot more flexibility in their implementation to form networks that can make inventory and supply chain management an easy task. RFID-based sensor tags offer additional advantages like tamper proof capability and entity sensing such as, pressure, stress, temperature and vibration [1].

2.2 RFID Readers

The function of RFID reader is to send a radio frequency signal, receive the information contained in the carrier coming from the transponder and process the data to be sent to the computer. Readers can be separated by the way they power the transponders. They can be categorized into "Constant Powered" and "Burst Powered'.

2.2.1 Constant Powered

The transponder is energized by the radio frequency (RF) or carrier signal after it has entered the radio frequency range of the reader. An AV voltage is generated across the coil when a RF field passes through the antenna coil of the transponder. This voltage is then rectified to supply power to the transponder. After the transponder has been energized, it transmits data back to the reader on the information it has stored in memory. This process is called backscattering modulation. Using backscattering modulation, the passive transponder is not a transmitter or transponder in the purest definition of the term. In spite of this, communication in both directions takes place. Figure 2 shows a version of the block diagram of a Constant Powered RFID reader.

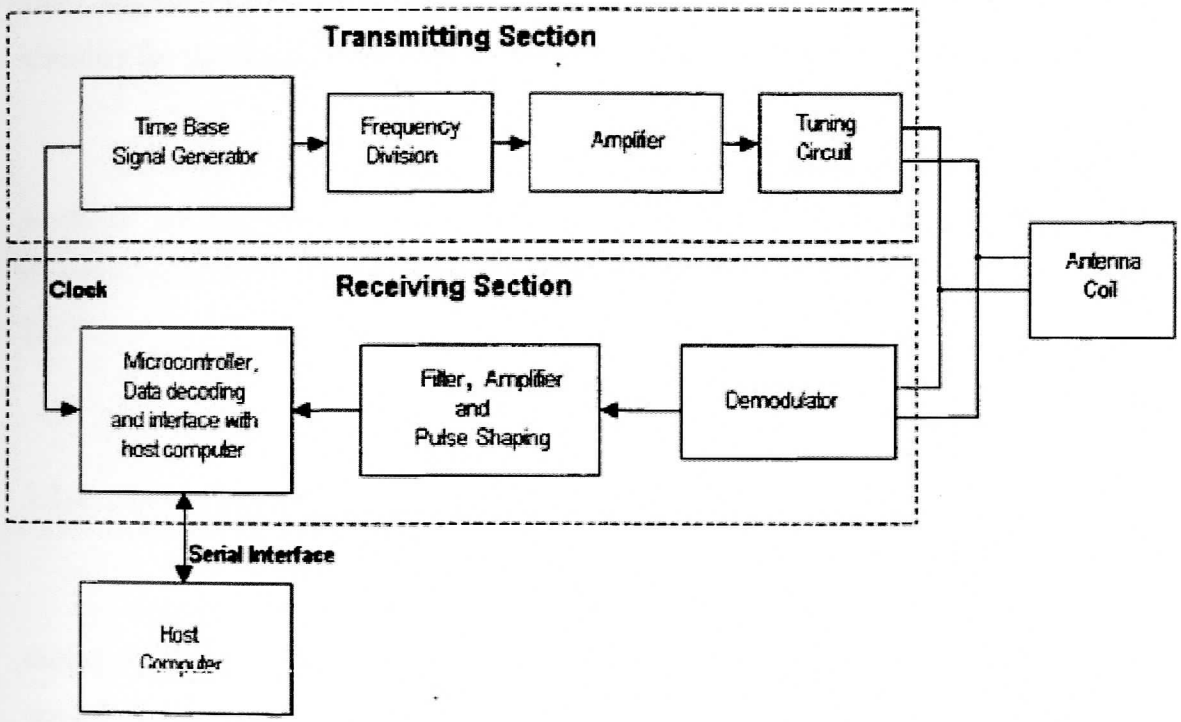

Figure 2.2: Block diagram of a Typical Constant Powered RFID Reader

The transmitting section contains the necessary circuitry to produce a carrier signal, amplification of the carrier, and the tuning of the antenna coil. The carrier signal is generated by a crystal oscillator in order to obtain a stable frequency. Standard carrier frequencies for passive RFID system are in the range of 30 kHz to 500 kHz. The signal is amplified and passed on to a tuning circuit block. This tuning circuit block consists of capacitors from different values connected to the coil and changes the impedance of the resonant circuit LC. In this way the LC tank can be tuned to resonant circuit LC. In this way the LC tank can be tuned to resonate at the appropriate carrier frequency to produce the maximum signal level. The tuning helps to compensate for the variations on the component values and the perturbation of coil inductance due to environmental effects.

The receiving section contains the antenna coil, a demodulator, a block with filter, amplifier and pulse shaping and a microcontroller. The type of modulation and the circuitry for the demodulator depend on the requirements of the RFID system used.

Constant Powered transponder has the advantage that no synchronization methods are needed to synchronize the reader and the transponder because the transponder is using the RF carrier from the reader to clock the data from the memory [2].

2.2.2 Burst Powered

Another way to power the transponder is to send RF energy from the reader during fixed time. The RF energy received by the transponder during this time is just enough to charge a capacitor that actuates as an energy accumulator. This energy needs to be sufficient to power the transponder. A block diagram for this case is presented in Figure 2.3.