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CHAPTER 1

INTRODUCTION

With the prosperous economy, nowadays, most of people own and use car for their everyday convenience. In 1981, 75 out of 1000 people around the world own the car. They use car to help them commute from one place to another. And, sometimes, people do forget where they have parked their vehicles. It may result in people making police reports thinking that their cars were stolen as they were not able to locate them. This has been mentioned in Info912 Programme aired on TraxxFM during one of its slots.

1.1 Problem Statement

The problem with this forgetfulness (and ignorance) could be solved with the help of the advancement in today's technology especially in terms of digital electronics, embedded systems and wireless communication.

- How to find where the car is at the parking lot compartment?

1.2 Research Objective

Thus, the objective of this project is to design a system that is able to locate the position of car (or other type of vehicle) when it is at halt. It is hope that this project would be able to provide the solution to the car owners in locating their car at the car park. It could also ease the worry of the owner as he knows that his car is still in the car park. Last but not least, it is hope that there will be no more false police report so as to fully utilise the police workforce in solving the real crime instead.

1.3 Scope of Work

The scope of this project involves in designing two units of embedded system, i.e. the MOBILE unit and the FIXED unit. Both of these units comprised of the hardware part and the software part. The hardware part includes the integration of the transceiver modules, one for the FIXED unit (to be placed in the car) and another one for mobile unit (to be kept by the car owner). Other than the transceiver modules, both units also include the control unit, i.e. the PIC18F448 microcontroller. While for user interface of the MOBILE unit, an LCD module is also included. The software part involves with the programming of the microcontrollers, i.e. the brains of both units. These microcontrollers control the communication between these two units. The computation of the car location is also done by the microcontroller of the MOBILE unit. The MOBILE unit's microcontroller also provides an interface link for the user, i.e. the control part of the LCD module.

The principle of Radio Frequency Identification (RFID) is applied in this system. It has been in which each unit is being assigned with a unique identification number.

A half-duplex system communication system is applied in this system so as to reduce the complexity of the system and at the same time cost is reduced as less hardware is required.

1.4 Background of Study

Radio frequency (RF) signal is the electromagnetic wave of which the frequency range is from 3 kHz to 300 MHz as shown in Figure 1.1 below, while the microwave frequency range is from 300 MHz to 300 GHz. RF is used in ICDS as it provides more advantages to the user compared to others. These advantages are due to the property of the RF signal itself. With the usage of RF, the system is able to function independent of the cable (as the system is non-wired) for easy handling. This is due to the fact that RF could transmit the signal through the air medium. Because of this property too, it enables RF the ability to pass through the walls/obstacles. Thus, it makes this system to function beyond walls/obstacles. Compared to Infra Red, although Infra Red also offers a wireless communication, it requires the Line Of Sight (LOS) communication in order for it to function. Thus, the system's communication will stop if the signal is blocked by the walls, making it an unsuitable choice for ICDS. The radio frequency of 433.92MHz is used in communicating between the two units.

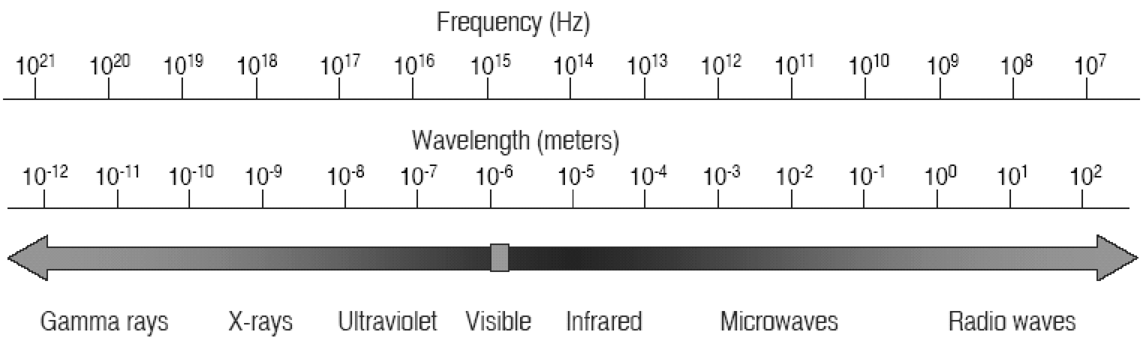

Figure 1.1: Electromagnetic spectrum

1.4.1 What is RFID?

Radio Frequency Identification (RFID) [1, 2] is a system used to replace the conventional barcode that we are using now. It has been applied in some application system such as by Mark & Spencer supermarket. The tag provides each item with individual ID number. In conventional barcode system, Infra Red has been used to read the barcode thus requiring the LOS between the barcode and the reader. Whereas in RFID, the tag itself will transmit the RF signal (its modulated ID code) during the reading process. First, the RFID reader transmits the RF signal. Then, RFID tag with the correct ID code will respond to the RFID reader by transmitting back the ID code. By using the RFID, the RFID reader is able to interrogate the RFID tag from far as it uses RF as a mean of communication.

RFID consists of 3 main components, namely:

1. Tags, which the identification data is embedded. They are known as transponder
2. Reader to communicate wirelessly to the tags
3. Software application that reads/writes data to/from tags through reader

Both, the reader and the tags are equipped with antennas in order for them to receive and emit the electromagnetic waves. There are endless benefits of RFID compared to conventional barcode in various fields from transportation, business, manufacturing and warehouse management. For example, the inventory process in a warehouse could be done automatically with the electronics labelling and wireless identification of objects using this RFID system, thus reducing the manpower needed in manual inventory process.

However, there is also a pressing issue of privacy invasion with regards to its application as experienced by Gillette and Tesco forcing them to terminate the RFID application. However, it is not relevant in this project as we do not pose any treat to this issue.

1.4.2 Half-Duplex Communication

One of the terms that could be used in characterising the wireless system is by looking at the directionality of the communication. This project will basically use a half-duplex system in which there will be two-way communication, but it does not occur simultaneously. It means that the channel could act as a transmitter at one time and as a receiver at another time. Therefore one antenna for each unit is sufficient (hence the low cost). Not only that, the interruption during data transmission is not necessary thus reducing the complexity of the control unit.

1.4.3 An Overview of Embedded Systems

An embedded system is a design making use of the power of a small microcontroller, like the Microchip PICmicro® MCU or dsPIC® Digital Signal Controller (DSCs). These microcontrollers combine a microprocessor unit (like the CPU in a desktop PC) with some additional circuits called “peripherals”, plus some additional circuits on the same chip to make a small control module requiring few other external devices. This single device can then be embedded into other electronic and mechanical devices for low-cost digital control.

The main difference between an embedded controller and a PC is that the embedded controller is dedicated to one specific task or set of tasks. A PC is designed to run many different types of programs and to connect to many different external devices. An embedded controller has a single program and, as a result, can be made cheaply to include just enough computing power and hardware to perform that dedicated task. A PC has a relatively expensive generalized central processing unit (CPU) at its heart with many other external devices (memory, disk drives, video controllers, network interface circuits, etc.). An embedded system has a low-cost microcontroller unit (MCU) for its intelligence, with many peripheral circuits on the same chip, and with relatively few external devices. Often, an embedded system is an invisible part, or sub-module of another product, such as a cordless drill, refrigerator or garage door opener. The controller in these products does a tiny portion of the function of the whole device. The controller adds low-cost intelligence to some of the critical sub-systems in these devices.

An example of an embedded system is a smoke detector. Its function is to evaluate signals from a sensor and sound an alarm if the signals indicate the presence of smoke. A small program in the smoke detector either runs in an infinite loop, sampling the signal from the smoke sensor, or lies dormant in a low-power "sleep" mode, being awakened by a signal from the sensor. The program then sounds the alarm. The program would possibly have a few other functions, such as a user test function, and a low battery alert. While a PC with a sensor and audio output could be programmed to do the same function, it would not be a cost-effective solution (nor would it run on a nine-volt battery, unattended for years!). Embedded designs use inexpensive microcontrollers to put intelligence into the everyday things in our environment, such as smoke detectors, cameras, cell phones, appliances, automobiles, smart cards and security systems.

1.5 Thesis Layout

The layout of this thesis is divided into seven chapters. These chapters are as stated below:

Chapter 1 – Introduction

Chapter 2 – Literature Review

Chapter 3 – Research Methodology

Chapter 4 – Hardware Design and Implementation

Chapter 5 – Software Design and Implementation

Chapter 6 – Results and Analysis

Chapter 7 – Conclusion and Recommendations

In Chapter 1, the brief description of the project is given. It includes the objective of this project, the scope of this project and the background of this project. It also includes the existing tracking systems available.

In Chapter 2, the important properties of the RF signal, the necessity of using the half-duplex communication system and the existing techniques in estimating the location are explained.

Chapter 3 explains the research methodology used in the project. As the methodology involved both the hardware and the software, the chapter provides the overall methodology involved.

Chapter 4 provides the explanations of the hardware development and its implementation in details. The hardware construction of both the MOBILE unit and the FIXED unit are shown here.

In Chapter 5, the software design and implementation are explained. They include the control setting of the hardware modules used in this project and the flow of the operation of each unit.

Chapter 6 focuses on the results of this project. These results are also analysed and discussed here to give an in-depth view of the accuracies of this system in calculating the position of the car.

Finally, in Chapter 7, a conclusion of the project is made together with the suggestions for future works that could be proceed from this project.