Application Radio Frequency In Keeping Track Shopping Trolley Using GSM

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To my beloved father, mother, brothers and sisters

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ABSTRACT

The objective of develop this project is to create a solution that can help the shopping management that provide trolleys services for the costumers or users to reduce cost to their company arising from the missing trolleys and frequently considered stolen This system consists of receiver and transmitter, and technically this device uses radio frequency wave concept to operate. If one of the trolleys is out of range, turn on a buzzer and a red light at the same time at control room than using GSM will sent Short Message Service (SMS) to guard. This capability provides ease and safety to safety guard, to monitor the trolleys frequently used by costumers or users. The operating frequency used by the transmitter is about 100MHz to 2.45GHz which the receiver can detect accurately within 10 to 100 meters; even through a protective casing is covering the transmitters. This covering is also use to avoid the users damaging the transmitters and to provide protection to the assembly. This is to ensure the trolley always in range.

ABSTRAK

Tujuan pembangunan projek ini adalah untuk mencipta suatu penyelesaian yang boleh membantu pihak pengurusan pasaraya yang menyediakan perkhidmatan troli untuk pelanggan atau pengguna bagi mengurangkan kos akibat kesan kecurian troli yang berlaku. Sistem ini terdiri daripada penerima dan pemancar, secara teknikal peranti ini menggunakan konsep frekuensi radio untuk beroperasi. Jika salah satu daripada troli adalah keluar dari kawasan, menghidupkan satu buzer dan lampu merah dalam masa yang sama di bilik kawalan daripada menggunakan GSM akan menghantar Khidmat Pesanan Ringkas (SMS) untuk Pengawal keselamatan. Keupayaan ini menyediakan kemudahan dan keselamatan kepada pengawal keselamatan, untuk memantau troli sering digunakan oleh Pelanggang atau pengguna. Kekerapan operasi yang digunakan oleh penghantar adalah kira-kira 100MHz untuk 2.45GHz yang penerima boleh mengesan dengan tepat dalam tempoh 10 hingga 100 meter, walaupun melalui selongsong perlindungan meliputi pemancar. Penutup ini juga digunakan untuk mengelakkan pengguna yang merosakkan pemancar dan untuk memberi perlindungan kepada perhimpunan. Ini adalah untuk memastikan troli sentiasa berada dalam lingkungan jarak.

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CHAPTER 1

INTRODUCTION

1.1 Background

Nowadays, shopping cart in one of the item that usually use at the supermarket or shopping mart. A shopping cart (trolley, carriage) is a cart supplied by a shop, especially supermarkets, for use by customers inside the shop for transport of merchandise to the check-out counter during shopping. Customers can then also use the cart to transport their purchased goods to their cars.

In some places, customers are allowed to leave the carts in the parking lot, and store personnel will return the carts to the storage area. In most Malaysian premises however, coin (or token) operated locking mechanisms are provided to encourage shoppers to return the carts to the correct location after use. In many countries, the customer has to pay a small deposit by inserting a coin, token or card, which is returned if and when the customer returns the cart to a designated cart parking point. The

motivation behind the deposit systems is not theft deterrent (the trolley is worth significantly more than the deposit) but to reduce the expense of employees having to gather carts that are not returned, and to avoid damage done by runaway trolleys.

From the history, the invention of Sylvan Goldman, owner of the Piggly Wiggly supermarket chain in Oklahoma City is one of the first shopping carts was introduced on June 1937. He found a wooden folding chair and put a basket on the seat and wheels on the legs. Goldman and one of his employees, Fred Young, a mechanic, began tinkering. Their first shopping cart was a metal frame that held two wire baskets. Since they were inspired by the folding chair, Goldman called his carts "folding basket carriers". [1]

The shopping cart has undergone many more changes as time has progressed. The shape has changed as ergonomic considerations were taken into account. For the most part, carts are bigger to hold more merchandise, thus enabling more sales. Although basic design hasn't changed much in the last 50 years, the next generation of carts is still evolving, with even bigger upper and lower baskets. Some stores are starting to get cart accessories that hold two kindergarten-size kids.

Practically all modern shopping carts are made of metal or a combination of metal and plastic and have been designed to nest within each other in a line to facilitate collecting and moving many at one time and also to save on storage space. The carts can come in many sizes, with larger ones able to carry a child. There are also specialized carts designed for two children, and electric mobility scooters with baskets designed for disabled customers.

Shopping trolleys also present tremendous logistic problem to the management. This is the result of trolleys being misplaced or stolen and this project aims at developing a solution to provide theft prevention.

1.2 Problem Statement

Most supermarket or hypermarkets in Malaysia share the same problem of keeping track of their trolleys when users use it. The main problem is, trolleys are always out of range from the supermarket because the users do not know where they should leave the trolleys and this causes lot of trouble to the supermarket management, and often most trolleys are considered stolen when this happened.

Figure 1.0: Trolley Is Out of Range from the Shopping Complex

1.3 Objective

The main objective of this project is to design and develop a device that detects the shopping trolleys when the trolleys are out of the market range, making use of wireless system concept. There are various types of wireless systems. This project uses the Radio Frequency for communication. This project is also implements the transmitter and receiver concept.

The main goal of developing this device is to alert the safety guard when the trolleys are out of range and to prevent shopping trolley from theft and lost.

1.4 Scope of Project

The scopes listed to ensure the project is conducted within its intended time frame and scale. It also helps to ensure that the project is heading in the right direction to achieve its objectives listed as follows:

1. Study the principle and application of Radio Frequency communication.
2. To construct and study the hardware of the circuit until it performs as desired.

The main scope of this project is primarily centered on hardware development. The scope includes the study of transmitter and receiver using Radio Frequency and its frequency coverage, the architecture, circuit diagram, how this system works and finally the development of the complete system

Fundamental requirement of the development of the system requires the following tasks:

1. To design a circuit that incorporates Radio Frequency (RF) Module. This module operates on 315 MHz and 433MHz of Radio Frequency spectrum. It has two components, one is RF Transmitter and the other one is RF Receiver.

2. To incorporate an Encoder circuit in transmitter and Decoder circuit in receiver. Encoder is used in the Transmitter Circuit. Decoder is used in Receiver circuits. The Encoder and Decoder are very important components in order to make a connection between RF Transmitter and RF Receiver.

To assist in the completion of final circuit layout, two software are used in creation of schematic circuit and the PCB design layout. The software is the Proteus 7 Professional

1.5 Project Methodology

This project begins with collecting data and information either from primary or secondary resources. Some of the information's are taken from the journal, book, magazine and web site. All the information gathered are scanned and skimmed in order to understand the concept of radio frequency and wireless communications. This project focus more on study case and the project development base on Radio frequency communication technology. The project methodology shows that the step by step taken to complete the project. The methodology includes the planning, the development of the design and the management of the project.

1.6 Thesis Structure

Chapter 1: The first chapter introduces brief idea of the project. It focused on the overview of the project, detailing the objectives, the problem statement, scope and outcome of the project.

Chapter 2: Project's background is discussed in this chapter. The method, concept, theory, and some characteristics of component or hardware that used in this project. Chapter 2 contains a definition of terms used throughout the report.

Chapter 3: The third section is the methodology's chapter. This chapter explains the procedure taken throughout the project. Methodology chapter is a schedule or steps that need to be complete, detailed reports of studies done to achieve aimed objectives.

Chapter 4: All the simulations, data collection and analysis obtained were discussed in detail. The results were compared with the outlined objectives in order to state some hypothesis and conclusion.

Chapter 5: Conclusions are detailed out in this chapter. It is followed by some recommendations on how to improve the performance of the system based on the desired results.

CHAPTER 2

LITERATURE REVIEW

2.1 Literature Background

Developing and designing of the project, requires lot of knowledge on theory and concept which play an important part in understanding the operation of transmitter, receiver, encoder, decoder, amplifier and so on. Additionally, understanding the concept of radio frequency (RF) and communication principle also play an important role in successful development of the project.

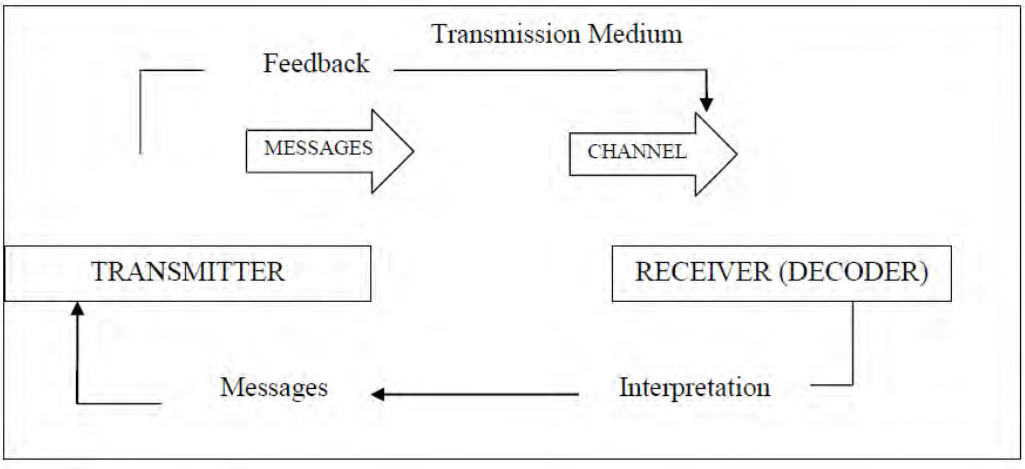

Figure 2.0: Basic Communication Model

Figure 2.0 shows the basic Communication model that consist two main part, which are the transmitter (encoder) and the receiver (decoder). This figure is the fundamental diagram of all communication interaction.

The massage was converts to other form as a signal at the transmitter part. The signal travels outward as the transmission signal to through the transmission medium to reach the receiver. The receiver part, interprets the message, which is sent in the signal form.

2.2 Radio Frequency (RF)

Radio frequency (abbreviated RF, rf, or r.f.) is a term that refers to alternating current (AC) having characteristics such that, if the current is input to an antenna, an electromagnetic (EM) field is generated suitable for wireless broadcasting and communications. These frequencies cover a significant portion of the electromagnetic radiation spectrum, extending from nine kilohertz (9 kHz), and the lowest allocated wireless communications frequency (it's within the range of human hearing), to thousands of gigahertz (GHz) that means is 1T Hz.

RF current gives rise to an electromagnetic field that propagates through space, when an RF current is supplied to an antenna. This field is sometimes called an RF field; in less technical jargon it is a "radiowave." Any RF field has a wavelength that is inversely proportional to the frequency. In the atmosphere or in outerspace, if ‘f’ is the frequency in megahertz(MHz) and ‘S’ is the wavelength in meters, then ‘S’ can find using this equation:

$$S = \frac{300}{f\ MHz}$$

The frequency of of RF signal is inversely proportional to the wavelength of the EM field to which it corresponds. At 9 kHz, the free-space wavelength is approximately 33 kilometers (km) or 21 miles. At the highest radio frequencies, the electromagnetic wavelengths measure approximately one millimeter (1 mm). As the frequency is increased beyond that of the RF spectrum, electromagnetic energy takes the form of ultraviolet (UV), visible, infrared (IR), gamma rays, and X-rays.

RF field was used many types of wireless devices. There are many example that operate in RF spectrum, such as Cordless and cellular telephone, radio and television broadcast stations, satellite communications systems, and two-way radio services. Some wireless devices operate at infrared (IR) or visible-light frequencies, whose electromagnetic wavelengths are shorter than those of RF fields. Examples include most some cordless computer keyboards and mice, television-set remote-control boxes, and a few wireless hi-fi stereo headsets. [2]

2.3 Radio Spectrum

Radio spectrum refers to the part of the electromagnetic spectrum corresponding to radio-frequencies that is, frequencies lower than around 300 GHz (or, equivalently, wavelengths longer than about 1 mm).Different parts of the radio spectrum are used for different radio transmission technologies and applications. Radio spectrum is typically government regulated in developed countries and, in some cases, is sold or licensed to operators of private radio transmission systems (for example, cellular telephone operators or broadcast television stations). Ranges of allocated frequencies are often referred to by their provisioned use (for example, cellular spectrum or television spectrum).[3]

The RF spectrum is divided into several ranges, or bands. With the exception of the lowest-frequency segment, each band represents an increase offrequency corresponding to an order of magnitude (power of 10). The Table 2.0 show the bands in

RF spectrum, showing frequency and wavelenght in air and also the example of uses every band.

Band name	**Abbr**	**ITU band**	**Frequency and wavelength in air**	**Example uses**
			< 3 Hz > 100,000 km	Natural and man-made electromagnetic noise
Extremely Low Frequency	ELF	1	3–30 Hz 100,000 km – 10,000 km	Communication with submarines
Super low frequency	SLF	2	30–300 Hz 10,000 km – 1000 km	Communication with submarines
Ultra low frequency	ULF	3	300–3000 Hz 1000 km – 100 km	Submarine communication, Communication within mines
Very low frequency	VLF	4	3–30 kHz 100 km – 10 km	Navigation, time signals, submarine communication, wireless heart rate monitors, geophysics

Low frequency	LF	5	30–300 kHz 10 km – 1 km	Navigation, time signals, AM long wave broadcasting
Medium frequency	MF	6	300–3000 kHz 1 km – 100 m	AM (medium-wave) broadcasts, amateur radio, avalanche beacons
High frequency	HF	7	3–30 MHz 100 m – 10 m	Shortwave broadcasts, citizens' band radio, amateur radio and over-the-horizon aviation communications
Very high frequency	VHF	8	30–300 MHz 10 m – 1 m	FM, television broadcasts and line-of-sight ground-to-aircraft and aircraft-to-aircraft communications. Land Mobile and Maritime Mobile communications, amateur radio, weather radio

Ultra high frequency	UHF	9	300–3000 MHz 1 m – 100 mm	Television broadcasts, microwave ovens, microwave devices/communications, radio astronomy, mobile phones, wireless LAN, Bluetooth, ZigBee, GPS and two-way radios such as Land Mobile, FRS and GMRS radios,
Super high frequency	SHF	10	3–30 GHz 100 mm – 10 mm	radio astronomy, microwave devices/communications, wireless LAN, most modern radars, communications satellites, satellite television broadcasting, DBS, amateur radio