

MAILBOX INDICATOR WITH REMOTE SWITCH

MOHAMAD SHARIFUDDIN BIN EZHAM

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ABSTRACT

The idea to design the electronic mailbox with remote switch came out when we think that this project can give a lot of benefit to the user. The idea came out when there are problem face by the user. So this product will help to solve that problem. Normally user needs to walk to the mailbox to check the letter. Sometimes when there is no letter it has waste our energy to go out there and go back to house without any letter. Environment factor also give a problem to the user. When outside of our house was too hot or raining, it makes us feel no desire to check the status of the mailbox. With this product, user just needs a remote control to check the status of the mail box inside of their house. The way to solve this problem is design an electronic mailbox that is able to sense letter and the status of the mailbox can be seen from the far distance. A remote control will be design to trigger the system at the mailbox. This remote control will use radio frequency technique which widely applied for much electronic application. This project has potential to be upgrade for advance specification and it has a big potential to be market to the user who live at the tall building like at the apartment.

ABSTRAK

Project ini dibina berdasarkan masalah yang dihadapi oleh pengguna. Projek ini akan melibatkan pembinaan sebuah petik surat elektronik yang mampu memudahkan para pengguna peti surat dan aplikasinya sangat praktikal. Saya pasti dengan adanya peti surat seperti ini masalah yang wujud akan selesai. Pada kebiasaannya pengguna perlu pergi ke peti surat itu sendiri untuk melihat sama ada peti surat itu mempunyai surat atau tidak. Pengguna akan mensia-siakan tenaga sekiranya tiada surat dalam peti surat tersebut. Selain itu faktor alam sekitar juga mampu memberi masalah kepada pengguna. Faktor seperti hujan atau cuaca yang panas terik akan memberi kesukaran kepada pengguna untuk menganbil surat yang berada jauh di luar rumah. Dengan adanya produk ini pengguna boleh melihat status peti surat tersebut dengan hanya menggunakan system kawalan jauh. Untuk mengatasi masalah yang sedia ada, peti surat akan dibina dengan dilengkapi kebolehan untuk mengesan kehadiran surat di dalam peti surat dan mampu memberi isyarat dari jauh untuk menunjukkan status peti surat itu sendiri. Untuk alat kawalan jauh saya akan menggunakan teknik frekuensi radio. Alat kawalan jauh ini digunakan sebagai suis untuk menhidupkan operasi sensor yang terdapat pada peti surat.

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CHAPTER 1

INTRODUCTION

1.1 Overview

This final year project report is all about how to design, implement and test an electronic letterbox/ mailbox that will indicate the box status if it is triggered by a remote control as far as 10 meters from the target (mailbox). When we triggered by a remote control it will send radio frequency through the transmitter to the receiver at the mailbox. Here the signal which contains data will be processed and translated using Programmable Integrated Circuit. To sense things in the box sensor will be used. When the sensor senses letters or flyers it will send back a signal to indicate that mailbox was occupied. The indicator should be small enough to fit inside a typical mailbox and can detect the existence of letter or papers such as notices and flyers. Its indicator will be visible through the transparent window.

1.2 Problem Statement

The purpose of developing this project was to upgrade the function of the mailbox. Before this the user need to walk to the mailbox to check whether there are letters inside. They have wasting their time and energy to walk to the mailbox if there are no letter or others thing like note and flyer. If there is a device that can be used to indicate the status of the mailbox, the user does not have to waste their time and energy anymore.

1.3 Project Objectives

In developing this project we have determined a few of objectives that we have to archive at the end of this project. This objective was create as a guide line to archive the purpose of developing electronic mailbox. We have consider a few things before determine the suitable objective for this project. All of the objectives relate to the problem faced by the user and the work procedure that we will undergone when developing this project.

- ✓ In our first objectives is to design electronic mailbox indicator that would show the box status empty or occupied. This first objective is our main objectives.
- ✓ Our second objective is to implement the concept of transmission signal and develop own program for its controller.

This objective was made because we also want to focus in concept of signal transmission using radio frequency. For our last objectives is to test the function of the project at the final task of this project by doing simulation.

1.4 Scope of Work

Scope of work is a guide line for our project. We have to archive all the target for each of the scope. Each of the scope is related to the operation of the system. Our scope consist 4 major parts that will play a main role in the system operation. There are sensor, transmission signal, indicator and controller.

- ✓ Our first scope is about a sensor. Sensor should be able to detect the small white envelope in the mailbox. This is our main target that we have to archive for the ability of the sensor to sense object.
- ✓ Our second scope is about the signal transmission. For our scope the transmitter and receiver should be able to transmit and received signal from 10 meter. This is a maximum range for the user to transmit signal using remote switch from the mailbox.
- ✓ For our third scope is about the indicator. Our minimum specification required LEDs as a device that will be display the indication at the transparent window of the mailbox.
- ✓ In our last scope microprocessor must be able to control the operation of the system by following the command program. Microprocessor will control sensor operation, translate data, and control the indicator.

1.5 Methodology

Process developing electronic mailbox follows the methodology of the project. Methodology help me to understand the goal of my project and it is overall step to develop this project until it archived all the objectives. It is a guide line for me and the progress of this project can be seen clearly.

CHAPTER 2

BACKGROUND STUDY

2.1 Introduction

In this final year project I have to design the electronic mailbox and remote control. So I have to fabricate for those thing. Before doing the fabrication process I have to identify the theory that I will apply in designing the operation circuit for the system. After understand the theory I have to design circuit by using electronic software. I also have undergone one workshop that was organized by the Faculty of Electronic and Computer Engineering. This workshop is all about the programmable integrated circuit. I have gained my knowledge through this workshop in application of PIC. PIC is one of the main parts that will be organizing all the application for my project.

The main purpose of developing this project is to indicate the mailbox status. The indicator will show whether that mailbox are occupied or not. The starting point how the electronic mailbox operate its function is from a device called remote control. With the hand held remote control it will trigger all the function that we program in the programmable integrated circuit on the main circuit. When design a remote control, we have to understand the concept of transmission signal, types of signal transmission,

concept of transferring data using signal and how the data was process before transmit and received operation.

2.2 Signal Transmission

I have analyzed the concept of signal transmission. Signal transmission is a process where we transfer signal which consists of data in it. The transmission process will involve two or more parties which react as a receiver to receive the data. There are two types of signal transmission that I have identified. There are analog and digital transmissions. For this project I have decide to apply the theory of digital transmission. As from the above definition digital signal will involve other parties as a receiver or transmitter. From the theory transmission signal will be modified to carry the transmitted information. Nowadays we see a lot of application from this concept. Example that we can take is in the microwave system which the carrier of radio frequency is in analog signal but its modulated information was in digital signal.

2.2.1 Data Transmission

The purpose of digital transmission is to transfer data from one point to other. It is representing as an electromagnetic signal over a physical point to point or multipoint of communication channel. The data transmission can be held in many ways such as optical fiber, copper wire, storage media and wireless communication channel. From the scope of this project, the remote control can trigger the indicator within 10 meters radius distance from the mailbox. So we will apply the wireless concept as a part of the project specification. Nowadays we did not use analog signal any more. We have move on to the digital signal and transferred data will be in digital bit stream. As we know the digital bit stream come from digital information source. Digital bit stream which consist of data will be modulate using line coding.

2.2.2 Remote Control

In the data transmission there are two ways or method to transmit data. There are parallel and serial transmissions. From the research under this topic serial transmission is the sequential transmission of signal element of a group which representing a character or other entity of data. Like from previous explanation digital serial transmissions are bits sent over a networking channel path sequentially. For this project networking channel mean air as a medium of transmission line which will be in frequency parameters. Serial transmission does not require lot of signal processing and it is less chance of error. Other advantage of serial transmission is the transfer rate of each individual path may be faster. For this electronic mail box, it does not have many operations to work with. It is only triggered to detect the paper especially letter. We are not going to involve with parallel transmission because we will not apply this concept in developing this electronic mailbox.

In designing the remote control we have to determine the types of remote control that we going to use. By following the information that we gathered there are two types of remote control in the market and there are radio frequency and infrared remote control. I have decided to use radio frequency as my hand held remote control for my final year project. Definition of the radio frequency or know as RF is oscillation rate which it is in the range of 3 Hz to 300 GHz. Alternating current electrical signal will depends on this range of frequency to detect and provide the radio waves. The radio frequency refers to oscillations in electromagnetic radiation.

Suitable radio frequency range was determined. I will applied ultra high frequency which it range start from 300 Hz to 3000MHz. This range of frequencies is suitable for remote control usage.

After we understand the concept of the signal transmission especially in digital signal we can proceed in developing the circuit for remote control. We will use the RF module in developing the design of remote control which will modulate the signal.

In the real application of remote control we can see how they applied the concept of RF on the radio control device. Let assume that the frequency used for one device is at 27.9 MHz. Below are how radio control its circuit:

1. You press a trigger button.
2. The trigger causes a pair of electrical contacts to touch, completing a circuit connected to a specific pin of an integrated circuit (IC).
3. The completed circuit causes the transmitter to transmit a set sequence of electrical pulses.

Each electrical sequence contains a short group of synchronization pulses, followed by the pulse sequence. For the operation of this device, the synchronization segment which alerts the receiver to incoming information is four pulses that are 2.1 milliseconds long, with 700-microsecond intervals. The pulse segment, which tells the antenna what the new information is, uses 700-microsecond pulses with 700-microsecond intervals.

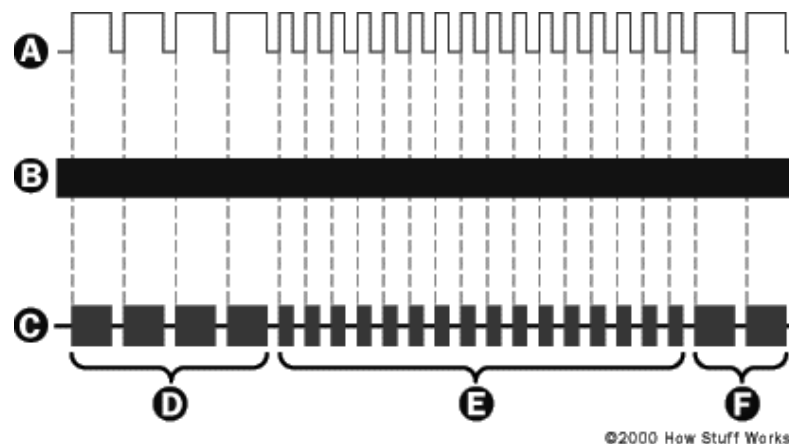


Figure 2.1 A typical RC signal transmission

- | | |
|--|---|
| A Pulse sequence | E Burst sequence,
each $\approx 700\mu\text{s}$ long
with $\approx 700\mu\text{s}$ spacing |
| B 27.9MHz signal | F Sequence repeats |
| C Transmitted signal | |
| D 4 synchronization bursts
each $\approx 2.1\text{ms}$ long
with $\approx 700\mu\text{s}$ spacing | |

Below are meaning of each pulse sequence that will be used in the pulse segment:

- Forward: 16 pulses
- Reverse: 40 pulses
- Forward/Left: 28 pulses
- Forward/Right: 34 pulses
- Reverse/Left: 52 pulses
- Reverse/Right: 46 pulses

4. The transmitter sends bursts of radio waves that oscillate with a frequency of 27,900,000 cycles per second (27.9 MHz). This process knows as pulse modulation.
5. When the receiver receives the radio bursts from the transmitter, it sends the signal to a filter that will blocks out any signals that are out of it range of 27.9 MHz. The signal is then converted back into an electrical pulse sequence.
6. The pulse sequence will be decodes that sequence and starts it certain function.

2.3 Sensor

Sensor is other important part for the project to operate. First of all I have to understand the operation concept of a sensor. After doing some research and study on this part I found that sensor is equipment that does measurement on the physical quality and the result can be seen by the observer and instrument. Nowadays application of the sensor has been widely use. Normally we can find sensor applied into the factory machine and robotic works. The sensitivity of one sensor can be determined by seeing how much the sensor output change by varying the measured quantity changes. So we say that a highly sensitive sensor is a sensor that can measure small change happen during measurement process.

To determine type of sensor that we will use for this project I should determine the main purpose or task needed in detecting my main target. For this project, paper and

letter will be the main target. From the observation the most common sensor that have been used in the factory sector is photoelectric sensor, vision sensor and vision systems. Functions for every type of sensor are:

- ✓ Detection
- ✓ Synchronization
- ✓ Inspection
- ✓ Detect classification / optical character verification

The functions above are defined in more detail below:

1. Detection: Sense an object that reached or cross a define reference point.
2. Synchronization: Tell where the object is at a certain point.
3. Inspection: Determine whether the object satisfied certain criteria.
4. Machine Vision: Guidance or alignment, precision measurement, complex defect detection and classification and output data for process control and traceability.

So, to determine type of sensor, firstly we have to decide type of output required for the design. I have decide to use photoelectric sensor because it is required a simple pass/ fail binary output indicating whether a target is present or not.

Photoelectric sensor is available for any sensing mode and performance levels and design to address a host of applications. The photoelectric sensor can detect color, opacity, shape size and reflective properties of the object. These entire requirements will determine the best sensor mode which can transmit beam, diffuse proximity and retroreflective. Most photoelectric sensors incorporate operator-selectable sensitivity to establish a light intensity above or below which an output signal will be energized.

A scan technique is a method used by photoelectric sensors to detect an object. In part, the best technique to use depends on the target. Some targets are opaque and others are highly reflective. In some cases it is necessary to detect a change in color. Scanning

distance is also a factor in selecting a scan technique. Some techniques work well at greater distances while others work better when the target is closer to the sensor.

For this project I have decided to use thru beam technique. This technique has two sensors that emit light and the light will be received at another point which is a receiver. The sensor detects the interrupt when the emitting light does not reach at the receiver. For this project application, fault may occur when letter or other opaque medium cross the light beam of the sensor. Normally the part will need to have a highly repeatable position to be detected consistently. The shape, color, opacity and distance from the sensor and the angle of the target impact the effectiveness of the sensor to reliably detect these targets. Objects in the background also can be an issue if the sensor detects this object and also the desired target.

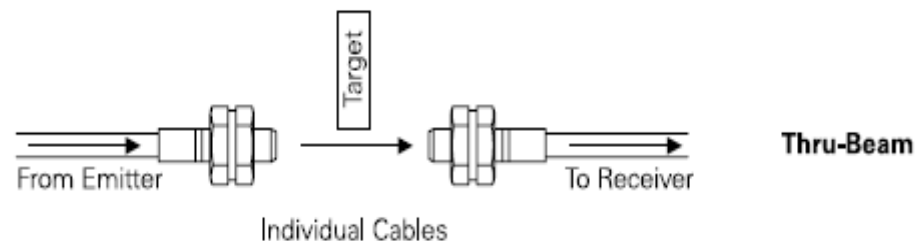


Figure 2.2 Thru beam technique.

A basic photoelectric sensor is a part detection device. The ability of the sensor is to look at one point and indicate whether a part is present or not. If the sensor is used as an inspection device, a single sensor is looking for a specific feature on a part. In order for the sensor to determine if the feature is present the application normally required:

- The object is fixed in a highly repeatable position and orientation during the detection process.
- The object has only one or two features to check that are not too close together.