UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Development Of Wireless Remote Control For An Outdoor Antenna Using Servo Motor Rotate In 360°

This report is submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Electronics Engineering Technology (Telecommunications) (Hons.)

by

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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TAJUK: Development of Wireless Remote Control for an Outdoor Antenna Using Servo Motor Rotate in 360°

SESI PENGAJIAN: **2014/15 Semester 2**

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ABSTRAK

Antena luar mampu menerima isyarat yang lebih baik daripada antena TV dalam kerana mereka mempunyai penglihatan langsung penghantar tanpa gangguan. Antena TV luar biasanya menerima VHF (Kekerapan Sangat Tinggi) atau UHF (Ultra Frekuensi Tinggi) frekuensi. Pembangunan kawalan jauh tanpa wayar(wireless) direka untuk mudah bagi pengguna untuk mendapatkan siaran televisyen yang dikehendaki dengan menggunakan kawalan jauh inframerah(infrared) yang asalnya diubahsuai untuk tanpa wayar(wireless) yang terdiri daripada jarak 100 meter untuk mengawal pergerakan antena luaran. Ia dilengkapi dengan butang kawalan yang mana satu saluran yang mampu mengawal dalam dua arah. Projek ini menggunakan motor servo untuk menggerakkan antena dan ia boleh berputar dalam 360 darjah. Ia menggunakan pengawal mikro untuk mengawal operasi.

ABSTRACT

Outdoor TV antennas are often capable of receiving a better signal than indoor TV antennas because they have a direct sight of a transmitter without interference. Outdoor TV antennas can range dramatically in design and usually receive VHF (Very High Frequencies) or UHF (Ultra High Frequencies) frequencies. The development of wireless remote control is designed to be easy for users to obtain the desired television broadcast by using remote control which originally infrared modified to wireless which consists of a 100 meter distance to control the movements of an outdoor antenna. It is equipped with a control button which one channel is able to control in two directions. This project uses servo motors to move the antenna and it can rotate in 360 degrees. It use microcontroller to control operations.

DEDICATION

Every challenging work needs self-efforts as well as guidance of elders especially those who were very close to our heart. My humble effort I dedicate to my sweet and loving

Father and Mother,

Whose affection, love, encouragement and prays of day and night make me able to get such success and honor

Along with all hardworking and respected

Lectures

ACKNOWLEDGEMENT

I would like to thanks to my supervisor Mr. Md Ashadi Bin Md Johari, lecturer of Faculty Technology Engineering and my co-supervisor Mrs. Raeihah Binti Mohd Zain for giving me a full cooperation and supervision during the making of this final year project report. Not to be forgotten, I would like to thank my family, sibling and my friends for contributing and helping to give ideas and give me a moral support in completing this project. Last but not least, special gratitude for those who are directly or indirectly involved during this project and completion of this report. All of your kindnesses are very much appreciated

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

RF	-	Radio frequency
Rx	-	Receive signal
Tx	-	Transmitter signal
UHF	-	Ultra High Frequency
VHF	-	Very High Frequency
AC	-	Alternating current
DC	-	Direct Current
JB	-	Jump below
DJNZ	-	Jump back to again
MOV	-	Move
RET	-	Return
V	-	Voltage

CHAPTER 1
INTRODUCTION

1.1 Project Background

TV antennas are one of the few technologies that have remained relatively unchanged until now. The development of this wireless remote control system is designed to solve the problems that users facing which is difficult to get the channel when the antenna rotating accidently. This kind of project is create and modified from the normal antenna by using wireless remote to control the rotation of the outdoor antenna from the inside of the building. In this project, the researcher would like to introduce the control button which is easily and readily understood by users which one channel is able to control the two directions either clockwise or anti-clockwise.

The remote control buttons look more simple and easy to be used compared to other outdoor television antenna available in market where the users need to rotate the antenna by themselves manually. The Outdoor Antenna is designed to allow users to receive UHF and VHF signals and a high level sensitivity compared to the others product of outdoor antennas. The direction of rotor rotation of the motor is reversed each time the motor is energized in response to a wireless channel selection signal.

Thus, the outdoors antenna is rotated in one direction when a user first activates a remote control unit to change the channel displayed on a television receiver. Subsequently, after the antenna has rotated past an optimal position, the user releases the channel selection button of the remote control unit and again pushes the same button to reverse the rotation of the antenna. The user releases the selected channel selection button when the antenna reaches its optimal orientation for the selected channel.

1.2 Problem Statement

People are faced problem of the antenna positioned in the right place to find good television channel. Although there are infrared remote control, but still it has limited distance. But with wireless remote control, they can be easily control the movement the outdoor antenna.

1.3 Project Objective

At the end of by doing this project;

i. Able to understand the programming and operation for the circuit.
ii. Able to identify the parameters between antenna and wireless remote control.
iii. Able to design in hardware of wireless remote control for an outdoor antenna.

1.4 Project Scope

In the design to improve the function of the outdoor television antenna, this project will focus more on the function of the remote control which has less options button set-degree rotation. The scope of this research project:

i. Study on the wireless architecture.
ii. Designing the specifications of the receiver and transmitter.
iii. Fabricating process are being done.
iv. The results obtained are being analyzed

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

The analysis of literature review is a significant part in this project. Literature review gives provide more details and evidence of the project. The materials used for literature review are from the book, internet and the journal. The aim is to identify the scope of the study or project.

2.2 Outdoor Antenna

Outdoor TV antennas often receive a better signal than indoor TV antennas because they are in direct sight of a transmitter without interference from walls, electrical wiring, or any electronic devices. Outdoor TV antennas range dramatically in design and usually receive VHF (Very High Frequencies) or UHF (Ultra High Frequencies).

An outdoor TV antenna, like every other type of antenna, is a transducer that converts electromagnetic waves into electricity and electricity into electromagnetic waves. As a result, antennas can be used as both receivers and transmitters. However, a typical outdoor TV antenna only receives electromagnetic waves. When a radio signal is emitted from a radio transmitter or satellite, the radio waves induce an electrical current in antennas.

This electricity, depending on the radio waves' frequency, is converted into audio and video that is then displayed on the user's television set. Applications Outdoor TV antennas have many purposes, but mostly receive television signals. They pick up radio broadcasts and transmit radio signals as well. The two main types of outdoor TV antennas are referred to as antenna and aerial. An antenna is made of metal while an aerial is made of wire.

2.3 Radio Frequency Range

Radio frequency (RF) is a rate of oscillation in the range of around 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals. It also uses to describe the use of wireless communication, as opposed to communication via electric wires. To receive radio signals an antenna must be used. However, since the antenna will pick up thousands of radio signals at a time, a radio tuner is necessary to tune into a particular frequency (or frequency range).

Table 2.3: Radio Frequency Range

Frequency	**Designation**	**Abbreviation**
30 – 300 MHz	Very high frequency	VHF
300 MHz – 3 GHz	Ultra high frequency	UHF

2.4 Radio Frequency (RF) based Remote control circuit

The circuit of this project utilizes the RF module (Tx/Rx) for making a wireless remote, which could be used to drive an output from a distant place. RF module, as the name suggests, uses radio frequency to send signals. These signals are transmitted at a particular frequency and a baud rate.

A receiver can receive these signals only if it is configured for that frequency. A four channel encoder/decoder pair has also been used in this system. The input signals, at the transmitter side, are taken through four switches while the outputs are monitored on a set of four LEDs corresponding to each input switch. The circuit can be used for designing Remote Appliance Control system. The outputs from the receiver can drive corresponding relays connected to any household appliance.

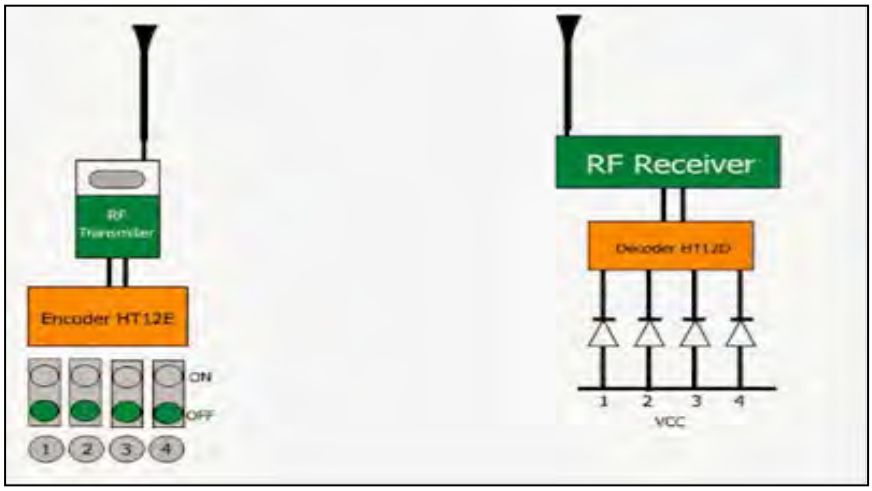

Figure 2.4: Remote control circuit

2.5 Radio Frequency (RF) Transmitter

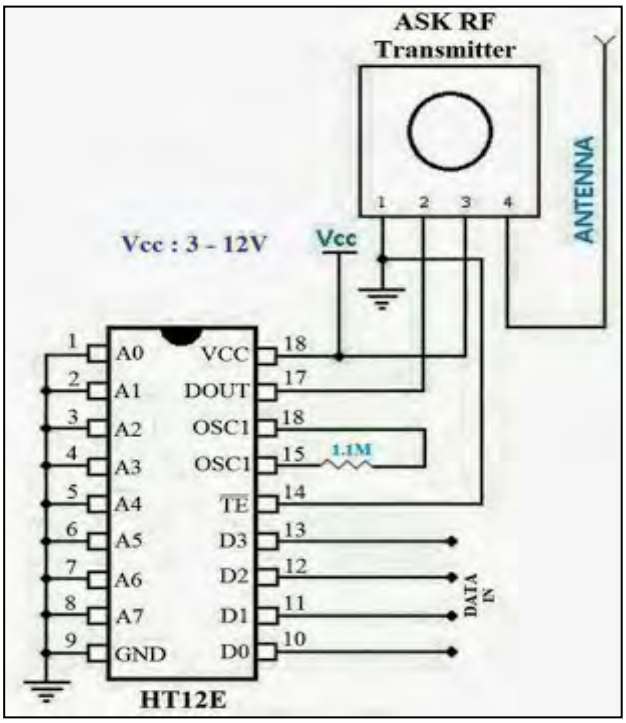

Figure 2.5: Radio Frequency (RF) Transmitter

The transmitter part of the wireless remote control comprises of two components an Encoder HT12E and an ASK RF transmitter module which is used for data transmission. The IC HT12E was an Encoder IC which is capable of converting 12 bit parallel data inputs into serial outputs. These 12 bits are classified into 8 address bits (A0-A7) and 4 data bits (D0-D3). The address bits are used to provide secured wireless transmission between the transmitter and the receiver. The address bits used in the transmitter should be similar to the bits used in the receiver part for enabling communication between the Tx and Rx modules.

In the above circuit, the pins D0 to D3 are assigned for the feeding the data into the encoder. The pins can be connected to switches enabling the logic 1 or logic 0 to the Encoder IC. The address pins was grounded and if want communication to be secured, vary the address bit values in the encoder and remember to use the same address value in the decoder.

The input data bits are encoded by the IC and it was obtained through DOUT pin of the IC and it can be directly fed into the transmitter module. These transmitter uses ASK signaling scheme for wireless transmission of bits. The Tx module is of various types which can choose the one which suits for requirements such as distance of transmission and power consumption.

2.6 Radio Frequency Radio Receiver

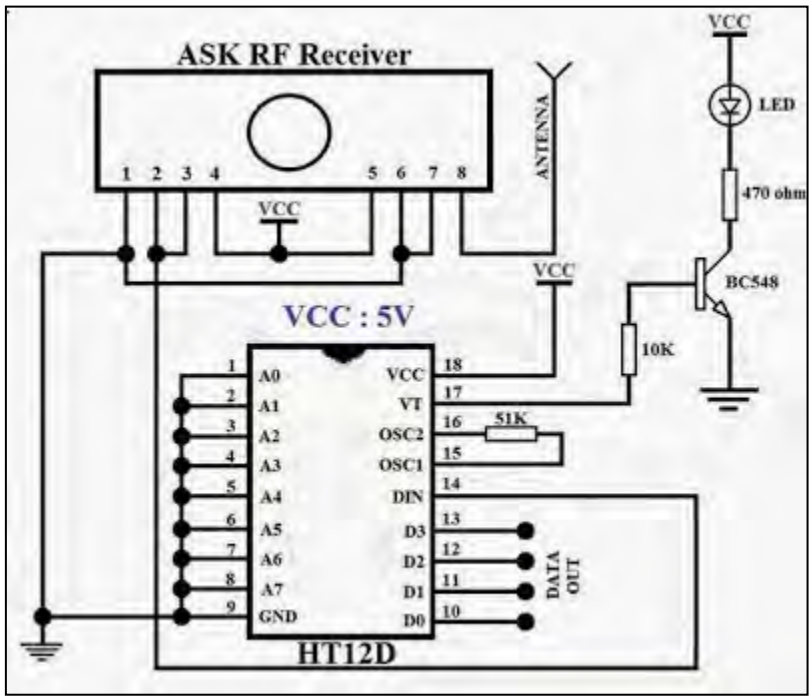

Figure 2.6: Radio Frequency Radio Receiver

The Receiver is comprised of HT12D a matching decoder IC and an ASK RF receiver module for receiving the incoming signal from the transmitter. The HT12D was a matching decoder IC to the HT12E which was consists of similar 8 bit Address bits (A0-A7) and 4 data output pins (D0-D3) to obtain the input data sent through the HT12E IC. For detailed description of this decoder IC check out this article Working of HT12D decoder.

The address bits A0-A7 was connected to ground since the all the address bits in the encoder also connected to the ground. The HT12D IC has a special pin known as VT which gives out high signal when the connection between the transmitter and receiver was established. The Decoder IC checks the address values of the incoming signal and then sends out the high signal to the VT pin, a LED was connected to it for indication of signal connection establishment.

2.7 RF Transmitter and Receiver Modules

The Antenna size also holds a significant position in a RF based wireless communication link. The suggested Antenna length is 17cm for modules of operating frequency around 433 Mhz. Now your circuit is ready and you can now use it either as Remote control or send simple data through wireless medium. Below is the pin diagram of RF transmitter and receiver modules used in the circuit diagram.

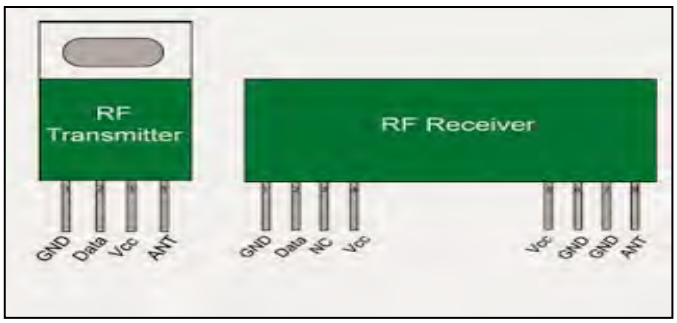

Figure 2.7: RF Transmitter and Receiver Modules

2.8 Description

The system allows one way communication between two nodes, namely, transmission and reception. The RF module has been used in conjunction with a set of four channel encoder/decoder ICs. Here HT12E & HT12D have been used as encoder and decoder respectively. The encoder converts the parallel inputs (from the remote switches) into serial set of signals. These signals are serially transferred through RF to the reception point. The decoder is used after the RF receiver to decode the serial format and retrieve the original signals as outputs. These outputs can be observed on corresponding LEDs.

2.8.1 Radio Frequency (RF) Transmission of Transmitter/Receiver (Tx/Rx) Pair Operating at 434 Mhz

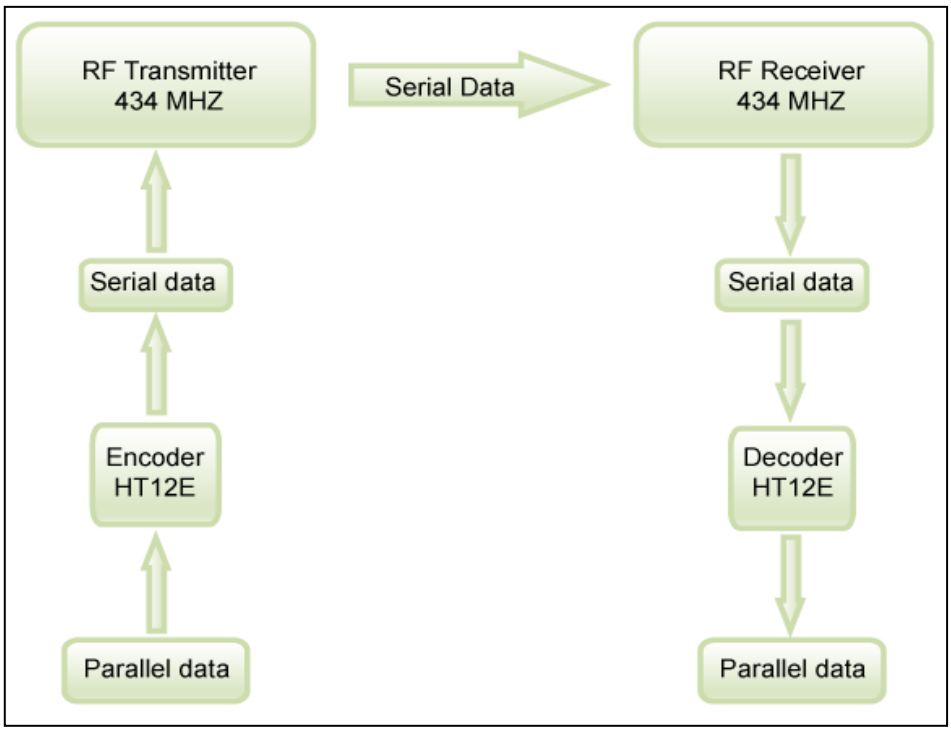

Figure 2.8.1: Radio Frequency (RF) Transmission of Transmitter/Receiver (Tx/Rx) Pair Operating At 434 Mhz

This radio frequency (RF) transmission of transmitter/receiver (Tx/Rx) pair operating at 434 MHz. The transmitter module takes serial input and transmits these signals through RF. The transmitted signals are received by the receiver module placed away from the source of transmission.

2.8.2 Encoder IC (HT12E)

Encoder IC (HT12E) receives parallel data in the form of address bits and control bits. The control signals from remote switches along with 8 address bits constitute a set of 12 parallel signals. The encoder HT12E encodes these parallel signals into serial bits. Transmission is enabled by providing ground to pin14 which is active low. The control signals are given at pins 10-13 of HT12E. The serial data is fed to the RF transmitter through pin17 of HT12E.

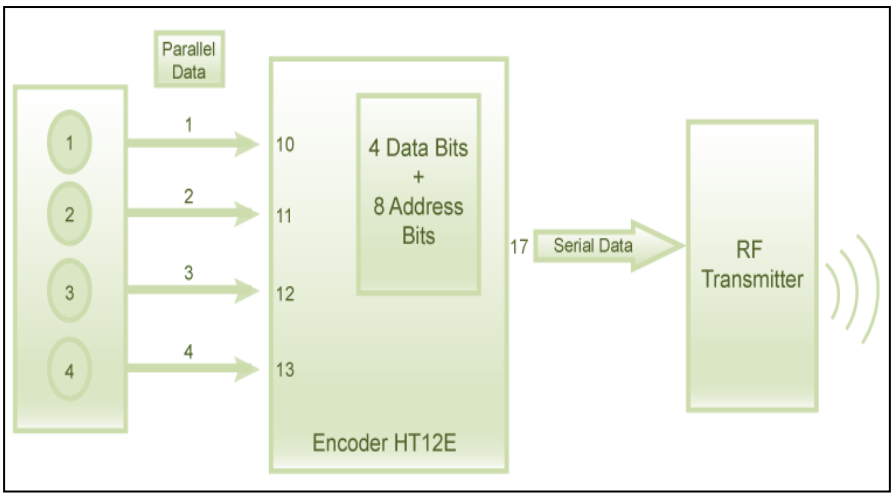

Figure 2.8.2: Encoder IC (HT12E)

2.8.3 Encoder IC (HT12D)

Transmitter, upon receiving serial data from encoder IC (HT12E), transmits it wirelessly to the RF receiver. The receiver, upon receiving these signals, sends them to the decoder IC (HT12D) through pin2. The serial data is received at the data pin (DIN, pin14) of HT12D. The decoder then retrieves the original parallel format from the received serial data.

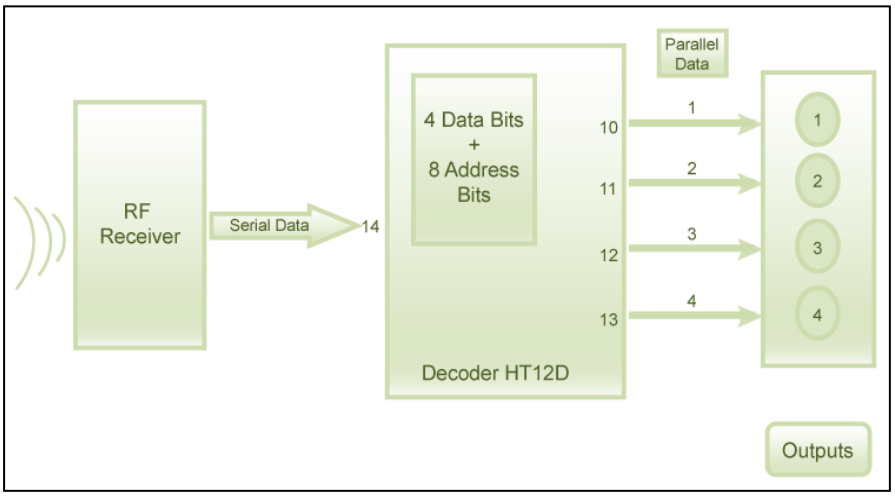

Figure 2.8.3: Encoder IC (HT12D)

When no signal is received at data pin of HT12D, it remains in standby mode and consumes very less current (less than 1µA) for a voltage of 5V. When signal is received by receiver, it is given to DIN pin (pin14) of HT12D. On reception of signal, oscillator of HT12D gets activated. IC HT12D then decodes the serial data and checks the address bits three times. If these bits match with the local address pins (pins 1-8) of HT12D, then it puts the data bits on its data pins (pins 10-13) and makes the VT pin high. An LED is connected to VT pin (pin17) of the decoder. This LED works as an indicator to indicate a valid transmission. The corresponding output is thus generated at the data pins of decoder IC.

A signal is sent by lowering any or all the pins 10-13 of HT12E and corresponding signal is received at receiver's end (at HT12D). Address bits are configured by using the by using the first 8 pins of both encoder and decoder ICs. To send a particular signal, address bits must be same at encoder and decoder ICs. By configuring the address bits properly, a single RF transmitter can also be used to control different RF receivers of same frequency.

To summarize, on each transmission, 12 bits of data is transmitted consisting of 8 address bits and 4 data bits. The signal is received at receiver's end which is then fed into decoder IC. If address bits get matched, decoder converts it into parallel data and the corresponding data bits get lowered which could be then used to drive the LEDs.

2.9 Components Introduction

In this section, it is about to understand each of the basic concepts and function of electronic components that related with this project. An electronic component is a basic discrete device or physical entity in an electronic system used to affect electrons or their associated fields. Electronic components have two or more electrical terminals. It is usually soldered to a printed circuit board, to create an electronic circuit (a discrete circuit) with a particular function.