DESIGN AND CONSRUCTION OF A RADIO WAVE REMOTE CONTROL SWITCH

BY

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A THESIS REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF ENGINEERING (B.ENG) DEGREE IN THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA,NIGER STATE.

NOVEMBER, 2008

DEDICATION

This project work is dedicated to Almighty Allah, the creator of Heaven and the Earth, who sustained my life throughout the course of this study

Also, I dedicated this work to the memories of my late mother Mrs. Hafsatu H. Omar and late two brothers Dr. Suleiman H. Omar and Mr. Abdul-mumini H. Omar, may Almighty Allah grand them Aljanna-fir-daus ameen.

DECLARATION

I Omar Hamidu Hassan, declare that this work was done by me and has never been presented elsewhere for the award of a degree. I also hereby relinquish the copyright to the Federal University of Technology, Minna.

Omar Hamidu Hassan	Date
Dr. E.N.Onwuka (Project Supervisor)	Date
Engr.Dr.Y.A.Adediran (Head of Department)	Date
(External Examiner)	Date

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Special thanks goes to my younger brothers, Umar, Maimuna, Abdul-Malik, Abdul-Rashid, Abdul-Azeez, and my beloved sister Aishat, and a very big thanks to my Commander's, Brig.Gen.A.M.Jibril, Brig.Gen.S.U.Abdul-Qadir, and the Commanding Officer of HQ TRADOC Sig. Tps Maj. T.U.Garba for his moral and advices and my colleagues in the military.

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My deepest gratitude goes to my friends and well wishers. May Almighty Allah bless and guide us through our life Amen.

ABSTRACT

Over the years, the use of a remote control device to operate gates, garage doors, and security alarm system and electronics devices has become widespread in industries, and construction has improved in satisfaction and style.

This project work is based on the design and construction of a radio wave remote control switch. This was achieved by the design and construction of the transmitter and the decoder circuit which consist of multi-vibrator, power amplifier, modulator, transistor switch D-type flip-flop etc.

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CHAPTER ONE

1.0 INTRODUCTION

With the increase in development in science and technology, man in conscious effort to better our society began to evolve contrivance from relatively new discoveries. It is difficult to imagine what modern life would look like without an access to reliable, economical and efficient means of communication.

Communication means converging or transmission of information from one place to another. In this design, emphasis would be on transmission and control engineering.

Remote control is the ability to control an object or device without physically contacting the device. Remote control devices or systems enable an operator to handle, work or manipulate an object while being separated from it. This may be necessary because the object is out of reach, and in under water salvage work or as in space vehicles, or because it is dangerous to approach the material being handled, due to radioactivity or toxicity or because the objects may be suspected of containing explosives.

Remote devices are in recent times used simply for convenience as in the remote controls of multi-purpose television and video sets. In certain cases this device serves to enhance security systems.

There are three essential components in a remote control system;

- A controlling quantity
- A transmission medium
- A controlled quantity

1.1 THE HISTORY OF REMOTE CONTROL

The earliest cases of remote control involved the handling and transfer of radio chemicals from one safe container to another-long reaches, which are just and extension of normal reach with tongs at the end could suffice, where partial shielding was employed to protect the operator from chemical substance.

In the handling of radioactive substances however, where the work required full radiation shielding, it was usually to employ tool mounted on straight rods passing through ball and socket joints into the cell wall. The operator actuates the tool by a piston-grip handle, and by moving this; he can move and operate the tool at will, any where within the shielded area.

Where separation between the operator and work is greater, as in heavily shielded radioactive master-slave systems are used. These reproduce the movement of the operator hand via a slave tool radiation area. Where distance between the operator and the work is very large, more advanced l systems are required. These use electronic or fluidic controls, and are being developed for tv of applications.

For example, a space shuttle has a 50 ft articulated arm with elbow and wrist movements for manipulation of payloads by the operator on the orbit flight deck. The need for the control of objects when separated by a large distance from the operator brought about the means to achieve such control without making any physical contact with the object to be controlled. Today this technology has given rise to the remote control of gadgets such as Television sets, video machines, cassette players etc.

1.2 OBJECTIVE AND MOTIVATION

The aim of this project is to design and construct a radio remote control switch in a building. This building could be residential, commercial or industrials.

This remote control switch could serve as:-

- Alleviate the inconvenience of walking to a switch wherever it is situated.
- Enhance safety especially in industrial buildings.
- Enhance security: in market today are some intruder's alarms that go off once an intrusion is sensed.
- Aid to individuals not tall enough to reach the allocation of a switch, the means to operate it.
- Low cost, as this frequency is much less costly to generate than infrared rays.
- The ability to use beyond the line of sight mode.

1.3 PROJECT DESCRIPTION

This project is design based on the principle of using F.M radio wave signal to control an electric switch. The circuit consists of one tone decoder, the transistor switch, the D-type flip-flop, the relay, the radio receiver, the astable multi-vibrator, the transmitter and the power source.

The power source: The transmitter is powered using D.C. power source for portability, the tone decoder, the transistor switches, the D-flip-flop, and the relay is powered by PHCN power supplied.

The receiver is F.M superhedrodyne radio, through already constructed (not designed as part of the project work). The receiver is turned to the hand held transmitter oscillating frequency and it demodulates the carrier wave at its demodulated output are the tune decoder to convert the audio tones to control the logic.

The tuned decoder I.C that has high/low logic output. The output goes low when a sustained frequency that is at the same frequency as the on-chip reference oscillator is present at the input, the logic output D flip-flop chip.

The transmitter is a low-power two transistor R.F oscillator with a modulating analogue audio signal applied into its base to modulate the collector-base capacitance to produce generated astable oscillator of F.M R.F signal wave. The R.F transmitter is modulated by audio tones.

CHAPTER TWO

2.0 LITERATURE REVIEW

The first machines to be operated by remote control were used mainly for military purposes. Radio-controlled motorboats, developed by the German Navy, were used to ram enemy ships in WW I. Radio controlled bombs and other remote control weapons were used in WW II.

Once the wars were over, United States scientists experimented to find non-military uses for the remote control. In the late 1940's automatic garage door openers were invented, and in the 1950's the first TV remote controls were used.

2.1 FIRST TV REMOTE CONTROL

The first TV remote control, called "Lazy Bones", was developed in 1950 by Zenith Electronics Corporation (then known as Zenith Radio Corporation). Lazy Bones used a cable that ran from the TV set to the viewer. A motor in the TV set operated the tuner through the remote control. Although customers liked having remote control of their television, they complained that people tripped over the unsightly cable that meandered across the living room floor.

Zenith engineer Eugene Polley invented the "Flashmatic", which represented the industry's first wireless TV remote. Introduced in 1955, Flashmatic operated by means of four photocells, one in each corner of the TV cabinet around the screen.

While it pioneered the concept of wireless TV remote control, the Flashmatic had some limitations. It was a simple device that had no protection circuits and, if the TV set in an area in which the sun shines directly on it, the tuner might start rotating.

2.2 DEVELOPMENT CHALLENGES

Zenith management loved the concepts proven by Polley's Flashmatic and directed his engineers to develop a better remote control. First thoughts pointed to radio. But, because they travel through walls, radio waves could in advertently control a TV set in an adjacent apartment or room.

Using distinctive sound signals was discussed, but Zenith engineers believed people might not like hearing a certain sound that would become characteristic of operating the TV set through a remote control. It would be difficult to find a sound that wouldn't accidentally be duplicated by either household noises or by the sound coming from TV programming.

2.3 THE BIRTH OF SPACE COMMAND

Zenith's Dr. Robert Adler suggested using "ultrasonic," that is, high frequency sound, beyond the range3 of human hearing. He was assigned to lead a team of engineers to work on the first use of ultrasonic technology in the home as a new approach for a remote control.

The transmitter used no batteries; it was build around aluminum rods that were light in weight and, when struck at one end, emitted distinctive high-frequency sounds. The first such remote control used four rods, each approximately 2-1/2 inches long: one for channel up, one for channel down, one for sound on and off and one for power on and off.

They were very carefully cut to lengths that would generate four slightly different frequencies. They were excited by a trigger mechanism-similar to the trigger of a gun, which stretched a spring and then released it so that a small hammer would strike the aluminum rod. The device was developing quickly, with the design phase beginning in 1955. Called "Zenith Space Command," the remote control went into production in the fall of 1956.

2.4 QUARTERCENTURY OF ULTRASONIC REMOTES

The original Space Command remote control was expensive because an elaborate receiver in the TV set, using six additional vacuum tubes, was needed to pick up and process the signals. Although adding the remote control system increased the price of the TV set by 30 percent, it was a technical success and was adopted in later years by other manufacturers.

In the early 1960s, solid-state circuitry (i.e. transistors) began to replace vacuum tubes. Hand-held, battery-powered control units could now be designed to generate the inaudible sound electronically. In this modified form, Dr. Adler's ultrasonic remote control invention lasted through the early 1980s, a quarter century from its inception.

2.5 TODAY'S INFRARED REMOTE CONTROLS

By the early 1980s, the industry moved to infrared, or IR, remote technology. The IR remote works by using a low frequency light beam, so low that the human eye cannot see it, but which can be detected by a receiver in the TV. Zenith's development of cable-compatible tuning and teletext technologies in the 1980s greatly enhanced the capabilities and uses for infrared TV remotes.

Today, remote control is a standard feature on other consumer electronics products, including VCRs, cable and satellite boxes, digital videodisc players and home audio receivers. And the most sophisticated TV sets have remotes with as many as 50 buttons.

Zenith developed the world's first wireless trackball TV remote control, called Z-Track. The remote work like a computer mouse – click the ball and a cursor appears on the TV screen. Roll the ball and the cursor activates control menus hidden in different corners of the screen. Then, activate something from those menus – bass, treble, contrast, color temperature, channels.....whatever.

Manufacturers used to make remote controls that operate one TV set. However, they are now making universal remote controls that can operate any TV set. Experts predict that someday remote control will control every device in the home.

2.6 SOME ACHIEVEMENTS IN REMOTE CONTROL SYSTEMS

- In 1999, more than 99 percent of all TV sets and 100 percent of all VCRs sold in the U.S. are equipped with remote control.
- More than 9 million ultrasonic remote control TVs were sold by the industry during the 25-year reign of Dr. Adler's invention.
- Zenith sales people were against using batteries in the remote control. In those days, batteries were used primarily in flashlights. If the battery went dead, the sales staff said, the customer might think something was wrong with the TV set.
- Early remote controls were expensive because an elaborate receiver in the TV set, using six additional vacuum tubes, was needed to pick up and process the signals. Adding a remote control system increased the price of the TV set by about 30 percent.
- Zenith's Dr. Robert Adler has more than 180 patents.

CHAPTER THREE

3.0 DESIGN AND CONSTRUCTION OF A RADIO WAVE REMOTE CONTROL SWITCH.

3.1 THE CIRCUIT OPERATION

The circuit works on the on the basic principle of decoding an audio tones produced by an oscillator whose output (tones), modulate a short range F.M.R.F oscillator.

For simplicity the project work was been broken down into three different section.

- Receiver
- Transmitter
- Decoder

THE RECEIVER: of a F.M. superhetrodyne radio, though already constructed i.e. not design as part of the project work. The receiver is turned to the hand-held transmitter oscillating frequency and demodulates the wave, its demodulate output is the tone decoder to convert the audio tone to a control logic.

TRANSMITTER: the transmitter is a low-power two transistor R.F. oscillator with a modulating analog audio signal applied into its base to modulate the collector-capacitance to produce in F.M. R.F. signal wave. The R.F. transmitter is modulated by tone decoder (1 KHz) generated by an astable oscillator.

The tone is presented to the decoder connected to a radio receiver to translate the tone into command signal.

THE DECODER: is an integrated circuit with a high/low logic output. Their output of the decoder goes low when a sustained frequency that is at the same frequency as the on-chips reference oscillator is present at the output.

3.2 DESIGNING OF THE TRANSMITTER SECTION

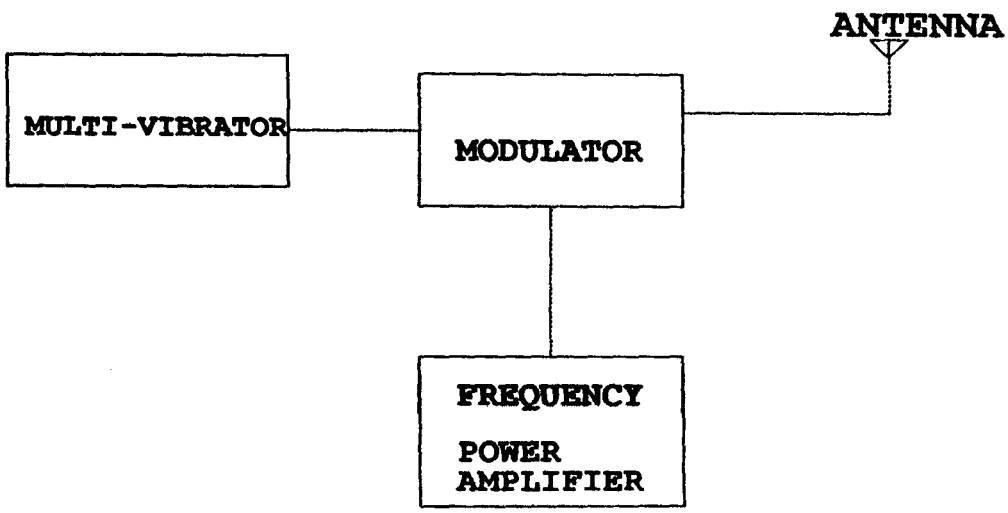


Fig. 3.1 BLOCKS DIAGRAM OF THE TRANSMITTER

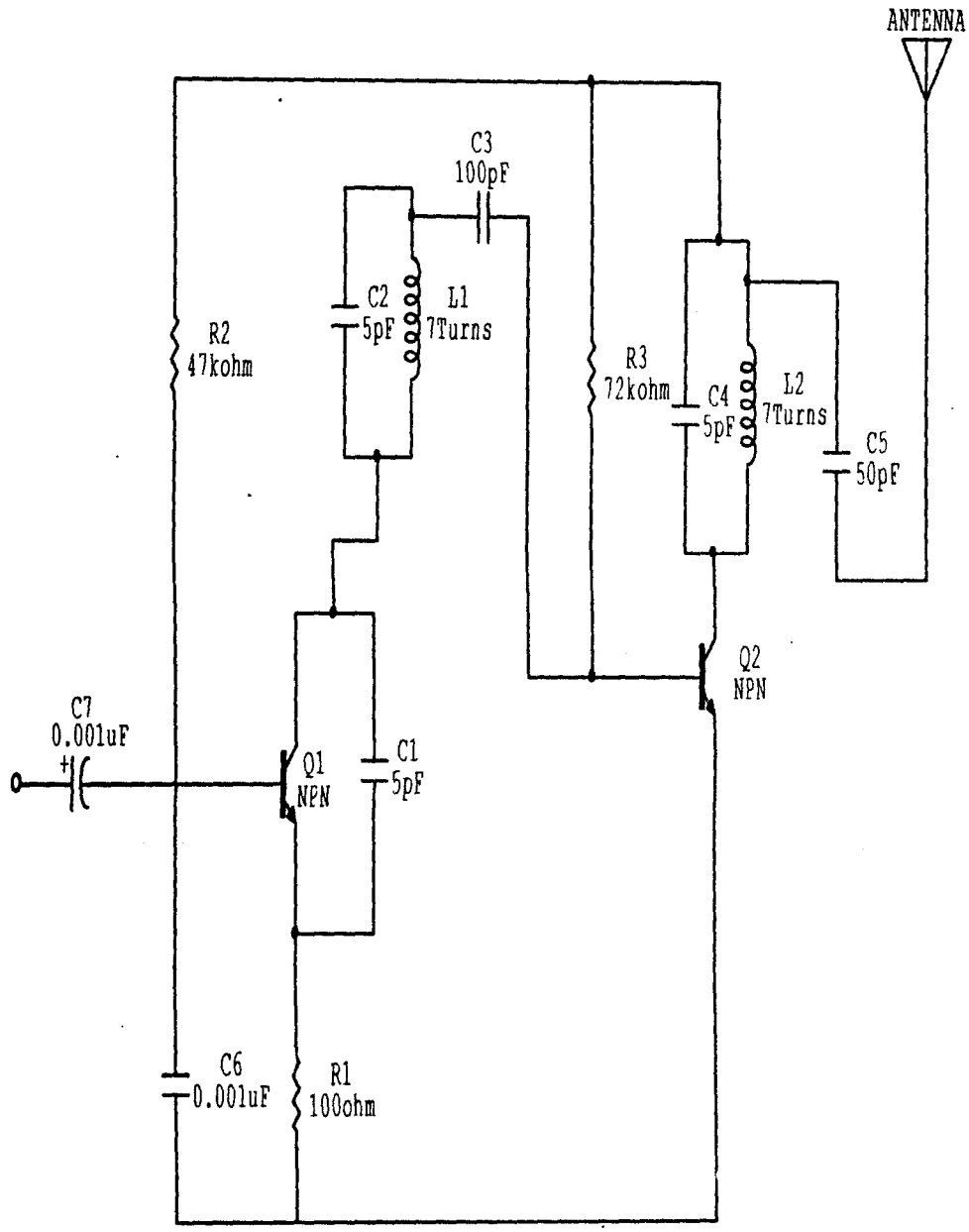
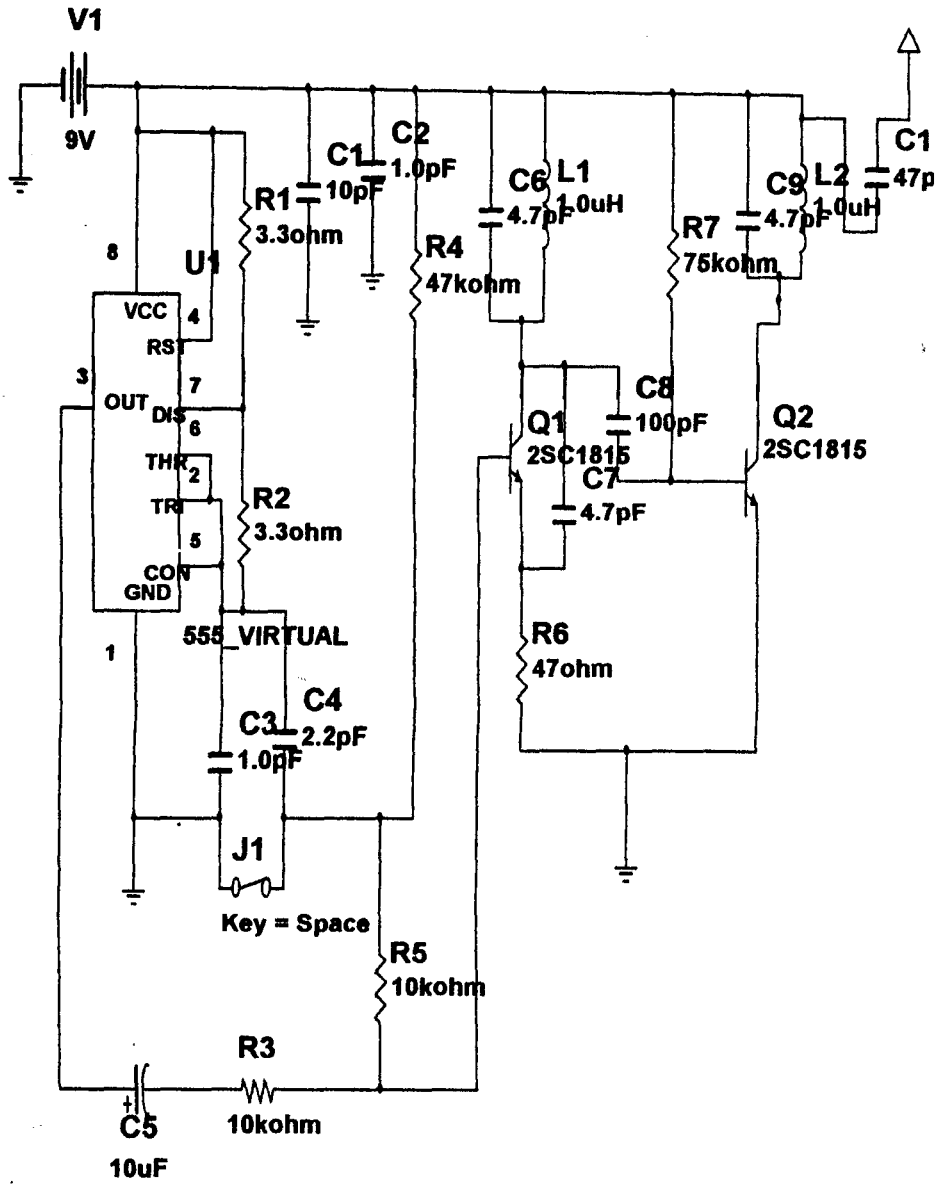


Fig. 3.2 CIRCUIT DIAGRAM OF THE MODULATOR



3.3 DESIGNING OF THE CONTROL TRANSMITTER

The control transmitter is a short range R.F oscillator with a set centre frequency determined by the values of the inductance and capacitance that form resonant tank circuit in the collector of a 2SC 9014 high frequency oscillator.

The transmitter section consists of the multi-vibrator, the modulator, the frequency power amplifier, and the antenna.

3.4 THE MULTI-VIBRATOR

The multi-vibrator used in this project is a NE 555 multi-vibrator connected in an astable mode as shown in fig.3.3 shown below.

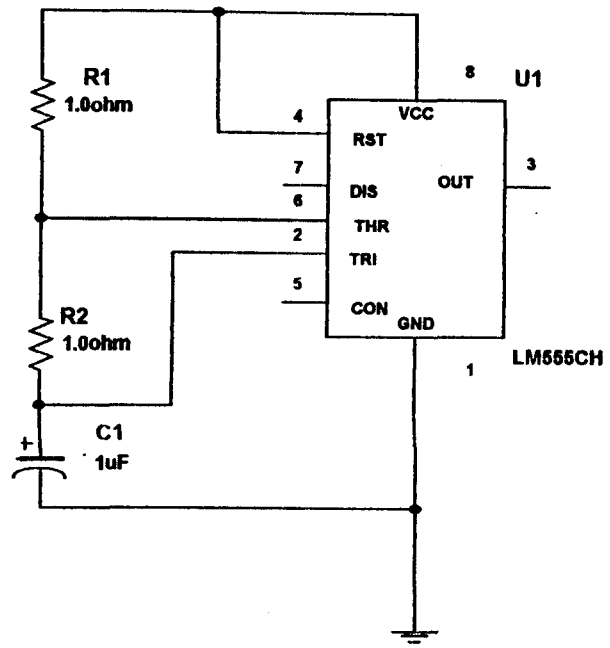


Fig. 3.4 NE555 CONNECTED IN ASTABLE MODE

Here pin 2 and 6 are connected so that the circuit will trigger itself each timing cycle, thereby function as an oscillator CT changes through R1 and R2 but discharges from 1/3 Vcc the oscillator frequency is independent of Vcc.

(a) FUNCTION OF EACH PIN

FUNCTION	555 PIN
GROUND	1
TRIGGER	2
OUTPUT	3
RESET	4
CONTROL V	5
THRESHOLD	6
DISCHARGE	7
V_{CC}	8

3.5 CONSTRUCTION OF MULTI-VIBRATOR

The circuit of the 555 astable oscillator is shown in fig. 3.4 as shown below, with the relevant data related to its operation.

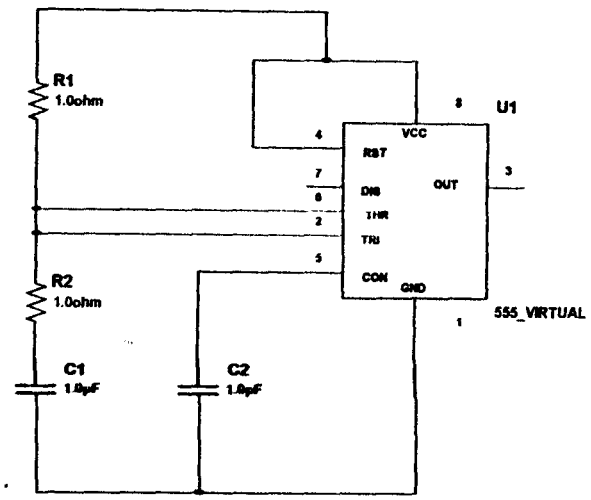


Fig. 3.6 MULTI-VIBRATOR CONNECTED IN ASTABLE MODE

The frequency generated by the oscillator is (Fosc.) set by:

$$Fosc = \frac{1.44}{0.693\,(R_1+2R_2)\times C_T}$$

In the project work, one audio tone 1 KHz is chosen to provide the control signal.

Inserting the value of R1 and R2 revised frequencies in the above expression yield

$$1000 = \frac{1.44}{0.693(99{,}000)\times C_T}$$

$$C = 21 \text{ nf}$$

The nearest standard value of 22nf was selected with adjustment to be made on the decoder circuitry.

Since only one tone can be generated by the oscillator at any time, determine by the value of the connected R_T/C a means of generating the required tone will devised. The value of the capacitance is keyed into the circuit through one normally open and closed switch as in fig.3.6 shown below.

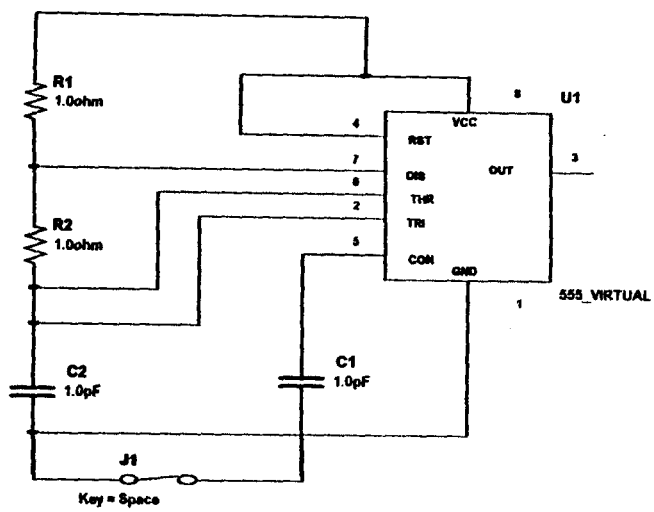


Fig..3.7 555 MULTI-VIBRATOR SWITCH

The Capacitance is switched as shown above with the switch open, there is no capacitance connected in the circuit, and hence no oscillation and the output (pin 3) are in its low state.

When the switch is depressed, the capacitance connected to the switch is taken to ground through the mechanical contact, and the tone incorporated in the astable circuit, the oscillator now oscillates at that very frequency determined by the RT/C.

The output of the astable is fed in to the base-emitter circuit of RF oscillator through in attenuator pad depicted in fig.3.7 as shown below.

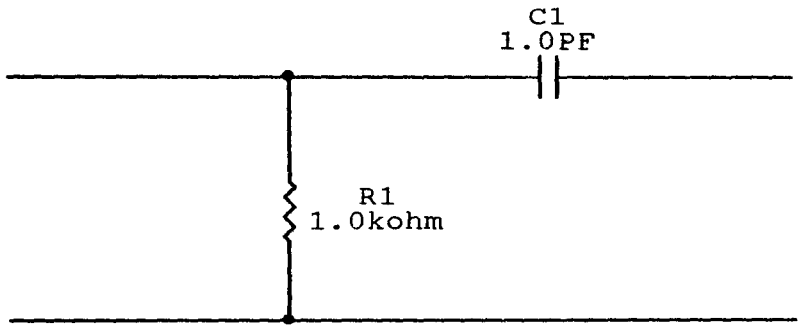


Fig. 3.8 ATTENUATOR PAD

Attenuator is needed to prevent overloading the transmitter, and since the tone decoder is very sensitive, only little of tone energy is needed to activate it.

3.5 OSCILLATION IN THE LC CIRCUIT

When a charge is applied to the capacitor of the parallel LC circuits shown in fig. 3.8 A current flow round the circuit, but after sometime of charge the current is reduce to zero, the current cannot immediately stop.

However, because of the collapsing magnetic field, the result of the falling current induces an Electromagnetic field across the inductor such as to maintain for the time being before the current reduces to zero.

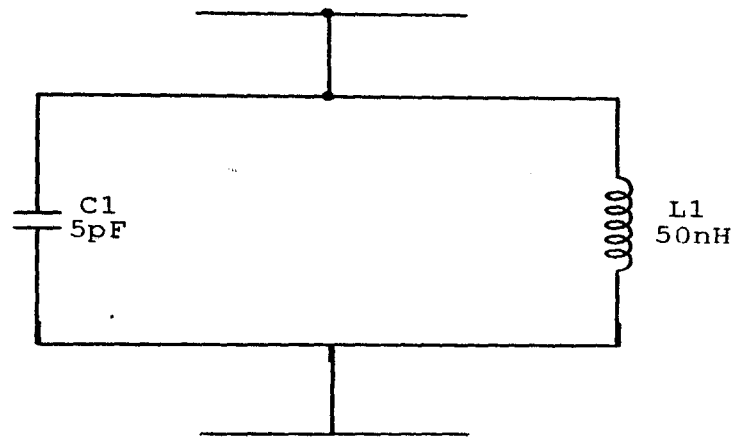


Fig. 3.9 OSCILLATOR CIRCUIT

The capacitor charge has been built up nearly the same magnitude as that which was obtained original current now flow in the opposite direction and some sequence follow. Since the source of power (A.C Source) enables oscillation to be maintained indefinitely, the D.C source must be so harnessed that the power is to the circuit at the correct time [Fitchen F.C.C (Pp85)].

3.7 DESIGN AND ANALYSIS

X_L = Inductive reactance

X_C = Capacitance reactance

But $X_L = W_L = 2\pi F_L\ (\Omega)$

And $X_C = 1/W_C = 1/2\pi F_C\ (\Omega)$

W = Angular frequency

$W = 2\pi f$

And that $X_L = X_C$

$1/2\pi F_L = 2\pi F_L$

Therefore, $L/(2\pi F)^2 \times C$

$L = 1/4\pi^2 F^2 C$

But operating frequency is 100 MHz

And capacitance C = 5 pf

Therefore, $L = 1/4\pi^2\ (100 \times 10^6)^2\ (5 \times 10^{-9})$

$L = 50.66nH$

3.8 POWER AMPLIFIER

The purpose of power amplifier is to obtain the maximum power while limiting distortion to a predetermined level. The aim of transmitter is to generate electromagnetic wave across the antenna, which received the E.M wave signal.

The R.F power must be at low level to ensure complete stability. The application work in turn with inductance, but inductor was excluded. Therefore in other to radiate the greatest power for the limited input, the collector circuit efficiency of the amplifier (i.e. conversion of D.C power to R.F power) must be as high as possible. This stage, provide best current and voltage gain is one of the basic thing R.F power amplifier needs. The resistor (Ra) to provide appropriate d.c condition (bias) in term of based current I_{BE}, collector current I_C, base emitter voltage V_{BE} and collector emitter voltage V_{CE}. This stage output is connected to the antenna to transmit the E.M wave signal.

3.9 DESIGN AND ANALYSIS OF POWER AMPLIFIER

Let the quiescent current be 0.25mA and $V_{BE} = 0.7V$ and for NPN silicon transistor, we can write that;

Since $V_{CC} = 12V$, therefore $V_{CE} = 9V$

$I_BR_B = 9\text{-}0.7$

$= 8.3$

But $I_B/I_C = h_{Fe} = 0.25/50 = 0.005$

$R_B = 8.3/0.005$

$= 1.060\Omega$

3.9.1 COUPLING CAPACITOR

We know that $X_C = \frac{1}{2}\pi FC$

Assuming the satisfactory, coupling is achieved at $X_C = R/10$

$C = \frac{1}{2}\Pi FX_C$

$= \frac{1}{2}\Pi FR/10$

Let the operating frequency be 94MHz and R=1060k

$$C = \frac{1}{2\Pi (94X10^6)\frac{(1.060X10^3)}{10}}$$

$C = 1.597 \times 10^{-14}f$

3.10 ANTENNA

An antenna or aerial is a structure that couples the output of a transmitter or the input of the receiver to space, it either convert high frequency current into electromagnetic wave for radiation (transmitting antenna) or collects electromagnetic wave into high frequency current (receiving antenna).

As a result of the important role played by an antenna in transmission. It has been employed in this project as a means of transmitting the radio frequency from the transmitter to the receiver.

3.10.1 ANTENNA DESIGN

Since we know the frequency at which the transmission is taking place, i.e.94MHz, therefore the length of the antenna is given by this relation.

$\lambda = V/F$

Where λ = wavelength of the signal.

V = velocity of sound in air $3X10^8 m/s$

F = frequency at which signal is to be radiated (94MHz)

$$\lambda = \frac{3X10^8}{94X10^6}$$

Therefore $\lambda = 3.2m$

But in order to enable the antenna radiate large fraction of power supply thereby achieving better efficiency, the length of the antenna needs to approach the wavelength of the working frequency.

$\lambda/4 = 3.2/4 = 0.8m$

In order to radiate a frequency of 94MHz, in aerial of length 0.8m is in need. The antenna must be put above the ground level for proper efficiency.

3.11 POWER SUPPLY UNIT OF THE TRANSMITTER

The source of power to the circuit is a portable 9V primary cell (battery), due to the portability of the project that is why an adaptor was avoided.

3.12 THE DECODER SECTION

The decoder section consists of tone decoder, the transistor switch, the D-type flip-flop, the delay and the power pack of the decoder. It block diagram and the circuit diagram are shown in fig. 3.9 and fig. 3.10 as shown below.

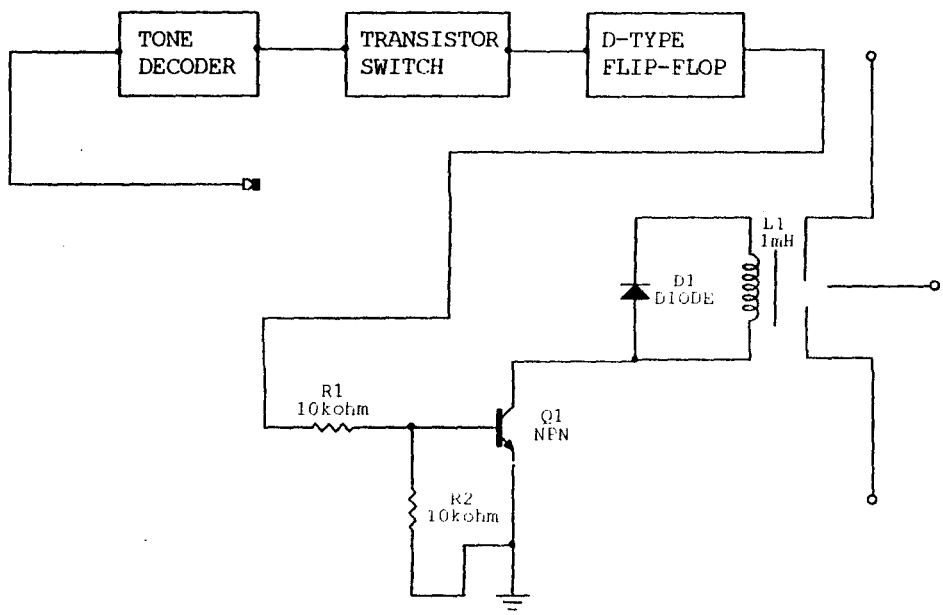
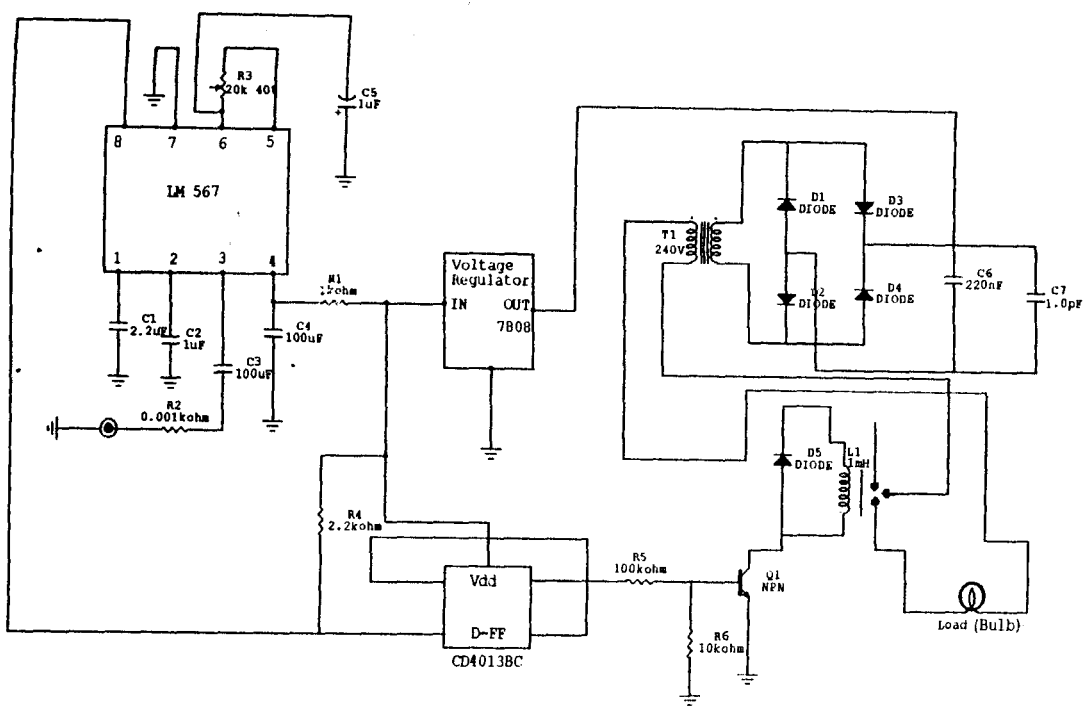


FIG 3.10 BLOCKS DIAGRAM OF A DECODER



P1

Fig. 3.11 CIRCUIT DIAGRAM OF THE DECODER SECTION

3.13 THE POWER SUPPLY UNIT OF THE DECODER

The power supply unit of the decoder section consists of the transformer, the rectification, the filter section and the regulator section as shown below.

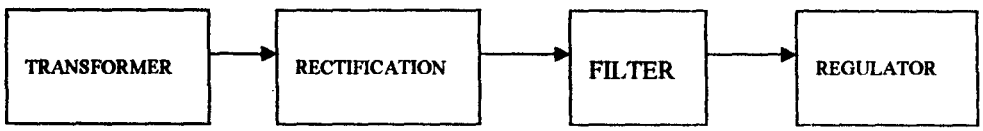


Fig. 3.12 BLOCKS DIAGRAM OF THE POWER SUPPLY UNIT

Most electronics system usually requires cement (D.C) supply, and the supply from the mains is usually about 120V, or 240V. There is need to design a power supply unit which get it supply (9V D.C) and step it down to a required low voltage designed by the circuit in question and then convert it from an A.C to D.C in a process known as rectification. For the decoder, while the regulator is used to produced a constant D.C voltage of ±9V which is required to power the I.C chips.

3.13.1 THE TRANSFORMER

The transformer reduces the ingoing voltage to the required low voltage. For this project the incoming voltage is 240V is reduced to 12V by the centre-tap transformer.

3.13.2 FILTER

Although the output of the A.C to D.C converter is of a single paralytic, the changes in the level are still undesirable to operate electronics equipment. The D.C is a constant level. This process of maintaining the level is called filtering.

A capacitor low filter is the most widely used. The charging and discharging of the capacitor in the filter designed so that is capable of maintaining a relatively constant level as the input of the filter varies.

3.13.3 REGULATOR

From the filter an operation step is taking to provide regulation. These maintain constant output under various load condition. A special diode can be used for regulation. Voltage regulators I.C are used, which provide production against overloading of the circuit component.

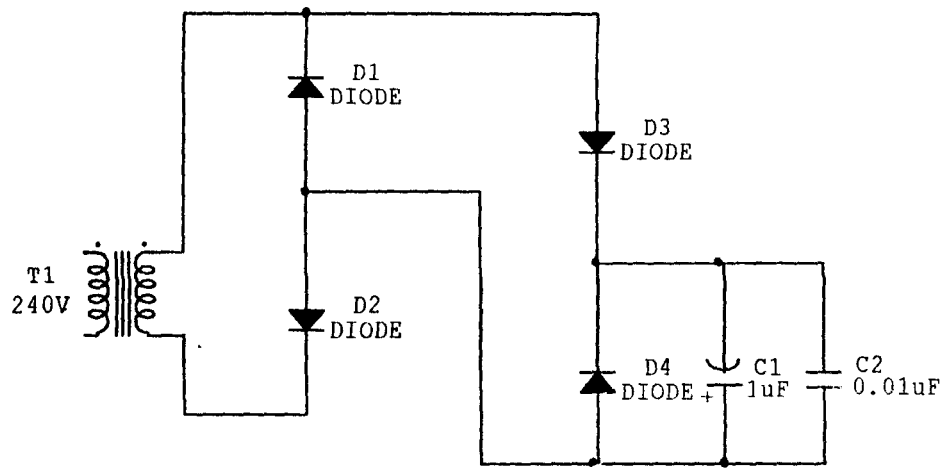


FIG 3.13 CIRCUIT DIAGRAM OF A POWER SUPPLY UNIT

3.14 GENERAL DESCRIPTION OF THE DECODER

The decoder used in the project is LM 567 and is a general purpose tone decoder designed to provide a transistor switch to the ground, when the input signal is present within the pass band. The circuit consists of T and Q detector driven by a voltage controlled oscillation which determines the centre frequency of the decoder. External components are used to independently set frequency bandwidth and the output delay.

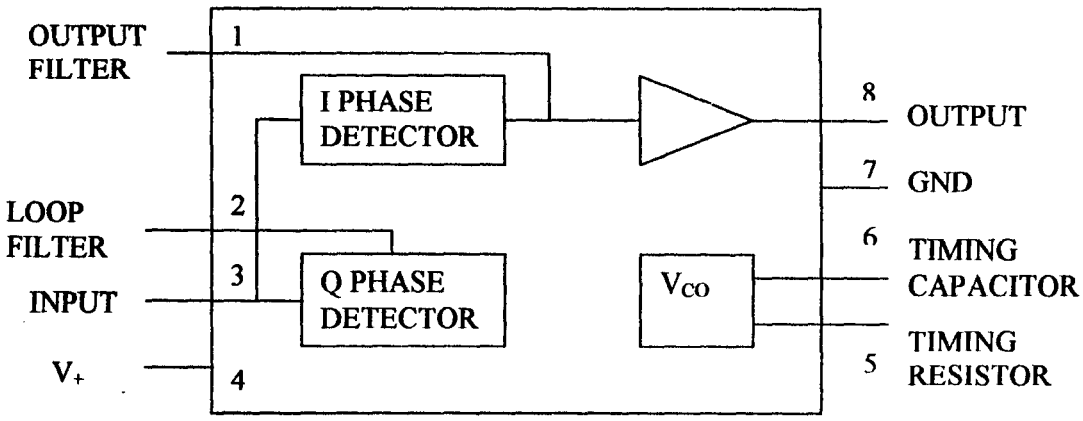


FIG 3.14 DUAL-IN-LINE SMALL OUTLINE PACKAGES

3.13 FEATURES OF LM 567

- 20 to 1 frequency range with an external resistor.
- Logic compatible output with 100mA circuit sinking capacity.
- Bandwidth adjustable from 0 to 14%.
- High rejection out of bind signals and noise.
- Immunity to false signal.
- Centre frequency adjustable from 0.01Hz to 500KHz

3.14 DESIGNING OF THE DECODER

The decoder is base on LM 567 tone decoder set up to respond to the audio tone transmitted by the hand-held transmitter, the tone decoder consists of a frequency voltage controlled oscillator (VCO), and quadrature dividers which establish the reference signals for phase and amplitude detectors. The phase detector and VCO form a phase-locked loop (PLL), which locks to an input signal frequency which is within the control range of the VCO. When the PLL is locked and the input signal amplitude exceeds an internally PnP set threshold, a switch to ground is activated on the output pin (pin 8).

The reference oscillator is setup by external components to run at the input frequency and these also determine the phase and amplitude filter time constants.

The centre frequency of the tone decoder is equal to the free running frequency of the VCO, and this is given by;

$$F_O = \frac{1}{1.1RC}$$

The bandwidth of the filter is found from the approximation.

$$\sqrt{\frac{V_I}{F_oC_2}} \quad \text{in \% of } F_O$$

Where V_I = input voltage (volts rms)

$V_I = 200mV$

C = capacitance at pin 2 (μf)

In this project work, R was chosen as an adjustable trimmer resistor so that all component variation in be accounted for, C was chosen as 0.1μf capacitance.

The input to the tone decoder is from 1 KHz F.M R.F receiver turned to the centre frequency of the nd-held transmitter. The demodulated output is then fed into pin 3 of the tone decoder and the volume ntrol adjusted to give voltage less than 200mV.

Outputs (pin 8) of the decoder is connected to the base terminal of the 2SA1015GR PnP transistor to ovide switching when the output reactivated the transistor switch circuit connected to a CD4013BC D-type p-flop.

When the output of the tone decoder is activated i.e. taken low when an input tone within its pass band detected, the low voltage at the base of PnP transistor switches on, conducting current in the collector itter junction, neglecting the 0.2V saturation voltage of the PnP transistor a voltage (Vdd-0.2) appears at collector of the conducting transistor.

This voltage is acknowledging us logic 1 at the D or clock input of the CD4013BC bistable. The put of the bistable goes high when clock input is high i.e. when 1 KHz is transmitted by the oscillator and ected by the decoder the Q output is forced low when the voltage at 1 KHz is not received at the decoder.

The Q output of the flip-flop is connected to a 25C1815GR transistor that switches on and off a 12V relay whose content is capable of switching 10A. Once lathed the bistable stays lathed until transmitter nges state.

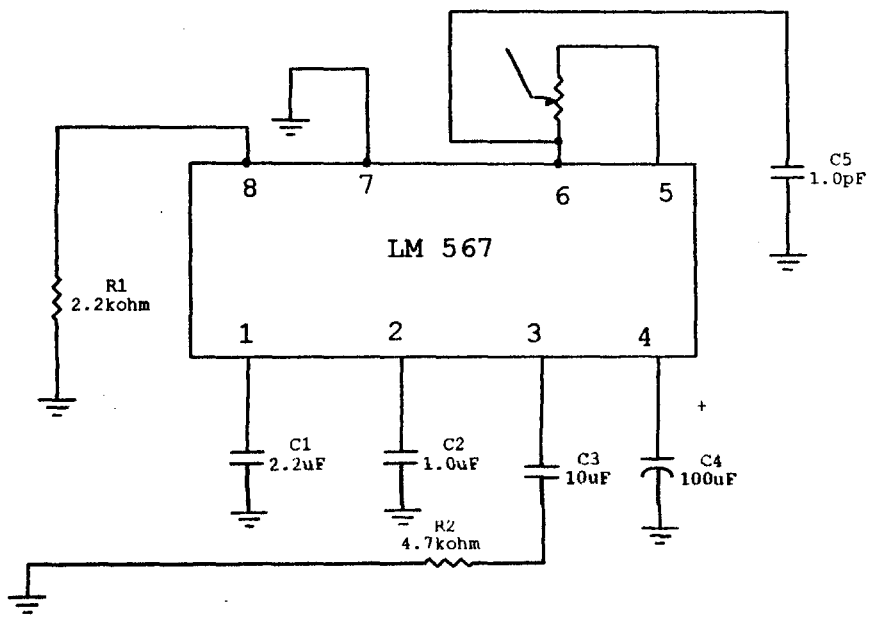


Fig. 3.15 TONE DECODER

CHAPTER FOUR

4 TESTING AND PROCEDURE

4.1 TESTING

The following test was carried out during the construction of this project. Testing the output of each unit during the construction process by the use of digital multi-meter.

Physical connecting of wires between the receivers to confirm if both are working as expected.

Finally disconnecting of the connection between the transmitter and receiver to see if the wireless nature has been achieved.

4.2 ACHIEVEMENT

This system has been able to fulfill the basic requirement of the radio wave remote controller. The transmitter circuit has been able to maintain constant power supply to the receiver, as there is power supply at the main.

The receiver has also been able to receive the transmitted signal and process it up to Schmidt trigger stage.

The receiver has also been able to receive the transmitted signal at quite a fair range of transmission.

4.3 SUGGESTION

Due to difficulties, encountered during the cause of this project, some suggestions have been made for future improvement.

The Nigerian University Commission (NUC) should endeavor to widing the scope of the syllabus of the Degree program at the tertiary institution so that it will be theoretically and practically oriented.

The government should make provision for libraries and research centers where student can go and do their project research and design.

It is indeed a good idea that engineering student's first degree final year project should be a practical one. However, the problem associated with construction with regard to finance and component availability should not be overlooked.

Due to this two factors, student tent to shy away by dropping very challenging projects and go for "easy doing" one proper attention given to student by their supervisors can also go along way in motivating student to pick reasonable project titles. And the university authority should resolve to

assist students in their final year and reduce the number of courses offered by student in their final year, and then we may eventually achieve the technological break-through we are pushing.

CHAPTER FIVE

5 CONCLUSION AND RECOMMENDATION

5.3 CONLUSION

This project was completed from development to fabrication within a time space of six months. The first four month was used to understand and develop the design while the remaining two month was used to implement and test the design.

The radio wave remote control switch system was complete. It worth mentioning how fascinating it was when one design a system constructs it and see it working satisfactory. This project has given a great experience especially in the designed construction of the system. It has also increased the knowledge and understanding of the use of different kinds of transmitter and receiver circuits. From the results, it showed the aim and objective state in the chapter one was achieved since the principle used in the system worked as expected.

5.4 RECOMMENDATION

For the improvement of this project, it is recommended that some sort of the feedback should be incorporated in the system, which would notified the transmitter part if the intended controlled system has been controlled or not in order to increase the effectiveness and efficiency of the system.

It is recommended that the frequency modulation (F.M) receiver should be part of the project construction and also increase the numbers of channels of control switches in other to control more than one device.

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