DESIGN AND CONSTRUCTION OF REMOTE CONTROLLED EXTENSION WIRE

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A PROJECT SUBMITTED TO THE DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING TECHNOLOGY IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF NATIONAL DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING TECHNOLOGY, SCHOOL OF ENGINEERING TECHNOLOGY NUHU BAMALLI POLYTECHNIC ZARIA

DECEMBER 2011

DECLARATION

I ABAH EMMANUEL OCHE, declare that this project 'design and construction remote controlled extension wire' is a completely result of my effort and has never been submitted as far as I know, anywhere for any certificate.

All literature sighted have been dully acknowledge by the references.

ABAH EMMANUEL OCHE

24/01/2012.

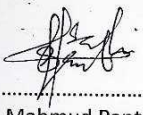
DATE

APPROVAL PAGE

This is to certify that this project "design and construction of remote controlled extension wire" meets the standard expectation for National Diploma project in the department of Electrical Electronic Engineering Technology in partial fulfillment for the award of National Diploma in the above named department

Mal. Mohammed Garba
(Project Supervisor)

4/1/12
Date



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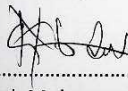
Date



Mal. Mohammed Garba
(Head of Department)

4/1/12
Date

DEDICATION

I dedicate this work to God Almighty for his abundant grace bestowed on me and my parents Mr. /Mrs. Benedict Abah Ukpoji and also to my brothers and sisters, my relatives for their support. May God continue to bless each and every one of them. (Amen).

ACKNOWLEDGEMENT

I must express my appreciation to Almighty God the father for his guidance and protection and his endless grace upon my life within and outside my course of study.

My sincere thanks goes to my supervisor in person of Mal. Mohammed Garba, who helped me immensely in the process of doing this work. In fact no amount of words can actually reflect his softness and friendly attitude; he always has a listening ear to render and makes correction where necessary. May the Almighty God reward him and his family I am grateful to all the lecturers and other staff members of the department for helping me in various ways during my studies.

My gratitude also goes to my brothers and sisters, Grace Abah, Juliana Abah, Livinus Abah, Joseph Abah, Paulina Abah, Janet Abah and rest of them including my late brother Francis Abah for their spiritual and financial support. I just want to say thank you all. You're all my pride.

My special gratitude and appreciation goes to my parents Mr. /Mrs. Benedict Ukpoji the family of Mr. /Mrs. Livinus Ukpoji and Mr. /Mrs. Ejah Emmanuel Abah for their encouragement prayers and financial support a word cannot express how grateful I am.

Also not forgetting my elder brother Livinus Abah (Friyo) for his financial support and encouragement right from day one till this time. Thank you and May God bless you all.

Not forgetting my course mates and friends, Solomon Yahaya (Solex), Ali Nurudeen, Prince Ifeanyi, Michael Nwafor, Glory Abikwu and her sisters, Agnes Joseph, Happiness Job, Alex Andrew (voice of the people) and all my well wishers that I forget to mention may God continue to bless you all.

Finally, I say thank you to every one who help me in any way.

ABSTRACT

The project is concerned with the design and construction of a remote control system for an extension wire using infrared frequency remote control as the transmitter a free space to the receiver circuit which has infrared detector module that work as the main receiving module is used as a trigger to a monostable multivibrator built using 555-timer IC. The output of the multivibrator is used to drive a decade counter (IC 4017) which is wired as a toggle switch.

The output of the 4017 toggle switch is used to put on and off the extension wire connected through a relay.

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CHAPTER ONE

1.0 PREAMBLE

The project is design in order to enhance users to switch on and off their appliances with the help of the remote control. The block diagram below shows the procedure in which the circuit is been constructed.

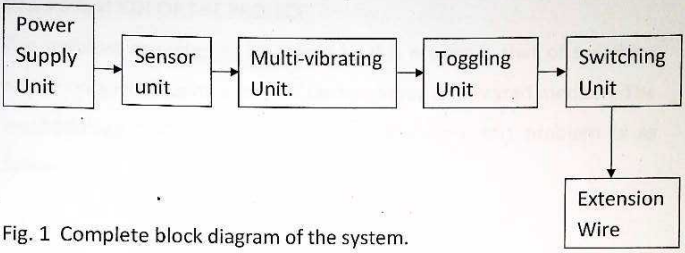


Fig. 1 Complete block diagram of the system.

1.1 AIM AND OBJECTIVES

The aim of this project is to design, construct and test a remote control for an extension wire using infrared control with a transmitter and a receiver made of IR sensor and other components like 555-timer decade counter (4017) and electromechanical relay.

1.2 MOTIVATION

Any electronic device needs to be controlled by switching on and off. The switching basically needs person that could be present for the job. But sometimes it is inconvenient for person to move from one place to another in order to switch on or off such devices. It is for this reason a motivation of coming up with a device that can simplify the act of switching the devices using remote control.

1.3 SCOPE AND LIMITATION

The remote control system is needed to test its workability. It can only switch on and off appliance within the range of 500 watt, heavy appliances within 1000 watt and above need a contactor.

1.4 ORGANIZATION OF THE PROJECT

The problem expected to be solved by this project is that of switching power on and off using a remote control based on infrared medium. The methodology that would be followed for solving this problem is as follows:

- Design of the remote control receiver circuit
- Design of the multivibrator circuit
- Design of the decade counter toggle switch
- Constructing the whole circuit.
- Carrying out measurement on the constructed circuit
- Casing the constructed circuit

1.5 PROJECT OUTLINE

This project report should be presented in five different chapters, which include the following chapter one would deal with basic introduction on the project.

Chapter two would cover the general theoretical background on which the project lies.

Chapter three will deal with the design procedure of the whole circuit

Chapter four covers the construction and testing of the circuit

Chapter five gives the conclusion recommendation for further work and references.

CHAPTER TWO

LITERATURE REVIEW

2.1 HISTORICAL BACKGROUND OF THE PROJECT

As usual many students or people had carried out work in the field of remote control generally. In 2001, Balarabe Ismai'l carried out a design and construction of an ultrasonic remote control which could control any device connected as the medium. Also in the circuit, ultrasonic frequency as the medium. Also in the year 2001, Taju Obelola designed and constructed an infrared based remote system that is only used to control of DC motor in forward and backward direction.

However, in the year 2005, Jonathan Atta have designed and constructed a remote control system using infrared signal to control door (gate) where the gate can be close and open using the device remotely.

After going through these work and related ones, decide to provide a remote control circuit that can be use to control an extension wire which can power any home electronic and electrical appliance via an electromagnetic relay.

2.2 REMOTE CONTROL GENERAL OVERVIEW

The first remote control intended to control a television was developed in the early 1950s, the remote used a wire to connect to the television remote control was the cumbersome set up; a wireless remote control was created in 1955.

The remote was called "plasmatic" it worked by shining a beam of light on to photoelectric cell. Unfortunately the cell did not distinguish between light from the remote and light from other sources, but in the early 1980s, when the semiconductor for emitting and receiving infrared radiation were developed the remote controls gradually switched to the technology which as of now is still widely used.

The aspect of remote controls is wide area that involves different forms of controlling system and device from a distant point. There are different ways in which the remote control is achieved. Most application of control is generally used in other to bring convenience to the operator. However in industries remote control system is used basically to improve safety in the operation of machines. The remote control usually use communication medium between the device under control and the remote control circuit which are separated by carting distance. One of the medium uses for remote control is the computer.

Some computers are used in industries mostly to control some machines and systems in the industry.

Another way of achieving remote control is using telephone lines. These are used to control some devices remotely using pre-programmed tones to achieve the machines. Ultrasonic devices are another way of controlling devices using remote control systems.

This kind of remote control, have short range of operation. The basically operate at ultrasonic frequency range. Radio systems are another well known method of remote controlling. They have the longest range among the all other methods. They are used controlling machines,

vehicles and aircrafts. Infrared remote control, this method is very versatile because it can be used almost with all electronics and electrical device system.

The operation of this system required line of sight between the controlling and the controlled devices.

This forms the basis of remote control in offices and residential electrical and electronic devices.

2.3 TRASMITER SECTION OF REMOTE CONTROL

In Remote Control System, the transmitter is the devices that generate the control signal using some circuit and then transmits the generated signal using some circuit and then transmits the generated signal us through the transmission medium. For this work the transmitter modulates the radio frequency at the selected frequency and transmits the modulated signal through any remote control for TV/DVD etc.

The transmitter however can be designed different oscillation circuit that can operate a high frequency.

Example of this circuit is an astable multivibrator using either discrete components or 555-timer circuit.

2.4 MULTIVIBRATOR (ASTABLE AND MONOSTABLE)

This kind of multivibrator is a type of multivibrator that oscillates from one stage to another. That is, it does not have any stable condition when it is triggered.

This multivibrator is used as an oscillator that operates at any frequency as determined by the designed using transistor as the active

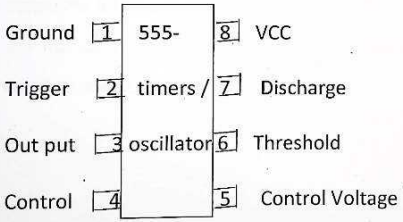
components that generate the oscillating frequency or using integrated circuit for the same purpose

Astable multivibrator is commonly used as transmitter in the infrared or ultrasonic remote control.

2.5 THE 555- TIMER

This is general purpose integrated circuit that is used in systems that involves oscillation, generation as well as timing applications it is dual-in-line 8-pin IC that has different terminals. The IC has two comparators which establish the two threshold voltages as fractions

of the supply voltage (VCC) by external R.C configuration. It also has switch and a control flip flop which drives the output buffer as directed by the comparator input.



2.6 INFRARED SENSOR MODULE

This device is three terminals in configuration that is responsible for the detection of the transmitted high frequency signal and converting it into electric signal. The device is made using semiconductor material that response to high frequency. The detected energy with particular

wavelength (frequency) and intensity is converted into electrical from with strength proportional to the incidence infrared light.

Other high frequency sensing devices are phototransistor, a device with two terminals: collector and emitter and photodiode, a device with two terminals also: cathode and anode. These high frequency detectors are mostly used together with signal amplifier that increases strength of the detected signal to produce a stronger electrical output signal.

2.7 POWER SUPPLY UNIT

Most electronic devices and circuit used dc supply for their operations. This type of power can be obtained from dry buttery as well as the wet once. These batteries are convenient source of power supply where small amount of energy is needed. But in situation where the systems consume a large amount of energy in their operation, the dry batteries are not capable to do the job. In this case dc power supply is obtained from ac mains source.

CHAPTER THREE

DESIGN OF THE CIRCUIT

In this chapter we are going to look at the general procedure of the design of the whole circuit of the infrared remote control device. The first thing we are to look at is the general circuit diagram.

3.1 COMPLETE CIRCUIT DIAGRAM

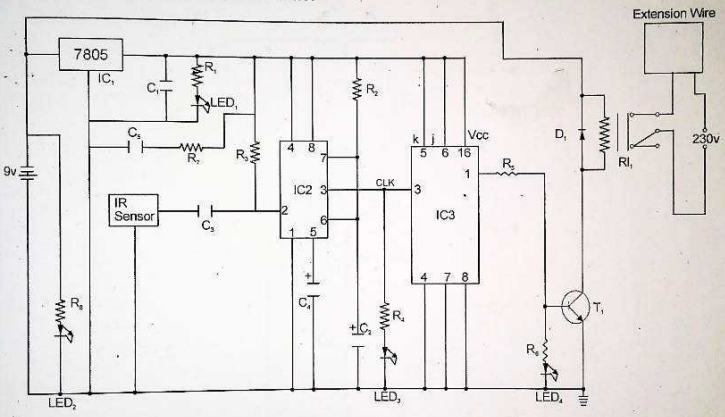


Fig. 3.1 General Circuit Diagram

The circuit is powered using a DC supply of 9v for the relay and 5v for the other part. The IR (infrared) sensor receives the signal from the transmitter.

The output of the sensor is pass to the monostable multivibrator made using 555-timer the toggle JK flip-flop finally the out of the flip-flop is used to turn on the driver transistor that drives the relay.

3.2 DESIGN OF THE MONOSTABLE MULTIVIBRATOR

The configuration of the multivibrator is given by the fig 3.2 as follows:-

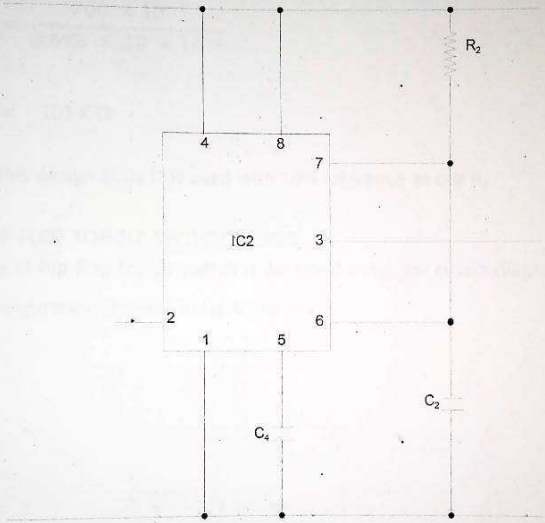


Fig. 3.2 Monostable Multivibrator Section

The trigger input to the IC is applied to the pin-2 pin 4 and 8 are connected to the positive voltage supply Vcc while pin 1 is connected to the ground terminal, pin -5 is grounded through a capacitor C_2 of 0.01 μf capacitor. The timing network is formed using capacitor c_2 and resistor R_2 connected to pins 6 and 7 of the IC.

The period of the multivibrator is calculated using the relation

$T = 0.693\ 6_2\ C_2$

If the capacitor is selected as 10mf and the period is set as 700ms we calculate the value of the R_2 as follow:

$$R_2 = \frac{T}{0.693C_2}$$

$$R_2 = \frac{700 \times 10^{-3}}{0.693 \times 10 \times 10^{-6}}$$

$R_2 = 101\ K\Omega$

In this design 100k Ω is used with 10% tolerance as our R_2

3.3 FLIP-FLOP TOGGLE SWITCH DESIGN

The JK flip-flop toggle switch is designed using the circuit diagram with c configuration showed in fig 3.3 below

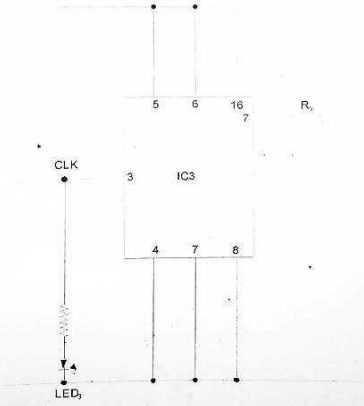


Fig 3.3 JK flip-flop switch section

Pin 16, 5 and 6 of the decade counter is connected to the high position (the VCC input). The reset terminal pin 4, 7 and 8connected to the ground. In this configuration the only thing that toggles the circuit is the clock input pulses obtained from the output of the as table multivibrator (555-timer IC)

Whenever the stage of the output of timer changes, the JK flip-flop toggles it output. In this way the output can be used to switch on and off any device connected to the output relay.

3.4 RELAY- DRIVER TRANSISTOR UNIT DESIGN

The output of the toggle JK flip-flop is further amplified using transistor (relay – driver) which gives more amplification to the output signal and produces enough signals at its collector terminal to control the relay

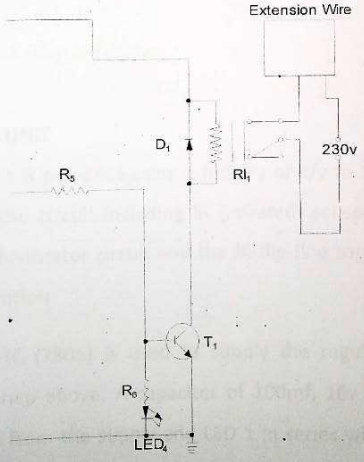


Fig 3.4 Relay Driver Unit

The output of the JK flip-flop at pin 1 is delivered to the base of transistor T1 through base resistor R_5 the transistor is an NPN type with part number SL 100 and amplification factor of 100 (min). The value of the required base resistor is given by the relation;

$R_B = 0.1\ BR_6$

Where $R_B = R_5$ and R_6 is selected to be 100Ω, the value of the R_4 is calculated as follows;

$R_4 = 0.1 \times 100 \times 100 = 1000\ \Omega$

$R_4 = 1\ K\Omega$

The resister used in this circuit is a type that triggered using 12v-dc and can withstand a maximum current of 7A with 250v – AC supply at 50/60 Hz frequency.

Given by the block diagram above.

3.5 POWER SUPPLY UNIT

The whole circuit is powered using a battery of c/v to 12v output. The initial stage of the circuit including IR (infrared) sensor the 555-timer monostable multivibrator circuit and the JK flip-flop toggle switch need 5v for their operation

A 5v regulator IC (7805) is used to supply the regulated 5v to the sections mentioned above. A capacitor of 100mf, 16v is used to filter unwanted noise from the supply and LED 1 in series with resistor R_1 of 470Ω is used to indicate the presence of the power supply from the regulator.

The IR sensor takes it power supply through resistor R_7 of 100Ω to its pin-3. The sensor produce it output from pin-1 through coupling capacitor C_3 of 0.01 mf to trigger input of the 55-timer at pin-1

CHAPTER FOUR

CONSTRUCTION, PACKAGING AND TESTING

4.1 INTRODUCTION

In this chapter the basic method followed in constructing the circuit and testing the constructed to confirm its proper operation would be discussed.

4.2 TEMPORARY CONSTRUCTION OF THE CIRCUIT

In the first place the circuit is constructed on a temporary project board (bread board) to be sure its ability to work according to the design specifications. The components were inserted into slots on the board and connected accordingly and wires were used as jumpers. After making sure that all the wiring is done properly with all components connected correctly, the circuit is using 12v power source. The circuit was found working normally by triggering the relay on and off which turns on and off the extension wire connected.

4.3 PERMANENT CONSTRUCTION OF THE CIRCUIT

The circuit was finally constructed on a Vero board after assembling the components on the board and using wires as jumpers to connect some terminals. The whole board is then soldered using soldering iron and soldering lead.

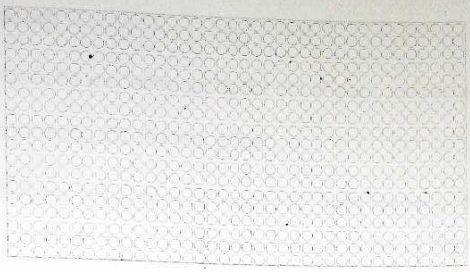


Fig 4.1 A Vero board

4.4 PACKAGING THE PROJECT

The circuit is cased after the permanent construction the casing material used is a plastic it is readily availed user friendly, since it is easy to manipulate as well as its insulating property. The shape of the case is of rectangular as show by fig 4.2

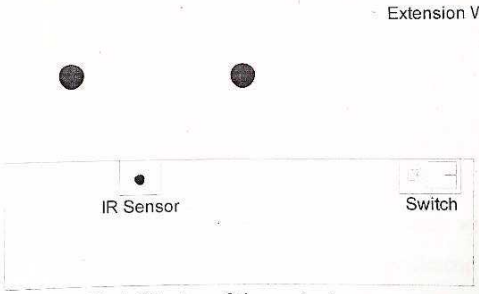


Fig 4.2 Casing of the project

4.5 ASSEMBLING

The assembling was achieved by the use of Vero and plastic casing

4.6 TESTS CARRIED OUT ON THE WORK

The circuit has underdone different test from the stage of construction to the point where it is finally constructed. Some of the tests done are explain below.

4.6.1 COMPONENT TEST

In this the individual component used for the construction of the circuit where tested one by one to ensure their good condition before being used in the construction. Digital multimetre is used to test components like resistors, capacitors, transistors the diode as well as the relay. While the integrated circuits were tested using simple circuit in which they worked perfectly.

4.6.2 WAVE FORM OF THE IR SENSOR OUTPUT

The waveform output of the IR (infrared) sensor was observed on an oscilloscope and the resulting output was satisfactory.

The expected waveform is supposed to be square but what was obtained was different as was seen on displayed on the oscilloscope. This could be due to distortion on the signal during transmission or some errors of design.

4.6.3 TEMPORARY TESTING:

After the temporary construction, the constructed circuit is test on the bread beard by connecting power supply and using transmitter to trigger the circuit. This is achieved completely because the relay switched on and off whenever the remote is pressed.

4.6.4 PERMANENT TESTING

The circuit after been constructed permanently on the Vero board is tested and was found functioning normally as expected. Different devices were connected to the relay for testing and the relay was able to switch them on and off when the remote is used for triggering.

4.7 LIST OF TOOLS USED

s/ no	ITEAM	Description	Quantity
1	Transistor		1
2	Diode	D1-D5in4007	5 each
3	Capacitor	C 2200nf, 60v	1
4	Regulator	U1 7812, ICl 7805	1 each
5	Resistor	R8, R6 R4 1k	1 each
6	Resistor	R3, R2, R7 100k	1 each
7	Resistor	R1 470	1
8	Resistor	R5, 330	1
9	Capacitor	C2, C5 10 µf 16v	1 each
10	Capacitor	C3, C4, 0.01µf	1 each
11	Capacitor	C1, 1000µf, 16v	1
12	Sensor	IR (TK 1838)	1
13	I C_2	NE 555	1
14	IC_3	CD 4027	1
15	TI	C 945	1
16	LED	LED 1, 2, 3, and 4 (green Col)	1 each
17	Relay	12v single output	1
18	Extension wire	Multi output	

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

The major aim of this project work is to design and construct a circuit that can act as a remote control switch can be used for switching on and off any home electrical/electronic appliances. At the end of this work the actual designed goal was achieved because the circuit designed was function properly where it is used to control many devices for testing its workability. (At the H.O.D office)

This type of project is very significant problems and it improves comfort to people. In addition, it exposes me to practical art of design and construction of useful electronic circuit.

5.1.1 DIFFICULTIES

There are number of problems encounter during the contraction of this project, some includes; problem due to inexperience in mounting of components are damaged. Most of the calculated components are not available in the market and so equivalents are used.

5.1.2 ACHIEVEMENTS

It was clearly seeing from chapter three above that remote control extension wire was achieved since it performed the function its design for.

5.2 RECOMMENDATION FOR FURTHER WORK

The general truth is that any project carried out must have some limitations in its applications and functions make it possible for other people to carry out further works on the same project. This project being not an exception has it own.

The basic limitation to this circuit is the range over which it can work properly. The following recommendations are made in order to improve the performance of the circuit.

1. The range of operation of the remote control should improved by boosting the power radiated.
2. Printed circuit board should be used to simplify the construction of the circuit.
3. The casing of the project should be made more compact and colourful.
4. The power supply unit should be improved to obtain smoother power from the mains.

   If the above suggestions are implemented, a more standard and more reliable version of the remote control would be obtained.

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