DESIGN AND CONSTRUCTION OF ULTRASONIC PEST REPELLER

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NUHU BAMALLI POLYTECHNIC, ZARIA
SCHOOL OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DESIGN AND CONSTRUCTION OF ULTRASONIC PEST REPELLER

NATIONAL DIPLOMA PROJECT

BY

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NOVEMBER, 2010

DECLARATION

I hereby declared that this project work was conducted by me under the supervision of the department of Electrical/Electronic Engineering Technology, Nuhu Bamalli Polytechnic Zaria. All literature consultation have been duly specified by means of reference neither did I copy some one's nor has some one else done it for me.

Suleiman Abdulkadir Alhassan

Signature

06/12/2010

Date

CERTIFICATION

This is to certify that this thesis title "Design and Construction of Ultrasonic Pest Repeller" has met the requirement of the department of Electrical Electronic Engineering Technology (EET) Nuhu Bamalli Polytechnic Zaria for the award of National Diploma (ND) in Electrical Electronic Engineering Technology.

Mahmud Mustapha
(Project Supervisor)

07-12-2020
Date

Mahmud Panti
(Project Coordinator)

Date

Mal. Muhammad Garba
(Head of Department)

Date

DEDICATION

This project is dedicated to my parents Alhaji Abdulkadir Alhassa, my beloved mother Majiya Hafsat, Alhaji Umaru and to my brothers and sisters.

ACKNOWLEDGMENT

My greatest thank goes to Almighty Allah (S.W.T) and his messenger Muhammad (S.A.W) Ibn Abdullahi whose mercy, protection and love has continue to reign on me and whose mercy have the ability of accomplishing this task.

I am highly and extremely delighted this point in time to show my sincere gratitude and thanks to all those who in one way or the other made my work successful and possible one.

My appreciation goes to my supervisor Malam Mahmud Mustapha for his guidance and help rendered to this project.

Also, my appreciation goes to the entire staff of Electrical Electronic Engineering Technology department for their support.

Finally, my most gratitude goes to my parent and brothers, also to all members of Electrical Electronics Engineering Technology (EEET) particularly my friends like Sa'idu Bala, Takubu Ibrahim, Abdulkarim Shehu, Musa Barau and the rest whose names have not been mentioned.

ABSTRACT

This project work of ultrasonic repeller as I mentioned earlier is a circuit developed in order to use it for protection against pest.

The circuit is audio frequency oscillator, which is designed using two transistors and a 555 timer IC as the acting components. The current flowing through the different branches of the circuit role determine using the different resistor in the circuit.

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CHAPTER ONE

1.0. INTRODUCTION:

1.1. PREAMBLE:

The field of electric and electronics engineering is one of the common areas that provide most basic solution to ordinary problems of life. This involves the application that has to do communication, security and other important areas. As we know one of the problem that disturbed human life is that of insect and other small creatures.

Pest always make a lot of damage to agricultural production, at the end result poor farm production. Application of chemicals has a negative effect on controlling pest, not only on the crops, but to human too.

In this observation on how chemical affect the crops and human, we tried to developed an alternative solution by using an electronics circuit which can produce a sound of a very high frequency enough to send away the pest. This sound is ultrasonic sound, it does not disturb the environment particularly human.

1.2. THE BACKGROUND OF THE PROJECT:

The project work of ultrasonic pest repeller is capable of controlling the problem of pest in our farms thereby get rid of the

pest. This project design and constructions details of the ultrasonic pest repeller.

1.3. OBJECTIVE:

The main objective of this project is to design and construct a devise that is capable of repelling pest in order to save the lives and properties of the people.

1.4. SCOPE OF THE PROJECT:

This project can only be work within the range of voltages 1 + 0 9v and cannot be work at the voltage that exceeds 9v.

1.5. PROBLEMS AND METHODOLOGY:

As we all know that before achieving any particular task the problems like absence of some components used in constructing the project. Although at last I was able to solve the problem and I successfully accomplished my goal of constructing the project for repelling pest.

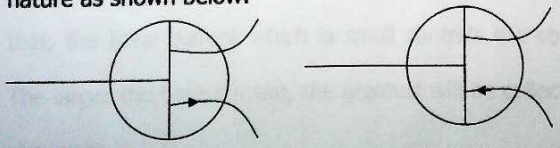
CHAPTER TWO

2.0. LITERATURE REVIEW

2.1. GENERAL OVERVIEW ON TRANSISTORS AND APPLICATION:

Transistor is generally an active component which is very useful in today's electronics technology. The transistor as an electronics technology. The transistor as an electronics component can be applied in three basic ways firstly, the transistor can be used as an oscillator device which can produced both the and frequency and the radio frequency. Secondary, the transistor can be used as an amplifier, it can amplify both signals i.e. audio and radio frequency.

Finally, transistor is used as an electronic switch in many applications. The most commonly used transistor now is called the bipolar junction translator (BJT) this device is three terminators in nature. The terminals are the Base (B) the collector (C) and the Emitter (E). the BJT) transistor can be either N.P.N or P.N.P in the nature as shown below:



(N.P.N) Transistor (P.N.P.) Transistor

Fig. 2.1.1.

There is another transistor which is common, and it is known as (FGT) field effect transistor, this is also device with three terminals are the Gate (G) the source (S) and the drain (D) as shown below.

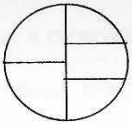


Fig. 2.1.2

(FGT)

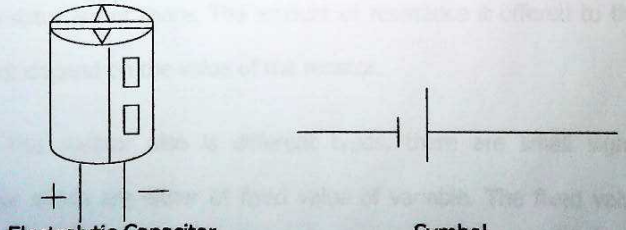
The (BJT) transistor operate in three basic configurations. These are common base, common collector and common emitter configuration. The choice of particular configuration depends on the application of the FGT also can operate either enhanced made or deflexed mode as the case may be.

When the collector of an NPN transistor for example is positive, the emitter negative and the base slightly positive, the transistor is correctly based (polarized) and there are two current flowing through it. The collector current I.C which is large and the base current (Ib) which is a small current. The interesting thing about transistors is that, the base current which is small controls the collector current. The larger the base current, the greatest will be collector current and vice-versa.

2.2. GENERAL OVERVIEW ON CAPACITORS AND APPLICATION:

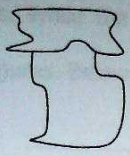
A capacitor is a device which has two terminals positive and negative terminal. Capacitor has the ability of storing electricity changes. The capacitance of a capacitor is the capacity of its charge stored, it is measured in farad (F), but the practically available capacitors are rated in microfarad. The capacitor can be electrolytic capacitor which contains dielectric in it i.e. (oil or any) electrolytic liquid) or mica, some use are or vacuum.

There are mica capacitors and others whose capacitances is always less than before and they any polarity. Most electrolytic capacitor can be seen clearly with a light blue colour strip-down to the negative terminal.

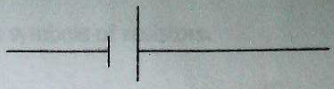


Electrolytic Capacitor Symbol

Fig. 2.2.3



Mica Capacitors



Symbol

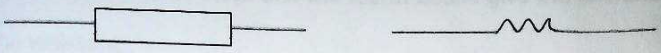
The capacitors are found in almost all electronics devices for example, it used in radio receivers, Television, Video players, computer and many other electronics devices.

2.3. GENERAL OVERVIEW ON RESISTORS AND THEIR APPLICATION:

Resistors are very important component used in electrical and electronics applications. The main function of the resistors in circuit is to resist the flow of current through a given branch in the circuit thereby regulating the amount of current that is supposed to pass if the resistor is not there. The amount of resistance it offered to the current depend on the value of the resistor.

The resistor also is different types, there are small signal resistor which are either of fixed value of variable. The fixed value resistors are generally colour code, that is the value of their resistance is determined by observing the colour bands round the

resistors. While the value of the variable resistors in written on it using figures. Below are the common symbols of resistors.



Fixed resistors

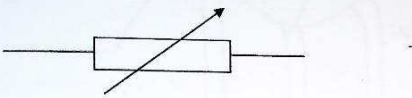


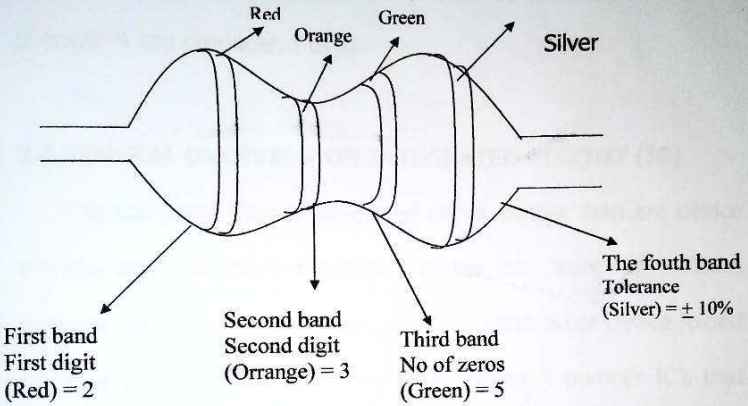
Fig. 2.3.5

Variable resistors

Table 2.3.1.

Colour	Code
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Bleu	6
Violent	7
Gray	8
White	9

To read a resistor, most resistors have four bound of colours. The first bound yellow give the first number, the second bound colour give the number of zeros and the fourth bound give the tolerance of the resistors.



The above resistor is 2300000n = 2300kn

2.4 THE LOUD SPEAKER

The loud speaker is an electronics device that convert electrical signals into sound form. The loud speaker is mainly using a permanent magnet and coil. Is magnetized when a currant flow through it, which create attraction and repulsion between the

permanent magnet and the coil and which set the diaphragm in to produce the sound at its own frequency.

2.5 THE SOUND AT ITS OWN FREQUENCY

The loud speaker is of different sound different an the amount of power it can producer. I used.

2.6 GENERAL OVERVIEW ON INTEGRATED CIRCUIT (IC)

As the name implies integrated circuit consist than are device like the one's we have mentioned earlier live; transistor?, diode, resistors, gates (AND, OR NAND, and NOR) and other device joined together to from a clip of IC. There are different number IC's that functions differently and have differently number terminals, but here am going to take about 555 timers IC which was the are I have used.

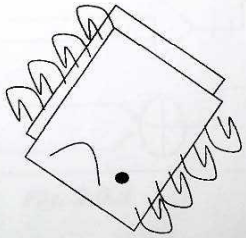
However, there are this main types of IC's those are (a) digital ICS and (b) linear IC's.

(a) **Digital IC's:** these contains switching types circuits handing electrical signals which have only one of two values i.e. their inputs and output are wither "high (near the supply voltage) or law (near

"O" voltage) they were the earlier IC because they wore easier to make.

(b) **LINEAR IC'S:** these include amplifier- type circuit of many kinds, for both audio and radio frequency, they handle signals that are often electrical representation i.e. analogues of physical quantities such ass sound, which change smoothly and consciously over range of values. Most of the versatile linear IC operation amplifier.

A 555 timer IC consist of only 8 terminal i.e. four at each side of the IC are show below



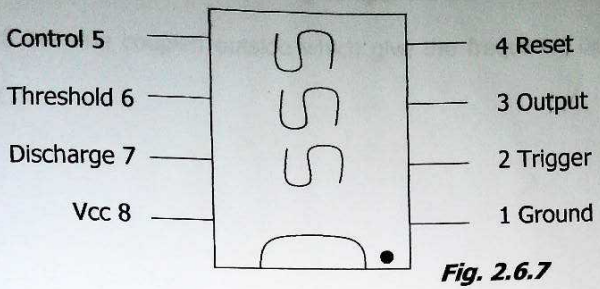


Fig. 2.6.7

The above diagram show the function of each terminal of the transistor i.e. from the first terminal to the last terminals. The internal part of the 555 timer transistor is show below.

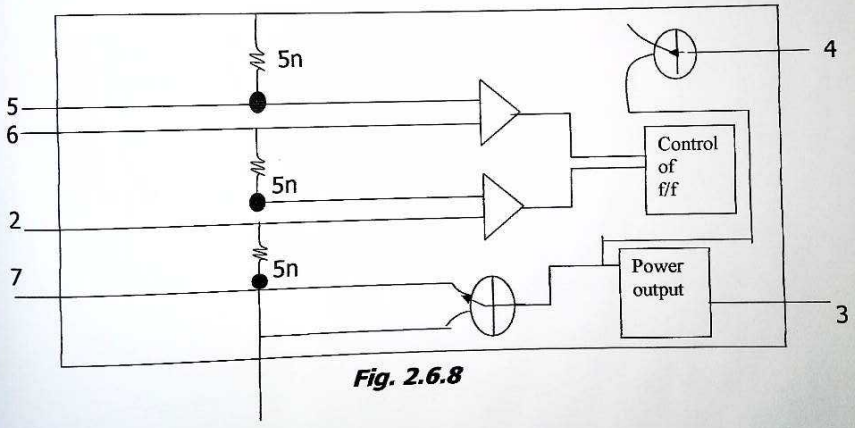
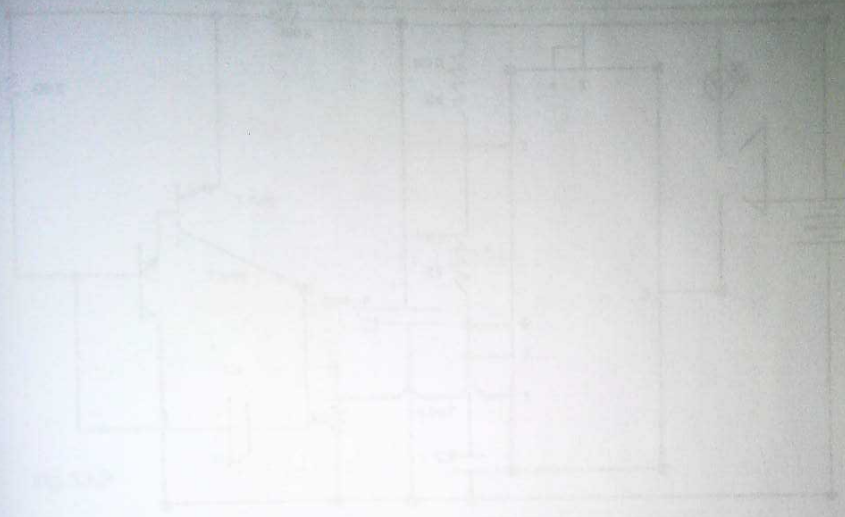


Fig. 2.6.8

The 555 timer IC a work as a mono stable multi vibration used to provides a specific time delay of an output which is independence of

the input trigger pulse. The timing component are not coupled inside the IC but one coupled outside which give the frequency output of the IC.



CHAPTER THREE

3.1. DESIGN AND ANALYSIS:

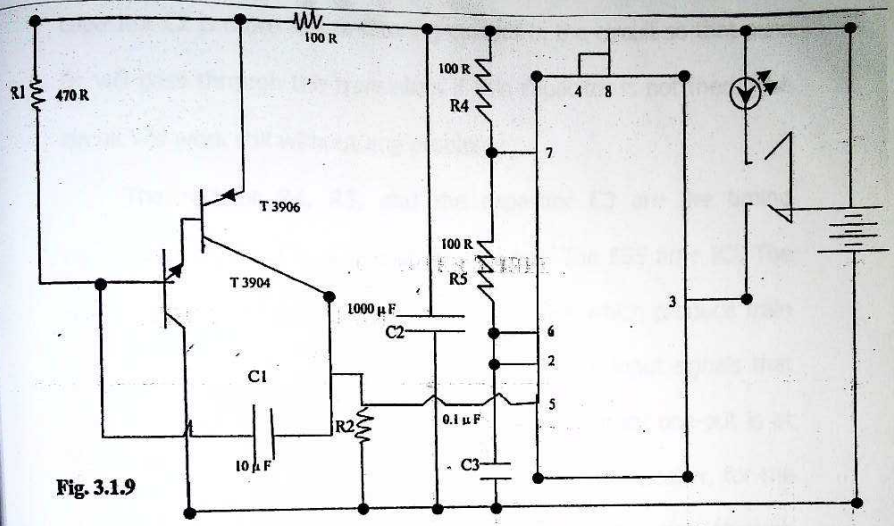


Fig. 3.1.9

The above diagram is the circuit of the ultrasonic pest repeller which consist of two transistors, where one of the transistor is N.P.N while the other is P.N.P. It also consists of several resistors of different values design in required farm, with some capacitor and a 555 timer IC.

From the above circuit, the resistor R1 reduce the current entering the transistor a. (3904) because base of transistor does not required large current. This transistor Q_1 (3904) act as an oscillator while Q_2 (3906) amplify the oscillated signal which pass through R3 supply E of Q_2 with current, which

resist the current to desired amount. The capacitor C1 stabilize the voltage flowing to the terminal "5" of the 555 timer IC. The R3 allow small current to flow to the negative terminals. the electromagnetic capacitor C2 is more like re-filtering current in the circuit so that pure Dc will pass through the transistors if this capacitor is not there, the circuit will work still without any problem.

The resistor R4, R5, and the capacitor C3 are the timing component of, this frequency at the one-put. The 555 time IC'. The whole circuit work as an as table multi vibrator which produce train of square waves as out put without any separate input signals that will set and reset it at this same time. The frequency one-put is at the terminal 3 of the IC which then couple with the speaker, for the output to be heard. R6 also reduce the amount of current through the load speaker because it required small amount of current.

The frequency of the pulse generated at the output given by

$F = 1.1 \times RaC_1$

Where $Ra = (R_1 + R_2)$

$F = 1.1 \times (1000 + 1000)\ 0.1 \times 10^{-6}$

$F = 1.1 \times 10^{6} \times 2000 \times 0.1 \times 10^{-6}$

$F = 2200H2$

$F = 22KH_{Z}$

The period of oscillation

$T = 1/f = 1/_{22000}$

$T = 4.5 \times 10^{-5}$ second

CHAPTER FOUR

4.1 CONSTRUCTION

The circuit was first constructed on the project board temporarily to test it work ability. The component were assembled on the project board as shown by the circuit diagram making sure that right terminals were connected correctly. Then the power supplied from 9v dry battery and the circuit work property when it switched on. The circuit was transferred to main construction board for permanent construction board for permanent construction. The construction would not be erectly the way the circuit is designed but, jumpers help a lot in transferring current from one place to another.

4.3 CASING

The whole project is cased in pack of rectangular shape, the material used for the casting is plastic which is bad conductor, to prevent any contact to the terminal on the board.

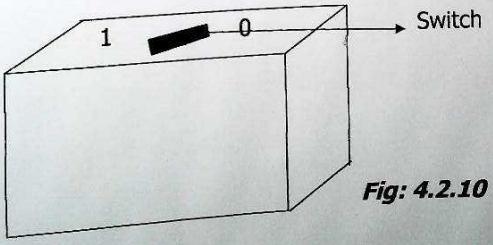


Fig: 4.2.10

4.3. TESTING:

The issue of testing is very important in the process of design in order to obtain an accurate result and expected performance from the designed device.

In this project we begin our testing by taking the individual component and test them using a digital multi timer when the component were found to work normally, we then break board with the help of wires as jumpers and the circuit work on board when tested.

However, the final testing was done after project is constructed permanently on the Vero board. When the power supply is put on, the a sound is produce from the speaker which is very low and have a very high frequency capable of sending away pest.

CHAPTER FIVE

5.1 CONCLUSION

I would like to conclude this project by saying that this type of project are the most important ones that should be encourage n our learning institutions because they can be put into practical application for solving typical problem of life. Although, these kind of load project are mainly considered inferior to the foreign ones. But they can be stabilized to compete with any other ones.

However, this type of project required much time, energy and resources but they are the same time expose the student to the practical aspects of their courses.

5.2 RECOMMENDATION

This can be recommended for us in different place due to the type of role it plays. In the first place recommended the use of this ultrasonic pest repeller in our farms to get rid of pest.

We recommended that a further work should be done on this project so that a means of controlling the circuit automatically should be encouraged instead of manual operation.

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