DESIGN AND CONSTRUCTION OF A WARBLING-WAILING SIREN WITH LIGHT DEPENDENT RESISTOR

BY

ADEPOJU JOSIAH OLUWAROTIMI

2003/15298EE

DEPARTMENT OF ELECTRICAL/COMPUTER ENGINEERING, SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY, FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGER STATE, NIGERIA.

NOVEMBER, 2008.

DESIGN AND CONSTRUCTION OF A WARBLING-WAILING SIREN WITH LIGHT DEPENDENT RESISTOR

BY

ADEPOJU JOSIAH OLUWAROTIMI

2003/15298EE

A Thesis Submitted To The Department Of Electrical/ Computer Engineering, School Of Engineering And Engineering Technology, Federal University Of Technology, Minna, Niger State, Nigeria.

November, 2008.

Dedication

I dedicate this work to GOD ALMIGHTY, the author of my strength, who by His divine mercy and grace gave me the ability to undertake this work and saw me through to completion. To HIM be glory, dominion and praise forever.

Declaration

I, Adepoju Josiah Oluwarotimi, hereby 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.

Adepoju, Josiah Oluwarotimi
....
Name of Student

13/11/08
....
Signature and Date

ENGR. Dr. Y. A. Adediran
....
Name of Supervisor

12/11/08
....
Signature and Date

ENGR. Dr. Y. A. Adediran
....
Name of H. O.D.

....
Signature and Date

....
Name of External Examiner

....
Signature and Date

Acknowledgement

I want to express my profound gratitude to the most high God for the gift of life, health and strength He gave me throughout the course of this work and my stay on this campus. To Him be all glory, honour, power and adoration forever (amen).

I want to appreciate my supervisor, Dr. Y.A Adediran, who created time for me out of his busy schedules and took his time to go through my work, I am grateful sir.

I want to sincerely thank my parents, Ven. (Dr) and Mrs Adepoju who have been a great support physically, spiritually, financially and emotionally through out this educational phase of my life. I sincerely pray that God will bless and reward you abundantly in Jesus mighty name (amen).

To my siblings: Dorcas, Elisha and Philip. This task would not have being easier if not for them. Thanks for all your prayers and concern throughout the period of my work. To my beloved friend, Gloria Lawai, I'm grateful for all your love and concern, God bless you real good.

To my best of friends: Dipo, Adeola, Obed, Abigail, Arike, I want to thank you all for all your efforts to see to the success of this work. I acknowledge and appreciate you, God bless you all.

To all others, whose name I can't mention because of space, you have all being there for me. Thank you and may God make you enjoy the benefits of all good you have done.

Table of Contents

CHAPTER ONE

INTRODUCTION

1.1 Expository introduction

With break-through in integrated circuit technology, electronic devices are made up of microelectronic components. These components are relatively low cost and are combined in some ways to make very useful devices.

With increase in road accidents, fire outbreaks, theft, traffic jams, moral decadence as it relates to the society and other emergency conditions, it became necessary to devise emergency alarms so as to make necessary individuals, victims of accidents or organizations responsible for emergencies to get to points of urgent attention in good time.

The warbling-wailing siren is a device used by agencies, such as Federal Road Safety commission, Red Cross and various hospital ambulances to indicate that a life or lives are at risk and they need immediate attention by medical personnel.

The warbling-wailing siren is also used by national security agencies such as the military and other Para-military agencies or organizations to convey top ranking officers or highly positioned government officials to point of duty. The siren is put on to make easy access for them, to their various points of duty through traffic jams.

The warbling-wailing siren can also be used by companies, like power stations, as an indicator to signal a problem that needs to be attended to immediately, when a button or buttons of the control panel comes on. The siren is simulated with the circuit such that any problem that is indicated on the control panel triggers on the siren.

The warbling-wailing siren could also be used for automobile-security such that, without the blinker, the attempt of any unauthorized entry into such a car triggers on the alarm, which now alerts the attention of the owner.

In the design and construction of a siren, it was designed to determine the frequency or number of vibrations per second, corresponding to a sound of any pitch [1].

1.2 Aims and Objectives

This project is aimed at the design and construction of a reliable and simple warbling-wailing siren suitable for use by various individuals and organizations for different purposes. It is to show how a siren could be a multi-operational device such that its implementation into any circuit can be effective through the use of its switching device.

1.3 Methodology

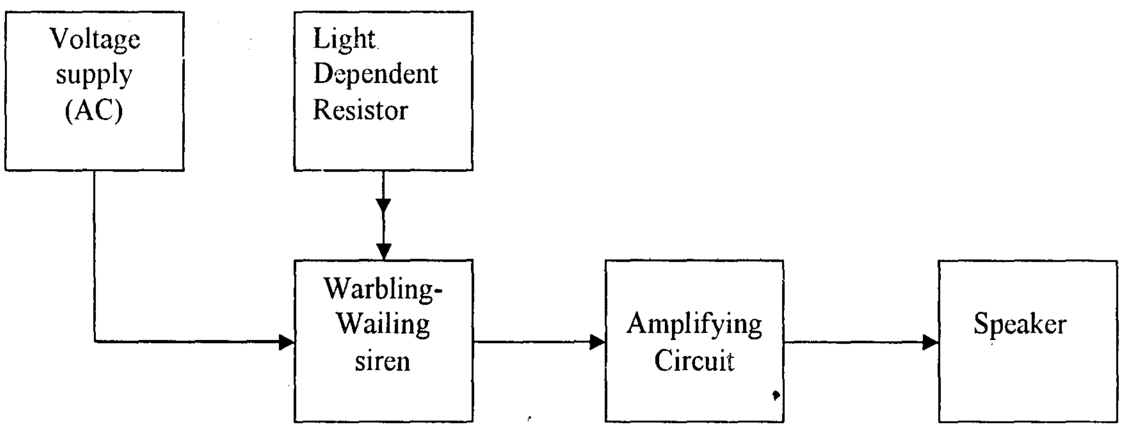


FIG 1.1 Block diagram of warbling-wailing siren with light dependent resistor

The warbling-wailing siren is composed of many functional blocks. Each block is a simple circuit with few components.

The figure 1.1 shows the block diagram of a warbling-wailing siren, incorporated with light dependent resistor and an alternative voltage supply for back up in the event of power outage.

The voltage sources supply either alternating current (AC) or direct current (DC) to the warbling-wailing siren. For this project, the design is based on the use and rectification of AC to DC. The alternating current is implemented by the use of a step down transformer and a rectifying circuit to the voltage suitable for the circuit. The concept of the alternating voltage is to ensure efficiency and reliability in the functionability of the siren, in the event that the AC goes off.

The inclusion of a light dependent resistor is to facilitate its use as a good security gadget or device such that any unauthorized entry into the secured facility will change the value of the resistance in the circuit by casting a shadow on the light dependent resistor, thereby triggering the siren.

The amplifying circuit is meant to amplify the pulse generated by the siren in the form of sound and thereby produce an alarm sound through the speaker.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical Background

The warbling-wailing siren has been in existence since the beginning of the 19th century. The system has undergone fundamental changes which produced the basis of the device generally used today. Modern sirens are electrically driven and their input power could be either alternating current or direct current as stated earlier in chapter one[2].

The siren system is a device used to generate audible sound i.e. siren is an acoustic device used to produce a signal or warning. The output of the siren can be used as an alarm signal. The use of a particular alarm depends on what it is desired for.

Sirens are now used only as signals. The basic form is a circular disk pierced with equally spaced holes in a concentric circle. A jet of air imping on this circle is alternately cut off and then free to blow through a hole, thus sending a succession of compression pulses per rotation or revolution into the atmosphere . If there are, for example, ten holes, a jet of air and the motor runs at one thousand, two hundred (1200) revolution per minute, the pitch or frequency of the tone will be calculated as: $\frac{10 \, X \, 1200}{60} = 200$cycles per seconds.

A siren will also sound under water when actuated by a jet of water [1].

Sirens are effective warning devices. The siren is majorly based on low pass or power astable multivibrator. This low power multivibrator is a free-running multivibrator circuit adapted to change oscillation frequency in response to the change in capacitance of at least one of a pair of capacitors which are not necessarily electrically isolated. The circuit comprises a free –running astable multivibrator of the common type which is controlled and synchronized by a set-reset bistable multivibrator [3].Examples of astable multivibrator integrated circuits are the 555 and 556 timers.

The outputs are sufficient to supply many transducers directly. This includes light emitting diodes (with a resistor in series), a low current lamp, piezo transducers loudspeakers (with a capacitor in series), relay coils (with diode protection). The outputs of the siren, graphically, are a set of square waves [4].

The astable multivibrator has the ability to both sink and source currents. This implies that two devices can be connected to the output so that one is on when the output is low and the other is on when the output is high[4].

The input of the astable multivibrator, when it is less than one-third (1/3) of the supplied voltage has what is known as 'trigger voltage input'. This trigger voltage is at active low and makes the output high. It also monitors the discharging of the timing capacitor in an astable circuit. It has high input impedance [4].

When the input is a 'threshold input', i.e. the input is greater than two-third (2/3) of supplied voltage, it is active high and makes the output low. It monitors the charging of the timing capacitor in astable and monostable circuits [4].

The astable multivibrator is called astable because it is not stable in any state. The output is continually changing between low and high [4].

This particular project has incorporated certain features that distinguish it from other sirens. Such feature like the light dependent resistor, which makes the siren not only an alert, but a security gadget. This feature makes it unique in its use and operations, since such a work as this has not been done in any siren to make it a single electronic system that can make it perform multi operation as an alarm.

2.2 Evaluation on Previous Work on the Siren.

The siren, being an electronic device, has undergone so many modifications from the original concept of the inventor to make it relevant as technology advances and improves.

The siren is a sound producing device invented in 1819 by French physicist, Charles cayniard de la tour. He devised the siren to determine the frequency or number of vibrations per second, corresponding to a sound of any pitch [1], as earlier stated in chapter one. Ever since then, different modification on the siren has been carried on, all of which produce a single tone.

A design that is recent before that used by this project is the use of NE555 integrated circuits (ICs) in building a siren. This development made use of four (4) 555 ICs to build a siren, making it a multi-tone siren [5].

This project has advanced the previous work by making use of a single 556 IC to make the siren a dual tone siren i.e. the siren can give a wailing tone which is the tone produced by American police sirens and it can give a warbling tone which is the tone for British-type police siren instead of using two or more ICs to vary its tone.

This project has also made the inclusion of a light dependent resistor (LDR) into the siren to make it a multi device i.e. a security alert that will call the attention of the owner of such facility when there is or are unauthorized entries into the facility. Such facility could be a car, a house, factory, industry, business organizations, and e.t.c.

2.3 Advantages and Limitations of Each Technique.

The various methods used have their advantages and also their limitations.

The first siren that was designed has the advantage of being the first alarm to be made that has the ability to vary in pitch of sound [1]. Its limitations are that it is big, expensive; it produces only one tone and it found no relevance as technology and time advanced.

The method of the use of 555 ICs has the advantage of being cheaper than the previous work or technology, it also has relevance to the recent technology designs and implementations, yet their limitations are:-

1) It is relatively expensive as compared to this project.
2) It is not designed to be used as a multi security gadget as in the case of this project.
3) It requires more components and circuit knowledge as compared to this project.

CHAPTER THREE

DESIGN ANALYSIS

3.1 System Analysis

For easy design and realization of the set objectives, top-down design method was used. This involves breaking the whole-conceived idea into manageable pieces. Hence, the project design was broken into sub units. These units are:

(1) The power supply unit.

(2) The siren unit.

(3) The light dependent resistor unit.

(4) The output unit.

3.2 Power Supply Unit

The power supply unit is the basic unit that is responsible for the supply of power required to drive the siren system. The power supply unit consist of a mains desired DC source. The process of generating the DC source, needed to drive this project is shown in figure 3.0

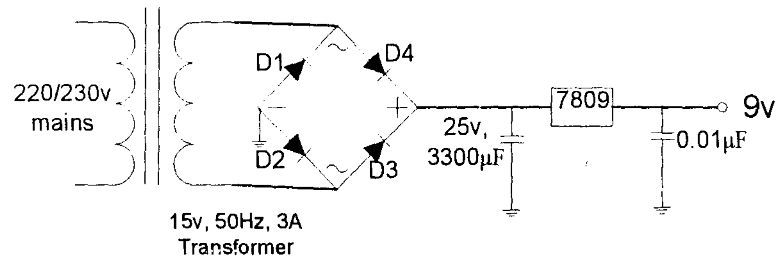


FIG 3.0 Power Rectification Process to 9v

A 15v transformer is wired to a full wave bridge rectifier to produce a pulsating DC voltage of amplitude.

The full wave bridge rectifier is made up of four (4) IN4002 diodes.

For the design, nine volts (9v) is needed to drive the designed circuit. In order to regulate the input voltage of the design from the output voltage of the step down transformer, i.e. to the desired voltage, a 7809 regulator, which is a nine-volt power regulator, was chosen, since it has the range of power desired to power the siren.

The 7809 regulator has a low power rating. So that the power necessary to drive the circuit is not exceeded, a capacitor is needed to help regulate the output voltage of the step down transformer.

The equation governing the choice of capacitance is given in the following expression.

$Q = CV$ .... (i)

$Q = It$ .... (ii)

From above, equation (i) is equal to equation (ii).

$CV = It$ .... (iii)

$C\Delta V = t\,\Delta I$

Where C = value of capacitance connected across the DC unit.

ΔV = AC ripple on the DC supply

ΔI = current of the regulator going through to the circuit

t = time of regulation, which is a constant

For the expression above,

$$C = \frac{t\,\Delta I}{\Delta V}$$

$$= K\frac{\Delta I}{\Delta V} \qquad \text{.............................. (iv)}$$

For the operation of this project, a 3300μF capacitor was chosen for the power rectification [6]. Period, T, for full wave rectifier is equal to 1/frequency=1/100 = 0.001sec.

From equation (iv) above, it implies that capacitance is directly proportional to change in current and inversely proportional to change in voltage [6]. A large value of capacitance C produces a proportionately small value of voltage V, thus reducing the ripple on the DC supply.

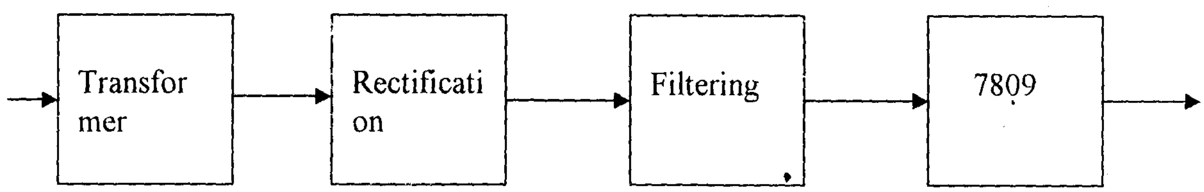
The value of voltage, peak voltage, fed to the regulator is given by

$$V_{pic} = 15\sqrt{2} - 1.4 = 19.8v$$

The 19.8v is fed into the 7809 regulator which now rectifies the voltage to 9v, which is the desired voltage for the circuit.

To smoothing the 9v so as to ensure it been free from high frequency noise, a 0.01μF capacitor is connected to the output end of the regulator as illustrated in figure 3.0.

The block diagram illustrating the sequence involved for conversion of 220/230v to 9v is shown in figure 3.1.



220v Transformer Rectification filtering 7809

9v

FIG 3.1 block diagram illustrating the sequence of rectification of this project

3.3 The Siren Unit

The siren unit is built and centered on the working principle of the 556 timer. Being a dual astable multivibrator, it can be said to have two (2) astable operations. Before going into the astable operation of the 556, it is necessary to know the following.

(1) The various functions of the 556 pins.

(2) The operation of the internal circuitry of 556 timer in astable mode.

3.3.1 The Various Functions of the 556 Pins

The 556 is known to have 14 pins. The various functions of the pins are enlisted in figure 3.2

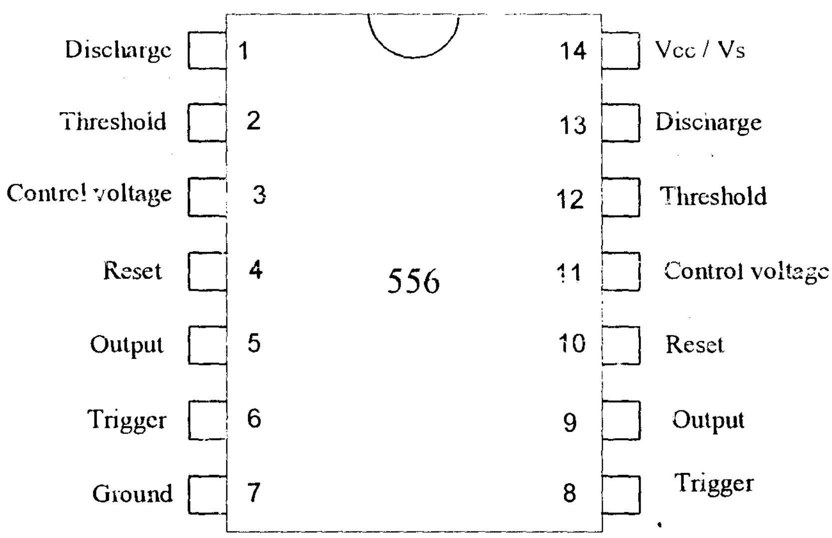


FIG 3.2 Pin Configuration of the 556 Integrated Circuit (IC)

The functions of the pins are explained as follows:

1. The Discharge Pin: this is not an input but is listed here for convenience. It is connected to 0v when the timer output is low and is used to discharge the timing capacitor in astable circuits. The discharge pins are pins 1 and 13 [7].

2. Threshold Input: When the voltage supplied is greater than two-third of the supplied voltage, Vs, i.e. voltage is at 'active high'. It makes the output low (0v) provided the trigger input is greater than one-third of the input voltage, otherwise the trigger input will override the threshold input and hold the output high (+Vs). The threshold pins are pins 2 and 12 [7].
3. Control Input voltage: This can be used to adjust the threshold voltage which is set internally to be two-third of the supplied voltage (Vs). Usually this function is not required and the control input is connected to 0v with a 0.01μF capacitor to eliminate electrical noise. It can be left unconnected if noise is not a problem. The control pins are pins 3 and 11 [7].
4. Reset input: When this input is less than 0.7v, it is 'active low'. This makes the output low (0v), overriding other inputs. When not required, it is connected to +Vs. The reset pins are pins 4 and 10 [7].
5. Trigger input: When this input is less than one-third of Vs, it makes the output high. It monitors the discharging of the timing capacitor in an astable circuit. The trigger pins are pins 6 and 8 [7].
6. Output pin: The output pins are responsible for sending or giving out the signals of internal operation of the 556 timer. When the output pins are connected to the input ends of an oscilloscope, the output gives square waves, a transition between low and high or mark time, Tm and Space time, Ts. T he output pins are pins 5 and 9 [7].
7. Ground: This is the pin that is set as ground or the negative terminal of the IC. All negative or neutral connection are connected to this pin. The ground pin is pin 7.

3.3.2 Operation of the Internal Circuitry of the 556 Timer in Astable Mode

It is important to investigate the internal principle of operation of the 556 timer since it is used extensively in this system. A 556 timer is a low frequency clock signal generator. It is a 14 pin integrated circuit, which could be monostable or astable. Attention is given to its astable mode of operation in this system. Figure 3.3 gives the general functional block diagram of the 556 in astable mode

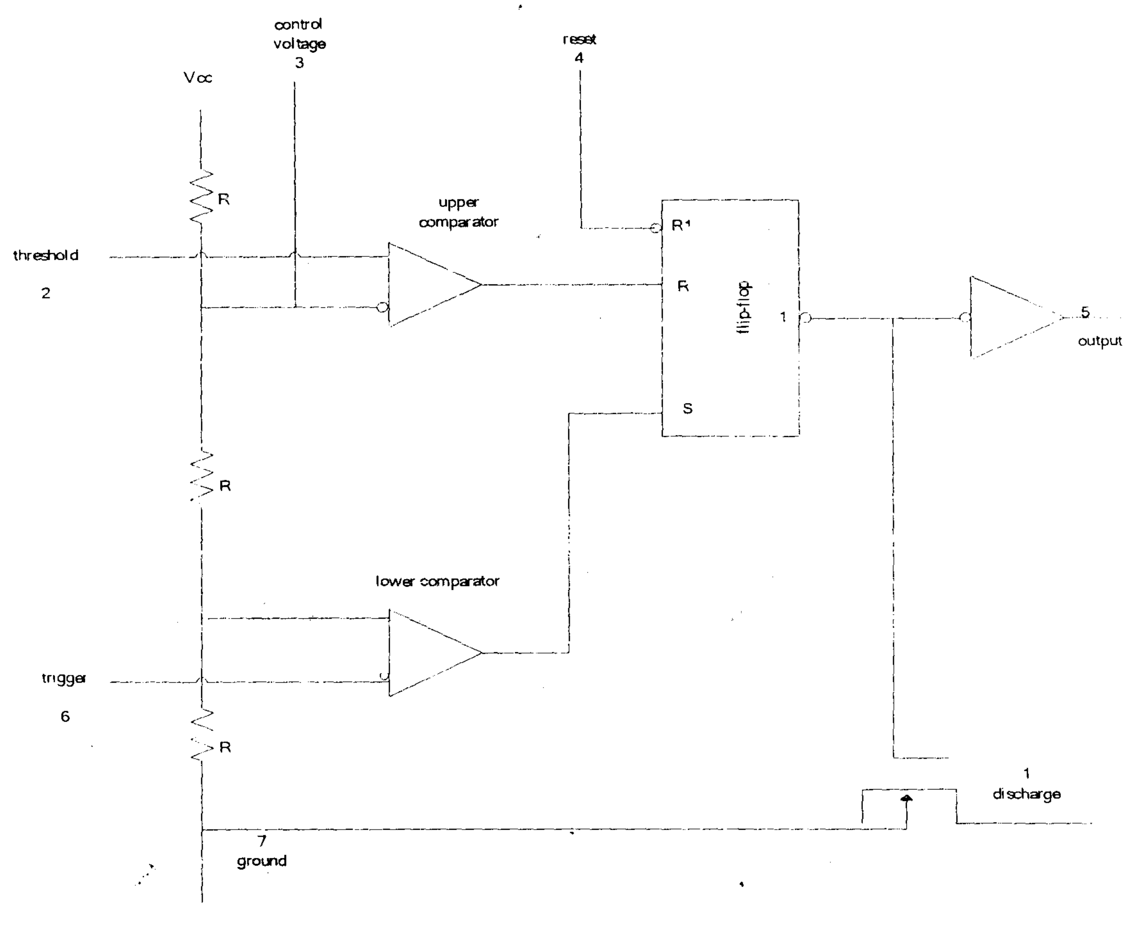


FIG 3.3 General Functional Block Diagram Of The 556 In Astable Mode

From figure 3.3, the values of the external components determine the frequency and duty cycle of the signal output of the 556. Voltage divider of the three (3) resistors R, sets a threshold of 1/3 V_{cc} on the positive non inverting side of the input of the lower comparator, and threshold of 2/3 (two-third) V_{cc} on the negative inverting side of the input of the upper comparator [3].

If the voltage applied to pin 6 of the comparator is less than 1/3 V_{cc}, the output of the comparator will be HIGH. This will SET the flip-flop. With the flip-flop SET, the output will be low and the discharge transistor will be off. Then the buffer output connected to 1 of the flip-flop will produce a HIGH on the final output.

If the voltage on the signal input pin 2 of the upper comparator is greater that 2/3 V_{cc}, the output of the upper comparator will be HIGH and the flip-flop will be RESET. This causes discharge transistor to be ON and the final output pin 5 will be low.

The control voltage pin 3 can be used to vary the output frequency. The cycle continues alternately as the circuit alternates between 1/3 V_{cc} and 2/3 V_{cc}.

The external reset pin (pin4) can be used to gate the circuit ON and OFF. If the external reset input of a 556 timer is made LOW, the output immediately goes LOW and stays LOW. When the reset is made HIGH, the circuit starts pulsating again. The control voltage (pin3) can be used to vary the output frequency of the circuit. A voltage applied to this input will change the threshold voltage of the comparator and then change the frequency oscillation [4].

3.3.3 Astable Operation Of 556

In this project, the 556 can be seen to perform two astable operations, hence it has two outputs.

Dividing the operation into two halves, we have that at the 'lower half', which is governed by resistors R_1,R_2, and capacitor C_1, it is used as a 'fast' astable, producing square pulses which is approximately 670Hz, as will be seen shortly. The 'upper half', which is governed by resistors R_4,R_5 and capacitor C_4 of the circuit, operates as a 'slow' astable, generating 'saw tooth' pulses with a frequency of approximately 1Hz.

The circuit symbol with its connections for this project is as shown in figure 3.4.

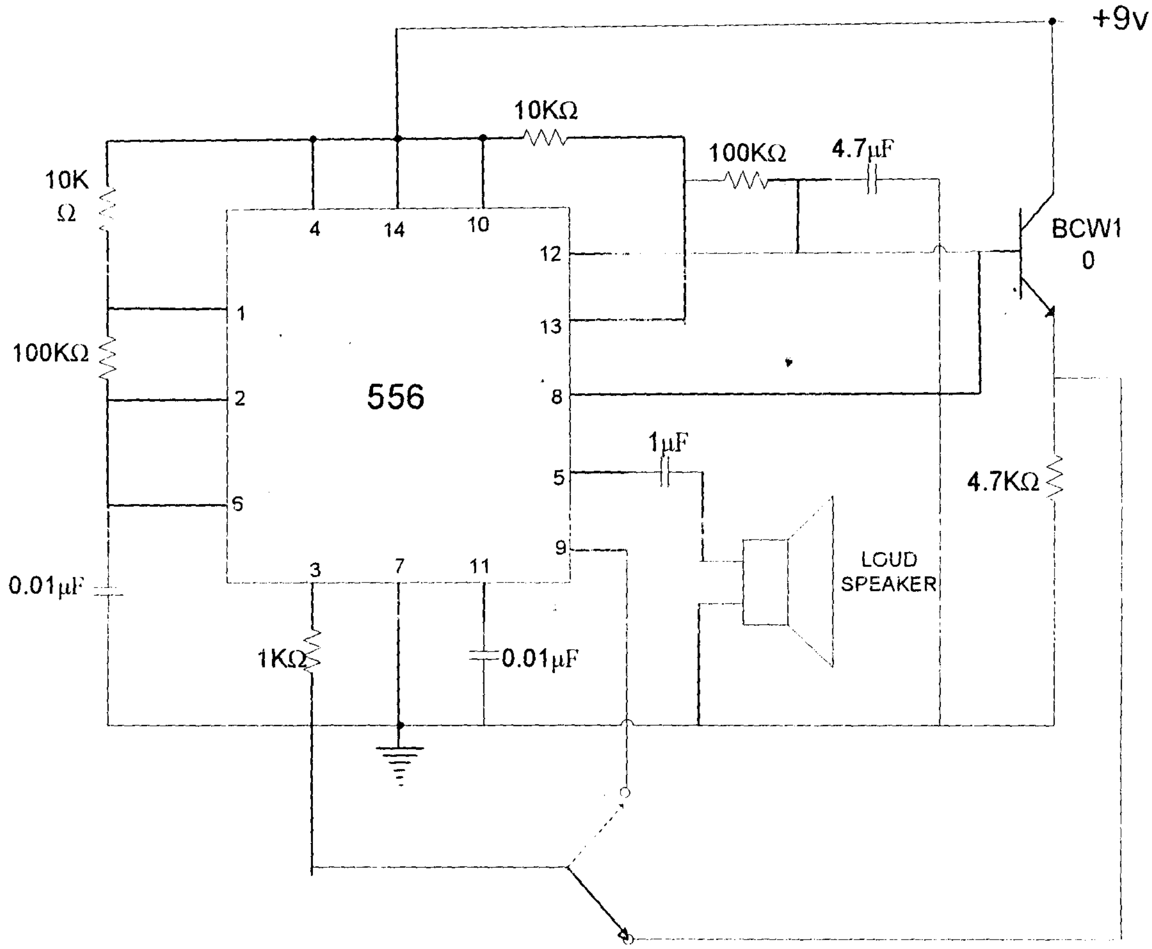


FIG 3.4 The circuit symbol with its connections for this project

The astable circuit of the 556 produces square waves [6]. This is a digital waveform with sharp transition between LOW (0v) and HIGH (+Vs).

The time period (T) of the square wave is the time for one complete cycle, but it is usually better to consider frequency (f) which is the number of cycles per second.

$$\text{Frequency, } f = \frac{1.4}{(R_1 + 2R_2) \times C_1}$$

Where f = frequency in Hertz (Hz)

R_1 = Resistance in ohms (Ω) = 10K Ω

R_2 = Resistance in ohms (Ω) = 100 K Ω.

C_1 = Capacitance in Farads (F) = 0.01μF.

$$\text{Frequency, } f = \frac{1.4}{(10\times10^3 + 2\times10^3)\times 0.01\times10^{-6}}.$$

$$f = \frac{1.4}{2.1\times10^{-3}} = 666.67\text{Hz}.$$

Frequency, $f \approx$ 670Hz (to the nearest whole number).

The operational frequency of this work is 670Hz.

The time period, $T = 0.7 \times (R_1 + 2R_2) \times C_1$.

$$= 0.7 \times (10\times 10^3 + 2\times100\times10^3)\times0.01\times10^{-6}$$

$$T = 1.47\times10^{-3}\text{sec.}$$

But $T = T_m + T_s$

Where T_m = mark time (output high) = $0.7 \times (R_1+R_2) \times C_1$

T_s = space time (output low) = $0.7 \times R_2 \times C_1$

Mark time, $T_m = 0.7(10\times10^3+100\times10^3)0.01\times10^{-6}$

Mark time = 7.7×10^{-4}sec.

Space time, $T_s = 0.7\times100\times10^3\times0.01\times10^{-6} = 7\times10^{-4}$sec.

From the above calculation, it shows that the time, t, for a complete cycle of output is 1.47×10^{-3}sec = 1.47 milliseconds.

With the output high (+Vs), the capacitor C_1 is charged by current flowing through R_1 and R_2. The threshold and trigger inputs monitor the capacitor voltage and when it reaches threshold voltage, the output becomes low and the discharge pin is connected to 0v [4].

The capacitor now charges with current flowing through R2 into the discharge pin. When the voltage falls to the trigger voltage, the output becomes high again and the discharge pin is disconnected, allowing the capacitor to start charging again.

The siren has a duty cycle . The duty cycle is the proportion of the complete cycle for which the output is high (mark time). It is usually a percentage.

For this project, duty cycle $= \frac{\text{mark time}}{\text{Total time}} = \frac{Tm}{Tm + Ts} = \frac{R1 + R2}{R1 + 2R2}$.

$$= \frac{10\times10^3+100\times10^3}{10\times10^3+2\times100\times10^3} = 0.5238 = 0.5 \times 100\% = 50\%.$$

3.4 The Light Dependent Resistor Unit

The light dependent resistor (LDR) is a sensor whose resistance decreases when light impinges on it. This kind of sensor is commonly used in light sensor circuits in open areas, to control street lamps for example. Another possible use is in spectroscopic apparatus [8]. In this kind of apparatus, continuous light or pulsed light can be used. Continuous light is used in common spectroscopic apparatus. The use of lock-in amplifiers made the use of pulsed light in spectroscopy easier, as is commonly used in photo acoustic spectroscopy [9]. LDR's are made of semiconductors as light sensitive materials, on an isolating base.

In the dark, the LDR exhibits a very high resistance and use the principle of potential divider to give its output. Figure 3.5 gives the application of the LDR in this project.

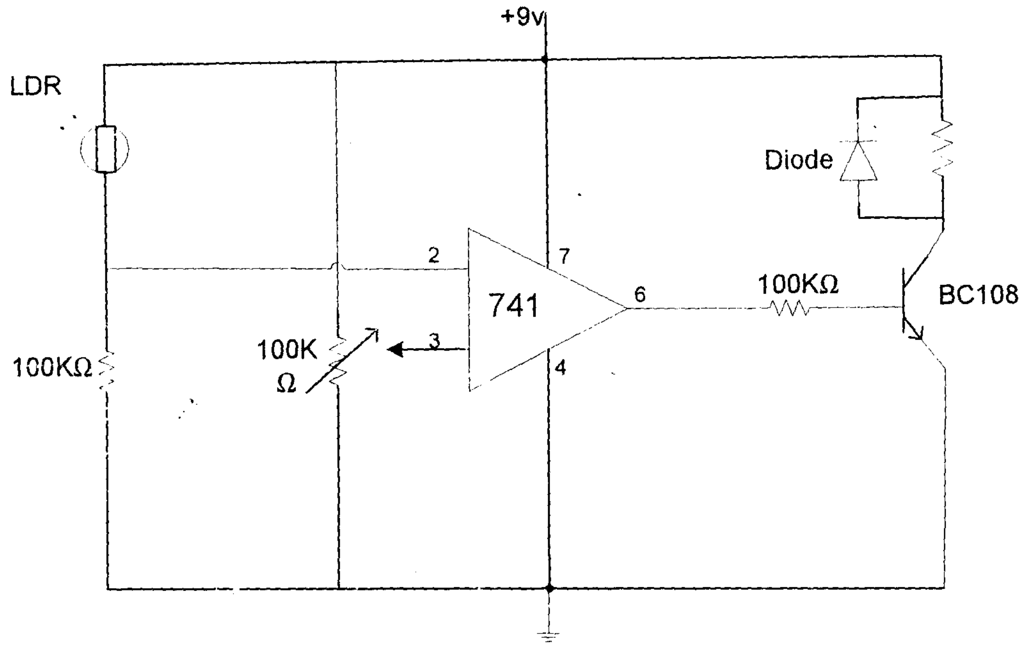


FIG 3.5 The LDR circuit diagram as used in this project.

For the LDR circuit, the supplied voltage Vcc, is given as the voltage used to the siren circuit.

$$V_{cc} = 9v.$$

$$\text{And } V_{cc} = I_cR_c + V_{ce}$$

At saturation, $V_{ce} = 0$.

This therefore gives $V_{cc} = I_cR_c$

Where R_c = resistance of relay = 400Ω

Therefore $I_c = \frac{9v}{400} = 0.0225A$

Voltage of the transistor BC108, V_{in}

$V_{in} = I_bR_b + V_{be}$

$V_{be} = 0.6$

$V_{in} = I_bR_b + 0.6$

$9v = I_bR_b$

But $h_{fe} = \underline{I_c}$ $\quad h_{fe} = 100$

$$I_b = \frac{Ic}{H_{fe}} = \frac{0.0225}{100} = 225\times10^{-6}A.$$

The operational current for the LDR = 2.25×10^{-4}A.

3.5 The Output Unit

The output unit of this project gives the results of all the operations that was carried out during the operation time. The various output wave forms when connected to an oscilloscope can be seen in two forms.

When the switch of the siren is switched to the wailing output, the 'fast astable multivibrator' is activated. This wail position will give saw tooth-shaped pulses which occur across C4 as fed to the base of the transistor and via R3 to the control voltage terminal (pin3) [7].

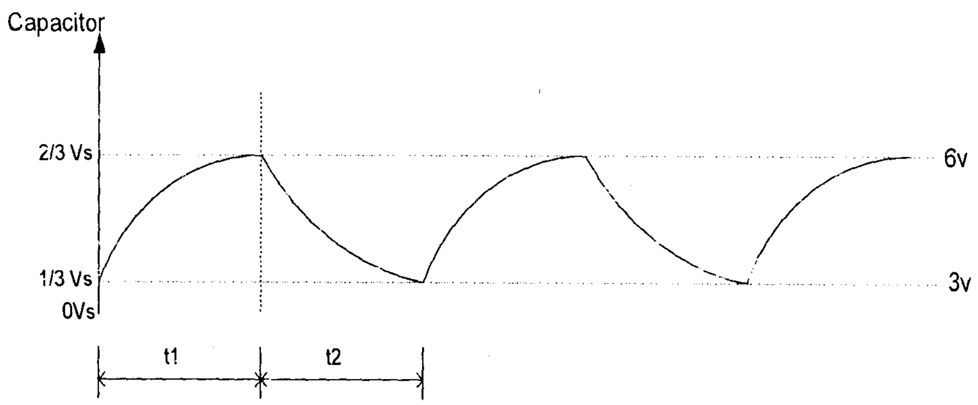


FIG 3.6 The Wailing Output Waveform of the Siren

Where t1 = charging time/ mark time, Tm

t2 = discharging time / space time, Ts.

When the switch is moved to the warble position, the square wave output pulses from the 'slow' astable (at pin 9) are applied to the control voltage terminal (pin 3) of the fast astable via R3 [10]. The waveform of the pulses is shown below.

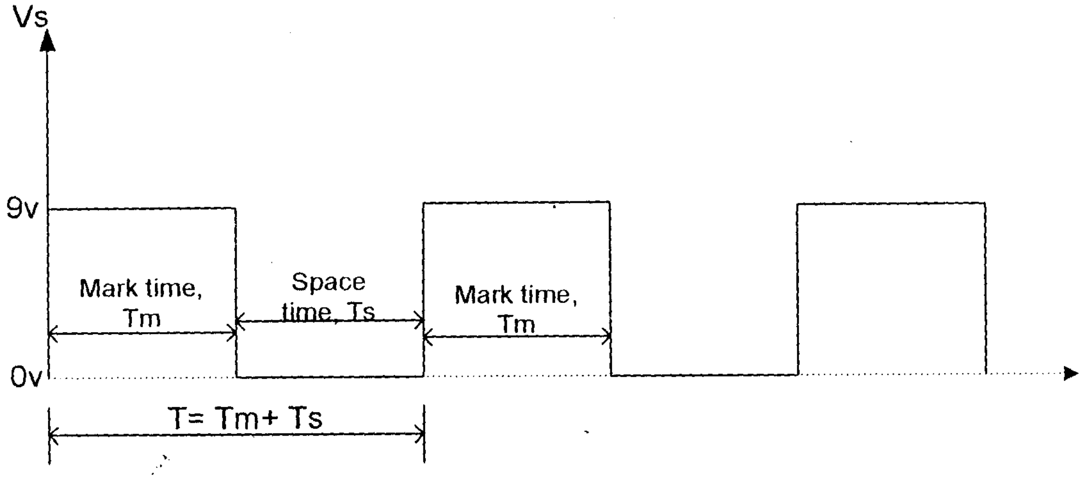


FIG 3.7 Square Waveform Output of a Warbling Siren

Each pulse causes the voltage at pin 9 to remain at 9v for time Tm and then change abruptly to 0v for a roughly equal time, Ts. As a result, the output of the 'fast' astable (at pin 5) is frequency modulated i.e. its frequency changes sharply from about 670Hz to a higher value and back to 670Hz, for every second. It produces this two-tone effect repeatedly so giving a warbling note [10].

The output of the siren, in this project, is not connected to an oscilloscope to view its waveforms, but to a speaker so as to hear its varying output signal as sound, making the project a warbling-wailing siren. The figure 3.8 shows the connection of the siren to the speaker.

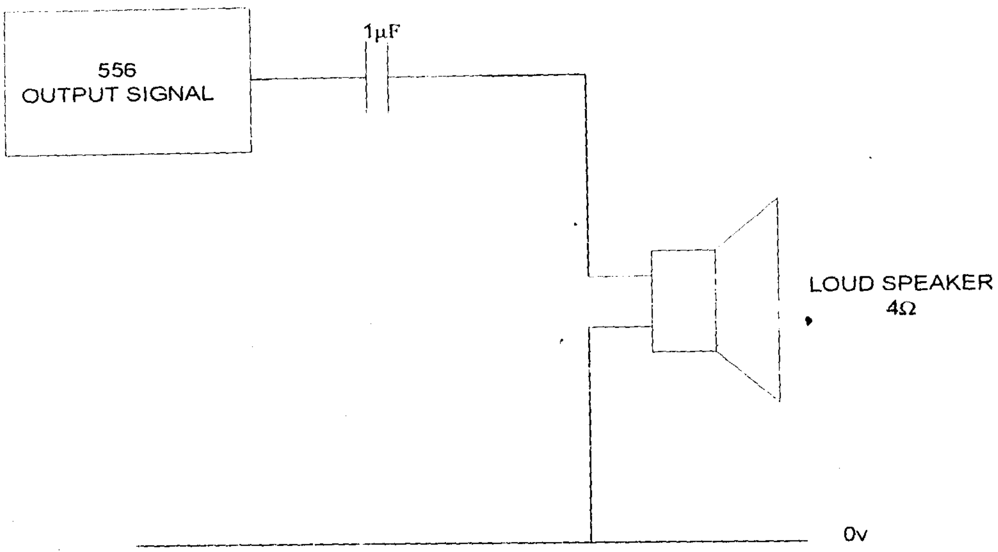


FIG 3.8 Connection of the Siren to the Speaker

3.6 The Working Principle.

This project is simulated or connected in a way as to make the siren a multi-option device.

The siren can be used as a device of its own. This done by employing the use of a switch across the terminal of the input of the siren and at the input terminal of the LDR. When the switch to the LDR is off, the siren can be made to make warble or wail sound.

When the siren is to be used as a security device, the switch at the input of the siren is switched off, thereby making the LDR's voltage variation frequency the input of the system. Once there is a shadow cast on the LDR, the voltage across the 100KΩ variable resistor goes high and sends in a high input to the 741 (operational amplifier), which now relates the signal to the transistor and switches on the siren alarm through the relay. If the LDR is off, it is used as a normal alert device, when the LDR is on, the project becomes a security device.

In the design of this projects, push switches were employed so as to avoid the use of so many switches and making the design cumbersome.

CHAPTER FOUR

CONSTRUCTION, TESTING AND RESULTS

4.1 Project Construction

The first step in the realization of this project work was the initial design. After the design was carried out and various component parts were gotten, the next thing was the prototype construction. The prototype construction (which was the first stage of the construction) was carried out based on the circuit developed from the design. This construction was done on project test board, commonly called 'bread-board'. Following the circuit diagram, the components were carefully bread-boarded with consideration for polarity and direction of flow of current.

The 556 IC was mounted first and properly spaced to allow for fixing of other components contained in the circuit. The passive elements (resistors, capacitors and variable resistors) were then mounted. Next were the connecting wires and the ascertaining of the workability of the siren circuit. After this, the LDR circuit was mounted on the bread board. It was then tested with DC power to be sure the circuit worked properly, before setting it up finally.

After all bread board connections, the entire circuit was implemented on a printed circuit board commonly called 'Vero board'. Mounting of components on the Vero board started with the same sequence that was done on the breadboard. Soldering was done on the legs of other components ensuring no bridge of lead occurred and on the sockets of the IC.

4.2 Casing.

With prior knowledge of the intended output, the choice of a wooden casing with a plastic lid was made. The desired output is sound and so I felt a wooden casing would be a better choice. This is due to availability, ease of construction and resonance. The resonance effect of the wood will be less than a metal casing.

The casing was constructed with an appropriate dimensions (20 by 15 by 15) cm, taking into cognizance the internal components. The speaker was super-glued to the plastic lid with holes drilled to the lid to allow sound to be heard. The switches of the project were also fixed to the lid to allow easy control of the circuit.

The LDR was placed at the side of the box so that the input of voltage can easily be varied once there is a shadow cast.

4.3 Testing

The system was tested both at the prototype stage and the final construction stage. The testing was done with the system connected to the mains and the power switch flicked on. With the power switch on, various sound effects were tested. This is by changing the sound selectable switch and also the input of the LDR to the siren Two sounds were heard and also, voltages at some selected point of the circuit were measured. The outputs were verified using an oscilloscope.

4.4 Results and Discussion.

As observed when using an oscilloscope, the output wave forms are as shown in the following figure.

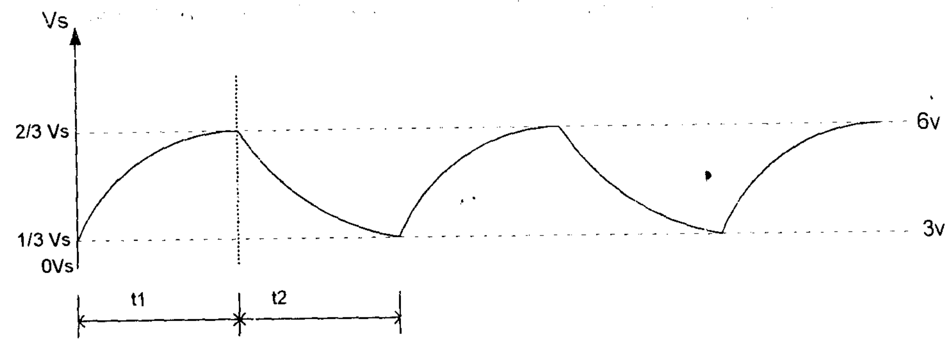


FIG 4. 1a Graphical Representation of the Capacitance Variation.

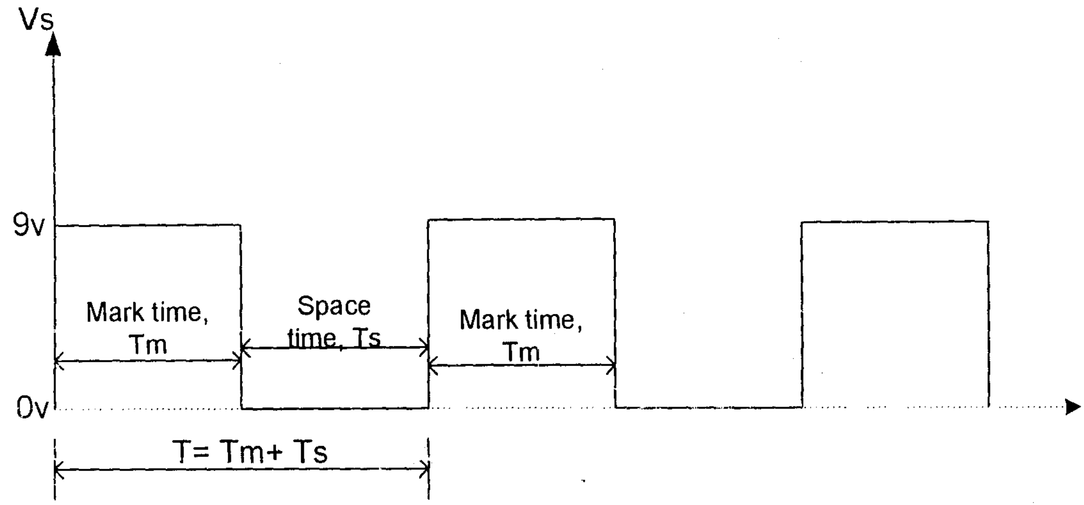


FIG 4. 1b Graphical Representation of the Siren Output

The 556 is a conventional astable IC. With the output high (+Vs), the capacitor C1 is charged by current flowing through R1 and R2.when the output becomes low, the capacitor now discharges with current flowing through R2 into the discharge pin. When the voltage falls to 1/3 Vs (trigger voltage), the output becomes high again and the discharge pin is disconnected, allowing the capacitor to start charging again. This cycle repeats continuously unless the reset input is connected to 0vwhich forces the output low while low while reset is 0v. this operation is illustrated with figure 4.1a.

With the output high, the threshold and trigger inputs monitor the capacitor voltage and when it reaches 2/3 Vs (threshold voltage),the output becomes low. The continuous cycle of charging and discharging the capacitor is responsible for the high and low output of the siren as illustrated in figure 4.1b.

CHAPTER FIVE

CONCLUSION, PROBLEMS ENCOUNTERED AND RECOMMENDATION.

5.1 Conclusion.

In view of modern electronic system, the design and construction of a warbling-wailing siren with light dependent resistor (LDR) requires proper and careful planning and implementation.

In this project work, astable circuit from a 556 timer was extensively used to generate tone signals of two kinds. This has shown how versatile the chip is. This equally forms the basis for any alarm or security.

As part of the versatility of the 556 timer, it has found so many applications in microcomputer systems of the modern day. This project as a whole affords one the ability to make choice of sound for a particular event.

5.2 Problems Encountered.

During the design of this project, the following problems were encountered:

1. At the initial stage of the design of this project, when the project was implemented on test board, there was no output voltage delivered to the 4Ω speaker. By re-evaluating the whole output stage of the circuit, it was discovered that the resistor at the end of the transistor (BCW10) was open circuited. This problem was rectified by properly connecting the resistor at the emitter of the end of the transistor, after which the output was heard from the speaker.

2. In the simulation of the LDR with the siren, the varying input of the 741 amplifier was not given any sound; this was due to the resistors that were initially used across the

inputs. This was discovered and properly corrected with the right values of resistors and the use of a relay across the output end of the LDR.

3. In the soldering of the 556 to the Vero board, the soldering heat burnt the IC. This caused back electromotive force (emf) to the transformer and blew the transformer when testing of the work was to be done. This was rectified by replacing the bad components and being mindful of the soldering heat.

4. During the purchase of components, the actual transistor and speaker that should be used for the project were unavailable. This led the using alternatives which now affected the output sound of the siren.

5.3 Recommendation.

Due to man's ingenuity, this project is subject to future improvement. I hereby recommend that it should be developed to form more than two sounds, if possible, with different code to convey the varying information.

REFERENCES

[1]. Richard F Deimel, the encyclopedia Americana international edition, © by *Groller incorporated*, vol 24, pp 847-848.

[2]. Google Search System [online]; ©2004-2008 americansignal.com, Available at: http://www.americansignal.com/Military.htm

[3]. Google Search System [online]; ©2004-2008 freepatentonline.com, Available at: http://www.freepatentonline.comcopyright2004-2008.

[4]. Google Search System [online]; electropage.com, Available at: http://www.electropage.com/555&556timers.

[5]. Google Search System [online]; electfree.com, Available at: http://www.electfree.com.

[6]. Giorgio Rizzan, Principles and applications of electrical engineering revised edition, *New York Mc Graw Hill*, pp 7, pp 713-715.

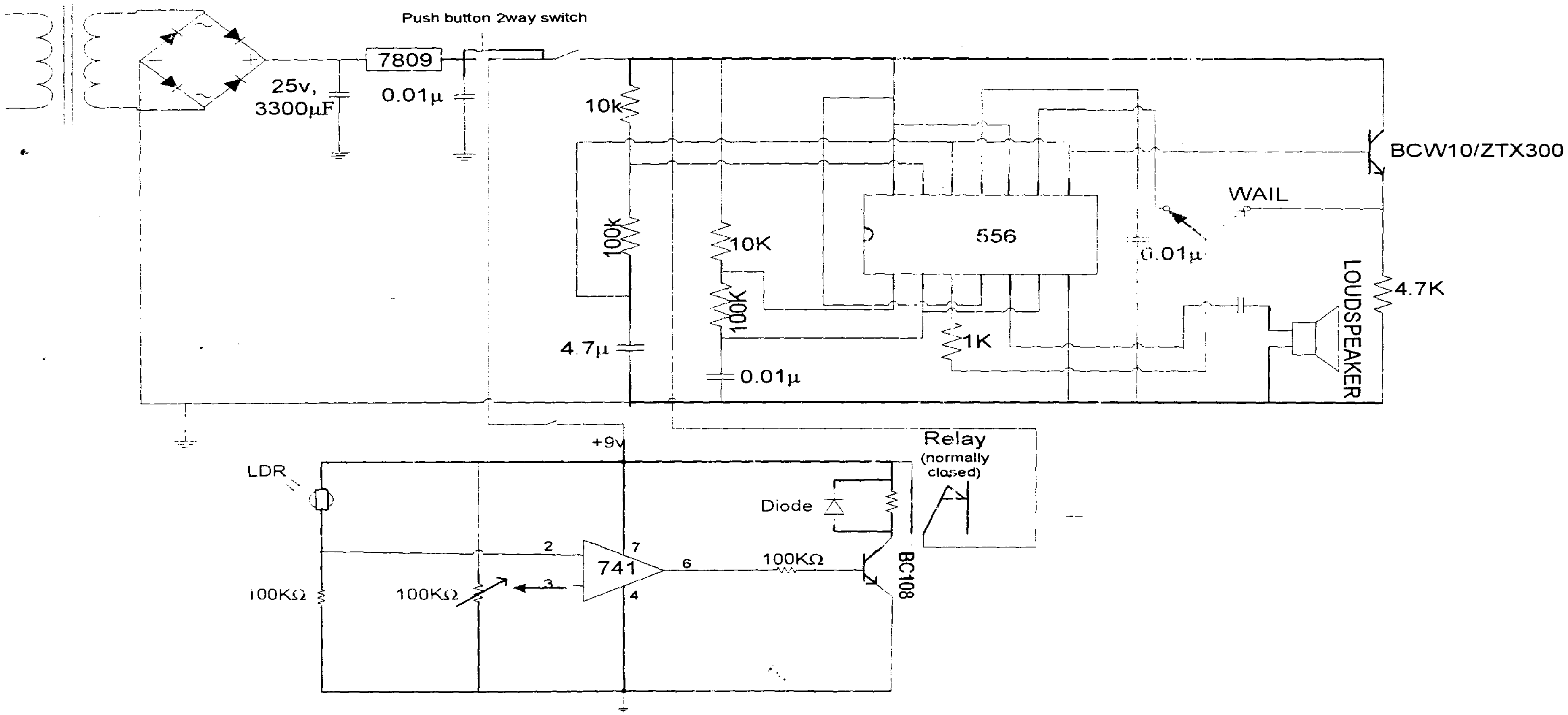
[7]. Google Search System [online]; ©2008 kpsec.com, Available at: http://www.kpsec.freeuk.com/2008

[8]. M. V. Marquezini, N. Cella and A. M Mansanares, L.C.M. Open photoacoustic cell spectroscopy: Meas. Sci. Technol. vol *2*, 1991, pp 396-401.

[9]. E. P. O'Hara, R. D. Tom and T. A. Moore, Determination of the in vivo absorption and photosynthetic properties of the lichen Acarospora schleiche`ri using photoacoustic spectroscopy: Photochem. Photobiol, 1992, pp 709 – 715.

[10]. G.J. Ritchie, Transistor circuit techniques discrete and integrated, 3rd edition, *Chapman and hall publishers {1986}*. Pp 256-272.

APPENDIX



THE OPERATIONAL CIRCUIR DIAGRAM OF THE WARBLING- WAILING SIREN.