DESIGN AND CONSTRUCTION OF DARK ACTIVATED INTRUDER ALARM SYSTEM

AKANBI RUKAYAT ABIDEMI

2000/9792EE

ELECTRICAL/COMPUTER ENGINEERING DEPARTMENT
FEDERAL UNIVERSITY OF TECHNOLOGY,
MINNA

NOVEMBER, 2007

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THESIS SUBMITTED TO THE DEPARTMENT OF ELECTRICAL/COMPUTER ENGINEERING FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

NOVEMBER, 2007

DEDICATION

This project is hereby dedicated to Almighty Allah.

DECLARATION

I, Akanbi Rukayat Abidemi (2000/9792EE), hereby declare that this project presented for the award of degree (B.ENG) in the Department of Electrical and Computer Engineering, Federal University of Technology, Minna, was fully carried out by me and has not been presented else where.

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27/10/2007

Akanbi Rukayat Abidemi **Date**

2000/9792EE

CERTIFICATION

This is to certify that the project was fully carried out by Akanbi Rukayat Abidemi, registration number 2000/9792EE of Department of Electrical and Computer Engineering, Federal University of Technology, Minna, under the supervision of Mr. Sulaiman Zubair.

Akanbi Rukayat Abidemi

29/11/2007

Name of student

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27-11-07

Name of Supervisor

Signature and Date

Signature and Date

Name of HOD

Name of External Examiner

Signature and Date

Signature and Date

ACKNOWLEDGEMENT

I will like to show my gratitude to Almighty Allah for granting me existence, good health and wisdom throughout my degree program.

I wish to express my gratitude to my parents, Mr. T.O Akanbi and Mrs. S.K Akanbi, who gave me the opportunity to acquire the greatest thing one can ever wish for, that is knowledge. You are my source of happiness, may you never be a source of sadness. Dad, mum, thanks for been there.

A very big thank to my husband, Mr. Ismaila Jaiyeola, for his support, encouragement and advice. U shall remain to be the head and never the tail. Sweetheart, thanks for been there too.

My appreciation also goes to my supervisor, Mr. Sulaiman Zubair, for sharing his precious time to supervise this project. My gratitude goes to the HOD Engr. M.D Abdullahi and to all the lecturers of the Electrical and Computer Engineering Department for the knowledge they impact on me.

Also, I will like to acknowledge the members of my family, my step mum, Mrs. Hafsat Akanbi, my blood brothers and sisters, my aunties, uncles, cousins and in-laws. For their moral support and understanding throughout my program. I love you all.

Finally, my acknowledgement goes to my colleague and friends for their support. You have all been a challenge to me in area of academic excellence, may God bless you all.

ABSTRACT

The project work is the Design and Construction of Dark Activated Intruder Alarm System. It is design to provide security against intruder, using sensor and time-out delay circuitry. The sensor is sensitive to shadow that is cast on it which through comparator activates the time out delay section. This section in turn holds the signal for 5 seconds before it is sent to the alarm section. The reason for this delay is to avoid false alarm due to presser that may cross the sensor. The alarm is made of a piezoelectric alarm which powered by 9v supply. The whole system is powered by on dc supply of 9v.

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CHAPTER ONE

INTRODUCTION

1.1 General Introduction

The basic needs of human being are food, shelter and water. When these needs are satisfied, the next is the need for security of life and property. It is necessary to device (electronic) system that can monitor what is happening around our homes and offices when we are around or not. Since any form of infusion by human being is brought about by movement of something or his body, this makes it possible to device a system to detect the presence of someone.

There are many ways to detect this movement for example, using trip wire which any contact with the wire causes an alarm to switch on. Another example is the use of infra red light. When these lights are obstructed from the sensor, due to movement of any intruder across it, it causes alarm to switch on. All these are not cost effective because one will need more than one infra red light in order not to cause false alarm. Similarly, the trip wire must be planted so that the intruder will find it difficult crossing it without fetching the wire. This shows that one will need more than one trip wire. To overcome these problems, this project intends to provide a solution using natural means. This project uses the shadow that is cast suddenly on the sensor to provide a form of trigger for the alarm to go on. This design took into consideration cost, sensitivity, efficiency, safety, reliability and availability.

1.2 Aims and Objective

The aim and objective of this project is to show that the security of a home or an office can be maintain using a simple and sensitive electric circuit called the Dark

Activated Intruder Alarm system. The beauty of this project is it use of natural means (i.e. shadow) to detect an intruder. The cost associated with other means of security system is also taken care of in this project.

1.3 Methodology

Dark activated intruder alarm system. in it scope describe how the shadow that falls on the sensor can trigger an alarm system. The system uses sensor due to shadow falling on it, to the reference voltage from a source. Using the principle of voltage divider, a light dependent resistor LDR is connected in parallel to a variable resistor which is used to vary the required intensity of the light required to cause the comparator to be ON the output of the comparator activates CD4060 ripple/oscillator which generates a time of delay. After the designed time delay elapses, the output of the time delay generate activities the audible alert generator.

The sound of the alarm shows that the intruder has been on same spot more than five seconds. This sensor is placed in a dimly lighted place where anybody that wants to enter the house has to stand for a while.

CHAPTER TWO

LITERATURE REVIEW

2.0 Literature Review

The security system falls into main categories, those concerned with fire protection, and those concerned with the protection against theft of property or information. The second group includes burglar alarm, of which this project is one of. The origin of security monitoring system is obscure, such as the use of locks and banned window, are very ancient.

As civilization developed, the distinction between passive and active security was recognized, and responsibility for active security measures was rested on the police and the fire-fighting agencies, and similar public services. The inability of community policing and fire departments to provide all the securities desired by some individuals and organization, led to the supplemented effort by private group. [5]

Not until seventeenth century, London had no organization which ensures the security of her citizens and inhabitant against crime. Only then were one thousand watchmen. "There are not physically and mentally competent" said Henry field, the magistrate and author. It was the appointment of Sir Robert Peel as home security in 1988 that police was instituted six years after. They were invested in the protection and prevented of crime. [5]

In 1883, George Lash Pearsian invented a system that would alarm by means of electronic communication. This was initially a revolving lamp on the exterior of the protected premises, or the use of bells. It was not until 1923 that the use of intruder alarms became generally available. Since that time, equipment has been designed which

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Security systems in recent years have benefited considerable from advance made in electronic field. The range of equipment available today includes ultrasonic, microwaves, television and LDR sensors.

The more traditional ones are the window tubes and batten, pressure mats, switches and simple bell system. Window tubes, for example, are made from aluminum held in position wooden battens. Though there is threaded a small delicate cable which is easily broken if the tubes are tampered with, this causing a break in the electric sensing circuit. Most systems are designed to monitor a continuous signal by means of control panel. When an intruder breaks the circuit producing the signal, the signal is interrupted and an alarm is set ON. The control panel is the nerve center of any security alarm system. This is where all the detection circuit terminates and where electronic monitors the circuit for the continuous presence of a voltage. When the detection equipment is disturbed, the circuit is broken and the control unit immediately registers the loss of voltage and activates the bells, sirens or piezoelectric alarm that gives warning of an intrusion. The switches inserted in the frame work of a door or window. When the magnetic and reel are within 6mm from each other, the switch remain closed, but once the magnetic field is removed i.e. when door or window is opened, the switch become opened and hence triggers an alarm.

Vibration transducers and inertia sensitive switch have been developed to be operated by high frequency vibration caused by intrusion or drilling. There is false alarm due to traffic rumble or weather condition such as thunder.

Another widely used switch is the pressure mat constructed from two pieces of foil held apart by a perforated piece of form. The switch created by this arrangement is open until pressure from intruder force the two piece of foil together and create a close switch across the circuit, thus alarming the control gadget. Touch switches are also used. They consist of two thin conductors with minute separation. A finger tip or touch will bridge the gap; closing the circuit. If within the reach, the intruder can jump the switch prior to entry, it then becomes a design necessary to install in places out of reach by intruders.

This project takes care of these disadvantages. This is because an intruder has to get close to the sensor before he can gain entry into the premises. And again, false is being taken care of the use the time out delay before the alarm can be triggered.

2.1 Theory of Electronic Components

2.1.1 NE 555 Timer IC

The NE 555 IC timer was developed by the Signatics Corporation in 1972. It provides circuit designers with cheep, a stable applications it is available in a 14-pin dual in-line package and 8-pin mini dual in-line package.

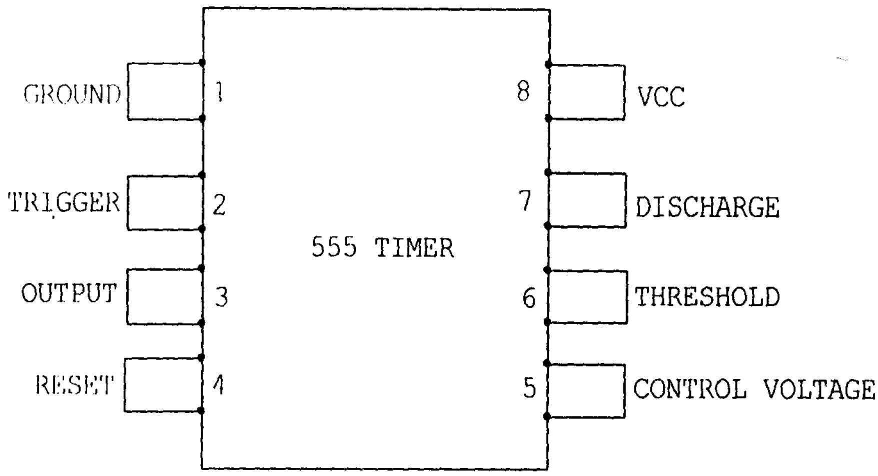

Fig. 2.0 8-pin T package 555 timer IC

The timer comprises of 23 transistors, 2 diodes and 16 resistors in its internal circuitry. It functional diagram is shown in fig 2.1

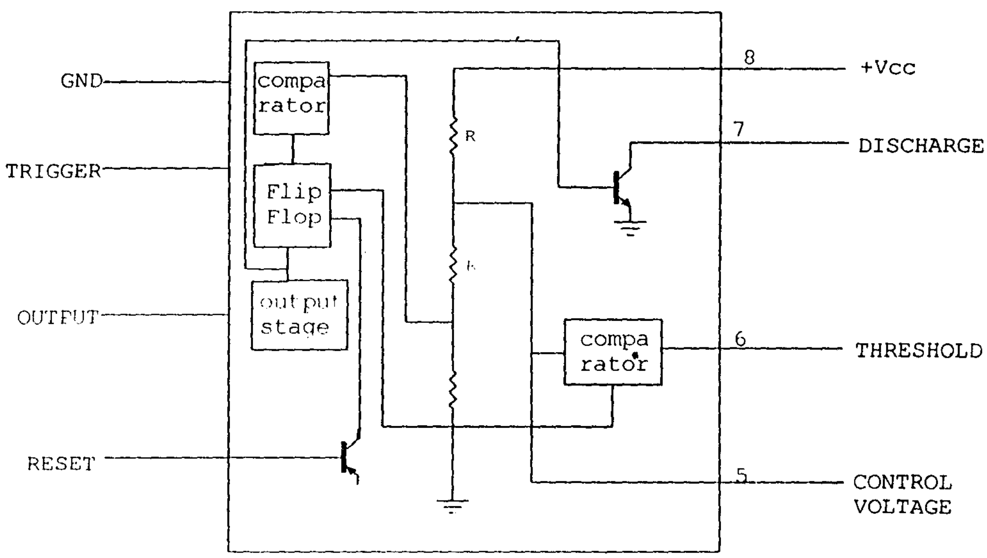

Fig.2.1 Functional diagram of 555 timer

The functional diagram consists of two comparators, a flip-flop, two control transistors and a high current output stage. Two comparators are actually operational amplifiers that compare input voltage to internal reference voltage which are generated by internal voltage divider of three 5K resistors.

The reference voltages provided are one third and two third of Vcc. When the input voltage to either of the comparators is higher than the reference voltage for the comparator, the amplifier goes to saturation and produces an output signal to trigger the flip-flop. The output of the flip-flop controls the output stage of the timer. The 555 timer chip works from a D.C supply between 3-15V and can source or sink up to 200mA at its output.

The operation of the 555 timers is further defining the functions of all pins. The details regarding connection to be made to pins are as follows.

Pin 1: This is ground pin and should be connected to the negative side of the power supply voltage.

Pin 2: This is the trigger input. A negative going voltage pulse applied to this pin when falling below 1/3 V_{CC} causes the comparator output to change state. The output level then switches from LOW to HIGH. The trigger pulse must be of shorter duration than the time interval set by the external CR network other wise the output remains high until trigger input is driven high again.

Pin 3: This is the output pin and is capable of sinking or sourcing a load requiring up to 200mV and can drive TTL circuits. The output voltage available is approximately -1.7V

Pin 4: This is the rest pin and is used to reset the flip-flop that controls the state of output pin3. Reset is activated with a voltage level of between 0V and 0.4V and forces the output to go low regardless of the state of the other flip-flop inputs. If reset is not required, then pin 4 should be connected to same point as pin 8 to prevent resetting.

Pin 5: This is the control voltage input. A voltage applied to this point to this pin allows the timing variations independently of the external timing network. Control voltage may be varied from between 45 to 90 of the Vcc value in monostable mode. In astable mode the variation is from 1.7 to the full value of supply voltage. This pin is connected to the internal voltage divider so that the voltage measurement from here to ground should read 2/3 of the voltage applied to pin 8. If this pin is not used it should be bypassed to ground, typically use a 10nF capacitor. This helps to maintain immunity from noise. The CMOS ICs for most applications will require the controlled voltage to be decoupled and it should be left unconnected.

Pin 6: This is the threshold input. It resets the flip-flop and hence drives the output low if the applied voltage rises above two-third of the voltage applied to pin 8. Additionally a current of minimum value 0.1 A must be supplied to this pin since this determines the maximum value of resistance that can be connected between the positive side of the supply and this pin. For a 15V supply the maximum value of resistance is 20M.

Pin 7: This is the discharge pin. It is connected to the collector of an NPN transistor while the emitter is grounded. Thus the transistor is turned on and pin 7 is effectively grounded. Usually the external timing capacitor is connected between pin 7 and ground and is thus discharged when the transistor goes on.

Pin 8: This is the power supply pin and is connected to the positive end of the supply voltage. The voltage applied may vary from 4.5V to 16V. Although, devices which operate up to 18V are available.

The reset input (555 pin 4) overrides all other inputs and the timing may be cancelled at any time by connecting reset to 0V, this instantly makes the output low and discharges the capacitor. If the reset function is not required the reset pin should he connected to +Vs.

- **Astable application of 555 timer**

In this operational mode of the 555 timer, it is simple an oscillator. It generates a continuous stream of rectangle OFF-ON pulses that switches between two voltage levels. The frequency of the pulse and their duty cycles are dependent upon the RC network values.

2.1.2 CD4060 IC

The CD4060 IC is a 14 stage ripple-carry binary counter/divider and oscillator with two oscillator terminals (R_S, R_T, and C_T), ten buffered output (O_3 to O_9 and O_{11} to O_{13}) and an overriding a synchronous master reset input (MR). The oscillator configuration allows design of either RC or crystal oscillator circuits. A high level on the MR resets the counter (O_3 to O_9 and O_{11} to O_{13}).

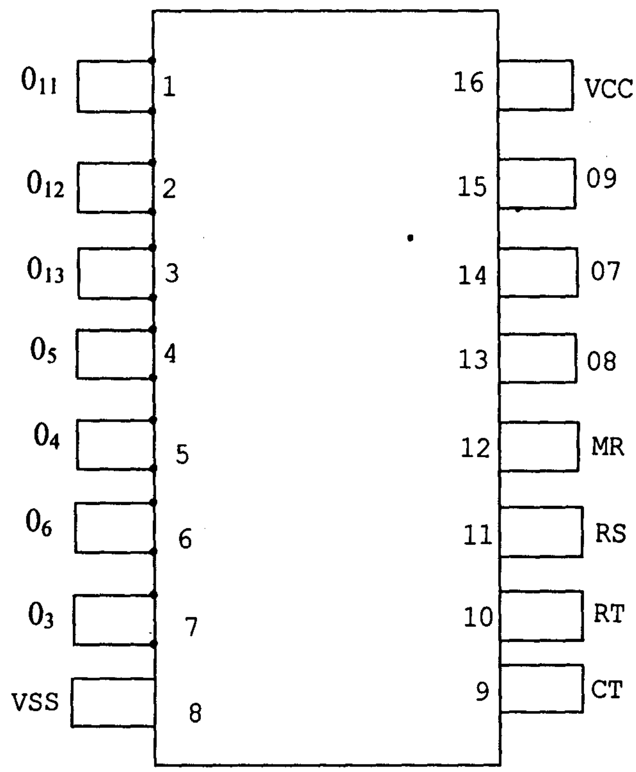

Fig 2.2 Pining diagram of CD4060

2.1.3 Active Components

Active components are components which can power and require an external power source to operate. They induces diodes, transistors, etc their applications range from rectifier (as in diodes), amplifiers and switches. The symbols are shown below.

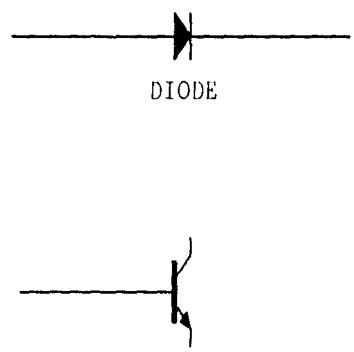

Fig 2.3 Symbols of active components

2.1.4 Passive Components

Passive components are components which cannot power and require an external power source to operate. They include resistors, capacitor, transformer, etc their application range from light detector (as in LDR), potential divider to control current (as in resistor), filtration of ripples voltages and blocking of unwanted DC voltage. They form the elements of the work circuit oscillation stages and are also used generally for signal conditioning in circuits. Their symbols are shown in fig 2.5.

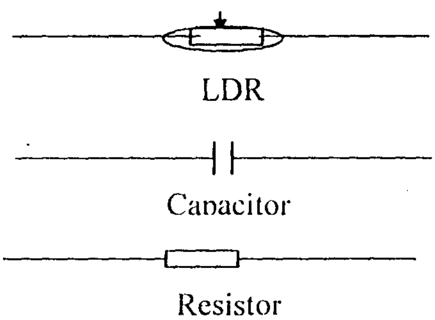

Fig 2.4 Symbols of passive components.

CHAPTER THREE

SYSTEM ANALYSIS, DESIGN AND CALCULATION

3.0 Sections of the Project

Dark activated intruder harm system comprises of four sections

i. The power supply unit

ii. The light detector section

iii. The time out delay generator

iv. The audible alert generator

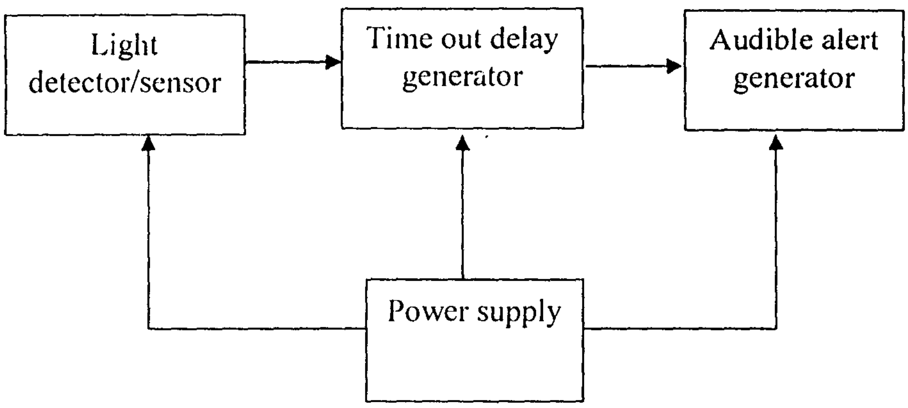

Fig 3.0 Block diagram of Dark Activated Intruder Alarm System

3.1 The Power Supply Unit

For the circuit we would require a 7809 regulation as shown in fig. 3.1, which gives a required output of 9v. The voltage regulator input voltage above it required output voltage. If the input voltage is below output voltage, it would be passed out without been regulated for example for a 7809, if the unregulated input voltage is greater than 9v, it will be regulated to 9v, but if less than 9v, for example 5v, the 5v will be outputted. To achieve this, the following steps were taken.

- Stepping down the AC supply with a transformer

- Full wave rectification
- Removal of ripple from the rectified wave form
- Voltage regulation to desired value

The power unit involves the transformer-bridge rectifier circuit. A 12v transformer is used to provide power to 7809 regulator, which produces regulated 9v.

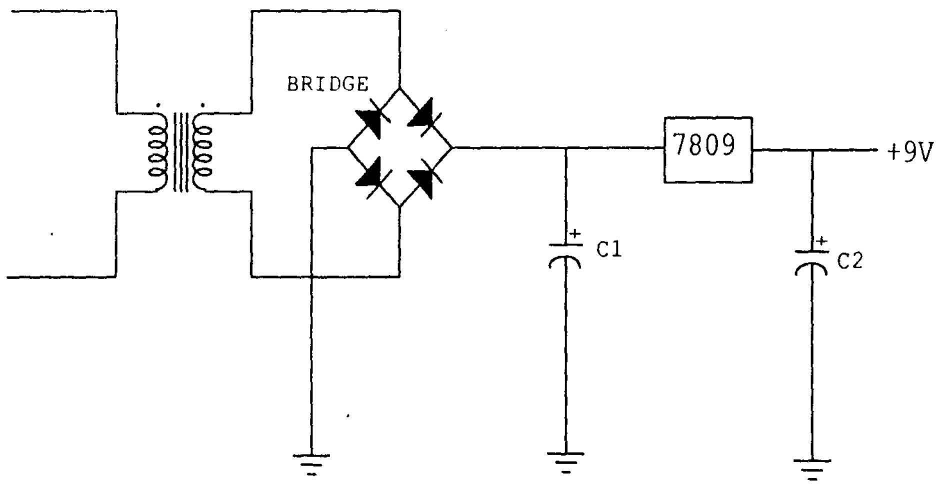

Fig 3.1 The power supply unit

The common full wave bridge rectifier, comprising of four diodes, is used for converting the 12v ac supply (i.e. output of the transformer) into corresponding roughly 12v dc voltage. This involved ripple at the output of the bridge rectifier is filtered through a 25v2200μf capacitor.

The 7809 voltage regulator is connected in parallel across the rectifier voltage output. The devices are aimed for stability of the complete circuit. The 9v power supply from the 7809 is connected to the main circuit to the main circuit.

3.1.1 Working Principle of the Rectifier

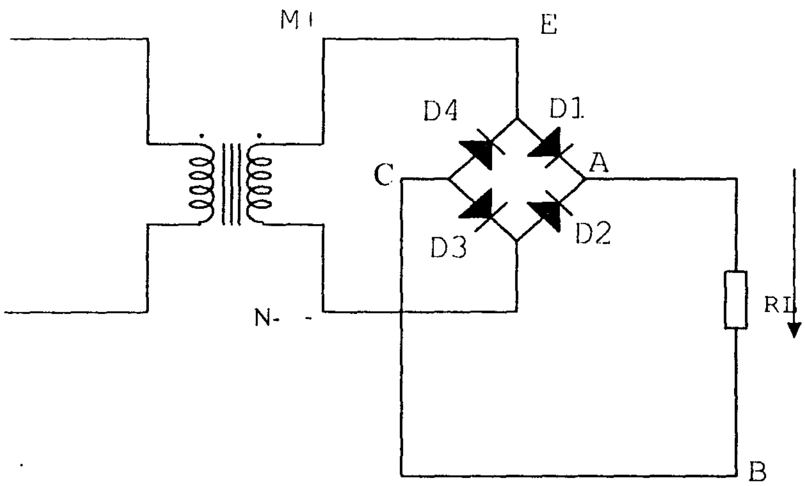

Fig 3.2 Full wave bridge rectifier

During the positive input half-wave cycles, terminal M of the secondary terminal of the transformer is positive and N is negative as shown in fig 3.2 Diodes D_1 and D_3 become forward biased (ON) and diode D_2 and D_4 are reverse-biased (OFF). Hence, current flows along MEABCFN, producing a drop across R_L.

Similarly, during the negative input half-wave cycle, secondary terminal of the transformer N is positive and M is negative. Diode D_2 and D_4 are forward biased (ON) while D_1 and D_3 are revered biased (OFF), as shown in fig 3.2 Hence, current flows along NFABCEM, and producing a drop across R_L.

This shows that current keeps flowing through R_L in the same direction at every half cycle of the ac input signal. Consequently, point A of the bridge rectifier always acts as the anode and point C acts as the cathode. The output voltage waveform across R_L is shown below.

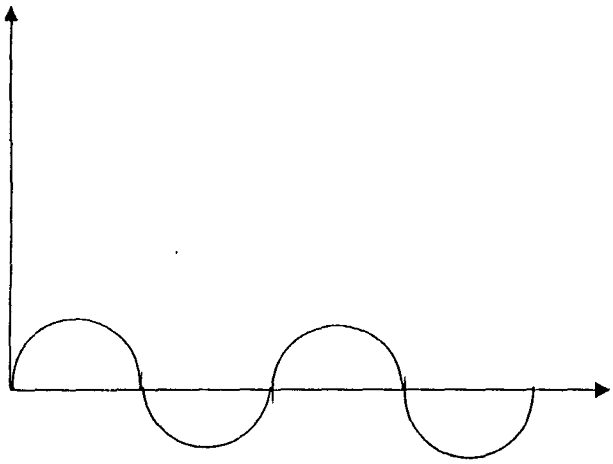

Fig 3.3a Input voltage waveform

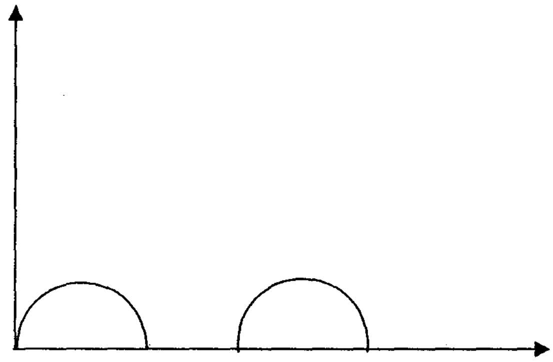

Fig 3.3b Output voltage waveform during the Positive cycle

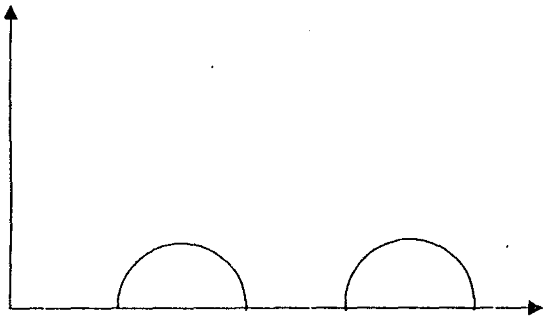

Fig 3.3c Output voltage waveform during the negative cycles

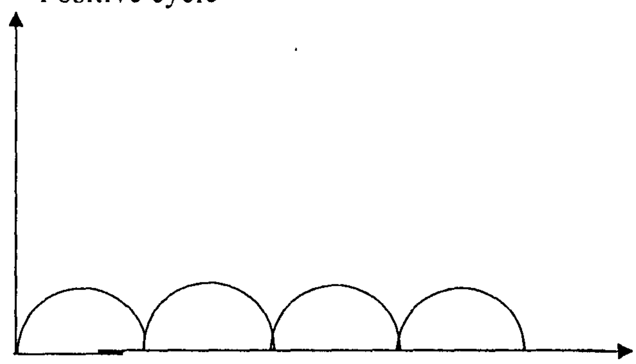

Fig 3.3d Output voltage waveform

Fig 3.3 voltage waveforms

3.1.2 Analysis of the Power Supply

From the regulator IC to work perfectly, the input voltage must be slightly above +9v, so that it will regulate the output. Assume that the input to the IC regulator is 14v. Since each of the diodes drops 0.6v and 4 rectifying diodes form the full-wave bridge, the voltage drop across them will then be $0.6 \times 4 = 2.4v$

The peak voltage will be $= (14 + 2.4)v = 16.4v$

rms voltage $= \frac{16.4}{\sqrt{2}} = \frac{16.4}{1.4} = 11.6v$

Hence, a transformer of a preferred value of 12v was employed i.e. 220/12v transformer

Assuming a ripple voltage of 12%

$$dv = \frac{12}{.10} \times 16.4$$

$$= 2.0$$

$$dt = \frac{1}{2f} = \frac{1}{2 \times 50} = \frac{1}{100} = 0.01$$

The required load current was about 0.4A

$$\therefore C_1 = \frac{dt}{dv} = \frac{0.4 \times 0.01}{2} = 2000\mu f$$

A nearest value of 2200 μ f was chosen for the capacitance. To reduce the ripple left a 16v 1000 μ f capacitance is used (i.e. C_2).

3.2 Light Detector/Sensor Section

The light detector section of this project consist of the light dependent resistor (LDR), comparator (NE 555) IC and resistor.

3.2.1 Light Dependent Resistor

The light dependent resistor is made from sulphur compound. It has high resistance at darkness (about 1 m ohm) and low resistance at bright light (less than $1k\Omega$). [2]

The LDR is placed in a dimly lighted area where anybody coming into the house must stay for some seconds. It is wired in a potential divider network with a 50Ω variable resistor to adjust the sensitivity of the system to the trigger condition. Since the resistance of a LDR varies inversely as the amount of light reaching it surface, any form of shadow been cast on it triggers the alarm.

3.2.2 The Comparator IC (NE 555)

The NE 555 has a Schmitt trigger encapsulated inside it. The Schmitt trigger inside of the NE555 comprises of two comparators with switching thresholds of $^1/_3$ V_{cc} and $^2/_3$ $V_{cc.}$ When the voltage on the comparator pins of the NE 555 (i.e. pins 2 and 6) is greater than the upper switching threshold. i.e. $^2/_3$ V_{cc}, the output, pin 3, switches LOW. Conversely, when the voltage at pins 2 and 6 fall below the low switching threshold of $^1/_3$ V_{cc}, pin 3 switches HIGH.

At normal lighting conditions, the output of the Schmitt trigger is LOW and when shadow falls on the LDR, the output of the Schmitt trigger is HIGH.

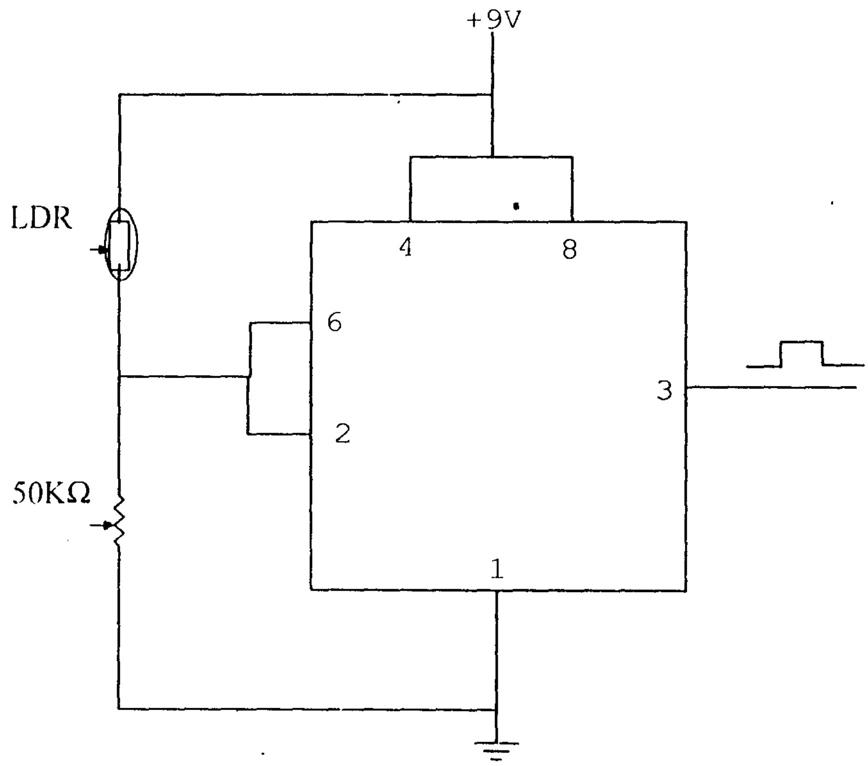

Fig 3.4 LRD-Schmitt trigger light detector.

3.3 The Time-Out Delay Generator

To avoid false alarm due to passer by that may cross the sensor, a time-out delay feature is implemented. This is realized using a CD 4060 14- stage ripple counter/divider and oscillation. It has an integral oscillation generating an output frequency of $F = \frac{1}{2.3R_T C_T}$ where R_T and C_T are indicated below

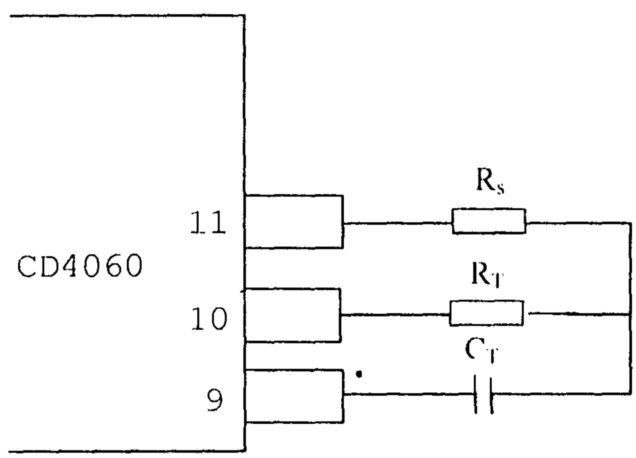

Fig 3.5 $R_T C_T$ on the CD 4060

The device has an active HIGH master rest pin that is use to enable or disable the time-out delay. The CD 4060 oscillator is wired of an output frequency of about 200113 by choice of tinning components shown in fig 3.5 since a delay of 5 seconds is needed before the alarm is triggered, therefore,

$$F = \frac{1}{T} = \frac{1}{5} = 0.2H_Z$$

Since the base frequency is 200Hz, the frequency is divided down by a factor of 1000 and yields the desired delay.

$2^n = 1000$

Therefore, output O_{13} is tapped to yield approximate time delay. The RESET input on the counter is controlled as shown in fig 3.6

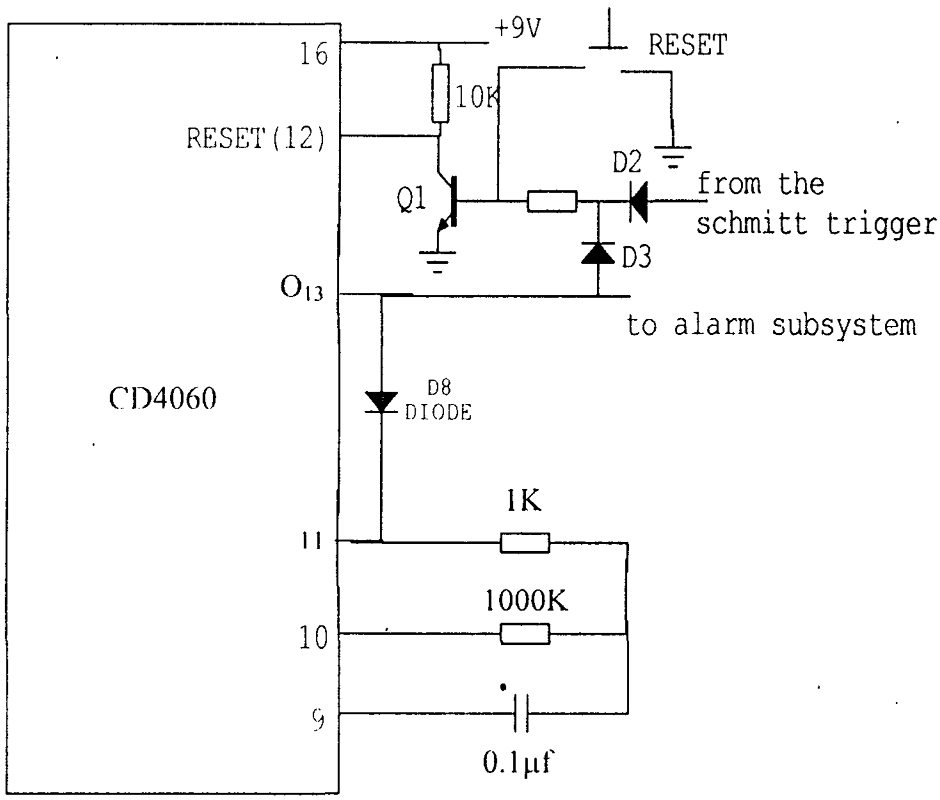

Fig 3.6 Wiring of CD 4060

Pin 12, the master reset input on the device is pulled high to +9v via a 10kΩ resistor. An NPN transistor, Q_1, is used as an open-collector device on the input.

- **Analysis of the time-out delay**

With light falling on the LDR, the output of the comparator is LOW, Q_1 is turned OFF, and 4060 is RESET. When shadow falls on the LDR, the output of the comparator is HIGH, turning ON Q_1 and activating the master reset at the pre-programmed output frequency. Time-delay logic states appear on different pins of the counter.

If the duration of obstruction of light from the sensor is less then the time-out delay, the 4060 is instantly reset. However, if the delay elapses, O_{13} switches HIGH, forcing Q_1 ON through a feedback as shown in fig 3.6. The system is now LOCKED and the only way to unlock is the use of RESET button.

At the instant of O_{13} going high, an active high switching logic is sent to the audible alert subsystem. When O_{13} goes high, a HIGH is also applied to pin 11 of the 4060, disabling further production of pulse. Thus, preventing a roll-over.

3.4 The audible Alert Generator

This section consists of the audio oscillator and the piezoelectric alarm.

3.4.1 The Audio Oscillator

The 555 timer IC has earlier been discussed, is configure in astable mode to generate a continuous stream of rectangular OFF-ON pulses.

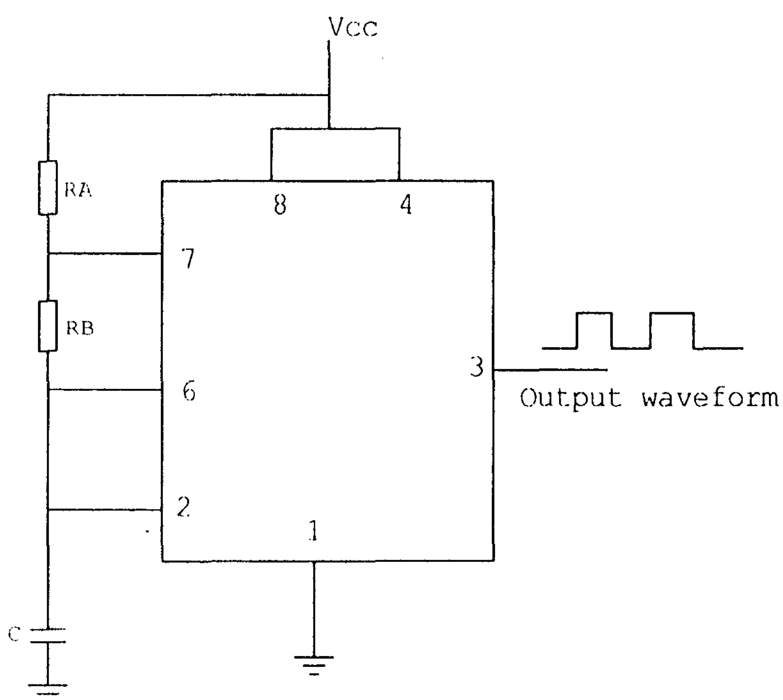

Fig 3.7 Astable oscillator

The 555 oscillator produce an output frequency of

$$F = \left[\frac{1.44}{(R_A + 2R_B)C}\right] H_Z$$

Where R_A, R_B and C are as shown in fig 3.7. An audio tone of 700Hz is predetermined to be generated by the circuit, independent of the duty cycle. R_A is chose as $1k\Omega$, C as $0.1\mu f$. Back substituting for R_B yield an approximate value of $10k\Omega$.

- Calculating using the values of the timing components.

$$F = \left[\frac{1.44}{(100 \times 20{,}000)10^{-7}}\right] Hz$$

$=680Hz$

The oscillator output is wired to a TIP41C transistor as shown below.

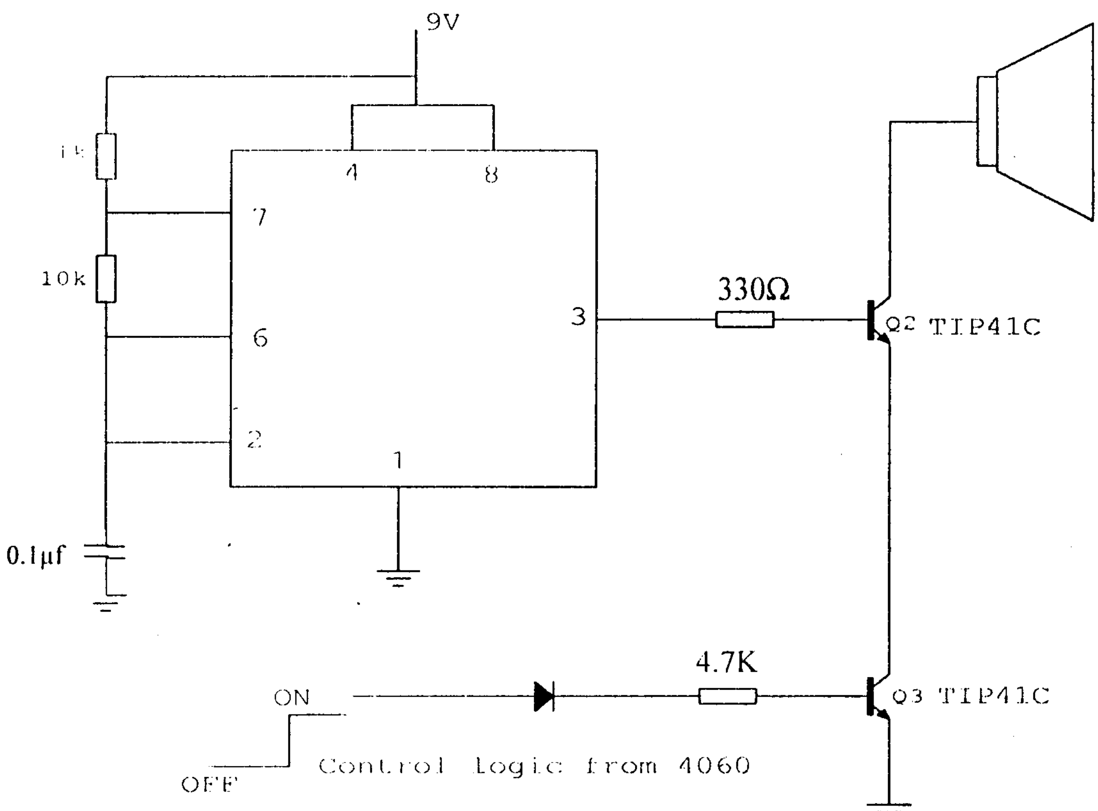

Fig 3.8 Audio oscillator

The TIP4K transistors have a typical β of 40 (from the date sheet). It is required to sink about 0.5A through the piezoelectric alarm at 9v.

$$i_c = 0.5A = \beta I_B$$

$$I_B = {}^{0.5}\!/_{40} = 12.5mA$$

$$R_b = \frac{V_b - V_{be}}{I_B} = \frac{8 - 2.1}{0.0125} = 472\Omega$$

A value of 330Ω is used to allow for lesser gain parts. Q_2 and Q_3 form a 2 input "NAND" gate with Q_3 molding the switching logic for Q_2. Q_2 is supplied with a base drive at all time, but only when Q_3 is ON is Q_2 able to sink current through the piezoelectric alarm to respond to audio output. Q_3 is switched on by O_{13} HIGH output when the time-out delay elapses, switching ON Q_2 and producing an audio output.

3.4.1 The Piezoelectric Alarm

A piezoelectric alarm is kind of transducer that converts electrical pulse into sound. It is made to produce a sound that is based on the frequency of the wave that is imputed into it. This alarm employs technology that allows continuous tone.

CHAPTER FOUR

CONSTRUCTION, TEST AND CASING

4.1 Construction

The construction was done was in a module-to-module pattern. The power supply was the first stage to be constructed. It was coupled on the breadboard, and latter transferred to the veroboard. The other stages were coupled on the breadboard, using the already constructed power supply unit to verifier the integrity of the circuit, it was then transferred to the veroboard.

The components were soldered on the veroboard using lead and 60w soldering iron. This provides electrical continuity and firmness on the board. Jumper-wire were use to connect various point together and also to bridge the connection between the components making up sections. The stages were tested to ensure that there were no deviation from the desired specification.

4.2 Testing and Result

In carrying out the test basic component of this project, the main instrument used are ohm meter, multimeter and frequency meter.

Testing carried out on the light dependent resistor, the output and input power supply to each stage and the output of each stage.

Ohmmeter was used to measure the resistor of the LDR at bright light and darkness. At bright light, the resistance of the LDR was 22ohm while at darkness; it was above 100kohm, which depends in the surrounding.

The output power of the rectifier stage is measured using millimeter. This was found to be 13-14v DC. The voltage at the input of the voltage regulator IC was 13.4v and the output was 9v. this is the voltage that was used to supply other stages of the project.

Frequency meter was use to measure the output of the astable multivibrator at the audio alert generator section of the project.

4.3 Construction of Casing

The casing is made up of plastic of the casing is rectangular box. The size is chosen such that it can contain the transformer and veroboard which contain all the components. It has the following dimensions:

Length = 135mm

Width = 100mm

Height = 70mm

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The design and construction of Dark Activated Intruder Alarm system was necessitated by the need of water tight security both in our homes and offices. This particular design was made to ensure effective security at a lower cost. This project is more reliable than keeping pet such as dog or parrot to scare away intruders is to notify when an intruder approaches a house.

In the design of this project, however, some problems were encountered which are not impossible to solve, such as availability of component which leads to modification of the design and choice of alternative components to suit the aim of the project.

In the event of mass production of this device, the manufacturer has to increase the sensor point and sensitivity of the sensor, so that it can be use by a large building or office complex.

The availability of A.C power source is very important in the operation of this design. This reduces the cost of the battery to be used to operate the project.

5.2 Recommendation

This project design is recommended for in home and offices. It can be used in the low cost houses where many flats are within same fence. It can be use in the office complex by the individual offices, so as to determine intrusion into the office.

Also, there is still room for further work on this project design to achieve its total completeness. It could be designed such that there will be indicator light that will come on the moment the sensor senses a shadow. Although, the alarm will not activated, but that will tell the person monitoring the security that there is someone around.

It is also recommended that a flash light should be incorporated in the case if it is a deaf person that is around when there is intruder. This will also enable the security man on duty to know at a glance that there is an intruder around.

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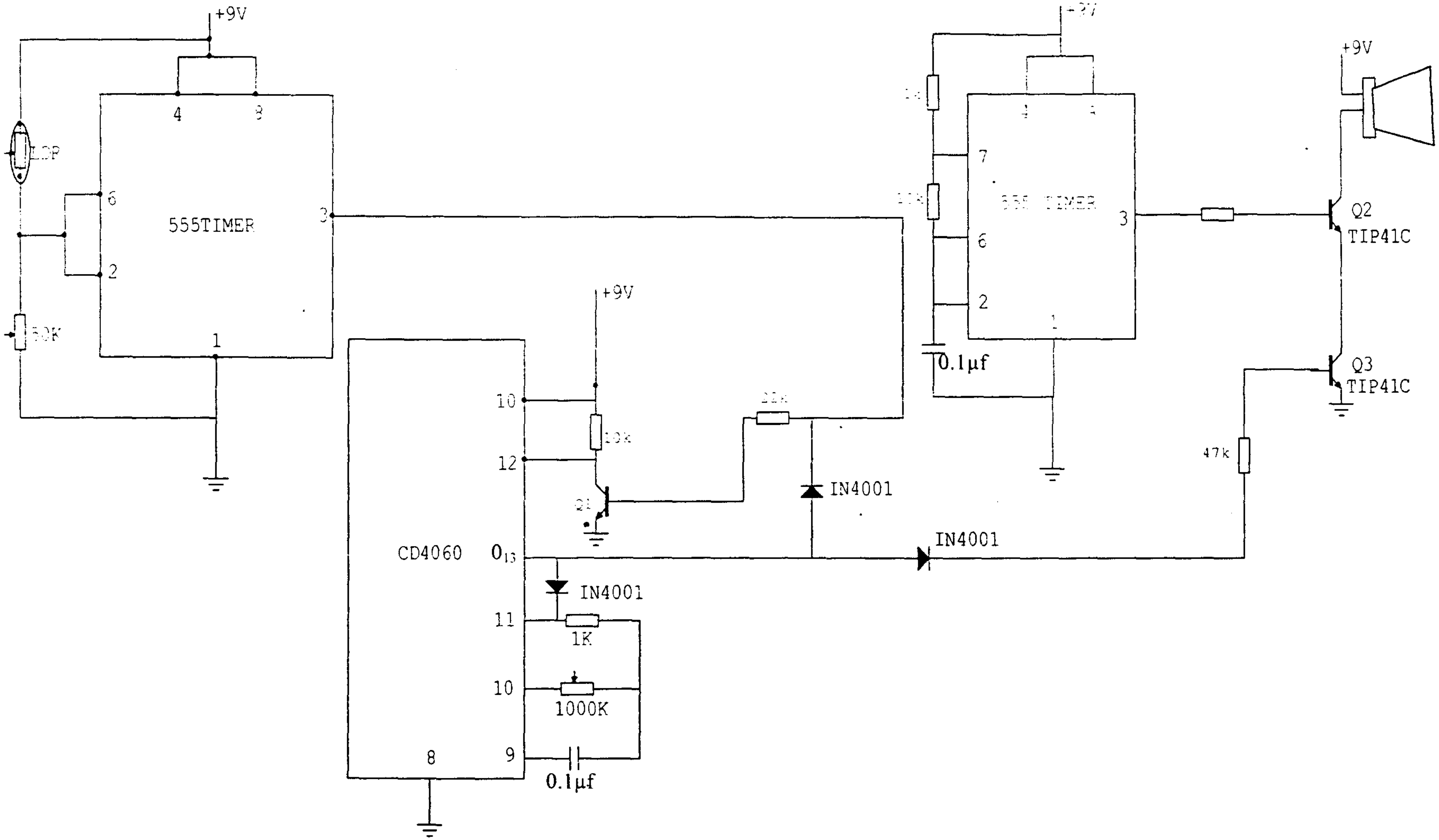
APPENDIX



COMPLETE CIRCUIT DIAGRAM OF DARK ACTIVATED INTRUDER ALARM SYSTEM