DESIGN AND CONSTRUCTION OF AUTOMATIC HEAT AND SMOKE DETECTOR

BY

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DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA NIGER STATE

NIGERIA

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A PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF ENGINEERING (B.ENG.) DEGREE IN THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

NIGER STATE.

SEPTEMBER 2003

DECLARATION

I **ABDULLAHI MOHAMMED MAIGIDA**, hereby declare that this project was written by me and that the contents are result of my own design and calculation. Information obtained from published and unpublished works of other have been well acknowledged by means of reference.

Signed…:……………

Date:…………………

DEDICATION

This project is dedicated to my Late father, Alhaji Abdullahi Abubakar, my mother Hajiya Adiza Abdullahi and my elder brother Mallam Abdullahi Ahmadu Mohammed (Ya-Alhaji) for all they have done for me and for enabling me to come this far in my endeavours.

My friends, brother and sisters, whose prayer, support and encouragement has been of tremendous help to me

Above all, I will like to dedicate this project to Almighty Allah for his grace, favour and faithfulness.

ACKNOWLEDGEMENT

I will like to thank God Almighty for the strength, wisdom, knowledge and understanding he has giving to me to complete my program. To God be the glory.

My sincere gratitude goes to my supervisor **Eng'r Rumala S.N**. For his intelligent and valuable suggestion provided throughout the period of this work. I am highly grateful to all members of staff in the department for the numerous ways in which they have been of help to me towards the course of my study. My special depth gratitude goes to **Eng'r (Dr) Y.A. Adediran** (H.O.D), and **Eng'r Musa D. Abdullahi** for his advice and understanding. May God bless you all. I sincerely express my appreciation and gratitude to my Late father Alhaji Abdullahi and my mother Hajiya Adiza, my brothers Mal. Mohammed (Ya-Alhaji) Abubakar, Ya-sule, Ya-Ndababo and sister Jummai, my uncles, Suleiman (Sabo), Dr. Isiaku, and uncle Joe, may God continue to renew your strength.

I am also most grateful to my grandparents paternal and maternal, Late Mal. Isiaku and Hajiya Mariam Isiaku, Aunty Hajiya Salu, my cousins Mohammed, Danjuma,and others. Thanks for the support and encouragement I received, both morally and spiritually. May Allah continue to guide and protect you all.

I remain forever grateful to Eng'r Musa Ibrahim and all the Muslim Student's of F.U.T Minna for their unreserved support, which contribute greatly to my success. May Allah reward you all. I am greatly indebted to my senior friends. They have been a source of inspiration towards me. I am forever grateful to you all.

Special complements are due to those who made my stay in F.U.T. worthwhile, my close friends, Abdulrazaq, Abdulkadiri, Abdullahi, Jimada, sisters friends Fausiat, Jamila and all my colleagues in the department, I thank you all and may God bless you.

CERTIFICATION

We certify that we had supervised, read and approved this project work. We had also found it to be adequate in scope and quality for the partial fulfillment of the award of a Bachelor's degree in Electrical and Computer Engineering (B. Eng.)

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ENG'R RUMALA
(SUPERVISOR)

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DATE

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(HEAD OF DEPARTMENT)

28/8/09
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EXTERNAL EXAMINER

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DATE

ABSTRACT

The design and construction of fire and smoke alarm system is described in this project the project is intended to produce and audible alarm tone in an 8 audio speaker, as well as a visual flashing light alarm using a 12V12W bulb of an interval of about 0.5seconds. On the detection of fire or smoke. This project report is intended to produce two output which depend solely upon the temperature of the sensor device (thermistor) and high resistance of the photocell sensor due to the blocking of light by smoke. The thermistor here is fully immersed in water (hot water) as the temperature of the thermistor increases its resistance decreases thereby causing it to approach the set trip value of the variable resistance. When the thermistor resistance becomes less than the set value of the variable resistor or when the photocell resistance becomes higher than the set trip value of the variable resistor. The comparator output switches to a high output state and both the low frequency and audio oscillator are free to run the output of the both oscillators are used to drive the two transistors respectively. The first transistor (TR1) is use to switch ON and OFF a LED bulb of at one Hertz pulse. At the same time the output of 1Hertz oscillator is used to gate the operation of the 2Hertz audio oscillator. A burst of 2 kilohertz pulse energy 0.5 seconds drive the second transistor (TR2) to give an audible alarm tone from the speaker. The project write up is divided into five chapters. **Chapter 1** Introduce the various method of fire and smoke detection, **Chapter 2** Takes a look at the system operation and Design, Comparator and Multivibrator unit, power supply unit, **Chapter 3** Analyses the construction, testing and result, **Chapter 4** The concluding chapter, outlines the merit and demerit of the present design approach as per performance evaluation and gives a recommendation for further improvement on the work.

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CHAPTER ONE

GENERAL INTRODUCTION

1.1 LITERATURE REVIEW

The use and control of fire and its products involve invention fundamental to human society and culture. Without them, contemporary technology-based society would be impossible. The ultimate movement of man over most of earth's land surface is also directly dependent upon is ability to produce and control fires.

Since fire presents a constant threat to life and property. Out of control fire can kill great numbers of persons, for instance (1152died as flames swept through the Lumber town of Peshtigo, Wis in 1871) and it can destroy on a massive scale (28,000 buildings were burned at a loss of $350 million in San Francisco after an earth quake in 1906)

To safeguard life and property, the fire department trained men with specialised equipment-has involved over the centuries. The cities of New-York and London and the Tokyo metropolitan fire board have the world's largest fire departments, which involves several apparatus ranging from pumper, the second most common piece of apparatus is the aerial ladder truck which depends on the need of the community, other vehicle involves include rescue, salvage searchlight and water tank truck (Tanker). Fire department situate alongside ocean, lakes and rivers usually operates fire boat as well, meanwhile pumpers in U.S is called the "Engine" while in British technology is the appliance.

Until recent years, the prime method of preventing personal injury and death in building fires was by shielding the occupants from the fires flame and heat. However, the late sixties and early seventies saw several major building fires in which people who died were far removed from the immediate fire area. The smoke and toxic gases from fire were causing more deaths than the direct effects of the flame and heat, the toxic gases given off during the thermal decomposition of the new plastics material were more deadly than those given off by traditional materials. Today 80% of deaths in building fire are caused by smoke inhalation.

A few breaths of some toxic gases will completely immobilize a person, with death following in a matter of minutes. The victims were death before the fire even reaches them.

Since fire affects not only property, but also more importantly life, fire systems should therefore not only give an early warning of an outbreak of fire but also provide some means of dousing the fire and preventing it from advancing into other areas.

For the purpose of this project, we shall restrict ourselves to early detection and communication of fire outbreak to the relevant authorities.

1.2 GENERAL INTRODUCTION ON ALARM SYSTEMS

An alarm is a device that warns or signals, while a system is a group of objects or units combine to form a whole functional unit. Collectively an alarm is an equipment employed is simple in design and extremely reliable. It employs a close electrical circuit with simple wire radiating from central alarm point through a neighborhood and returning to the central alarm points. The alarm "boxes" or station are located at strategic points on the circuit, where they are readily accessible and easily identified by the public incase of any dangerous or unfavourable situation, ensure security and provide certain information when required.

Alarm systems in buildings, serves to protect the building, it's equipment and it's occupant from impending disaster and, as such may as well be one of the most important system in the building. They serve as round clock watchdogs against fire, smoke, holdup, and burglary as well as monitors various parameter such as pressure, temperatures, liquid levels e.t.c.

For the purpose of this project, the safety aspect will be considered, and it will be based on the fire alarm feature.

1.3 INTRODUCTION TO FIRE DETECTION SYSTEMS

The building occupancy plays a major role as to the type of detection systems to be used. Smoke detectors have proven very effective in sensing fires in their early stages. Heat detectors react very slowly to fires and require high temperatures before they respond.

1.3.1 HEAT DETECTION

Heat detectors are the oldest types of automatic fire detection devices. They are the least expensive fire detectors and have the least false alarm rate of all fire detectors. This is because heat-sensing elements, such as fusible links, react very slowly to fire and require high temperatures before they react. For this reason, heat detectors best suited for fire detection in small confined spaces. Where rapid fires with high heat output are expected and in other areas where ambient conditions would not allow the use of other fire detection devices, or where speed of detection and life safety are not a major consideration. And example of this would be low value protection, where fire would cause minimum damage to the structure or contents. Heat detectors may be thought of as detecting fire within minutes of ignition.

1.3.2 SMOKE DETECTION

Smoke detectors cost more than heat detectors but provide considerably faster detection time and subsequently high false alarm rates due to their increased sensitivity. Smoke detection circuits use devices such as photoelectric cells and ionization detectors.

The photoelectric detectors respond quickly to smoldering fires. A light source, which sends out a light beam, is interrupted by smoke entering the detector and the circuit is closed.

The ionization detector responds more quickly to flaming fast burning fires. A radioactive element inside the ionization detector changes the air inside the chambers and makes it a conductor of electricity. Any smoke entering the detector slows or blocks the current and the circuit is closed. Smoke detector are very effective for life saving applications, but are more difficult to locate, in that air current, which might affect the direction of smoke flow, must be taken into consideration.

Smoke detector should be used in areas where the value of protection is high and in area where life safety and fast respond time is paramount. Smoke detector can operate within seconds of fire ignition.

1.3.3 FLAME DETECTION

These optically sense either the ultra violet or infra-red radiation given off by flames or glowing embers. They have the highest false alarm rate and the fasted detection times of any type of fire detector. Detection times for flames detectors are generally measured in milliseconds from fire ignition.

They generally use only in high-natural situations such as fuel loading, loading platforms and hyperbaric chambers, high ceiling areas and other places with hazardous atmospheres in which explosions or very rapid fire may occur. Flames detectors are" line of sight" devices, as they most be able to" see" the fire and they are subject to being blocked by object places in front of them. In general this detectors is restricted to no-smoking areas or places where highly flammable materials are stored or used.

CHAPTER TWO

SYSTEM OPERATION AND DESIGN

2.1 DESIGN OVERVIEW

The design of the fire alarm can be subdivide into three building blocks, namely, Input, Control, and Output devices respectively. The block diagram is as shown in fig. While the smoke and fire detecting circuit is also shown in fig. Details of the component values are given in the appendix.

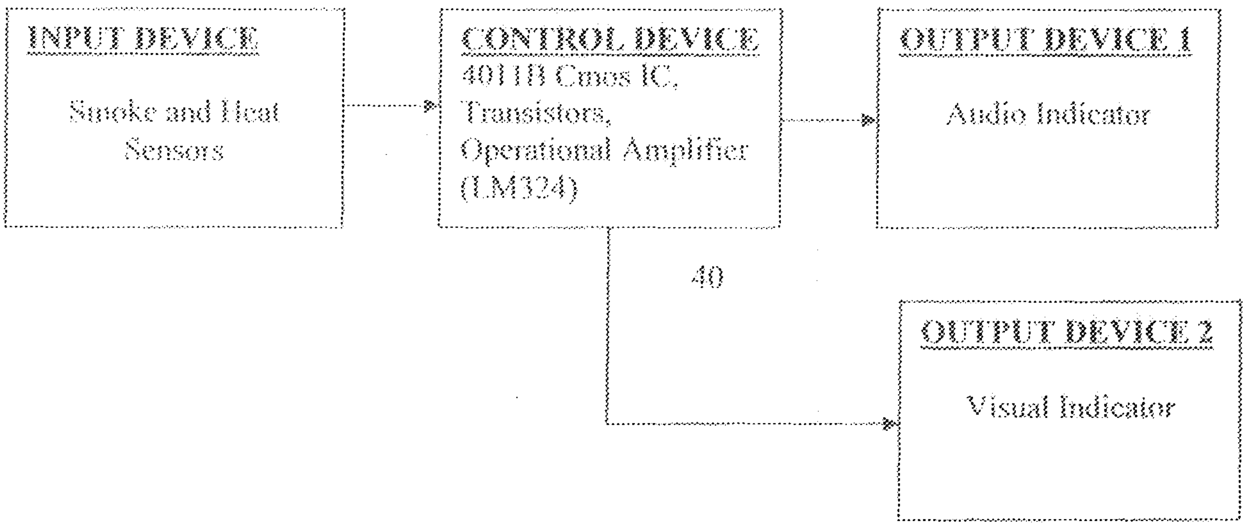


Fig 2.1.1 Block Diagram Of Smoke And Fire Detector Circuit

2.2.1 THE THERMISTOR BRIDGE CIRCUIT

From the Fig.2.2.1 shown below, thermistor was used to sense the change in temperature, and the thermistor R_T is a negative temperature co-efficient type, which means that it's resistance increases as the temperature decreases and vise versa. It means that if there is any rise in temperature (probably from fire) the voltage drop across the thermistor will decrease. The operational amplifier in the heat detecting circuit will have a voltage of 6V, at it's non-inverting input. Whenever the voltage at the inverting input is less than 6V, the output voltage of the op-amp will be equal to V_{CC}. The voltage at the inverting input will be equal to the voltage drop across the variable resistor (R_{V2}). At room temperature, the voltage drop across the R_{V2} will be less than 6V. but whenever there is temperature rise (above room temperature) i.e. 50°C (Probably due to presence of fire) the voltage at the inverting input will rise above 6V and will result in a low output at the op-amp ends

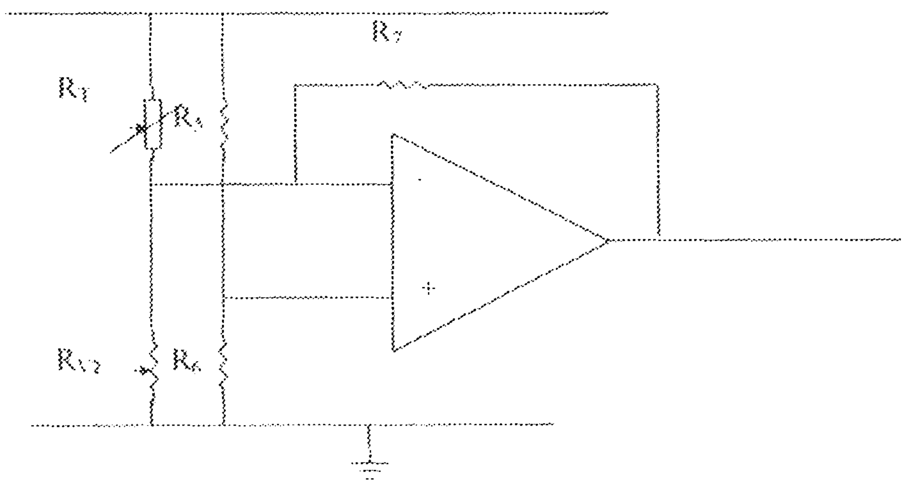


Fig 2.2.1 Circuit Diagram of Heat Detecting Circuit

CIRCUIT ANALYSIS OF HEAT DETECTING CIRCUIT

<u>SECOND ANALYSIS</u>

R_{RT1} = 36K (thermistor resistance in the absence of heat)

R_{RT2} = 10K (thermistor resistance in presence of heat)

R_{V2} = 50K (variable resistance 2)

R_5 = 10K (fixed resistor 5)

R_6 =10K (fixed resistor 6)

THE RATIO ANALYSIS FROM THE (THERMISTOR) BRIDGE CIRCUIT

First Stage:

$[R_{RT1} * R_{V2}/R_{RT1} + R_{V2}] = [36 * 50K / 36 + 50] = 20.9K$

$[R_5 * R_6 / R_5 + R_6] = [10 * 10 / 10 + 10] = 5.0K$

Ratio 5: 21 Equal to 1: 4 This put OFF the Alarm system

Second Stage:

$[R_5 * R_6 / R_5 + R_6] = [10 * 10 / 10 + 10] = 5.0K$

$[R_{RT2} * R_{V2} / R_{RT2} + R_{V2}] = [10 * 50 / 10 + 50] = 8.3K$

Ratio 5 : 8 Equal to 1: 2 This trigger the Alarm system.

2.2.2 THE PHOTOCELL BRIDGE CIRCUIT

From the fig shown below, resistance R1 acts as a current limiter to the light emitting diode (LED) it limit the current flowing through the LED. The resistance of the light dependent resistor (LDR) is light dependant, as such it resistance is determined by the intensity of light from the LED. In the absence of smoke, the light intensity from the LED will be high, which eventually results in a low potential drop across the LDR.

Meanwhile the presence of smoke causes the light intensity from the LED to go low due to obstruction from smoke. This will lead to an increase in the resistance of the LDR and subsequently results in a rise in the voltage drop across the LDR. The circuit diagram of the smoke detector is shown in fig 2.2.2. the at inverting input of the operational amplifier (op-amp) is equal to the voltage drop across the LDR, while the voltage at the non-inverting input of the op-amp is equal to the voltage drop across R_2. in the absence of smoke, the voltage drop across R_2 will be 6V. this will cause the output of op-amp to be high. The output voltage will be equal to V_{CC}. In the presence of smoke, the voltage drop across LDR will rise above 6V, which will cause the output of the op-amp to go low. All the calculation involve in the circuit analysis of the smoke detector is shown below

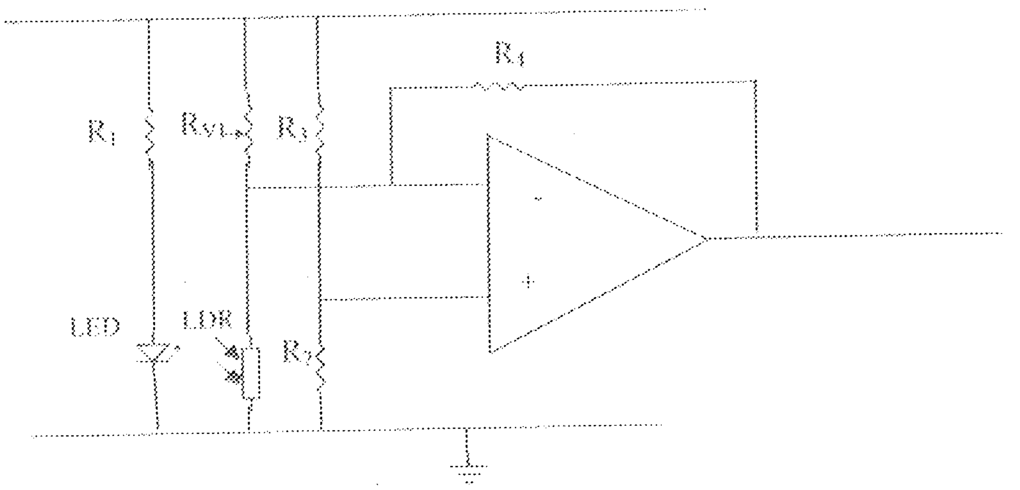


Fig 2.2.2 Circuit Diagram of Smoke Detecting Circuit

CIRCUIT ANALYSIS OF SMOKE DETECTING CIRCUIT

FIRST ANALYSIS

THE RATIO ANALYSIS FROM THE (PHOTOCELL) BRIDGE CIRCUIT

R_{LDR1} = 5K (LDR Resistance in presence of LED light)

R_{LDR2} =160K (LDR Resistance in absence of LED light)

R_{V1} = 50K (Variable Resistor 1)

R_2 = 10K (Fixed Resistor 2)

R_3 = 10K (Fixed Resistor 3)

First Stage

$(R_2 * R_3)/(R_2+R_3) =$ (10*10)K / (10+10)K = 5.0K

$(R_{LDR1}\ R_{V1})/(R_{LDR1} + R_{V1}) =$ 5 * 50)K / (5 + 50)K = 4.5K

Ratio = 5 : 5 Equal to 1 : 1 This put OFF the Alarm system.

Second Stage

$R_2 * R_3/R_2 + R_3 =$ (10 * 10)K / (10 + 10)K = 5.0K

$R_{LDR2} * R_{V1} / R_{LDR2} + R_{V1} =$ (160 * 50)K /(160 + 50)K = 38.0K

Ratio = 5 : 38 Equal to 1: 7 This trigger the Alarm system.

2.3 THE VOLTAGE COMPARATOR UNIT

INTRODUCTION

Operational Amplifier. Many modern electronic circuits used op-amp which are high gain voltage amplifiers. If the amplifier has two non grounded input terminals, it is a differential amplifier, since it amplifies the voltage differential between the two inputs. Op-amp are nearly always used in feedback circuits, in such a way that the properties of the circuit are controlled by the circuit parameters and not by characteristic of the op-amp.

In analyzing an op-amp feedback circuit, ones uses the properties of high gain and high input impedance to established a virtual short between the amplifier input terminals. This means that the voltage between the input terminals is essentially zero, but no current flows in them.

Fig2.3.1a shows a block diagram of an op-amp the input stage is a differential amplifier, followed by more stages of gain and class Bpush-pull emitter follower. because a differential amplifier is the first, it determines the input characteristic of the op-amp. In most op-amp the input is single-ended output is design to have a quiescent value of zero. This way, zero input voltage ideally results in zero output value.

Not all op-amp are design like in fig for instance, some do not use a class B push-pull output, and others may have a double ended output. also op-amp are not as simple as fig suggest. The internal design of a monolithic op-amp is very complicated. Using dozen on transistor as current mirrors, active load and other innovations that are not possible in discrete designs for our need, the block diagram capture two important features that apply to typical op-amps the differential input and the single-ended output.

Fig2.3.1b is the schematic symbols of an op-amp. It as non-inverting and inverting inputs and a single –ended output. Ideally, this symbols means that the amplifier has infinite voltage gain, infinite input impedance and zero output impedance. The ideal op-amp represent a perfect voltage amplifier and is often reffered to as "voltage controlled voltage source" (V_cV_s). We can visualize a V_cV_s as shown in fig where R_{in} is infinite and Rout is zero. It should be noted that voltage comparison is just one area of application of op-amp, others also include, detect the two input voltages, provides an output that has two discrete state. The output of the circuit is proportional to the differential signal between input and it is given by

$V_{out} = A_o V_{in} - V_R$

A_o = the open loop of the op-amp

V_{in} = the input signal at the non-inverting terminal

V_R = The reference voltage at the inverting terminal

V_{out} = the output voltage

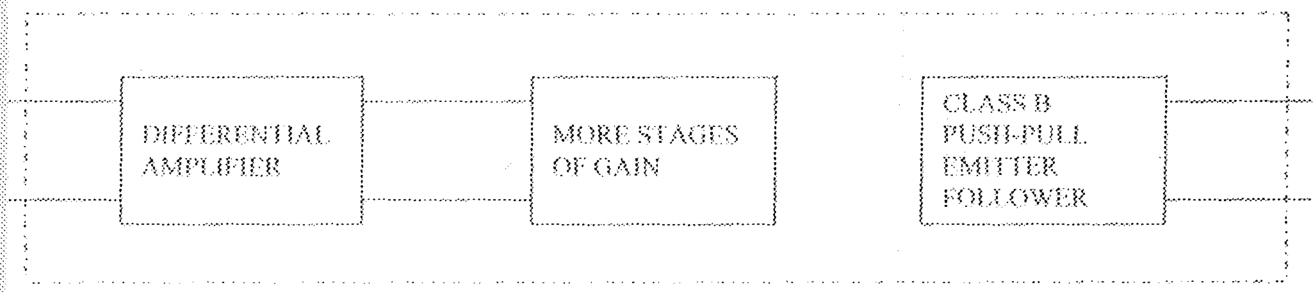


Fig. 2.3.1a Block Diagram of an Op-amp

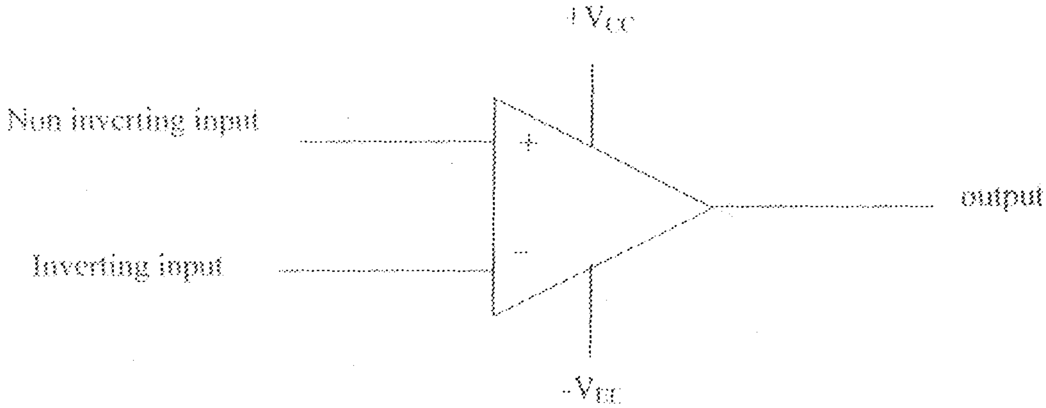


Fig 2.3.1b Schematic Symbol for Op-amp

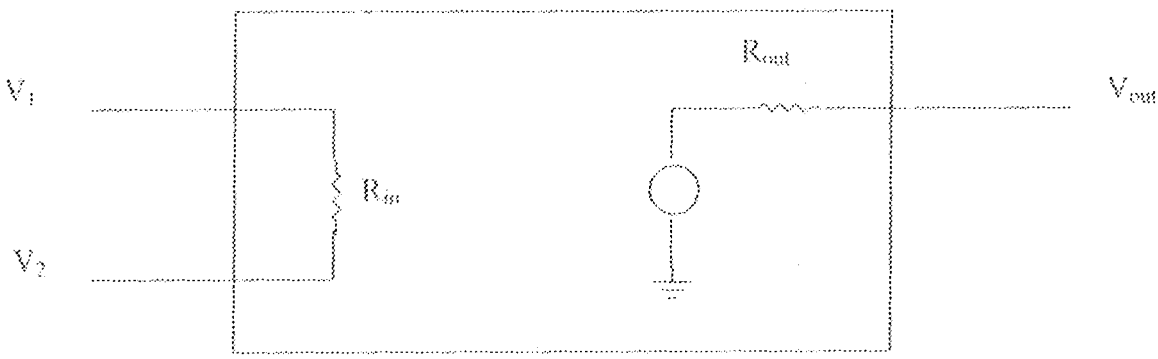


Fig 2.3.1c Equivalent Circuit of Op-amp

THE LM324 AS A COMPARATOR (QUAD OP AMP)

The LM324 has four internally compensated op-amps. Although it can operate with two supplies like most op-amp, it was specifically design single power supply, a definite advantage in many applications, Another convienence of the LM324 is that it can work with single power supply as low as +5V the standard voltage for many digital systems. It also eliminate the need for dual supplies, with open loop voltage gain of100dB, input biasing current of 45nA, input offset current of 5nA, and input offset voltage of 2mv, because of those listed characteristic is convienent to use as an interface with digital circuit that runs off a single positive supply

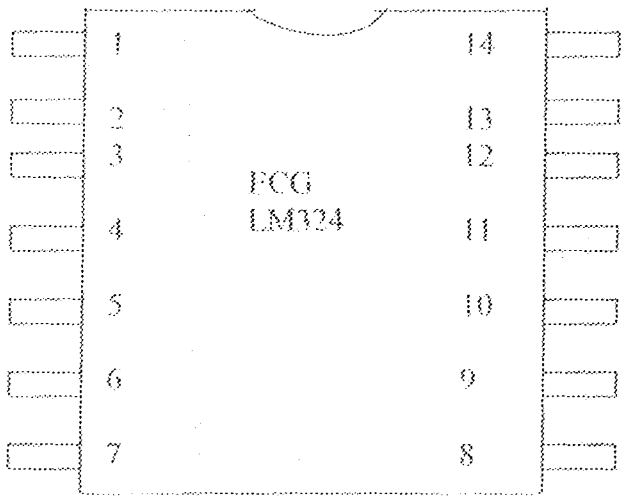


Fig. 2.3.1 The LM324 as Quad Op-amp

2.4 THE ASTABLE MULTIVIBRATOR UNIT

INTRODUCTION

Astable multivibrator has no stable operation state oscillating back and forth between a reset and set states.

The circuit of fig shows how two inverters can be connected to form as astable multivibrator. If the values of R and C for each unit are the same, then a clock signal having equal mark to space ratio is obtained.

The 4011B and the NAND gate form the bases of an astable multivibrator, with proper external components used as shown below, it is connected so that neither of the output levels is stable and so circuit continuously switch back and forth between this two unstable state and so the output of the periodic waveform.

Basically the waveform is rectangular, the chip could also be used depending on the connections of the external component as a monostable or bistable multivibrator, the frequency of the oscillator as well as the duty cycle are accurately controlled by the two external resistor and a single turning capacitor. The pin configuration diagram of the dual-in-line package.

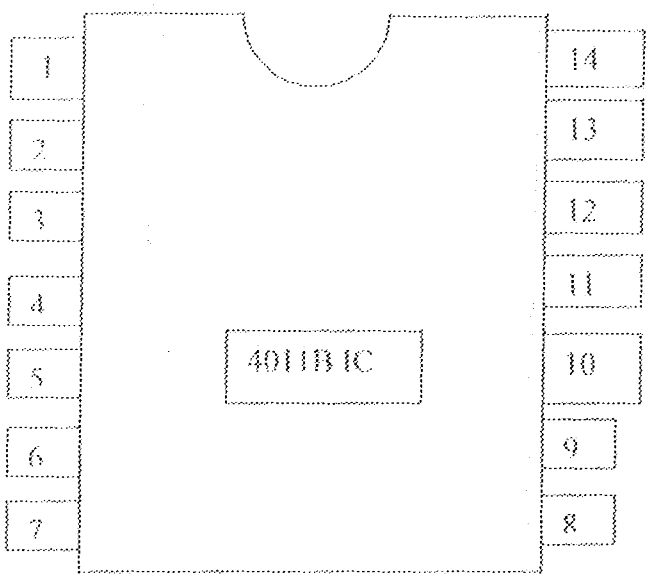
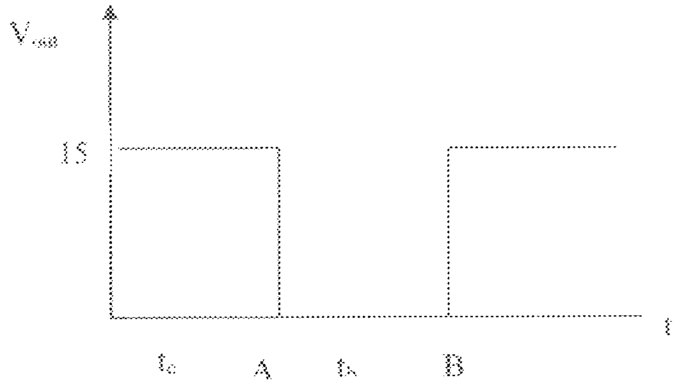


Fig. 2.4.1. Pin Configuration of the 4011B IC

The input signal is a rectangular pulse that switches from 0 to 15V at point A and from 15V to 0 at point B. before point A at time Q1 is ON and Q2 is OFF. Since Q1hasresistance of 100ohm compared to a resistance of 1Mili-lohm for Q2, the output voltage is pull up to 15V.

Between point A and B, the input voltage is 15V this cut off Q1, and turns ON Q2. in this case, the low result resistance of Q2 pulls the output voltage down to approximately zero.



Charging and Discharging waveform for 4011B Astable Multivibrator

2.5 POWER SUPPLY UNIT

INTRODUCTION

The power supply unit consist of the A.C and D.C. the A.C. supply is from the National Electric Power Authority (N.E.P.A.) is at 220V A. C, which was step down through 240/12V transformer to 12V A.C. and then converted to12V D.C. through the bridge rectifier. The detector unit operates on two different voltage supplies. There is 9Vterminal tapped via 9V voltage regulator, which are meant to supply the comparator and the Cmos IC. The 12Vterminal is meant to supply for the Audio Visual alarm system.

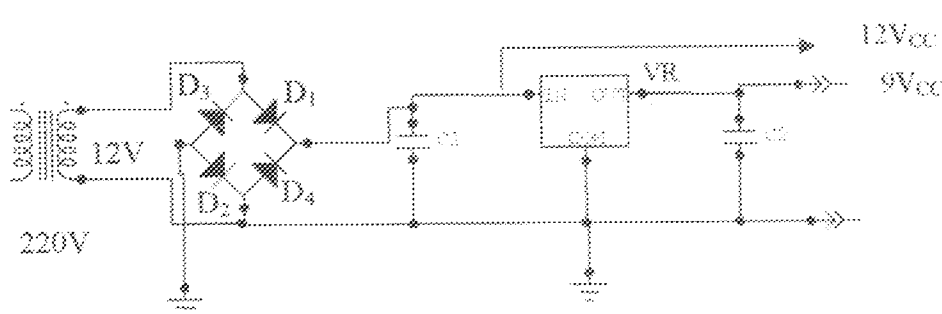


Fig. 2.5.1: The Power Supply Unit

MODE OF OPERATION

Fig.2.5.1a Shows a bridge rectifier circuit. The 220 A.C mains from N.E.P.A. is stepped down using a 240/12V transformer and then rectified through the bridge rectifier. The bridge rectifier is similar to a full-wave rectifier because it produces a full-wave output voltage. Diode D1 and D2 conduct on the positive half cycle and D3 and D4 conduct on the negative half cycle. As a result, the rectified load current flows during both half cycle.

Fig 2.5.1b shows the equivalent circuit for the positive half cycle. As you can see D1 and D2 are forward-biased. This produces a positive load voltage as indicated by the plus-minus polarity across the load resistor. As a memory aid, visualize D2 shorted. Then the circuit that remains is a full- wave rectifier.

Fig 2.5.1c shows the equivalent circuit for the negative half cycle. This time D3 and D4 are forward-biased. This also produces a positive load voltage. If you visualize D3 shorted the circuit looks like a half-wave rectifier. So the bridge rectifier act like two back-to-back half wave rectifier. During both half cycles, the load voltage has the same polarity and the load current is in the same direction. The circuit has changed the A.C. input voltage to the pulsating D.C . output voltage shown in fig the capacitors connected to output of the bridge rectifier are meant to smoothen the output voltages by connecting the output terminal of the bridge rectifier via the capacitors to the ground to remove part of the alternating component and give an output independent of load fluctuation.

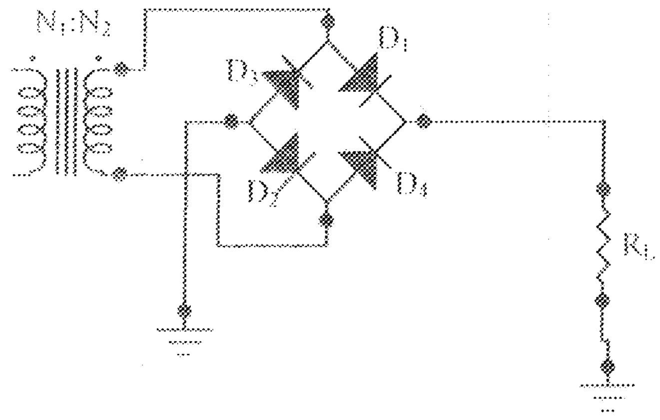


Fig. 2.5.1a Bridge Rectifier

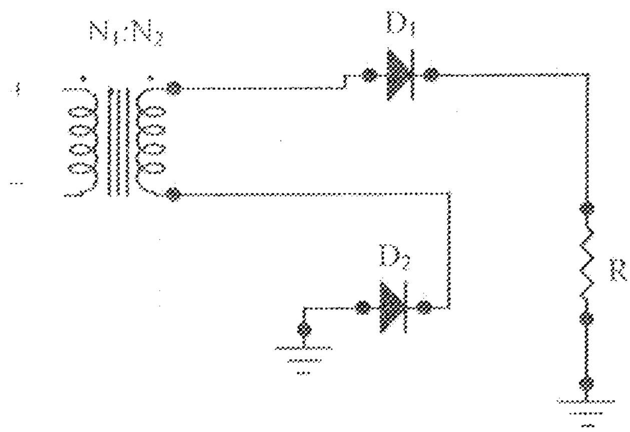


Fig. 2.5.1b Equivalent Circuit for Positive Half Cycle

$N_1:N_2$

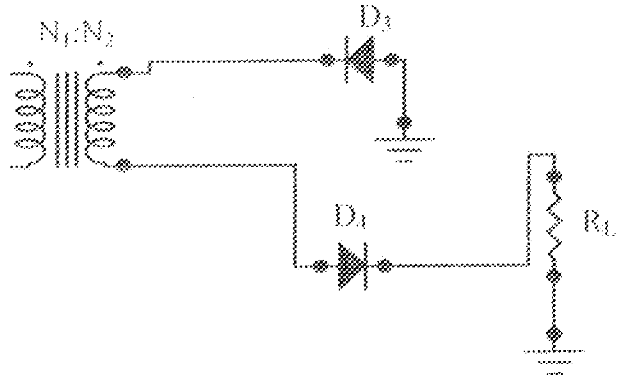


Fig. 2.5.1d Equivalent Circuit for Negative Half Cycle

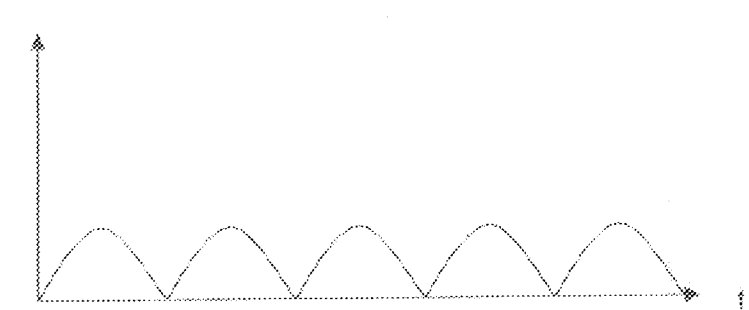


Fig. 2.5.1e Full-wave Rectifier Output

CHAPTER THREE

CONSTRUCTION, TESTING AND RESULT

3.1 ASSEMBLY OF SUB-UNIT

As earlier stated in the previous chapters, the system is made up of three building blocks namely:

i) INPUT DEVICE: These include the transducers like the Thermistor (for heat detection) and the Light Dependent Resistor (for smoke detection).

ii) CONTROL DEVICE: These also includes Cmos IC (4011B NAND GATE), Operational Amplifier (LM324).

iii) OUTPUT DEVICE: this includes the Speaker (8ohm, 3watt), Light Emitting Diode (LED).

The system was power with two different D.C voltages (12Vand 9V) power supply, the 9Vsupply terminal is meant to feed the operational amplifier and IC oscillator, while the 12VD.C terminal is also meant to supply the output devices like the speaker and LED.

The construction was first done on a breadboard and tested in other to have a satisfactory output, i.e. Preliminary test were carried out under induced alarm conditions, and some major and minor adjustment were made on some part and components, for instance, some values of resistors, capacitor and replacement of 9V zener diode with 9Vvoltage regulator until the system operate as expected. With the result gotten as required, then the component were finally transferred into the Vero-board and tested in stages.

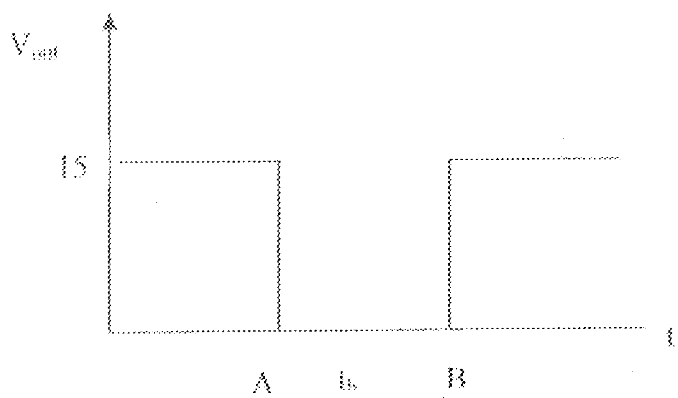
3.2 SYSTEM TESTING

The basic principle of operation of each stages and the expected output were treated in earlier chapters.

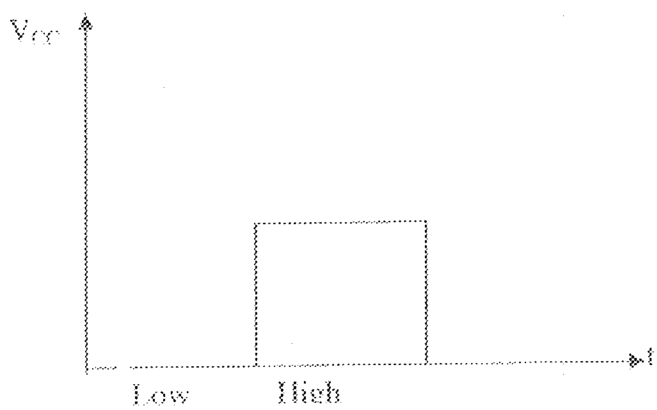
The chapter shows the practical output of all wave-forms of every stages and the expected voltage level at various point were measured respectively. The waveforms were monitored through the use of cathode ray oscilloscope (C.R.O), while the voltage levels were measured using a digital voltmeter.

Resistances and other component specification were gotten from the data book. Those values used can be found in Appendix in the last chapter.

This was done in other to compare the results with the expected theoretical values, the result of the waveforms and voltages at each output stages were drawn as shown below of the



4011B Charging and Discharging Wave-form



LM324 Output Wave-form

3.3 SYSTEM PACKAGING

The complete unit was housed in a wooden case with the following dimension

Height = 8 inches

Length = 13 inches

Width = 8 inches

The power pack, the speaker and the LED bulb were mounted on the front of the case, while provision were made at the back of the casing for A.C and D.C supply, for the input transducers.

The Vero-board was mounted firmly on the base of the wooden case with nuts

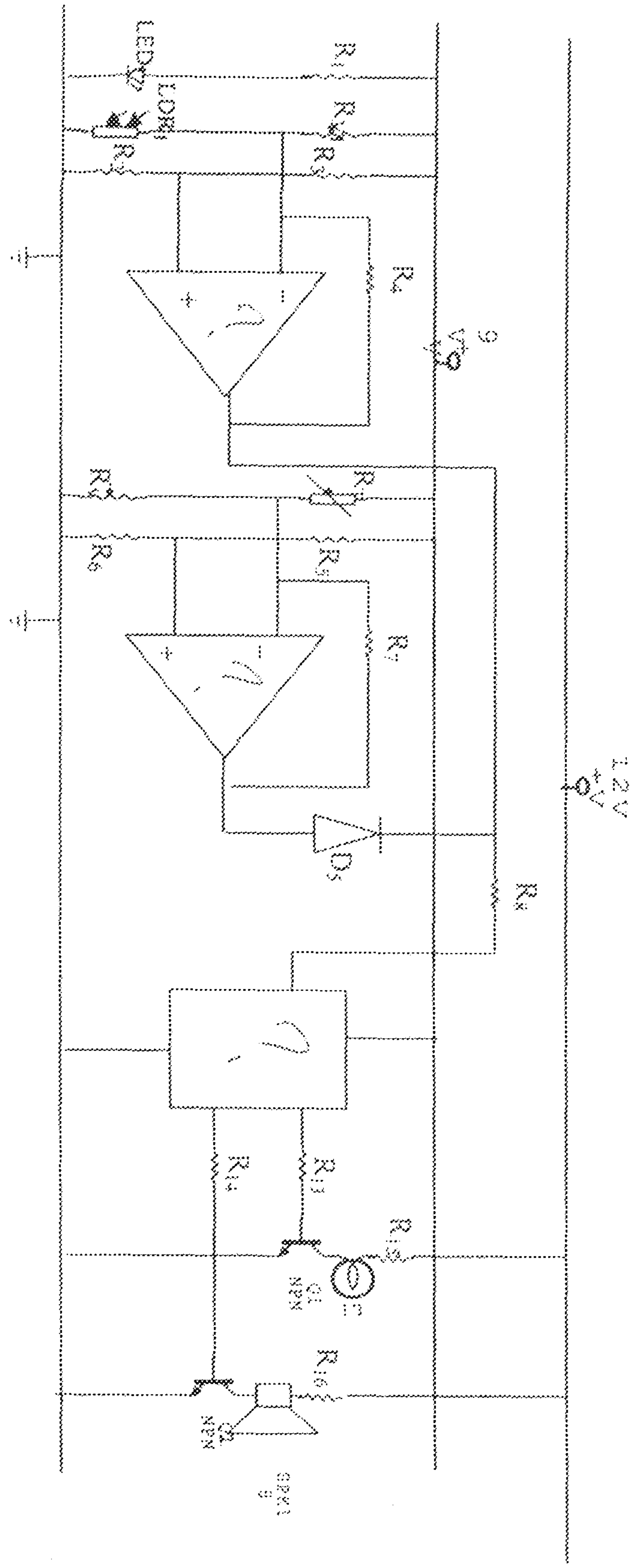


Fig. 2.1 Smoke And Fire Detector Circuit

CHAPTER FOUR

4.1 RECOMMENDATION

Despite the high reliability of the design, some area of the circuit can still be improved upon so as to enhance it, performance. Such improvement could include an increase in sensitivity of the smoke and heat detector, and the use of high watt speaker.

The fire alarm system should be completely segregated from the other wiring circuit, and it should not follow a common route with other route. Other source of power supply should be provided so as to provide an emergency supply to the alarm system incase of power failure from N.E.P.A.

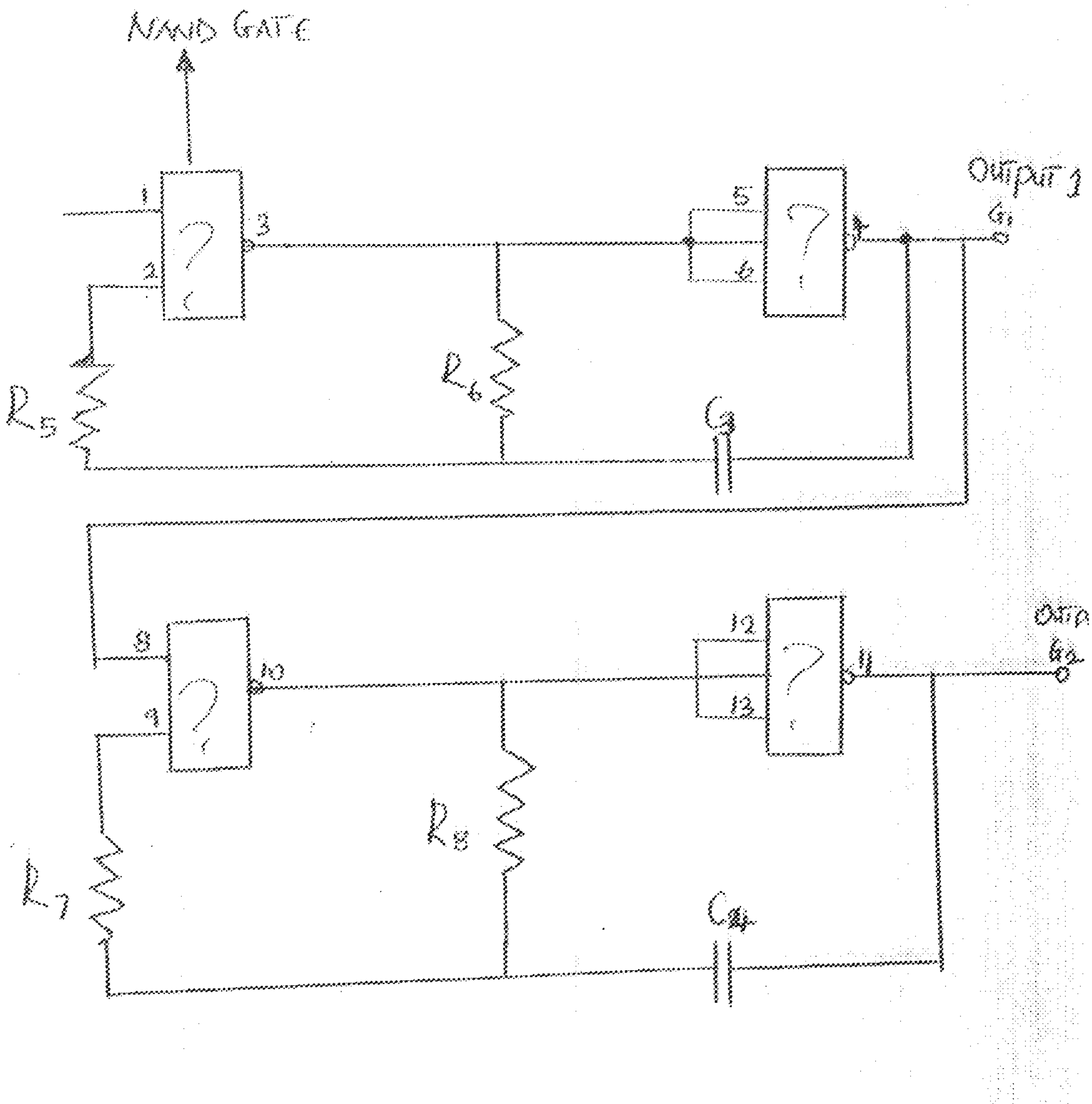


Fig 5.3 Schematic Diagram of the Cmos 4011B IC as Astable Multivibrator

4.2 CONCLUSION

The design and construction of fire and smoke detecting circuit through an alarm system had been carried out successfully. The demonstration of the detecting circuit followed the other of which. Fire produces the heat which are detected through the input transducer the "Thermistor", while the smoke is been detected by the light dependent resistance (LDR)

The primary objective of this project was to produce a prototype detector circuit that would detect the presence of smoke via the combination of the LED and LDR, withy an increase in the temperature of the environment beyond the required temperature (tri-point) through the thermistor and subsequently give an output to indicate the condition of the input ,which as been fulfilled.

With regard to the detector, a detail block schematic diagram and typical installation diagrams were provided in addition to information about the waveforms.

The voltage and current signal in some strategic point in the circuit were also included. This is done in other to facilitate easy maintenance.

The component that made up the detecting circuit include the following, the input transducers, comprises of the Thermistor and Light Dependent Resistor, others include operational amplifier (LM324), IC. Oscillator (4011B), Capacitors, resistors, while 8Ohms, 3Watt Speaker and the Bulb were the output transducers used.

5.3

REFERENCES

1. Albert Paul Marino [1999] Electronics Principles Sixth Edition
2. Bryan John L [1982] Fire Supervision and Detecting Systems
   Second Edition Macmillan.
3. Bare William K,[1977] Foundamental of Fire Prevention Willy.
4. Tom Ducan [1979] Adventures with Micro-Electronic.

4.4 APPENDIX

PART LIST

Item Number	Description	Types
R1	390 Ω	Fixed Resistor
R2	10 kΩ	
R3	10kΩ	"
R4	10kΩ	
R5	10kΩ	
R6	10kΩ	
R7	10kΩ	
R8	1mΩ	
R9	820kΩ	
R10	47kΩ	
R11	22kΩ	
R12	10kΩ	
R13	10kΩ	
R14	330Ω	
R15	330Ω	
R16	50kΩ	"
RV1	50kΩ	Variable Resistor
RV2	3300uf	"
C1	1uf	Electrolytic Type
C2	47nf	Ceramic Type
C3	10nf	
C4	Light Emitting Diode	
LED	Light Emitting Diode Bulb	
LED BULB	Thermistor	
RT	Light Dependent Resistor	
LDR	Tip41 Transistor	
TR1	BD244 Transistor	
TR2	IN5404 Diode	
D1	IN5404 Diode	
D2	IN5404 Diode	
D3	IN5404 Diode	
D4	IN4002 Diode	
D5	LM 324 Op-Amp	
IC1	4011B Cmos IC	
IC2	[220-240]V-12V A.C	
TRANS.	Transformer	
FB	Bridge Rectifier	
RV	Voltage Regulator	
SPK	3Watt, 8ohms Speaker	