DESIGN AND CONSTRUCTION

OF A

FOUR POINT CLOSED CONTACT ALARM UNIT

BY

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SCHOOL OF ENGINERING AND ENGINEERING TECHNOLOGY

NOVEMBER 2007

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IN PARTIAL FULFILLMENT OF THE AWARD OF BACHELOR OF ENGINEERING (B.ENG)
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DEDICATION

I dedicate this project to him whose charge I am, Gracias Sen`or, the LORD Adonai, by whose "effort" this project was brought to a successful completion.

DECLARATION

I, EDDOH AZUMDIALO OLISAELOKA, hereby declare that this thesis is an original work of mine, and has never been presented in any form for the award of degree certificate anywhere. All information obtained from published and unpublished works have been acknowledged.

....	....
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My sincere gratitude goes to my Dad Late Mr Joenez N. Eddoh who received mercy and hold dear to his heart that pristine image of Jesus. My Mum Mrs Francisca N. Eddoh, the pascal Lamb and Laudable Lioness of time and endless Zion,for their love encouragement and support throughout my course. May God bless you all. Amen.

My gratitude also goes to My dear brothers (ADIMABUA and UDOCHUKWU), my dear sisters (NKEMDILIM, NWAKAUSO AND NNEAMAKA),You are special. And to my friends ADESOJI OYEDEJI, GOODMAN and OLADAYO, who have one way or the other contributed immensely. I am very grateful and I pray that God Almighty will bless you in return.

ABSTRACT

This work describes a house burglar Alarm which is a circuit designed basically for the situation where immediate points such as architectural designs and fittings could be a targeted entry point into a building beside the must entry/exit door. If any of the windows, architectural glass designs or door is opened while the system is enabled, the circuit will trip. When the alarm is tripped, the LED light corresponding to the broken point goes off and the buzzer gives a continuous beep. In the case where the house owner or unintentionally trips the alarm a reset button could be pushed within a specific time. This switches off the LED, indicating that the alarm has been reset.

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CHAPTER ONE

INTRODUCTION

1.1 GENERAL INTRODUCTION

Intrusion or burglar alarms have been in existence for over 50 years [1]. They were earlier seen in crude and ineffective mechanical designs. Such devices are found in electronic form today. A system of sensors is connected to a control unit, which in turn connects to a means for announcing the alarm, hopefully to elicit some response. Some systems are dedicated to one mission; others handle fire, intrusion, and safety alarms simultaneously. Sophistication ranges from small, self-contained noisemakers, to complicated, multi-zoned digital systems with color-coded computer monitor outputs. Many of these concepts also apply to portable alarms for protecting cars, trucks or other vehicles and their contents (i.e., "car alarms"). Burglar alarms are sometimes referred to as alarm systems in manner of complexity.

The project is all about a domestic intrusion alarm system that possesses four pressure micro-switches or sensors. That is, the system is useful for 4-point security. Each sensor can be situated at contact point of a door or window. The sensors are on or off in accordance with the state of the targets. Sensors or switches provide information which is electronically manipulated to trigger on a security alarm. The design embodies a special sensor, out of the four, for application in a main entrance. This sensor works alongside two, enabling and disenabling switches which are hidden on a door for its private access. The remaining three sensors can be placed at any other entrances like windows or other architectural designs. The simple device is quite of great importance to home security.

The project is aimed at a reasonable simplicity, therefore, the involved electronic components are quite cheap, compact, flexible, low power consumption and readily available. These leading advantages coupled with intense information about the related components, ease the course of work.

1.2 THE SCOPE OF THE PROJECT

The project is all about a domestic alarm system for 4-points pressure sensor system. The design holds a manual alarm reset. The device is aimed for reasonable simplicity and economic.

1.3 AIM AND OBJECTIVE

The main objective of this project is to design and construct an alarm system using micro-switches as intrusion detectors to trigger on an alarm. The project is aimed at providing a security alarm system to protect users against thieves and intruders, and which helps in pin-pointing exact point(s) of intrusion hence reducing the time spent in searching for the point of intrusion which could give the intruder an escapetimetoescape.

1.4 METHODOLOGY

As earlier explained, the design is based on four pressure micro-switches as input sensors. They provide a high logical level signal as intrusion and otherwise normal situation. A latch is required to hold the summed signal from the sensors altogether. This leading device triggers on an alarm circuit. A reset button is used for getting the alarm off.

In addition, the integrated circuits used are all complementary metal oxide semiconductor (CMOS) type. The logic class of these ICs provide suitable characteristic such as low power consumption, low cost, and wide voltage supply. The integrated circuits are placed under the CMOS 4000 series. This logic series holds numerous functions for almost any logic design.

1.5 MOTIVATION

The high rate of burglar crime which does not spare even the common man is quite alarming. Desires to see this reduced to its barest minimum and give the common man some security serves as motivation.

Furthermore, the drive to reduce the huge resources spent on importing similar and more expensive products from without the country, thereby enhancing our foreign reserves, present a strong motivation in the execution of this project.

CHAPTER TWO

LITERATURE REVIEW / THEORITICAL BACKGROUND

2.1 LITERATURE REVIEW

Alarm is defined as a state of fear or heightened anxiety and comes from old Italian all arme - all arm - a call to arms. Nature makes wide use of alarm calls. The raucous shriek of angry birds echoes through every jungle alerting of danger. In any back garden a stalking cat can be thwarted by the shrill cries of a startled worm-puller.

Humans have adopted and adapted many ways of providing alarms [2]. Early men kept barking dogs to alert of approaching danger. Through the centuries guards blew horns, lit hill top beacons, sent smoke signals, flashed mirrors, fired gunshots, rang church bells, shot rockets to alert the tribe or army, Little bells attached to a door that rang when it was opened, tin cans tied to a string across a pathway, and the likes served. One day, someone placed a large bell into a metal enclosure and placed four lantern batteries inside of it with a relay and mounted it to the outside of the building.

From the enclosure there were two sets of wires, one for the door contacts and the other for the key switch that turned the bell on and off. This technology is commonly referred to as the 'local bell'. Keeping the batteries running was one major setback to its application.

This simple system used the relay to monitor the door contacts. The key switch was located outside, and the owner would close all of the doors and turn the key at night. If the doors were opened with the key switch on, the bell would ring. Closing the door would stop the bell, only by turning the key could one silence it. The local bell uses a wiring scheme that latches the relay contact into an alarm condition. This was very popular for a while until people figured out that the bell could be yanked from the wall and quickly silenced.[3].

Development and discoveries through the years in the technologies of electronic components, like the resistors diodes, transistors, capacitors, etc has also translated into technological growth in the construction of burglar alarms. Engineers had to use vacuum tubes before the transistors. Just as the transistor, the vacuum tube can switch electricity on or off, or amplify a current. But there were several reasons to replace the vacuum tube. It generates a lot of heat and has a tendency to burn out. Compared to the transistor, it is slow, big and bulky. The invention of transistors came as a revolution. It was small, fast, reliable and effective, it quickly replaced the vacuum tube [4].

Hence, use of security alarms is dated back far in time. From early available designs involved mechanical configurations adapted from old mechanical alarm clocks to those applying highly sensitive sensors and automatic in operation. Traditional mechanical alarm clocks having a bell on top that rings was easily modified and replaced by electrically designed sound producers like buzzers, sirens and loudspeakers for security applications.

The development of solid-state electronics has provided room for smaller advanced and effective security devices. The most interesting advantage of electronic security devices is the cognizance of present day realities, availability, reliability and low cost of installation. The Closed Contact Alarm utilizes the simplest of components to give the much desired result, rendering it cost effective since components are readily available and reliable at regulated ratings.

2.2 THEORETICAL BACKGROUND

Most burglar alarm systems involve a circuit loop system that rings a bell or activates a siren when set off. A central control box can monitor more than one related detectors or sensors. The controls monitor responses to corresponding signals from the sensors by triggering on an alarm.

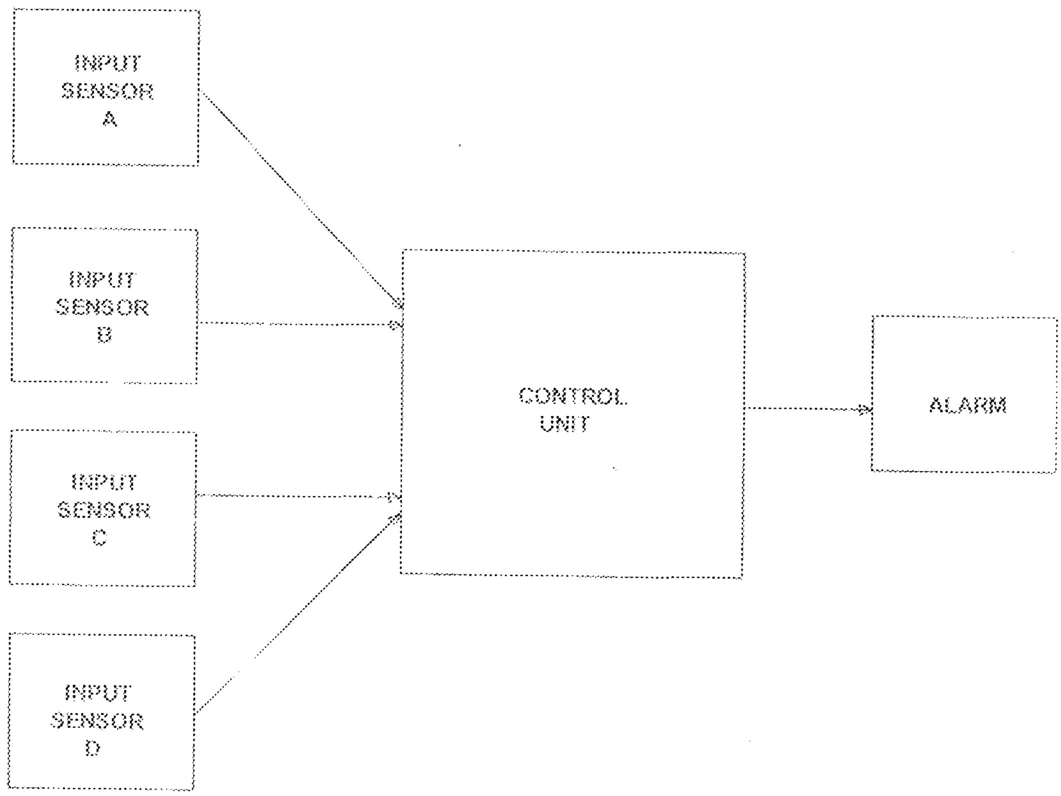

Fig 2.1: A Typical Intruder Alarm System Block Diagram

2.3 TYPE OF INTRUSION DETECTORS

Intrusion detectors are generally of two classes:

1) Point detectors

2) Area (or volume) detectors.

[1] Point detectors indicate an intrusion at a specific point, and types include mechanical or magnetic contacts on doors and windows to detect when they are opened or broken, photocell or microwave beams across pathways, pressure-sensitive mats, fiber-optic bend or stress sensors (e.g for wire fences), proximity switches that detect humans and vibration sensors among others.

[2] Area detectors indicate an intruder's presence within the protected area and use such technologies as Ultrasonic transducers, passive infra-red (heat) detectors, and microwave transducers (sometimes in combination within one sensor). In general, area sensors detect a sudden change in the measurements being taken and trigger at some predetermined threshold. They are much more prone to false alarms than Point sensors, often because of improper aiming or other adjustments [5].

2.4 ACCESS, CONTROL AND BYPASS CODES

To be useful, an intrusion alarm system is deactivated or reconfigured when authorized personnel are present. Authorization may be indicated in any number of ways, often with keys or codes used at the control panel or a remote panel near an entry. High-security alarms may require multiple codes, or a fingerprint, badge, hand-geometry, retinal scan, encrypted response generator, or other means that are deemed sufficiently secure for the purpose.

Failed authorizations should result in an alarm or at least a timed lockout to prevent "experimenting" with possible codes. Some systems can be configured to permit deactivation of individual sensors or groups. Others can also be programmed to bypass or ignore individual sensors (once or multiple times) and leave the remainder of the system armed. This feature is useful for permitting a single door to be opened and closed before the alarm is armed, or to permit a person to leave, but not return. High-end systems allow multiple access codes, and may even permit them to be used only once, or on particular days, or only in combination with other users' codes (i.e., escorted). In any case, a remote monitoring center should arrange an oral code to be provided by an authorized person in case of false alarms, so the monitoring center can be assured that a further alarm response is unnecessary. As with access codes, there can also be a hierarchy of oral codes, say, for furnace repairperson to enter the kitchen and basement sensor areas but not the silver vault in the butler's pantry. There are also systems that permit a "duress" code to be entered and silence the local alarm, but still trigger the remote alarm to summon the police to a robbery [6].

2.5 PRINCIPLE OF OPERATION

The system depends on the opening of any of the doors, windows or any suspected architectural design to operate. The opening of any of the aforementioned points triggers the circuit. The circuit is powered from the alternating current source. This makes it possible to link both the door (MUST ENTRY/ENTRY POINT), windows and several other house designs (IMMEDIATE POINTS) through a common means to the alarm circuit.

The switch is OFF WHEN all the points are closed and ON when any of the doors is open. When an immediate point is opened, the alarm is immediately turned on. This is indicated by the LED lighting corresponding to that point going off and the buzzer giving a continuous beep. Its length is determined by pressing the reset button. The must entry and exit works in a slightly different manner. It permits entry/exit without triggering an alarm if its DISABLE button is opened. When ENABLED and door is opened, the alarm is immediately turned on. This is indicated by the LED lighting corresponding to that point going off and the buzzer giving a continuous beep. Its length is determined by pressing the reset button. The set and reset buttons are only concealed to the user and placed in a position only known to the user. In a situation where an authorized person unintentionally trips the circuit; these first indications are to alert such a person to the need to push the reset button. Once the reset button is pushed, the LED is switched off to indicate that the alarm has reset.

If the reset button is not pressed, which begin to sound continuously. This is primarily to attract the attention of security personnel. The reset button will be placed where only authorized persons can locate it. The system has got a silence button; therefore siren could be silenced by user if he/she gets use to any LED indication going off signaling intrusion of either point.

CHAPTER THREE

CIRCUIT DESIGN ANALYSIS

3.1 DESIGN ANALYSIS

The project involves the following units:

1) Power unit
2) Input sensor/switch unit
3) control latch unit
4) Alarm unit

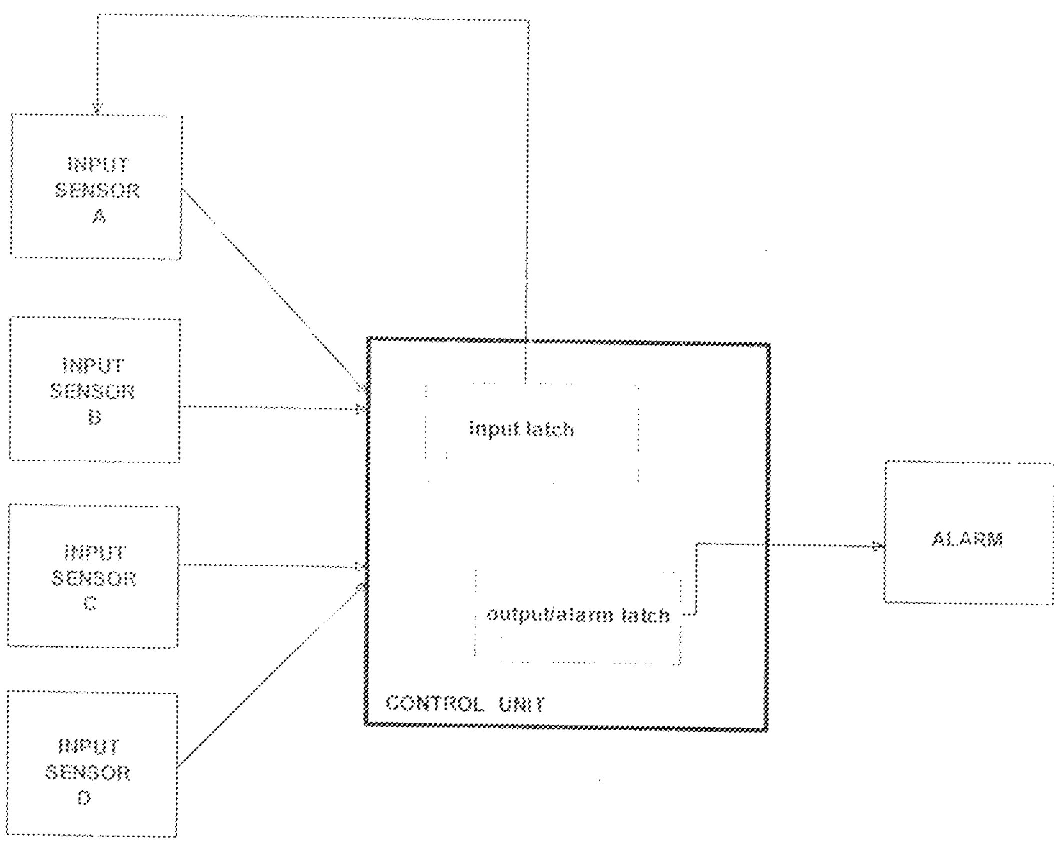

Fig 3.1: The Simple Circuit's Block Diagram

3.1.1 THE POWER UNIT

The power unit holds a 220/12V step-down transformer, bridge rectifier, a filter capacitor (2200µF 35V), a power indicator circuit, and a 5V regulator (7805).

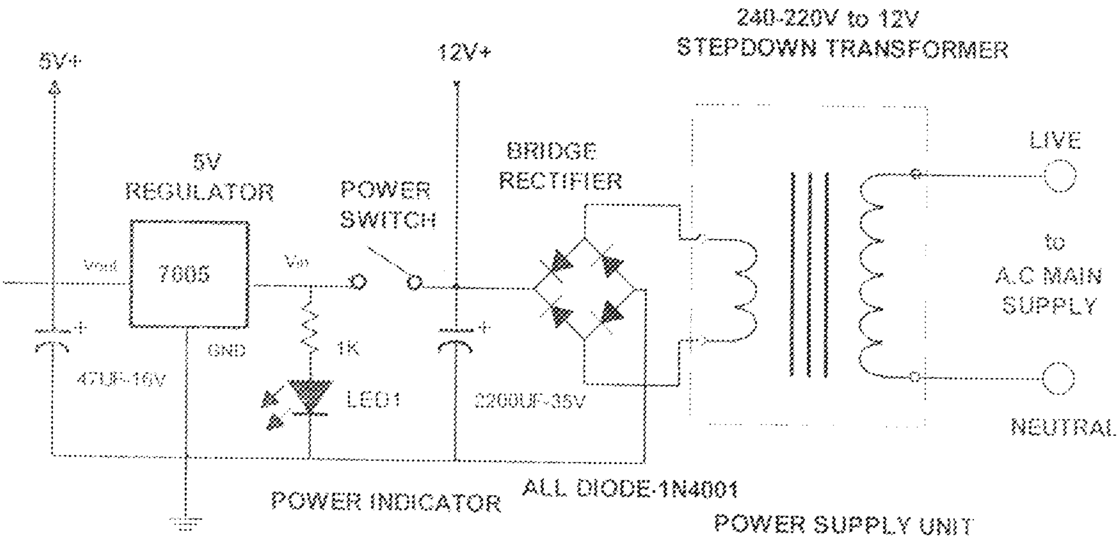

Fig 3.2: The Power Unit

The transformer is rated at 500mA.It steps down 220V A.C from mains input into corresponding 12V for the bridge rectifier.

3.1.1.1 THE RECTIFIER

The common bridge rectifier, comprising of four rectifying diodes, is the base of the power supply unit. The diodes serve in converting the12V AC into corresponding D.C. The leading connection allows only two of the diodes to be active or forward biased at a particular half-cycle of the alternating voltage.

The devices direct the negative and positive components of the alternating current to separate terminals or points. Therefore, a polarized output is given fonn the configuration.

The output from the rectifier is expected to be fully D.C. But, this is not always true. The voltage is attributed to ripple, a signal of small component of the A.C input. The frequent way of removing the unwanted feature is the use of a polarized or electrolytic capacitor.

The peak output voltage of the supply transformer is V_p

Where $V_p = \sqrt{2}\ V_{rms}$ and $V_{rms} = 12V$

$V_p = 12\sqrt{2}$

$V_p = 16.97V$

The peak-to-peak current of the supply is given as $I_p = I_{dc} = 500mA$

Since the DC voltage is given as approximately 12V,the filter capacitor working voltage must be twice V_p i.e $(2 * 16.97V) = 33.941V$, hence a 35V capacitor was chosen.

3.1.1.2 VOLTAGE REGULATOR

In order to supply a steady 5V to the circuit, especially to the section involving the logical devices, a 7805 regulator is incorporated into the design.

The 7805 is a positive voltage regulator. It is rated maximum current and voltage of 1A and 35V respectively.

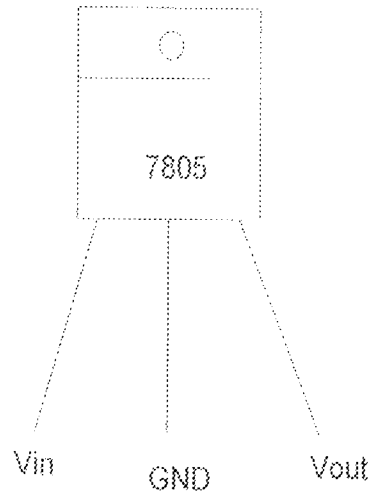

Fig 3.3: The Pin Arrangement of The 7805

A power indicator circuit is involved for indicating the presence of electric current in the circuit. The circuit involves a resistor and light emitting diode (LED). The resistor allows a voltage drop of around 2.7V across the light indicator.
The circuit involves a resistor and Light Emitting Diode (LED). The resistor allows a voltage drop of around 2.7V across the light indicator.

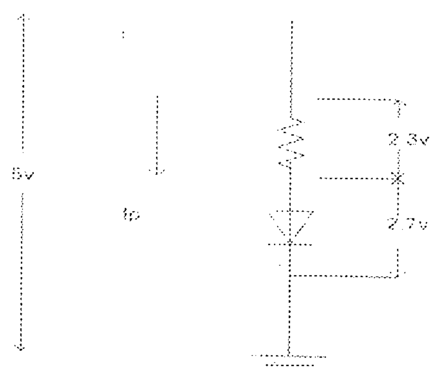

Fig 3.4 : Indicating Voltage Drop Across Resistor and LED

3.1.1.3 THE POWER INDICATOR CIRCUIT

A typical current (I_p) of 3mA is expected flowing in the series connection.

Therefore, the likely value of R_p is given below; -

$$R_p = \frac{2.3}{3 \times 10^{-3}}$$

$$R_p = 766.65\Omega$$

A 100 Ohms resistor is used in the circuit. It is quite a practical value. The use results into little or no difference in the circuit, only the light coming out of the LED is dimmer.

Moreover, the unregulated voltage, from the rectifier, is directly supplied to the alarm unit for high current availability.

3.2 INPUT SENSOR/SWITCH UINT

The diagram below shows the connection of a sensor. The sensor or switch is normally opened. Points "a" and "b" are always negative and positive respectively. Terminal "b' attains the state of "a" whenever the switch is at the close state. Therefore, whenever a secured entrance is opened, the output of the sensor is positive or logical 1 at 5V.Otherwise, the output is low or at logical 0 at relatively 0V.All the four sensors work in similar ways.

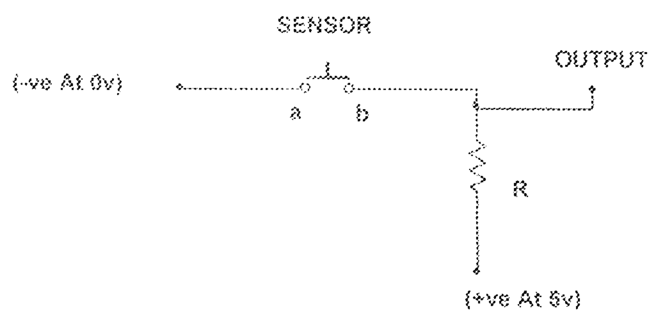

Fig 3.5: The Connection of An Input Sensor

Moreover, input pressure sensor A works in a slightly different manner to others. Its terminal b is connected to the output of the input control latch in which availability of high logical level can be controlled through a reset and set buttons. This operation is explained latter at the control latch unit

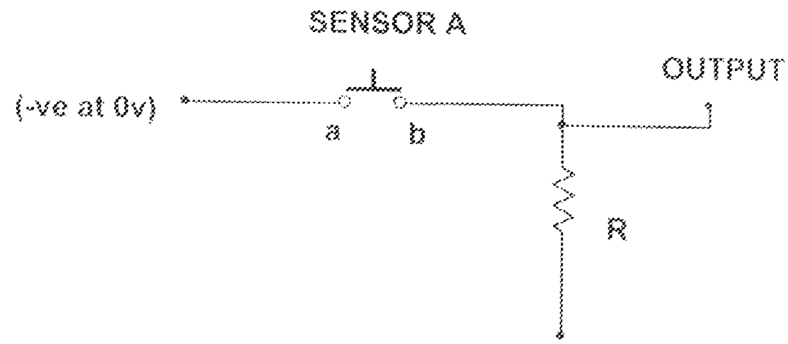

Fig 3.6: The Connection of Input Sensor A

The altogether four outputs from the sensors are summed into one terminal by a 4-input Diode-Resistor-logic OR gate. The application diode for such logic involves economic. The diagram below shows the equivalent of the logic.

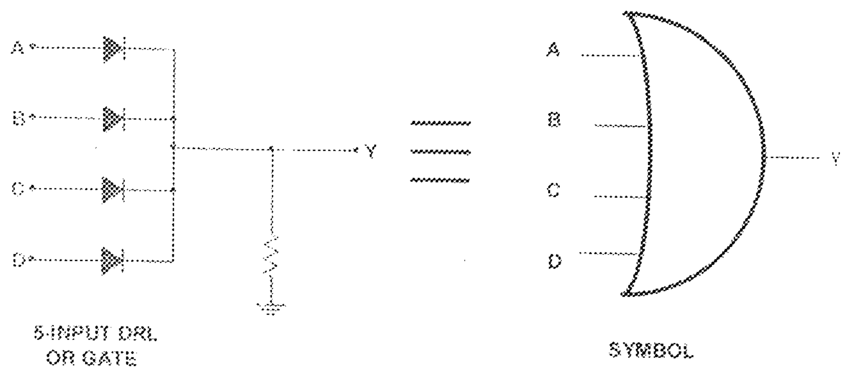

Fig 3.7: Diagram of a 4-Input Diode-Resistor-Logic OR Gate

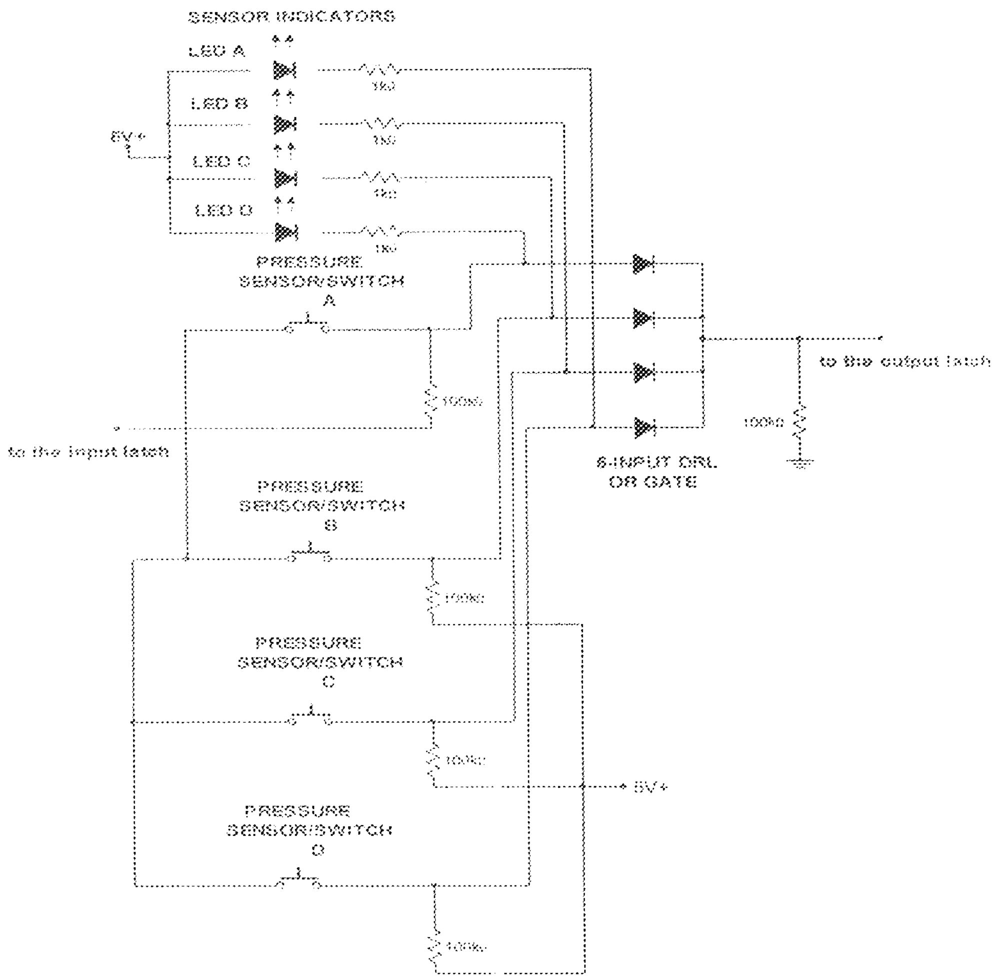

Fig 3.8: The Main Input Sensor Unit

Also, the circuit embodies a set of Light Emitting Diode (LED) indicators for showing the state of the sensors. Normally, the indicators are ought to be on. Otherwise, the corresponding sensor is opened, a detection of intrusion. Each LED is biased through the negative terminal of the output of the corresponding input sensor. The leading connection takes the case of the power indicator, therefore, similar calculations.

3.3 CONTROL LATCH UNIT

There are two involved latches. They are derived from the 4013B CMOS integrated circuit. The 4013B is a dual D-type flip-flop integrated circuit with SET and RESET features. The device has fourteen pins and operates with 3-18V power supply range. The whole input of the logic device is active high. It is usually used for storage and holding control applications. It serves the project through input latch operation.

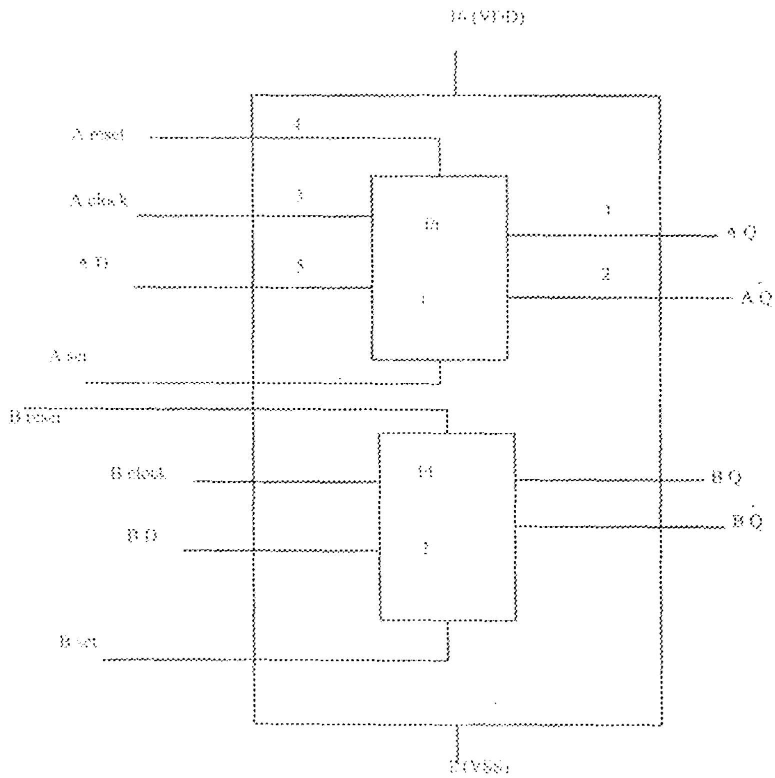

Fig 3.9: The Functional Diagram of The 4013B.

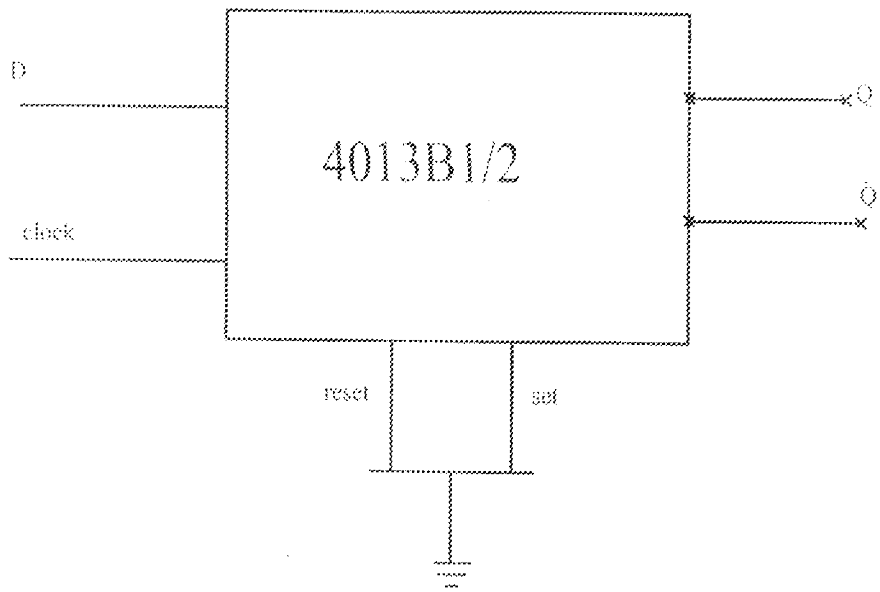

Fig. 3.1.0: The D-Type Configuration of The 4013B

The D-type configuration involves the grounding of both reset and set terminals. The logical level at D input is stored at Q output in positive trigger for the clock.

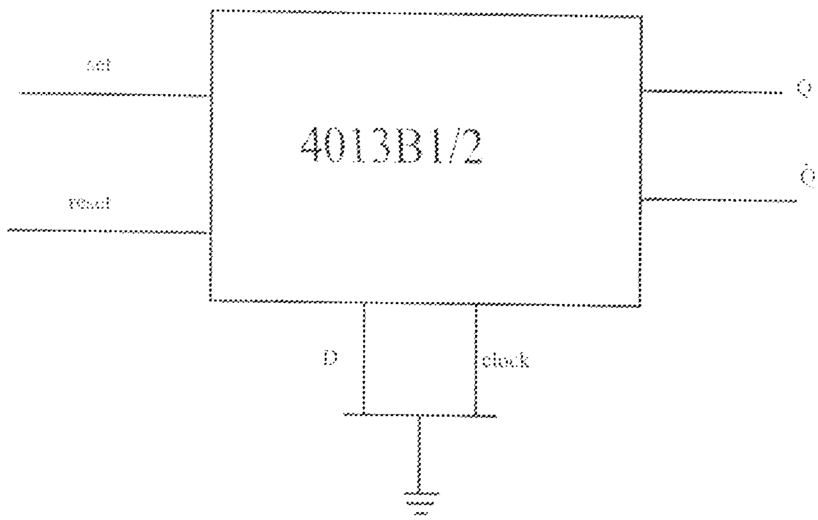

Fig. 3.1.1: The SR Configuration of The 4013B

Tab 3.1: An SR Configuration truth table

S	R	Q	$\overline{Q}$
0	1	0	1
1	0	1	0
1	1	1	1
0	0	Qn	$\overline{Q}$ n

Qn, $\overline{Q}$ n are indifferent starters.

3.3.1 INPUT LATCH

The input latch is designed to control input sensor A through the input set and reset buttons. The two soft touch buttons are pressed to make the set and reset terminals of the latch logical 1.The connected resistors provide an initially logical 0 state for the terminals. By convention, the value of the resistors ranges from 1K to 1M Ohms. Therefore, the choice of 10K Ohms is quite suitable.

Moreover, a high logical level signal is required from the sensors in other to trigger on the alarm. The input latch allows the disenabling and enabling of the input sensor A through its output, a means of "access control" and "bypass codes". The two control micro-switches are hidden at entrance, especially door, in order for an authorized person to access the entrance. Therefore, each one is placed at one side of the entrance or door.

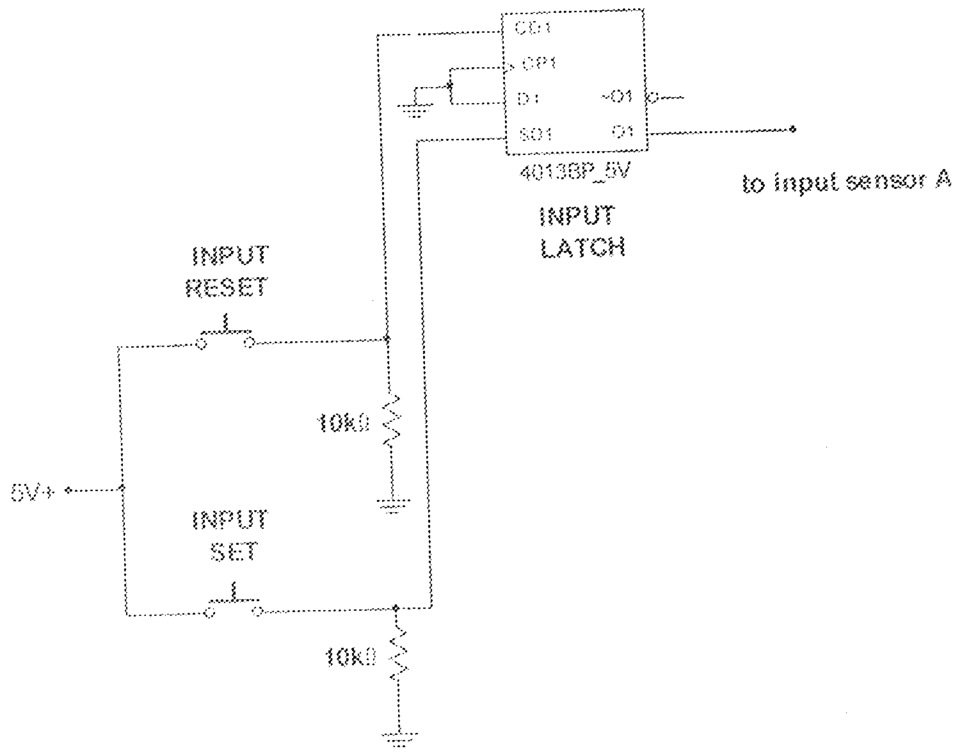

Fig 3.1.2 . The Input Latch Unit.

The input set micro-switch enables security at the entrance; while the other switch, disenabling.

3.3.2 ALARM LATCH

The alarm latch is incorporated into the design to control the alarm or the involved oscillator (4060B).It works one and the same way as the other latch only that their targets are different. A high logical level signal from the 4-input OR gate gets the ~Q of the alarm latch low logical level. This logical state enables the alarm oscillator (4060B).

The 2-input DRL OR gate allows two inputs into the reset terminal of the alarm latch in order to get the ~Q output logical 1.In other words, the alarm oscillator is discnabled.

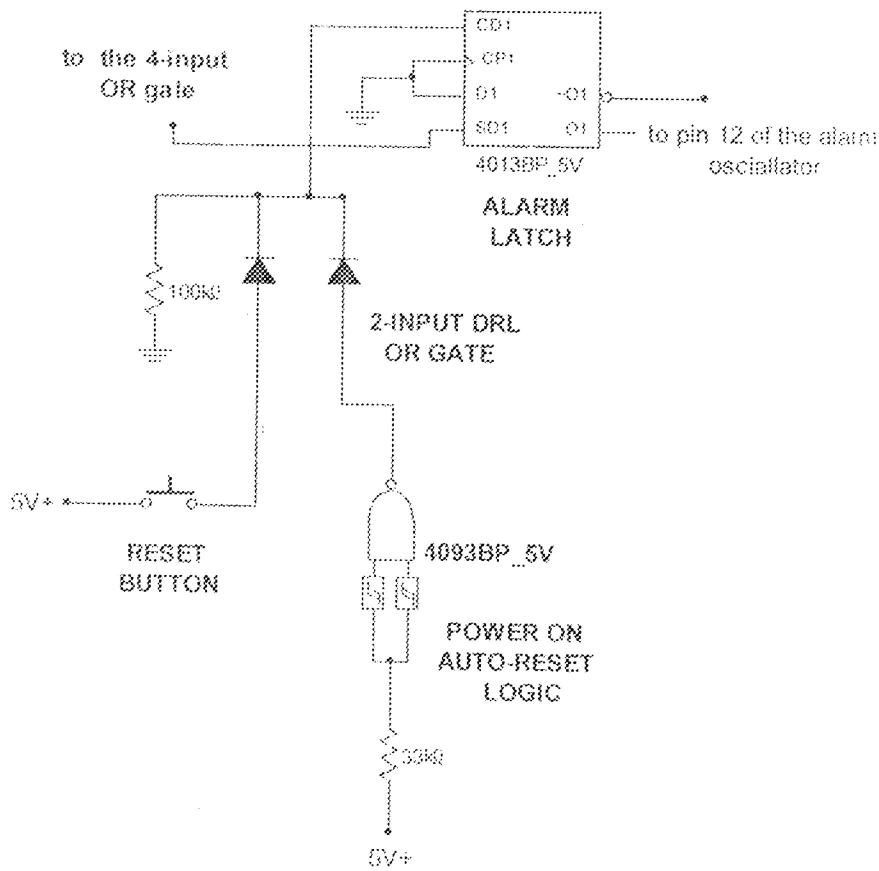

Fig 3.1.3: The Alarm Latch Unit

One of the terminals of the 2-input OR gate is connected to a Schmitt trigger 2-input AND gate. The two inputs of the AND gate are connected together then through a 33KΩ resistor to the positive power terminal. This configuration allows the alarm latch to be at the state to disable the alarm oscillator whenever the power is just on. In such situation, the Schmitt trigger sends a sharp high level signal to the reset terminal of the alarm latch through the OR gate, instead of the expected steady high logical level signal. The other terminal of the OR gate provides manual reset of the latch through a high logical level signal from the pressed rest button. The associated resistor to the Schmitt trigger can be any value within 1K-1MΩ.

3.4 THE ALARM UNIT

The main component of the alarm unit is the 4060B CMOS integrated circuit. The 4060B is a 16-Pin 4000 series CMOS 14-stage counter/oscillator/divider integrated circuit. It is designed to generate ten (10) different frequencies from a practical high one. The oscillator can be configured both in RC and crystal mode [8]. The RC configuration used in this work. The RC mode is commonly used for different applications. Three terminals (pin 12, 11, 10) deal with the oscillation modes. Power supply range is within 3-18V. Pin 12 of the 4060B is normally made logic 0 for enabling. Whenever high local level is applied to this pin; all the frequency outputs are reset or low level. In addition, its whole outputs are buffered. This feature protects the integrated circuit from destruction due to static charge

This integrated circuit is far better than the common 555 timer in numerous ways, one of which is the multiple frequency outputs associated with the 4060B, but the 555 timer is not capable of performing such function.

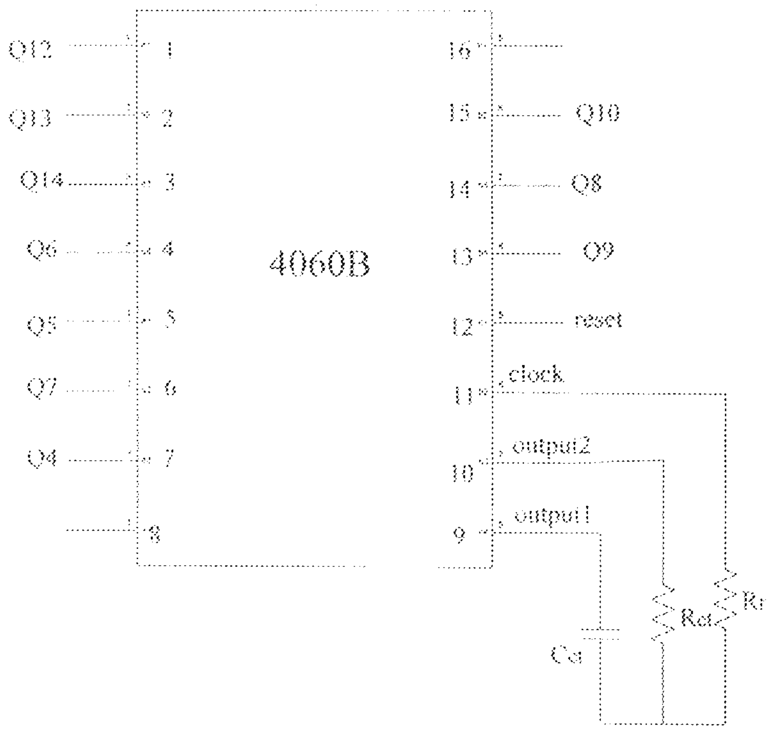

Fig 3.1.4: The Functional Diagram of The 4060B

Two resistors and a capacitor are required for any RL configuration of the 4060B.

The main frequency of operation is given below:-

$f_m = 1/2.3(R_{ct} C_{ct})$

The relationship between R_t and R_{ct} is given below:-

$10R_{ct} \geq R_t \geq 2R_{ct}$

The value of the resistance is below 1mΩ and, the two relationships are useful for frequency below 100 kHz at 10V power supply [7].

For the alarm oscillator:

F_m=1/(2.3 * 33 * 10^3 *0.001 * 10^{-6})

F_m=13.2 kHz

The frequency output from pin 3 is given below:

$F_{pin\ 3} = F_m / 2^{14}$ = 13.2 kHz / 2^{14} = 0.805Hz

F_{pin3} = 0.805Hz

The frequency output of pin 6 is given below:

$F_{pin6} = F_m / 2^7$ = 13.2 kHz / 2^7

F_{pin6} = 103.125 Hz

These two frequencies are required to be mixed together to generate an alarm signal. The mixing is done with two 1KΩ resistor .They are connected to the base of the output NPN transistor as shown in the diagram below. Moreover, the alarm latch control the 4060B.

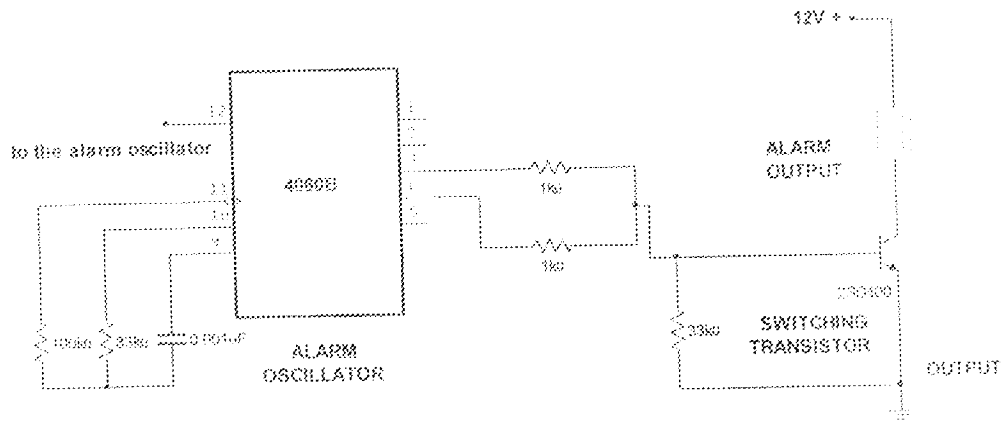

Fig 3..1.5: The Alarm Unit

3.4.1 THE OUTPUT AMPLIFIER

A 2SD400 NPN transistor is used in the amplification of the resulting alarm signal to a 1 watt speaker. The leading amplifier is common emitter configuration. The circuit is a mere switch.

The 2SD400 is an NPN transistor with maximum voltage and current of 30V and 1A respectively. It is used for high current switching operations.

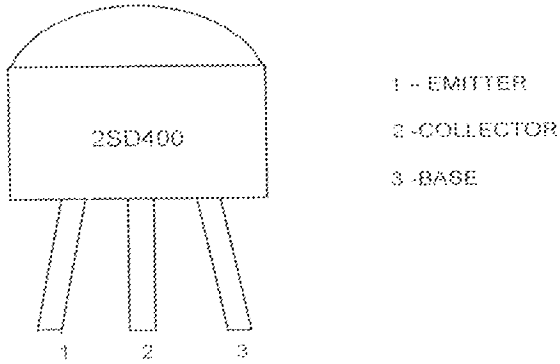

Fig 3.1.6: Pin layout of 2SD400 transistor

The resistances of the output speaker is 8Ω

The expected theoretical current of the collector of the transistor is given below:

$I_c = V_{cc} / 8 = 12 / 8 = 1.5$ A

The real or practical current value is for below the above.

Taken the Current gain (h_{fe}) of the transistor as 100.

Therefore, $I_b = 1.5 / 100 = 0.015$ A

The base resistance = 5 / 0.015 = 333.33 Ω

But, a base resistance of 1kΩ is used for each mixing signal to the output transistor in order to lower the base current. This is because the transistor in use has a maximum allowable current at the oscillator, I_C of 1A. Therefore, the available output electric current for the speaker is reduced or lower than expected. The reduction limits power consumption or output of the output stage.

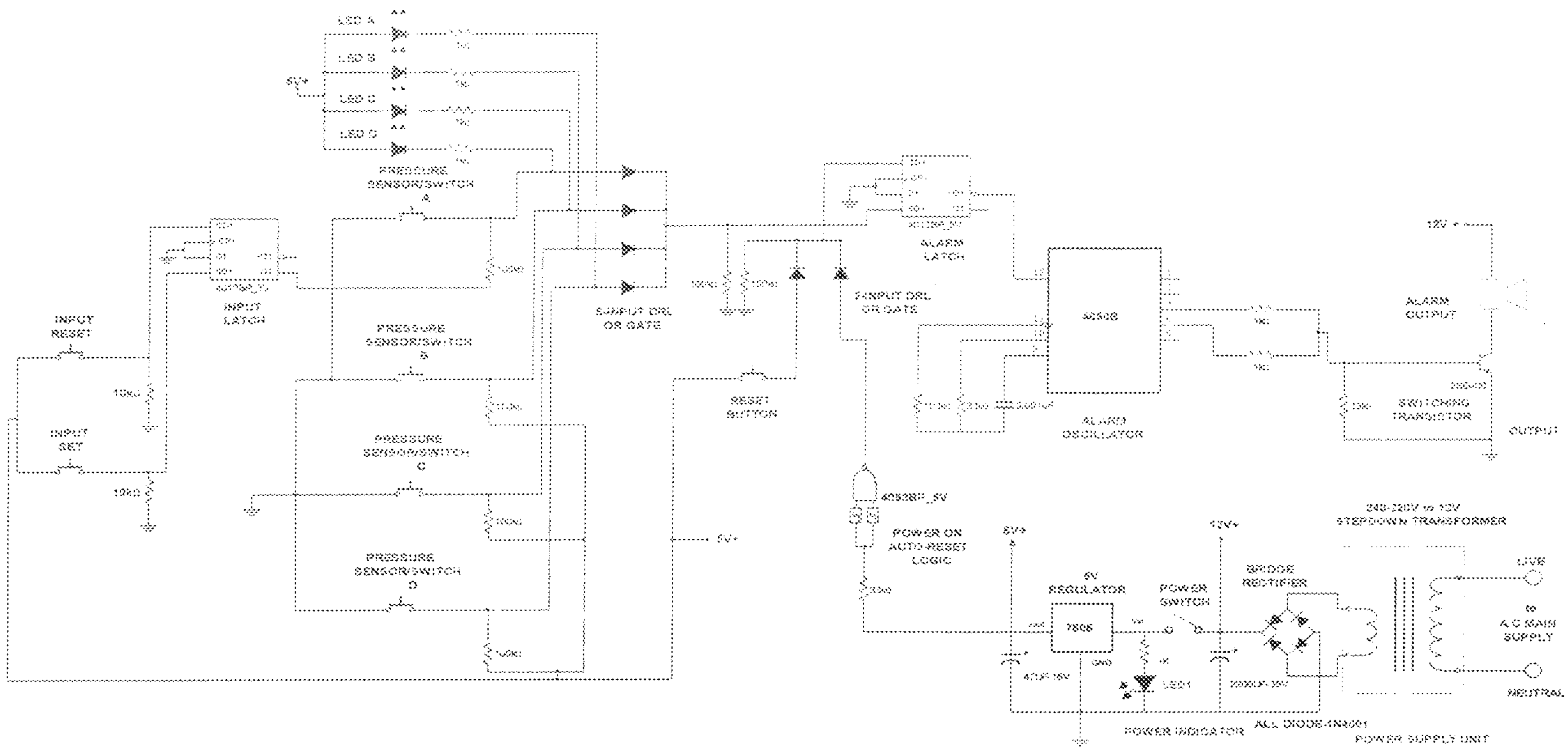

Fig. 3.1.7: circuit diagram showing 4-points closed contact alarm unit

CHAPTER FOUR

CONSTRUCTION, TESTING AND DISCUSSION OF RESULT

4.1 CIRCUIT CONSTRUCTION

The first step in the construction of the project was the purchase of the needed components and materials. Each part is independently and properly tested for any malfunction or defect.

The power circuit was first mounted on a Vero board which was before then cut into proper shape to fit the estimated size of the circuit. Integrated circuit sockets were used to protect the components from heat related damage that may occur during soldering. Other component such as capacitors, resistor and diodes were directly soldered to the Vero board. The soldering operation was done as fast as possible to avoid damage of the component due to heat. Connecting wires were extensively used for connecting the component in line with the circuit diagram. Some of these wires were needed to be glue to the board to avoid prevent unwanted removal. Afterwards the circuit connections were properly tested for any wrong or error placement. Short circuit was quite avoided managing the involved components when the circuit was plugged to electricity.

4.2 CASING CONSTRUCTION

The casing was made with a plastic case which is available in the market, suitable positions were selected for each part of the complete circuit and holes were bored in the case to properly fit the project use.

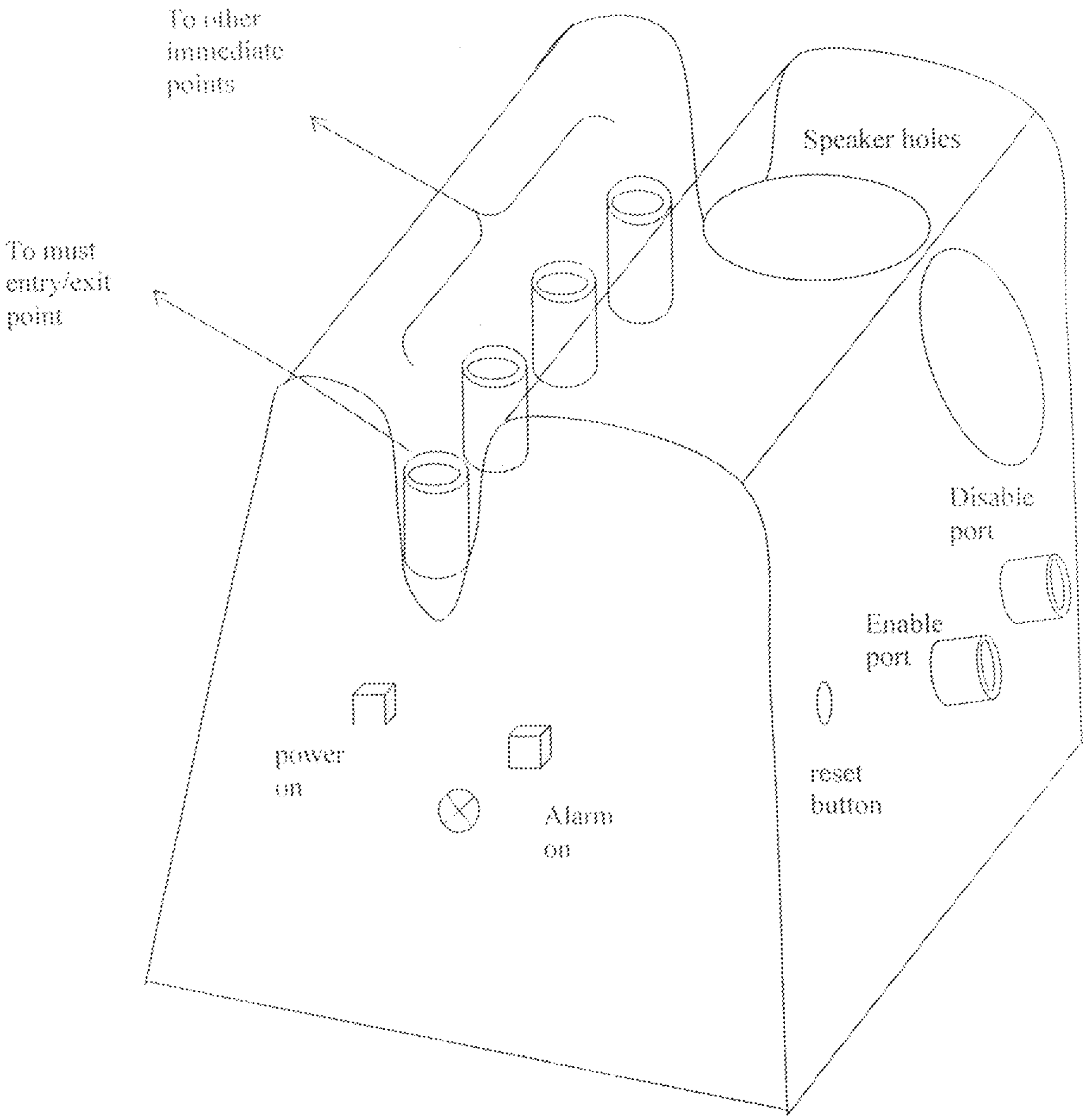

Fig 4.1: Diagram of Alarm Unit Showing Encasement

4.3 TESTING

The testing was done after the whole components are connected to their proper points. The device was powered while the four input switches or sensors were under pressure, simulating close state. The one of the sensor was set free then returned back to the close state. Moreover, more of such test was performed to the other sensors even in groups.

Sensor A was tested to check the workability of the corresponding disenabling and enabling micro-switches. The main alarm reset button was tested for control over the output alarm. These tests were properly carried out for true results.

4.4 RESULT AND DISCUSSION

It was observed that any loosed or free input sensor triggered on the alarm. The alarm was still on even when the sensors were returned back to the close state. The input sensor behaved quite differently to the others through its relationship with the input latch.

When activated, the disenabling micro-switch was enabling to put the leading sensor in action. The other micro-switch activates the inputs switch. The alarm could be off whenever the reset button was pressed.

CHAPTER FIVE

CONCLUSION, PRECAUTIONS AND RECOMMENDATIONS

5.1 CONCLUSION

The project demonstrated the mere application of logic units for security importance. The attributed simplicity of the circuit corresponds to limited level of problems during the course of circuit's design and construction. In fact, the ease of work is attributed to the acquired relevant information on the involved components.

The project provided an interesting practical experience of electronics and its economic value.

Moreover, the main aim of this project, which is to design and construct an intruder alarm system using micro-switches as intrusion sensors and which could trigger on an alarm was a success.

5.2 PROBLEM ENCOUNTERED

* The acquisition of related components was quite a task

* The initial design went through numerous modifications before success

* The access to relevant information was quite a problem

* The placement of the completed circuit board and other relevant components into the casing

5.3 RECOMMENDATION

- The circuit could be made more complicated through the application of microcontroller.
- More sensors could be incorporated into the system to secure more points.
- Each input sensor could be connected to a particular latch to hold the information of intrusion moment after the event.
- Different alarm could be use in identifying intrusion points
- The device could be battery powered for portability, efficiency and flexibility.
- The enabling and disabling micro-switches could take other secret configurations to increase the chances of detection.

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