THE DESIGN AND CONSTRUCTION OF A TOUCH ALARM SECURITY SYSTEM

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A THESIS REPORT SUBMITTED AS A PRE-REQUISTIE FOR AWARD OF BACHELOR OF ENGINEERING (B.Eng) DEGREE IN THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING IN THE SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY
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DEDICATION

I dedicate this project to Almighty God for being my shepherd throughout my research that finally culminated in this feasible work piece, may his grace continue to be my strength. (Amen).

ACKNOWLEDGEMENT

With all honor and deep sense of appreciation, my gratitude goes to almighty God for his protection, guidance and his inspiration during and after the completion of this project work. My profound gratitude goes to my supervisor Mr. Ozomata David Ahmed for his encouragement,timelyand useful suggestion.

To my esteemed and irreplaceable Family, Mr. And Mrs., U.E. Attoh, for the untiring support. My Brothers (Olisa and Emeka), my Sister (Ifeoma) my Aunt (Nkechi, Ekwi) for there prayers, support and love. You are all the best.

Credit also goes to my friends (Choosey, Oba, Jalil, Bongus, & Usman) love you all so much. With your support this project was possible. I am grateful to all those who in different ways immeasurable have been instrumental to my achievement, I remain forever grateful.

DECLARATION

I, ATTOH UCHE ADEBAYO, hereby declare that this thesis is an original work of mine, and that it has never been presented in any form for the award of either Diploma or Degree Certificate any where

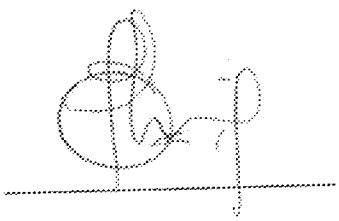
All information obtained from published and unpublished work has been acknowledged.

Signed: _____

Date: _____

CERTIFICATION

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



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ABSTRACT

The Touch Alarm Security System, the purpose of the project, is to provide a cost – effective security for both homes and industries to assist other security placements. The core of the project is the touch sensitive sensor. This is responsible for detecting intrusion by an unauthorized person. There are three different alarm sounds, one for each probe touched and a third for when both probes are touched. This is to make location of intrusion easier to detect by making a counter decision easier to make.

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CHAPTER ONE

1.1 INTRODUCTION

Engineering as we know it is the ingenious process of identifying a problem and finding a calculated solution to the problem. This problem could be mechanical, structural, environmental, chemical or electrical. This gives rise to the various branches of Engineering. Electrical engineering can now be imperatively said to be the finding of electrical solutions to various human needs and problems. This can be achieved using electrical components and circuits. Several problem solving steps in electrical and electronics engineering are summarized below:

- Identifying of an area of interest
- Formation of a problem statement unambiguous.
- Design a set of feasible circuit that can solve the problem.
- Choosing the most effective circuit.
- Particularizing the chosen circuit with necessary details
- Lasting the implemented work.

1.2 AIMS AND OBJECTIVES.

Man has always has needs and desires Engineering's greatest goal is to satisfy all man's needs found within it's fields and current capabilities. Man needs spread from easier ways of production to construction to our

own very protection. Protection from nature's elements to our own fellow kind.

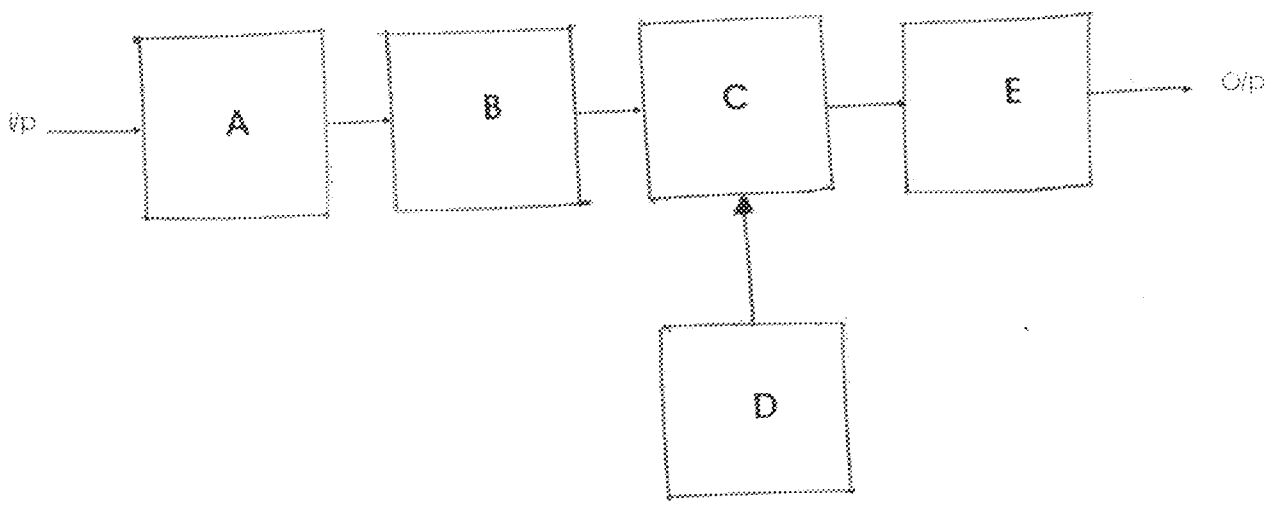
One major problem faced with man in our recent times, in our houses, office and even care is burglary. In spite of various complex measures and mean employed to combat this canker worm of society. Ranging from employing security officers to guard homes and industries, fencing and mounting of story gates in homes and industries using guard animals. E.g. dogs, mounting of burglar proofs for doors and windows.

Even with these measures the canker worm continues to eat deeper into the fabric of the society. With the advancement in technology, new electrical devices with various levels of complexity have been designed to forewarn of intrusions. Even with this, different failures from these systems have been recorded. These systems also have a minus for the cost of their production and installation. Noting the economical states of some parts of the world, these systems are deemed unaffordable. This gave the inspiration to design a reliable, cost – effective, electrical touch alarm system to be used in collaboration with some other forms anti-theft measures (protectors, window and door). The primary aim of this project is to give a simple, cost-effective and reliable circuit (alarm system) which will give forewarning of impending instruction primary to be used in homes and business office.

1.3 PRINCIPLE OF OPERATION

For the circuit to be cost-effective minimum number of components we utilized to achieve design. It is designed in such a way that the specific area or location touched can be identified from the different alarm sound output indicating LEDS.

Below is a block diagram of the design



I/p - Input

A - Transistor Stage

B - Bistable multivibrators Stage

C - Logic Stage

D - Oscillatory Stage

E - Alarm Stage

O/p - Output

The design circuit comprises of transistors which serve as the probes (The base). The transistors feed set S.R flip flops. A CMOS Oscillator (4060B) is used to generate and divide a frequency less than 20 kHz (minimum frequency the human ear can hear). The Oscillator has a main RC circuit integrated in it. And a 14 stage division by 14 toggle flip flop i.e. toggle flip flop divide the input waveform/frequency by two. In this design only two of the Oscillators 10 outputs are used since just two probes are utilized for the prototype (this can be expanded.) the frequency form the Oscillator and signal for the S.R flip flops are imputed into an and gates. When there's an output from the AND gates (when both input are high "1"), the signal in then switched by the field effect transistor (FET), in this case, an N - channel MOSFET is used. Sound is the final output, which now serves as the Alarm sound. There are three different output sound which depart on when probe in act rated. There is a sound for probe another for probe 2 and a third for when both probes are activated.

Also integrated in the circuit in a full were rectifier unit of a 220v transformer and a regulating unit, which produce the direct current regarded is power the other modules of the current. A RESET button is also present in the current. Once activated, the alarm centimes sounding

until the RESET button is pushed. This function works with the latches located in the SR Flip flops.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

An alarm is an electronic device that gives a warning sound/signal of an eminent event. This event could be instabilily in a system, or a birthday, meeting or intrusion into an area restricted. This chapter browses through the industrial development of alarms and some types of alarms and their specific uses.

2.2 EVOLUTION OF ALARMS

According to Joe Maurath, the development of alarm systems started by the time man was created. Man, being a more intelligent animal had to device a means to protect himself. One of the measures taken gave rise to the popular saying "to be forewarned is to be forearmed", the meaning easily understandable. Man has to find ways to forewarn himself of imminent danger. When a hand in clapped at a particular time and environ, a signal has been initiated which can be interpreted by another person. A serious decision can now be taken to combat that situation. No sooner the use of smoke signals to warn far villages of approaching trouble. Drums were also use to give warming of danger. All these methods/measures were crude and unreliable. With the evolution of

technology, more effective solution which exceeded limitations of the past methods of alarming soon after the invention of the telegraph by Samuel FB Morse. In 1884, the concept of utilizing the Bastion alarm telegraph system of communication for reporting incident by means of alarm signal boxes, wired to the nearest station, was realized.

Here the dispatch teams know of the citizen call for help immediately and could responds to the location much rapidly pioneer alarm telegraph system nominated in the larger United State cities and had greatly spread in popularity in most other communities, especially in the east, by 1900 The Boston system is of great interest, since it was amongst the first and certainly utilized a great many glass insulation that are highly sought after today. The introduction of this system revolutionized communication by permitting messages to be transmitted instantly over long distances.

Dr. William F. Channing of Boston and graduate of the university published an article in the Boston daily advertiser. He described in general terms how a practical alarm telegraph system in the city of Boston could be constructed. He convinced Boston city government in 1851, were founds were appropriated for the construction of such a system based upon plans me devised with associate, Moses G. Farmer, a telegraphic engineer, this was to be the first alarm telegraph system of

its type in the world. Most principles of today's fire alarm telegraph were embodies in the system, namely a closed electrically assembly pf circuits, street fire alarm boxes with code wheels and key breaks, determine the number of circuit interruptions which produces coded signal, on local instruments at central offices. The central office is where an operator transmitted signal is received over separate alarm circuits to the appropriate fire house. The system also featured telegraphing communication by and sound between individual street boxes and the central office. This completed system was placed in services at 12 noon April 1852, with the first alarm office located in the Aty building at court square and William court. Staff included a superintendent, fire alarm operators and repairmen. These were the first of types of position in the world.

Over time this system was improved. The original system had 40 street boxes in 3 box circuits and is alarm bells on the three circuits. The first recorded alarm triggered on the system was recorded to have taken place on 19th April 1892 at 8.25pm. Some underground cabling was introduced into the system when a new alarm office was commissioned into service on 20th May 1895. By 1907 all fire alarm boxes in the city of Boston were equipped into keyless doors. With the advancement in technology, other different alarms emerged. These systems were built

not just for five alarms like the Boston system but for various functions to be performed by each one. A few are mentioned below:

i. **Professional Burglar Alarm**:

This operates based on circuit break. The alarm is triggered when the protective circuit is opened. It is usually used to protect windows or glass areas. Once triggered, it can only be turned off by the opening of the master switch.

ii. **Infra – Red Alarms**

Just like the anti-theft car alarm, the infra-Red alarm was different designs all based on specific functions required of it. One of the various types simply consists of an infrared sensor which detects intrusion by motion and heat. It could further be incorporated with a transmitter which sends a signal to a receiver (could be located some distance of up to 1500ft from the infra-red sensor) which now sounds the alarm. This form of alarm systems are commonly used in military installations.

iii. **Latching burglar alarm:**

This makes use of relay latching circuit. The input terminals are connected to parallel wired, normally open magnate switches or wire type security switches stretch across a window that closes a ball contact

circuit the wire is pushed or pulled. When a security switch closes the series battery circuit the relay pulls in. On set of contacts close the alarm bell circuit, while the second set "latches" the battery circuit. In this system even if the security switches are opened, the alarm which is usually concealed continues sounding until the reset button is pushed.

iv. Speed Unit Alarms:

This is a wireless portable device/unit adaptable with most internal combustion engines. This circuit in designed to alert the vehicle driver when he has reached the maximum speed unit. It eliminates the need to look at the speedometer and tachometer reducing the risks of instruction from driving. There is a strict relationship between the revolution per minutes (RPM) and speed of a vehicle. The system monitors the RPM and starts giving a deep when the maximum speed in reached. Its outstanding feature is the fact that no connection is necessary from circuit to engine.

CHAPTER THREE

DESIGN ANALYSIS

3.1 INTRODUCTION

The system of the touch alarm involves different stages of operation. It includes:

Power/regulator stage

Detector stage

Logic control

Oscillatory stages

Alarm stage.

The power stage of the design involves the use of a transformers that has 240v primary as input and 12v secondary as output. This provides the required voltage for the operation of the electronic circuitry under constant operation. 7809 IC (9V regulator) further steps down the 12v to 9v for the part of the circuitry that uses 9v.

The detector for stage involves the use of a sensitive touch points (the base end of a transistor). The outputs of these are fed to S.R Flip flops (through an inverter). The logic control consist of S.R flip flops which has

two inputs, SET and RESET and two out puts Q and Q. when SET terminal is input high Q turns from logic 0 to 1 and Q turns logic O. The logic 1 output from Q (When on logic 1) is then used to enable the corresponding AND gate in the logic control.

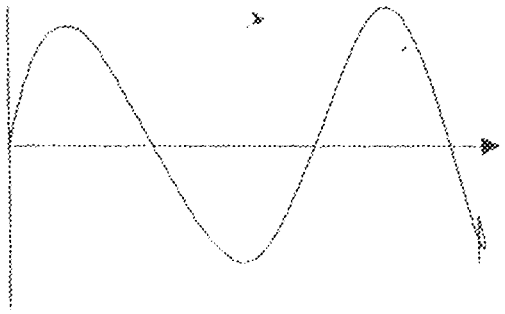
An Oscillator (4060B) is used to generate a frequency which is also fed to the corresponding and gate. The CMOS oscillator has a main RC Oscillator (RC means resistor capacitor) and 14 stage toggle flip flops i.e. loggle flip-flop deride the input wave form or frequency by 2. Therefore, only 10 frequencies are out of the IC.

The amplification stage simply uses a field affect transistor to amplify the output signal from the logic control, which then fed into the speaker to produce the alarm sound.

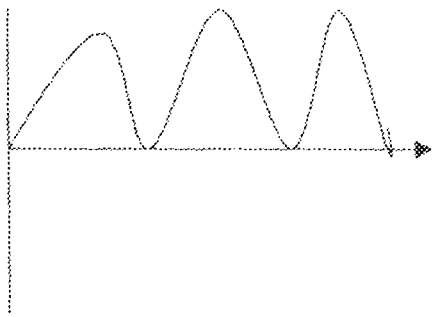
3.2 POWER / REGULATOR STAGE

The input power to the system is 240v, which is stepped down to 12v through a step – down transformer. The down 12v is still A.C and needs to be converied to D.C required by the system. To achieve this, the rectification section is used, which comprises of four diodes. Discrete diode can be used or IC diodes of which the IC types used in this design. Output from the full-wave rectifier contains undesired ripples and needs to be smoothening further. The capacitor takes the voltage and charges

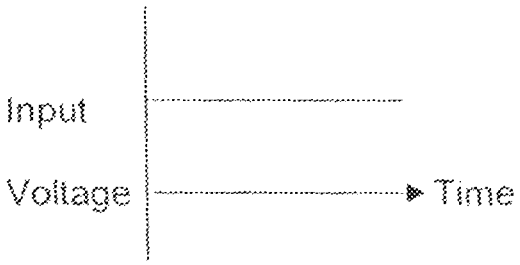
during positive half signal and during the negative half, it discharge giving a continuous signal. Capacitors of higher values are used to give the require output. In this case 16b, 0.022uf is used. A 9v regulator is used to ensure constant out put of 9v irrespective of variation/fluctuation of input voltage.



a. *Full wave rectification*



b. *Fluctuating direct Current*

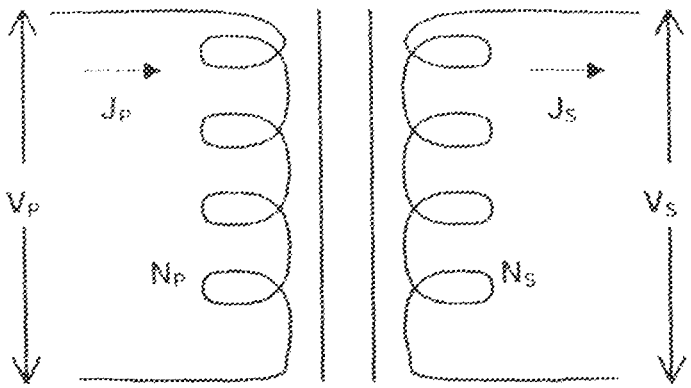


c. Steady Direct Current

3.2.1 TRANSFORMER

It is a device consisting of two closely coupled coils in which an a-c signal is applied to the primary appears across the secondary with voltage transformation. Circuit multiplication is inversely proportional to the ratio of turns.

A transformer could be a step-up or step-down. A step-up transformer is one in which the number of windings on the secondary side is greater than the number of windings on the primary side i.e. Turns ratio; K > 1 while a step-down transformer is one in which the number of winding on the primary side is greater than the number of windings on the secondary side i.e. K < 1. In this design a step-down transformer was utilized.



Ns = Number of turns in secondary coil

Np = Number of turns in primary coil

Vp = Primary terminal voltage

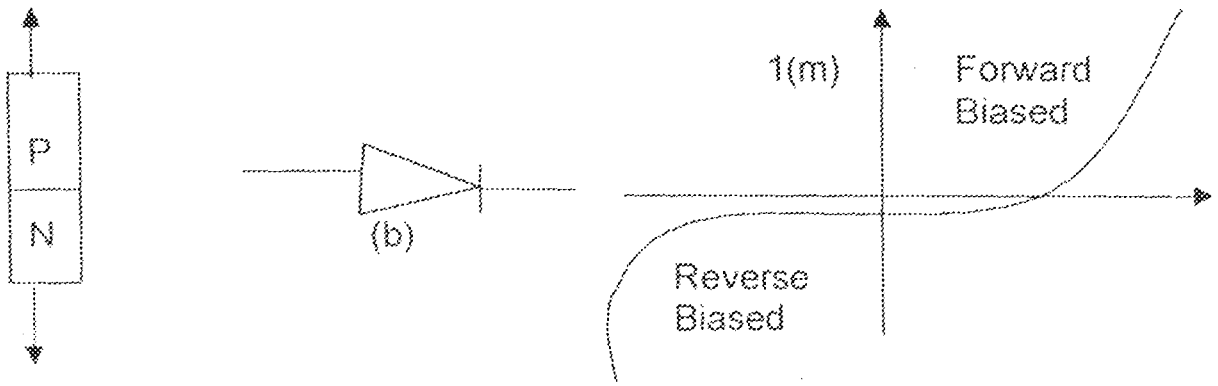
Vs = Secondary voltage

Is = Secondary current

Ip = Primary current

3.2.2 DIODES

A diode is made up of two pieces of series conductor material joined together. One is p-type diode and the other is n-type, the cathode.



(a) PN – Junction Diode *(b) Schematic Symbol* *(c) Diode characteristics*

The diode offers low resistance when forward biased and behaves almost like an insulator when reversed biased.

Forward biased: When forward biased from zero voltage hardly any current flows because of the barrier voltage and once this is neutralized current begins to flow. It can result in a burnout if the voltage is increased beyond a certain safe value.

Reverse Biased: On reverse biasing the diode, majority carries are blocked and only a small current flow in the diode but when the reverse voltage exceeds a certain value called breakdown voltage the leakage current shaping increases and may cause a burnout.

The analytical equation for determining the dived characteristics is given below by the Boltzmann's equation.

$I = F_o (e^{eV/nkT} - 1)$

Where,

I = diode current

Io = diode reverse saturation current

V = Junction voltage

K = Boltzmann's constant

N = I for germanium and 2 for silicon

T = Temperature in Kelvin

The diode plays a very important role in electronic systems such as

Rectification

As a switch

As an AND gate

In this design the diode is used as rectifiers and indicators.

3.2.3 CAPACITORS

Capacitors is made up of two parallel plates separated by an insulator called dielectric, the external leads are attached to the two metal plates. A flow of electrons bucket that in filled and emptied by the reset of the circuit. For a perfect capacitor no electricity flows across the gap and it has the property,

Q = CV

Where,

Q = Charge stored in capacitor

C = Capacitance of capacitor

V = Voltage across the capacitor.

To a first approximation, the capacitor is a device that might be considered simply as a frequency dependent resistor. They are used for storing electricity.

- Wave form generation filtering
- Blocking the bypass application
- Integrators and differentiators.

Taking the derivative of the defining equation above, we get I = cdv/dt

A farad is very large, so micro-farads or Pico-farads are normally used as units of measurement. Capacitors come in an amazing variety of shapes, sizes and types via mica, ceramic, polyester, porcelain electrolytic e.t.c

(a) Symbol of a capacitor

The capacitance of several capacitors in parallel is the sum of their individual capacitance.

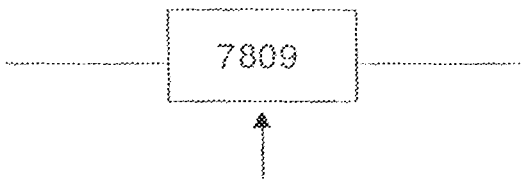
$$C_T = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \cdots \frac{1}{C_n}}$$

The capacitor is used in this design because of its waveform generation filtering ability.

3.2.4 VOLTAGE REGULATOR

Line voltage at output of a power supply often fluctuates by as much 10 – 20% causing the output voltage of the phasor to vary. The current drawn by the power supply load may have a wide range of values. In addition the temperature may change this effect and tend to change the out put voltage. A regulator is normally connected between the filter and the load designed to maintain a nearly constant output voltage for anticipated variation in input voltage load current and temperature. There are several regulation circuits used for power supply design, the IC voltage regulator and the series voltage regulator.

An IC regulator was used for this design, for a fixed SV output, the IC voltage regulator 7809 was used to obtain this output. The symbolic diagram of the voltage regulator is shown below.



Symbolic representation of the voltage regulator

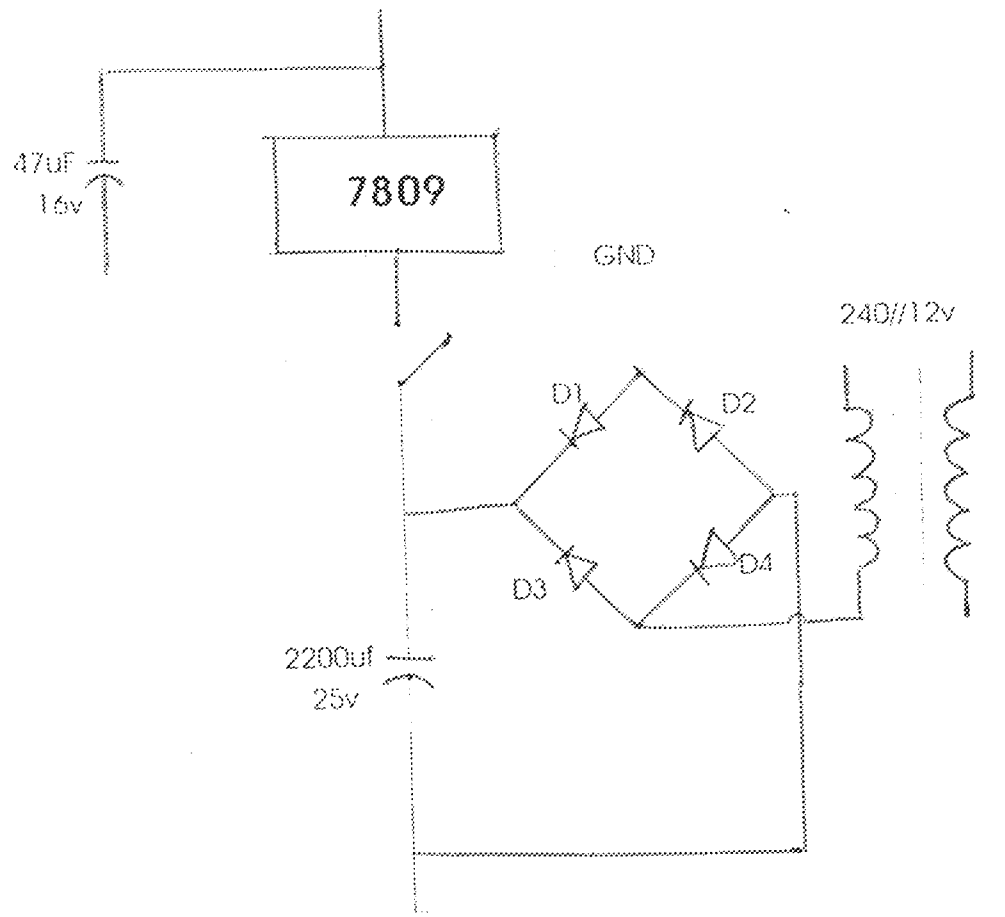
For the 9v out put, the IC voltage regulator 7809 was used to obtain this output. These include fairly simple, fixed voltage types of high quality precision regulators. These IC regulators have much improved performance as compared to those made from discrete components.

C = dv/dt

C = 6ms/2.55v where dt = 6ms for 50 Hz

C = 2352.9μF

A preferred value of 2200μF was employed for the rectification aspects of the power supply stage. C2 acts as a filter and filters unwanted A.C signal remnants before the output of 9 volts which supplies the necessary voltage to the other stages of the circuit. C3 acts as a smoothening choke.



Circuit diagram of the power stage

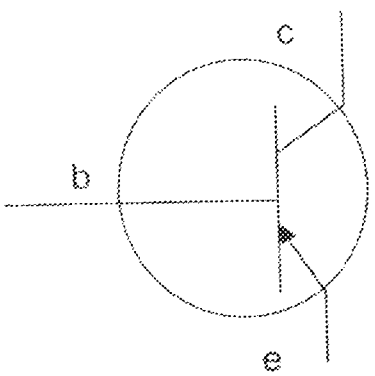
3.4 DETECTOR STAGE

The detector stage consists of individual components used Stated below

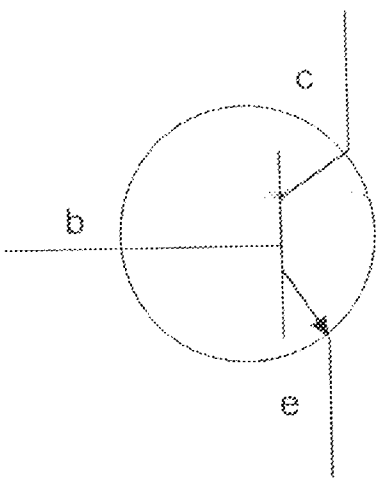
1. Transistor
2. Resistor

3.4.1 TRANSISTOR

A transistor is a three-layer semi conductor device consisting of either two n-type and one p-type layer of materials or two p-type and n-type material. The former is called npn transistor and the later pnp transistor. Like divides, it is formed from a single crystal with a thin layer of a-type material (emitter or collector). This arrangement results in the npn transistor. The alternative arrangement is the pup transistor in which n-type is sandwiched between the p-type emitter and collector. The middle layer of the transistor is called the base, which in practical may be as one micron while the two outer layers are called emitter and collector respectively.



a. pnp transistor



b. npn transistor

Transistor symbol and designation

Transistors are used at high frequency for switching in high power applications and under extremely environmental stress. For proper working of a transistor, it is essential is apply voltage of correct polarity across its two junction. For normal operation, the emitter base junction in reversed biased. The transistor can be operated three modes in the common emitter configuration.

i. Active region: V_{BE} > o BE junction forward biased and V_{cd} > o CB junction forward biased.

ii. Saturation region both junctions forward biased.

iii. Cur off region: both junctions reversed biased.

ACTIVE REGION:

The transistor is operated in active region when current flows in to the base, that is when I_b is positive and V_{cc} is more positive than V_{bc}. Transistors used in television or radio circuits are most often in the active region because a small change in base current causes a large change in collector current. With this, making it possible to amplify the input.

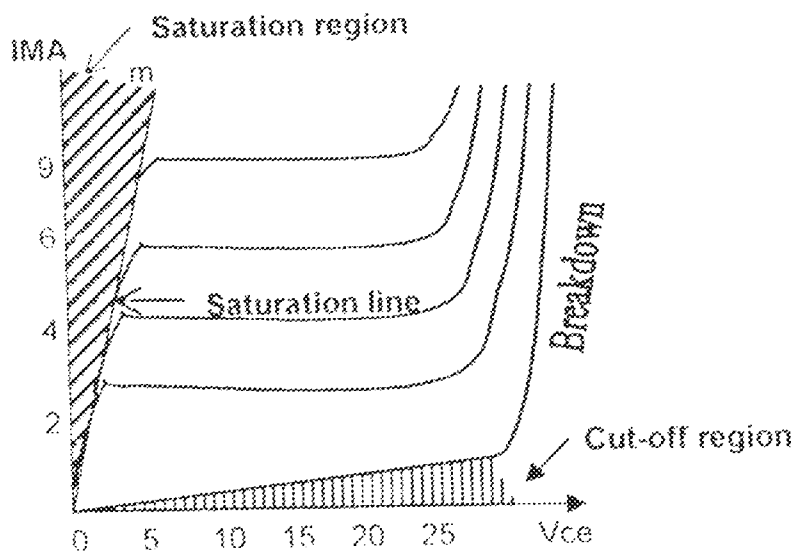
SATURATED REGION:

The transistor is in saturated region when positive current flows through the base and when V_{cc} is equal to or less than V_{bc}. During saturated both the base collector and the biased emitter junctions will be forward based and the transistor will look like two forward biased diodes and current will

flow freely in both the base emitter and the base collector junction. The boundary between the active and saturated region occur at $V_{cb} = o$

CUT – OFF REGION:

This occurs when both junctions are reversed biased. Any current that flows is of the order of magnitude of reverse saturation current. Thus I_B and I_C ale very small (as in F_T). This condition evidently occurs near the Vic axis, the boundary between the cut-off region and active region occurs at I_B.



Characteristic Diagram of a transistor

In this design the npn transistor type in used. It is so sensitive that electrical charges from human hands such from human nerve operation

can cause switching When loaded with a high resistive load as high as 100 kΩ.

3.4.2 RESISTOR

These are components such provide opposition to the flow of current in a circuit.

They are used in amplifiers as load for active devices, in bias network and hi feed back elements. In combination with capacitors they establish time constant and act as filters. They are used to set operating currents and signal levels. They are used in power circuits to reduce voltage by dissipating power; to measure currents and to discharge capacitors after power removed resistors are used in precision circuits to establish currents, to provide accurate voltage levels/ratio and to set precise gain value in logic circuits they act as bus and line terminators and as "pull-up" and "pull-down" resistors. In high voltage circuits, they are used to measure voltage and to equalise leakage currents among divides and capacitor connected in series in ratio frequency circuits, they are even used as cool formed for indicator.

Resistors are available with resistance from 0.01Ω through $10^{12}\Omega$.

Standard power rating from 1/8 watts through 250 watts and accuracy from 0.o95% through 20% the total resist antes of resistor wrecked in serve in given below

$R_T = R_1 + R_2 + R_3 \ldots\ldots R_n$

While in parallel in given by

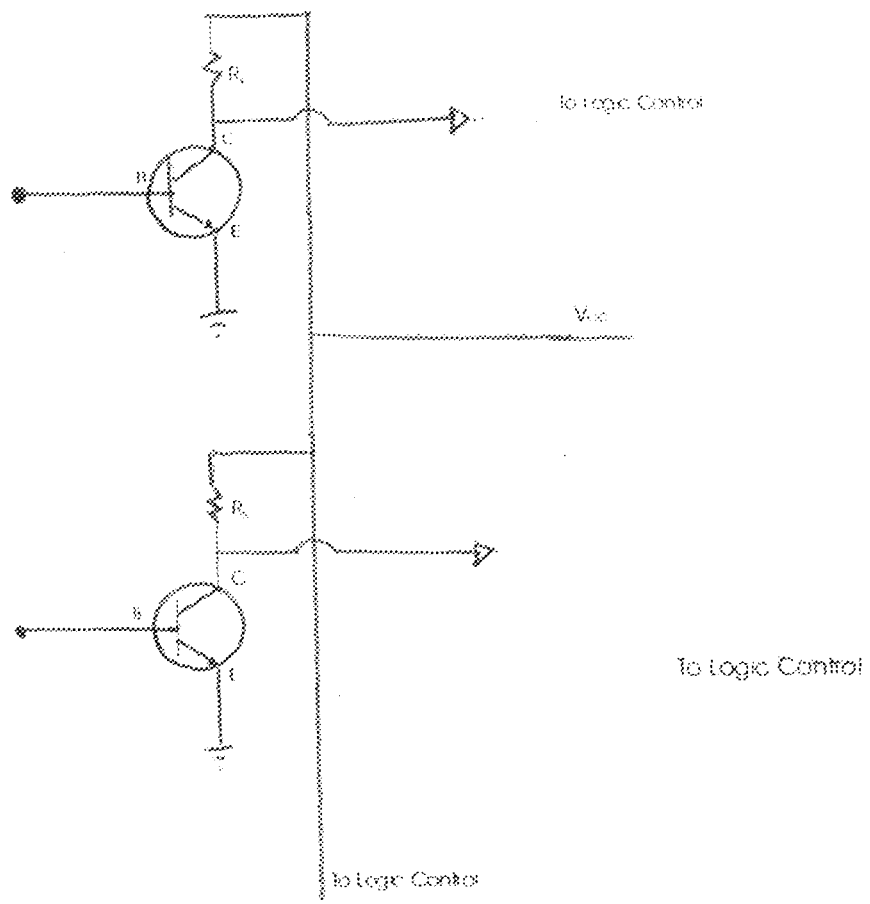
$$R_t = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots \frac{1}{R_n}$$

The symbolic representation of a resistor is shown below:

3.4.3 DESIGN ANALYSIS

The human body is a conductor of electric charges. A any 0particular point in time there are electrostatic charges on the human body. The detector stage which consist of a CE (common emitter) transistor and inverter (also a transistor, since transistors act as inverters). The probe (base end of the transistor) is connected to the door handle knob or other conducting points that could be contacted when the intruder is trying to break in. When contact is made with these conductors, there is net transfer of charges between the conductor and the human body. This sets up a potential difference which in turn causes the flow of current into the base of the transistor. This current flow causes a voltage, which must be above 0.7v (base emitter voltage drop, which must be sufficient to drive the transistor in order for the transistor to start conducting.

The output of the transistor will be low since the transistor acts as an inverter i.e. for every high input there is a low output and vice-versa. Also the output is 180° out of phase with the input. The low output of the transistor is fed to the inverter (another transistor). This then inverts the signal to get a high output which has a very high power gain. The output of the inverter is transferred to the flip flops in the logic control stage.



Circuit diagram of transistor stage

3.5 LOGIC CONTROL

This stage consist of the flip flops, and gate and OR – Gate

3.5.1 FLIP FLOPS

These are sequential devices which store information about a previous event and can also be called bistable multivibrators flip-flops provide single bit storage. Flip-flops are widely used as building blocks in counter circuits, shift and storage resistor and control circuits. Some types of flip-flops are listed below:

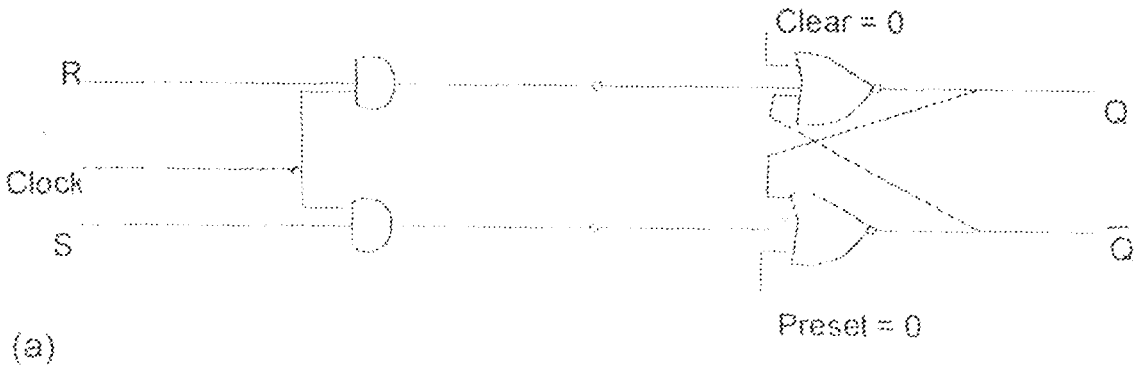
a. Set – Reset bistable (RS – FF)

b. Trigger bistable (T – FF)

c. The D-type bistable (D- FF)

d. The JK – Bistable (JK – FF)

In this project RS – FF is used the SR – FF in gotten from an SR – latch which could be constructed from either NIP gates in NAND gates. When the state changes of the SR – latch in synchronized we have the SR – Flip flop. This synchronization is achieved using a common sources of pulse known as clock the S.R. flip flop has two inputs, SET and RESET and two outputs Q and Q. when set terminal is input high Q turns logic I and Q logic O. but when RESET terminal is input high Q turns logic O and Q turn logic I. Below is the internal circuit of SR flip-flop and its truth table.



(a)

R	S	Q	$\overline{Q}$
0	0	No Change	
0	1	1	0
1	0	0	0
1	1	Not allowed	

(b)

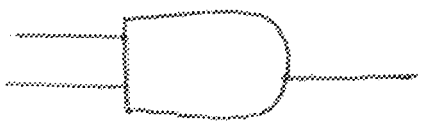
a. Internal circuit of the S.R flip –flop b. truth table

3.5.2 THE AND GATE

This is a logic gate which gives an out put only when at its inputs are preset (high). The AND gate has a 1 output when both inputs are 1. Hence, this gate is an all-or-nothing gate whose output occurs only when

all its inputs are preset. Below is the truth table for the NAD-Gate of two inputs:-

A	B	C
O	O	O
O	1	0
1	O	O
1	1	1



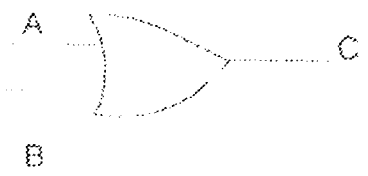
(a) Truth table for a two input *(b) Electronic symbol*

3.5.3 THE OR GATE

This is a logic gate which has an output of I when either of its input are high both are in high state (1).

In other words, it is an any-or-all gate because an output occurs when any or all the inputs are preset (high). Below is the symbolic representation and truth table.

a.



b.

A	B	C
O	O	O
O	1	1
1	O	1
1	1	1

a. Symbolic representation *B. Truth table.*

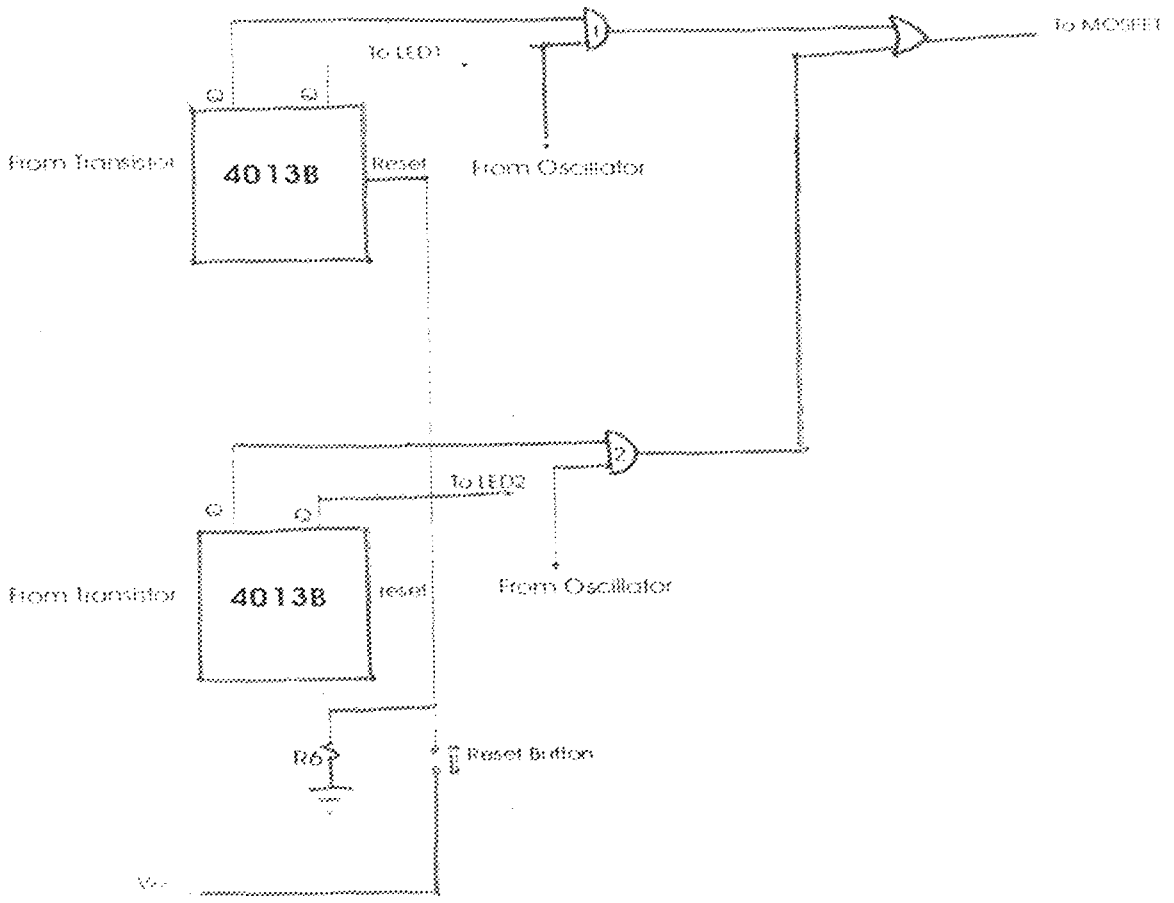
Note: A logic gate in an electronic circuit which makes logic decisions. It has one output and on or more inputs. The output signal appears only for certain combinations of the input signals.

3.5.4 DESIGN ANALYSIS

The logic control which comprises of the S.R flip flops, AND gates and OR gates is where all logic process occur. The output from the detector stage and oscillatory stage are fed into this sage. When there is a high output from the detector stage which is fed into the SET terminal of the S.R flip flops, Q gives a high output which is fed to the AND gate to be compared with the signal from the oscillator. Q becomes low and is fed

to the negative en of the LED (light emitting diode). The RESET terminal is used to reset the circuit when triggered.

R5 is used to give the RESET terminal an initial determinate state when the circuit is powered on. The output from the oscillator is constantly fed into one terminal of the AND gate to be compared with the output of the S.R flip flop. So to say, the output of the AND gate is determined b the output from the flip flop since there is no change in the output of the oscillator. When there is a high output from the flip flop, the AND gate gives a high as the output which is now fed into the OR gate to be compare with the output from the second AND gate.



Cir

cuit diagram of flip flop stage

The output from the OR gate is in turn sent to the amplification stage for amplification and Alarm output i.e. the output rives the speaker through the N-channel MOSFET.

3.6 THE OSCILLATOR STAGE

With positive feedback, it is possible to builds oscillator circuits that generate an output no external input signal. Positive feedback alternatively drives the output in positive and negative saturation. The principle be hind a relaxation oscillator is to let the charging and discharging of a capacitor determine the frequency of the putout square wave.

To build an oscillator an amplifier with positive feedback is required the idea is to use the feedback signal in place of an input signal. If the loop gain and phase are correct there will be an output signal even though there is no external input signal. In other words, an oscillator is an amplifier that has been modified by positive feedback to supply its own input signal may sound like perpetual motion and in a way it is but it must be noted that an oscillator does not create energy. It only changes d.c energy from the power supply to a energy there are various types of oscillators, under the RC and LC families namely:

Crystal oscillator

Wien – Bridge oscillator

Colpitts oscillator

Twin – T oscillator

Armstrong oscillator

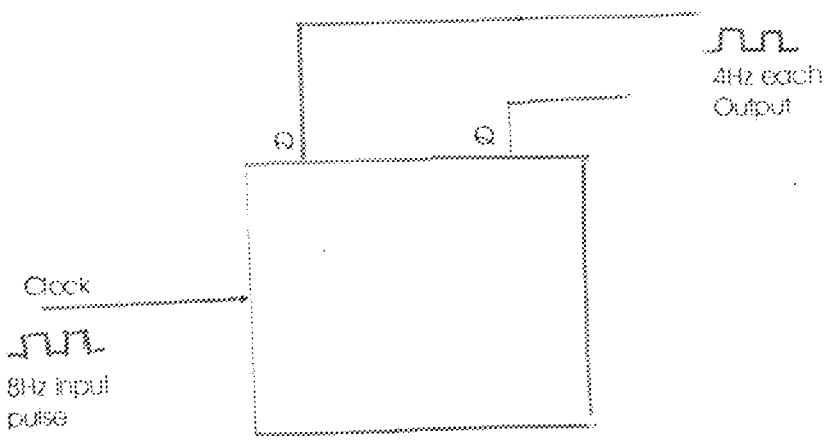
Hartley

Clap oscillator

3.6.1 CMOS OSCILLATOR:

For this project the 4060B was used. It is a very useful CMOS (complementary metallic semi-conductor) integrated circuit. It has two set logic. Square ware oscillator and 14 toggle flip-flop (toggle flip flops are JK type with J and K input at logic 1).

The main factors of the toggle flip-flops in division of the input square ware. For instance.



In the diagram above an $8H_z$ square wave enters the lock input of the toggle flip-flop and a $4H_z$ square wave some out of both the Q and Q outputs.

For the 4060B there are only 10 frequency that are led out of the I.C 50 10 frequency are available a time for use in the current.

Note: The oscillator does not divide the input square wave into equal frequency at the output. In this design only two of the 10 frequency are used for each probe. (This is the reason for different audio sounds for the different probes). A frequency of less than 20 kHz is needed to be generated from the oscillator. This is because the minimum hearing frequency by the human each in 20 KHz.

3.6.2 DESIGN ANALYSIS

The oscillator was designed using the 4060B. A frequency of less than 20 KHz is required because it is the minimum frequency the human ear can hear. This was achieved using the design analysis as follows:

Using the formula,

$F = 1 / 2.5R_2C_1$

Assuming a value of 33kΩ for R2 and 0.001μF for C1, we have

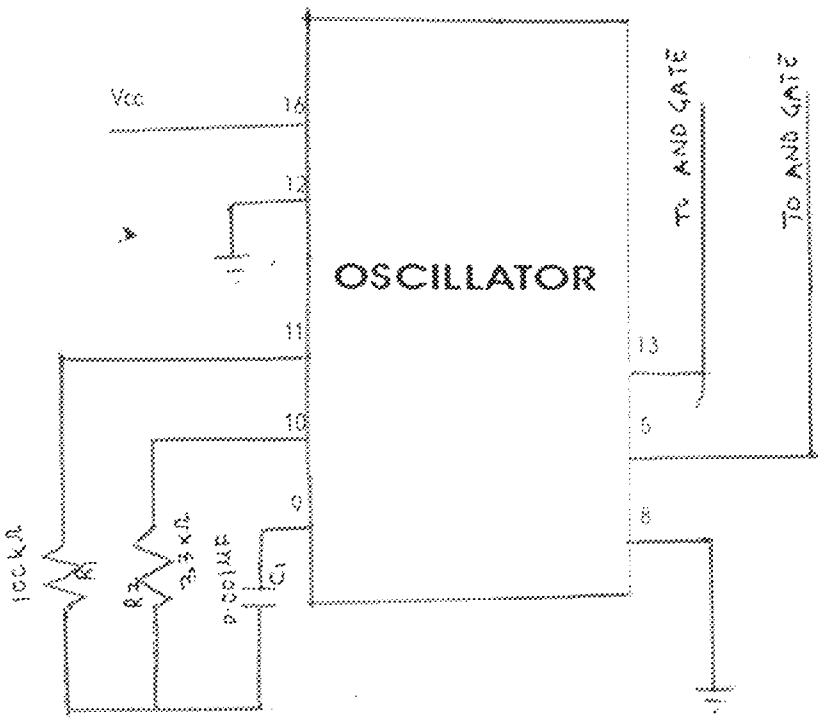
$F = 1/2.5 \times 33 \times 10^3 \times 0.001$

This gives us a value of 13.2 kHz. This value is well above the mark spot of 20 kHz which makes it appropriate for use. The frequency is divided in the oscillator and 10 outputs given out. Two of the outputs from the oscillator where utilized and their frequencies fed into the AND gates of the logic control stage. Resistor R1 helps to stabilize the oscillator frequency against changes due to different V_{cc}.

Typically R1 should be 2 to 3 times R2. Therefore,

R1 = 3 x 33 kΩ = 99Ω

Thus a value of 100kΩ was used. .



Circuit diagram of the oscillatory Stage

3.7 ALARM STAGE

This is the stage where the output of the OR – gate in amplified A FET is used for switching the speaker. FET stands for field effect transistor. It is a three terminal unipolar solid – state device is which current is controlled by an electric field as is done in vacuum tubes. There are basically two types of FETs

a) Junction field effect transistor (JFET)

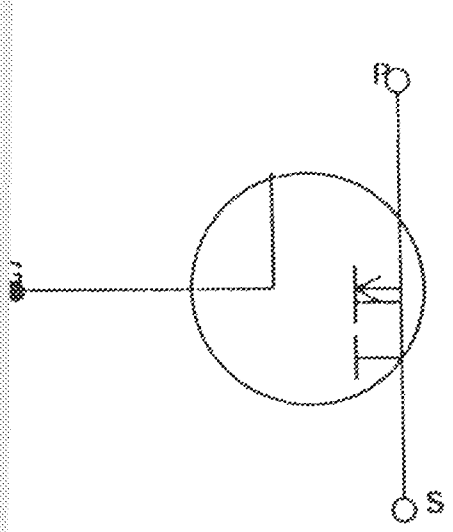
b) Metallic oxide semiconductor FET (MOSFET).

In this project, the metallic-oxide semiconductor FET (MOSFET) was utilized. The metallic-oxide semi conductor can also be sub divided into two namely:

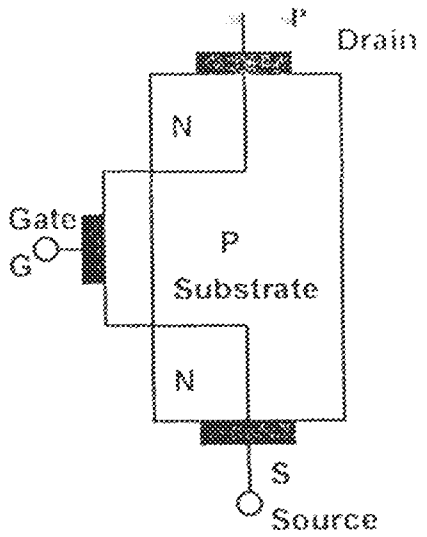
i. Depletion – enhancement MOSFET (DE MOSFET)

ii Enhancement only MOSFET (E – only MOSFET)

Both of which can be rather P-Channel or N-channel. The enhancement – only MOSFET was used. Shown below in the symbolic representation.



(a) *Symbolic Representation Of the n-channel MOSFET*

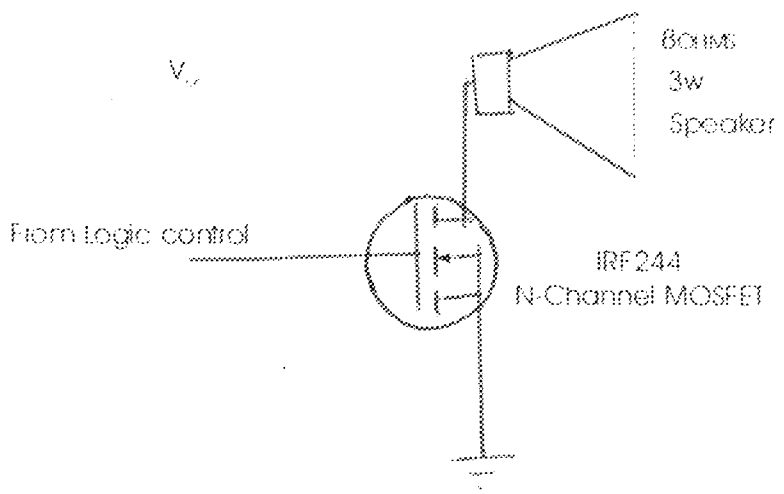


(b) *Internal Structure of the n – channel MOSFET*

As its name indicates, the enhancement – MOSFET operates only in enhancement mode and have no depletion mode. It works with large positive gate voltages only. It does not conduct when the gate voltage VG = 0. That is why it is called normally - OFF MOSFET.

3.7.1 DESIGN ANALYSIS

The MOSFET in this design was used as a switch for the speaker. The output from the logic control unit is a pulsating signal. This pulsating signal is fed into the gate terminal of the MOSFET. For every positive end of the pulse, the MOSFET conducts and sends as output through the drain terminal (which is connected to the negative terminal of the speaker) a negative signal. Note that when a positive signal is applied to the gate of an N-channel MOSFET, there will be flow of charges from the source (in this case negative charges form the earth. This is what triggers the speaker.



Circuit Diagram of alarm stage

3.7.2 SPEAKER

The output of the MOSFET in fed into an 8Ω, 3w speaker which now produces sound as the alarm. There are three different sounds produced by the speaker, this is dependent on the frequency used from the oscillator and which of the probes has been triggered.

CHAPTER FOUR

CONSTRUCTION, IMPLEMENTATION AND INSTALLATION

This chapter summarized methods that were used in assembling the different components that were chosen for the design.

4.1 CONSTRUCTION

An ideal security system should be reliable and inexpensive. The construction of the device was then aimed at meeting these requirements. Since the unit is to be used for long period of time, it was designed to have extremely low standby current.

Each of the components to be used was first tested to check if they were good or bad. These were then inserted on the bread-board in various stages and outputs tested to see how they perform after which all stages were then integrated together on the Vero board.

The components now inserted in the Vero board were soldered together. Soldering was carried out on the side of the Vero board that had metallic stripes. The components were inserted on the component side of the Vero board, it was then turned over and heat was applied simultaneously to prevent dry joints. The leads were trimmed after soldering.

The following tools used during construction are listed below

i Digital Meter

ii Soldering iron

iii Soldering Lead

iv Pliers

v Cutter

vi Lead sucker

4.2 TABLE OF COMPONENTS

STAGE	COMPONENTS	TYPE	RATING
DETECTOR STAGE	TRANSISTORS	2SC603	
	RESISTORS R_3, R_4		120 KV
	INVERTERS	2SC603	
LOGIC CONTROL	FUP FLOPS	401 3B	
	AND GATES 1 & 2	4081 B	
	OR GATE	DIODE RESISTOR LOGIC	
OSCILLATORY STAGE	OSCILLATOR	4060 B	
	RESISTORS R_1, R_2		100KV 33KV

	CAPACITOR		0.001μF
AMPLIFICATION STAGE	N-CHANNERL MOSFET	IRF244	
POWER STAGE	TRANSFORMER		240V/12V
	DIODES D1, D2, D3 P4	IN4001	
	CAPACITOR		25V, 2200μF
	9V REGULATOR	7809	

4.3 IMPLEMENTATION/TESTING

The components were first mounted on the breadboard and tested to ensure that respective modules operate efficiently. Also the circuit implemented on electronic work bench on the computer to also ensure that the circuit was functional. The components were then transferred to a Vero-board and soldered on it.

The component layout of this shown in Appendix A. The transformer and Vero boards were mounted to the base of the wooden casing which is already an insulating material to prevent shock in handling the casing the

wires were not closely connected to reduce induced magnetic flux that could create unwanted ripples. Care was taken to avoid bad or dry joints as well as too much heat to prevent damage to components and circuit board. The two probes were made to come out of the casing through connection of wires same goes for the speaker.

4.4 METHOD OF INSTALLATION/OPERATION

The main alarm bus should be kept in a main room where the alarm should easily be heard. The robes should be placed on the various touch points. (Door handles, windows). If an instructor touches the door handle or window it triggers, the flip flop there by causing the alarm to go on until the RESET button is pushed.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

The touch burglary alarm system is a device that provides warning signal when there is a breach of securily, that is to say when there is an unauthorized person within a restricted area. It has an incorporated 240V/12V transformer to make the system work even under low voltage; this makes the system very versatile its major objective revolves around providing a cost-effective securily system to the vicinity that the alarm will be operational. This was achieved in the course of this project.

5.2 PROBLEM AND SOLUTIONS

The system power on indicating LED was fluctuating with trigger indicating divides. This was rectified by placing the diode before the input of the 9v regulator.

5.3 RECOMMENDATIONS

As always every functional system even operating normally without faults has imperfections in its design, it is the duty of design specialist to seek out these imperfections in order to improve the systems efficiency. As in the case of he project, certain aspects of the system design can be Improved, such areas as:

i. The use of a backup battery could be incorporated.

ii. The system can be incorporated with a computer system that interprets alarm.

iii. The stability of the system can be improved upon by making it less susceptible to interference.

iv. The reset could be designed in such a way that it can be turned off by remote control.

These suggestions made can improve the system functionally and value.

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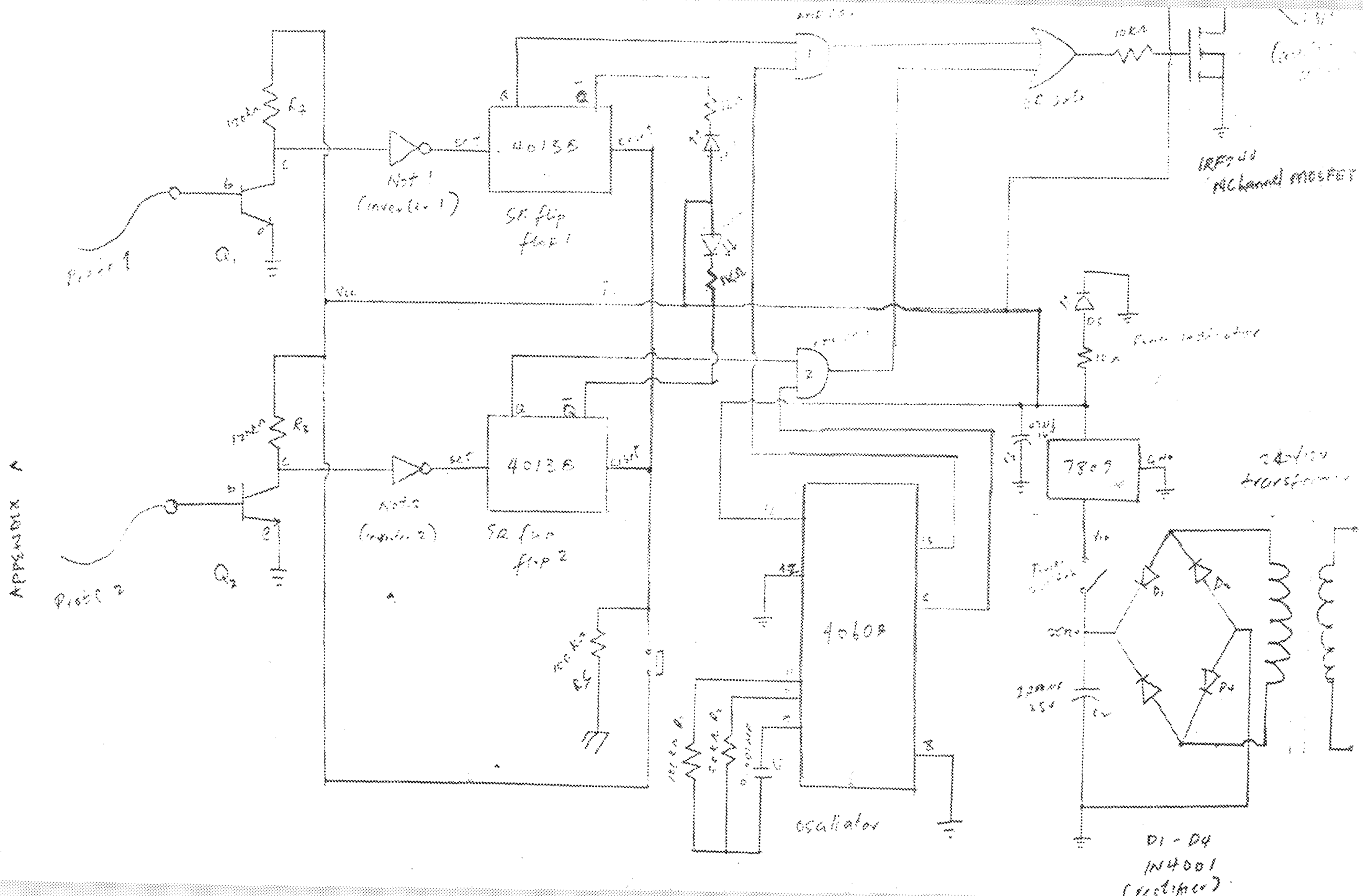
4013B
SR flip flop 1
4013B
SR flip flop 2
4060B
oscillator
7809
IRF540
N-channel MOSFET
D1 - D4
IN4001
(rectifier)