DESIGN AND CONSTRUCTION OF AN INFRARED PROXIMITY SECURITY SYSTEM

BY

SALEH ABRAHAM DAUDA
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DEDICATION

I dedicate the project to God almighty, my fortress and protective shield.

DECLARATION

I, Saleh Abraham D. declare that this work was done by me and has never been presented elsewhere for the award of a degree. I also hereby relinquish the copyright to the Federal University of Technology, Minna, Niger State.

SALEH ABRAHAM D

(Name of student)

05/05/2010

(Signature and date)

MR A.B.M. ZUNGERU

(Name of supervisor)

5/05/2010

(Signature and date)

DR Y.A. ADEDIRAN

(Name of H.O.D)

(May 6, 2010)

(Signature)

DR. (ENGR.) B. A. ADEGBOYEGA

(Name of External Examiner)

09/03/10

(Signature and date)

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ABSTRACT

The design and construction of an infrared beam barrier/ proximity sensor is simply a security system, which serve the purpose of save guarding the immediate environment. The objectives of the project is to create a device that can transmit infrared beam and also a device to sense the beam, which serve as a barrier to a location which is protected. The concept behind the project is to clearly and concisely state the methods to achieve the required target. The project has six stage which are, the power unit which is the source of power to the whole circuit of the project, the transmitter unit, that transmits the infrared beam, the receiver unit, which is the section that senses the infrared beam, the amplification unit, which amplifies the signal from the receiver, the control unit, that triggers the alarm circuit on/off and finally the alarm unit which is the audible sound that warns that the beam has been bridged. This project will aim in achieving a sensitive sensor that detects IR beam from a distant area, and to design an IR transmitter that can transmit to a far area, to have a wide range of protection.

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CHAPTER ONE

1.0 INTRODUCTION

Protecting your home is becoming more and more important all of the time. Not so long ago an alarm was a fairly rare sight, however now almost every house has an alarm of some kind most developed countries but could play a vital role in the underdeveloped countries like Nigeria. One common kind of security system is a wireless infrared home security system. These are so popular because they are easy to install without having to drill holes and lay cables.

Wireless home security systems are well suited to being used actors drive ways, and also to cover wide areas of ground. Infrared is very useful to cover large areas however it cannot be used to actually transmit your alarm signals. Infrared alarms work by sending out a beam of light, if this beam is broken the alarm will be sounded [1].

Infrared security devices are perfect for covering an entire room with just one device. You may have seen similar devices many times in movies! Lots of modern alarms use infrared detectors in order to cover large rooms without having to put sensors on each individual door and window. Wireless home security systems can cover huge areas of ground without having to use separate devices.

An Infrared Beam Barrier/ Proximity sensor is a security device, which is simply a save guarding device used in the immediate environment which is being installed.

Infrared beam barrier has a sensor which detects changes in the infrared light radiation from parts of the protected area. Presence of an intruder in the area changes the infrared light intensity from his or her direction. The Sensor consists of two housings; one housing contains an Infrared emitter diode and an infrared sensitive receiver, the other housing contain infrared reflector. When positioned in front of an entrance to the protected area, the two housing establish an invisible beam, if an intruder enters the area and interrupt the beam and then triggers the alarm.

Proximity sensor (Capacitance Alarm System) in which a protected object is electrically connected as a capacitor sensor. The approach of an intruder causes sufficient change in capacitance to upset the balance of the system and initiate an alarm signal [2].

1.1 APPLICATION OF THE ALARM SYSTEM.

The Infra Red beam barrier and proximity sensor has many applications. The system can be used as a Luxury system or security system, which is stated below.

1.1.1 LUXURY SYSTEM.

The Infra red beam barrier and proximity sensor can serve for luxury application. It can be employed in automatic doors for airports, hospital, banks, hotels etc. it can be also be used in automatic light activated switch control.

1.1.2 SECURITY SYSTEM

The system can also be used as a burglary alarm system, in our homes, offices, and other very sensitive area, areas such as high tension electrical installation (electric substations), nuclear plants, oil pipelines. The system can also be used by the

1.2 AIMS/OBJECTIVES

1. To determine the sensitivity of detection of the infrared beam.
2. To determine the proximity state of the IR sensor.
3. To detect any intruding object through the IR beam.
4. To design an IR alarm system this will serve as a security device.

1.3 METHODOLOGY

Infrared Radiation (beam) of this device is the emission of energy as electromagnetic waves in the portion of the spectrum just beyond the limit of the red portion of visible radiation. The wavelengths of infrared radiation are shorter than those of radio waves and longer than those of light waves. They range between approximately 10^{-6} and 10^{-3} (about 0.0004 and 0.04 in) [3]. Infrared radiation may be detected as heat, and instrument such as bolometer is used to detect it.

A burglar alarm can initiate a considerable response by police, private security personnel or occupant of the area, who may leave other important duties to race to the scene of the alarm. Therefore, it is important to prevent false alarms when designing and installing alarm systems. Modern burglar alarms make use of several different technologies to reduce false alarms.

Passive infrared detectors can be programmed to ignore the first movement detected, as in when the intruder moves from one detection zone to another, and to sound the alarm only when the movement passes through two or more detection zones within a specified period of time. In this way, an insect landing on the detector's lens, or a sudden rise in background temperature caused by an activated furnace, is ignored [4].

Another means of preventing false alarms is the dual-technology motion detector. This is probably the most common type of detector used in more sophisticated burglar alarm systems. A dual-technology detector combines a passive infrared device and a microwave device in one small unit. The passive infrared device sees many detection zones and measures the change in background temperature as a target moves across them. At the same time, the detector projects microwaves and measures the Doppler shift when a target moves through the protected space [5].

An infrared motion detector will detect movement regardless of whether the target is moving across the field of view or toward the detector. But such a detector is more sensitive to movement across its field of view. Thus, it is more prone to false alarms caused by disturbances such as a mouse or rat moving across its field of view than by movement toward it. Microwave detectors are just the opposite: more sensitive to targets moving toward them than they are to targets moving across their field of view. If a large leaf falls off a plant in a room, a microwave detector is more likely to detect the motion than is an infrared detector. But if there is movement outside a window, a microwave detector might detect it when an infrared detector probably would not.

Dual-technology motion detectors use a circuit that requires both devices to detect motion before an alarm is sounded. A bird landing on an outside windowsill might trip the microwave device but not the infrared device, so no false alarm would be transmitted. Military to monitor enemy advancement, detection of military war ship in restricted water, implanted in heat seeking missiles etc.

1.4 LIMITATION OF INFRA RED BEAM BARRIER AND PROXIMITY SENSOR.

Though the system is very reliable very effective and finds a wide range of applications, its major limitation apart from the inability to find components which are used in the construction of the system. The radiation source can only be detected if it most pass across the sensor in a horizontal direction, because interference has to be so in a horizontal plane so that the elements are sequentially exposed to the IR beam.

CHAPTER TWO

2.0 LITERATURE REVIEW

Motion detectors are mainly used in security systems [4]. It is typically positioned near exterior doorways or windows of a building to monitor the area around it. Since motion detectors are so flexible and have so many uses, it offers feelings of protection and security for the average homeowner as well as commercial organizations [4].

An electronic motion detector is a device used to detect any physical movement in a given area and transforms motion into an electric signal. It consist of sensor that electrically connected to other devices such as security system, lighting, audio alarms, and other applications. Motion sensors are used in a wide variety of applications and as a result, many different types of motion sensors are available including the infrared sensor.

Infrared sensors are widely known in the arts of intrusion detection and in fire or smoke detection. It is a device that often used in automatic light switches and security systems to turn on a light or to activate some other form of alarm or warning indicator when a person enters a monitored area [4]. The infrared sensors have basically two forms: active and passive. [4]

An active infrared detector includes a radiation source and an infrared sensor which is sensitive to interruptions in the radiation sensed from the source. [4] These detectors are used as intrusion detectors by providing a path of radiation from the source to the sensor in a place where the path is likely to be interrupted by an intruder.

The proposed active infrared method of motion detection has the advantage of fast speed response of a relatively large sensor. This advantage permits simpler optical system design, especially for wide fields of view. Besides, it is insensitivity to mechanical and acoustic noise, which presents substantial problems in the passive infrared (PIR) sensors. Low production cost is another advantage of these active infrared detectors. [4] Passive infrared motion detection detects heat energy radiated or emitted by an object, such as a body of a person, moving across a field of view of a heat sensor of the motion detection system. It is generally use an optical collection system and multiple sensing elements of alternating polarity to create a detection pattern in the volume of interest.

PIR detectors employ a group of radiation sensors coupled through amplifiers to a logic circuit. The radiation sensors detect changes in ambient infrared radiation. The detection system has an electrical circuit operatively coupled to the heat sensor fo r producing a detection signal in response to the heat sensor detecting a change of temperature caused by the body heat of a person entering the detection pattern. PIR motion detectors are perhaps the most frequently used home security device. [4] Passive IR motion detectors are usually designed to provide an indication to an alarm panel in response to detecting IR that is indicative of motion of the object. The alarm panel is responsive to receipt of the breach indication to cause an alarm condition to occur.

The other motion detector used in security system is an ultrasonic motion detector. It is commonly used for automatic door openers and security alarms [4]. It is inexpensive and can operate with narrow beam-widths. The ultrasonic transducers are the sensor that used in ultrasonic motion detector. It can be used to detect motion in an area where there are not supposed to be any moving objects.

This type of motion detector is most commonly used in burglar alarm systems since they are very effective in this application [4]. In an ultrasonic motion detector, there are two transducers; one emits an ultrasonic wave and the other picks up reflections from the different objects in the area. The reflected waves arrive at the receiver in constant phase if none of the objects in the area are moving. If something moves, the received signal is shifted in phase. A phase comparator detects the shifted phase and sends a triggering pulse to the alarm .

Ultrasonic motion detectors have certain advantages and disadvantages when compared with other types of motion detectors. The main advantage is that they are very sensitive and extremely fast acting. However, the largest problem with this type of motion detector is that it sometimes responds to normal environmental vibration that can be caused by a passing car or a plane overhead. Besides, the installation options on this type of motion detector are limited because ultrasonic beams are easily blocked by thin materials, including paper. False triggering is easily caused by reflections from blowing curtains, pets, and flying insects. While the passive infrared motion detectors offers problem where it can be falsely triggered by warm air movement or other disturbances that can alter the infrared radiation levels in an area. In order to prevent this problem, newer systems use two infrared sensors, which monitor different zones within a protected area. Logic within system triggers the alarm only when the two zones are activated in sequence, as would occur if a person walked through the protected area. For that reason, the purpose of using the active infrared as a sensor to detect motion for this project is surely on the advantage offers by the sensor. Its capability on detecting motion with a simple design at lowest cost is needed to build an effective house security system based on motion detection.

CHAPTER THREE

3.0 DESIGN AND CONSTRUCTION

This Chapter will take a look at the units that make up the alarm system, how they were designed, constructed and how they operate according to the Infrared beam barrier and proximity sensor (burglary alarm system). The Chapter will take a look at the six (6) units that make up the alarm system, as shown in the block diagram below.

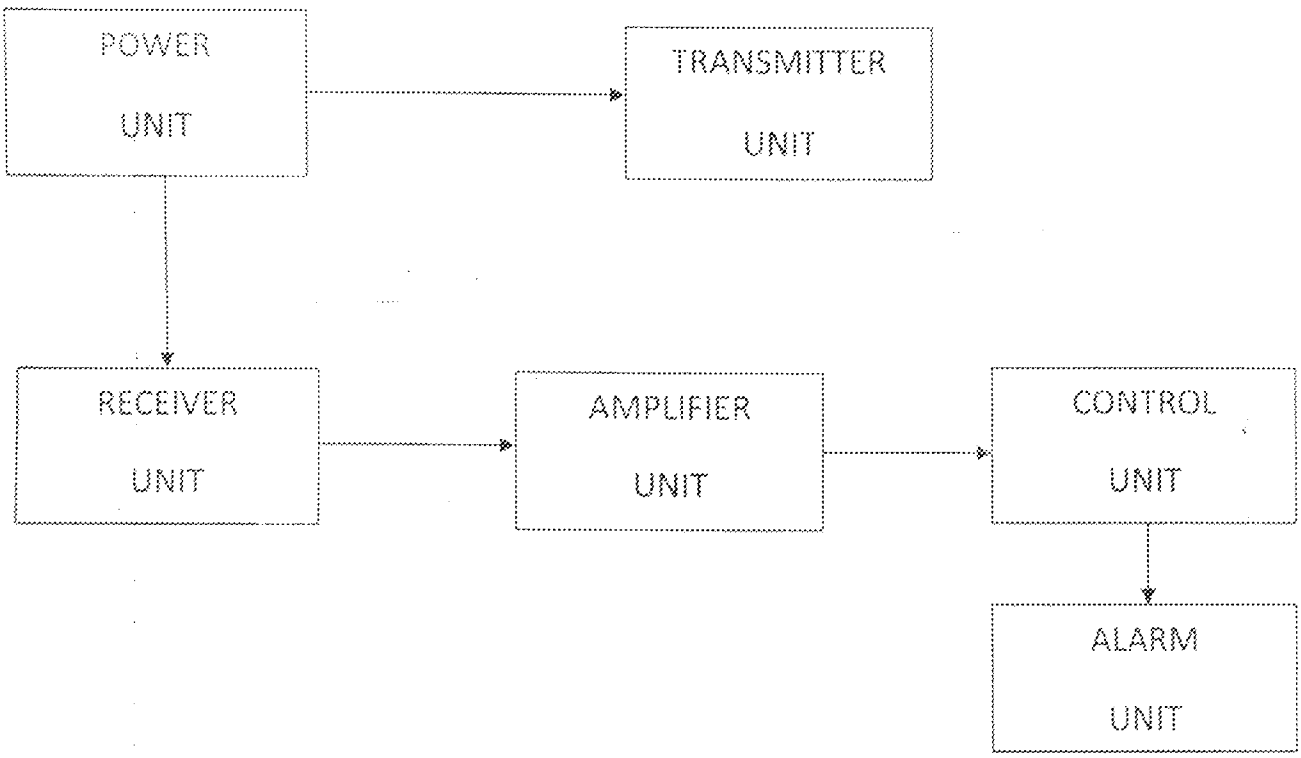


FIG 3.0 BLOCK DIAGRAM OF INFRARED BEAM BARRIER AND PROXIMITY SENSOR

3.1 POWER SUPPLY UNIT.

This device can be powered by either one of the two power source, that is AC power source or the DC power source (9V Battery) which the constructed project is being powered with. But as another option, AC power source can be used. In the AC from the mains electricity the high voltage is converted to a suitable low voltage supply for electronic circuits and other devices. A power supply can be divided into various units, each of which performs a specified duty.

3.1.1 THE TRANSFORMER.

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only in AC and this is one of the reasons why mains electricity is AC. This device will use a step-down transformer to reduce the voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (220-240V) to a safer low voltage. The input coil is called the primary and the output coil is called the secondary. There is no connection between the two coils; instead they are linked by magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core. The ratio of the number of turns on each coil, called the turn ratio, determines the ratio of the voltages. A step-down transformer has a large number of turns on its primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage.[7][8]

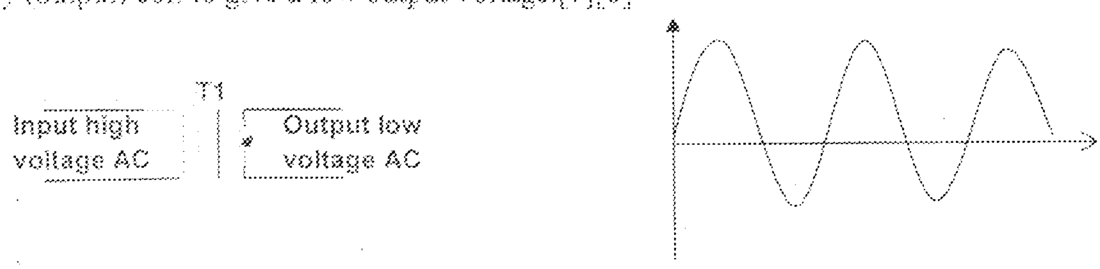


Fig 3.1 Step-Down transformer

Turn Ratio = $(V_p/V_s) = (N_p/N_s)$

Power = $V_p \times I_s = V_p \times I_p$

V_p = Primary (Input) Voltage

V_s = Secondary (Output) Voltage

N_p = No. of turns on Primary Coil

N_s = No. of turns of Secondary Coil.

I_p = Primary (Input) Current.

I_s = Secondary (Output) Current

3.1.2 TRANSFORMER + RECTIFIER

There are several ways to connecting diodes to make a rectifier to convert AC to DC. The bridge rectifier is the most important and it produces full-wave rectification of DC. A full-wave rectifier can also be made from just two diodes if a centre-tap transformer is used, but this method is rarely used now that diodes are cheaper. A bridge rectifier can be made using four individual diodes, but it is also available in special packages containing he four diodes required. It is called a full-wave rectifier because it uses the entire AC wave (both negative and positive sections). 1.4V is used up in bridge rectifier because each diode uses 0.7V when conducting and there are always two diodes conducting. Bridge rectifiers are rated by the maximum current they can pass and the maximum reverse voltage they can withstand (this must be at least three times the supply RMS voltage so the rectifier can withstand the peak voltages).[7][8]

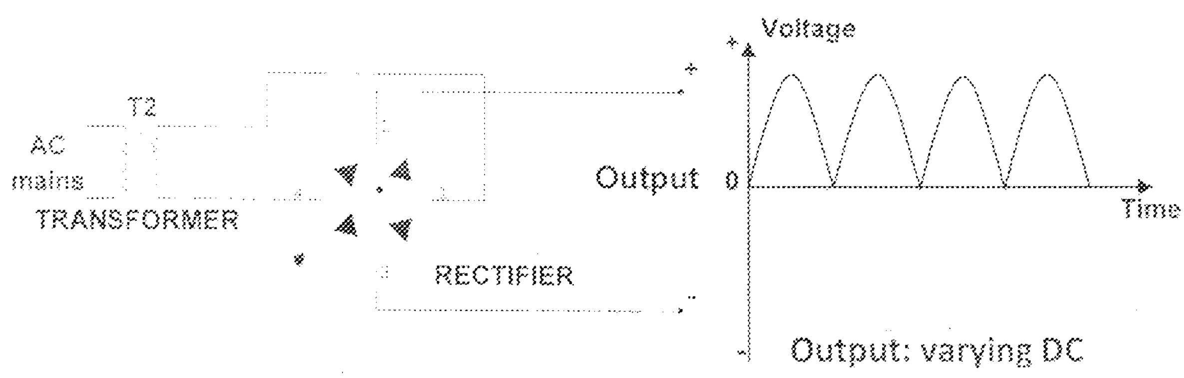


Fig 3.2 Transformer + Rectifier

3.1.3 TRANSFORMER + RECTIFIER + FILTER.

The smoothing is performed by a large value electrolytic capacitor connected across the DC supply to act as a reservoir, supplying current to the output when the varying DC voltage from the rectifier is falling. Fig 3.3 shows the unsmoothed varying DC (dotted line) and the smoothed DC (Solid Line). The capacitor charges quickly near the peak of the varying DC, and then discharges as it supplies current to the output. Smoothing is not perfect due to the capacitor voltage dropping a little as it discharges, giving a small ripple voltage. For many circuits a ripple which is 10% of the supply voltage is satisfactory and the equation below gives the required value for the smoothing capacitor. A larger capacitor will give fewer ripples. The capacitor value must be doubled when smoothing half-wave DC.[7][8]

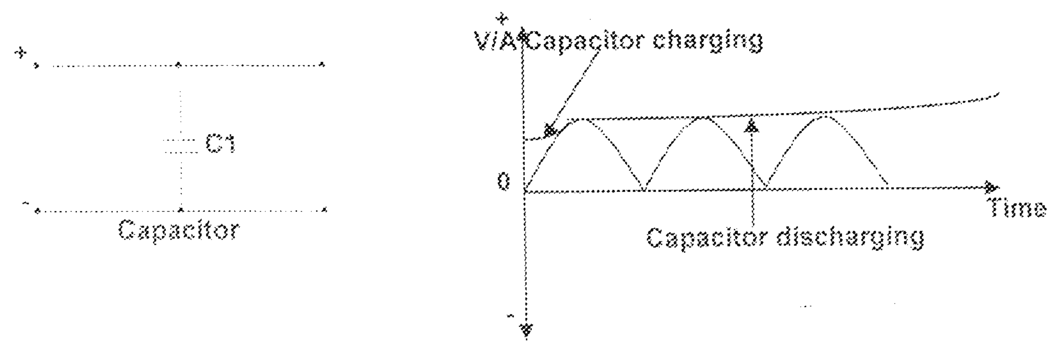


Fig 3.3 Smoothing (Capacitor)

C = Smoothing capacitance in farad (F).

I_o = output current from the supply in amps (A).

V_s = Supply voltage in volts (V).

f = frequency of the AC supply in hertz (Hz), 50Hz

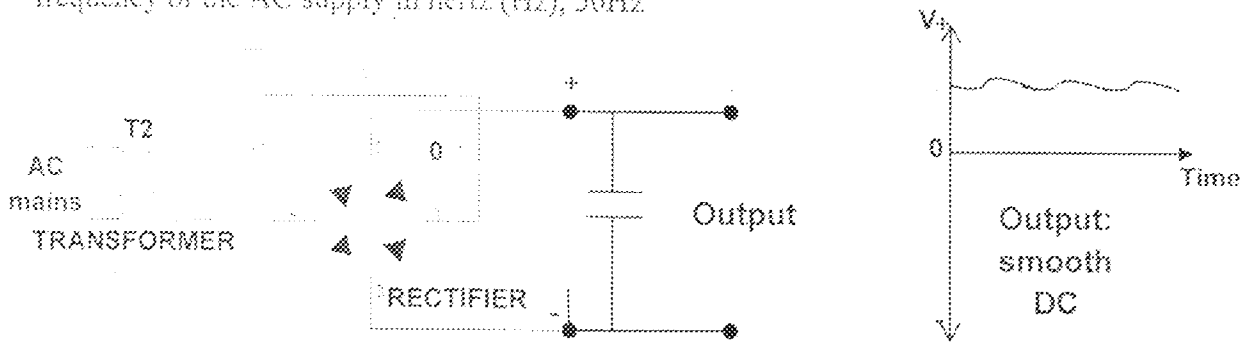


Fig 3.4 Transformer + rectifier + Filter

3.1.4 TRANSFORMER + RECTIFIER + FILTER + VOLTAGE (REGULATOR).

Voltage regulator ICs are available with fixed (typically 5, 9, 12, and 15V) or variable output voltages. They are also rated by the maximum current they can pass. Negative voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current (overload protection) and overheating (thermal protection). This device uses a 9V regulator.

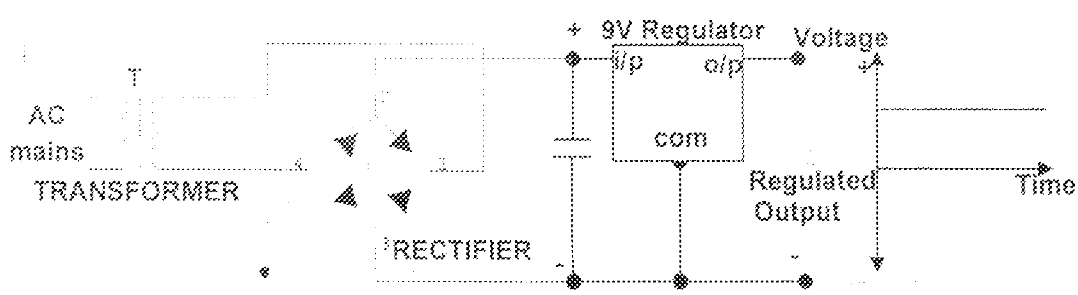


Fig 3.5 Transformer + rectifier + filter + voltage regulator

3.2 TRANSMITTER UNIT

The transmitter is part of the system that transmits the infrared beam which consists of a 555 timer which is in an astable mode.

Astable operation: Figure 3.3 shows the 555 connected as an astable multivibrator. Both the trigger and threshold inputs (pins 2 and 6) to the two comparators are connected together and to the external capacitor. The capacitor charges toward the supply voltage through the two resistors, R1 (27K) and R2 (25K VR), the discharge pin (7) connected to the internal transistor is connected to the junction of those two resistors.

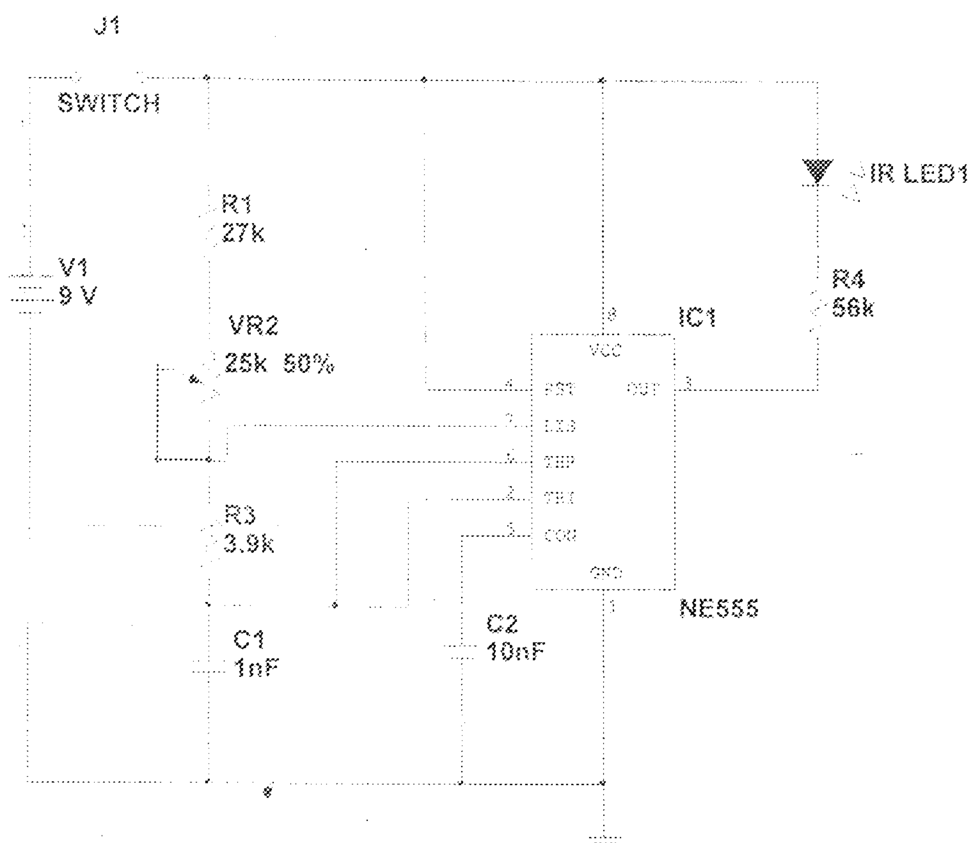


Fig 3.6 Astable Mode 555 timer of IR Transmitter

When power is first applied to the circuit, the capacitor will be uncharged; therefore, both the trigger and threshold inputs will be near zero volts (see Fig. 10). The lower comparator sets the control flip-flop causing the output to switch high. That also turns off transistor T1. That allows the capacitor to begin charging through R1 and R2. As soon as the charge on the capacitor reaches 2/3 of the supply voltage, the upper comparator will trigger causing the flip-flop to reset That causes the output to switch low. Transistor T1 also conducts. The effect of T1 conducting causes resistor R2 to be connected across the external capacitor. Resistor R2 is effectively connected to ground through internal transistor T1. The result of that is that the capacitor now begins to discharge through R2.

The only difference between the single 555, dual 556, and quad 558 (both 14-pin types), is the common power rail. For the rest everything remains the same as the single version, 8-pin 555.As soon as the voltage across the capacitor reaches 1/3 of the supply voltage, the lower comparator is triggered. That again causes the control flip-flop to set and the output to go high. Transistor T1 cuts off and again the capacitor begins to charge. That cycle continues to repeat with the capacitor alternately charging and discharging, as the comparators cause the flip-flop to be repeatedly set and reset. The resulting output is a continuous stream of rectangular pulses.

The frequency of operation of the astable circuit is dependent upon the values of R1, R2, and C The frequency can be calculated with the formula:

$$f = 1/(.693 \times C \times (R1 + 2 \times R2))$$

$$f = 1/((.693 \times 1nF)\times(27K\Omega + 2 \times 25K\Omega))$$

$$f = 18.7\ KHz$$

The Frequency f is in Hz, R1 and R2 are in ohms, and C is in farads. The time duration between pulses is known as the 'period', and usually designated with t.

The pulse is on for t1 seconds, then off for t2 seconds. The total period (t) is t1 + t2 (see fig. 3.7). That time interval is related to the frequency by the familiar relationship.

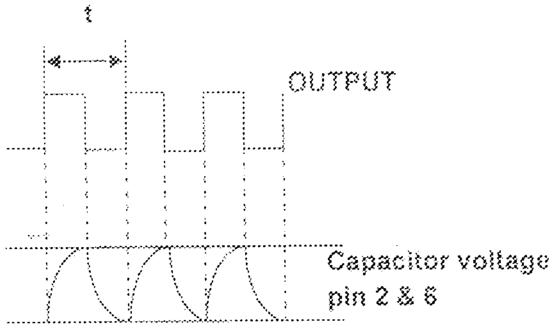


Fig 3.7

$f = 1/t$ or $t = 1/f$

$t = 1/18.7$ KHz = 0.53μs

The time intervals for the on and off portions of the output depend upon the values of R1 and R2. The ratio of the time duration when the output pulse is high to the total period is known as the duty-cycle. The duty-cycle can be calculated with the formula:

$D = t1/t = (R1 + R2) / (R1 + 2R2)$

D = (27KΩ + 25kΩ) / (27KΩ + 2 x 25KΩ)

D = 0.675 = 67.5%

You can calculate t1 and t2 times with the formulas below:

t1 = .693(R1+R2) C

t1 = .693(27KΩ+25KΩ)1nF

t1 = .36 μs

t2 = .693 x R2 x C

t2 = .693 x 27KΩ x 1nF

t2 = 0.17 μs

The 555, when connected as shown in Fig. 3.3, can produce duty-cycles in the range of approximately 55 to 95%. A duty-cycle of 80% means that the output pulse is on or high for 80%

circuit diagram. The LEDs is properly covered with a reflective material like glass on the sides to avoid the spreading of the IR beam and to get a sharp focus of the beam.

The IR SENSOR(sharp IR module) is an in built diode which operates in forward bias and senses IR from remote control with a frequency of 38kHz. Infrared sensors are widely known in the arts of intrusion detection and in fire or smoke detection. An active infrared detector includes a radiation source and an infrared sensor which is sensitive to interruptions in the radiation sensed from the source.

When there is nothing in front of them, the IR beam is not reflected onto the module and hence the circuit is not activated. When an object that comes near the device, the IR light from the LEDs is reflected by the object onto the module and hence the circuit gets activated. If there still a lot of mis-triggering, use a 1uF or higher capacitor instead of the 0.01uF.

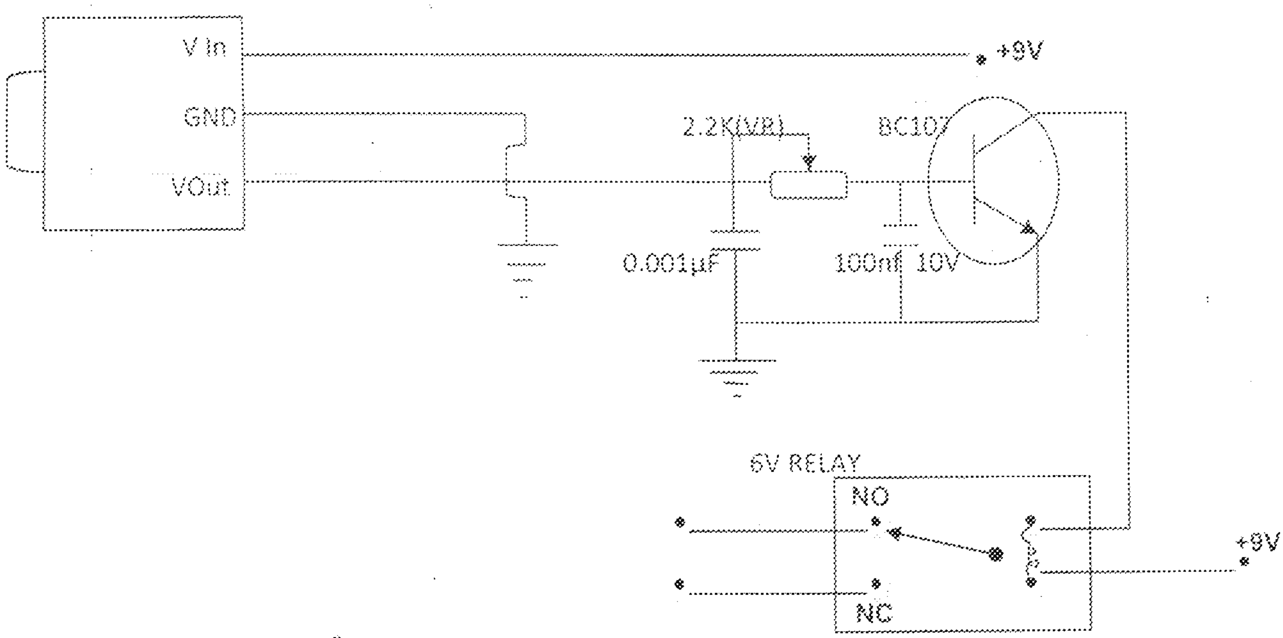


Fig 3.9 Diagram of Receiver Unit

The sharp IR Module is applicable for the use in optic application equipment, audio visual equipment, home appliances, telecommunication equipment (terminal) and etc. Sharp IR Module is built-in photodiode and has a B.P.F centre frequency of 38KHz. The schematic of the internal part of the module is shown in the figure in the next page.

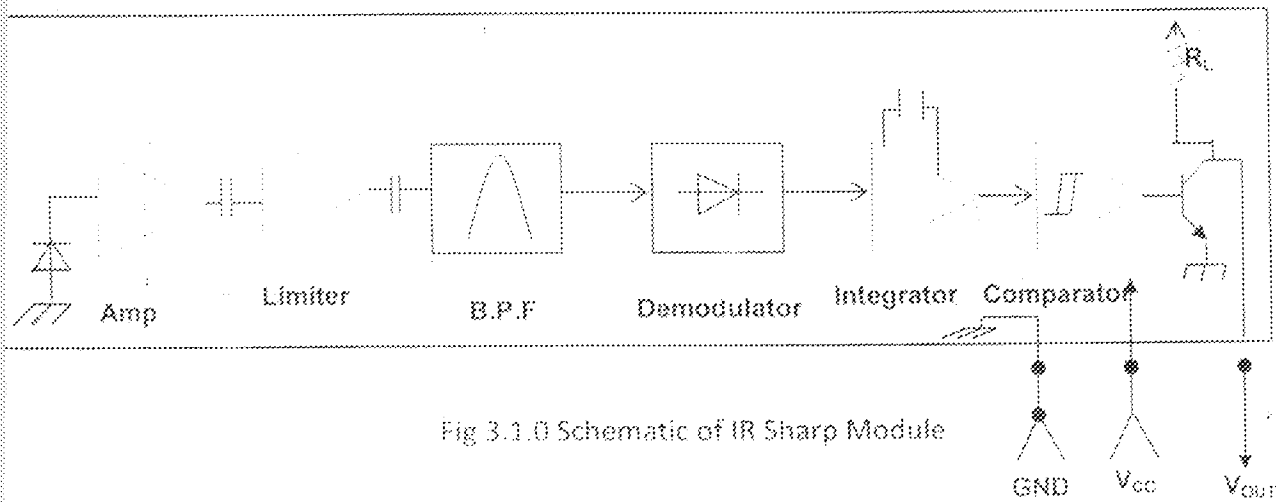


Fig 3.1.0 Schematic of IR Sharp Module

The absolute maximum rating of the supply voltage is 0 to 6V (Vcc) and recommended operating conditions of 2.4 to 3.4V (Vcc). The characteristic of linear reception distance is around 0.2m to 8m at an angle of 0^0, sensitivity angle reception distance of 0.2m to 6m at an angle of 30^0, as shown in figure below. The anti-outer peripheral light reception distance is around 0.2m to 4m at 0^0.

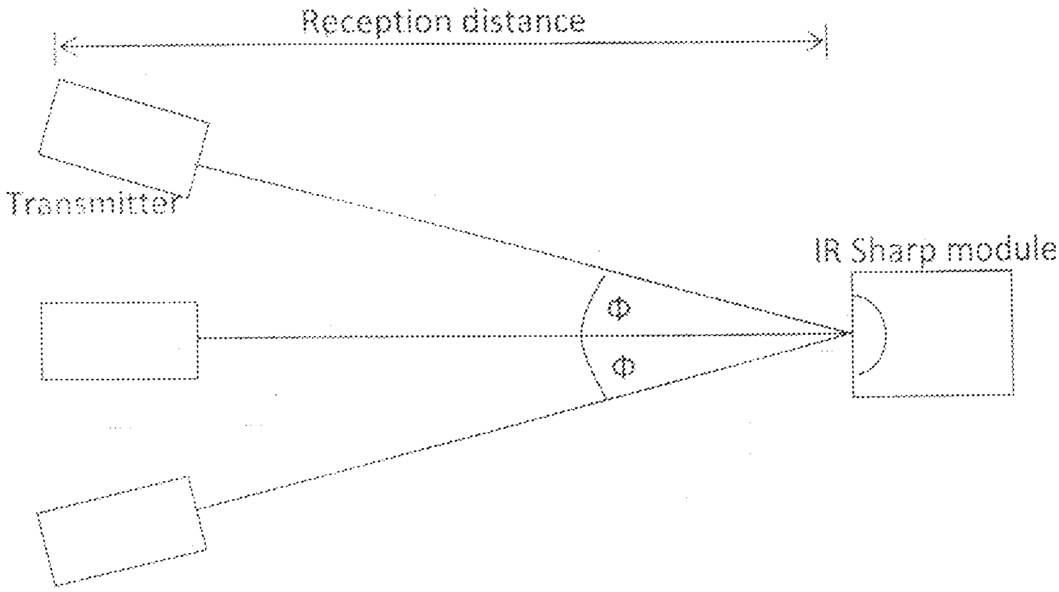


Fig 3.1.1 Standard optic system of IR Sharp module

3.4 THE AMPLIFIER UNIT

The amplification section of the devices consist of a BC107 NPN Transistor, connected to the output voltage of the receiver, which amplifies electric signal, that is the Infrared signal received by the receiver which is converted to electric signal, the amplified signal is transferred to the relay.

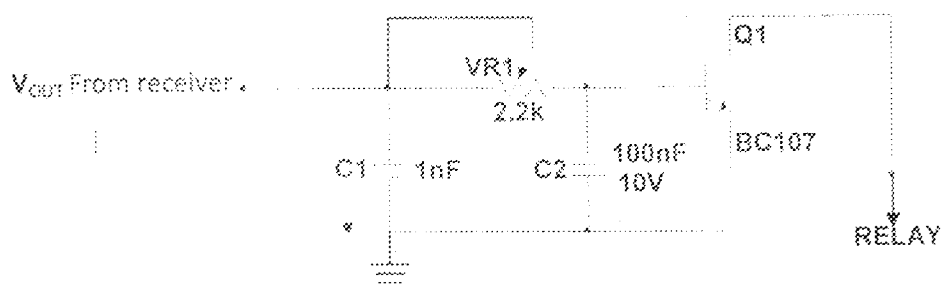


Fig 3.1.2 Diagram of Amplifier Unit

The NPN Transistor, both collector and base are positive with respect to the emitter (the P of the Positive being the same as the middle letter of NPN). The collector is more positive than the base as shown in the figure below.

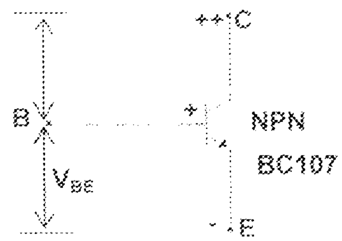


Fig 3.1.3 Diagram of a NPN Transistor

The three major primary currents which flow in a properly-biased transistor are I_C, I_B and I_C.

$$I_E = I_B + I_C$$

The ratio of the collector current to emitter current is called DC alpha (α_{dc}).

$$\alpha_{dc} = -I_C / I_E$$

The negative sign is due to the fact that current I_E flows into the transistor, where as I_C flows out of it. Hence, I_E is taken as positive and I_C as negative. The alpha (α) of a transistor is a measure of the quality of a transistor, higher the value of α, better the transistor in the sense that collector current more closely equals the emitter current. Its value ranges from 0.95 to 0.999. Obviously, it applies only to CB configuration of a transistor.

$$I_C = \alpha I_E$$

$$\text{Now, } I_B = I_E - \alpha I_E = (1-\alpha) I_E$$

3.5 THE CONTROL UNIT

The control unit of the project is consisting of a 6V relay which serves as a trigger to switch the alarm of the system. The relay is connected to the collector pin of the NPN Transistor which amplifies the electric signal from the receiver. When the transistor amplifies the signal to the relay, the relay is activated to trigger the alarm circuit. The relay is configured in a way that when the IR Beam is being received by the receiver is transfer to transistor; the relay will not trigger the alarm, only when the beam is being cut that the relay will trigger the alarm. The relay uses the same 9V voltage source used by the receiver and the transistor, which is why a 6V relay was used, because higher than that will consume excess voltage.

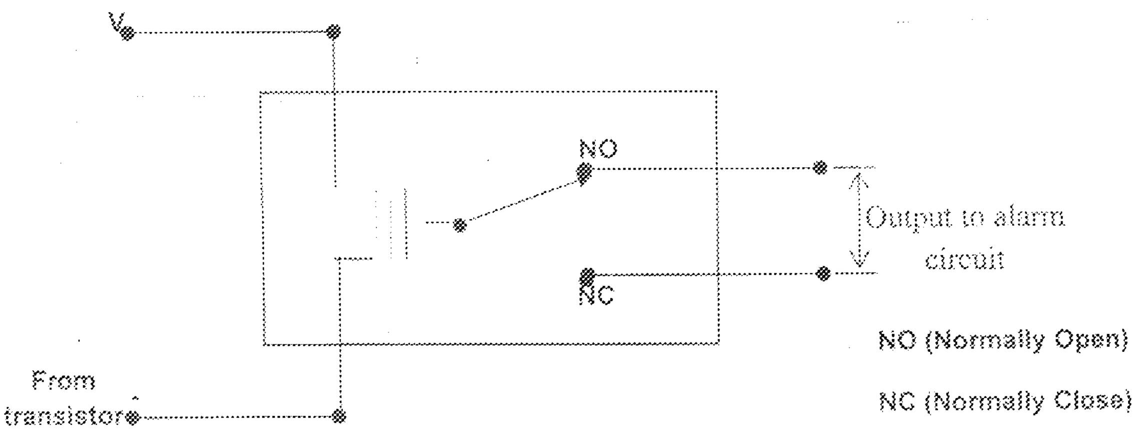


Fig 3.1.4 Diagram of 6V Relay

STATE OF POINTER	STATE OF ALARM
NC	ON
NO	OFF

Table 3.0

The Figure above shows the state of the pointer to the alarm. That is when the relay is triggered, indicating that the receiver has received the beam initially points to B, and when the beam is cut, the pointer changes to A and the Alarm is activated.

3.6 THE ALARM UNIT

This section of the project serves as the alarm section of the whole project. The alarm circuit consist of two 555 timers which are in an astable mode of operation.

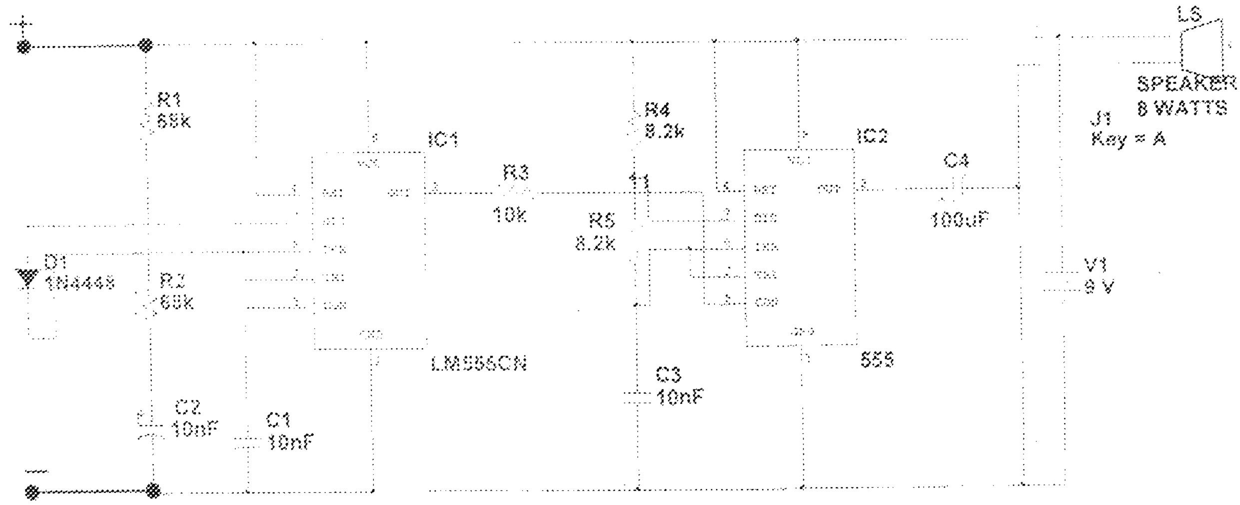
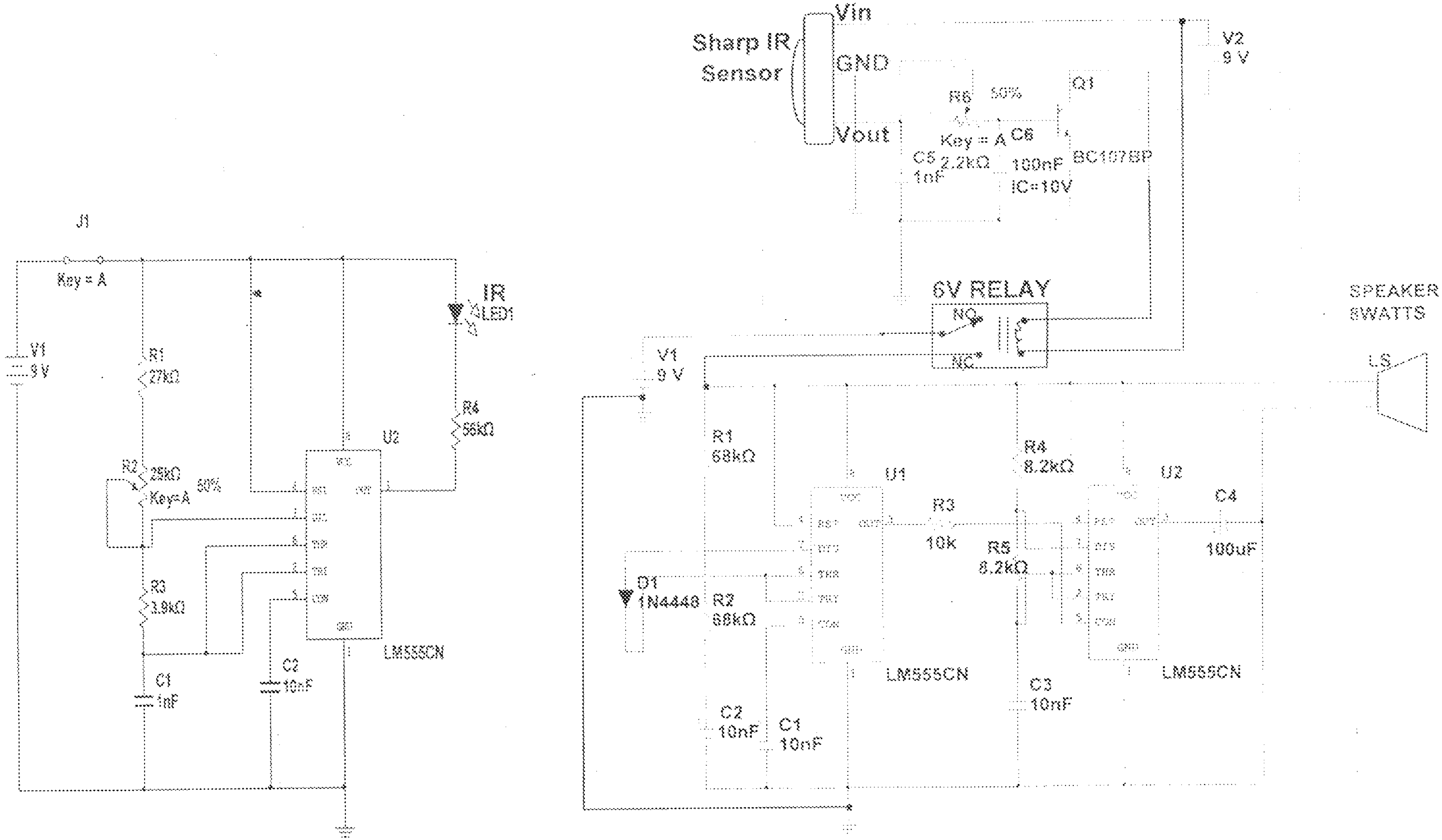


Fig 3.1.5 Circuit diagram of Alarm unit

The alarm circuit is powered by a 9V voltage source which is enough to power the whole circuitry. The two ICs each generates their own tune, the first 555 timer receives the electric signal which triggers the alarm, and it produces its tune which pin 3 the output of the first IC links to pin5 of the second, the pin5 of the second IC serves as the modulator of the signal from pin3, which generates the second tune of the alarm. The 100μF capacitor from IC2 pin3 (output) determines the frequency of the sound produced, the 8watts speaker is connected to the 100μF capacitor, which determines the frequency of the tune generated by the speaker.



Circuit diagram of IR beam barrier/ proximity sensor

CHAPTER FOUR

4.0 TEST, RESULT AND DISCUSSION

4.1 TEST

The following measurement apparatus were used to carry out the test.

1. Multimeter
2. Oscilloscope
3. Simulation (Multisim)

The entire device was analyzed accordingly, that is the power unit, the transmitter unit, control unit, amplifier unit and the alarm unit. Using the above instruments to test the performance of the various units, the project was firstly constructed on a breadboard for proper testing and analyzing, the multimeter use to test the input voltage when using a DC source and also used the multimeter to test the input/output when using the alternating AC voltage source. During the testing of the project, the IR transmitter was simulated using the multisim and made some corrections, the IR transmitter was placed facing the receiver which was connected to a relay. The transmitter and receiver were switched ON using different voltage source, it was noticed that the relay was triggered, indicating the infrared is been transmitted and the frequency of the IR beam was adjusted by adjusting the 25KΩ Variable resistor to have a precise accuracy to the receiver. The connection from the relay to the alarm unit was configure in a way that, when the receiver detects the IR beam, the relay will not trigger the alarm, but only when the IR beam is being cut by an object that the relay will trigger the alarm.

The receiver's variable resistor (2.2KΩ) was adjusted to increase or decrease the distance of reception of the receiver and since receiver has a 30^0 reception, a remote control, which the receiver can detect, is used with the constructed transmitter to test the angle and distance the receiver can detect the beam. Using the simulation workbench to make a precise analysis of the voltage required powering the circuit, before transferring it to the breadboard for further analyzing and the components were selected according to repeated analysis. These procedures were repeated to get a much accurate result before transferring it to the veroboard.

4.2 RESULT

The input voltage for the transmitter is 9V, according to the theoretical nature of the circuit; the IR beam has a frequency of 18.7 KHz and interval time (t) of 0.53μs, which is closer to the theoretical value of the project. The receiver and the control unit is also powered by approximately 9V, the alarm unit has a circuit, with two 555 timer which is constructed in an astable mode to create a tune and an 8W speaker which is powered by 9V voltage source. The alarm has a delay of 10 seconds and the 100μF of the alarm circuit of the second 555 timer, determines the tune of the speaker.

4.3 DISCUSSION

The output of the relay of the receiver circuit was a 9V relay but notice that it consumes more than half the voltage of the circuit; it was replaced with a 6V relay. The 8W speaker used as the output of the alarm circuit draws excessive current which causes instability in the circuit was observed when initially using a 6V power source, and a 9V was much more preferred.

The frequency of the infrared beam determines how the alarm will behave if the beam is broken very fast. The frequency is being reduced to ensure that when the beam is broken with a high speed the alarm is still triggered.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

In order to solve one of man's problems which is efficient and cost effective security system, infrared related systems play a vital role in ensuring that application is made easy. The complications associated with working with infrared were noticed and the use of digital electronics to overcome such problems was really appreciated.

The project gave me real practical experience in circuit designs. Due to the nature of the circuit and the components used, the entire project is cheap thereby making it affordable to the general public, the accuracy and sensitivity makes it a good option for sensitive locations such as banks, offices and military environments.

5.2 RECOMMENDATION

The infrared beam barrier and proximity sensor is a project that puts in mind the limitation of finance and other limiting factors, which the following advice or recommendation is given for a much easier future projects.

1. The range of the infrared transmitter could be increased by modifying the circuit for high amplification.
2. The design could be modified to secure a wider area through linked version of this project.

3. The infrared application could be advanced to sense the nature of material intruding the infrared beam.

4. The alarm could be fixed to set and reset automatically, without doing it manually.

5. The device could be modified for remote monitoring applications.

6. The signal from the disabling transmitter could be encoded so that the receiver only responds to a particular signal, this will enhance the security.

5.3 PROBLEMS ENCOUNTERED DURING THE PROJECT

1. Information is expensive and stressful.

2. Getting infrared sensors was quite a demanding task.

3. External light attenuate the infrared beam therefore testing the circuit in the day time was difficult and the sensors needed to be shielded.

4. Short circuits were also one of the problems faced.

5. Difficult of finding required components.

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