# DESIGN AND CONSTRUCTION OF AN INFRARED WIRELESS AUDIO TRANSCEIVER

BY

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# DEDICATION

This project is specially and particularly dedicated to God and my beloved family of Elder J. O. Alere and Deaconess D. Alere, my elder Brother Toyin Alere, my other brothers and sweet sister.

# DECLARATION

I ALERE TEMIDAYO. O declare that this work was done by me and has never been presented else where for the award of a degree. I also hereby relinquish the copyright to the Federal University of Technology Minna.

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My sincere appreciation goes to ENGR P. O. ATTAH who supervised me at the course of my project work.

Lastly, the project technical report would not have been completed without the effort and the financial contribution of my parents, ELDER & DEACONESS ALERE, MY ELDER BROTHER, TOYIN ALERE, and lastly BISHOP DAYO OLUTAYO and MRS OLUTAYO, who made the success of this project a reality.

May God Almighty reward you all. Amen

# ABSTRACT

The infrared wireless audio transmitter/receiver is aimed at transmitting audio wirelessly using high power infrared beams amplitude modulated. The modulation is done by a linear audio amplifier and drives 2-3 infrared diodes connected in series across a distance which is a function of power deliver to the diodes. The infrared wireless audio transmitter/receiver was design and constructed. Quality output was gotten from the transmitter to the receiver at a maximum distance of 6m with operating frequency of 20Hz-20 KHz.

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# CHAPTER ONE

# GENERAL INTRODUCTION

## 1.1 Introduction

The primary purpose of a communication system is to transmit and receive information such as audio, video or binary data over a communication medium or channel. [1] The basic components in a communication system are the transmitter, communication medium or channel and the receiver. Before the information can be transmitted, it must be converted into an electrical signal compatible with the communication medium. This is the purpose of the transmitter. The purpose of the receiver is to receive the transmitted signal from the channel and convert it back into its original information signal form. If the original electrical signal is transmitted directly over" the communication channel, it is called Base band transmission. [2] Cordless headphones and TV remote control often make use of infrared light (IR) to make the desired links. With most pieces of consumer electronics, from camcorders to stereo equipment, [2, 3] an infrared remote control is usually always included. Video and audio apparatus, computers and also lighting installations nowadays often operate on infrared remote control. The carrier frequency of such infrared signals is typically in the order of around 36KHz. There are many different coding systems in use. And generally different manufacturers use different codes and different data rates for transmission. Infrared light is invisible since its frequency is below that of visible red. Otherwise, |H| it is like any other light source, operating under the same laws of physics. In most cases, the IR signals are produced by a LED sources. TV remote send commands only one way in a low-speed burst for distance of up to 30 feel. They use directed IR with LED that have a moderated cone angle to improve ease of use characteristics. The IR signal sent out by those devices is generally modulated to around 38KHz carrier using amplitude shift keying (carrier ON or OFF). The data rate send is generally in a range of I00-2000bps. Interference from, other IR sources can be a minor issue. Thus there is some IR systems that use other frequencies and other modulation systems. IR transmitter and receiver systems are inexpensive and are generally reliable, [10 11].

Interference can come from IR remote controls, IR audio systems (these broadcast an IR signal continuously) or other IR sources. The interference can also be caused by other light sources such as fluorescent light (the ballast can cause IR interferences). In order to avoid any interference with this kind of equipments, the operating frequency of all electronic ballast has to be chosen so that problems in the 36KHZ frequency area are out of the question. One other way to limit interference is to use higher IR carrier frequencies. Some IR systems now use carrier frequencies into 'megahertz region. The carried frequency is amplitude modulated by the data, usually full on/off type modulation (K).

On the receiver side a photodiode takes up the signal. The out put is the demodulated digital input, just what was used to derive the transmitter usually receiver work so that when IR carrier is present, this output is high, when no carrier is detected, the output is low. [ 3 ]

The project is aimed at a frequency range response of 20Hz - 20KHz which is reasonable since the dynamic range of the most common devices falls within this range. The value is approximately average when compared to other similar devices. Hence lime was spent comparing commercially available product so as to determine a basic for my design.

## 1.2 Aims/Objectives

The project is designed due to the following objectives:

- To achieve quality output and to also reduce the cost of wiring when addressing audience in large halls and lecture theatres.
- To set a device suitable for wireless transmission of audio signals.
- Bearing in mind that since it is a low power infrared system, it can be battery powered while maintaining a sufficient power output for reliable transmission.

## 1.3 Methodology

The idea is to amplify, regulate and transmit audio signals wirelessly using high power infrared beams. The modulation is done by a linear audio amplifier and drives 2 - 3 infrared diodes connected in series across a distance, which a function of power is delivered to the diodes. The receiver is built around a photodiode detector designed for IR reception by reason of the in-cooperated UV filter.

### 1.4 Scope of work:

1. Chapter One gives the general introduction of the whole thesis, aim of project and methodology.
2. Chapter Two gives a brief historical background and the theoretical background behind the project.
3. Chapter Three gives the full design specification and construction on the

project.

4. Chapter Four contains the procedures involved in testing the work, the result obtained as well as the discussion of results.
5. Chapter Five gives the conclusions of the project, improvements and recommendations.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Theoretical background

The transmission of sound has been achieved in the past using cords and other devices. This idea of wireless sound transmission began using the wireless headphone which allows the user enjoy sound (music) subsequently solving the problem of the in conveniences in using cord. Modern computing and communication devices offer a wide range of wireless communication protocols to transmit data such as infrared and Bluetooth. However, one technology, although even more ubiquitous with lower power requirements, has fallen off the radar in recent year. Audio networking uses audible sounds as a low bandwidth data channel and can enhance, for example, smart phone usability. In that domain audio networking offers both short-range communications with near by device as well as longer-range data transfer by introducing audio data packets into ongoing telephone conversation. [10]

However, high-qualify audio sources are now taken for granted, not only from audio equipment, but also due to the success of the DVD, in video equipment as well, and these systems, which use analog modulation (FM modulation) are no longer appropriate for the current generation of audio technology, [1, 2]. Thus the DIAT digital audio transmission system has among other things the usage of QPSK digital modulation. Therefore the DIAT system was developed based on the concept of a wireless version of digital audio interface. This meant the DIAT system would not only handle audio signals, but would also be able to transmit, at the same lime, the main subsidiary information handed by the digital audio interface. [3] The DIAT system supports the same sampling rates as digital audio interface 32, 44. 1 and 48 KHz. A part from the wireless digital audio interface, it can be used as conventional infrared systems, also two nodes for different types of application, powerful error correction capabilities and chip set for easy system implementation. Other IK equipment includes wireless head phones and wireless mouse and pointing devices for PLs. This IR equipment normally uses IR light in the 800 to 1000nm wave length range, and changes the brightness of IR light (intensity modulation) to transmit information.

The D1AT system provides two modes so that the most appropriate mode can be selected for the application. [2.3] these modes are the full-band mode and the half-band mode. In full-band mode, the whole allocated band is used directly; it can transmit up to 24 bits of digital audio data as well as all the sub-data handled by the digital audio interface.

While the half-band mode, the allocated band is divided into smaller bands and each of those bands can be used independently, it can transmit up to 16 bits of the digital audio data.

## 2.2 Class A Power Amplifier

A power amplifier is a large-signal amplifier in the final stage of a communications transmitter the provide power to the antenna or in the final stage of a receiver that drives the speaker-when an amplifier is biased so that it operates in the region of the transistor collector characteristic cure for the full 360 degree of the input sine wave cycle [1]. It is classified as class A amplifier. This means that collector current flows during the full since wave cycle, making class A amplifiers the least efficient of the different classes of large signal amplifiers. In a large-signal amplifier, the input signal causes the operation point (Q-point) to move over a much larger portion of the AC load line than in a small-signal amplifier. Therefore, large-signal class A amplifiers require the operation point to be as close as possible to the center of the ac load line to avoid clipping of the output, wave form. In a class A amplifier, the output voltage waveform, has the same shape as the input voltage waveform, making it the most linear of the different classes of amplifiers. Most small-signal amplifier are class A amplifiers. When a class A amplifier is used as a larger-signal amplifier, it is normally used in a low power application that requires a lineal-amplifiers such as an audio power amplifier as a power amplifier in a low-power transmitter with low-level AM or SSB modulation. For a large-signal class A common emitter amplifiers the de collector-emitter voltage ($V_{CE}$) can be calculated thus.

$$V_{CE} = V_C - V_E \qquad \text{- - - - - - - -} \qquad 2.2.1$$

The DC collector current ($I_C$) can be determined by calculating the current in the collector resistor ($R_C$). Therefore,

$$I_C = \frac{V_{CC} - V_C}{R_C} \qquad \text{- - - - - - - -} \qquad 2.2.2$$

The **AC collector resistance ($R_C$)** is equal to the parallel equivalent of the collector resistor ($R_C$). Therefore,

$$R_C = \frac{R_C R_L}{R_C + R_L} \qquad \text{- - - - - - -} \qquad 2.2.3$$

The **AC load line** has a slope of $\frac{1}{(R_c + R_e)}$

and crosses the dc line Q-point. The AC load line crosses the horizontal axis of the transistor collector characteristic curve plot at $V_{ce}$ equal to $V_{CEQ}$ +

$(I_{CQ})(R_C + R_e)$, where $V_{CEQ}$ is the collector-emitter voltage at the Q-point and $I_{CQ}$ is the collector current at the Q-point.

The amplifier **voltage gain** is measured by dividing the ac peak-to-peak output voltage ($V_O$) by the AC peak-to-peak input voltage ($V_{in}$). The expected amplifier voltage gain for a common-emitter amplifier is calculated from

$$AV = \frac{R_C}{r_e + R_e}$$

Where RC is the ac collector resistance, $r_e = 25\ mV/I_E\ (mA)$, and $R_e$ is the Um-bypassed emitter resistance.

In order to center the Q-point on the load line, you must try different values of $R_E$ until $V_{CEQ} = (I_{CQ})(R_C + Re)$,

where $I_{CQ} = I_{EQ} = \dfrac{V_E}{(R_E + r_e)}$,

$V_{CEQ} = V_{CC} - I_{CQ}(R_E + r_e + R_C)$, $R_C$ is equal to the ac collector resistance, and $R_C$ is equal to the dc collector resistance.

The **output power (Po)** is calculated as follows:

$$Po = \frac{V^2_{RMS}}{R_L} = \frac{V_O^2{}_{(P-P)}}{8R_L}$$

Where $Vo_{(P-P)}$ is the peak-to-peak output voltage and $V_{RMS} = \dfrac{V_{O(P-P)}}{2\sqrt{2}}$

The **percent efficiency (η)** of a large-signal amplifier is equal to the maximum output power ($P_O$) divided by the power supplied by the source ($P_S$) times 100%. Therefore,

$$\eta = \frac{P_O}{P_S} x\, 100\%$$

Where PS = (Vcc)(Is). The current at the source (Is) is determined from

$$I_s = I_{12} + I_{CQ}$$

Where $I_{12}$ = Vcc/($R_1$ + $R_2$). *Note:* $I_{12}$ is the current in resistor $R_1$ and $R_2$, neglecting the base current.

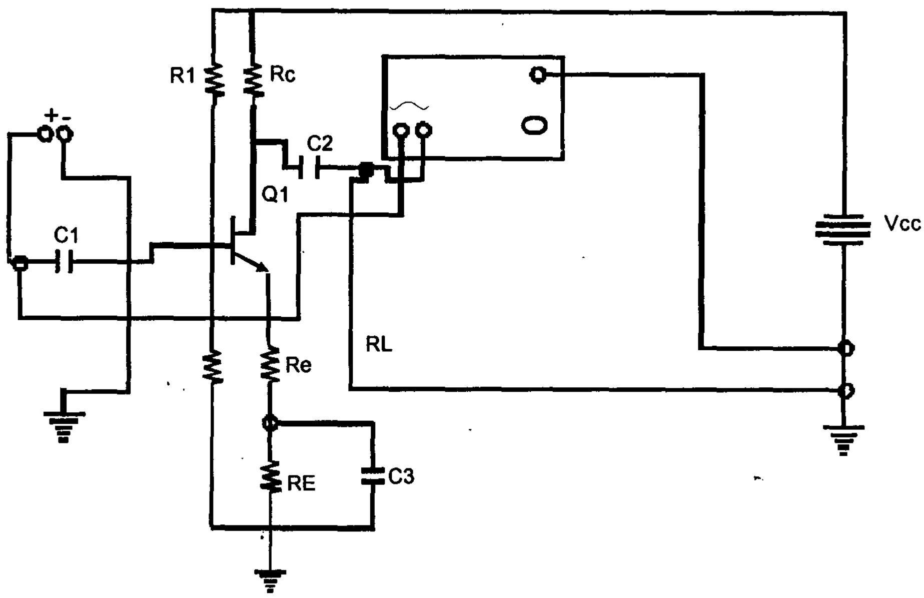


Fig. 2.0 Class A amplifier

## 2.3 Transistors

Transistors are active components basically, used as amplifiers and switches. Hence the two main types arc the bipolar transistors whose operation depends on the flow of both minority and majority carriers, and the unipolar or Field effect transistors (called FETs) in which current is due to majority carriers only (either electrons or holes). [8 , 9 ] The transistors as a switch operates in class A mode. In this mode of bias the circuit is designed such that current flows without any signal present. [5] The value of bias current is cither increased or decreased about it mean value by the input signal (if operated as an amplifier) or ON and OFF by the input signal if operated as a switch

Fig 2.1 shows the transistor of an amplifier.

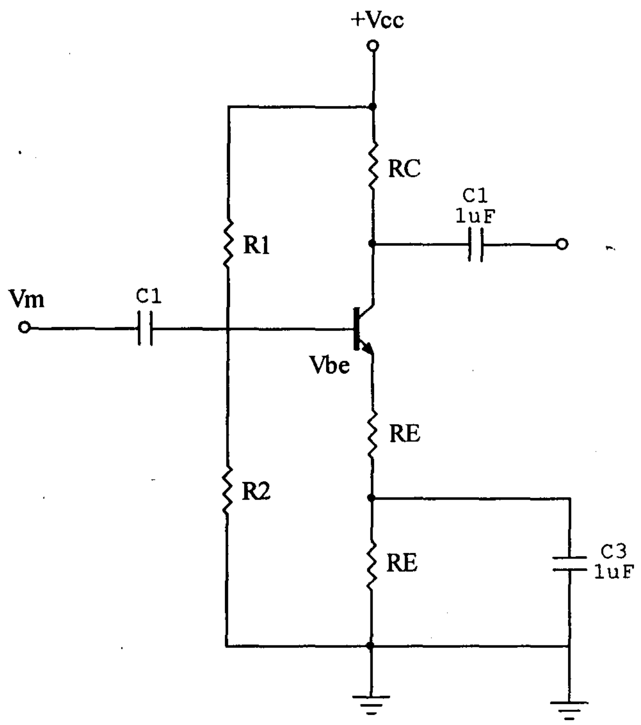


Fig 2.1 Transistor as an Amplifier

## 2.4. Using transistor as a switch

The diagram below shows how a transistor can be used as a switch.

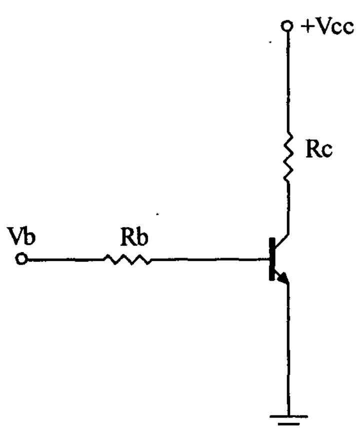


Fig 2.2 Transistor as a Switch

For the transistor configuration, since the transistor is biased to saturation

$V_{CE} = 0$, when the transistor is ON,

This implies that,

$$V_+ = I_C R_C + V_{CE} \qquad \text{.................................} \quad (2.5)$$

$$V_{IN} = I_B R_B + V_{BE} \qquad \text{.................................} \quad (2.6)$$

$$\frac{I_c}{I_b} = h_{FE} \qquad \text{.................................} \quad (2.7)$$

$$R_b = \frac{V_{in} - V_{BE}}{I_b} \qquad \text{.................................} \quad (2.8)$$

Where

$I_c$ = collector current

$I_b$ = base current

$V_{IN}$ = input voltage

$V^+$ = Supply voltage

$V_{CE}$ = collector emitter voltage

$H_{FE}$ = current gain

$V_{BE}$ = Base emitter voltage.

## 2.5 Operational amplifier

The Basic Amplifier; The basic amplifier may be represented by the symbol shown in Fig 2.3 The amplifier has two inputs, which are denoted by $V_{i+}$ and Vi-, and a single output, Vo positive and negative power supplies of equal magnitude are normally used, (although single supply operation is possible) and arc shown as + $V_s$ and -$V_s$ in Fig 2.3 (for simplicity these connections are not normally shown tin circuit diagrams). The common zero + $V_s$ and - Vs is an important reference value for $V_{i+}$ , Vi-, and Vo that does not appear explicitly on the amplifier symbol, since a direct connection is not required. However one of the amplifier inputs may be connected to it either directly or indirectly, depending on the required mode of operation.

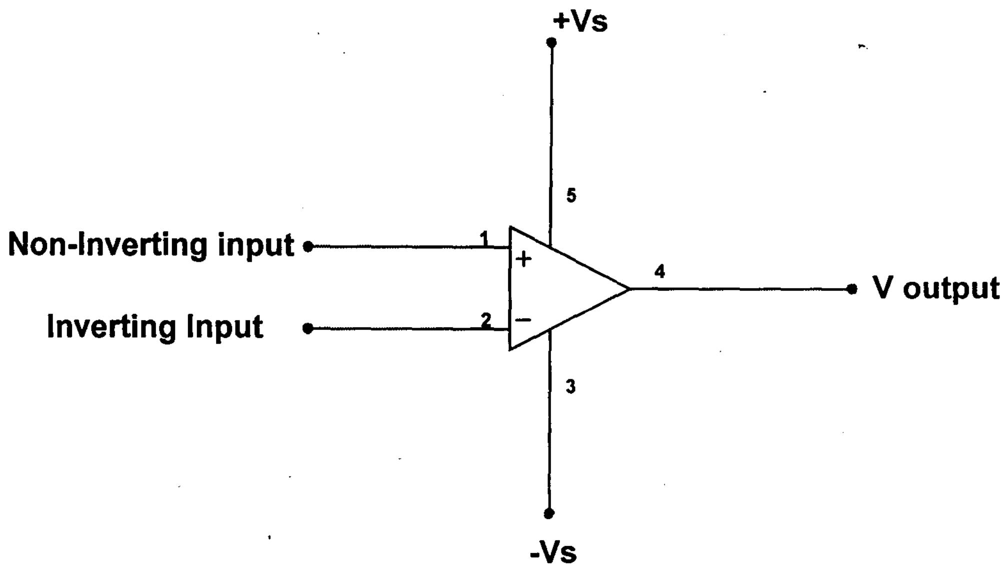


Fig 2.3 Basic operational amplifier symbol

For a characteristic having a finite slope, the input/output relationship may be written as

$$V_O = A(V_{i+1} - V_{i-1}) \qquad - \quad - \quad - \quad - \quad - \quad - \quad - \qquad 2.6.0$$

Where A is the gain of the amplifier in the region between the two output saturation voltages. [14] The value of A is large for practical amplifiers (typical) more than 50,000) and theoretically infinite for ideal ones. A is known as the open loop gain, which is the gain of the amplifier without feed back (an external connection that makes Vi depend on $V_0$ in some way). The inputs (indicated by + and - in Fig 2.3 are referred to as non inverting and inverting, respectively, for reasons that are evident from equation (2.6.0) [14].

### 2.5.1 Inverting mode operation as scalar and summer

The basic configuration is shown in figure 2.4, where the resistors Rl and RF are the input and feed back resistors, respectively. The non inverting input of the amplifier is connected to the common zero of the power supplies, [ 2 ] and the inverting input has a voltage V with respect to this. Let the currents in the input and feed back resistors be I as shown. In fig 2.4 such that the input resistance of the amplifier it self is so high that the current flowing into the inverting input may be neglected on an assumption that is normally justified. In practice the currents will sum to Ohm's law can be applied to each resistor.

$$\frac{(Vi - V)}{Ri} + \frac{(Vo - V)}{R_f} = 0 \quad - \quad - \quad - \quad - \quad - \quad - \qquad 2.6.1$$

In this configuration, equation (2.6.0) becomes

$$\frac{Vo}{V} = A \qquad \text{and therefore,}$$

$$\frac{V_0}{A} = - Vo \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \qquad 2.6.2$$

Substituting this into (2.6.1) yields

$$\frac{Vi + \frac{Vo}{A}}{R_i} + \frac{Vo + \frac{Vo}{A}}{R_f} \quad - \quad - \quad - \quad - \quad - \quad - \quad - \qquad 2.6.3$$

For a large value of A, V tends forward O and this reduces to [14]

$$\frac{Vi}{R_i} + \frac{Vo}{R_f} = 0 \quad - \quad - \quad - \quad - \quad - \quad - \quad - \qquad - 2.6.4$$

$$V_o = \frac{-(R_f)\,V_i}{R_i} \qquad - 2.6.5$$

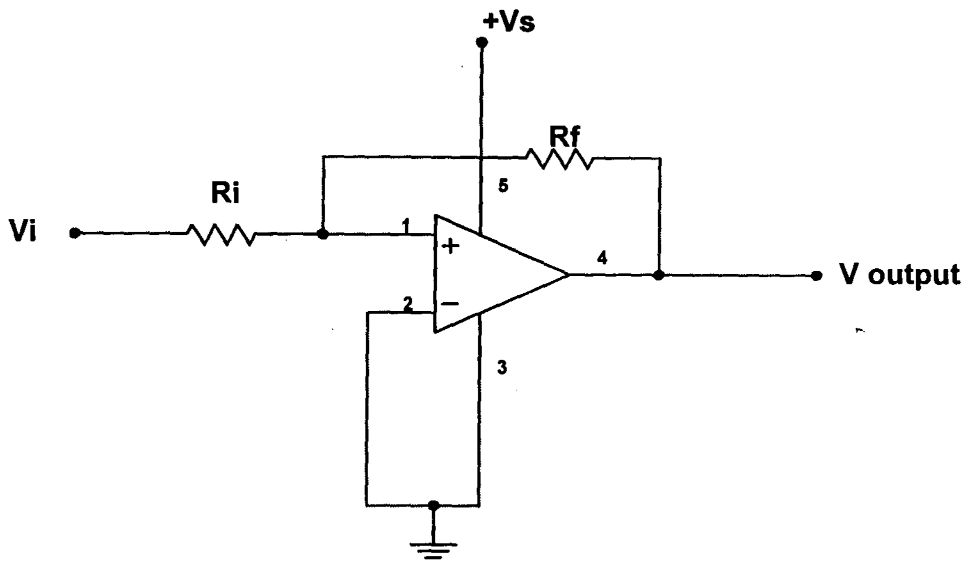


Fig 2.4 Operational amplifier configuration

### 2.5.2 Operational amplifier configuration

This is an important and useful result since the relationship between $V_o$ and $V_i$ (a "gain" of - $R_F/R_I$) depends only on the values of the resistors and not on the characteristics of the amplifier itself this is true of course, only when the circuit is operating under such conditions that the assumptions of negligible amplifier input current and very high open loop gain are valid. Since V has become very small, the potential of the inverting input is very close to that of the common reference. Consequently, this point is often referred to as a virtual ground. [14]

# CHAPTER THREE

## DESIGN AND IMPLEMENTATION

### 3.1 Design Review

The basic components in an audio communication system are the audio source, a transmitter, communication medium or channel. the receiver and an output. The figure below is the diagram of the General block diagram.

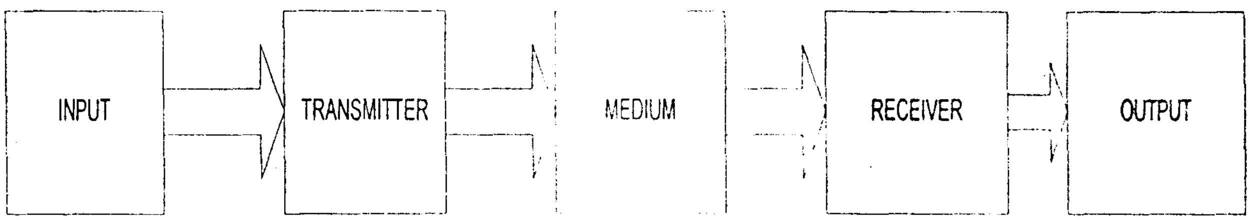


Fig 3.0 General Block Diagram

### 3.2 Input Stage

Before the information can be transmitted. it must be converted into an electrical signal compatible with the communication medium. This is the purpose of the input stage.

This is done via an audio source which could be from any of the following devices:

(i) Personal computer

(ii). Tape recorder

(iii) Radio receiver

(iv) CD audio player etc

The Audio sound is taken via a cord or wire from the output jack of any of the above devices and taken to the next stage.

## 3.3 Transmitter Stage

The infrared transmitter consists of three Gallium Arsenide Infrared light emitting Diode (ILED) two (9014) NPN small signal transistors. The three series connected one-one are made the collector load of the class A biased amplifier whose base voltage ($V_b$) is derived from a 5KΩ potentiometer. The audio signal is AC coupled into the base-emitter circuit of the transistors through a 0.1μf capacitor to prevent the DC levels of the amplifier getting disturbed.

As VIN changes, so does IC and the current through the LEDs. This current change is translated into invisible IR radiation that can be propagated across space, carrying the modulating signal. The signal is then radiated via free space as it's communication medium.

The transmitter stage having the three Gallium Arsenide infrared light emitting Diode (LED) and the NPN small signal transistors a class A biased amplifier is shown in fig 3.2 below:

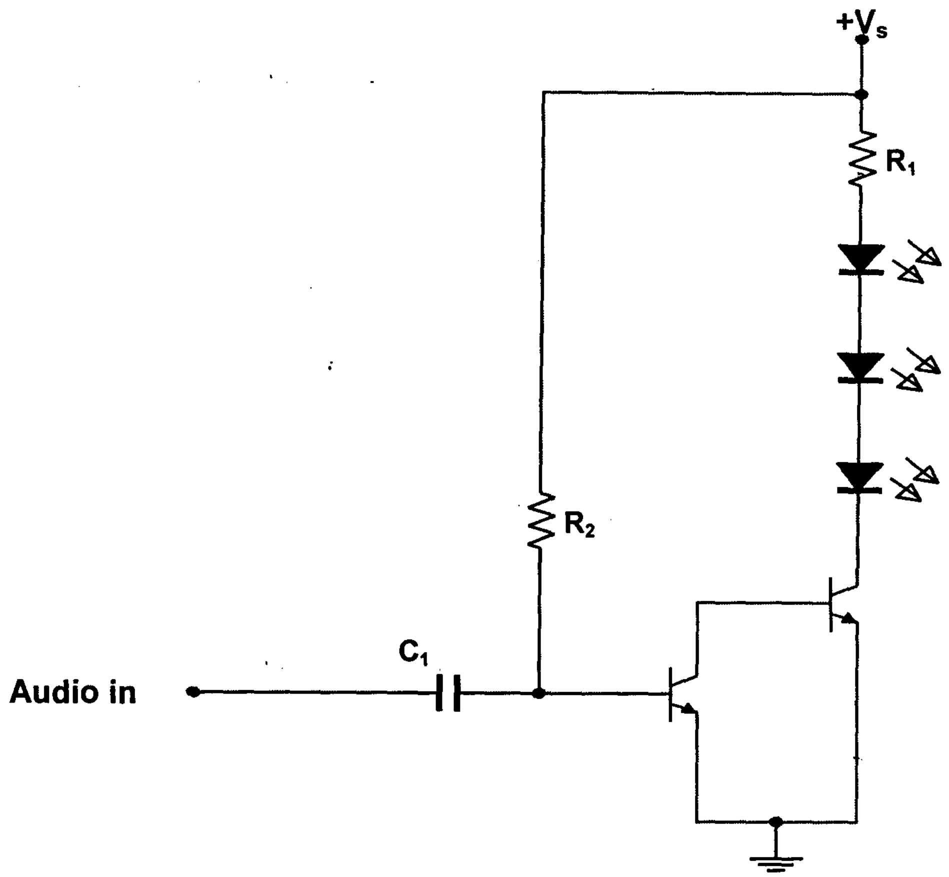


Fig 3.1 The transmitter stage

D1, $D_2$, and D3 are Infrared Light Emitting diode

## 3.4 The Receiver

The modular diagram below briefly summarizes the reception stage.

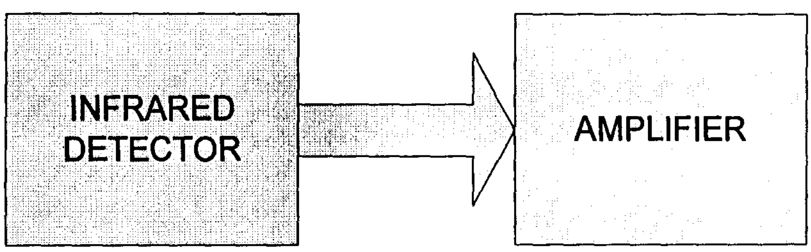


Fig.3.2 Block Diagram of the receiver circuit

### 3.4.1 The Detector Stage

A photodiode was used to detect/sense the incoming transmitted infrared signal. The photodiode is operated in a reverse biased mode, i.e. it's cathode is made more positive relative to the anode. That is to say that in darkness the photodiode has a high resistance hence a low forward current.

In this biasing, it sources current from the positive supply upon excitation by trans-resistance.

The photo diode was used as the main photo - sensor due to its ability to resist day light interference better than the other optical devices.

### 3.4.2 Pre amplification Stage

This current is transformed into voltage by the feedback resistance from the output of the inverting amplifier to its (-) input.

One goal of the op- amp is to generate the biasing reference level for the other half configured as an amplifier. Running on + 6V ac, a potential divider formed by two series connected 10 k Ω Resistances provide a ± 3.0v potential that is buffered by a half of the op- amp connected as a voltage follower with 100% negative feed back.

This fully- buffered 3. 0V is applied to the (+) input of the inverting amplifier to establish a reference 3.0 Vac level at it out put around which a symmetrical swing of the Ac is centered.

When the IR photodiode is irradiated by IR signal it sources current from the positive supply into the inverting input of the Op- amp. This current varies in amplitude with respect to the amount of irradiation if the irradiating IR source is an amplitude modulated ware form a replica of the modulation signal is recovered by the photodiode.

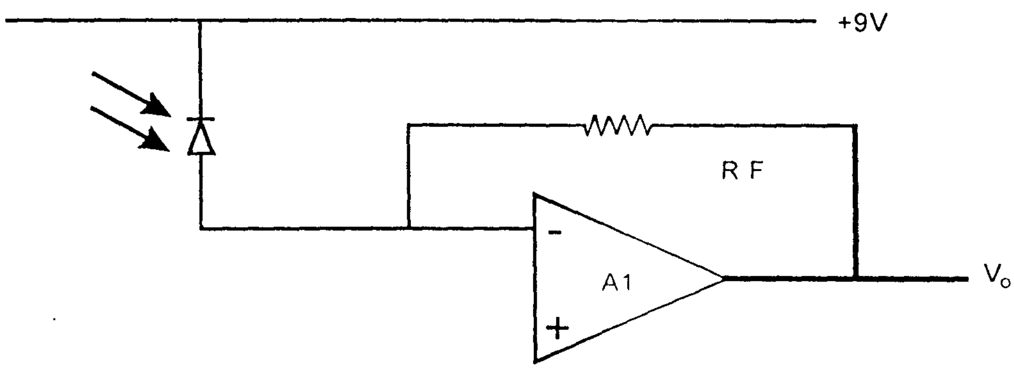


Fig. 3.3 (Photodiode and operational amplifier)

The resistance measured from the photodiode when there is no transmission is approximately 1MΩ. The voltage gain A(v) is given as

$$A(v) = \frac{-R_F}{R_D}$$

The feedback resistor used is 4.7MΩ. Hence the magnitude for the voltage gain is given as

$$|A(v)| = 4.7M / 1M.$$

$$= 4.7$$

## 3.5 The Output Stage

The AC output voltage of the photodiode amplifier is fed into TDA 2822 power Amplifier where it is further amplified to a level that can directly drive the speaker.

The TDA 2822 is dual audio amplifier with 8- pin configuration. It has a wide operating supply voltage (Vcc) ranging 1.8v - 1.2v, with a low Crossover distortion and quiescent circuit current. The signals obtained from the audio amplifier is then fed to a speaker. The diagram below shows the circuit for the output stage.

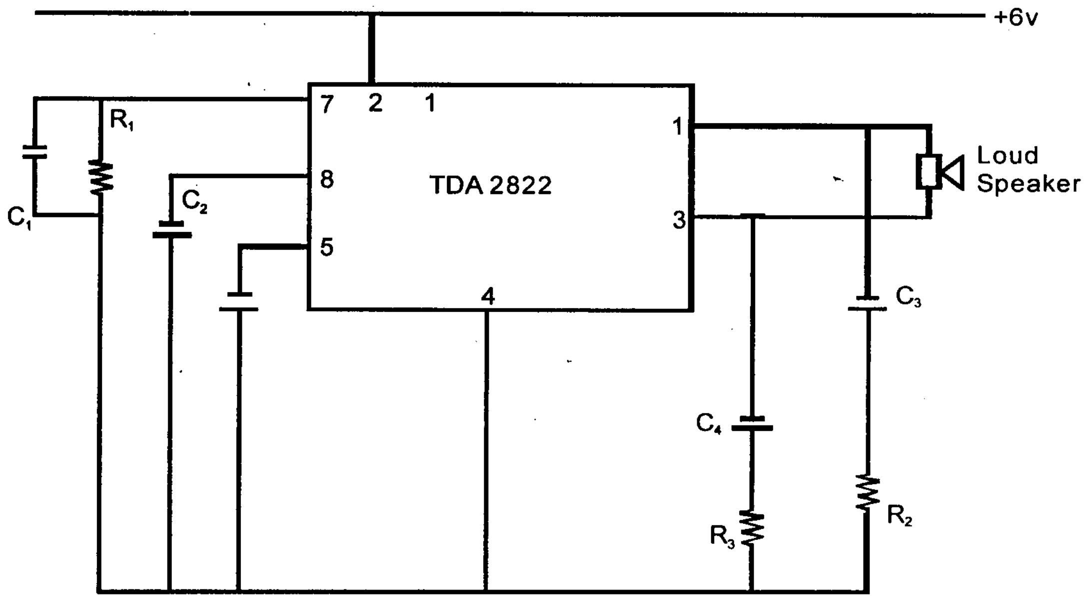


Fig. 3.4 Output stage circuit diagram

### 3.6 Power Supply Unit of the Transmitting Section

The transmitter is powered via a 9v battery. This power is further regulated via an integrated circuit regulator. The integrated circuit used is 7809.

### 3.7 Power Supply Unit of the receiver circuit

All stages in the project use + 15V or 12VDC. The power supply stage is a linear power supply type and involves in step down transformer. Filter [6] capacitor and voltage regulators. To give the various voltage levels. The power supply circuit diagram is show in fig 3.5 below.

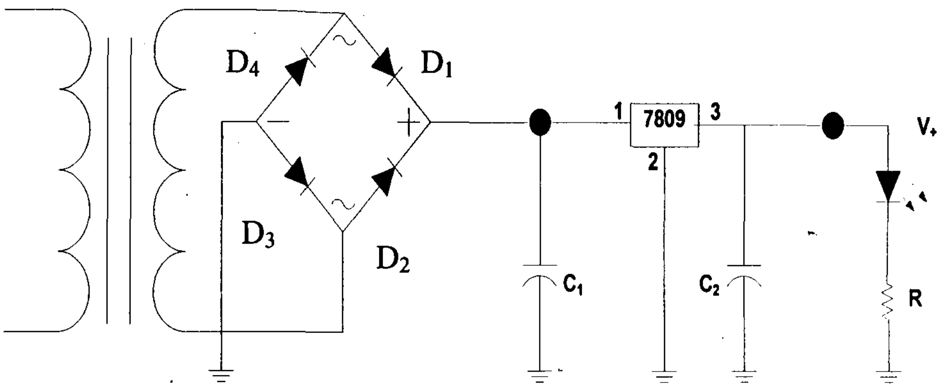


FIG. 3.5 Power supply circuit

The rectifier is designed with four diodes to form a full ware bridge network, d is the filler capacitor and C, is inversely proportional to the ripple gradient of the power supply.

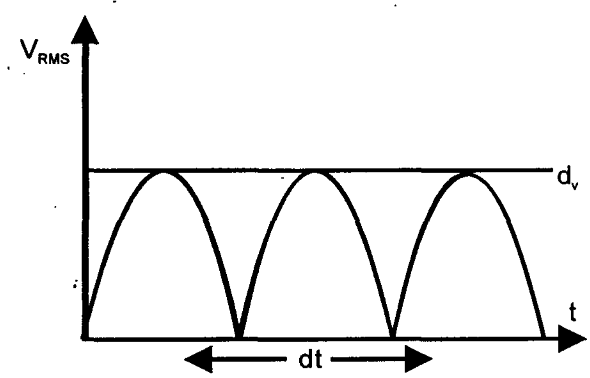


Fig 3.6 Ripple gradient of power supply output

Fig. 3.6 Where dv is the ripple voltage for time dt, where dt is a dependent in power supply frequency. For an RMS voltage 6 volts (from the transformer).

V peak =15 x √2 = 21.2V hence letting a ripple voltage of 15% makes

dv = 15x21 .2 /100 =3.18V

But $I = C\frac{dv}{dt}$

$$= \frac{dt}{dv}\Omega$$

1Oms/**3.1** (where dt is 1Oms for 50Hz) = 3225.8µf

A preferred valve of 330µf was employed for the power supply stage.

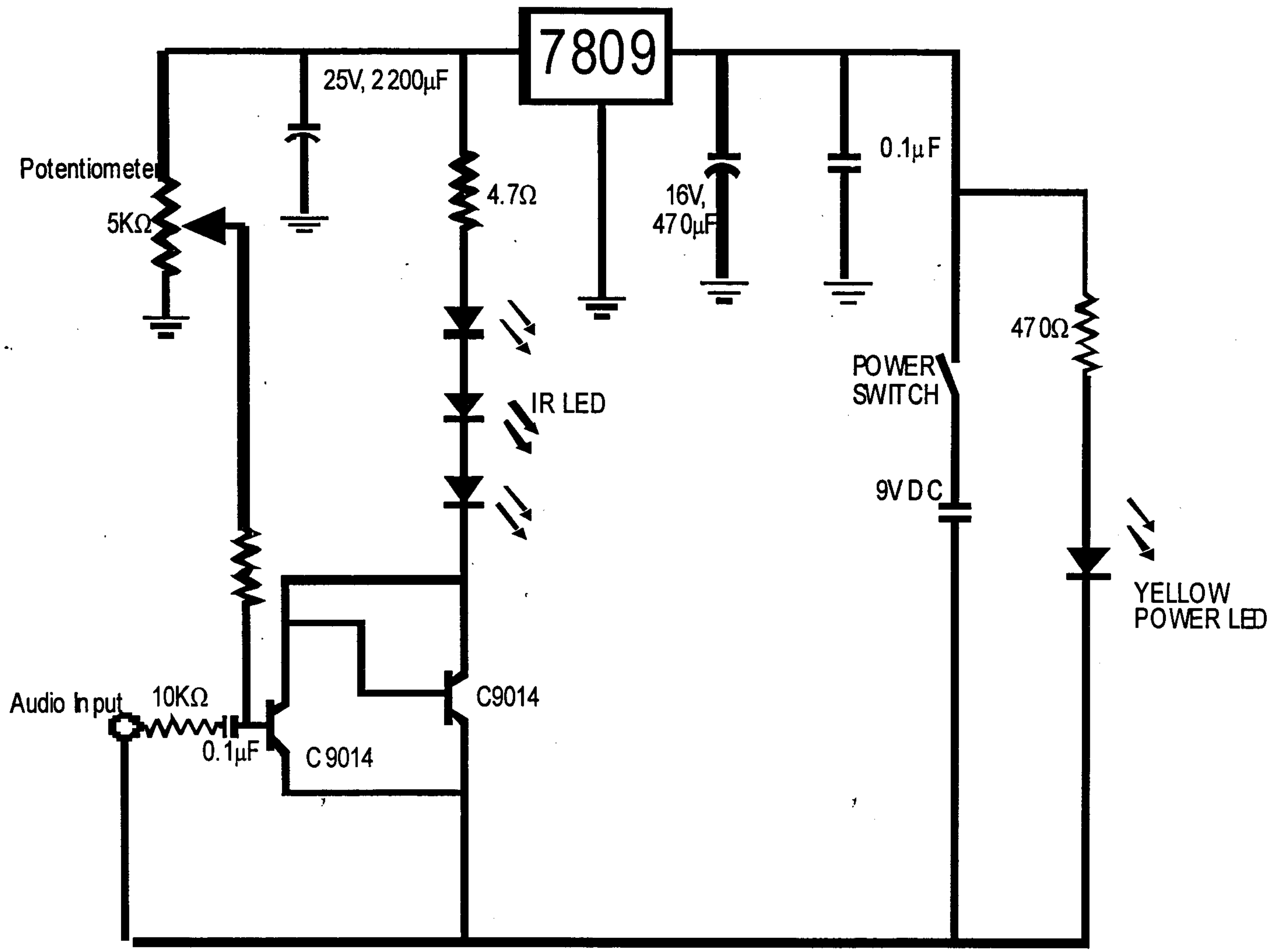


**FIG. 3.7 CIRCUIT DIAGRAM OF TRANSMITTER**

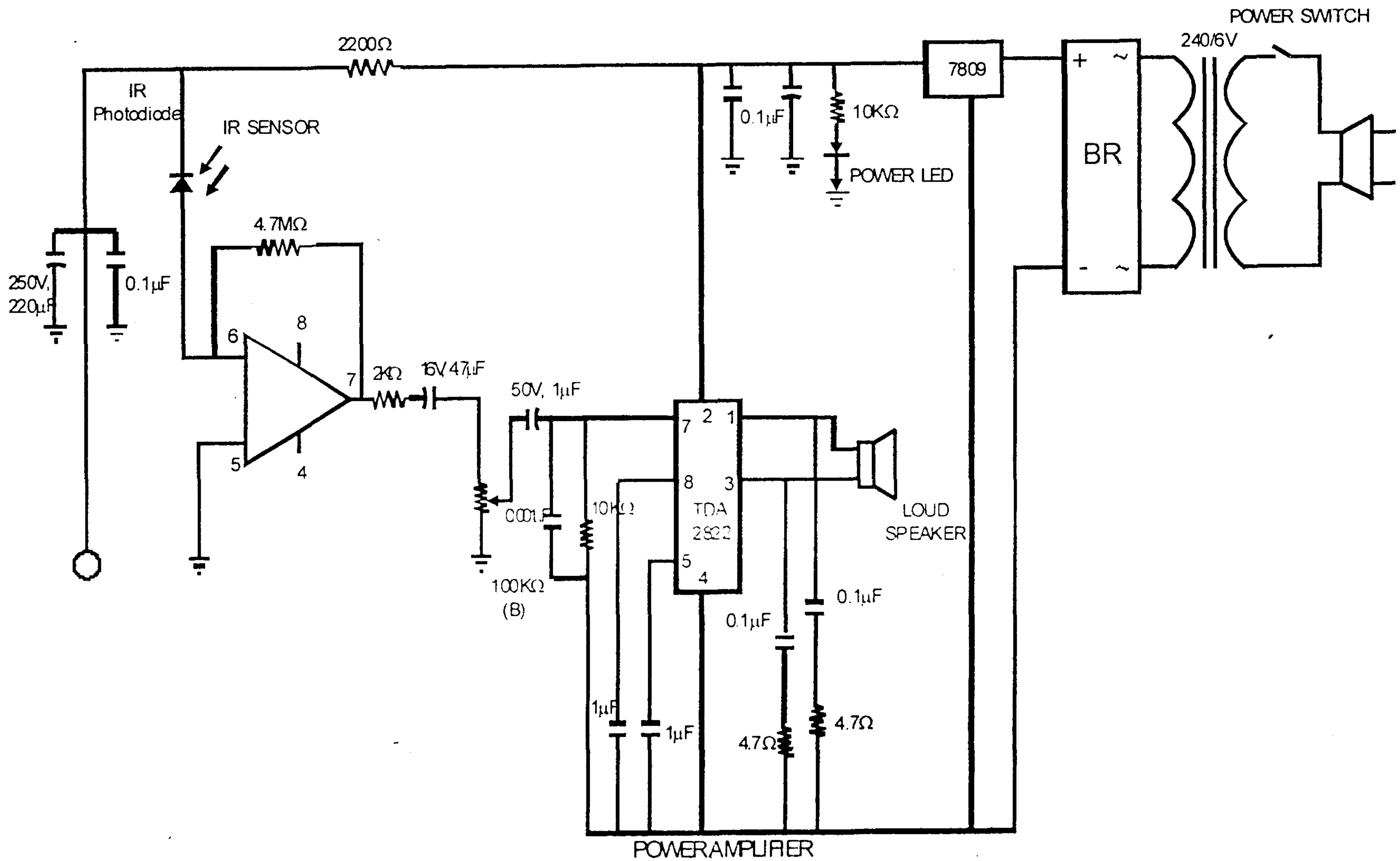


FIG. 3.8 **CIRCUIT DIAGRAM OF RECEIVER**

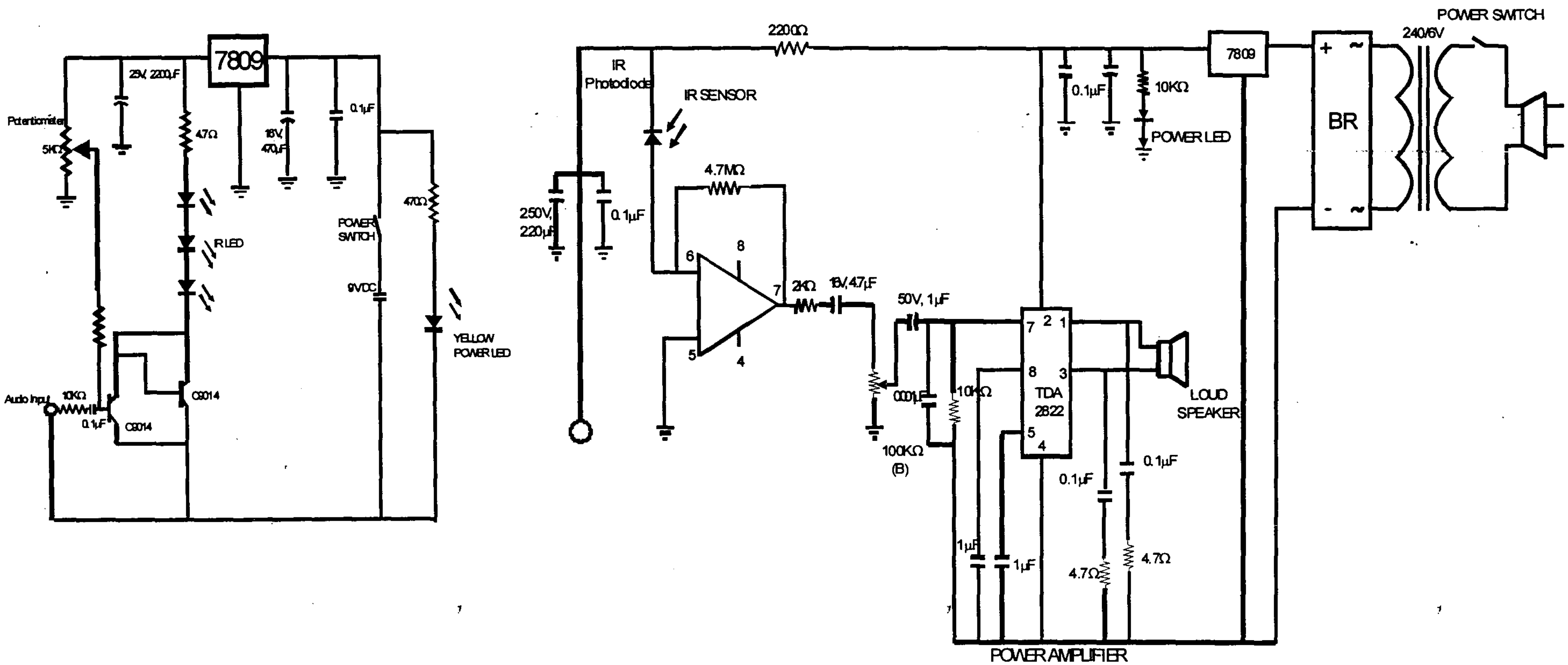


Fig. 3.9 **COMPLETE CIRCUIT DIAGRAM OF AN INFRARED WIRELESS AUDIO TRANSMITTER / RECEIVER**

# CHAPTER FOUR

# CONSTRUCTION, TESTING AND RESULT

## 4.1 Construction

The soldering of the circuits and coupling of the entire project to the casing was done. The infrared was soldered followed by the receiver. The soldering of the circuit was done on a Vero- board after testing it working on a bread board.

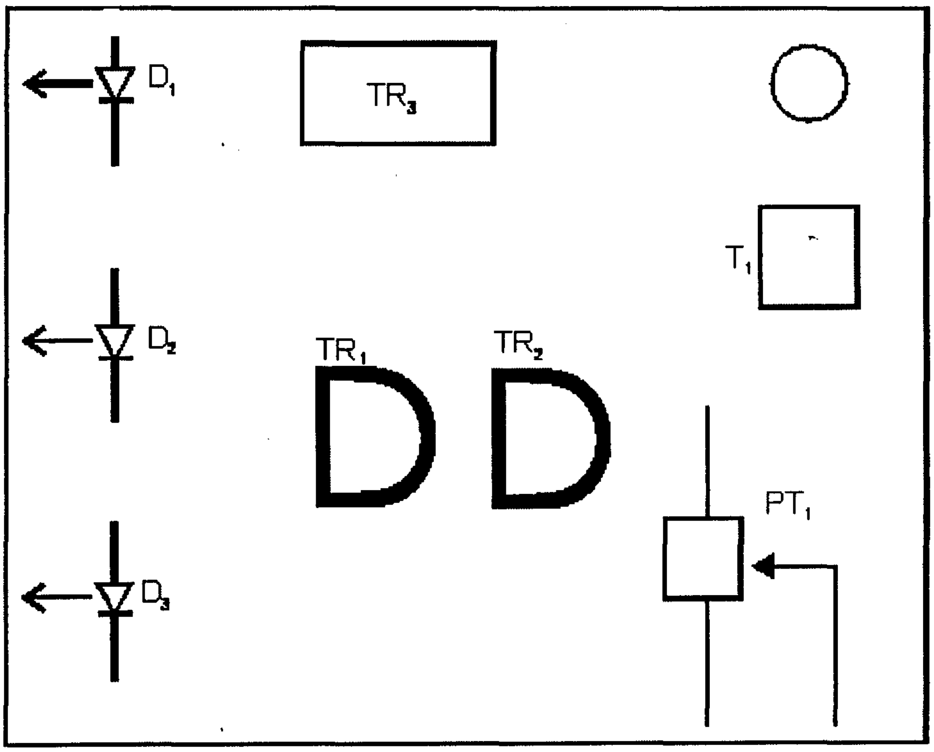


Fig. 4.0 Component layout of the transmitter on vero board

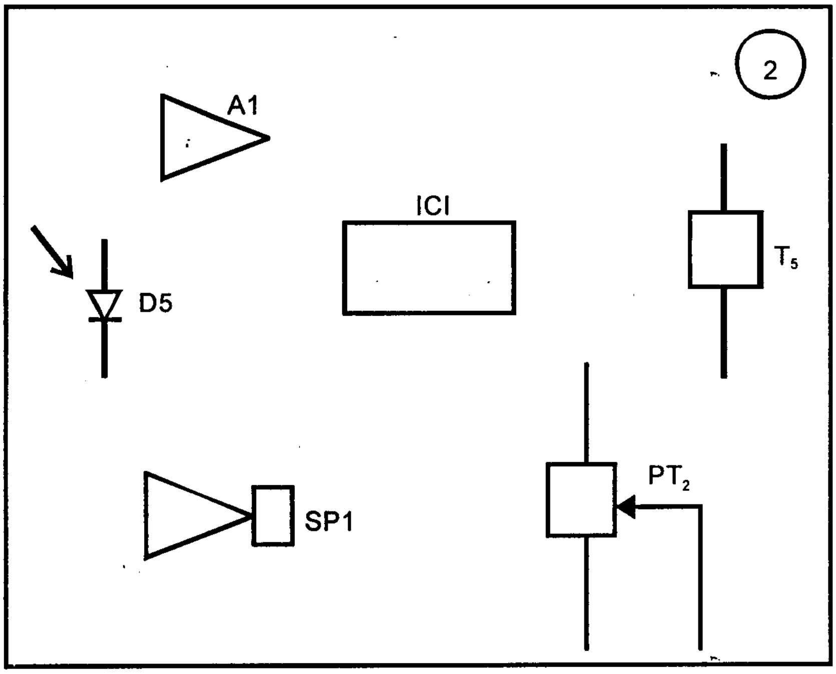


Fig. 4.1 Component Layout of the Receiver on Vero board II

**Table 4.0 Component list on Vero board.**

| | |
|---|---|
| Infrared LED | D 1,D2,D3 |
| C9014 Transistors | TRI,TR2 |
| Power Switch | (I) |
| 7805 | T4 |
| Potentiometer | PT1 |
| 240/6 Transformer | Tf |
| Power Switch | (2) |
| Photodiode | D5 |
| 8 Ω 3 W Speaker, | SPI |
| TDA 2822 | CI |
| 7806 | T5 |
| LM 358 | Al |
| Power Switch | (2) |

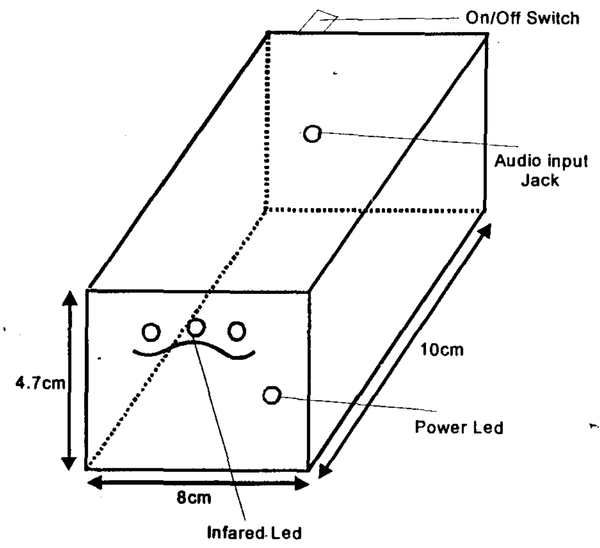


Fig. 4.2 Isometric view of transmitter cased with dimensions

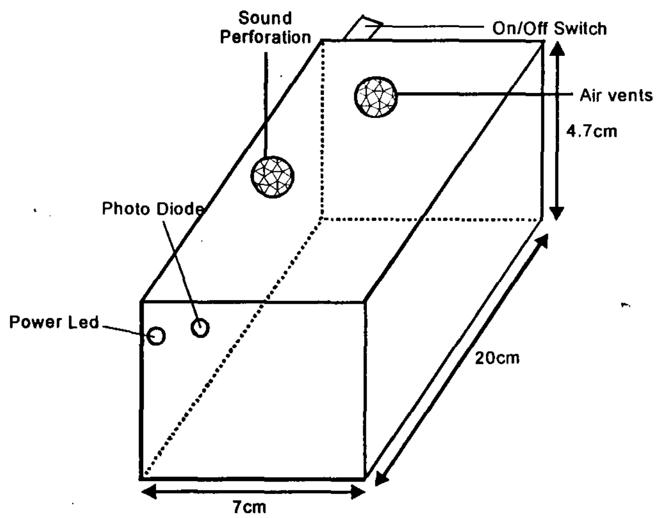


Fig. 4.3 Isometric view of receiver cased with dimensions

This project was couple to a plastic casing. The plastic material was properly perforated and ventilated to ensure the system is not affected by overheating. The position of the speaker was also perforated for clarity of sound.

Inter connection was made through earthen of the Vero-board and the use of insulated copper wire connected at the bottom of the Vero- board. While the components were mounted on the top of the Vero- board and then soldered underneath, thus giving the component good layout and space to give proper chances for trouble- shooting and subsequent replacement of faulty components.

The long leads or legs of various components such as transistors, resistors and capacitors were reducing so as to prevent short circuit.

Having made necessary connection and soldering on the Vero- board, adequate care was taken to avoid bridging/ short circuit which was attained through examination of the connection hole (line) and non- connecting hole (line). The above was done to ensure that the required current was supplied and proper connection between components on the board.

## 4.2 Testing, Result and Discussion.

Hardware Testing

After the completion of the hardware Construction, a careful hardware test of the completed circuits was carried out. The process of testing and implementation involved the use of some equipment as slated below.

(a) **Bench power supply:** The equipment was used to supply voltage to various stages of the circuit during the breadboard test before building the power supply unit. In a like manner during the soldering of the project the power supply was used to Lest various stage before the dc power supply used in the project was finally built.

(b) **Oscilloscope;** 'To observe the ripples ware form of the power supply an oscilloscope was used. The equipment gives an accurate ware form and frequencies.

(c) **Digital multimeter:** Quantities as voltage, resistance, current, and continuity were measured by the digital multimeter. During implementation the bread boarding design was used to measure parameters like voltages, continuity resistance value of the components. The meter was also to check the various voltage drops stage wise. The meter assisted during trouble shooting when soldering and coupling. The output of **the** transformer (secondary out put Voltage) was observed and measure lo be 6v as required by the circuit (Receiver).

### 4.3 Result and Discussion.

As the distance increased from 0.5m to 4 m the output was audible at 7m the sound was audible with more noise, thus, the best output was obtained when the transmitter and the receiver were 6m apart.

**Table 4.1 Test and result**

| TEST | RESULT | REMARKS |
|---|---|---|
| 9V Voltage Supply | 6v obtained | As required lo power the transmitter. |
| 220 voltage supply, | 6v obtained | As required to power the receiver. |
| 0.5m transmission distance. | Sound too low | This distance being lot) close, hence no amplification. |
| 1m transmission distance. | Receiving | Output was also very low. |
| 2.5m transmission distance. | Receiving | Better output was observed. |
| 3.0m transmission distance. | Receiving | Same output was maintained as 1.0m above. |
| 4m transmission distance. | Receiving | *Clear* and louder output was obtained. |
| 5m transmission distance. | Receiving | Reduction and introduction of noise. |
| 7m transmission distance. | Receiving | More noise with very low output obtained. |
| 8m transmission distance. | No reception. | Out of transmission range. |

# CHAPTER FIVE

# CONCLUSIONS AND RECOMMENDATION

## 5.1 Conclusion

The infrared (III) head phone / speaker system is an amplitude modulated scheme; hence, the received signal strength at the receiver is an inverse of the distance separating the receiver and the transmitter. This Greater distance can he covered if two or more IR photodiodes are used or better photo transistor. Finally, I wish to thank the department, my supervisor and project coordinator for giving me this opportunity to work on this project.

### 5.2 Problems encountered

Series of problems were encountered at all stages of this project. These ranges from the design, implementation and the construction.

The major problems are enumerated below.

1. Exact calculated values for components were not gotten. Hence preferred values were used instead and this caused drifts in the signal strength, although these drifts were negligible since they were within receiving and transmitting ranges of the diodes.
2. Soldering and measurement errors, which was solved by careful troubles shooting and proper care in the constructing of the project.

* Sensitivity to day light

### 5.3 Recommendation.

The following are my recommendations to this project work.

1. That more infrared LED is placed around the transmitter to enhance transmission at various direction and line of sights.

2. That additional photodiode be added to the receiver to create higher distance range and good out put reception.

3. That the department acquire more research oriented books in the departmental library" that would bring about enough materials available for students use.

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# MANUAL OF OPERATION FOR A INFRA-RED WIRELESS AUDIO TRANSCEIVER

To operate the infra-red wireless audio transceiver, the following steps should be taken,

(1) Switch on the ON/OFF of the device.

(2) Connect the transmitter to an audio producing device via an audio jack

(3) Also connect the receiver to power supply using the required cable to turn on the infrared sensor.

(4) Place the receiver in the active region (Range) of the transmitting infra-red.

(5) When this is done, the receiver produces the same audio signal that is sent to the transmitter via the audio jack.