VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"IR BASED WIRELESS AUDIO TRANSMITTER AND RECEIVER"

A MINI PROJECT REPORT

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CERTIFICATE

Certified that the mini project work entitled "**IR BASED WIRELESS AUDIO TRANSMITTER AND RECEIVER**" carried out by **PRAMOD AITHAL(1NH18EC087), PUDI YASHWANTH(1NH18EC134), NAVEEN KRISHNA(1NH18EC082), VYSHAK SATISH SHETTY(1NH18EC123), VARUN GOWDA K V(1NH18EC119)** bonafide students of Electronics and Communication Department, New Horizon College of Engineering, Bangalore.

The mini project report has been approved as it satisfies the academic requirements in respect of mini project work prescribed for the said degree.

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ACKNOWLEDGEMENT

The satisfaction that accompany the successful completion of any task would be, but impossible without the mention of the people who made it possible, whose constant guidance and encouragement helped us succeed.

We thank **Dr. Mohan Manghnani**, Chairman of **New Horizon Educational Institution**, for providing necessary infrastructure and creating good environment.

We also record here the constant encouragement and facilities extended to us by **Dr.Manjunatha**, Principal, NHCE and **Dr. Sanjeev Sharma**, head of the department of Electronics and Communication Engineering. We extend sincere gratitude to them.

We sincerely acknowledge the encouragement, timely help and guidance to us by our beloved guide **Mr. Puvirajan** to complete the project within stipulated time successfully.

Finally, a note of thanks to the teaching and non-teaching staff of electronics and communication department for their co-operation extended to us, who helped us directly or indirectly in this successful completion of mini project.

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ABSTRACT

In this project we are employing the use of infrared rays to wirelessly transfer and receive information without the connections of cables and wires.

The most commonly used medium in wireless data transfer for limited range communication is infrared. Using this set up which we have configured we can play songs or audio files from any electronic devices such as mobile phones, computers to an external speaker without having to connect them directly through a wire or an AUX cable.

Wireless audio is already a technically advanced field but in recent times Bluetooth and RF communications have become the norm. Most of the commercial audio equipment is built for bluetooth connectivity.

Due to Bluetooth technology advancing so rapidly infrared based transmitter and receiver set up have become obsolete. The reason for not being beneficial is because both the transmitter and receiver have to face each other without the obstruction of any foreign object at a particular angle to communicate effectively.

The main principle used in this circuit is IR communication. It employs the use of a simple infrared LED with specific wavelengths to communicate. To detect the IR rays we use photodiodes or photo transistors.

CHAPTER 01

INTRODUCTION

In this project we've designed and implemented an easy wireless transmitter and receiver system that establishes an audio communication at shorter distances with weak signal using infrared communication.

Infrared transmission refers to the energy in the region of electromagnetic radiation spectrum at wavelengths longer than those of visible light but shorter than radio waves. The frequencies of infrared is higher than frequencies of radio waves but lower than those of visible light.

Infrared radiation is divided into 3 types:-

1. **NEAR IR BAND** (750 - 1300 nm)
2. **INTERMEDIATE IR BAND** (1300 - 3000 nm)
3. **FAR IR BAND** (3000 - 14000 nm)

Transmission of IR data from one device to another is referred to as beaming.

Basically in this project we are employing the use of two breadboards which have two individual circuits connected on them. One circuit is used for transmission of the signal and the other circuit is used for receiving.

The transmitter circuit is connected to an audio jack which has a 3.5mm port for audio input and the receiver circuit is connected to an output such as a speaker or buzzer to play audio files.

Basically what happens is the audio signal gets transmitted through an infrared LED which is connected to the transmitter circuit and then the infrared signals will be then received by a photodiode which is connected to the receiver circuit on the other breadboard.

The audio signal received by the photodiode in the receiver circuit is too weak to get the output on the speaker therefore we use an amplifier to amplify to get the output. In our project we employ the use of a LM386 amplifier to get the desired output.

A photodiode is a semiconductor diode which when exposed to light generates a potential difference or voltage which inturn produces current to drive the circuit. Its use is to convert light into current. It has an anode and cathode

We are using the LM386 amplifier to amplify our signal because it provides very low distortion to our audio signal due to which certain amount of noise can be cancelled.

CHAPTER 02

LITERATURE SURVEY

Paper No	Title of the paper	Author & Year of Publication	Outcome	Limitation
1.	Performance of infrared transmission	A.G.C Moreira R.T Valadas A.Manuel D Olivera 1997	It explains concept of infrared transmission	It Doesn't give much information regarding the use for wireless communication
+ 2.	Transmitter Circuit and Optimization Design of Receiver Circuit for Wireless Power Transfer	Irawan Sukma Siddque Hidayat AR Hidayat 2018	Explains the working of transmitter and receiver circuit	It Doesn't give a clear picture on the medium
3.	An Overview of Wireless Communication Technologies Used in Wireless Sensor Networks	Svetoslav Atanasov 2013	Helps us to understand wireless communication	It doesn't give information about the use of infrared

			through wireless sensor networks	in transmission and also RF
4.	Development of Optical Wireless Audio System Using Infrared Light Communications	N. R. Mohamad A. A. Wakiran M. F. Iswandi3 A. Salleh4 S. A. M. J. Yunus F. Sallehuddin N. F. Azmi S. A. M. Chachuli 2013	Explains wireless audio transmission using infrared light	The circuit is complex to connect
5.	Transmission of data, audio signal and text using Li-Fi	A.Vinnarasi S.T.Aarthy 2017	Gives description about transmission of data and audio signals	Doesn't employ the use of infrared rays

Table 1.1

CHAPTER 03

PROPOSED METHODOLOGY

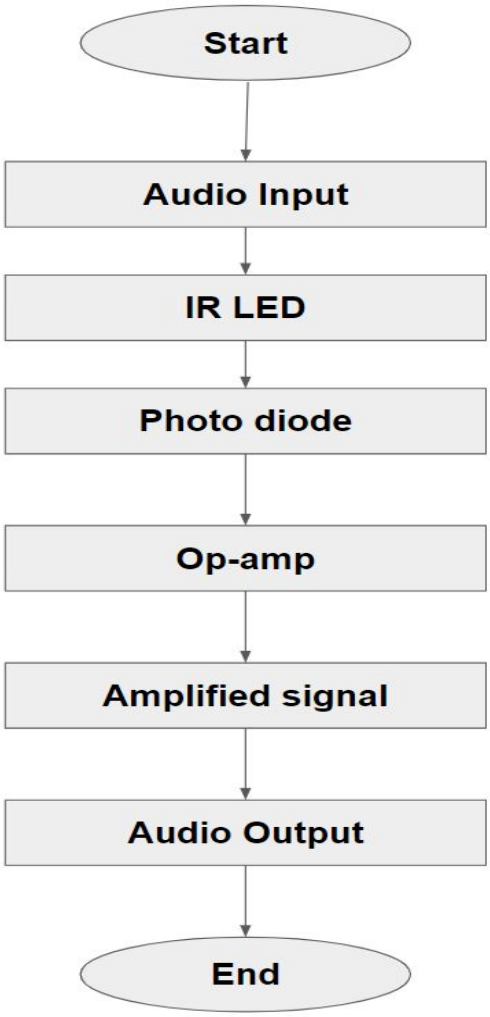
The main principle behind our circuit is that we will be using two individual circuits. One will be used for transmitting the signal and the other circuit will be used for receiving the signal. The transmitting circuit will be connected to the audio input through a 3.5mm audio jack and the receiving circuit will be connected to a speaker to play the audio. The signal will be transmitted among the two circuits through an Infrared LED. The transmitter circuit will send the signal using the IR LED. This signal will be then received by a photodiode which will be placed on the receiver circuit. But the audio signal that is received by the receiver circuit will be very weak and hence we will be using a LM386 amplifier circuit to amplify the signal which can finally be played on a speaker.

This is very much like the TV remote, when we press a button the IR led at the front of your TV, it transmits a signal which will be picked up by a photodiode and the signal will be decoded to find which button you have pressed. Similarly here the signal transmitted will be an audio signal and the receiver will be a plain photodiode.

The detailed circuit diagram and the process of the transmitter and receiver circuit is described in the project description part of this report.

After assembling both the transmitter and receiver part of the circuit, we power them individually and then connect the audio source to the transmitter part of the circuit. The receiver circuit should be placed inline with a transmitter circuit in the range of around 10cm.

Block Diagram:



Variables:

Detecting the variables of the project is one of the most important things because they are the reason for some errors in the project. Variables can be adjusted to get the optimum output. Some of the variables in this project are,

Potentiometer RV1 (with reference to the circuit diagram shown in project description)

If we don't hear any sort of audio from the receiving end then it is recommended to try adjusting the position of the potentiometer RV1. Varying this will tune the circuit such that the audio starts playing and the circuit works properly.

Distance:

This circuit is not designed to work for a longer range and hence we cannot expect it to transmit long distances. We should make sure that the IR LED and the photodiode is placed at about 10cm distance among each other.

Position:

As mentioned previously, the IR LED on the transmitter and the photodiode on the receiving end should be placed across each other in a straight line. If they are not present on a straight line then the signal will not be able to reach properly and the circuit may not work as we expect it to.

Hardware:

Many a time when we cannot find any defect, it is usually a hardware fault. It is a possibility that we may be using some defective hardware and not be aware of it. It is always better to test the components either using a potentiometer or by some other practical means so that we ensure there may not be any errors in the project model.

Further modifications can be done to the project to improve its applications and efficiency. With some specific modifications, the circuit will be able to,

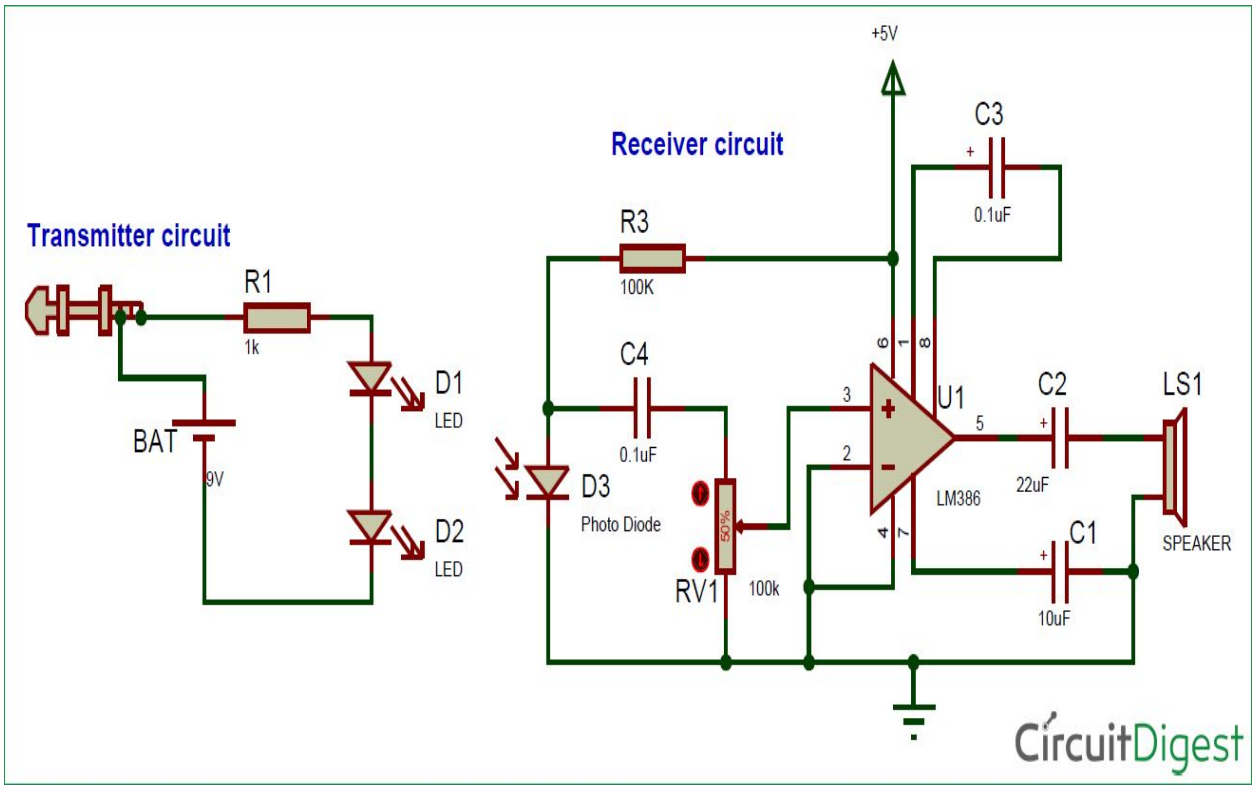
- Increase the range of the signal transfer
- Rate of transmission of the signal can be improved
- Ability to transmit the signal to multiple receivers

CHAPTER 04

PROJECT DESCRIPTION

In this project we have designed and implemented a wireless transmitter and receiver system that can establish audio communication at short distances with weak signal via infrared communication.

CIRCUIT DIAGRAM

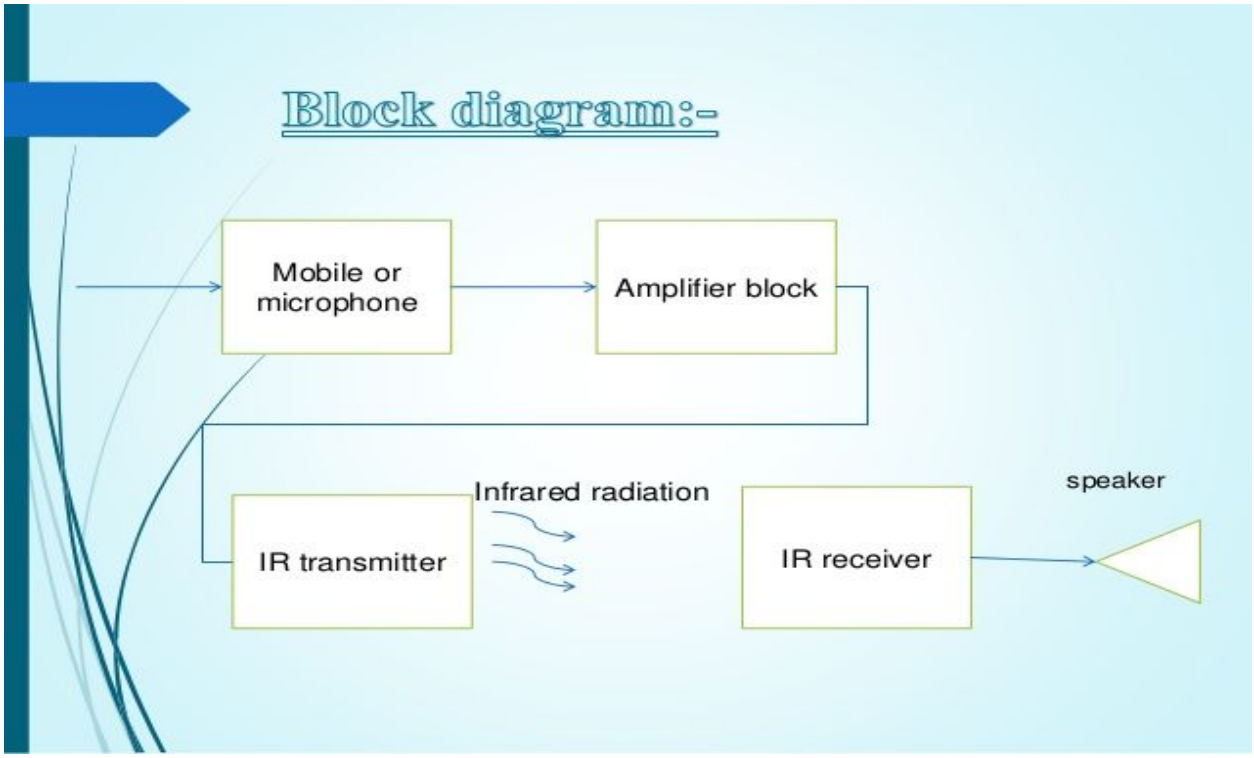


img 4.1

In this project we are employing the use of two breadboards which have two individual circuits connected on them. One circuit is used for transmission of the signal and the other circuit is used for receiving.

The transmitter circuit is connected to an audio jack which has a 3.5mm port for audio input and the receiver circuit is connected to an output such as a speaker or buzzer to play audio files.

BLOCK DIAGRAM



img 4.2

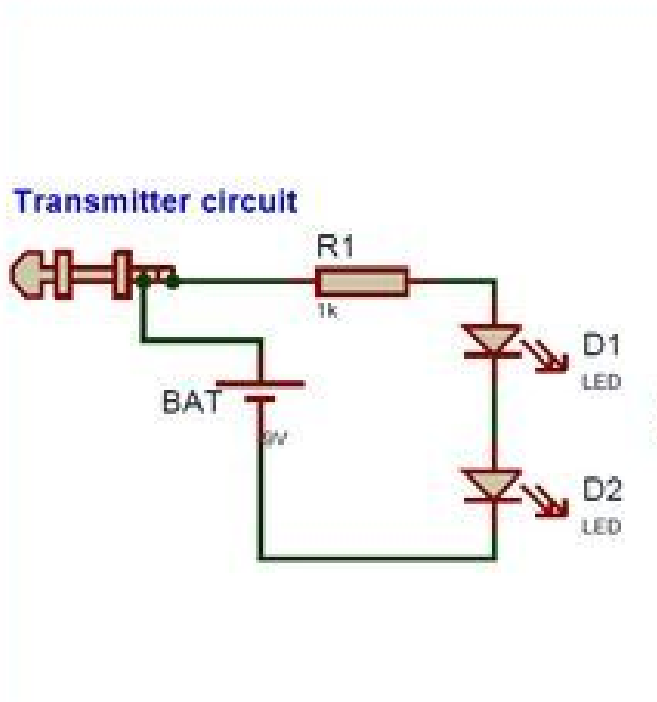
Basically what happens is the audio signal gets transmitted through an infrared LED which is connected to the transmitter circuit and then the infrared signals will be then received by a photodiode which is connected to the receiver circuit on the other breadboard.

The audio signal received by the photodiode in the receiver circuit is too weak to get the output on the speaker therefore we use an amplifier to amplify to get the output. In our project we employ the use of a LM386 amplifier to get the desired output.

The concept we are using to transmit and receive is very similar to TV remote, when the button is pressed the infrared LED at the front of the TV transmits a signal which will be picked up by a photodiode or a phototransistor(TSOP commonly) and the signal is decoded to find which button was pressed on the remote.

Similarly in our project the signal transmitted will be an audio signal and the receiver consists of a simple photodiode. This technique can also be used with normal LEDs and solar panels.

TRANSMITTER CIRCUIT

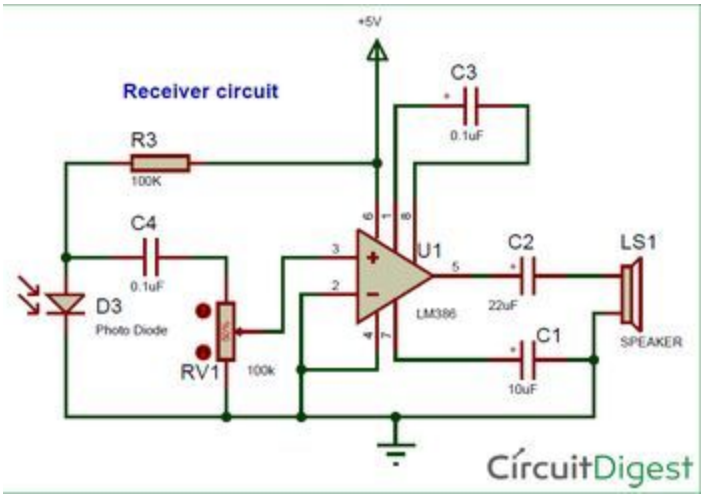


img4.3

The transmitter circuit only consists of a few IR LEDs and resistor connected on to the audio source and therefore the battery.

The working of the Transmitter circuit is pretty simple, the IR light from the IR LED acts as a carrier signal and therefore the intensity of the IR light acts as a modulating signal. So if we power the IR led through an Audio source the battery will illuminate the IR led and therefore the intensity with which it glows is going to be supported by the audio signal. We have used two IR LEDs here just to extend the range of the circuit; otherwise we will use even one. Our circuit is built over a breadboard and the circuit can be powered anywhere between 5V to 9V.

RECEIVER CIRCUIT



img 4.4

The receiver circuit consists of a photodiode which is connected to an amplifier circuit. The amplifier circuit is rigged using the favored LM386 IC from Texas instruments, the advantage of this circuit is that the minimal requirement of components to complete the circuit. This circuit also can be powered from a voltage starting from 5V to 12V, we have used a 9V battery.

4.1 HARDWARE DESCRIPTION

MATERIALS REQUIRED

TRANSMITTER CIRCUIT :

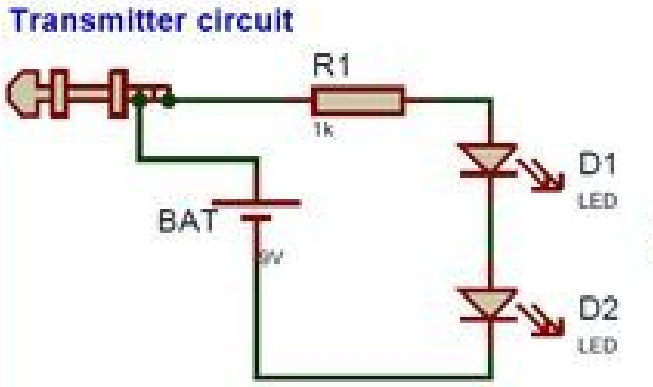
- 3.5 mm jack
- 9v battery
- 1k ohm resistor
- IR LEDs
- jumper wires male
- jumper wires female
- bread board

RECEIVER CIRCUIT :

- Audio Amplifier
- Potentiometer 100k
- 5v battery

- 100k ohm resistor
- Photodiode
- jumper wires male
- jumper wires female
- bread board

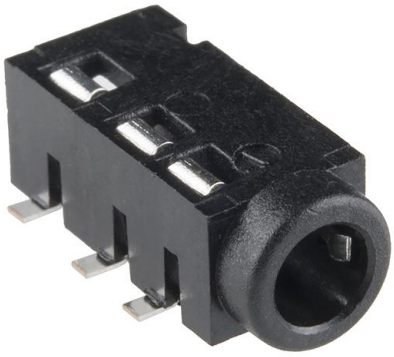
TRANSMITTER CIRCUIT:

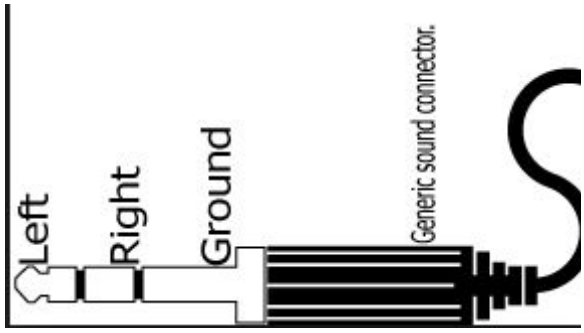


img 4.5

In this, we send audio signals to the 3.5mm audio jack through the iPod. The 3.5mm jack has 3 pins - left, right and ground. We either use the left pin or the right pin. This pin acts as the signal pin. Through the IR LEDs the IR waves are produced and propagated.

3.5mm JACK:





img 4.6

An audio jack is a part of a family of electrical connectors typically used for analog audio signals. The standard is that a plug will connect with a jack (described as female).

The phone connector was invented for its use in telephone switchboards in the 19th century and is still widely used.

The phone connector is cylindrical in shape, with a curved tip to retain it. In its original audio configuration, it typically has two, three, four and, sometimes, five contacts. Three-contact versions are there, which are as follows TRS connectors, where T stands for "tip", R stands for "ring" and S stands for "sleeve". Ring contacts are typically the same dimensions as the sleeve, the long shank. Similarly, 2,4 and 5- contact versions are called TS, TRRS and TRRRS connectors. The outside radius of the "sleeve" conductor is 3.175 millimetres (1⁄8 inch). The "mini" connector has a radius of 1.75 mm (0.07 in) and the "sub-mini" connector has a radius of 1.25 mm (0.049 in).

IR LEDs :

img 4.7

An IR LED (infrared light emitting diode) is a type of a solid state lighting (SSL) device that emits light in the infrared range.

IR LEDs allow for cheap and efficient production of infrared light (700 nm to 1mm range). IR LEDs are useful in many types of remote controls for televisions and other electronics. Used with infrared cameras, IR LEDs can act like a spot light while remaining invisible to the human eye.

As IR LEDs can be used in conjunction with a number of different types of sensors, they are becoming common in machine-to-machine (M2M) environments and IoT applications

9V Battery:

img 4.8

A nine-volt battery, or 9v battery, is a common module of battery that was introduced before for early transistor radios. It's a rectangular prism shape with rounded edges and a polarized

snap connector at the topside . This type is commonly used in devices like walkie-talkies, clocks and smoke detectors.

PHOTODIODE:

img 4.9

A photodiode is an important component of the project and is a semiconductor device that converts light into an electrical current. The current is generated when photons are absorbed in the photodiode and move from anode to cathode. Photodiodes may contain optical filters, built-in lenses, and may have small or big surface areas. Photodiodes usually have a slower response time as their surface area increases with respect to the environment. The common, traditional solar cell used to generate electric solar power is a photodiode with large surface area.

Photodiodes are like regular semiconductors; they may be either exposed packaged with a window or the optical fiber connection to allow light to travel and reach the sensitive and delicate part of the device. Many diodes designed for use specially as a photodiode use a PIN junction and not a p–n junction, to increase the speed of response and make it faster and efficient. A photodiode is designed to operate in reverse bias not forward bias.

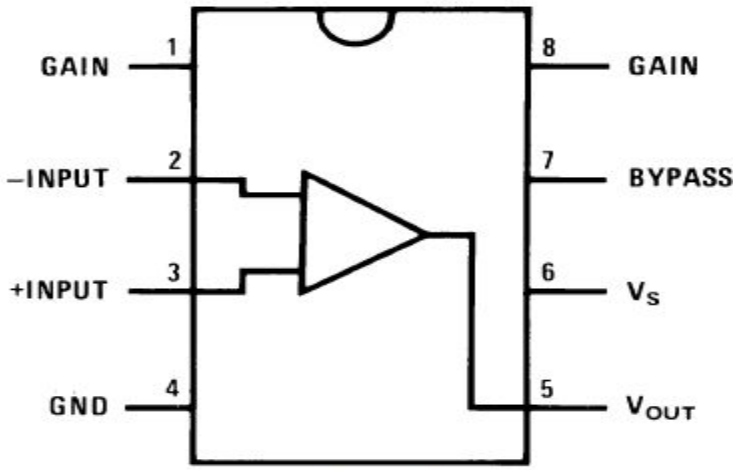
POTENTIOMETER:

img 4.10

potentiometer it's a three-terminal resistor with a rotating contact that forms an adjustable voltage divider. If only the two terminals are used, one end and wiper, it acts as a variable resistor or rheostat.

The measuring instrument also called a potentiometer is essentially a voltage divider used for measuring electric potential is also known (voltage); the component is an implementation of the same principle, hence its name is the potentiometer.These are commonly used to control the electrical devices such as volume controls or consoles on audio equipment. Potentiometers are operated by a mechanism that can be used as position transducers, for example, in a joystick. Potentiometers are rarely used to directly control significantly power (more than a watt), since the power dissipated in the potentiometer would be comparable to the power in the controlled load.

AUDIO AMPLIFIER LM386:



LM386 Pin Diagram

img 4.11

The LM386 is an all – in – one Class AB Audio Amplifier IC that is and can be used in a variety of applications.an amp LM386 IC has been in use for decades and is still being used as amplifier in Computer speakers and Portable Stereos.

LM386 is considered to be low voltage power amplifier with an inactive power draw of 24mW, which happens to make it suitable for battery controlled applications and many more .The most common package for the great LM386 is an 8 – pin DIP. The following image shows the pinout diagram of the IC LM386.

Pin Number	Pin Name	Function
1	Gain	Gain Setting Pin
2	Input –	Inverting Input
3	Input +	Non – Inverting Input
4	GND	Ground
5	Vout	Output
6	Vs	Power Supply Voltage
7	Bypass	Bypass decoupling path
8	Gain	Gain Setting Pin

Pins 1 and 8 are Gain Control Pins. By default, the Gain of the LM386 Amplifier is set to a factor of around 20. When a capacitor is placed between pins 1 and 8, it bypasses the internal resistor (which is responsible for setting the gain to 20) and increases the gain to 200.

Pins 2 and 3 are the inverting and non – inverting inputs of the amplifier (internally, they are connected to an OP-AMP). Audio input from devices like microphone, mobile phones, laptops, etc. is given through these pins.

NOTE: The inverting input (Pin 2) of LM386 is usually connected to Ground.

Pins 6 and 4 are the power supply pins. The maximum power supply to LM386 is 15V. We have used a 12V Power supply in this project.

Pin 7 sets the path for decoupling and a capacitor must be connected between Pin 7 and Ground. Pin 5 is the output pin. Proper filtering should be done before connecting the output to a speaker as any DC signal might not temporarily damage the speaker.

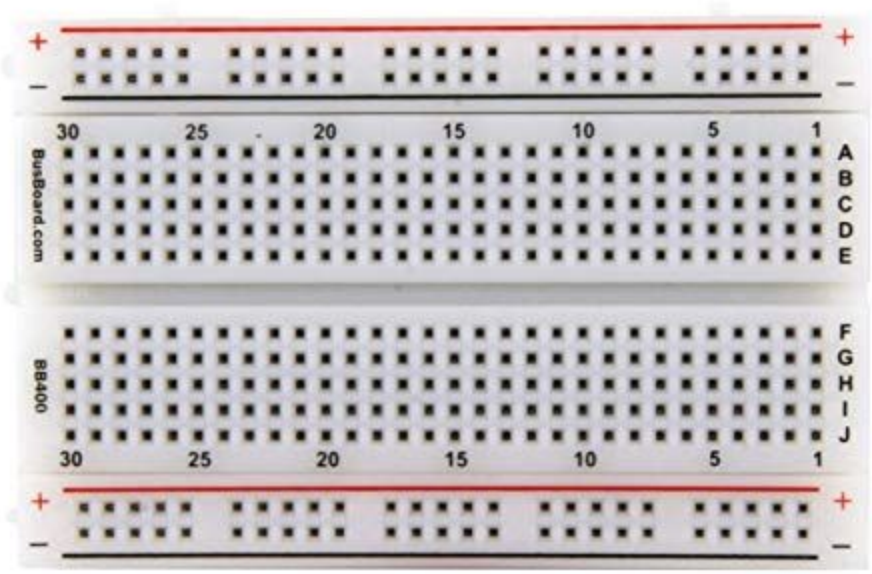
SPEAKER:

img 4.12

A speaker is an electroacoustic device, often used for fun, that is connected as a component in an audio system, its function being to make sound audible.

COMMON COMPONENTS:

BREAD BOARD:



img 4.13

Bread Boards are used to build and test circuits without soldering or testing on printed circuit boards.

It is the easiest way to rig up a circuit and troubleshoot problems if they are any.

Components are connected using jumper wires.

First 5 consecutive ports are connected to a common power and ground supply.

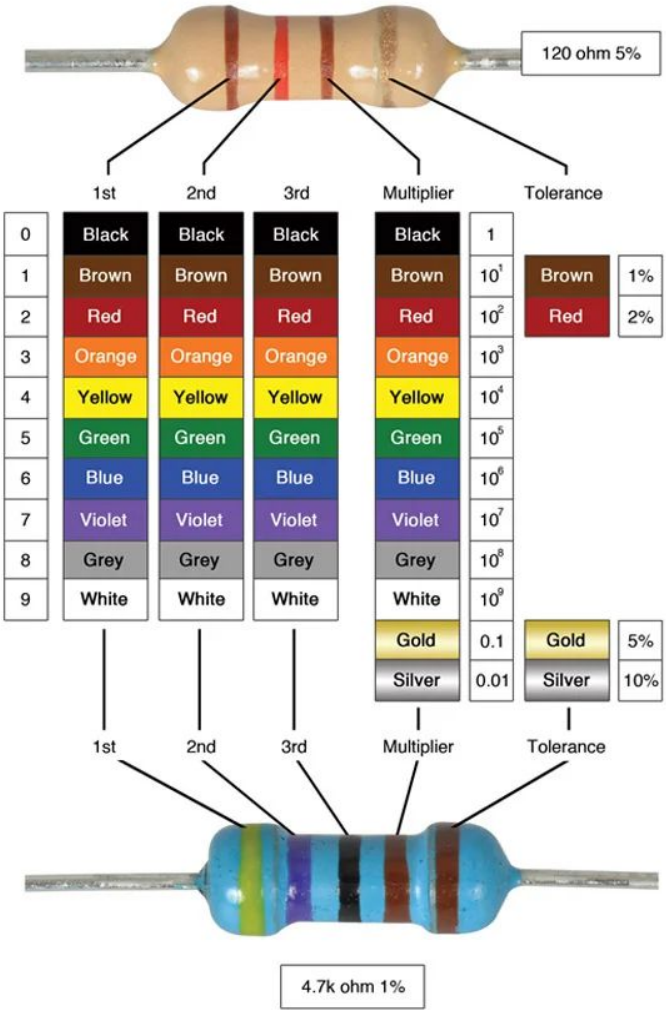
The middle section of the bread board are short circuited vertically.

JUMPER WIRES:

img 4.14

Jump wires (also called jumper wires) for solderless breadboarding can be found in ready-to-use jump wire sets or can be manufactured on your own. The latter can become tedious work for humongous circuits. Ready-to-use jump wires come in different qualities and quantities, some even with tiny plugs attached to the wire ends. Jump wire material for ready-made or homemade wires should usually be 22 AWG (0.33 mm2) solid copper, tin-plated wire - assuming no tiny plugs are to be attached to the wire ends. Shorter stripped wires might result in ugly and bad contact with the board's spring clips insulation being caught in the springs which could result in a short circuit. Longer stripped wires increase the likelihood of short-circuits on the board, which is not good. Needle-nose pliers and tweezers are helpful when using that is, inserting or removing wires, particularly on crowded boards.

RESISTOR:



img 4.15

A resistor is a non active two-terminal electrical component that performs electrical resistance as a circuit element. Resistors are used to reduce current flow, adjust signal levels, or to divide voltages, bias active elements, and end transmission lines, among other things.

High-power resistors that can dissipate many watts of electrical power as heat and light, may be used as components of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that change very less with temperature, time or voltage. Variable resistors are used to adjust circuit components (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity and force.

CAPACITOR:

img 4.16

A capacitor is an electronic device that stores electrical energy in an electric field. It is a passive electronic component with two terminals and not three or more.

The effect and impact and use of a capacitor is known as capacitance. While some capacitance exists between any two electrical conductors in proximity in a circuit, a capacitor is a component designed to add or change and manipulate the capacitance to a circuit. The capacitor was first known as a condenser or condensator.

CHAPTER 05

RESULT AND DISCUSSION

RESULT

Infrared systems provide a natural resistance to eavesdropping, because the signals are con¯ned

within the walls of the space. This also reduces the potential for neighboring wireless communication systems to interfere with one another , which may be a significant issue for radio-based communication systems.

Inband interference may be a significant problem for both sorts of systems. a spread of electronic and electrical equipment radiates in transmission bands of current radio systems; microwave ovens are an honest example. For infrared systems, ambient light, either man-made or natural, may be a dominant source of noise.

The primary limiting factor of infrared systems is their limited range, particularly when no good optical paths are often made available. for instance ,wireless communication between conventional rooms with opaque walls and doors can't be accomplished;one must resort to using either a radio-based or a wireline network to bypass the obstruction.

DISCUSSIONS

A variety of techniques are considered to enhance upon the performance of wireless infrared communication systems. At the transmitter, the radiation diagrams are often optimized to enhance performance characteristics like range. Some optical techniques for achieving this are diffusing screens, multiple-beam transmitters, and computer-generated holographic images.At the receiver, performance is ultimately determined by signal collection (limited by the dimensions of the photodetector) and by ambient noise filtering.

optical interference filters are often wont to reduce the impact of background noise; the first difficulty is in achieving a wide-field-of-view. This will be done using non-planar filters or multiple narrow FOV receiving elements.

CHAPTER 06

CONCLUSION AND FUTURE SCOPE

The proposed model is to work by connecting a 3.5mm headphone jack to one part of the circuit which is then transmitted to the other part through infrared rays. These rays are collected by a receiver circuit using infrared detectors .The signals received are then transmitted to a speaker which creates the audio played the device.The distance between the transmitter and receiver circuit should be minimum as to avoid distortions.

When both circuits are placed in proper distance , the model is expected to work with no distortions and with proper audio.

Advantages: The audio gets transmitted with little to no distortions.The trouble of hanging wires between the source and the speaker is minimised. The circuit is quite easy to build with easily available components.

Limitations: The transmitter and receiver part of the circuit should be placed apart in minimum distance for it to work with no distortion. The range of transmitted audio is very low when compared to other available methods on the market.

FUTURE SCOPE: The mode for transmission in the model (infrared rays) can be replaced with better alternatives to achieve lesser distortion and longer range. Various substitutions for this would be bluetooth, wifi etc. These are far more reliable than the infrared rays for transmission of audio signals.

REFERENCES AND APPENDIX

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[2] IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) e-ISSN: 2278-2834,p- ISSN: 2278-8735.Volume 8, Issue 6 (Nov. - Dec. 2013), PP 65-69 www.iosrjournals.org www.iosrjournals.org 65 | “Optical Wireless Audio System Using Infrared Light Communications”

[3]Al-Nassar, Suha & Hatem, Haraa & Shehab, Jinan. (2018). Design and Implementation of Infrared (IR) Communication System. 29-33. 10.26367/DJES/VOL.11/NO.3/5.

IR BASED WIRELESS AUDIO TRANSMITTER AND RECEIVER

ORIGINALITY REPORT

10%	%	10%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Jeffrey B. Carruthers. "Wireless Infrared Communications", Wiley, 2003 Publication	3%
2	Mohit Vasuja, Amritansh Kumar Mishra, Udbhav Singh Chauhan, Deeksha Chandola, Shashank Kapoor. "Image Transmission Using Li-Fi", 2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT), 2018 Publication	1%
3	Omveer Singh, Tushar Singh Sisodia. "Solar LED street light system with automatic scheme", 2017 International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS), 2017 Publication	1%
4	Monica Michel, Chandan Biswas, Chandra S Tiwary, Gustavo A Saenz, Ridwan F Hossain, Pulickel Ajayan, Anupama B Kaul. "A thermally-invariant, additively manufactured, high-power graphene resistor for flexible electronics", 2D	1%

Materials, 2017
Publication

5	"Innovations in Electronics and Communication Engineering", Springer Science and Business Media LLC, 2020 Publication	1%
6	Akshay Bharadwaj K H, Deepak, V Ghanavanth, Harish Bharadwaj R, R Uma, Gowranga Krishnamurthy. "Smart CCTV Surveillance System for Intrusion Detection With Live Streaming", 2018 3rd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), 2018 Publication	<1%
7	Gleb S. Vasilyev, Oleg R. Kuzichkin, Dmitriy I. Surzhik, vetlana M. Kharchuk. "Application of communication systems via the ultraviolet channel in FANET networks", MATEC Web of Conferences, 2020 Publication	<1%
8	Metuku Shyamsunder .. "CYCLOSTATIONARY ANALYSIS OF POLYTIME CODED SIGNALS FOR LPI RADARS", International Journal of Research in Engineering and Technology, 2015 Publication	<1%
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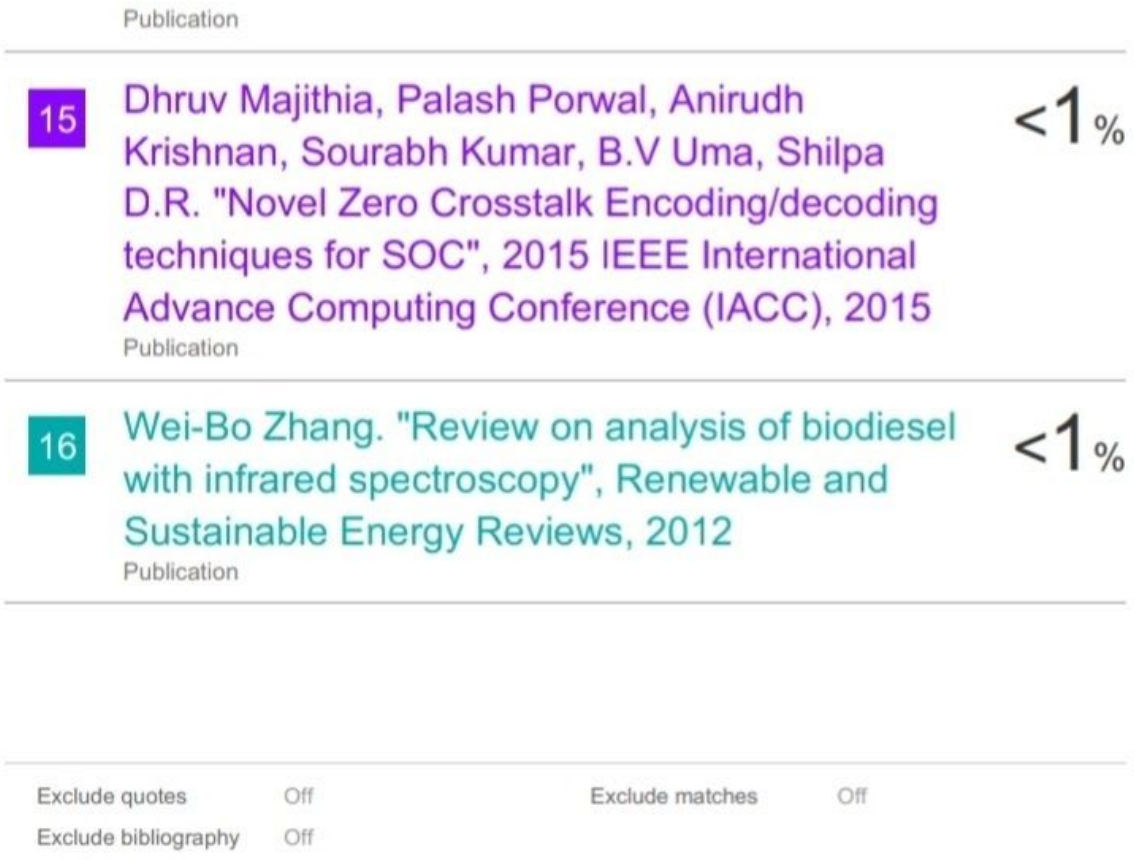

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