D. Y. PATIL COLLEGE OF ENGINEERING AND TECHNOLOGY, KOLHAPUR

(An Autonomous Institute)

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING

PROJECT

REPORT ON

Laser Based Communication System

SUBMITTED BY:

NAME	ROLL NO.
Gaurav Rathod	56
Nikhil Airekar	57
Shruti Pokale	60
Tanvi Shevale	61
Sharad Maskar	62

Research Paper Guide

Prof.S.R.Khot

HOD

Dr. T.B. Mohite.Patil

1. Introduction :-

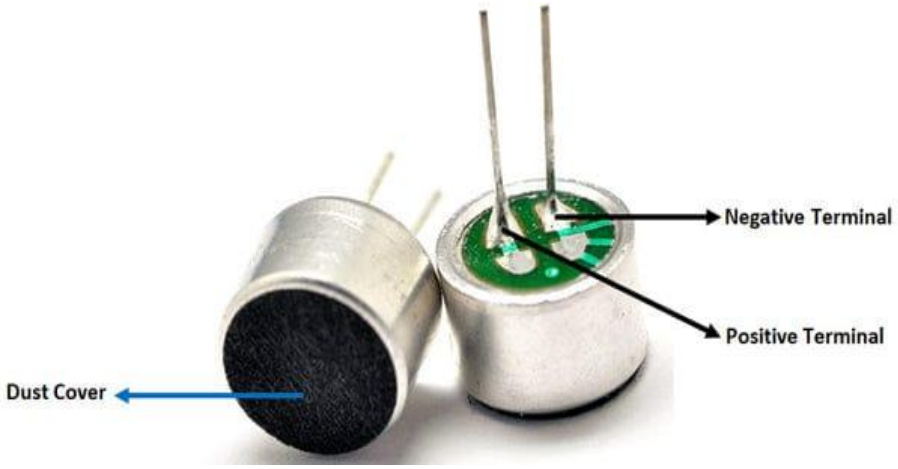
Laser communication is a wireless data transmission system that uses a laser beam to transmit voice or data instead of radio frequency (RF) waves.It works on the principle of modulating the intensity of a laser light according to an input signal (such as sound).

The laser beam carries this modulated signal to a receiver, where a phototransistor detects the light variations and converts them back into an electrical signal. After amplification, the signal is reproduced as the original sound through a speaker.

This system offers high speed, low interference, and strong signal security over line-of-sight communication paths.

2. Components Specifications :-

1.Microphone (Condenser Microphone):-



Fig(1). Condenser Microphone

1. Converts sound waves into electrical signals.
2. Operating voltage: 2V–10V DC.
3. Sensitivity: –44 dB (typical).
4. Frequency response: 20 Hz to 20 kHz.
5. Used at the transmitter to capture voice signals.

2.Speaker :-

Fig (2).Speaker

1. Low voltage audio amplifier used in the receiver circuit.
2. Supply voltage: 4V–12V DC.
3. Output power: 0.5W at 8Ω load.
4. Gain: Adjustable up to 200.
5. Drives the speaker to reproduce sound clearly.

3.IC LM386 (Audio Power Amplifier) :-

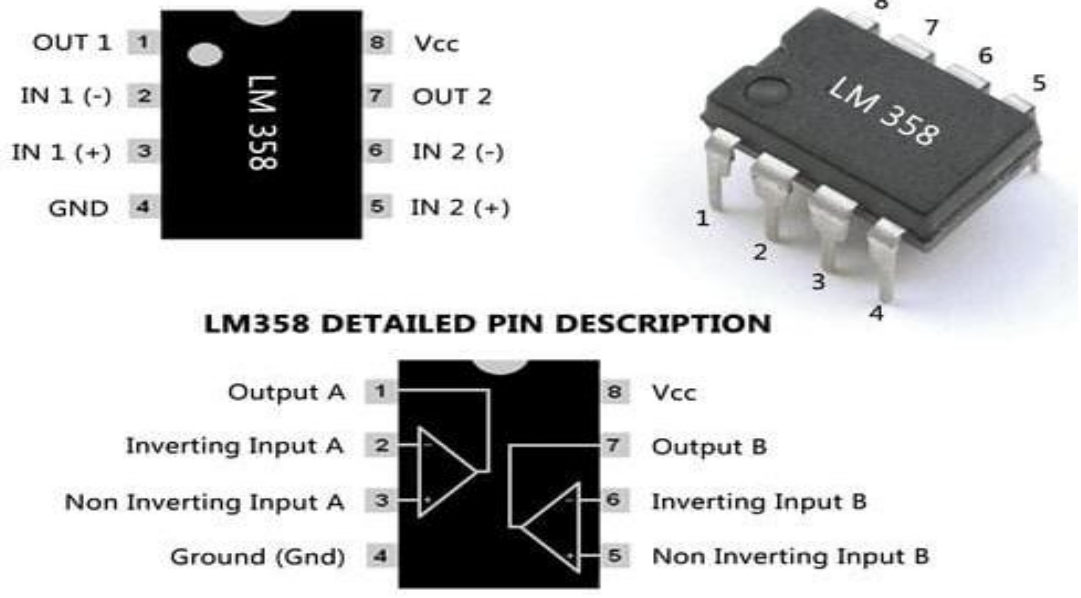


Fig (3).IC LM386

1. Low voltage audio amplifier used in the receiver circuit.

2. Supply voltage: 4V–12V DC.
3. Output power: 0.5W at 8Ω load.
4. Gain: Adjustable up to 200.
5. Drives the speaker to reproduce sound clearly.

4.Phototransistor (Receiver Light Sensor):-

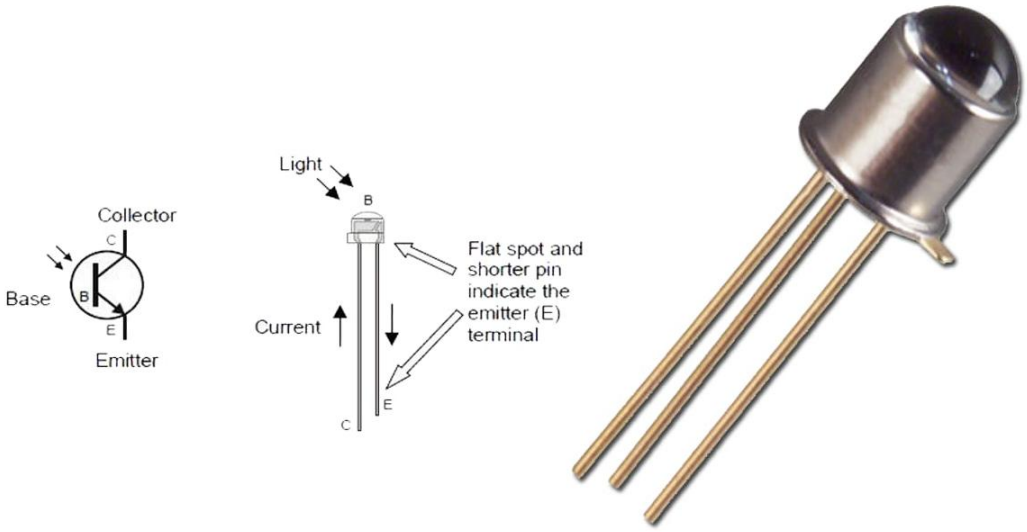
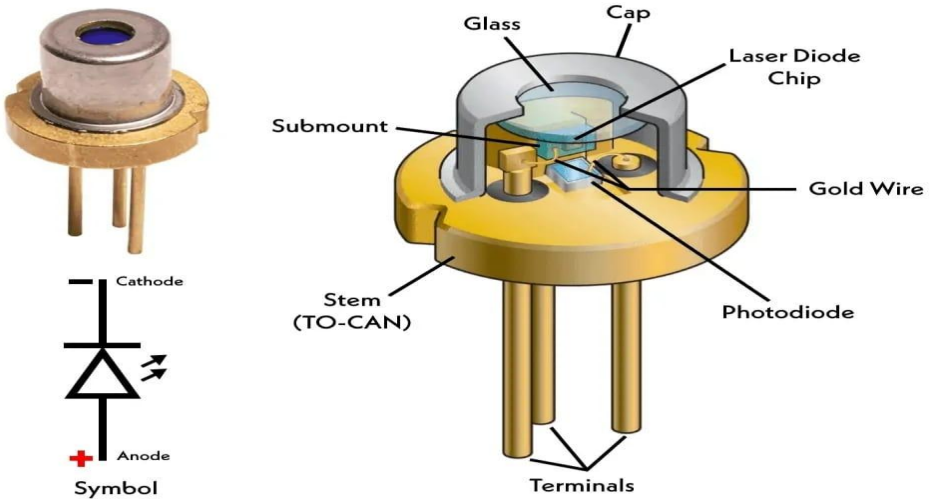


Fig (4).Phototransistor

1. Acts as a light sensor at the receiver.
2. Type: NPN silicon phototransistor.
3. Wavelength sensitivity: 700–1100 nm (infrared and visible red).
4. Collector current: up to 1 mA (depends on light intensity).
5. Converts laser light intensity changes into electrical signals.

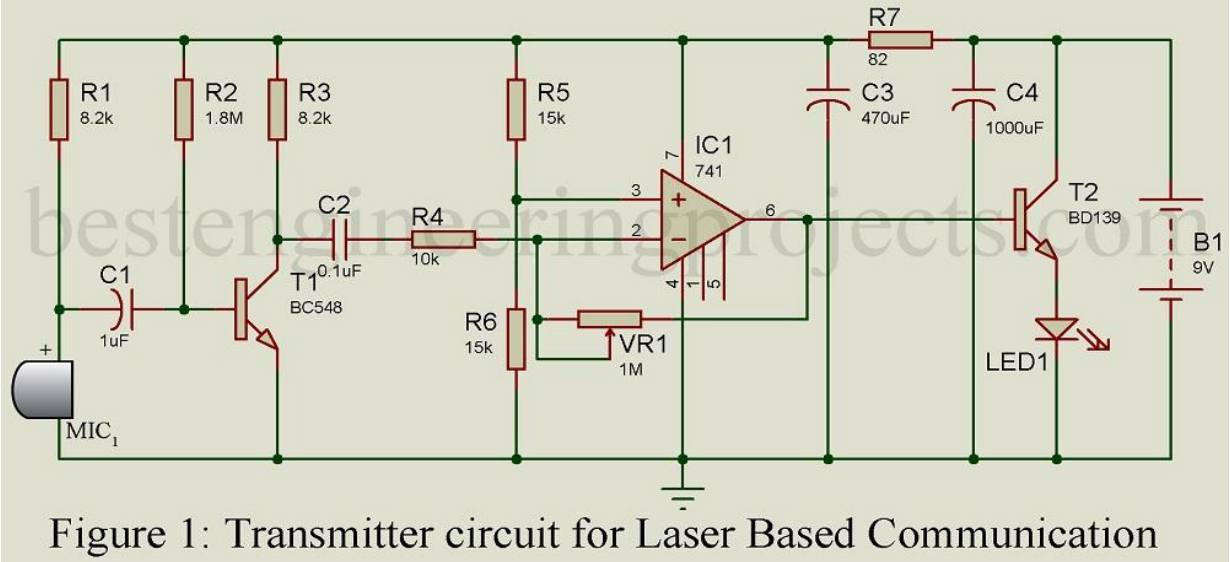
5.Laser Diode (Transmitter Light Source):-



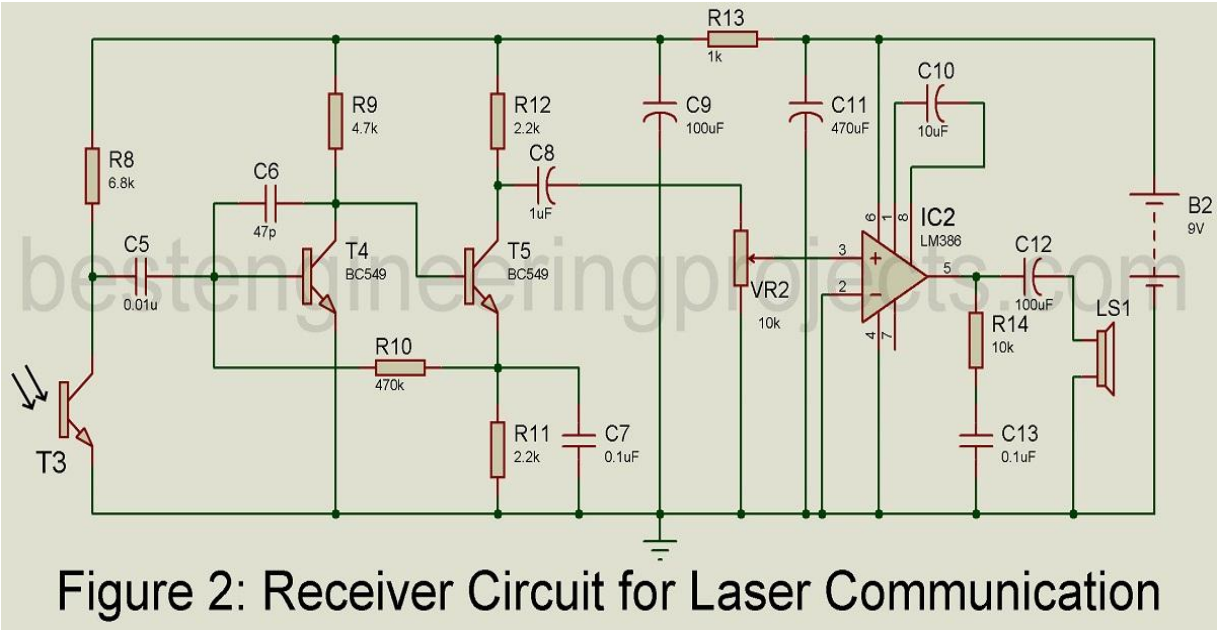
Fig(5). Laser Diode

1. Used as the main transmitter light source.
2. Output power: 5 mW (red laser type).
3. Operating voltage: 3V–5V DC.
4. Wavelength: 650 nm (visible red light).
5. The intensity of the laser varies according to the audio signal, carrying the modulated information.

3. Circuit Diagram :-



Fig(1).Transmitter circuit for Laser Based Communication



Fig(2). Receiver circuit for Laser Based Communication

4. Working :-

This project works by sending your voice through a laser beam instead of wires. On the transmitter side, when you speak, the 'microphone' listens to your voice and changes it into a tiny electrical signal. This signal is very weak, so the transistors and the 741 amplifier make it stronger. After the signal gets strong enough, it goes to another transistor which controls the laser light. The laser does not turn ON and OFF, but its "brightness changes according to your voice". So now, your voice is hidden inside the brightness of the laser beam. You simply point this laser beam straight towards the receiver circuit.

On the receiver side, a 'phototransistor' is placed in the path of the laser light. When the laser brightness changes, the phototransistor produces a changing electrical signal that matches your voice pattern. However, this signal is again very small, so two transistors amplify it further. Then the LM386 audio amplifier IC makes the signal strong enough so that it can drive a speaker. Finally, the speaker converts that signal back into sound, and you hear the same voice that was spoken at the transmitter.

So simply, your voice becomes an electrical signal, then it becomes light, then the receiver converts the light back to electrical signal, and finally back to sound. All the resistors and capacitors in the circuit help in keeping the sound clear, stable and clean, while the battery supplies the power. The only important requirement is that the laser beam must directly fall on the phototransistor for the communication.

5. Advantages :-

1. Low cost communication system
2. No wiring needed
3. High security due to narrow beam
4. Immune to RF interference
5. Suitable for long-distance line-of-sight communication

6. Applications :-

1. Military secure communication
2. Disaster rescue communication
3. Ship and battlefield communication
4. Educational demonstration of optical communication

7. Result :-

The Laser Communication system was successfully designed and tested. The transmitter converted audio signals from the microphone into modulated laser light, which was transmitted over a visible laser beam to the receiver. The receiver circuit detected the variations in the laser beam using a phototransistor and reproduced the original sound through the speaker.

The communication was clear and noise-free when the laser beam was properly aligned with the receiver phototransistor.

The maximum range achieved under normal indoor conditions was around 10 to 15 meters, depending on the alignment and ambient light interference. Even in partially lit environments, the system showed good performance with minimal distortion.

This confirms that voice communication using laser light is possible without any physical wire connection.

Overall, the project proved to be a low-cost, efficient, and reliable optical communication system suitable for short-distance line-of-sight data or voice transmission.

8. Conclusion :-

The Laser Communication project demonstrates the basic concept of optical wireless communication using a modulated laser beam as the medium of signal transmission. It successfully shows how electrical audio signals can be converted into light variations and transmitted through free space, then detected and converted back into sound.

This project highlights the importance of light-based data transfer, which serves as the foundation of modern optical communication systems such as fiber optics and laser-based wireless links.The use of a laser provides several advantages like high bandwidth, immunity to

electromagnetic interference, enhanced security, and low power consumption.

In conclusion, this experiment not only verifies the feasibility of laser-based voice communication but also encourages further study into high-speed, long-range laser and fiber-optic technologies that form the backbone of today's high-speed internet and data transmission networks.