Devlopment of Point To Point Laser Communication Model

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Abstract— Laser communication is one of the key areas in Wireless Communications. This paper includes analysis, optimization, and design and system level development of signal transformation between satellites or any two sources which work similarly to fiber optic links, except the beam is transmitted through free space while the transmitter and receiver must require line-of-sight conditions, they have the benefit of eliminating the need for broadcast rights and buried cables.

Laser communications systems can be easily deployed since they are inexpensive, small, low power and do not require any radio interference studies.The carrier used for the transmission signal is typically generated by a laser diode. Two parallel beams are needed, one for transmission and one for reception. The system can be used to transmit a person's voice or music from sources such as an mp3 player or radio over a distance.The design of the systemutilises the concept of amplitude modulation and pulse width modulation.

This paper investigates the design of an amplifier using Laser as Transmitter and Solar Panel as Receiver. The input given is an mp3 song from a mobile phone which is a low signal input. It is then amplified by the amplifier so a high input signal is being generated. This paper deals with the fabrication of modulator and demodulator circuits which uses microphone as an input and loudspeaker as an output. The high input signal generated by the amplifier is then transmitted by a Laser Diode. This Laser Beam is given as input to the Sensor (Solar Panel) which is amplified by an amplifier so that a high signal is being generated. A 9V DC Power Supply is given to the Amplifier by a battery. The generated high output signal is given to the loud speaker.

Index Terms— LASER, FREE SPACE,LINE OFSIGHT, MODULATION, TRANSMITTER, LASERBEAM, RECEIVER, SOLAR PANEL

I. INTRODUCTION

The objective of the paper is to implement light based voice transmission and reception system by using light from a laser diode as the carrier of the signal.

1.1 LASER COMMUNICATION

From the beginning of human living, before the invention of language, communication was the biggest challenge. Human being had always the necessity for communication throughout the history [1]. Initially, communication was done through signals, voice or primitive forms of writing. As time has changed, the necessity of communication through distances was grown to pass information from one place to another. Different ways to exchange information over long distances like pigeons and smoke signals have been adopted in every stages of civilization advancement, some of them have sustained and some has vanished. All these methods were the pioneer of today's modern technological long-distance communication system. This system involves transmission and reception of a large amount of information in a short period of time. Gradually through the technological development, man has invented different procedure of communication with each other. Now communication has entered in our daily life in many ways like telephone, radio, televisions, cell phone, computer and Internet, in our office and home. Different modes of communication can provide rapid connection from every corner of the globe and even out of the globe (aircrafts, rockets and satellites in space). Along with the wire communication system like telephone, two ways wireless communication system like mobile, internet have become popular now a day. As Laser is stimulated radiation, problem of interference occurs in electromagnetic wave is eliminated, it can be a good substitution of present day communication systems [2].

Laser communication system is one of the modes of telecommunication which occurs through wireless connections in the atmosphere [3]. Laser communication came into existence in 1960 and since then many advancements have been made in this discipline [4,5]. In this mode of communication, the information is transferred through free space. In the laser mode of communication; the signals are transmitted from the wireless transmitter to a wireless receiver without any hindrance or obstruction. Such condition is also called line of sight condition where the signals are transmitted without any obstruction. Laser diode is the major carrier in this mode of communication. This mode of communication is also faster as compared to the other modes and thus is mostly preferred over other types of communication system.

Laser Communication is one of the emerging areas of wireless communication system. Due to its low noise ratio makes its one of the well suited communication medium for exchange of information. Currently laser commutation is adopted in satellite communication for space research activities and due to its efficiency on low

noise ratio, inexpensive, low power and its flexibility and its resistance to the radio interferences makes laser communication as one of research area in wireless communication. In this process, this paper comprises the one such application of laser communication for information exchange between any two devices.

In Laser Communication the transmitter and receiver must require a line-of-sight conditions and Laser communications systems have the benefit of eliminating the need for broadcast rights and buried cables. The carrier used for the transmission signal is typically generated by a laser diode. Two parallel beams are needed, one for transmission and one for reception.

Laser communications systems are wireless connectionthrough the atmosphere.

This is focused on decreasing the noise ratio in optical communication system. Laser communications systems work similarly to fiber optic links, except the beam is transmitted through free space. In Laser Communication the transmitter and receiver must require a line-of-sight conditions and Laser communications systems have the benefit of eliminating the need for broadcast rights and buried cables.

II. METHODOLOGY & WORKING

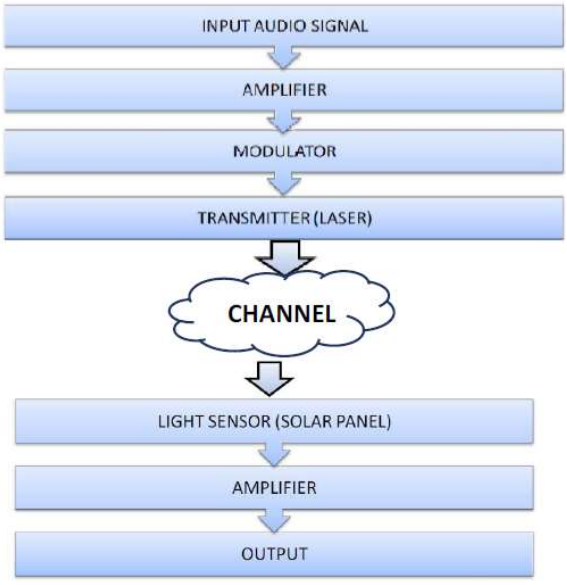

Fig.1. Block Diagram Of Laser Communication Circuit

Transmitter uses a MP3 song from the mobile, modulator and an amplifier. Theinput is an MP3 song given from the mobile phone which is a low signal input. It is thenamplified by the amplifier LM386 so a high input signal is being generated. A 9V DCPower Supply is given to the Amplifier by a battery. The high input signal generated bythe amplifier is then transmitted by a Laser Diode. This Laser Beam is given as input tothe Sensor (Solar Cell)

The laser communication system transmits sounds though a laser beam. The intensity oflaser beam changes with the amplitude of sound signal coming from the mobile.Here a laser diode (LD_1) with maximum operating voltage of around 5V DC andmaximum operating current of 45 mA issued to transmit the audio signal. The voltagedivider network formed by R_2, R_3 and V_{R3} keeps the voltage as well as the current forthe laser diode in the safe region. In place of the laser diode, you can also use a laserpointer. Remove the battery from the laser pointer. Extend two wires from terminals ofLD_1 and connect them to the battery terminals of laser pointer. The spring inside thelaser pointer is the negative terminal.The output power of the laser pointer is 5 mW. Take care while working with laser, asdirect exposure to the laser beam can be hazardous to your eyes. Point the laser beam tothe solar panel. Potentiometer VR_1 (10-kilo-ohm) is used to change the level of the inputaudio signal. The audio input (V_{in}) is taken from the preamplifier output of the musicsystem (CD player, DVD player, etc). Capacitor C_2 and preset V_{R2} are used to vary thegain of the LM386.The LM386 is a low voltage power amplifier (audio amp chip) IC is designed for use inlow voltage customer applications. The inside gain is set to 20, but adding of an externalresistor and capacitor between pins 1 and 8 will enlarge the gain to any value from 20 to200.The inputs are ground referenced while the outputautomatically biases to one half the supply voltage. The quiescent power drain is only 36milliwatts when operating from a 9V supply. Here a laser communication transmitterand LASER communication receiver circuit schematic is described.In radio communication signals from various sources are transmitted through the freespace. This causes interference among various signals, and no useful message is receivedby the receiver. The problem of interference is solved by translating the message signalsto different radio frequency spectrum. This is done by the transmitter by a processknown as modulation and the device which does modulation is known as modulator. Laser beam is the input of the receiver circuit. It uses a solar panel, audio amplifier and aloudspeaker. The transmitted light is received by the solar panel and amplified by audiopower amplifier LM386.Thegain of the amplifier is fixed by capacitor C_7.Preset V_{R4} isused to change the signal level from solar panel. C_5 acts as coupling capacitor it removesthe DC voltages from the solar panel. The output is fed to speaker via another couplingcapacitor C_8.The variation in LASER beam intensity is converted to variation in voltage level by asolar panel. The voltage variation in solar panel is amplified by a low voltage audiopower amplifier LM386 and reproduced by speaker. The maximum output of audioamplifier LM386 is 1 watt, while its voltage gain is 20 to 200.The audio signal transmitted by the laser diode (LD_1) is received by the calculator'ssolar panel and amplified by IC_2. The gain of the amplifier is fixed by capacitor C_7.Preset V_{R4} is used to change the signal level from the solar panel. This signal is fed toinput pin 3 of IC_2 through coupling capacitor C5 so that the DC value from the solarpanel can be eliminated.

The amplified output from IC_2 is fed to the speaker, whichplays the music from the CD player connected atthe input (V_{in}) of IC_1.

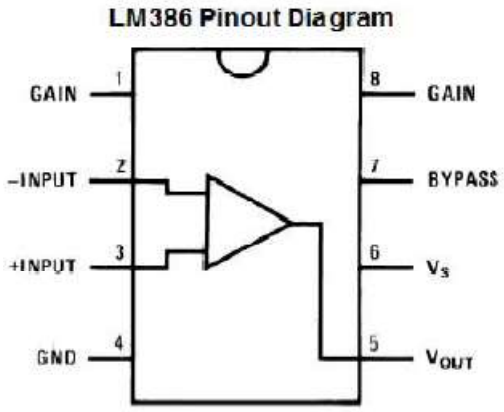

Fig.2. PIN Diagram Of LM386

III. RESULTS & FINAL OUTCOME

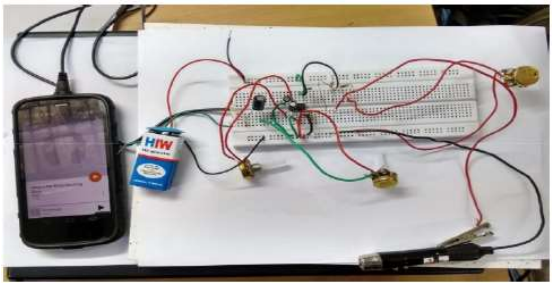

Fig.3. Transmitter Circuit

Transmitter uses a MP3 song from the mobile, modulator and an amplifier as shown in Fig.3. The input is an MP3 song given from the mobile phone which is a low signal input. It is then amplified by the amplifier LM386 so a high input signal is being generated. A 9V DC Power Supply is given to the Amplifier by a battery. The high input signal generated by the amplifier is then transmitted by a Laser Diode. This Laser Beam is given as input to the Sensor (Solar Cell)

Fig.4.Input Voice Signal Waveform Obtained InOscilloscope

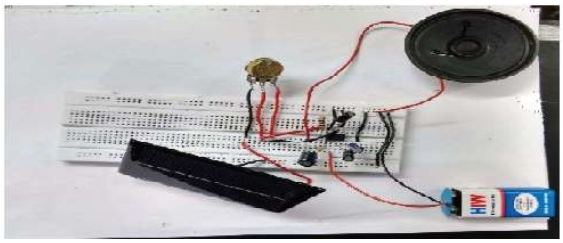

Fig.5. Receiver Circuit

Laser beam is the input of the receiver circuit. It uses a solar panel, audio amplifier and a loudspeaker. The transmitted light is received by the solar panel and amplified by audio power amplifier LM386.The amplified outputis fed to the speaker, which plays the music from the CD player connected at the input (V_{in}).

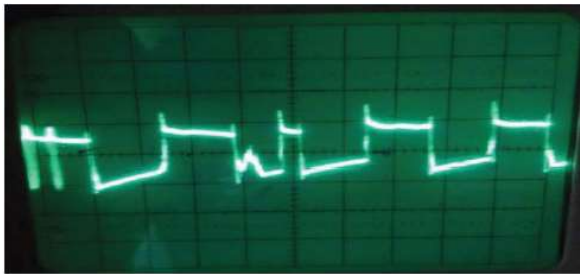

Fig.5.Output Voice Signal Waveform Obtained InOscilloscope

IV. CONCLUSION

We have successfully developed point to point laser communication model and transmit sound signal from one section to other section through the laser beam of the system.

This is new wireless technology to transmit the data or sound signal from one section to other section through the laser beam of the system. This system is safe without radiation. So it is harmless to living beings. The system can likely transmit data and sound much faster than the other system (like 1GB/s). Because of this, laser communication systemhave become more popular system than the other systems.

Laser Based Transmission and Reception are cheaper and simpler in construction than RF transmitter and receiver. Infra-Red and Blue-Tooth can also be used for voice transmission and Reception purpose, but their range is small compared with their price. This project can be made and used successfully at conference room, political assembly, and class room and for general conversation between two houses.

Improved design of this system can be used to transmit confidential voice and data from one hill top to other hill top in remote area

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