Study and Design of a LASER based Wireless Optical Voice and Data Transmission System

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***Abstract*—The LASER communications systems are wireless data links through the atmosphere. They work only for clear line-of-sight conditions between transmitter and receiver unit, but they eliminate the need for cables if used for shorter distances, buried cable installations and no government licensing is necessary. LASER communications systems can be quickly deployed since they are smaller and do not need any radio interference calculations. Additionally, no spectrum fees have to be paid by the users. LASER based project has been attempted before but data were inputted through computer. Also we have tried to simplify it by using 4x3 keypad which provides the complete set of numeric digits. We have also tried to enhance it by implementing voice communication as well through the LASER system. LASER communication is a modern technology in the sector of voice and data communication where bandwidth allocation, power requirement, and dispersion parameter are becoming major challenging factors due to rapid increase in number of user. So considering these facts we put our interest in this communication system.**

Keywords*— *LASER, optical communication, wireless transmission, data rates.

I. INTRODUCTION

This paper is about laser based voice and data communication system, which is one of the best form of optical communications system. It is used for inter and intra-building communication, closed circuit TV's, PC, LAN etc. It may be also suitable for the study of optical communication (more specifically laser based communication). This paper helps us for the better understanding of optical communication which has become a primary means of communication in the present world and gives us the view about free optics [1]. It enables communication up to several hundred meters without the aid of any cable and this technology can be extended in future to enable longer distance communication by using optical cables. For voice transmission amplitude modulation of laser pulse was used to transmit the voice signal. Condenser microphone converts the voice into electric pulse which was then amplified and transmitted through laser. Photo detector at receiver detects the laser light and voice was output through loud speaker.

II. MODEL ARCHITECTURE

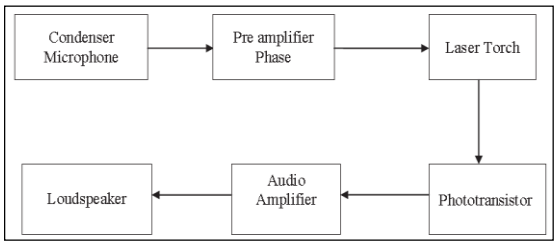

Fig.1. Block diagram of optical voice communication system.

The microphone senses the voice from any audio source, which is given to an amplifier unit. amplifier amplifies the voice upto a level which may be processed further without losses. The output of Pre-amplifier is given to a LASER torch which converts the electrical energy into light energy. This combination is known as transmitter unit.

At the receiver end the LASER light is given to a phototransistor which converts the LASER light into electrical energy back. The output of this phototransistor is fed to an audio amplifier which amplifies the level. From audio amplifier this energy is converter into sound audible to the users. This subset may be said to be the receiver part of this wireless optical communication system.

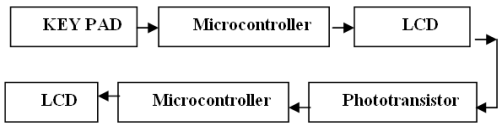

Fig.2. Block diagram of optical data communication system.

This above block diagram shows the concept for optical data communication system. For the transmission of data, the

information is carried in the pulse duration of the laser. When a key is pressed, corresponding 8 bit binary value is given to micro-controller. Depending upon the value of row and column, micro-controller displays one of the 26 alphabets. Then it stores these data in SBUF register to transmit it serially. The two transistors connected as a Darlington pair at the transmission port provide sufficient current to drive the laser. Then pulse duration of data is given to laser. The length of the pulse duration carries the information of the data.

Photo transistor at receiving side detects the incidence laser light which causes it to switch from low current condition to the high current condition. The output voltage of photo transistor is then amplified and fed to the receiving port of second micro-controller. When micro-controller detects the logic 1, data are serially read from the SBUF register. The received data are then displayed on LCD.

III. CIRCUIT DIAGRAM

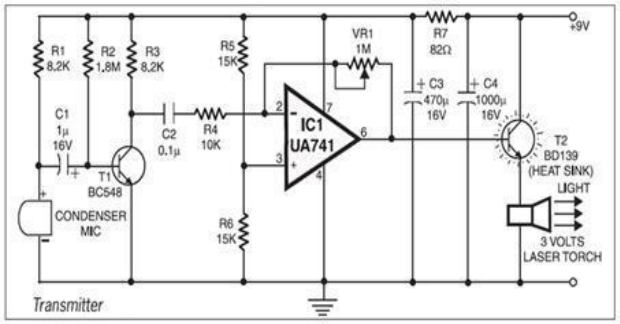

Fig. 3. Circuit diagram of a voice transmitter.

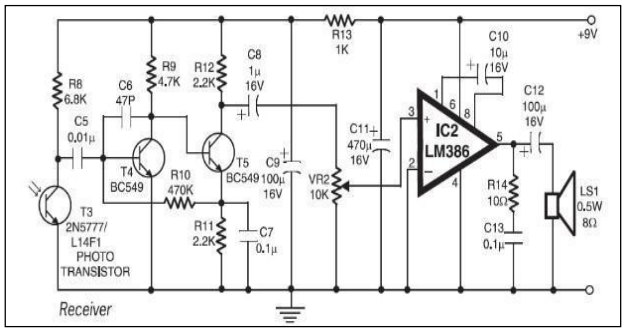

Fig. 4. Circuit diagram of a voice receiver.

The circuit is based upon the principle of LIGHT MODULATION where instead of, Radio frequency signals; light from a laser torch is used as the carrier in the circuit. Here, the transmitter uses 9V power supply. Audio signal or voice is taken as input from the condenser mic, which is, followed transistor amplifier BC548 along with op-amp stage built around UA741.The gain of the op-amp can be controlled with the help of 1 mega ohms pot meter.

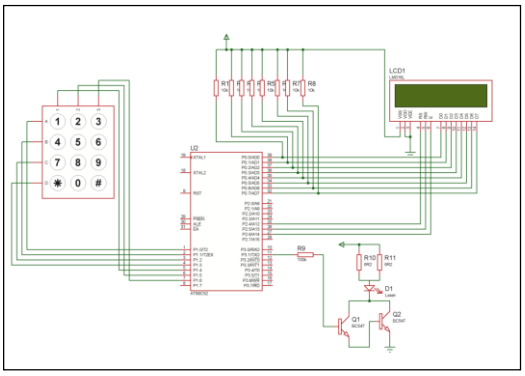

Fig. 5. Circuit diagram of a data transmitter.

The AF output from op-amp UA741 is coupled to the base of the power transistor BD139, which in turn, modulates the laser. However, the three volts laser torch can be directly connected to the emitter of BD139 and the spring loaded lead protruding from inside the torch to the ground.

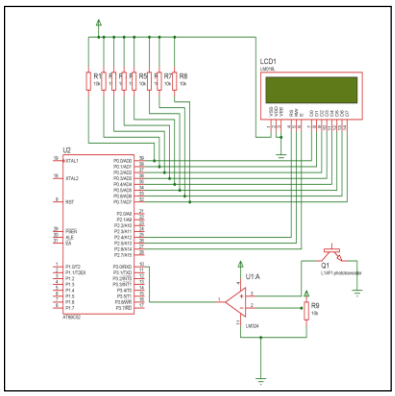

Fig. 6. Circuit diagram of a data receiver

Condenser mic is directly followed by the transistor amplifier stage consist of BC548.Transistor BC548 is connected in common emitter configuration. Resistor R1 is the source resistor, which is directly connected to the power-supply.R2, R3 and capacitor C1 are acting as self-biasing circuits, which is used for the biasing transistor.

IV. APPLICATIONS & ADVANTAGES

Though this is just a small-scale demonstration, Free Space Optics (FSO) is a very promising point-to-point communication technology. These days the use of laser communication is widely done in satellite application and communication between space crafts [3]. The light beam can be very narrow, which makes FSO hard to intercept, improving security. The concept can be implemented for home automation data transfer. Military application (Dedicated Base communication system). It is narrow beam of coherent light i.e. all the waves are in same phase. It is highly directed beam/intense light. Optical video transmission can also be possible with this concept [2]. It has shorter spectral line width. It has low lost coupling to fiber. It is power efficient.

V. CHALLENGES

The various design parameters for a good communication system which would minimize the noise and interference and

losses is a key challenge for this system. Also the communication range is required to be increased up to a level which is acceptable for the users.

VI. CONCLUSION

The communication systems adopting optical communication based on optical laws will prove themselves a very fast and efficient communication system. This paper presented a LASER based optical wireless voice and data communication system model for the users of communication industry. This system will be very promising for the users when data rates and low cost of operation is preferred.

REFERENCES

[1] www.wikipedia.co.in/optical/
[2] S.Ramesh, D.Suresh, A.SyedAlthaf Hussain, D.Tamilvanan, M.P.Prabakaran, "Video Transmission through Optical Wireless Communication", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 2, Issue 4, April 2013.
[3] Optical communication (4th edition) Govind P. Agrawal, Willey.
[4] http://www.wikiforu.com/