Underwater Communication System using Laser

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Abstract— In today's time, there is a persistent and immense need of a high fidelity system which would guarantee easy, fast and secure means of underwater communication. Today the world is at the brim of technological advancement however nowadays underwater communication is carried out with the help age old method of using radio waves. The radio waves have a few disadvantages, compared to which the proposed utilization of Blue LASER is better in various aspects. LASER communication plays a key role as a solution to satisfy ever increasing high demand for bandwidth. This system can be used in turbid water provided that line of sight conditions are established, The speed of communication is comparatively faster than the traditionally used method. This system can be reliably used to facilitate communication between two bodies (submarines, scuba divers, etc.) separated by a distance range of 500-750 m.

Key words: Underwater communication, LM 386, Submarines, LASER, Transmitter, Receiver, Radio waves

I. INTRODUCTION

Need: The use of radio waves in underwater communication has a number of shortcomings. Radio waves can have disastrous effects on the organisms like sea plantations and other aquatic animals such as fish etc. The speed of transmission of data using radio waves is low. In view of all these shortcomings, the proposed system is better and it tries to eliminate the above mentioned drawbacks. The LASER communication system is a wireless setup which includes both the receiver and the transmitter. Both the subsystems make use of low voltage audio amplifier IC LM386.The only necessary requirement is the line of sight condition. The biggest advantage it has over its counterparts is the less requirement of bandwidth. The proposed system is not only low power but also is inexpensive and to top it all it does not involve radio interference studies. In this system, the high wavelength LASER beam is used as a carrier. The variation in intensity of the LASER beam facilitates the transmission of information from the transmitter to receiver.

II. SYSTEM DESCRIPTION

Given below are the main subsystems used in the proposed system.

A. Transmitter

The figure 1 shows the circuit diagram of transmitter section consists of LM386 IC, which is a low voltage audio amplifier IC. It also has a LASER diode and a provision to provide the input data. The potentiometers are used to vary the voltage in the circuit. The input is provided into the circuit through Vin it passes through the IC, here the signal is amplified which in turn causes variations in the intensity of LASER.

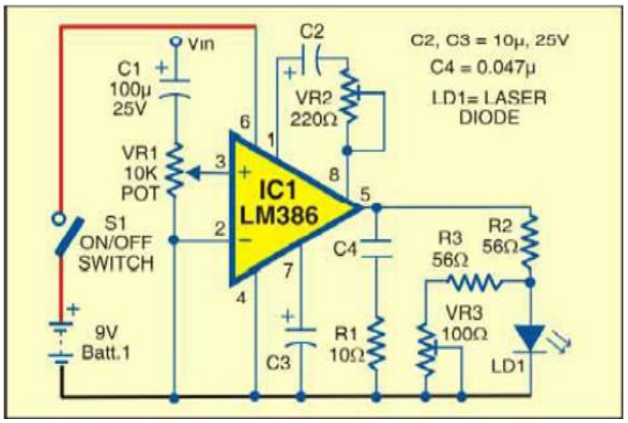

Fig. 1:

B. Receiver

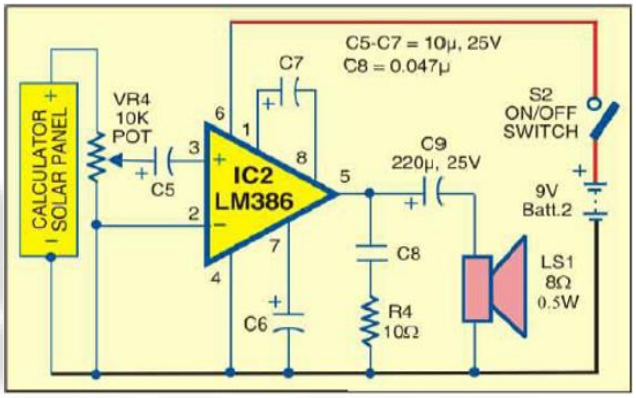

Fig. 2:

The figure 2 shows the receiver subsection also consists of IC LM386. Apart from that it consists of solar panel and a loudspeaker to give out the output. The LASER beam from the LASER diode is made to focus on the solar panel. The variation in intensity of LASER beam is read by the solar panel, which in turn is fed again to the LM386. Here the signal is amplified and fed to loudspeaker and the output signal is received

III. IMPLEMENTATION AND WORKING

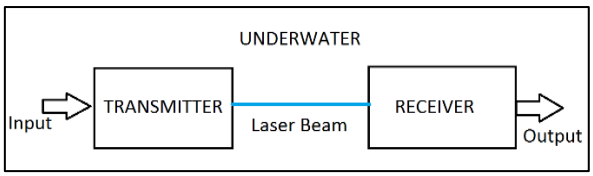

Fig. 3:

The figure 3 shows the generalized block diagram of underwater communication system. The voltage variation on the solar panel is amplified by a low-voltage audio power amplifier LM386 and reproduced by a speaker. The maximum output of audio amplifier LM386 is 1 watt, while its voltage gain is 20 to 200.

The circuit consists of a transmitter and a receiver. Both the transmitter and the receiver are built around IC

LM386, powered by a 9V battery. Figure 1 shows the transmitter circuit here a LASER diode with maximum operating voltage of around 2.6V DC and maximum operating current of 45 m A is used to transmit the signal. The voltage divider network keeps the voltage as well as the current for the LASER diode in the safe region. The output power of the LASER diode is 5 mW .Point the LASER beam to the solar panel. Potentiometer(10-kilo-ohm) is used to change the level of the input signal. Capacitor and preset are used to vary the gain of the LM386. Figure shows the receiver circuit. The audio signal transmitted by the LASER diode is received by the solar panel and amplified by IC LM386. The gain of the amplifier is fixed by capacitor. Preset is used to change the signal level from the solar panel. This signal is fed to input pin 3 of IC LM386 through coupling capacitor so that the DC value from the solar panel can be eliminated. The amplified output from IC LM386 is fed to the speaker. Assemble the transmitter and receiver circuits on separate PCBs and enclose in suitable cabinets. In the transmitter cabinet, fix two terminals for connecting the audio signal. Fix switch on the front panel and the LASER diode to the rear side of the cabinet. Keep the 9V battery inside the cabinet. In the receiver cabinet, fix the calculator's solar panel to the rear side such that the transmitted beam directly falls on it. Fix switch on the front panel and the speaker to the rear side. Keep the 9V battery inside the Cabinet.

The entire assembly which includes the transmitter and the Receiver should be enclosed in vaccum tight water proof cabinet.

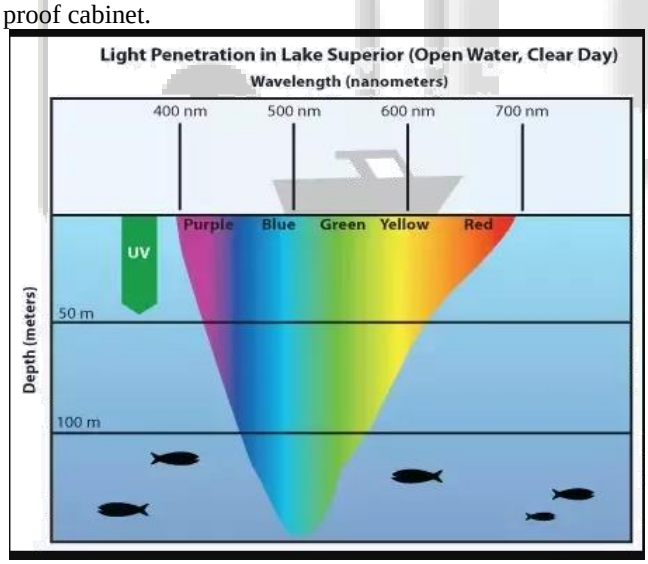

Fig. 4:

The figure 4 shows the graph which depicts information about the penetration levels of various lights in the salty water. It proves the usefulness of blue green light and its comparatively better penetration in sea water

IV. Application in Submarine Communication

Underwater LASER communication system can be effectively used in submarines. Radio waves cause danger to aquatic life. This is very upsetting considering the fact that there is presence of endangered species in deep sea water. In addition to that the communication speed is low and the bandwidth requirement is high too. A blue-green dye LASER (550 nm) can be used in submarine communication because of its better penetration and higher temperature stability in sea water. We can achieve communication speeds upto 12.4 Gbps.

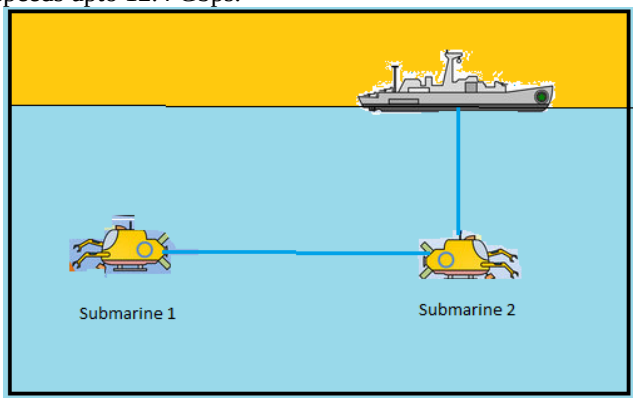

Fig. 5:

Similarly, this system can be used for communication between a submarine and a ship. As depicted in the figure 5 shown above.

V. Limitations

This system also has a few limitations as listed below:

1) For the proper functioning of the system, line of sight condition mut be achieved.
2) Both the subsections namely the transmitter and the receiver must be sturdy during process of communication.

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