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Optical infrared laser communication

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ABSTRACT

In the industry, the Modulated IR laser plays an important role for a lot of gigantic sensor modules and laser communications between the transmitter and receiver. So far the method discussed in this paper is about the modulated IR laser retransmitted wave by the sensor, after sensing the type modulation of the laser and then transmitting the same laser again.

Keywords: *Laser communication, Optical fibre, Modulated IR Laser, Emitter, Susceptible, Ambient light*

1. INTRODUCTION

The proposed methodology is applicable to Optical Laser Communication and thus will give a boost to the industry of Laser Communication in a variety of different fields. In the purposed model for doing this project we have to synchronize the following things together:

- Modulated IR Laser Transmitter
- Modulated IR Receiver
- Modulated IR Sensor with regenerator for the same laser using fiber optic laser communication.

The underlying phenomenon of modulated/demodulated IR light detecting works by producing light from the emitter, which in the presence of an object is reflected by that object into a detector, thereby enabling the detection of the object.

- The direction of LED emitter and detector is same.
- The susceptibility of modulated light is quite low to the environment.
- The amount of ambient light and reflection capabilities of different objects

This technical paper explains about the modulated laser IR retransmit phenomenon. The frequency at which IR light works is different than that of ambient light. The use for IR sensors is the same as that of visible light, though IR sensors are used in a more robust manner.

- Reflectance sensors break beams, sensor reports the amount of overall illumination,
- Modulation/demodulation is used to rapidly turn on and off the source of light.
- LED is important part it emits the light so it can easily convert into laser beam using the LED AND LENS with particular focal length. The laser can travel minimum 3kms. The infrared laser can extend the today's communication boundaries i.e. only up to about **10 meters.**

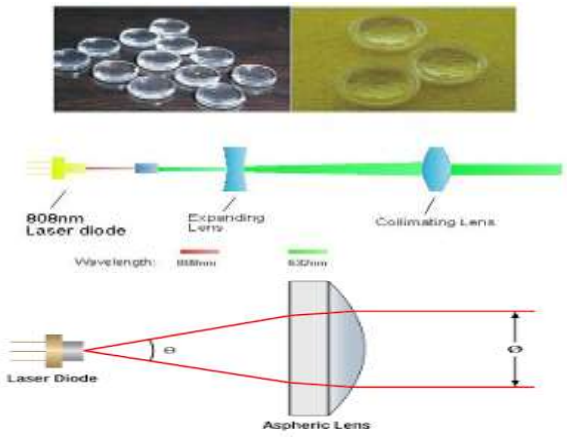

Fig. 1: Infrared laser creation

The most common use for modulated IR is of communication. When the light source flashes at a particular frequency, the process is known as modulation. The signal is then sensed by a demodulator which has been adjusted to that frequency. This whole process is a great way to offer resistance/ insensitivity to ambient light. The special characteristic of this process is that light flashes can be identified even if they are weak. [2]

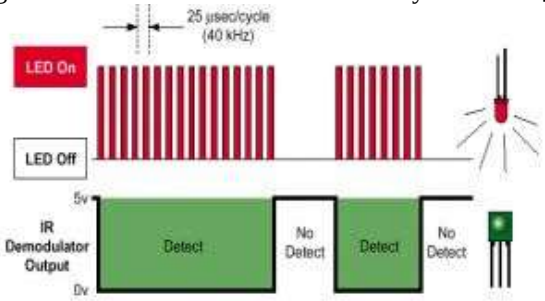

Fig. 2: Modulated laser operation

2. PROPERTIES OF INFRARED

1. Electromagnetic waves having frequencies from 300 GHz to 400 THz are called IR waves or Infrared waves.

2. IR waves are used for short-range communication and use line-of-sight propagation
3. Infrared waves cannot pass through solid objects, like walls and can be easily contained in a room.
4. They are cheap, easy to build and do not require any government license to use them.
5. IR waves offer very large bandwidth for use. [4]

3. LITERATURE REVIEW

The process of Laser proposed in this paper is that firstly the Modulated IR Laser transmits the pulse of laser and the Laser Sensor receives it. After getting the transmitted laser, the Laser Sensor sends the information about the laser to the Receiver and at that end, we put the circuitry which tells the type of Modulation used in the Modulated Laser Transmitter. After this mechanism, the Receiver Retransmits the same Laser which was transmitted by the Modulated IR laser Transmitter. IR communication can be done in two ways. [5]

•Bit Frames

– All bits take the same amount of time to transmit.
– The signal is sampled in the middle of the bit frame.
– This type of IR communications is used for standard computer/modem communication and is also useful when the waveform can be reliably transmitted.

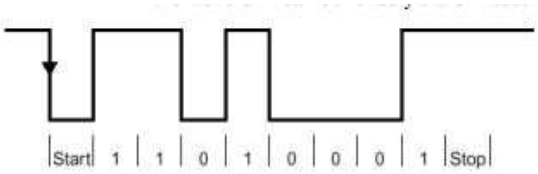

Fig. 3: Bit frame

• Bit Intervals

– Sampled at the falling edge.
– Duration of the interval between sampling determines whether it is a 0 or 1.
– This type of communication is commonly used for commercial purposes. It is particularly useful when it is difficult to control the exact shape of the waveform. [5]

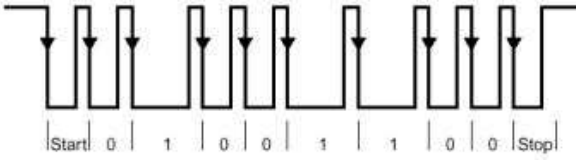

Fig. 4: Bit intervals

4. RESEARCH METHODOLOGY

Keeping in view the scope of this research, we will present a model of Laser Module. The modulated laser sends the Laser pulse and by the difference of frequencies, we can differentiate between two different Lasers. The Modulated laser is detected on the Laser sensor which detects the hit by the laser and tells the type of modulation and also retransmits the original signal.

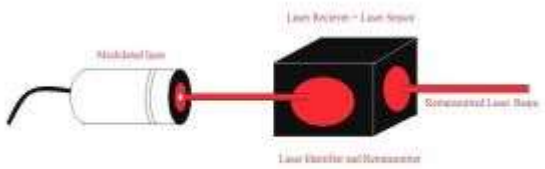

Fig. 5: Overall graphic view of the project

A. TTL Modulation

The UT series infrared module is able to TTL modulate between zero and full power by the application of an external TTL input signal, which can come from a function generator by the use of a third wire. At low TTL input, the power of the laser is completely turned off. At high TTL input full power of the laser output is received. The TTL signal can be a combination of on-off time. [2]

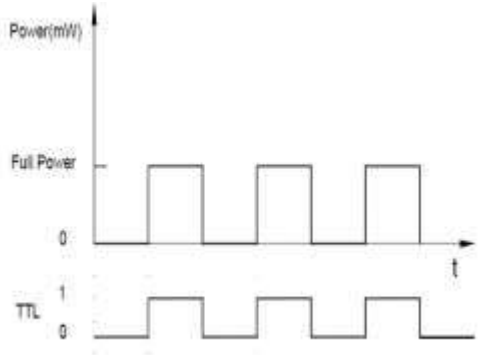

Fig. 6. TTL modulation

B. Circuitry for the modulated laser

The optical laser communication makes it easy to retransmit the laser with lesser loss and attenuation, so in this case, it is suitable to use optical laser communication for retransmitting of the laser. The semiconductor laser is generally used in fiber-optic telecommunication because of its compatibility with the communication system. The small size and configuration of semiconductor lasers are suitable for a smaller core diameter of an optical fiber. The lasers working at mW power levels are adequate for fiber-optic communications. These lasers can easily be modulated to frequencies up to the GHz range, through the modulation of an electric signal. The modulation of a beam-light from laser using optical fibers can be done for the transmission of signals. The semiconductor laser to be used in fiber communications is an obvious choice because of it smaller emitting area. [7]

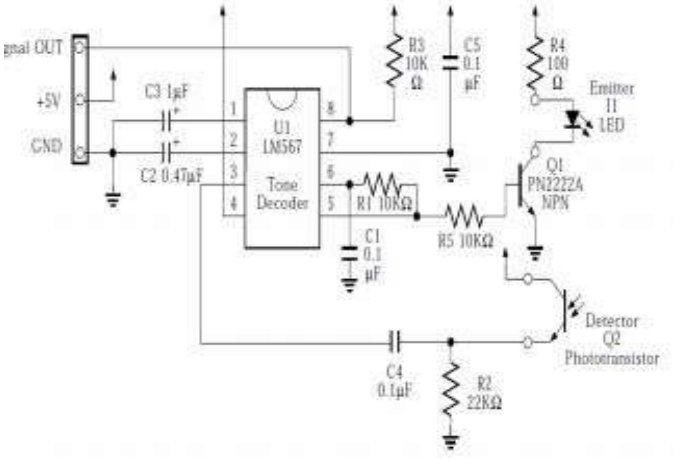

Fig. 7: Circuitry for the modulated laser

The life period of lasers was very small and the accompanying fiber losses were considered very high during the past few years. Owing to these factors laser-based fiber communications did not gain popularity. However, in present times the type of lasers and fibers have advanced significantly and the problems associated with laser lifespan and fiber losses have seen rapid improvements by factors of ten. Till the late 1970s, the threshold used to signal usage of laser-based fiber optic telecommunications a grave danger was such that

laser lifetime had to attain 105 hours or more and fiber losses had to be kept back to dB/km before being considered a danger.

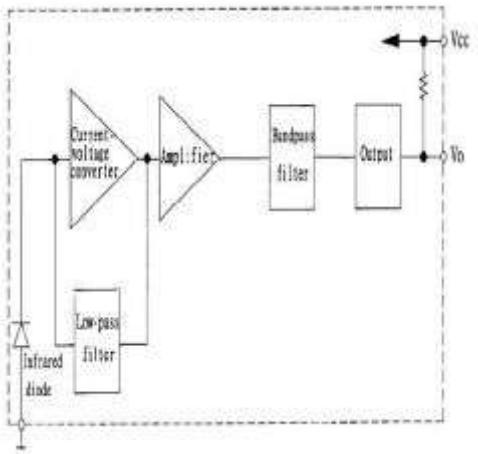

Fig. 8: Block diagram of modulated laser with optical laser communication

But in the current years, fiber optic telecommunication systems are being used extensively for carrying information for inter-city telephone trunk lines, video data links, information links and telephone links between computers. The output of the laser is modulated to obtain a digital pulse coded modulated signal which is basically a sequence of zeroes and ones. The input signal assists to continue the power supply of laser in a running condition. The laser light is fixed in the fiber; whose end contains a connector which maximizes the input. At the end of the fiber, a receiver is located which contains an optical detector. This detector senses and converts the light into an electrical signal. Other than the optical detector, the receiver also contains an amplifier and regenerator. The output of the receiver is a pulse coded modulated train of digital information and is same as the original input given at the transmitter. PCM is the modulation technique used by fiber optic telecommunication systems. The information is transmitted as a series of ones and zeroes, resembling information as a system of binary bits. If the pulse is present at a given time interval it will be represented by a one, and if it is not present then it will be represented by a zero. Information can be missed by the pulse either if its amplitude becomes very small to be detectable, or if the shape of the pulse extends out and does not fall within the appropriate time spans. The information carried by the pulse is lost for the particular time period and cannot be received by the receiver, in any of the two cases. [7]

Infrared Circuit Diagram

Figure 9 shows simple infrared transmitter circuit diagram.

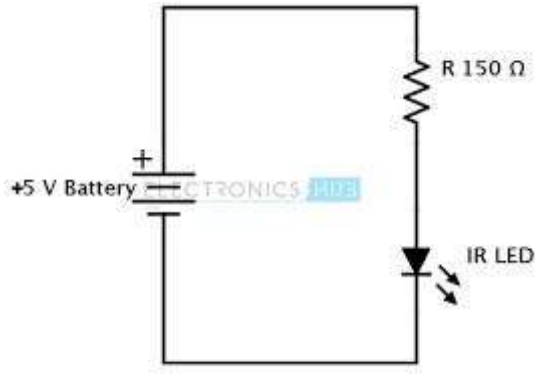

Fig. 9: Circuit diagram infrared transmitter

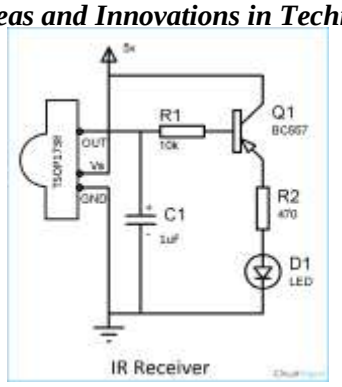

Fig. 10: Infrared receiver

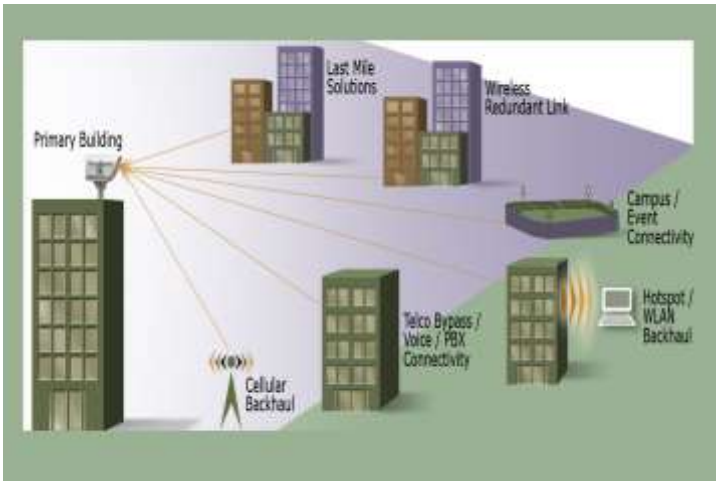

Fig. 11: Over view of communication

5. CONCLUSIONS

The invention of the laser and its subsequent uses in communications provided a consistent optical source for information transmission at higher data rates. On the other hand, there were certain factors which limited the effectiveness of lasers for information transmission. Restrictions on transmitting light through the atmosphere, for example, likely effects of fog, turbulence, haze, rain, and absorption, were some of the factors posing a restriction on laser transmission. In the modern communication systems of the optical fiber, semiconductor lasers could be used to broadcast light through optical fibers. Systems such as this one are being used extensively for telecommunication systems. Optical fibers dominate laser-based communications. Fiber-optic based telecommunication systems are used for information transmission, for example, TV pictures, conversations, and telemetry data over far longer distances. The system of optical communication is very much similar to closed circuit systems or to the systems of radio frequency in its usage terms. But the way in which transmission is projected is different in several ways. It will put emphasis on the distinctiveness of communication systems, as opposed to optical communication. Fiber communication systems have also been emphasized more. The assumptions are that lasers, detectors, and fibers are the major components. The implementation of Laser retransmitted is also one of the phases of Optical Laser Communication.

Optical infrared laser communication systems provide a useful complement to radio-based systems, particularly for systems requiring low cost, lightweight, moderate data rates. Optical infrared laser communications systems will compete in a number of areas. Infrared systems have already proven their effectiveness for short-range temporary communications and

in high data rate longer range point-to-point systems. Optical infrared laser communication care replaces the wire communication completely. [5]

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