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Underwater Communication Using Li-Fi

S. U. Lakshmeesh[1], K. S. Karthik[2], Nagabhushan Hegde[3], C. N. Ramya[4]
[1,2,3]*Student, Department of Electronics and Communication Engineering, Atria Institute of Technology, Bangalore, India*
[4]*Assistant Professor, Department of Electronics and Communication Engineering, Atria Institute of Technology, Bangalore, India*

***Abstract*: Now-a-days, there is extensive ongoing research activity relating to underwater communications and underwater sensor networks. So, based on increasing bandwidth and network speed to attempt the high-speed communication. The proposed system is underwater communication system using Li Fi technology. Li-Fi or Light Fidelity refers to Visible Light Communication (VLC) systems using light-emitting diodes as a medium to high-speed communication. The LI-FI System consists of headlights such as LEDs acting as transmitter, communicate with photo sensors acting as receiver. It is possible to encode data in the light by varying the rate at which the LEDs flicker on and off very quickly to give different strings 1s and 0s. The aim of this project is to transfer text, audio, image in underwater using VLC technique.**

***Keywords*: Li-Fi, LED's, Underwater, Visible Light Communication (VLC).**

1. Introduction

Light Fidelity known as Li-Fi is an outcome of twenty first century. The basic ideology behind this technology is that the data can be transmitted through LED light whose intensity varies even faster than the human eye. As the transmission of the data takes place through the light emitting diodes (LED's) the amount is comparatively small. In modern times, it is called as the optimized version of Wi-Fi. The advantageous thing is the wireless communication which decreases the cost enormously. The important segment of the Li-Fi technology is the high power Led lights, led can be turned on & off quickly because the reaction time of the led is lesser than 1 microsecond which cannot be detected by the human eye this will appear to be continues beam of light. This change from on state to off state in high frequencies enables the data transmission. On states '1' and off states '0'the data can be encoded and modulation techniques can be done faster than the human eye can detect it. A photo detector can be used to receive the transmitted data from the light source and generates the original data. Li-Fi, or "light fidelity", is a technology, that can be a complement of RF communication (Wi-Fi or Cellular network), or a replacement in contexts of data broadcasting. Li-Fi, like Wi-Fi, is the high speed, bidirectional and fully networked subset of visible light communications (VLC). It is wireless and uses visible light communication (instead of radio frequency waves), which carries much more information, and has been proposed as a solution to the RF-bandwidth limitations. The demonstration of this technology took place using two smart phones. The data was made to exchange between the phones using light. Even though the distance was nominal, it is sure that there would be a rapid increase in the distance of transmission. A number of companies formed a consortium called Li-Fi consortium in order to promote high speed optical wireless systems. The members of this consortium believe that a speed of 10 Gbps can be achieved in no time. If this would be possible then a high definition video would take about 30 seconds to download.

2. Literature survey

[1] In this project data is transmitted by modulating the intensity of the light, which is then received by a photosensitive detector, and the light signal is demodulated into electronic form. White LED's used in the head and tail lights can effectively be used for short range communication with the photo detectors.

[2] VLC refers to data transmission using visible light between 400 to 800 THz. The bandwidth of VLC is certainly much greater than the bandwidth of radio frequencies, which range from 3KHz to 300GHz. Audio is transmitted through the optical channel established between the LED and the photodiode module using OOK modulation.

[3] Li-Fi system can be used to provide short-range tele-operational control of an underwater vehicle. It is used to communicate underwater at distances up to 5m under favorable lighting conditions using visible light.

[4] We present a framework for estimating the expected variations in the emitted light quality of illumination LEDs due to Li-Fi.

[5] A novel bidirectional underwater visible light communication (BiUVLC) is proposed. The VLC transmitter transmits an information signal using the one of RGB LED through the water tank that represents an underwater environment and then is received by VLC receiver via a color filter.

[6] The system able to send text and image data perfectly with maximum transmission distance is 98 cm. The maximum acceptance angle for transmission is 70^{o} with maximum baud rate is 19200 bps. The quality of the system for text

transmission is measured by calculating character error rate (CER), while the quality of image transmission is calculated by using Bit Error Rate (BER).

[7] The system consists of a transmitter that directs light beam in the direction of the receiver, thereby, converting the electrical data signal into optical signal. Transmitter accepts data over a serial interface which is encoded according to the specification and light pulses generated through LED's. Receiver detects the optical signal and transforms it into electrical signal.

[8] In this technology has increased speed, improved bandwidth, and reduced noise. Thus, the audio signal transmitting with the use of Li-Fi. Initially, the voice signal is converted into digital values and these digital data values are converted to RGB values. RGB values obtained are transmitted as light waves of receiver submarines.

[9] Image transmission between two devices is done by using the medium of visible light of electromagnetic spectrum. In Li-Fi basically we focus to transmitting multimedia data between two terminals using LED's. Li-Fi is a transmission of data through illumination, in which data can be sent through a LED light bulb that varies in intensity faster than human eye can follow.

[10] In this project Under water is the communication medium. A small 20 micro meter white LED is the source of light and the silicon-based photo diode is used for the realization of the system. LASER can also be used as an alternative for LED. The transmitter will be sending signal pulses. This light is allowed to fall in the photo diode and by using the interference filter, any possible stray of radiation can be emitted.

[11] Li-Fi is ideal for high density wireless data coverage in confined area and for relieving radio interference issues. Li-Fi provides better bandwidth, efficiency, availability and security than Wi-Fi. Important factors we should consider while designing Li-Fi as following: (1) Presence of Light (2) Line of Sight (Los) (3) For better performance use fluorescent light and LED.

[12] Author will discuss the audio transfer technology through visible light. The proposed system explains Li-Fi technology is employed as wireless medium to achieve machine movements according to the operator's voice using speech recognition algorithm. The micro-controller will transmit command through the Li-Fi medium. The LEDs are used for the transmission of light giving a range of around 12-15 cm. The range can be increased by multiple other light sources like bulb, laser.

[13] The authors will discuss the technology in detail and also how Wi-Fi can be replaced by Li-Fi. Wi-Fi is useful for general wireless coverage within buildings while Li-Fi is ideal for high density wireless data coverage in confined areas where there are no obstacles.

[14] The data is sent in the way of light rays that has been generated using LED light source the intensity of the light source as been increased by reducing the amplitude of the digital data that as to be transmitted.

[15] This paper discusses a novel idea for Transmission of voices in a real time underwater so that the system can be used by the deep-sea divers for both lightning and data transfer applications simultaneously. Main blocks in the transmitter module are microphone with an amplifier, modulator, LED driver and a power supply block. The audio signal is detected by using a miniature microphone.

3. Objectives

- The main objective of the project is to provide an efficient, low cost, digitally controlled and fast data transfer technique.
- It can overcome the problem occurring in the communication (Interference and bandwidth).
- Data density can be increased and also it gives secure communication.
- In this project, we are transferring text, audio and image from transmitter end to receiver end in underwater using Li-Fi.

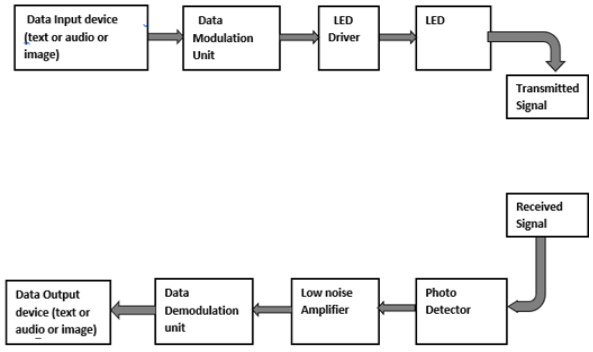

Fig. 1. Block diagram

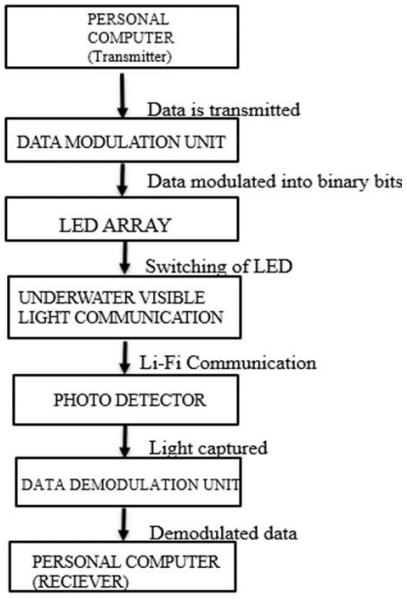

Fig. 2. Flowchart

4. Conclusion

The possibilities are numerous and can be explored further. If his technology can be put into practical use, every bulb can be used something like a Wi-Fi hotspot to transmit wireless data and we will proceed toward the cleaner, greener, safer and brighter future. The concept of Li-Fi is currently attracting a great deal of interest, not least because it may offer a genuine and very efficient alternative to radio-based wireless. As a growing number of people and their many devices access wireless internet, the airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, high-speed signal. This may solve issues such as the shortage of radio-frequency bandwidth and also allow internet where traditional radio-based wireless isn't allowed such as aircraft or hospitals. One of the shortcomings however is that it only works in direct line of sight.

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