INTERNATIONAL RESEARCH JOURNAL IN ADVANCED ENGINEERING AND TECHNOLOGY (IRJAET) E - ISSN: 2454-4752 P - ISSN : 2454-4744
VOL 4 ISSUE 2 (2018) PAGES 3385 - 3391
RECEIVED : 15.03.2018 PUBLISHED : 23.04.2018 April 23, 2018

LED LAMP BASED VISIBLE LIGHT COMMUNICATION IN UNDERWATER VEHICLE

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ABSTRACT:-

Wi-Fi technology becomes more popular today. Every public spots and private offices have wifi because of this wireless spectrum is blocked very frequently. Due to maximum utility RF interferences are getting more common to overcome this problem light fidelity (Li-Fi) technology was introduced in the year 2011. Li-Fi is similar to other wireless communication which uses the communication medium as light. Visible light is use to transfer data between the system instead of radio signals. LIFI set up comprises a transceiver unit. LIFI data input (i.e. serial data input) is given to the transmitter section in underwater for communication from which the data is transmitted and gets received in a LIFI receiver. The data which received gets amplified and get by means of TTL output. New vlc technology over the existing wifi technology and the challenges of new Li-Fi technology.

Keywords :- Wi-Fi, Li-Fi, Wireless Spectrum, Wireless Communication.

1. INTRODUCTION

1.1.OVERVIEW:

Light Emitting Diode (LED) OUWC systems have been studied and developed for high data rate transfer in deep ocean scenarios where the optical nodes are displaced over the sea bottom to cover the area where an AUV is operated to retrieve data from deep submerged observatories. Recently, the Woods Hole Oceanographic Institution (WHOI) performed various demonstrations in such scenario, evaluating the performance of the developed optical modem at different altitudes above the seafloor. Other scenarios have been proposed in, e.g. battery powered Remotely Operated Vehicles (ROVs) commanded via ship-mounted OUWC systems or via subsea infrastructure, to avoid drag and tether management issues. Successful OUWC systems were developed, achieving a range of 100-200 meter with 5 Mb/s data rate in very clear deep ocean water and 4 Mb/s at 20 meter in clear water near the surface. In lab other OUWC systems achieved a data rate of 5 Mb/s in 7 meters water tank pool and 1 Gb/s with expensive laser diode set-up in a water pipe 2 meters long. A notable development has been the Aqua Optical system, starting from three different portable OUWC LED based prototypes. Aqua Optical systems were tested in water pool and in shallow waters near a harbor in Singapore, achieving as best result, with the long distance system, 8 meters range and 0.6 Mb/s data rate. The Aqua Optical II is the direct evolution of Aqua Optical: tests in an indoor Olympic size pool demonstrated the capacity of the system to reach a range of 50 meters at 2 Mb/s data rate and bi-directional communication at 21 meters. Commercial modems are designed for very clear water in deep sea scenario, characterized by the total absence of sunlight disturbance, or for clear shallow water promising to achieve 4 Mb/s at 20 m distance. In, we achieved a 6.25 Mb/s data rate with Manchester code (MC), 12.5 Mb/s NRZ 8b/10b code and 58 Mb/s using Discrete Multi-Tone (DMT), by a blue LED based OUWC system at a range of 2.5m. The results were taken and

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averaged over several hours of experimental tests in an outdoor water tank pool, during summer days in Italy, i.e. under strong sunlight noise; error free transmission was achieved throughout all the tests. The OptoCOMM subproject, financed within the EU-FP7 SUNRISE consortium, has the goal to develop a bi-directional OUWC modem based on LED technology. It is always difficult to make a fair comparison among tests taken in different conditions; however, starting from the results, the developed modems aims to achieve a data rate of 10 Mb/s at a range of at least 10 meters in a natural environmental like the Littoral Ocean Observatory Network (LOON) test-bed where sunlight noise, turbidity and scattering are present. This will be achieved by design and selection of the source characteristics (source power and wavelength, divergence etc.) as well as of the receiver (photodiode and electronics specification, collimating lenses etc.). The realization of a rugged prototype, to be installed also in AUVs or ROVs, is a further step to demonstrate in the field the capability of OUWC technology, and to provide it as a tool for the scientific community.

1.2 OBJECTIVE:

Li-Fi is a bidirectional, high-speed and fully networked wireless communication technology similar to Wi-Fi. The term was coined by Harald Haas[1] and is a form of visible light communication and a subset of optical wireless communications (OWC) and could be a complement to RF communication (Wi-Fi or cellular networks), or even a replacement in contexts of data broadcasting. It is wire and UV visible-light communication or infrared and near-ultraviolet instead of radio-frequency spectrum, part of optical wireless communications technology, which carries much more information and has been proposed as a solution to the RF-bandwidth limitations

1.3 MOTIVATION:

While wireless communication technology today has become part of our daily life, the idea of wireless undersea communications may still seem far-fetched. However, research has been active for over a decade on designing the methods for wireless information transmission underwater. Human knowledge and understanding of the world’s oceans, which constitute the major part of our planet, rests on our ability to collect information from remote undersea locations. The major discoveries of the past decades, such as the remains of Titanic, or the hydro-thermal vents at bottom of deep ocean, were made using cabled submersibles. Although such systems remain indispensable if high-speed communication link is to exists between the remote end and the surface, it is natural to wonder what one could accomplish without the burden (and cost) of heavy cables. Hence the motivation and our interest in wireless underwater communications. Together with sensor technology and vehicular technology, wireless communications will enable new applications ranging from environmental monitoring to gathering of oceanographic data, marine archaeology, and search and rescue missions.

The signals that are used to carry digital information through an underwater channel are not radio signals, as electro-magnetic waves propagate only over extremely short distances. Instead, acoustic waves are used, which can propagate over long distances. However, an underwater acoustic channel presents a communication system designer with many difficulties. The three distinguishing characteristics of this channel are frequency-dependent propagation loss, severe multipath, and low speed of sound propagation.

None of these characteristics are nearly as pronounced in land-based radio channels, the fact that makes underwater wireless communication extremely difficult, and necessitates dedicated system design.

Communication system while in a cellular radio system multipath spans a few symbol intervals, in an underwater acoustic channel it can spans few tens, or even hundreds of symbol intervals! To avoid the inter symbol interference, a guard time, of length at least equal to the multipath spread, must be inserted between successively transmitted symbols. However, this will reduce the overall symbol rate, which is already limited by the system bandwidth. To maximize the symbol rate, a receiver must be designed to counteract very long inter symbol interference. The speed of sound underwater varies with depth and also depends on the environment. Its nominal value is only 1500 m/s, and this fact has a twofold implication on the communication system design. First, it implies long signal delay, which severely reduces the efficiency of any communication protocol that is based on receiver feedback, or hand-shaking between the transmitter and receiver.

The resulting latency is similar to that of a space communication system, although there it is a consequence of long distances traveled. Secondly, low speed of sound results in severe Doppler distortion in a mobile acoustic system. Namely, if the relative velocity between the transmitter and receiver is ±v, then a signal of frequency fc will be observed at the receiver as having frequency fc(1±v/c). At the same time, a waveform of duration T will be observed at the receiver as having duration T (1±v/c). Hence, Doppler shifting and spreading occur. For the velocity v on the order of few m/s, the factor v/c, which determines the severity of the Doppler distortion, can be several orders of magnitude greater than the one observed in a land-mobile radio system! To avoid this distortion, a non coherent modulation/detection must be employed. Coherent modulation/detection offers a far better utilization of bandwidth, but the receiver must be designed to deal with extreme Doppler distortion.

Summarizing the channel characteristics, one comes to the conclusion that an underwater acoustic link combines in itself the worst aspects of radio channels: poor quality of a land-mobile link, and high latency of a space link. In addition, current technology offers limited transducer bandwidth (typically a few kHz, or few tens of kHz in a wideband system), half-duplex operation, and limited power supply of battery-operated instruments.

2. PROPOSED SYSTEM

In proposed design, Optical under water communication provides better solution for wireless communication. An advance way to transfer information could drastically change path that systems can communication with each other called Li-fi. Li-fi uses visible light to transfer data between two devices which do not have physical connection. This idea is inspired from VLC which uses visible light LED for transmitting data and we use proximity sensor and PIR sensor to detect the human, mammals or vehicle presence in underwater and data is received through lifi receiver by using UART cable and data shown in computer use advance LIFI underwater data transmission for high speed data transmission .

ADVANTAGES

- Optical under water communication provides better solution for wireless communication.

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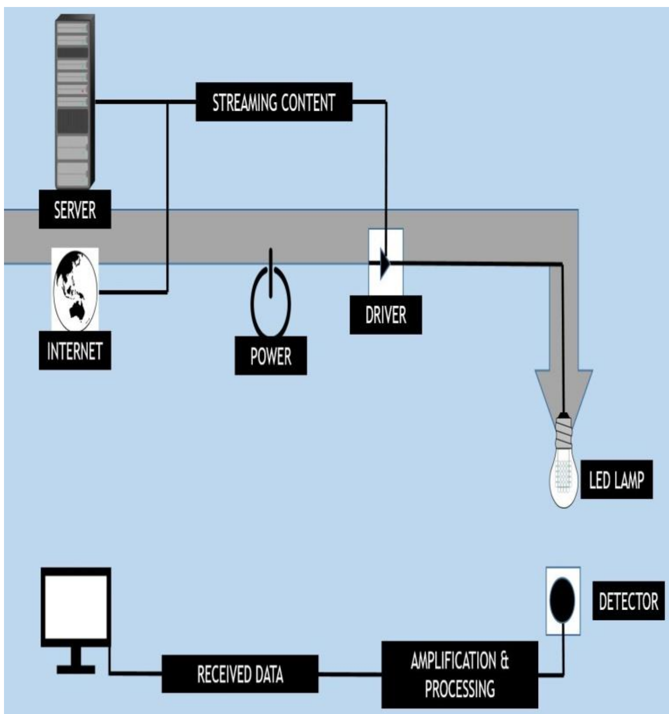
- It has high transmission frequency when compare to other transmitting devices.
- Optical based underwater communication system is cost effective, small in size and power efficient.
- It provides wireless transfer of high volumes of data between underwater agents.
- It is used in secure transmission for sub marine system.

2.1 ARCHITECTURE DIAGRAM



2.2 BLOCK DIAGRAM

2.2.1 TRANSMITTER

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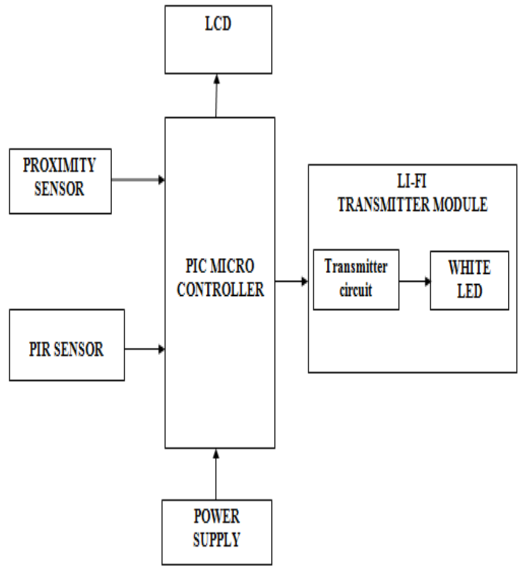
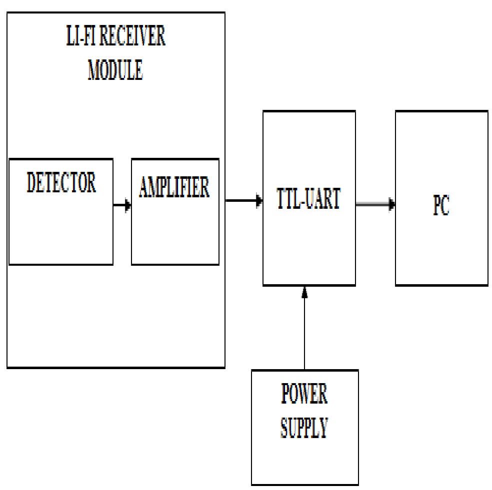


2.2.2 RECEIVER



3. MODULE DESCRIPTION

Data Transmission

Data Detection

Underwater Communications

3.1.Data Transmission:

Li-Fi:

LiFi is a wireless optical networking technology that uses light-emitting diodes (LEDs) for data transmission.

LiFi is designed to use LED light bulbs similar to those currently in use in many energy-conscious homes and offices. However, LiFi bulbs are outfitted with a chip that modulates the light imperceptibly for optical data transmission. LiFi data is transmitted by the LED bulbs and received by photoreceptors.

LiFi's early developmental models were capable of 150 megabits-per-second (Mbps). Some commercial kits enabling that speed have been released. In the lab, with stronger LEDs and different technology, researchers have enabled 10 gigabits-per-second (Gbps), which is faster than 802.11ad.

Benefits of LiFi:

- Higher speeds than Wi-Fi.
- 10000 times the frequency spectrum of radio.
- More secure because data cannot be intercepted without a clear line of sight.
- Prevents piggybacking.
- Eliminates neighboring network interference.
- Unimpeded by radio interference.
- Does not create interference in sensitive electronics, making it better for use in environments like hospitals and aircraft.

By using LiFi in all the lights in and around a building, the technology could enable greater area of coverage than a single WiFi router. Drawbacks to the technology include the need for a clear line of sight, difficulties with mobility and the requirement that lights stay on for operation.

3.2.DATA DETECTION

Applications

A. Measuring the pulsewidth or viewing the pulse profile of Q-switched lasers.

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B. Monitoring the output of mode-locked lasers.

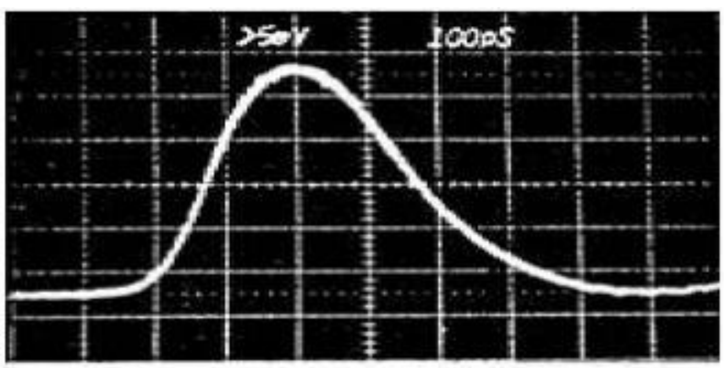
C. Viewing the rapid modulation of diode lasers and externally-modulated CW laser pulses.

D. Beamfinding/alignment of CW and pulsed lasers.

E. Triggering applications using EOT's TTL Photodetectors, which incorporate all of the features of our biased photodetectors, plus an adjustable threshold ultrafast comparator with a TTL output accessible via a second BNC connector.

F. Large area photodetectors can be used as power meters by using Ohm's Law to calculate power levels.

Figures 1 and 2 demonstrate some of the applications for which the ET Series photodetectors are used:



< 100 psec pulse @1064nm viewed with the ET 2000 shows a typical response profile

4. CONCLUSION :

The project describes the UNDERWATER COMMUNICATION using lifi project and its motivations in developing an OUWC modem accessible to the scientific community. The preliminary dry experimental lab tests validated the proposal technology and the robustness of the transmission protocol. The early results are very promising and the assemble of the entire modem along with wet and sea water experiments are expected in the forthcoming period. The remaining process will be implemented in phase2.