

# SUBAQUATIC MESSAGE TRANSMISSION USING LIFI

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## Abstract

It is very difficult to communicate underwater so divers use white boards to communicate. But today an amazing technology that uses light to make underwater communication possible, proposed by the German physicist Harald Haas is Li-Fi technology. Light Fidelity (Li-Fi) is a bidirectional, high speed and fully networked wireless optical communication. By widening the angle even when the light is obstructed by floating objects it will be either reflected or refracted, this raises its ability to reach the receiver and even as the light sways the current it is still adequate. The specific uses for Li-Fi are infinite. The Navy uses the li-fi to enhance submarine communication systems. The future applications of Li-Fi could serve a much more purpose than just for underwater, airplane, and chemical plant usage.

*Keywords*—Communication, Li Fi, LED, Underwater, VLC

## I. INTRODUCTION

This paper deals with the application of Li Fi for underwater communications. Under water communication is a real challenge and already a lot of technologies have been tried to make the communication easy. Most of them are complex architectures as they have to deal with water, mostly saline sea water. Li Fi, on the other hand makes things easy by keeping things simple. Li Fi generally can be realized using LEDs. Light fidelity can utilize a wavelength in the range of 400 nm to 700 nm which is 10000 times broader than the existing radio spectrum. If the LED is ON it means digital data 1 is transmitted and if LED is OFF means digital data 0 is transmitted. Since it does not require base stations, licensed spectrum, sophisticated transmitter, complex antenna structures etc., the system is simple, safe and hazard free.

## II. PRINCIPLE OF LI-FI TECHNOLOGY

The important component of the Li-Fi technology is the high power Led lights, it can be turned on & off quickly less than 1 microsecond which cannot be detected by the human eye and 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. This method continuously receives

the pulses of light and decode into the stream of data is referred as VLC (visible light communication).

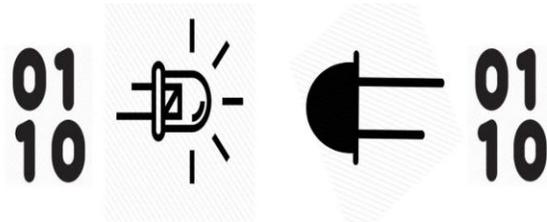


Fig.1 Working of LiFi

## III. EXISTING SYSTEM

Acoustic is the most preferred signal used as carrier by many application, owing to its low absorption characteristic for underwater communication. Using electromagnetic wave, the communication can be established at higher frequency and bandwidth. The limitation is due to high absorption/attenuation that has significant effect on the transmitted signals. Antenna needed for this type of communication, thus affects design complexity and cost. Due to absorption characteristics of sea water ultrasound is not used for underwater communication. If the source or destination is moving then the Doppler effect will stretch or shrink the transmitter section. Unwanted noise signal may be present. Digital signal processing can be used for minimizing the disadvantages of ultrasound underwater communication.

**PROPOSED SYSTEM**

Implementation of underwater communication through Li-Fi. The system transfers voice signal, which is transmitted using light waves.



Fig.2 VLC under water

**IV. SYSTEM ARCHITECTURE**

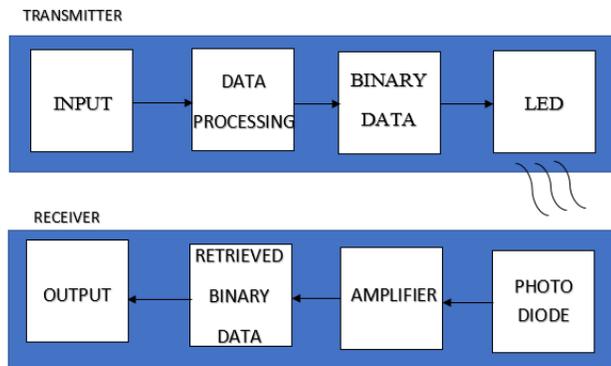


Figure 1. Basic Architecture

When a constant current source is applied to an LED bulb, it emits a constant stream of photons observed as visible light. When this current is varied slowly, the bulb dims up and down. As these LED bulbs are semiconductor, the current and optical output can be modulated at extremely high speeds that can be detected by a photo-detector device and converted back to electrical current.

**A. Transmitter**

The audio transmission of submarines has two sections. It has transmitter and receiver. In this model audio signals are converted to electrical signals using a microphone. The electrical signals are attenuated by passing through bandpass filter and are amplified by passing through power amplifier. FM modulation is chosen over AM modulation since it is more resistant to fading and variations in the signal amplitude.

Voltage Controlled Oscillator is used for FM modulation. For electrical impedance transformation a buffer is used and then again amplified. The amplified signal is then fed into the LED. The LED transmit data when they are switched on and off so rapidly in nanoseconds.

**A1. Microphone**

Microphones are transducers, which convert one form of energy into another. They are sensitive to changes in pressure in the surrounding air, and they convert those changes into changes in voltage of an electrical current, which travels down the mic cable to whatever gear the mic is connected to.

**A2. Bandpass Filter**

Bandpass filters are mainly involved in wireless transmitters and wireless receivers. The main objective of this filter in a transmitter is to limit the bandwidth of the o/p signal to the minimum required level and to convey data at the preferred speed and in the preferred form.

**A3. Audio Amplifier**

An audio amplifier is an electronic device that increases the strength (amplitude) of audio signals that pass through it. An audio amplifier amplifies low-power audio signals to a level which is suitable for driving loudspeakers. The input signal of an audio amplifier may only measure a few hundred microwatts, but its output may be tens or even thousands of watts.

**A4. Voltage Controlled Oscillator**

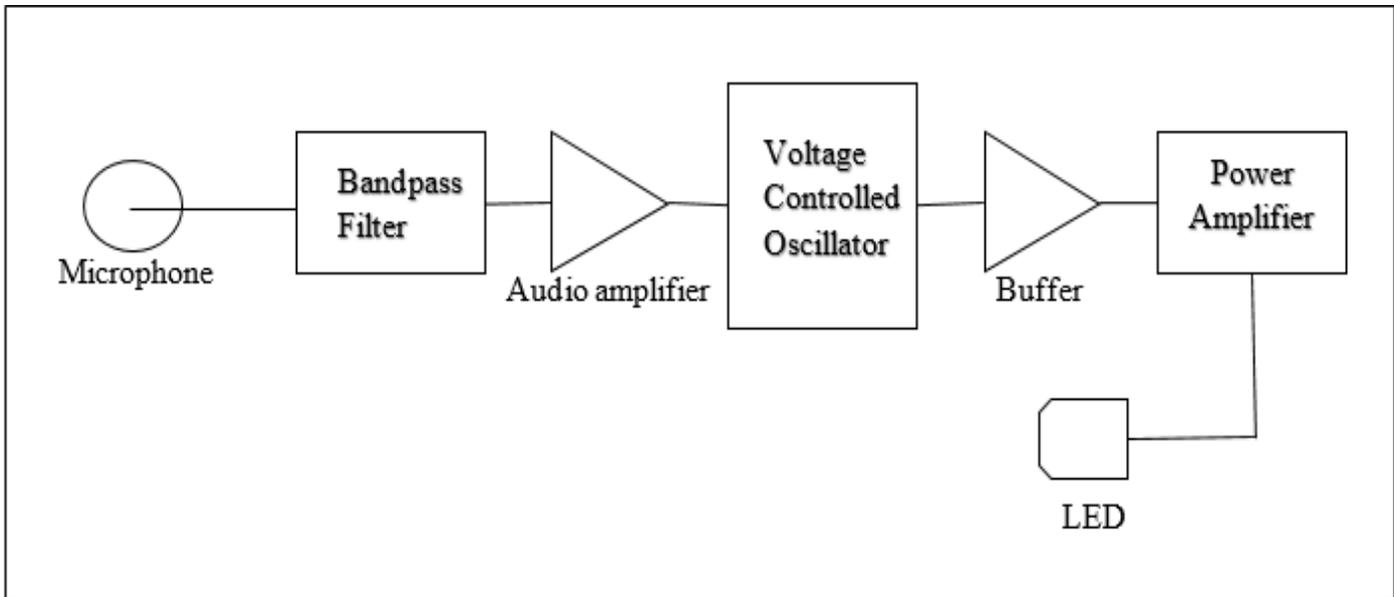
Voltage controlled oscillator is a type of oscillator where the frequency of the output oscillations can be varied by varying the amplitude of an input voltage signal.

**A5. Buffer**

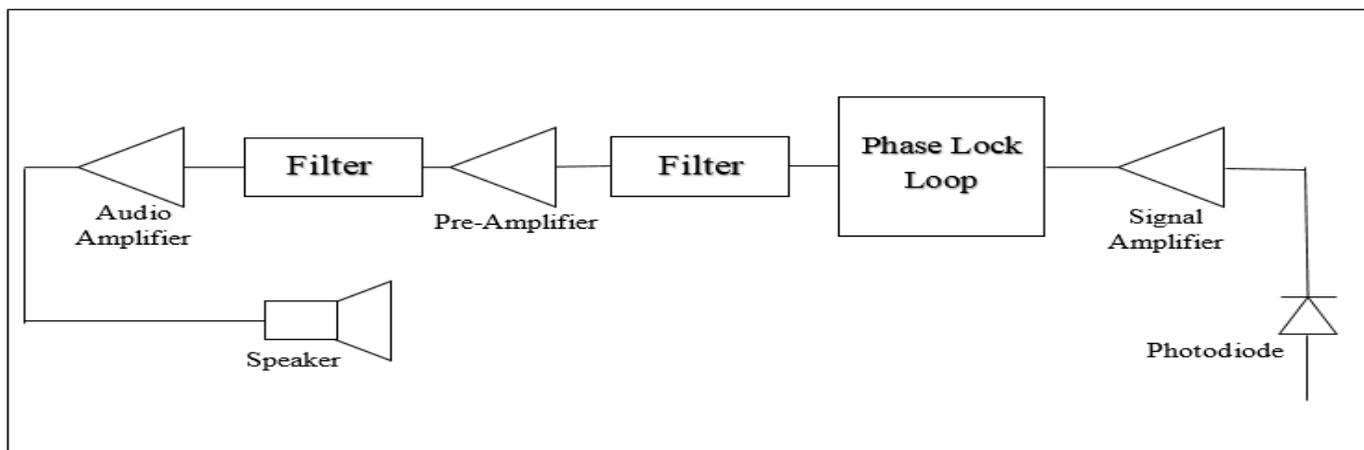
A voltage buffer amplifier is used to transfer a voltage from a first circuit, having a high output impedance level, to a second circuit with a low input impedance level.

**A6. Power Amplifier**

Power amplifier is meant to raise the power level of the input signal. In order to get large power at the output, it is necessary that the input-signal voltage is large. That is why, in an electronic system, a voltage amplifier always precedes the power amplifier.



*Fig.4 Transmitter*



*Fig.5 Receiver*

**A7. LED**

Li-Fi uses common household LED (light emitting diodes) light bulbs to enable data transfer, boasting speeds of up to 224 gigabits per second.

**B. Receiver**

At receiver, the photodiode converts the light into the electrical signals. A voltage controlled oscillator (VCO) is the integral part of a phase locked loop. After further filtering and amplification, the input audio signal is achieved at the speaker as the output.

**B1. Photodiode**

A photodiode is a p-n junction that consumes light energy to produce electric current. Sometimes it is also called as photo-detector, a light detector, and photo-sensor.

**B2. PLL**

A phase-locked loop or phase lock loop abbreviated as PLL is a control system that generates an output signal whose phase is related to the phase of an input signal.

**B3. Pre-amplifier**

A preamplifier is an electronic amplifier that converts a weak electrical signal into an output signal strong enough to be noise-tolerant and strong enough for further processing, or for sending to a power amplifier and a loudspeaker. Without this, the final signal would be noisy or distorted.

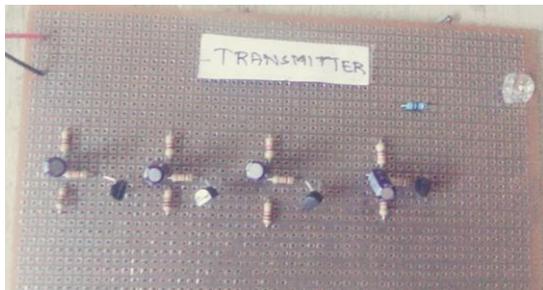
#### B4. Speaker

In order to translate an electrical signal into an audible sound, speakers contain an electromagnet: a metal coil which creates a magnetic field when an electric current flow through it.

### V. RESULTS

The prototype of the underwater communication using Li-Fi is made. The system has been tested and the audio signal is transmitted from transmitter to the receiver and vice versa. It will be very useful for the divers to communicate with one another.

### VI. FINAL BOARD DESIGN



### VIII. CONCLUSION

This proposed system is useful for the underwater communication at faster speed in Gbps. It can overcome the problem occurring in the communication also it gives the secure communication so the hacking of the system has less chance. It is effective for the security purpose. If this system is used in the Indian Navy it can be more effective for avoids the many problems occurs in the communication between the ships. This system is very cost effective so it can be more effective than the other systems like the Acoustic wave communication and Ultrasonic wave communication. So, this system may be replaced by existing underwater communication techniques and it is better than the existing systems.

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