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Research Article

SUBAQUEOUS COMMUNICATION VIA LUMIE'RE

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A R T I C L E I N F O

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A B S T R A C T

In this paper a new approach for the underwater wireless communication using the Li-Fi technology is proposed. The need for underwater wireless communication exists in application such as collection of scientific data recorded at ocean-bottom stations, military purpose, speech transmission between divers and mapping of the ocean floor for detection of objects, as well as for the discovery of new resources. In this project, is intended to take advantage of the recent developments of Laser, (specially with the higher light output and more precise tuning of the wavelength) and photo-sensor technology. These will be used to develop an improved communication module, in response to the growing demand of robotic solutions for the marine environment. Which features a high speed communication system at short ranges, where low power, complexity and small dimensions are pretended. Because of high speed of light, in underwater date communication is possible to increase the data rate using "Li-Fi" technology.

INTRODUCTION

The name Li-Fi is due to the similarity of the working of Wi-Fi except light source instead of radio waves. The Li-Fi technology was first proposed by Harald Hass a German physicist. Li-Fi comprises a wide range of frequencies and wavelengths, from the infrared through visible and down to the ultraviolet spectrum. It includes sub-gigabit and gigabit-class communication speeds for short, medium and long ranges and unidirectional and bidirectional data transfer using line-of-sight or diffuse links, reflections and much more.

The technology is demonstrated for the first time in los Vegas using a pair of smart phones up to the distance range of 10 meters. The data is send 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

Existing System

As for terrestrial application, the underwater wireless communication is not a straight forward process. 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. Big antenna also needed for this type of communication, thus affects design complexity and cost.

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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 of shrink the transmitter section. Unwanted noise signal may be present. Digital signal processing can be used for minimizing the disadvantages of ultrasound underwater communication.

Li-Fi Technology

Principle of Li-Fi Technology

The important segment of the Li-Fi technology is the high power Led lights, led can be turned on and 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. This method continuously receives the pulses of light and decode into the stream of data. Here, in our project we are going to use laser.

Fig 1 Visible light

Construction and Working of Li-Fi Technology

Li-Fi is performed using the power led bulbs for down link transition. A constant power source has been given to the system. By change in the input power supply the optical data transition can be achieved. The variation in the intensity transition can be achieved. The variation in the intensity of the light source carries the high speed data working of Li-Fi. The Led light which has been placed above Led light which has the system is connected to the driver module which drives the led light source based on the data transmitted through it. The data has been transmitted in form of light beam. The receiver segments The receiver segment that has been placed in the table detects the changes in the light beam and separates the data from the light source and generates the electrical signal based on the intensity of the light fall on it. The converted signal was transmitted to the computer or other electronic devices

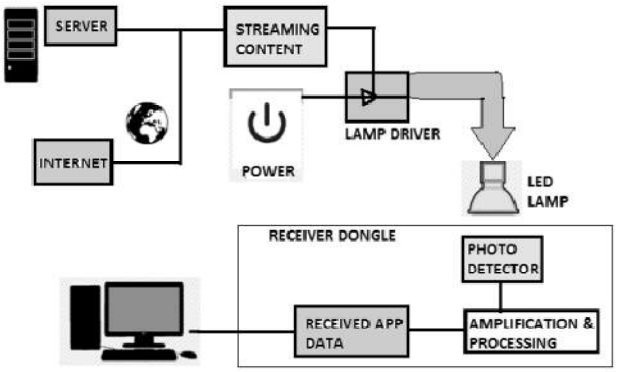

Fig 2 Block diagram of Li-Fi Technology

Proposed system

This system deals with the communication between the sea diver and ship and also between ship and the submarine, through light (LASER)

Block Diagram

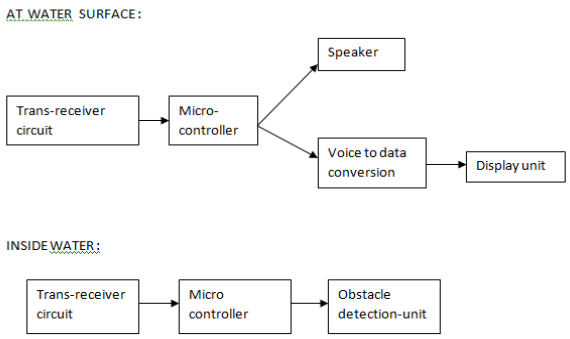

Fig 3 Block diagram of underwater communication

Tran receiver

The dates are transmitted through laser which acts as a medium. The data are sent through a frequency of 6-8 KHz from the air and this frequency is carried by the carrier frequency (frequency of laser) of 7Hz. In the receiver, the frequency is absorbed by the photo trans-receiver, the frequency in the receiver is set in such a way that it is same in both the receiver and transmitter.

Laser

A Laser diode, is an electrically pumped semiconductor laser in which the active laser medium is formed by a p-n junction of a semiconductor diode similar to that found in a light-emitting diode.

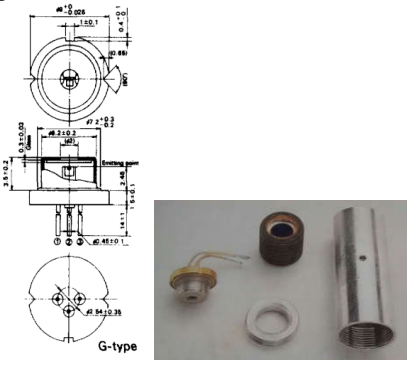

Fig 4 Laser Diode –HL6711G

Table 1 Laser's Absolute maximum ratings

ITEMS	SYMBOLS	VALUE	UNITS
Optical output power	Po	5	mW
Laser diode reverse voltage	VR(LD)	2	V
Photodiode reverse voltage	VR(PD)	30	V
Operating temperature	T(opr)	-10 to +50	Degree Celsius
Storage temperature	T(stg)	-40 to +85	Degree Celsius

Photodiode

A photodiode (BP104) is a semiconductor device that converts a light into current.The current is generated when photons are absorbed in the photodiode. A small amount of current is also produced when no light is present .Photodiodes may contain optical filters, built-in lenses and may have large or small surface areas.

Fig 5 Photodiode –BP104

Detection Unit

The obstacles are detected with the help of IR. The circuit consists of a led(LD274) and a photodiode(BP104).Here the object in this figure can be anything like metal, stone or plastic.

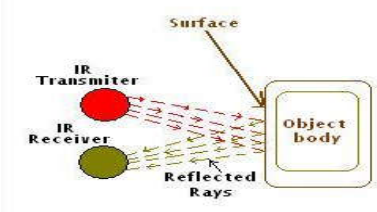

Fig 6 Infrared object detection

Working

In this project, the movement of the submarine is controlled by the ship, when the button is pressed the data is transmitted

through IR frequency and this is carried by the carrier frequency of the laser, now the data is transmitted with the help of the laser through water. The photo diode receives the signal and it is sent to the microcontroller(89c51), the signals from the microcontroller is used to operate the motor which in turn leads to movement of the submarine. The detection unit in submarine transmits a frequency of 20khz and if an object is present it gets reflected back and reaches the photo-diode, this signal is sent to the microcontroller and now again the signal is transmitted through laser and received by the receiver in the ship. Now this signal is converted to data and voice and the data is displayed using a LCD display and the voice is heard through a speaker.

Table 2 Analysis between Asoustic ,EM and Light.

	ACOUSTIC	EM	LIGHT
SPEED	1.5x10^3 m/sec	3x10^8 m/sec	3X10^8 m/sec
BANDWIDTH	~KHZ	~MHZ	10-150MHZ
DATE RATE	Order of kbps	10kbps	300kbps
FREQUENCY	~KHZ	~MHZ	10^14 -10^15 HZ
PROPAGATION DISTANCE	Several kms	10 m	30m
DELAY	high	high	low
ENERGY CONSUMPTION	high	high	low

CONCLUSION

As Lasers is able to transmit date underwater. When a diver wants to communicate with another diver, tests have been done to turn sound spoken or data into a helmet into electrical signals and then passed through water via a laser to a receiver in another diver's helmet. Same thing can be done when a diver wants to communicate with the ship. The possible uses that lasers have in underwater environments are growing. Hence lasers have potential in becoming practical solution to the problem of underwater communication

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