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LIFI BASED UNDER WATER COMMUNICATION SYSTEM

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ABSTRACT

The light fidelity technology refers to visible light communication that uses light as a medium to deliver high speed data which is much greater than that of WiFi. LiFi data is transmitted in several bit streams and the receiver side consisting an IR detector decodes the message. The transmission happens in the form of binary data where 0 means LED in „OFF" state and 1 means that the LED is in the „ON" state. Transmitter and receiver sections contain Arduino which is programmed using Arduino IDE. High power intensity led"s are used in the LiFi transmitter. In receiver section photodiode module is used to detect the light signal generated by the LiFi transmitter. In this we are transmitting the 2 different data using light they are Audio signal and Text signal. Hence the study of various topologies to understand the characteristics a LiFi system.

Keywords: LEDs, LIFI, Arduino, Data, Solar panel.

INTRODUCTION

LiFi technology uses led"s for transmitting data. It is derivative of optical wireless communication technology using light from Led to deliver high speed communication. Visible light communication works by switching the Led off and on at very high speed, it can"t noticed by the human eye. The intensity of the LiFi LED emitter is kept low enough so that it cannot be seen by the human eye but high enough to carry out the communication easily. It is also very

secure from hacking as the light cannot penetrate the walls. However, this also limits the range. This is advantageous in electromagnetic sensitive areas where electromagnetic interference is especially avoided like hospitals, nuclear power plants and aircrafts. Although WiFi and LiFi both employ electromagnetic spectrum to transmit information, WiFi uses radio waves and LiFi uses visible light. Li-Fi has almost no limitations on capacity. Visible light spectrum is 10,000 times larger than the entire radio frequency spectrum. The light signals are transmitted via wireless channels to the receiver. The detector in the receiver converts the optical signals to recover the message. Since light cannot travel through the walls, hence LiFi signals can be secured in physical space.

In today world, communication between the devices are much common. Radio wave spectrum is very small part of spectrum available for communication. Wi-Fi and Bluetooth are currently the two prominent short range wireless technologies But with increase in advanced technology and number of user the network becomes overloaded which results in failure to provide high data rate. Visible light acts as rival to the present wireless radio frequency communication by achieving larger bandwidth and high data rate. Because with larger frequency spectrum it is possible to provide a larger portion of the bandwidth to each user to transfer information. A switching LED can be improbably causing annoyance, but data can therefore be encoded in the light by varying the rate at the LEDs switch on and off to provide various strings of 1’s and 0’s. The use of fast pulses of light to transfer data without physical connection such method is called as Visible light communication (VLC).The LEDs can be switched ON and OFF very fast which is not noticeable by human eye thus the light source appear to be constantly on.When these signals transmitted to the receiver via the wireless channel, the photo diode will convert these optical signals to electrical signals and the original information will be recovered..

As the demand for wireless data communication is increasing rapidly, new technologies are arriving which uses the different frequencies in electromagnetic spectrum as the carrier for transmitting data wirelessly. Wi-Fi is

one such method which uses radio waves to communicate wirelessly within an area. As radio waves have some drawbacks, it is replaced by visible light and hence the emerged technology is called Li–Fi technology. Li–Fi technology uses visible light frequency (430THz770THz) which is comparatively higher than that of radio wave frequency (3kHz – 300GHz). LED is used as a source of VLC (380nm – 740nm) to transmit information. LED which is used as the source for text data transmission has high brightness, low cost, small size, low power consumption, long lifetime and low heat radiation and hence it is used as a substitute for established radio waves. High flickering LED is used to transmit data, wherein the change in current intensity is detected by photo detecting resistor and is not visible to human eyes. When the LED is Off, data '0' is transmitted and similarly when it is on data '1' is transmitted. Related Work: In reference with [1] transmitter and receiver have been implemented where the flickering in LED is basically used as the signal to be transmitted. The rapid ON (transmits 1) and OFF (transmits 0) of the LED is used to encode a string of data signal. In the receiver the data is converted into digital signals with the help of modulation. The optical concentrator is using to compensate for high spatial attenuation due to the beam divergence from the LEDs to illuminate large area. In reference with [2] audio transmission using Li-Fi have been implemented. They have implemented Li-Fi transmitter module consisting of amplifiers and power LED whereas the LI-Fi receiver module consists of amplifiers and LDR. They have used a way like Wi-Fi hotspots which are used to transmit the data wirelessly. This reduces the electrical overhead and is ecofriendly and hence the environment will be more radiation free zone. In reference with [3] 2D Image transmission have been implemented using Li-Fi. They have used light as a data transmission medium to securely transmit data as it overcomes the disadvantage of data leakage and efficiently transmit multimedia data over a medium. It uses Visible light communication technology.

LITERATURE SURVEY

The Li-Fi technology are being developed to improve the data rate, efficiency and low power consumption.

LiFi is a bidirectional network system and provides a substantially similar experience as WiFi to the user. As we move toward the future, the connectivity demands are going to increase exponentially.[6] To cater to these demands we need higher spectral capacity network. With, LiFi we can utilize the spectrum 100000 times greater than that of radio frequency. LiFi is now providing unprecedented data and bandwidth.

It is a category of optical wireless communications, includes infra-red and ultra-violet communication as well as visible light [3]. However, Li-Fi is unique in that the same light energy used for illumination may also be used for communication. The working of LiFi is simple but powerful. When an LED light bulb is supplied with constant current stream of photons are emitted from the bulb which is seen as illumination. LED bulbs are semiconductor devices, which means the current, and therefore the illumination can be modulated at extremely high speeds which can be detected by the photo detector. Using this technique, transmission of high-speed information can be done through a LED bulb. LiFi uses direct modulation methods that are similar to the low-cost infrared devices like remote controls.

Also, LED light bulbs can have very large data rates as the LED bulbs have very high intensities.[2] A good data density reduces the need to share the bandwidth with other users hence, improving the user experience. The achievable data density by the LiFi is 1000 times greater than the WiFi. Hence, this provides more data per square meter[4].

The LiFi communication system can work even under the sunlight as the modulated light rays can still be detected. Since the system works on the detection of rapid changing light intensity and not the slow varying levels which can be caused by disruptions due to the sunlight. As light waves in LiFi are heavily modulated, the sun just adds a constant light which can be easily filtered out by the receiver.

EXISTING SYSTEM

The existing Wireless communication makes use of electromagnetic waves for communication system. For instance, the deployment of Wi-Fi obviously brings

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several important benefits. Because it is very convenient that numbers of equipment connect to each other using wireless networks. Home-based Wi-Fi enabled device helps you to connect PC, game console or laptop. There are no boundaries if you are using Wi-Fi, you can move from one room to another or even away from home you have the liberty to access internet within the range of radial distance. Wi-Fi hotspots concept is getting popularity among business communities and mobile workers. For this reason ISPs are consolidating Wi-Fi switches to numerous spots for the scope of wide range.

PROPOSED SYSTEM

The proposed system consists of a transmission section and a receiver section. The transmitter section consists of an APR, Li-Fi transmitting module,MIC and the receiver section consists of a Li-Fi receiving module, PIC microcontroller, an amplifier, speaker and a transformer.

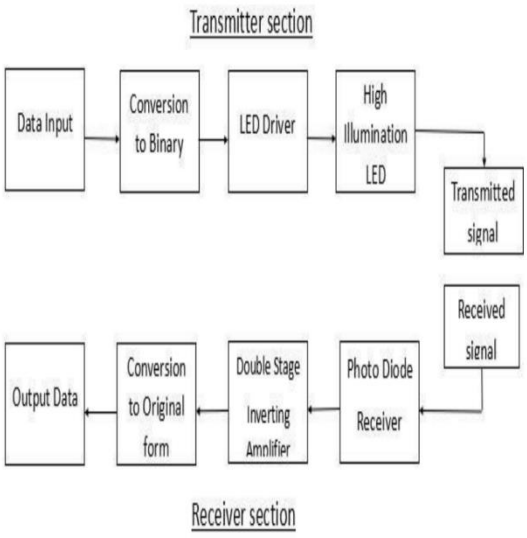

Fig.1.block diagram.

Underwater Li-Fi communication operates on the same fundamental principles as its terrestrial counterpart but is adapted to the challenges posed by underwater environments. At its core, Li-Fi relies on modulating data onto light signals emitted by specialized underwater LEDs. These LEDs serve as the light source, transmitting data through the water medium. However, underwater communication faces unique hurdles, such as high attenuation and scattering of light in water, which can degrade signal quality and limit range. To mitigate these challenges, sophisticated optics and signal processing techniques are employed to

enhance signal propagation and reception.

In the transmission process, data is encoded onto the light signals using modulation techniques, typically intensity modulation, where variations in light intensity represent digital data. This modulated light propagates through the water, reaching the receiving end where photodetectors capture the optical signals. Photodetectors convert the light signals back into electrical signals for processing. Signal processing algorithms then extract the transmitted data, employing error correction methods to compensate for signal degradation caused by underwater conditions. By carefully managing signal propagation and employing robust error correction, underwater Li-Fi systems can achieve reliable data transmission despite the challenges of the aquatic environment.

Underwater Li-Fi finds applications in various domains, including underwater sensor networks, oceanographic research, underwater exploration, and subsea monitoring. Its high bandwidth capabilities and low latency make it suitable for transmitting large volumes of data in real-time, facilitating tasks such as underwater surveillance, environmental monitoring, and offshore communication. Ongoing research aims to further refine underwater Li-Fi technology, improving its range, speed, and reliability, and unlocking its full potential for underwater communication and exploration endeavors.

EXPLANATION OF RESULT WITH KIT IMAGES

The audio amplifier gain is internally set to 20db but can be increased to 200db by using a resistor and capacitor between pin1 and pin8 or just with a capacitor. The output signal as both AC and DC components and DC component cannot be fed to the speaker so to remove this DC component capacitor is used at pin5. Along with this capacitor, a filter circuit is used to remove high frequency oscillations or noise. Pin7 can be grounded using a capacitor or left open for stability. 3. Working The audio input signal is given through media players. These analog signals are converted to digital switching signal using transistor, for switching ON and OFF the LED. These signals are then transmitted. The transmitted light signal is received by the photo receiver. Here

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we have used Solar cell as Photo receiver. These received signals are fed to amplifier. The signals are amplified using audio amplifier and these amplified signals are given to speakers.

Trans-reception of the audio and text files is successfully implemented using Visible light as the carrier. The following observations are made.

As the distance between the transmitter and receiver increases, the received signal quality decreases.

The experimental result defines that maximum distance achieved in visible light communication system is approximately 2m for data transmission and around 15ft for audio transmission.

3) The received data is affected if the angle between the receiver and LOS of the LED changes.

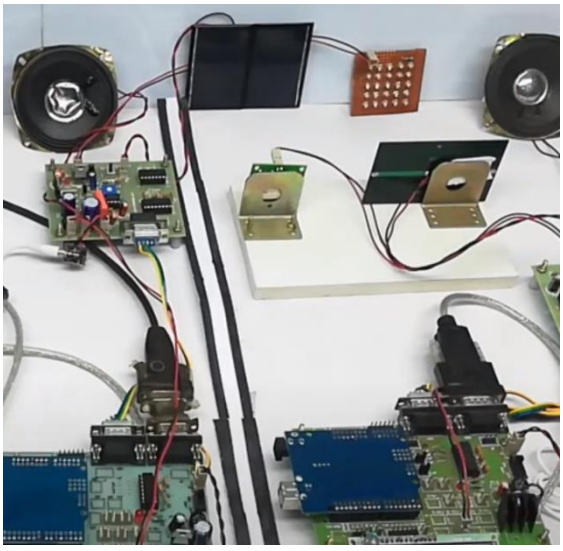

Fig.1. Hardware kit module.

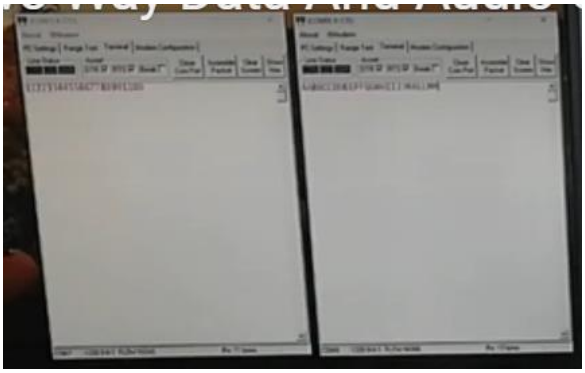

Fig.2. DATA transfer technology with serial module.

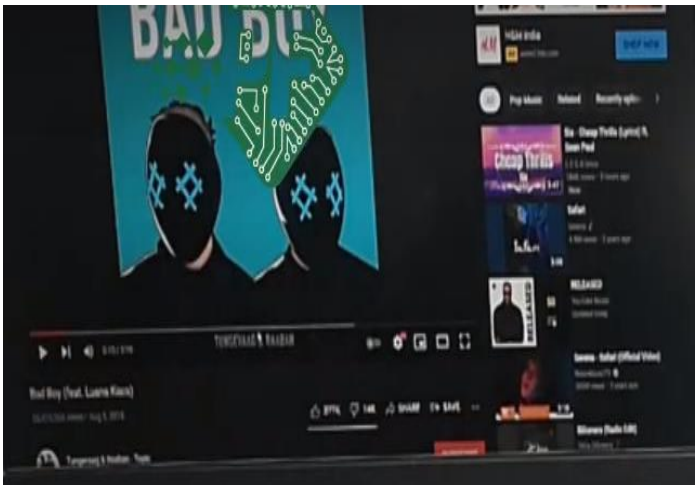

Fig.3. Audion mode application.

CONCLUSION

Li–Fi is an emerging technology, as the radio wave communication has certain drawbacks. This technology can transmit data with the speed of 100gbps approximately which is entirely greater than radio waves. Li–Fi is categorized as reliable communication technique as it provides high data security transmission with low cost. In the proposed work, Li-Fi module for transmitting and receiving the text data and audio is built and tested successfully. It is possible to achieve text data transmission of up to 2m by using LDR as the detector. audio transmission of around 15 feet using solar panel in the receiver side. In future, this work can be enhanced by 1) Adding the high intensity LEDs or focusing lens to increase the range of communication. 2) Output disturbance can be reduced by adding the noise termination circuit at the receiver end.

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