International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 06 | June 2022 www.irjet.net p-ISSN: 2395-0072

Li-Fi Is the Next Generation of Secure Data Transmission Using IOT Devices

Sunny Maurya[1], Amar Chauhan[2], Dr. Shivkumar Goel[3]

[1,2] *Student, Vivekanand Education Society's Institute of Technology,Mumbai – 400074*

[3]*Associate Professor, Vivekanand Education Society's Institute of Technology,Mumbai-400074*

Abstract: *We are living in the generation where data is generating at a rapid pace and sharing data securely is most important aspect. To transfer data from one device to another, everyone uses a WI-FI hotspot on their smartphone, because it provides much faster transfer speeds than Bluetooth or infrared medium. Hackers can exploit this as it penetrates through walls easily but security and speed are the major concerns.So for that Li-Fi as the medium should be require to adapt it. The term Li-Fi stands for Light Fidelity which enables transmission of data through LED light bulb.Wi-Fi is great for general wireless application within a limited coverage area, while Li-Fi is most suited for high density wireless data coverage in a restricted area and for mitigating radiation problems. So our goal is not to replace Wi-Fi but we can use Li-Fi instead of current existing technologies. This paper contains the information related to use of IOT devices for data transmission using led and Raspberry Pi. It also contains the new areas of application as a proof of concept(POC) which can be implemented in future.*

Key Words: Visible light communication,IOT,LIFI

1. INTRODUCTION

Li-Fi is the new technology was developed by German physicist Harold Haas using light emitting diode(LED) bulbs to transmit data over high speed datanetworks.Transmitted data by LI-FI is known as visible light communication(VLC). Through visible light communication (VLC)electronic bias can connect to the internet wirelessly. A transceiver is used to establish communication between bumps and transmit and admit A modulations fashion is used in the transceiver to enable the LED to carry data through light bulb. Utmost of the device in current time connected to the Internet using the LIFI technology, which was developed to combine the failings of current technology which is substantially used by WIFI technology. Over offers. In our present world, LI-FI is veritably effective because it offers a briskly, more effective way of delivering data. LI-FI can be regarded as a light-grounded form of WI- FI, since it transmits data using light rather of radio swells. Li- Fi has the benefits of being useful in magnetic sensitive areas such as in hospitals, aircraft cabins, and power plants.

When a signal is sent and received, Wi-Fi's latency are measured in milliseconds, whereas Li-Fi latency is measured in microseconds. Li-Fi's low latency and high data rates would make it useful in industrial applications where data must flow between sensors and control units, where Wi-Fi is not available. Private and public sectors have been using different techniques and methods to protect sensitive data from intruders since electronic data security is a vital concern today. Encryption and decryption are two vital processes used in cryptography to protect data from an attacker. The next stage involves converting the original data into an unreadable format called Cipher text. This is followed by a process called Decryption by the authorized person/device. In contrast with encryption, decryption is the process of transforming cipher text into plain text without losing any words in the original.

This paper describes the information related to data transfer technique where we can use IOT devices like raspberry pi for transferring the data using visible light communication. For visible light communication we needed a two devices like transmitter and receiver for that we can use raspberry Lifi nano. It is an easy-to-use platform for evaluating visible light communication applications in a wide range of uses, including consumer, wearable, industrial, medical, and Internet of Things (IoT). The LiFi Nano V2 transmits data from one source to another without flickering It transmits a signal in 1 seconds (LED on) and 0 seconds (LED off) at very high speeds where even the human eye cannot notice visual flickering.

time, the use of internet grounded bias has increased, causing the capacity of WIFI to dwindle due to the limitations of radio frequency

2. How LIFI Technology Works

LIFI is bidirectional; full duplex in nature which means data can be transmitted and received in two directions at the same time and fully networked wireless communications using LED lights. In addition to providing high-speed, secure wireless communication, it repurposes the same light we use for lighting our homes, offices, and streets.

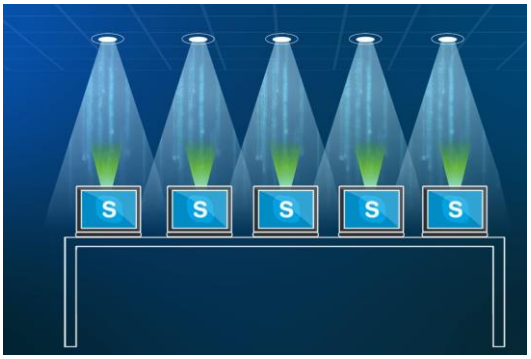


Fig1. Bidirectional Data Transmission Through VLC

In LIFI, data is transmitted by changing the intensity of the light. This signal is then received by a photo diode, and is converted into digital data. Once transmitted, the data is transmitted back to the access point in the ceiling, enabling fast, full-duplex communication. Due to the fact that the intensity modulation can't be seen by the human eye, communication with LIFI is just as seamless as other radio systems. Through this technique, data can be transmitted from an LED light bulb at high speeds.

2.1 Disadvantage Of WIFI over LIFI

Wireless networks also have many disadvantages. For example, WiFi connections tend to be insecure and network is easily accessible within a radius of around 20 to 50 meters because of its wide signal range. The problem is that others can access the network if they're within range. Even when the connection is protected by a password, anyone may attempt to hack into the network and access all private data. As a result, most companies use sophisticated technologies to protect their data. However, these tools have their own vulnerabilities that can be exploited by hackers. They are also so much expensive to implement.

WIFI signals are unreliable and because of external signal interference it can cause variety of problems such as poor signal or loss of connection. If we compare WIFI over wired connections then wireless connections are slower than the wired connections and it's speed ranges from 1 to 54 Mbps and wired connections having speed of 100 Mbps or greater.

2.2 Advantage of LIFI over WIFI

LIFI makes use of Visible Light Communication technology, which in turn makes use of effectively high performing LED bulbs, and these devices consume low power. Advantage is that it's already available within most households and other establishments, for that we don't require to bare any extra cost. Another advantage of LIFI is that it allows LIFI connections to occur almost instantaneous because light travels at extremely high speeds and usage of LIFI can achieve 100 times faster speed than WIFI.

Now days people are mostly dependent on LED light bulb because it is cheap and can sustain for longer period of time. Globally, there are trillions of light bulbs. If you want proper data transmission, you just need to replace them with LEDs. Light waves do not pass through walls and it prevents unauthorized access of the LIFI connection which adds another layer of protection to the network.

2.3 How LIFI is benefiting the Environment

LIFI uses led light bulb for transmitting the data and it's has huge benefit over environment is that it doesn't emit any radioactive waves like WIFI. But there is a concern for LIFI also, in direct sunlight it's not effective that much as it is in indoor condition. For indoor condition LIFI is cost effective and led light doesn't uses hazardous chemicals which is harmful for the environment. To transmit data we don't require large number of

LED bulbs for distribution and also it has longer life span compare to other types of light.

3. Architecture Of Proposed System

Our proposed system uses a LIFI nano v2 device to transfer a data from one device to another. Where LIFI consist of two module transmitter and receiver respectively. Nano supports baud rate ranges from 38400 to 115200. It support distance from the ceiling 6 to 15 feet max, so we can connect this modules in the ceilings for the communication.

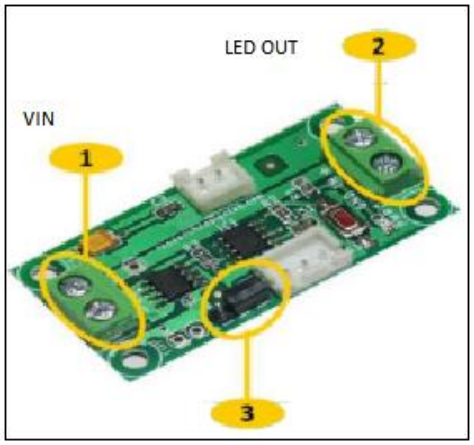


Fig.1: Transmitter

We can transfer data by using LIFI nano through visible light communication without getting the flickering effect of light. Here data transmission happens so rapidly where humans eye not able to see the effect of flickering.

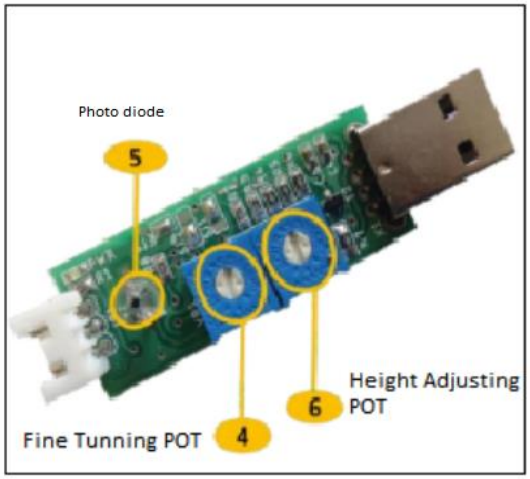


Fig.2 Receiver

4. Workflow

Here to interact with LIFI nano module we can use IOT device like raspberry pi and workflow will be divided into two parts such as

1. Transmitter Module
2. Receiver

Transmitter Module

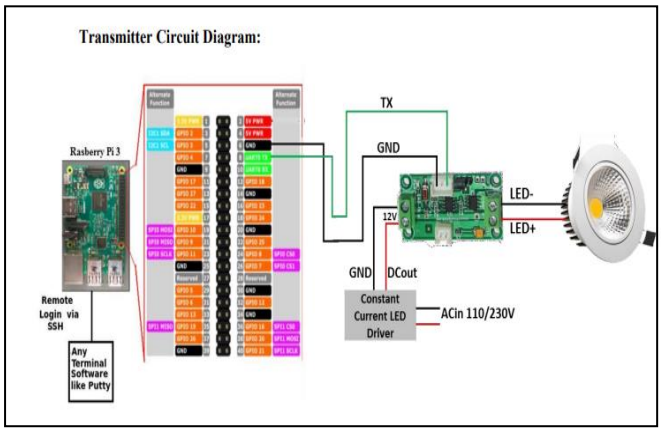


Fig.3: Lifi Nano Transmitter Circuit Diagram

3.1 LIFI Transmitter Specification

	Transmitter
Module Version	V2
Current	50 mA
Voltage	5V
Power Consumption	0.25 Watt
Receiver Sensor	Photodiode
Communication	serial communication
Baud Rate	38400 bps
Constant Power	18 watt
USB	2.0

3.2 LIFI Receiver Specification

	Transmitter
Module Version	V2
Current	50 mA
Voltage	12V
Power Consumption	0.6 Watt
Source LED	18 Watt
Communication	serial communication
Baud Rate	38400 bps
Constant Power	18 Watt

3.3 Comparsion Table Of Data Transmission Media

Media	IEEE Standard	Range	Data Speed	Bandwidth	Technology
LIFI	802.15.7	10M	1.3.5 Gbps	100T Hz	Light Fiedality
WIFI	802.11	40M	11-54 Mbps	2.4-5 GHz	Radio Frequency
Bluetooth	802.15.1	10m	789kbps	2.4Ghz	ISM BAND
2G	-	Changes	64kbps	900 MHz	GSM
3G	802.16e	Changes	144-2 Mbps	100 MHz	CDMA,EDGE
4G	802.16m	Changes	100Mbps-1Gbps	100 MHz	LTE,WIFI
5G	-	Changes	1Gbps	1000xBW/area	OFDM

Transmitter module take the input data from the attached devices and then it will try to encode the data with the Base64 algorithm. Base64 algorithm help us to convert bytes data which contains binary data or text data to ASCII characters. Base64 started when MIME content needs to encrypt the data and Base64 digit in binary holds 6 bits of data. Three 8-bit bytes which mean a total of 24 bits can that's why it's represented by four 6-bit Base64 digits.

Receiver Module

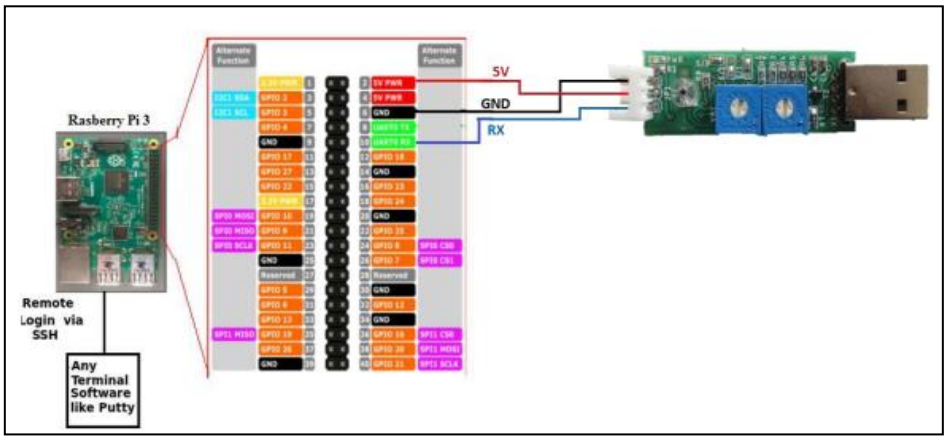


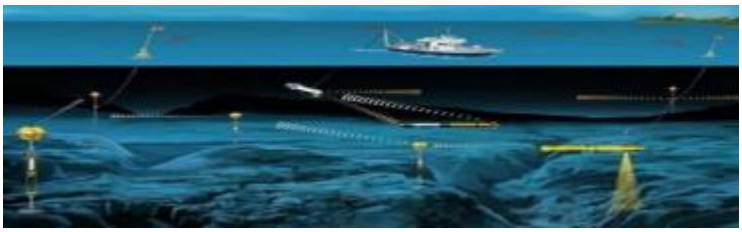
Fig.4: Lifi Nano Receiver Circuit Diagram

Receiver module receives the data from the transmitter device and it will place the data at the target path. Once the data has been received it will take the data and perform decoding of Base64 file so that data can be represented in the original form as it was before. Lifi nano consist of photo diode which helps to receive the data it can be from ceilings or lamp. But for interfacing with raspberry pi there are two ways either attached using usb or use serial interfacing or use putty by ssh terminal.

4. Applications Of LIFI

5.1 Underwater communication

LiFi enables communication among divers, mini-subs, drilling rigs, and mini-subs, since underwater radio waves are absorbed quickly. Because light can penetrate for longer distances, underwater radio communication is impossible; however, underwater radio communications are possible using LiFi.



5.2 Intelligent transportation systems

With LED versions replacing current car headlights and taillights, there are possibilities for inter-vehicle communications through LiFi, allowing vehicles to share information about driving conditions between themselves and exchange anti-collision systems. Traffic lights already operate in this way.

5.3 Connectivity

As usually we all uses the light in our home for clearing viewing of the all object. But at same time if we require for the internet we need some extra device in home. But now era lifi is the best solution to reduce the devices in the expansiveness.

5.4 Sensitive data

Li-Fi can, for instance, be used to facilitate the deployment of secure networked medical instruments, patient records, etc. in hospitals, which are sensitive to EMI and sensitive to data security.

5.5 Indoor navigation

In home, offices or anywhere indoor places can be used for navigation purposes using smart light. Based on the movement it will take input and guides us the place where we want to go. Also light can also be used to detect the location of the place where places like hotel can be used.

5.6 Augmented reality

Exhibitions in museums and galleries are illuminated by special lighting. Li-Fi enabled lighting can provide us location information within that light. This means that the guest camera or smartphone can be used to download additional information about the object being viewed in the light that illuminates the show.

5.7 Advertising in local area

We can use store light as a LiFi broadcast channel, because it is possible to transfer advertising data about visual goods, as well as special offers and coupon code. This will allow for the integration of highway and online shopping information, and allow new business modeling models to emerge. catalog information, discount and promotional videos all can be provided to consumers.

6. Conclusion

Based on research we have found that LIFI is having very broad application and in future, this technology is going to implemented everywhere where every light source like LED will going to have data transmission capability at a faster rate. For a transmission of data we can use a IOT device like raspberry pi with LIFI nano v2 which consist of two module transmitter and receiver. With the

help of transmitter we can take data from raspberry pi and transmit through light and with help of nano receiver we can save the data. This implementation is given as proof of concept(POC) which can be implemented in future for OTG purpose. In this OTG implementation we are not only transmitting the file but also securing the data by encrypting during transmission and decoding it while receiving. So we have not only covers the IOT data transmission technique but also others application of it which can be implemented in future.

7. References

[1] Badeel, R.; Subramaniam,S.K.; Hanapi, Z.M.; Muhammed - A Review on LiFi Network Research: Open Issues, Applications and Future Directions. Appl. Sci. 2021, 11, 11118.
[2] PORSELVI, BHAGYALAKSHMI, SANJAY KUMAR SUMAN- "HEALTHCARE MONITORING SYSTEMS USING LI-FI NETWORKS" Innovare Journal of Engineering and Technology.
[3] Kirrbach, René & Faulwaßer, Michael & Jakob, Benjamin & Schneider, Tobias & Noack,Alexander. (2019). Li-Fi for Augmented Reality Glasses: A Proof of Concept.10.1109.
[4] K, Jyothsna and SAMBHAV, SAURABH, Li-Fi in Future Technology: Working, Application & Limitation (March 20, 2020). International Journal of Current Research Vol. 12, Issue, 06, pp.12090-12093, June, 2020.
[5] Badeel, Rozin, Shamala K. Subramaniam, Zurina M. Hanapi, and Abdullah Muhammed 2021 "A Review on LiFi Network Research: Open Issues, Applications and Future Directions".
[6] Dr. Amit Kumar Singh, Neeraj Bhatt, Md Kowser Uddin, Mithun Sarker,Tarra Suribabu, "SMART CHARGING WITH SOLAR PANEL AND COMMUNICATION WITH LI-FI".
[7] Kuppusamy, P., S. Muthuraj, and S. Gopinath. "Survey and challenges of Li-Fi with comparison of Wi-Fi." In 2016 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET), pp. 896-899. IEEE, 2016.
[8] Sameer Bin Ali, 2018, Implementation Issues of Li-Fi, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) SETS – 2018 (Volume 6 – Issue 09).
[9] Sergio Sandoval Reyes, Victor Hugo Herver Segur "Android App of Location Awareness Using Li-Fi" Instituto Politecnico Nacional, Centro de Investigacion en Computacion, Mexico City, Mexico.
[10]https://researchdesignlab.com/lifi-nano v2.html.