

# Text Data Transfer Using Li-Fi Communication

V. Parthasaradi<sup>1\*</sup>, T. Senthil Kumar<sup>2</sup>, R. Aswin Saravanan<sup>3</sup>, A. Andro Edwin<sup>4</sup>,  
M. Yohesh<sup>5</sup>, S. Kamalesh<sup>6</sup>, K.K. Shanthosh Shree<sup>7</sup>, R. Deepa<sup>8</sup>

<sup>1\*,2,7</sup>Assistant Professor, Department of Electronics and Communication Engineering,  
E.G.S. Pillay Engineering College, Nagapattinam, Tamilnadu.

<sup>3-6</sup>UG Scholar, Department of Electronics and Communication Engineering  
E.G.S. Pillay Engineering College, Nagapattinam, Tamilnadu.

**Abstract:-** A new and innovative technology called Light Fidelity (Li-Fi) has been developed in the past few years which are an alternate solution for wireless fidelity (Wi-Fi). Li-Fi uses light source as a transmitting medium for data transmission. The data is transmitted by flickering the light source (i.e. switching them On and Off) at a speed that cannot be noticeable to the eye. In this proposed article, wireless data transfer between two systems is established with the support of Li-Fi technology. Here data is transmitted from Tx PC via the LASER module that is driven by the Arduino UNO. On the receiver side data will be received on Rx PC using the photodiode (Solar panel), which is also connected to the Arduino UNO to extract the original data from the light. Li-Fi provides better bandwidth, efficiency, connectivity and security than Wi-Fi and achieved high speeds larger than 1 Gbps under the laboratory conditions. The experimental report shows that the bit rate is enhanced using the proposed system and reached up to 147 bps with 100 % accuracy, over a 50 cm distance. And the setup also made it simpler than others out there and overall cost also reduced.

**Keywords:-** Li-Fi, LASER, PC to PC Communication, Text Data Transmission, Solar Panel.

## I. INTRODUCTION

In today's world of overcrowded data communication, lots of research works are available in solitons [1-2], and Light Fidelity (Li-Fi) is a new and efficient way of wireless communication. The idea of Li-Fi was introduced for the first time by a German physicist Harald Hass in the TED (Technology, Entertainment, and Design) Global talk on Visible Light Communication (VLC) in July 2011, by introducing it as "data through illumination".

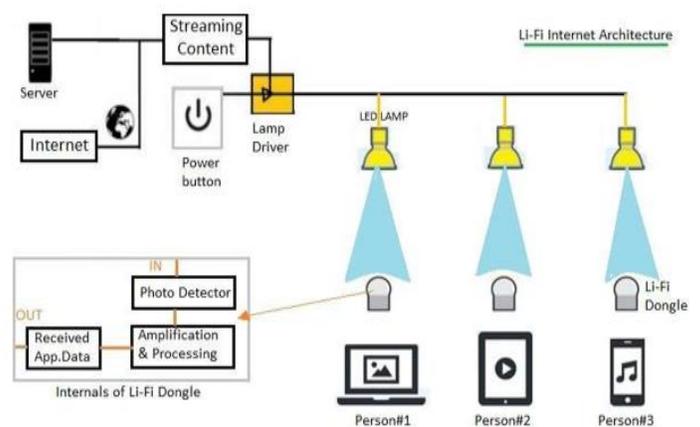


Fig 1. Basic Li-Fi communication setup



Fig 2. Li-Fi communication

In that talk, he demonstrated the setup of a table lamp with an LED bulb to transmit a video of a blooming flower that was then projected onto a screen. In simple words, Li-Fi is another form of light enabled Wi-Fi i.e. instead of using radio frequency it uses visible lights to transmit the data. It may offer an additional frequency band of the order of 400 THz compared to that available in RF communication which is about 300 GHz.

Widely available light is the basic source for Li-Fi technology infrastructure. The studies using Light Emitting Diode in the submission point are eco-friendly and absorb destructive radiation. The proposed technology requires less power and having good switching speed, which creates them riffle faster so that they are imperceptible by the human eyes also.

The major apparatuses of a basic Li-Fi system may contain the following:

- A high brightness white LED which acts as transmission source.
- A silicon photodiode (PV) with good reaction to visible light as the receiver.

Digital strings with different combinations of 1s and 0s are generated by turning the LEDs on and off. LED performance appears constant to humans because LEDs blink at an astonishing rate (millions of times per second) and it is impossible for the human eye to detect this frequency. By using high-speed LEDs with various multiplexing techniques, communication speeds of over 100 Mbit/s can be achieved. This VLC data rate can also be further accelerated up to 10 Gbps by parallel data transmission using a series of LED lights, each LED carrying a different data stream. Two basic functions: Lighting and wireless data transmissions are combined by attaching a small microchip to the potential lighting device. This relationship between these features solves four major problems facing wireless communications today: capacity, cost, efficiency, and security.

➤ *Advantages of Li-Fi:*

- Efficiency: Very little additional power is required to transmit data, making it very efficient both in terms of cost and energy.
- High speed: The combination of low interference, high bandwidth and high brightness output allows Li-Fi to deliver high data rates.H. 1 Gbps or or higher
- Security: The main advantage of Li-Fi is security. Because light cannot pass through opaque structures, Li-Fi Internet can only be used by users within a limited area and cannot be intercepted or exploited outside the operational area.

**II. LITERATURE SURVEY**

The need for an alternate means of communication makes Light Fidelity extremely important (Ifada, et al., 2019). By the year 2020, 10 billion devices will be subscribed to LTE, which would result in exponential growth of wireless traffic demand and result in a congested, scarce, and expensive RF-spectrum [3].

In October 2011, companies and industry groups overcome the limited amount of available radio-based wireless spectrum by promoting high-speed optical wireless systems, utilizing a very different part of the electromagnetic spectrum. For this reason, the Li-Fi Consortium was formed [4]. Hence, PureLiFi introduced its first LiFi-X dongle in February 2016. About the size and width of a business card, LiFi-X plugs into a computer’s USB port [5-6].

Mahendran, (2016) proposed a smart communication system using illumination but couldn’t address the issue of cost-effectiveness alongside. Although the system was able to meet some other requirements like security, and speed, the essence of cost-effectiveness of LiFi systems cannot be overemphasised. The system demonstrated in Shakeera, Manideep, Begum, Bhargav, & Malleswara, (2017) showed bidirectional Visible Light Communication (VLC) between two computers where both computers can act as a transceiver. Using a processing software and the Arduino microcontroller, the transmission of files occurred between the computers where LEDs and LDRs used were in the same line of sight.

Importantly, Shakeera, Manideep, Begum, Bhargav, & Malleswara, [7] opined that VLC based text and file transfer systems were best implemented with white LED bulbs. Shruti, Shivam, Prateek, & Kamakshi, [8], developed a highway navigation system using cost-effective components depicting the use of Li-Fi in establishing smart cities and managing traffic seamlessly. Also, Jilani, Vijayashree, Aseem, Ashwini, & Mithapelli, [9] presented a way for Serial and Parallel Communication of data through Li-Fi.

**III. DESIGN METHODOLOGY**

*A. Hardware Section*

- *Transmitter Side*

In every Li-Fi system LEDs were used bt they are incoherent and not much directional, So Because of coherent nature, and highly directional ability then LEDs, at the transmitter side we used the LASER module (650nm 5v) as light source, connected to a Arduino UNO microcontroller. And the UNO board is connected with the PC through USB A to B cable.

Table 1. Transmitter components

SI No	COMPONENTS	QUANTITY
01	PC	01
02	Arduino UNO	01
03	Laser Module (650nm 5v)	01

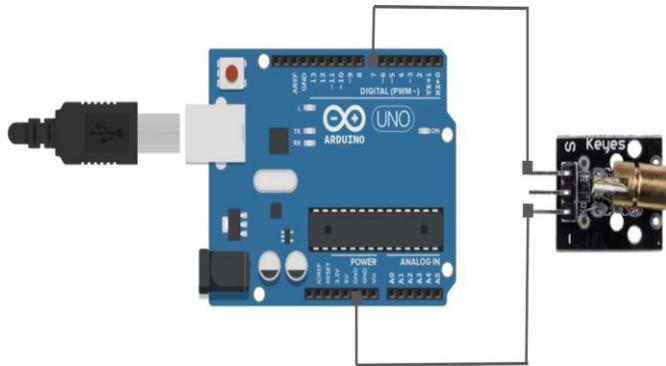


Fig 3. Transmitter

For the wide area of acceptance, Solar Panel [10-16] (70mm\*70mm\*03mm) is used and connected with the Arduino UNO microcontroller. Then this setup is made to connect with the Rx PC through USB A to B cable.

Table 2. Receiver components

SI No	COMPONENTS	QUANTITY
01	PC	01
02	Arduino UNO	01
03	Solar Panel (70mm*70mm*03mm)	01

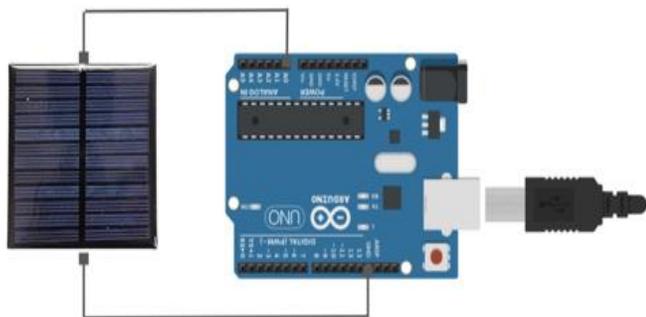


Fig 4. Receiver

**B. Software Section**

On both PCs (Tx & Rx side), Arduino IDE is used as controlling software. Serial monitor of Arduino IDE on Tx PC is used for sending the data. And the Serial monitor of IDE on Rx PC will display the decoded original information.

**IV. WORKING PRINCIPLE**

The process will start at getting the Character of a sentence one by one, which is stored in an Array. After that, the specific character will be converted into its Binary value. Then the UNO will write the LASER as HIGH and LOW as well according to its binary value. Based on the binary number the output will be produced. On the receiver side the program will start by checking whether the current analog Read() value of the panel is greater than the threshold. It's necessary to check the threshold of the solar panel before starting the transmission. The program or the algorithm we used to print the specific characters

at the output one by one. This allows signals to be transmitted by modulating light at different rates. The signal is then received by a detector that interprets changes in light intensity. Intensity modulation is invisible to the human eye, so communication is as seamless as any other wireless system, allowing users to connect wherever her Li-Fi enabled light is.

**V. RESULTS OF THE EXPERIMENT**



(a) ON condition state (b) OFF condition state

Fig 6. Receiver

**VI. CONCLUSION**

Even this is a simple Li-Fi setup, while setting up we were faced with lots of issues. There is something that we need to make sure before starting the transmission. And those are discussed below. First thing is that we should make sure the threshold value is set correctly, because this value is the decision maker of this whole project. If you are using solar panel means, you should set the T value every time before you run the setup according to your place's ambient. Make sure you set up all the devices in a fixed position. Make the LASER source fall on the center of that solar panel. Before uploading the source code into the UNO, make sure to compile the sketch without an error. The code that we were fetched above is fully functional, and you can change as per your need.

**REFERENCES**

- [1]. S. Senthilkumar, V. Mohan, T. Senthil Kumar & G. Chitrakala, "Soliton propagation in colloidal suspension: Numerical simulation and modulation instability", *Neuro Quantology*, vol. 20, no. 7, pp. 2277-2284, 2022. 10.14704/nq.2022.20.7.NQ33295.
- [2]. Senthilkumar Selvaraj, "Semi-Analytical Solution for Soliton Propagation in Colloidal Suspension", *International Journal of Engineering and Technology*, vol. 5, no. 2, Apr-May 2013.
- [3]. Ashmita, S. (2016). A Comparative Study and Analysis of Li-Fi and Wi-Fi. Retrieved May 2020 Badamasi, Y. A. (2014). The Working Principle of an Arduino. 11th International Conference on Electronics, Computer and Computation (ICECCO). Abuja.

- [4]. Ekta, B., & Kaur, R. (2014, April). Light Fidelity (LI-FI) - A Comprehensive Study. *International Journal of Computer Science and Mobile Computing*, 3(4), 475 - 481.
- [5]. L. I. Albraheem, L. H. Alhudaithy, A. A. Aljaser, M. R. Aldhafian, and G. M. Bahliwah, "Toward designing a Li-Fi-based hierarchical IoT architecture", *IEEE Access*, vol.3, p.p.40811 – 40825, Jul.2018.
- [6]. Harald Haas My Li-Fi Revolution (2014) Tam Dalyell Lecture, Professor Harald Haas, Chair Of Mobile Communications At The University Of Edinburgh, Reveals An Amazing Innovation That Could Change Wireless Communications Forever.
- [7]. Begam, J. Nalifa, N. Askarali, Aravindhraj Natarajan, and R. Deepa. "Arduino Based Visible Light Communications Between Two Devices Using Li-Fi Technology." In 2021 International Conference on Advancements in Electrical, Electronics, Communication, Computing and Automation (ICAECA), pp. 1- 4. IEEE, 2021.
- [8]. Ambika Neelopant, Madhuri Yavagal, Rachita Byahatti, "PC to PC Data Transfer using Li-Fi", In *International Research Journal of Engineering and Technology (IRJET)*, Aug 2020
- [9]. Aldarkazaly, Z. T., and Z. S. Alwan. "Transfer data from PC to PC based on Li-Fi communication using Arduino." *Int. J. Adv. Sci. Eng. Inf. Technol* 11: 433-439, no. 2 – 2021.
- [10]. S. Senthilkumar, V. Mohan , S. P. Mangaiyarkarasi & M. Karthikeyan, "Analysis of Single-Diode PV Model and Optimized MPPT Model for Different Environmental Conditions", *International Transactions on Electrical Energy Systems*, Volume 2022, Article ID 4980843, 17 pages, 2022, <https://doi.org/10.1155/2022/4980843>.
- [11]. G. Krithiga, V. Mohan, G. Chitrakala & S. Senthilkumar, "Optimization of switching angles for selective harmonic elimination in cascaded h-bridge multilevel inverters employing artificial intelligence techniques – A mini review", *International Journal of Engineering Technologies and Management Research*, vol. 10, no. 1, pp. 1–16, 2023. 10.29121/ijetmr.v10.i1.2023.1278
- [12]. V. Mohan & S. Senthilkumar, "IoT based fault identification in solar photovoltaic systems using an extreme learning machine technique", *Journal of Intelligent & Fuzzy Systems*, vol. 43, no. 3, pp. 3087-3100, 2022. 10.3233/JIFS-220012, 2022.
- [13]. S. Senthilkumar, V. Mohan, T. Senthil Kumar, G. Chitrakala, L. Ramachandran & D. Devarajan, "Solar Powered Pesticide Sprayer with Mobile Charger and LED Light", *International Journal of Innovative Science and Research Technology*, vol. 7, no. 4, pp. 205-210, 2022.
- [14]. D. Nathangashree, L. Ramachandran, S. Senthilkumar & R. Lakshmi rekha, "PLC based smart monitoring system for photovoltaic panel using GSM technology", *International Journal of Advanced Research in Electronics and Communication Engineering*, vol. 5, no. 2, pp.251-255, 2016.
- [15]. S. Senthilkumar, L. Ramachandran, R. S. Aarthi, "Pick and place of Robotic Vehicle by using an Arm based Solar tracking system", *International Journal of Advanced Engineering Research and Science*, vol. 1, no. 7, pp. 39-43, 2014.
- [16]. S. Senthilkumar, Moazzam Haidari, G. Devi, A. Sagai Francis Britto, Rajasekhar Gorthi, Hemavathi, M. Sivaramkrishnan, "Wireless Bidirectional Power Transfer for E-Vehicle Charging System", 2022 *International Conference on Edge Computing and Applications (ICECAA)*, IEEE, 13-15 October 2022. 10.1109/ICECAA55415.2022.9936175.