

PC to PC Data Transfer using Li-Fi

Ambika Neelopant¹, Madhuri Yavagal², Rachita Byahatti³

¹⁻³Student, Dept. of Electronics and Communication Engineering, SDMCET College, Karnataka, India

Abstract - The role of communication is very critical in day to day life. Communication can be of two types: wireless or wired communication. Wireless communication is usually preferred over wired communication. Light Fidelity is abbreviated as Li-Fi. In 2011, in a TED Global Talk on Visible Light Communication, a German physicist Harald Haas introduced this technology. Li-Fi employs the visible light band within the spectrum of electromagnetic waves. This band is ten thousand times the size of the RF band and cannot be overloaded. Light waves may be modulated to hold large portions of simultaneous data, at very high speeds. Data transmission using Li-Fi is hundred times faster when compared to data transmission using Wi-Fi. In this paper, we present new mode of communication between two laptops or PC's using Li-Fi technology. Li-Fi refers to wireless communication systems that use light from LEDs as a medium rather than conventional RF, as used in Wi-Fi technology. Li-Fi yields enhanced bandwidth, performance, connectivity & security compared to Wireless Fidelity. One of the benefit of Light Fidelity is that it can be used in electromagnetically subtle conditions such as airlines and thermonuclear energy stations without any interference.

Key Words: LED, Li-Fi, Radio Frequency, USB to TTL converter, Visible Light Communication, Wi-Fi.

1. INTRODUCTION

With globalization and society-wide need for networking, there is increasing need for cellular networks and their usefulness, and growth in user counts that use the Internet, limited bandwidth capacity makes it even harder to enjoy high data transfer speeds and connect to a stable network. Due to the reduced bandwidth available in the RF range, this tool would reach the critical threshold very soon. Radio waves, that can be used for transmitting data are only a minor portion of the electromagnetic spectrum. There needs to be a way to defeat imminent exhaustion.

Li-Fi has a much wider data transmission spectrum. The fundamental concept behind this invention is the propagation of data through LED illumination, through changing light intensities that cannot be determined through human eyes. In reality, light has been a big part of our lives for thousands and thousands of years, and has no great ill impact. Li-Fi will have a crucial contribution towards the easement of the massive load which the present wireless network is facing. It can deliver additionally a frequency band of 400THz compared to the one present in Radio Frequency communication which is 300GHz.

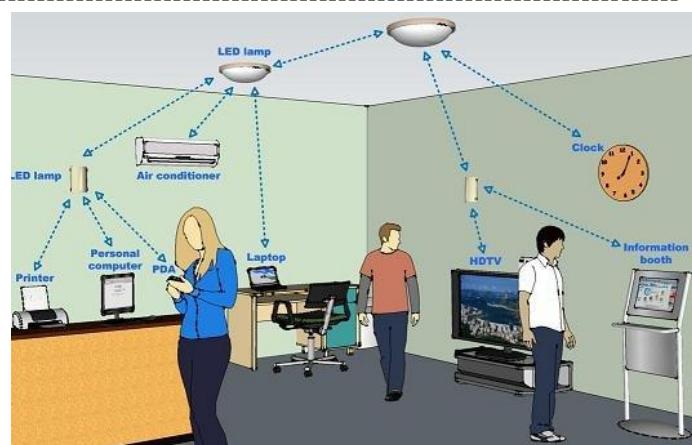


Fig -1: Li-Fi system connecting devices in a room

1.1 Comparison between Wi-fi and Li-fi

Feature	Wi-Fi	Li-Fi
Full Form	Wireless Fidelity	Light Fidelity
Data Rate	150Mbps	>10Gbps
Operating Range	100 meters	Inside a confined area or 10 meters
Operating Frequency	2.4GHz to 5GHz	400THz to 800THz
Security	Not Secured: can be hacked	Secured: cannot be hacked
IEEE Standard	IEEE802.11	IEEE802.15.7

2. ARCHITECTURE AND WORKING

Li-Fi, that might be the inevitable technique for data transmission has all the earmarks of being a straightforward and reasonable optical Wi-Fi adaptation. It uses quick variations in light to communicate information. When the LED is ON it will send a binary 1, if it's off it'll communicate a 0. We simply have to alter the frequency with which the LED's glimmer pertaining to the information that needs to be encoded. The central components in a Core Li-Fi set-up includes:

- a) A luminosity Light Emitting Diode which acts as a source of transmission

b) A device which encodes the information into the Light Emitting Diode

c) A photosensitive component

2.1 Transmitter Module

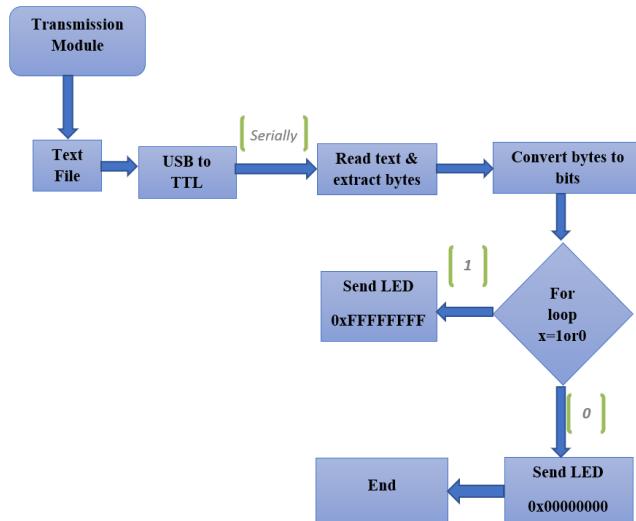


Fig -2: Transmitter Block Diagram

The transmitter has the following operations: selection of the document for transmission, then extracts the data in the form of 1's and 0's. codes it to serial data on a GPIO, processes the data and turns the LED ON or OFF according to the data encoded.

- Text to be transmitted is given as an input to the transmitter PC consisting of a python program reserved for serially transmitting the text to Raspberry Pi.
- The python program in the transmitter PC serially sends the text to Pi via a USB to TTL converter cable which is connected to the COM3 serial port of the transmitter PC with the baud rate of 9600.
- A python code is now written in Raspberry Pi's Thonny platform to convert the received text into binary bits
- The python program extracts the bits from the text and sends them to the LED connected to Pi. When the transmitted bit is '1' the LED turns on and when the transmitted bit is '0' the LED is switched off.

2.2 Receiver Module

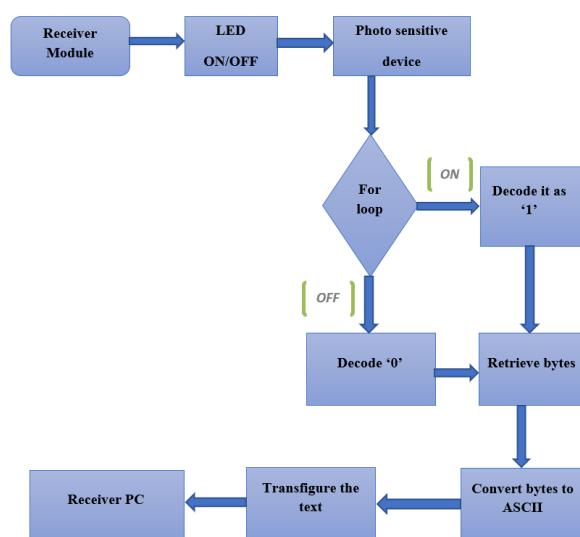


Fig -3: Receiver Block Diagram

The receiver module requires almost the same components as that of the transmission module. The primary difference is the solar panel. Receiver module has the function of receiving the transmitted bits from LED on the solar panel & sending it to Raspberry Pi and then to the receiver PC via the USB to TTL converter. The configuration of Raspberry Pi remains same as the one used in transmitter module.

The receiver module does the reverse engineering of the operations in the transmitter module. The light encountered from the Light Emitting Diode is captivated by the photosensitive component which plays the role of a sensor and transfers the output to the receiver PC and the original text is recovered using python code. Solar panels cannot be directly connected to Raspberry Pi because the Raspberry Pi has no analog GPIO pins unlike in an Arduino. Analog sources like solar panel to be connected to the Raspberry Pi, what is called as an ADC is needed (analog-to-digital converter).

- The photosensitive component detects the On & OFF of the LED and is sent to the Raspberry Pi of the receiver.
- The python program written on the Raspberry Pi of the recipient sends 1/0 by means of sequential port to the processing software. Processing software receives the data in the serial port.
- The processing software has code for reading the data on the serial port, retrieving the bytes and displaying the original data sent from the transmitter and displaying it on the Receiver PC.

3. APPLICATIONS

Hospitals: Since Li-Fi doesn't rival radio recurrence hardware, Li-Fi can be utilized securely in numerous applications in emergency clinic. Li-Fi innovation, for instance, would permit a light correspondence organize in corridors, sitting areas, persistent rooms and working theatres, which will wipe out electromagnetic obstruction issues from cell phones and utilization of Wi-Fi in emergency clinics.

Schools: A key component of delivering new learning opportunities is the right wireless network by linking students and teachers to smart devices, allowing learning apps on any mobile device. Li-Fi can also provide seamless connectivity and security across the entire school.

EMI sensitive environments: Li-Fi allowed lighting on aircraft would require high access to the data rate for each passenger. This will require communication at all times, without causing electromagnetic interference (EMI) on the flight deck with sensitive radio equipment. Reducing the cabling demand often implies a smaller airlines.

Underwater communication: Radio waves are virtually absorbed in water, removing radio touch underwater, but lightweight will penetrate for extensive distances. Li-Fi can accordingly permit touch from one aquanaut to another etc.

Localized advertising: By using shop show lighting as a Li-Fi transmission screen, promotional information about the items being displayed may be distributed, as well as exclusive sales and coupons may be said. This will cause the high street and online retail experience to blend together.

4. ADVANTAGES

Efficiency: The usage of light from the Light Emitting Diodes that is being previously used for lighting purposes in home, workplaces & mall etc. will reduce energy usage. Thus, data transmission requires zero additional power, which makes it very cost-effective & energy intensive.

High speed: Combining lower latency, higher bandwidth & higher-power performance, allow Light Fidelity achieve higher data speeds, i.e. 1 Gbps or even more.

Availability: This isn't a problem because light sources are everywhere. There can be net where there's a supply of sunshine. There are bulbs in all places -in houses, workplaces, business units and even craft, that might be used for transmitting data.

Cheaper: Not only does Light Fidelity need minimum elements in order to work it also requires only a small amount of power for transmitting data.

Security: Li-Fi's major benefits includes safety. Owing to the fact that light can't penetrate into non-transparent devices, Li-Fi connectivity can only be availed by users in a restricted zone & can't be accessed & exploited by users staying outside the restricted zone.

5. CONCLUSION

Quite obviously development in research on Light Fidelity will reveal that it'll be available to every individual in the coming times. This technology will benefit maximum of the experimentations, undersea studies & verbal exchange, scientific technology, or even in navy sectors for its useful resource in secured verbal exchange. A top-notch alternate in everyday life on every factor will show up if Li-Fi generation supersedes Wireless Fidelity and different broadband connections. While Li-Fi has many blessings, records offer us one-of-a-kind exposure to factors and facts added at a very fast rate, is this technology's biggest challenge. In this task, an actual-time textual content broadcast prototype off the home LEDs are used, it's far envisaged that the usage of industrial LED's could bring about higher distances of transmission. VLC continues to be in a totally early level. The interest in VLC is growing throughout the world and we can quickly anticipate many actual-international packages. Li-Fi is a fast and cheap wireless-communication technique. There is a growing demand for better bandwidths, faster, and extra at ease data transmission in addition to environmental and surely human friendly is all fulfilled by using Li-Fi.

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BIOGRAPHIES



Ambika A Neelopant
Student
Dept. of Electronics & Communication
Engineering, SDMCET, Dharwad, India.



Madhuri M Yavagal
Student
Dept. of Electronics & Communication
Engineering, SDMCET, Dharwad, India.



Rachita V Byahatti
Student
Dept. of Electronics & Communication
Engineering, SDMCET, Dharwad, India.