Li-Fi (Light Fidelity): The Future Technology in Wireless Communication

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Abstract—Li-Fi technology means Light technology which was suggested by Harald Haas. As is the name suggests Li-Fi is an information indication technique which uses lighting for sending information or light as a medium of communication. Data transmission transfers by using an LED bulb having variation in its intensity with a velocity acceleration of actually faster than which human eye can follow. Also known as optical celluartechnology or noticeable light communication. This paper concentratest to explore this surprising technology. It provides better efficiency, higher bandwidth, best security and availability with a very high velocity than Wi-Fi.

Keywords: Li-Fi technology, LED, data transmission, Visible light communication, Wi-Fi technology.

I. INTRODUCTION

Li-Fi (Light Fidelity) is a quick and easy optic version of Wi-Fi, it is Depends on Visible Light Communication (VLC). VLC is a medium of data communication, which uses obvious light between 400 THz (780 nm) and 800 THz (375 nm) as optic carrier for data transmitting indication and illumination. It uses fast pulses of light to transfer information easily. The main pieces of this communication system are LED, Which rule as a communication source and a silicon, photodiode which shows good response to obvious wavelength region serving as the obtaining element. LED can be switched by on and off to create digital strings of 1s and 0s. Information can be encoded in the sunshine to make a new data stream by differ the remittent rate of the LED. To make more pure, by modulating the LED light with the data indication, as the remittent rate is so fast, the LED outcome appears regular to the human eye. Data rate of greater than 100 Mbps is possible by using high velocity LEDs with suitable multiplexing techniques, data rate of vlc can be increased by parallel data indication using LED arrays where each LED transmits a unique data stream [1].

II. ARCHITECTURE of Li-Fi

Li-Fi architecture consists of numbers of Led bulbs or lighting fixtures, many wireless devices such as PDA, Mobile Cell phones, and laptops. Li-Fi based onimportantoperator:
- Presence of Light.
- Collection of Sight.
- For better performance use LED.

Figure [2] shows that internet streaming content must have suitable amalgamation with server & internet network, so that it is definitely possible to work efficiently [2].

![Architecture of Li-Fi](image)

**Fig 2: Architecture of Li-Fi**

### III. WORKING OF LI-FI

The primary part of this technology is creation high intensity Led's. These types of LED's varies in depth (that is gets on and off) so fast that a human vision cannot find it. If perhaps LED is on, then we transmit a digital signal one of course, if the LED is off, then we transfer signal zero [3]. A control mechanism is also linked at the backside of these LED bulbs to code data to these LEDs. It is possible to code data in the light by differing the rate at which LED's flash on and off to give different gift items of 1s and 0s. Modulation is so fast that human eye does not observe. Thus every light source will continue to work as a hub for data transmitting. On one end all the data on the internet will be live-streaming to a lamp drivers when the LED is turned on the microchip transforms the digital data in form of light. A light sensitive device (photo detector) receives the signal and return it into original data. This method of using quick pulses of light to transmit information easily this technically indicate as Visible Light Communication [4].
IV. SIMULATION AND RESULT OF LI-FI

This project, an indoor visible light communication environment based on Simulink in MATLAB. For visible light communication environment, the illumination light-emitting diode used also as a communication appliance. Using the simulation program, the distributions of light and root-mean-square delay spread are analyzed at bottom surface. White LEDs (Light Emitting Diodes) in light fidelity is an emerging technology that is being researched so it can finally be used for communications systems. LEDs have a number of advantages, one of which is long life expectation. However, like many emerging technologies, light fidelity has many technical issues that need to be addressed. The problem i faced is that the most of simulation programs does not offer realistic simulation for transmission using LEDs. But factorizing the measured current with some proportional constant will give an approximate model for luminance output of a LED. The model was designed to demonstrate li-fi transmission and reception using MATLAB simulink. We transmit and received black and white image.
Fig 4: General Block Diagram of Simulink Model

4.1 Electrical Circuit Model of Transmitter and Receiver Block:

Fig 5: Electrical Model of Transmitter and Receiver Block
Transmitter Model: In VLC communications the transmitter is a LED driven with a switching transistor and a current limiting resistor. Basically, the current passing through LED is proportional with the luminance of the light emitted. For 1W Power LED for current of 350mA, the luminance is 110 lx. Factorizing the measured current with some proportional constant will give an approximate model for luminance output of a LED.

Receiver Model: The receiver is actually a photo detector. The photo detector is a photo transistor switch in which when light hits the base (gate for mosfet) of the transistor is switched on. The resistor output models the TTL output of the received binary data.

4.2 Result of Li-Fi

Input and Output scopes show the data input and output

- Path Loss (Air):
The Path Loss block simulates the decrease of luminance in air. As light travels, it loses its strength proportional to \(1/\text{Distance}^2\). In the model, it is assumed that the distance traveled is 4 meters.

- Noise from Path, Switching and Semiconductors:
A noise source is added to model the noise created by path, switching, and semiconductors. A Gaussian noise distribution function generates random noise which is approximately the same in real systems.
V. APPLICATION OF LI-FI

1. Education systems: As with the progress of science the most advanced technology is the LIFI which is the most effective acceleration internet access service.

2. Significantly Lower Power Consumption: LEDs on the other hands use very little electric power. Concurrently Li-Fi a room, that means it can do two works for the price of one.

3. Intelligent Transport System: Li-Fi enabled Traffic lights and street lights can talk with each other and also to the cars which can reduce the number of accidents [6].

4. Airlines: United is designing on speeds as high as 9.8 Mbps per plane. Li-Fi could easily submitting that sort of speed to each seat's reading light.

5. Medical field: Not allowed to run Wi-Fi in the hospital room because it used RF and this can affect the medical devices, so Li-Fi solve this problem Where the light does not affect the medical devices[7].

VI. CONCLUSION

Li-Fi is attract significant amounts of attention, because has wonderful technology and It has many advantage like: no license is needed for the Li-Fi , We are able to use Li-Fi in private hospitals and aircraft and Visible light spectrum is a totally free charge spectrum band also Thousands and millions of street lighting fixtures can be used in Li-Fi lamps to transfer data.

REFERENCES

2. http://en.wikipedia.org/wiki/Li-Fi