CONCEPTS, OPPORTUNITIES &CHALLENGES IN 5G WIRELESS COMMUNICATION USING WI-FI AND LI-FI

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Abstract- Nowa days, Wireless technology playing anvitalrolein communication process. The main way we send and receive wireless data by using electromagnetic waves. However, these waves can support less bandwidth because of compact spectrum availability and intrusion. The solution to this problem is data transmission using Visible Light Communication (VLC).VLC applications include Li-Fi, vehicle to vehicle communication, robots in hospitals, underwater communication and information displayed on sign boards.The Li-Fi uses visible light for communication to provide high speed internet up to 10Gbits/s.Both Wi-Fi and Li-Fi transmit data over the electromagnetic spectrum,Where as Wi-Fi uses radio waves, Li-Fi uses visible light, Ultraviolet and Infrared. In Li-Filight is transmitted using a LED. It works as a Transmitter. And light detector works as areceiver,which can be placed in the phone, camera, tablet or PC.

*Keywords-*Wi-Fi (Wireless Fidelity), Li-Fi (Light Fidelity), VLC (Visible Light Communication), LED (Light Emitting Diode).

I. Introduction

Li-Fi is a bidirectional, high-speed and fully networked wireless communication technology similar to Wi-Fi.Li-Fi basically transmits data between two terminals using LEDs. The speed of data transmission was about 10 mbps. Wi-Fi uses radio waves for data transmission and communication between terminals proves fatal in areas like oil petroleum which can harm the environment causing vast destruction so to avoid such situation using of light in some area proves beneficial. Li-Fi is more secure as it does not allow data leakage[2].

II. Proposed System

In Li-Fi technology data transmission is done through light or LED. The working concept of Li-Fi will be categorized in two modules i.e. Transmitter and Receiver.
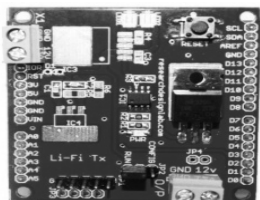
A Transmitter

Figure 1:Working of Transmitter

Atthe transmitter section we use PC which contains MATLAB software. This MATLAB softwareconverts the data into its binary form and it also transmits the binary conversion to the receiver through LED. Next is the USB to TTL which is used so deal with the communication of a microcontroller. The microcontroller helps to generate square wave form from the binary data converted by MATLAB and inputs the square wave to the LED. Later which helps the LED to glow and allow transmission[1].
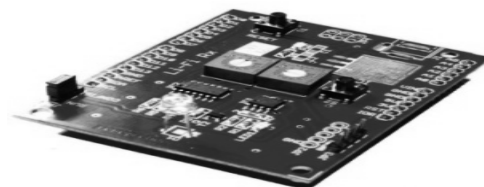
B. Receiver

Figure 2: Working Of Receiver

At the receiver section exact opposite operation of Transmitter takes place. The light received from the LED is captured by the photo diode. This photo diode works as a Sensor and passes the output to the Comparator which compares the binary inputdata.Similarly the original data is recovered using Mat labsoftware[1].
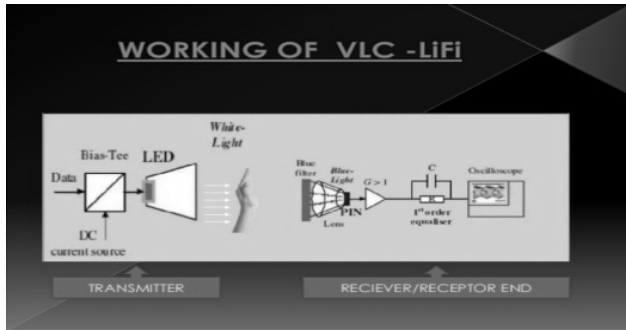
C. Visible Light Communication

Figure 3: Visible Light Communication

Visible Light Communication (VLC) is a modern communication technology which employs visible light sources (LEDs). Li-Fi is implemented using LEDs. If the LED is ON we transmit a digital '1' and if the LED is OFF we transmit a digital '0'. The continuous flickering of LED helps in data travelling from one terminal to another[7].

Figure 4: Visible Light Communication
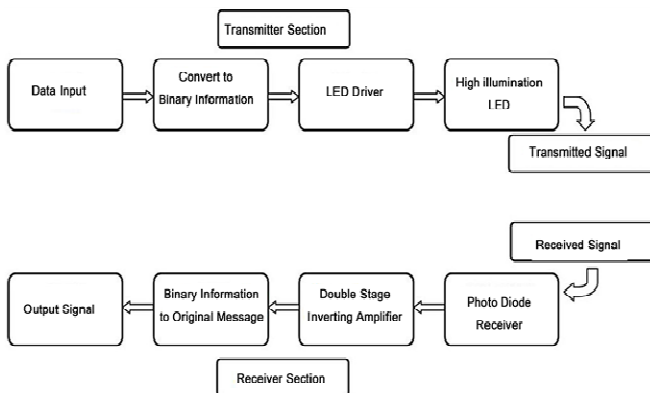
III. Block Diagram Of Li-Fi

Figure 5: Block Diagram of Li-Fi

- **MICROCONTROLLER**: Microcontroller is low power, high performance 8bit CMOS microcomputer with 4kb of EPROM (Electrically Programmable Read Only Memory).

- **PC (Transmitter & Receiver)**: It is used to provide the operation of image processing to be done at the transmitter side for sending the input image and at the receiver side for reconstructing the sent image. This processing is done by using MatLab software in PC.

- **Phototransisto**r: It produces some voltage at its output terminal connected to microcontroller when lights from LEDs fall on it. Phototransistor is a device that converts light energy into electric energy. Phototransistors are same as photo resistors that produce both current and voltage, where as photo resistors produce current only.

- **USB to TTL**: The cable is easiest way ever to connect to the microcontroller router serial solace port.

- **Comparator (LM358N)**: In electronics, a comparator is a device that equates two voltages or two currents and outputs a digital signal indicating larger voltage.
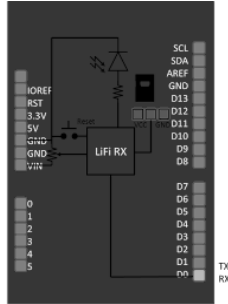
IV.Experimental Setup

Experimental setup basically comprises of transmitter setup and receiver setup.

A. Transmitter Setup
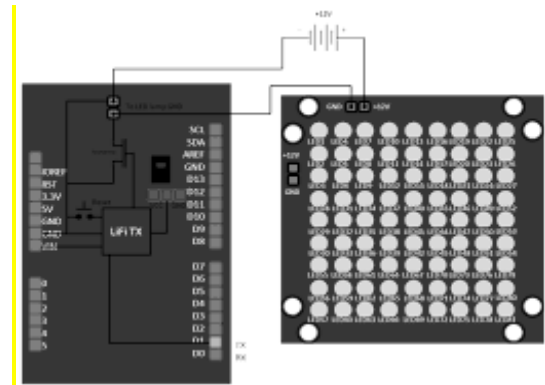

B. Receiver Setup

V. Results And Discussions

Using light as a data transmission medium helps to securely transmit data as it overcomes the problems of data leakage and efficiently transmit multimedia data over a medium. It uses Visible Light Communication technology[3]. Visible light communication using white LEDs offers the potential for such alternative. The main reasons are as follows:

• Bandwidth is not limited.

• Existing local power line infrastructure can potentially be utilized.

C. Communication Between Wi-Fi And Li-Fi
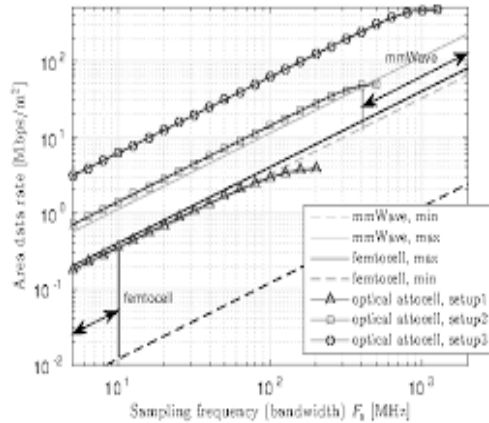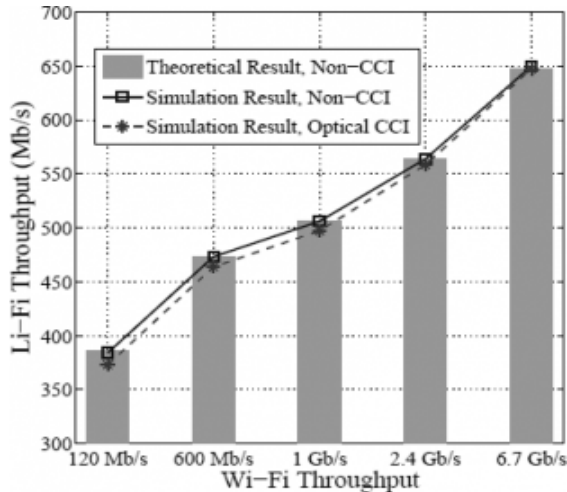
Following Table-1 mentions comparison between Li-Fi and Wi-Fi.

Feature	Li-Fi	Wi-Fi
Full Form	Light Fidelity	Wireless Fidelity
Operation	Li-Fi transmits data using light with the help of LED bulbs.	Wi-Fi transmits data using radio waves with the help of Wi-Fi router.
Interference	Do not have any interference issues similar to radio frequency waves.	Will have interference issues from nearby access points(routers)
Technology	Present IrDA compliant devices	WLAN 802.11a/b/g/n/ac/ad standard compliant devices
Applications	Used in airlines, Undersea explorations, Operation theatres in the hospitals, Office and Home premises for data transfer and internet browsing.	Used for internet browsing with the help of Wi-Fi kiosks or Wi-Fi hotspots
Merits(Advantages)	Interference is less, can pass through salty sea water, works in density region	Interference is more, cannot pass through sea water. Works in less density region.

Privacy	In Li-Fi, light is blocked by the walls and hence will provide more secure data transfer	In Wi-Fi, RF signal cannot be blocked by the walls and hence need to employ techniques to achieve secure data transfer.
Data transfer speed	About 1 Gbps	WLAN-11n offers 150Mbps, About 1-2 Gbps can be achieved using WiGig/Giga-IR
Frequency of operation	10 thousand times frequency spectrum of the radio	2.4GHz, 4.9GHz and 5GHz
Data density	Works in high dense environment.	Works in less dense environment due to interference related issues
Coverage distance	About 10 meters	About 32 meters (WLAN 802.11b/11g), vary based on transmit power and antenna type
System components	Lamp driver, LED bulb(lamp) and photo detector will make up complete Li-Fi system.	requires routers to be installed, subscriber devices(laptops,PDAs, Desktops) are referred as stations

V. Conclusion And Future Scope

Conclusion from the above implemented concept is data Transmission using light is cheaper and secured. We can use Li-Fi in future in which data for smart phones, tablets etc can be dealt using lights fitted in the room. Radio waves cannot be used by commuters in aircrafts. LED-based lights are already used in aircraft cabins and

each of these lights could be potentials VLC transmitters to provide both illumination and media services for travellers. Moreover, this will reduce the aircraft construction costs and its weight [6]. Underwater ROVs (Remotely Operated Vehicles) operate from large cables that supply their power and allow them to receive signals from their pilots above. They could also use their front lights to communicate with each other, processing data independently and sending their information back to the surface [4].

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