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"A review of LiFi communication system"

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ABSTRACT: At the present time in contrast with the past, it's very important to use light waves in place of radio waves. Because radio waves are very harmful to animals and humans. Light Fidelity (LiFi) can be boon option to solve this problem. In present radio waves are widely spread, due to this reason we need to adopt new wireless technology. Transmit data through visible light may be silver lining to future technologies and decrease the use of radio waves. This paper elaborate the features and needs of Light fidelity(LiFi), and also compare LiFi and WiFi technologies advantages and disadvantages.

I. INTRODUCTION:

Now a day the internet is very essential part of our life, it is just like ted, newspaper or food for us. Such huge increase of internet make radio wave, spectrum insufficient to fill the demand. The radio wave, spectrum of before 10nGHz is insufficient [1], but if we increase radio wave spectrum of above 10 GHz then it may cause the path loss, scheduling and blocking [1,2]. The insufficiency of radio wave spectrum give rise to visible light communication. We can use visible light in place of radio wave for wireless communication, as visible light have 10000 times more spectrum than radio waves[3]. The communication by using visible light is very old technique. In ancient times, the fire was use to send the message. Now this technology is enhancing as per the need of our life style.

In 1792, Claude Chappe has invented visual telegraph [4]. Heliograph, which reflect sunlight was invented in early 1800 [5] and in 1880 Alexander Graham bell invented first wireless telephone [6]. Many more invention was made in 20th Century like single mode optical fiberin 1970 [7]. In 2003, at Nakagawa Lab (Japan) the LED was used for data transmission [8].

In 2011 LiFi technology was first introduced by Prof. Harald Haas in TED Global Talk [3]

COMPARISON BETWEEN LIFI &WIFI :

LiFi use visible light for communication &Wifi use radio waves

Features	LiFi	WiFi
Capacity	Visible light have 10000 times more spectrum [3]	Radio waves have less spectrum comparatively.
Availability	Visible light is easily available everywhere where radio waves are prohibited like Hospital, Airoplane.	As many research says that radio waves are harmful for human health [9], therefore some places it is restricted to use phones.
Efficiency	We use LED bulbs for communication. As LED is used for two purposes at same time[10] i.e. for illumination and communication therefore it is more efficient,	WiFi use radio wave stations for communication. The base station are heated due to radiation emission [3], To cool down these base stations extra energy is required.
Security	Visible light can notpasses through the wall. Therefore they are secure[11]	Radio waves can easily penetrate the wall.

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BASIC CONCEPT OF LIFI SYSTEM:

Light travels easily in mostly mediums without major disturbance. That's why it can use to transmit data in different mediums.

Concept of the Li-Fi system is wireless data transmission through illumination [8].Li-Fi is closely similar to that of Wi-Fi, as both transmit and receive data electromagnetically but Wifi transmit data through radio waves and LiFi transmit data through light. Li-Fi system has a data transmitter like LED light at sender end and a data receiver at destination end like photo detector.

LEDs selection plays important part as the data rate in a Li-Fi system can be related with LEDs. Parameters like ON-OFF speed and number of LEDs can affect the data of the communication. If ON-OFF speed ofLEDisfast,thendatacanbetransmittedathighratesin the form of 1's and 0's. Higher the number of LED's in a system results in more transmission of data.

1) SOURCESIDE– At the sender end, LED convert data into light signals for transmission is achieved by varying the light intensity of the LED, which causes the LED to flicker ON an OFF at a very high speed [5]. These flickers represent the data being transmitted. When the LED is switched ON, it logically represents the transmission of a ''1,'' and when it is switched OFF, it transmits a ''0.'' A combination of 1s and 0s generates different data strings. However,theflick erring speedissohighthattheLEDappears to be constant to the human eye, causing no harm to it [9].

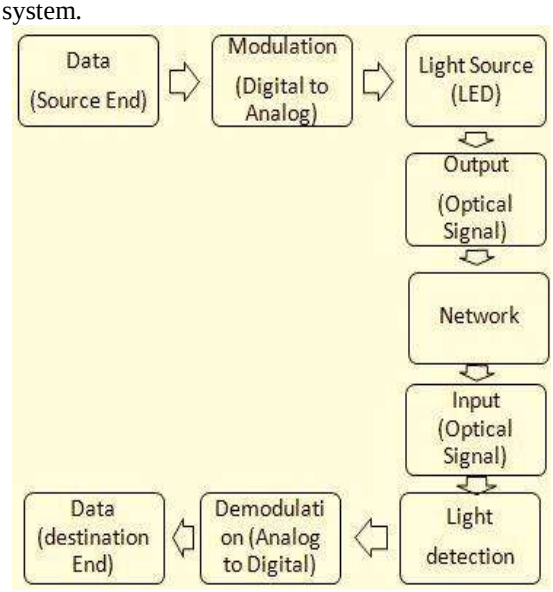
Fig : LED is a transmitter for LiFi Communication

2) DESTINATION SIDE– At the receiver end, A PD detects the light source and converts the changes in its intensity into an electrical signal. When the LED flickers ON, the PD registers a binary 1; otherwise, it registers a binary 0. Then, the received data are amplified, processed, and forwarded to the user [10].

Fig: Solar panel as a light receiver

LIFI ARCHITECTURE :

Main Concept of light fidelity is based on light communication. Fig 1 shows the block diagram of wireless communication through light fidelity system.



Basic principle of light fidelity system :

LiFi is running on visual light communication. It travels information through electromagnetically. Lifi system used LED bulbs to transmit information one place to other place and a photo detector used to get information[12]. Data travels through light. It is safe and secure to transmit data. It may be a boon over Radio frequency use.

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ADVANTAGES OF LIFI TECHNOLOGY :

1. Light does not harmful as compare radio waves, that's why it is good for health
2. LiFi enhancement light infrastructures
3. LiFi solve the radio frequency spectrum crunch issue.
4. Light transfer data with very high speed.
5. Secure communication.
6. Enhanced energy-efficiency by combining data communication and illumination (100 times energy reduction)

DISADVANTAGES OF LIFI TECHNOLOGY:

Lifi has so many advantages but it has also some disadvantages as follows

1. Light does not travel into a wall.
2. LED bulb needs to on whole time when we use LiFi.
3. At day time other light (as sun light) effects to LiFi system.
4. It requires a perfect line-of-sight to receive data.
5. It is a short distance communication system.
6. Light travel over transparent medium due to this reason security may be sacrifice.

APPLICATIONS :Some applications based on light fidelity are -

PURELIFI DEVICE -PureLiFi introduced in 2016 as a world's first LiFi dongle, it provides uplink and downlink speeds of up to 42 Mbps.it is Full compatibility with Windows 7, Windows 10, Linux, and Mac OS operating systems. It isbi-directional, and fully-networked communications.The world is now one step closer to commercially-available LiFi systems thanks to the pureLiFi's first certified, complete LiFi system. [42], [43].

Fig : Pure LiFi Modem

1. **CORREFOUR LILLE –**In France Philips lighting solution company install on LED based communication system.This system helps to customers to search items throughout the shops using Smartphone application[13].

Fig: Main user interface of Carrefour mobile application [13].

2. **E. LECLERC RETAIL STORES –**This is indoor system that is used to tracks trolleys handles path. It shows the geo-localization of the LEDs enables the system to accurately define the customer's journey[14]. This system helps to owners about the shopping behavior of the customer [15].
3. **GRAND CURTIUS MUSEUM –** In Belgium Oledcumm company worked on project with Grand CurtiusMuseum[16].

LIFIMAX DEVICE –LiFiMAX is introduced by Oledcommto provides consumers and businesses with a significant upgrade over current WiFi systems. This system provide a high-speed, extremely reliable and secure connection through invisible light. Fast and secure connectivity free from radio waves [14]

II. CONCLUSION:

This time light fidelity isan interesting topic to scientists and researchers due to its scope. It resolves so many issues in communication. Internet of thing is an essential segment in ordinary life. Light is an essential part of our life and normal light has no side effects to human and animals body. That's why we can called, light fidelity is a good technology.It has a high transfer rate of the data. LiFi spectrum range is more than 1000 times of WiFi that's may be solve spectrum crunch problem in future. LiFi may be a boon technology

to replace or reduce the radio waves communication.

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