A SURVEY ON LI-FI ADVANCED TECHNOLOGY

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Abstract: Today data transmission by internet increasing day by day because every device connected to internetby using different technologies. A new technology introduce by Mr. Harald Haas for fast transmission of data is visual light communication, LI-FI is the latest technology of wireless data transmission, it use the concept of flickering lights.LI-Fi works on two major concern of our data, first is data transmission and another is security. LI-FI provides fastest data transmission over ability of human eye's data transmission. As we know that speed of wireless data transmission if slower than light. Light provide higher security from invisible radio waves. In this paper I have introduce many concepts related to LI-FI in term of security, transmission, features and comparison with other data transmission technology.

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

I. INTRODUCTION

Light Fidelity refers to Visible Light Communication systems using diodes as a medium to fast communication is same as Wi-Fi. "In today era everyone wants security in data transmission by internet and internet is fast growing technology for data transmission. Li-Fi is new growing technology; Li-Fi is basically called "Light Fidelity" and is the result of 21st century. Basic theory behind this development is that data can be fired through the LED light, the power change much fire than the human eye. This term initiated by HaraldHaasand is a collection of unparalleled optical and optical remote transaction that can be used as a supplement of a RF communication (Wi-Ficellular framework) or even, data alternative to broadcast setting. The rate of measurement so far has been 100 times faster than some Wi-Fi execution speed of 224 gigabytes[1]. The trouble with conventional Wi-Fi switches is that the various device in space may interface with each other however Li-Fi can use a variety of light in the room without impedance. In the present case it is called Wi-Fi advancement adjustment. The benefit is remote connections which greatly reduce cost. As the number of device continued to expand. Survey show that Wi-Fi stopped due to weak development and security. So it is necessary to spread freely. In this paper we are providing progress of Li-FI, using Li-Fi data can store in light by comparing the flicker rate of Li-Fi. ON or OFF to fast, cannot seen by user. ON means value is 1 and OFF means value is 0".

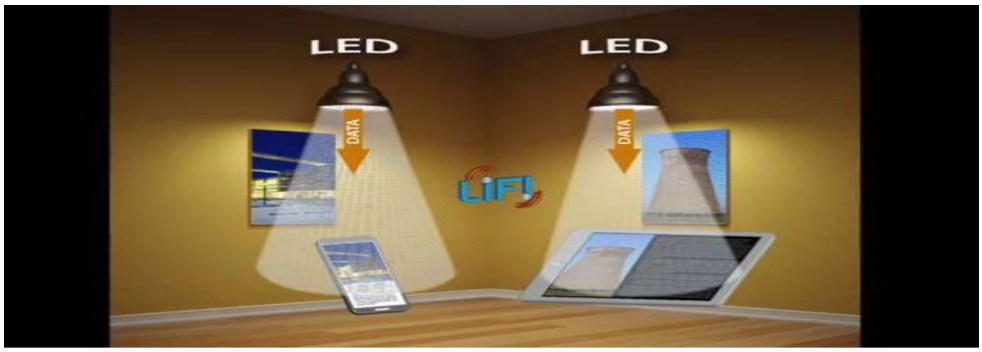

Figure 1.1: Li-Fi

II. DESIGN AND WORKING OF LI-FI

Li-Fi architecture consists of a number of LED bulbs or lamps including many wireless devices such as Mobile Phones, Servers, Laptops and PDA. The following factors should be taken into concern while designing Li-Fi:

1. Presence of light.
2. Line of sight (LOS).
3. For better performance use fluorescent light and LED.
4. A photo detector received data.

Hence all that is required is some LEDs and a controller that will code data into those LED switch

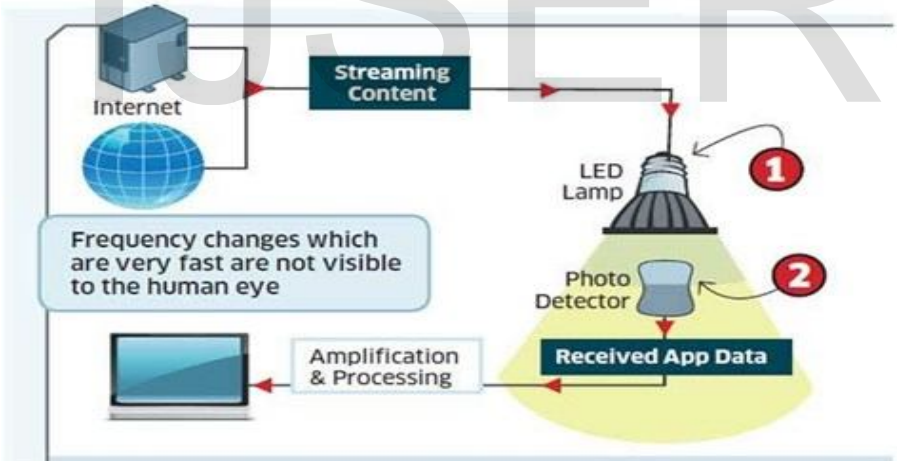

Figure 2.1: Design of Li-Fi

In Figure 2.1 shows the binary data are captured by few light receptors are required, and are installed on all types of connected devices, from computers to tablets, to phones, televisions or appliances. Matter experts make clear that the light pulses are imperceptible to the human eye, without causing damage or discomfort of any kind. In addition, any lamp or flashlight can become a hotspot. How Li-fi works is simple: You have a light on one end (an LED), and a photo detector (light sensor) on the other. If the LED is ON, the photo detector registers a binary one; otherwise it's a binary zero. Flash the LED enough times and you build up a message. Use

an array of LEDs, and perhaps a few different colors, and very soon you are dealing with data rates in the range of hundreds or megabits per second, this is accomplished by the flickering of LED light bulbs to create binary code (on = 1, off = 0), and is done at higher rates than the human eye can detect. The more LEDs in your lamp, the more data it can process [10].

III. IMPLEMENTATION OF LIFI

The implementation of light-fidelity (Li-Fi) eliminates the use of instrument wiring systems and cable infrastructure, thereby reducing the cost and security risks.[2] The Li-Fi instrument communication networks are best-suited for plants where Wi-Fi and other radiation is bad for sensitive areas. It offers safe, abundant connectivity and can solve issues related to the short range of radio-frequency bandwidth. The Li-Fi instrument communication network also could enable greater capabilities to realize the Industrial Internet of Things (IIoT) and offer advanced connectivity between field devices and systems that go beyond machine-to-machine connections. The system has relatively low capital expenditure (CAPEX) and operating expenses (OPEX).

Li-Fi implementations mainly require 12 steps:

Step 1: The transmitter sensor module—temperature, pressure, level, flow—measures the real-time process variables in the plant. The real-time process-variable information will be sent to the nearby optical access point (OAP) via optical signal—transmitted light, not radio signal. The process variable information shall be updated to the OAP or DCS, as per the user-defined update rate. The update rate of the optical wireless instruments will be decided on the basis of loop criticality of the process.

The optical transmitter module measures the real-time process-variable information and the process-variable value is sent to the transmitter control module via hardwire signal.

The transmitter control module processes the process-variable value and converts it into a certain frequency of the switching signal. This encoded switching signal drives the high-speed LED driver, which controls the switching of LED lights to create the optical signal transmitted to the corresponding optical access points (OAPs).

Step 2: The light-sensitivity sensor of the OAP, senses the flickering or change in intensity modulation or on-off frequency of LED lights and converts the optical signal from the field optical transmitter into a corresponding electrical signal. Then the output of the light-sensitive sensor is sent to a signal processing and amplification module.

Step 3: The signal-filtering, -processing and -amplification module receive the output electrical signal from the light-sensitive sensor module for filtration, amplification, analysis and processing. Then the amplified signal is sent to the Ethernet media conversion module.

Step 4: The Ethernet media conversion module is used to facilitate the amplified electrical media conversion into a fiberoptic-compatible optical signal, or light signal. Then this optical signal is sent to the control room/local substation via redundant fiberoptic cable (Figure 2).

Step 5: The fiberoptic cable (FOC) connects the field optical access point (OAP) to the LER communication control switch network. The ICS communication cabinet consists of multiple control switches, which convert the received optical signal from a field optical access point into the corresponding Ethernet-compatible electrical signal.

Step 6: The ICS communication cabinet is connected to the DCS via redundant Ethernet cable—copper, twisted pair, Cat. 5—or RJ45 or 8P8C connector. The DCS receives the electrical signal from the field instrument for processing and sends the field process-variable information to the display module. The display module presents the process-variable information to the engineering workstation (EWS) or operator workstation (OWS) for further action.

Step 7: After analysis of the process-value information from the field optical instrument, the appropriate control action signal is generated by the DCS to control the process in the plant. The control signal is sent to the ICS communication cabinet via Ethernet cable.

Step 8: The ICS communication cabinet contains multiple control network switches to facilitate the media conversion from Ethernet to fiberoptic-compatible. The fiberoptic cable carrying the corresponding control signal in the form of an optical beam, or light beam, is sent to the field optical access point followed by fiberoptic/Ethernet media conversion.

Step 9: The received control signal from the DCS to the fiberoptic/Ethernet media conversion, located in the field and/or module, converts the optical signal media into an Ethernet-compatible corresponding electrical signal. This electrical signal carries control-action information to the OAP.

Step 10: The OAP receives the control signal from the DCS located in the LCR/SUB via redundant fiberoptic/Ethernet cable. This electrical signal is further encoded in a certain frequency of the switching signal. This switching signal is further sent to the high-speed LED light driver.

Step 11: The high-speed LED light driver regulates the intensity modulation of the LED lights, which is not observed by human eye, as per the received encoded switching signal. The optical access point emits the control signal in the form of an optical signal, which is further received by the control device, such as a valve.

Step 12: The received optical signal carries action information of the final control element and is further converted into an electrical or pneumatic or hydraulic signal to control the process.

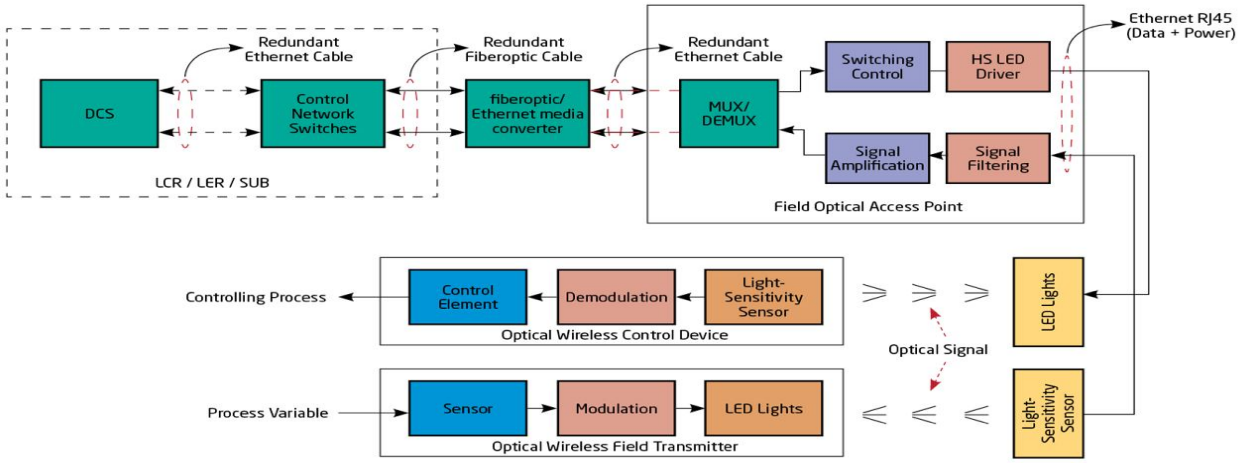

Figure 3.1: Li-Fi Implementation

IV. APPLICATIONS OF LI-FI

With a wide use of data transmission thesedays, Li-Fi has proved to be moreadvantageous than the present daytechnology of Wi-Fi. There are many fieldswhere Wi-Fi and many technologies havefailed but Li-Fi has proved its excellence.

Li-Fi can be used in sensitive areas such as aircraft for data transmission without causing interference, place where it is difficult to lay optical fiber such as operation theaters, traffic scenario, thereby reducing accidents, under water applications where radio wave cannot propagate, industry like petrochemical pants, nuclear plant and petrol pump.

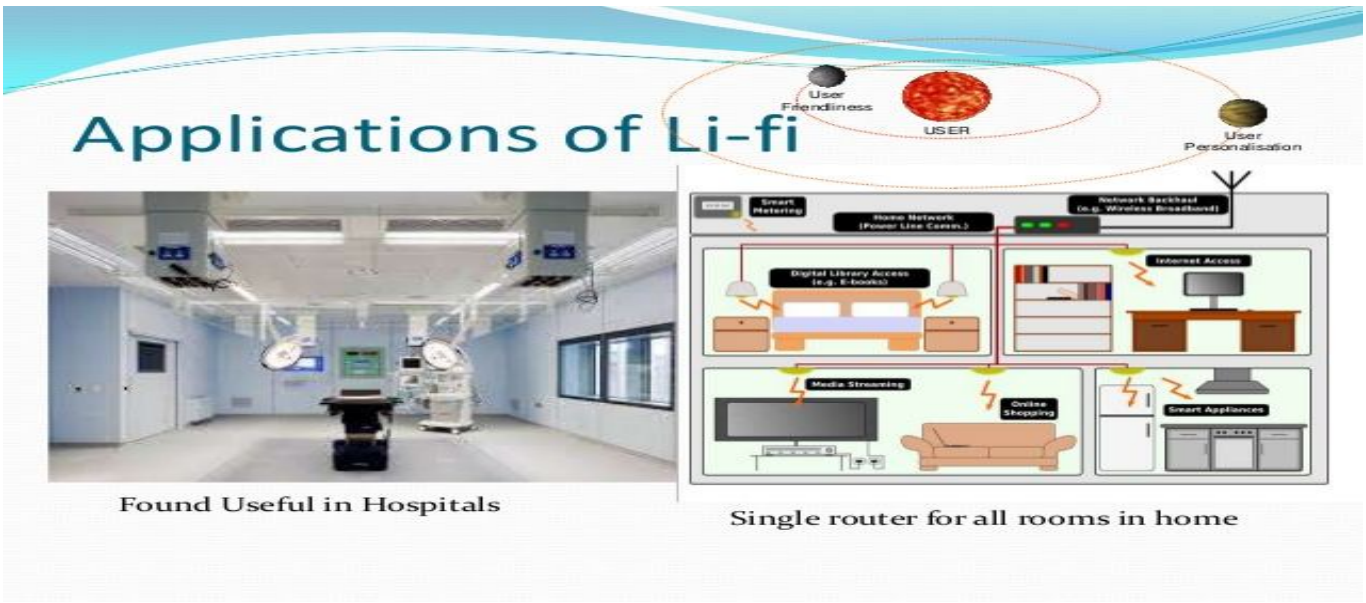

Figure 4.1: Applications of Li-Fi

V. COMPRESSIONS OF TECHNOLOGY FOR DATA TRANSMISSION

We know that Li-Fi is the short form of Light Fidelity and Wi-Fi is the short form of Wireless Fidelity. Li-Fi uses light for data transmission while Wi-Fi uses electro-magnetic waves at radio frequencies for data transmission. Due to less interference incurred by light compare to radio frequency waves, it is used in more dense environments. In below tables we have explained differences between wired and wireless technology with the help of parameters.

Table 1.1 Compression between Wired, Wireless technology

Technology	Speed	Data Density
Wired		
Firewire	800 Mbps	*****
USB 3.0	5 Gbps	*****
Thunderbold	2*10 Gbps	*****
Wireless (Current)		
Wi-Fi- IEEE (802.11N)	150 Mbps	*
Bluetooth	3 Mbps	*
Irda	4 Mbps	***
Wireless (Future)		
Wi-Gig	2 Gbps	**
Giga	1 Gbps	***
Li-Fi	>10 Gbps	****

Table 1.2: Compression between Li-Fi and Wi-Fi

S. No.	Parameters	Wireless Technologies	
		Light Fidelity	Wireless Fidelity
1.	Speed for data transfer	Faster transfer speed (>1 Gbps)	Data Transfer speed (150 Mbps)
2.	Medium through which data transfers occurs	Used Light as a carrier	Used Radio spectrum
3.	Spectrum Range	Visible light spectrum has 10,000 time broad spectrum in comparison to radio frequency	Radio frequency spectrum range is less than visible light spectrum.
4.	Cost	Cheaper than Wi-Fi because free band doesn't need license and it uses light.	Expensive in comparison to Li-Fi because its uses radio spectrum.
5.	Network topology	Point to point	Point to point
6.	Operating frequency	Hundreds of Tera Hz	2.4 GHz

VI. CONCLUSION

In this paper, I have explained survey on Light Fidelity technology. We are using Li-Fi technology for fast transmission of data through light, because data transmission through light is more secure and powerful. Li-Fi is fast growing technology in current era.This survey also provide compression between all wired and wireless technology with the help of different parameters.. Li-Fi has provided a step forward invention in the world of growing hunger communication, this is safe to all biodiversity including humans and progressing towards a greener, cheaper and brighter future of technologies.

References

[1].22) Dr. Y.P.Singh,"Critical Technical Aspect and Extensive Research Study of the Light Fidelity"International Journal of IT, Engineering and Applied Sciences Research(IJIEASR),Volume 2, No. 9, September 2013
[2]. M. Thanigavel "Li-fi Technology in Wireless Communication", International Journal of Engineering Research &Technology(IJERT),ISSN: 2278-0181,Vol. 2 Issue 10, October-2013
[3]. http://recombu.com/digital/news/china-lifi-kits-150mbps-broadband-speeds-over-led-bulbs_M12309.html
[4]. http://seminarprojects.com/Thread-ieee-paper-on-5g-technology
[5]. http://seminarprojects.com/Thread-report-on-li-fi-technology
[6]. http://www.technewspaper.net/best-five-benefits-of-li-fi-technology/
[7]. http://www.youtube.com/watch?v=gjqSgsKbagQ
[8]. http://lificenter.net/solutions/lifi-solutions
[9]. http://lighting.com/led-lights-lifi/
[10]. http://www.dvice.com/archives/2012/08/lifi_ten_ways_i.php
[12]. http://en.wikipedia.org/wiki/Li-Fi
[13]. www.macmillandictionary.com/buzzword/entries/Li-Fi.html
[14]. http://www.digplanet.com/wiki/Li-Fi
[15]. http://www.scribd.com/doc/163399643/Researchpaper-Li-Fi-Light-Fidelity-LED-Based-Alternative