140930,140935_WIRELESS COMMUNICATION AND LI-FI TECHNOLOGY (The future Li-Fi Technology)

N.Dhivyabharathi , J.Sanju Sneha Priya (UG students),
Adithya Institute Of Technology

Abstract:

Now a days with the advent of technology**,** LI-FI describes transmission of "data through illumination" taking the fiber out of fiber optic by sending data through an LED light bulb that varies in intensity faster than the human eye can follow. It's the same idea band behind infrared remote controls but far more powerful. One germen physist **.** Harald Haas says his invention, which he calls D-LIGHT, can produce data rates faster than 10 megabits per second, which is speedier than your average broadband connection. He envisions a future where data for laptops, smart phones, and tablets is transmitted through the light in a room. And security would be snap – if you can't see the light, you can't access the data. Present paper reflects the Future of Communication (LI-FI) which may affect all lives. It a technology that may be as fast as 500MBPS (30GBPS per minute) an alternative, cost effective and more robust and useful than Wi-Fi. The Visible light communication which may be the future of Internet.

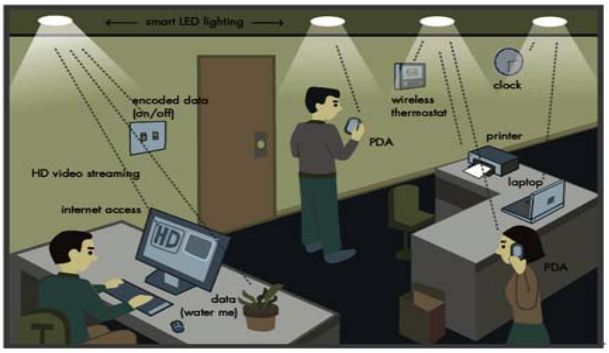
Keyword:

Wi-Fi, Li-Fi, VLC, Visible light communication, MBPS, VLC transmitter, photo detector, amplification and processing, data utilization, server, lamp driver, LED based headlights, LED based backlights, penetrate through wall(LED),D-Light.

Introduction:

It was observed that the data can be transmitted through LED light. If there will be an LED, there will be data. "Data illumination" . Through this technique has taken the optical part of fiber optics and sending data through light bulbs [1]. It was called D-light, can produce data rates faster than 10 megabits per second which is speedier than your average broadband connection. Li-Fi is transmission of data through illumination by taking the fiber out of fiber optics by sending data through a LED light bulb that varies in intensity faster than the human eye can follow .Li-Fi is the term some have used to label the fast and cheap wireless-communication system, which is the optical version of Wi-Fi. The term was first used in this context by Harald Haas in his TED Global talk on Visible Light Communication. "At the heart of this technology is a new generation of high brightness light-emitting diodes", says Harald Haas from the University of Edinburgh, UK," Very simply, if the LED is on, you transmit a digital 1, if it's off you transmit a 0,"Haas says, "They can be switched on and off very quickly, which gives nice opportunities for transmitted data."It is possible to encode data in the light by varying the rate at which the LEDs flicker on and off to give different strings of 1s and 0s.The LED intensity is modulated so rapidly that human eye cannot notice, so the output appears constant. More sophisticated techniques could dramatically increase VLC data rate. Other group are using mixtures of red, green and blue LEDs to alter the light frequency encoding a different data channel. Li-Fi, as it has been dubbed, has already. In October 2011 a number of companies and industry groups formed the Li-Fi Consortium, to promote high-speed optical wireless systems and to overcome the limited amount of radio based wireless spectrum available by exploiting a completely different part of the electromagnetic spectrum. The consortium believes it is possible to achieve more than 10 Gbps, theoretically allowing a high-definition film to be downloaded in 30 seconds. He envisions a future where data for laptops, smart phones, and tablets is transmitted through the light in a room. So in a near future you will see that the street lamps are transmitting data, the headlights of car will be also able to transmit data.

About Li-Fi Technology:
Will Li-Fi be the new Wi-Fi?
This brilliant idea was first showcased by Harald Haas from
University of Edinburgh, UK, in his TED Global talk on VLC.

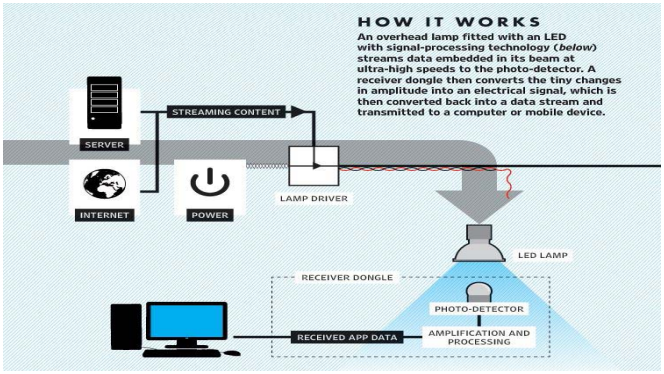


He explained," Very simple, if the LED is on, you transmit a digital 1, if it's off you transmit a 0. The LEDs can be switched on and off very quickly, which gives nice opportunities for transmitting data." So what you require at all are some LEDs and a controller that code data into those LEDs. We have to just vary the rate at which the LED's flicker depending upon the data we want to encode. Further enhancements can be made in this method, like using an array of LEDs for parallel data transmission, or using mixtures of red, green and

blue LEDs to alter the light's frequency with each frequency encoding a different data channel. Such advancements promise a theoretical speed of 10 Gbps – meaning you can download a full high-definition film in just 30 seconds. Simply awesome! But blazingly fast data rates and depleting bandwidths worldwide are not the only reasons that give this technology an upper hand. Since Li-Fi uses just the light, it can be used safely in aircrafts and hospitals that are prone to interference from radio waves. This can even work underwater where Wi-Fi fails completely, thereby throwing
open endless opportunities for military operations. Imagine only needing to hover under a street lamp to get public internet access, or downloading a movie from the lamp on your desk. There's a new technology on the block which could, quite literally as well as metaphorically, 'throw light on' how to meet the ever-increasing demand for high-speed wireless connectivity. Radio waves are replaced by light waves in a new method of data transmission which is being called Li-Fi .Light-emitting diodes can be switched on and off faster than the human eye can detect, causing the light source to appear to be on continuously. A flickering light can be incredibly annoying, but has turned out to have its upside, being precisely what makes it possible to use light for wireless data transmission. Light-emitting diodes (commonly referred to as LEDs and found in traffic and street lights, car brake lights , remote control units and countless other applications) can be switched on and off faster than the human eye can detect , causing the light source to appear to be on continuously , even though it is in fact 'flickering'. This invisible on-off activity enables a kind of data transmission using binary codes: switching on an LED is a logical '1',switching it off is a logical '0'. Information can therefore be encoded in the light by varying the rate at which the LEDs flicker on and off to give different strings of 1s and 0s. This method of using rapid pulses of light to transmit information wirelessly is technically referred to as Visible Light Communication (VLC), though it's potential to complete with conventional Wi-Fi has inspired the popular characterization Li-Fi. Li-Fi-technology has higher potential, it is very much possible to transmit the data via light by changing the flicker rate that provide different strings of 1 and 0, and its intensity is modulated so quickly that the human eyes cannot notice. There are around 19 billion light emits worldwide. Which in turns may be replaced by LED, i.e. potential source of transmitting data? "At the heart of this technology is a new generation of high brightness (LED) light emitting diodes," says Herald Hass, from the University of Edinburg, U.K. Very simply, if the LED is on, you transmit a digital 1 if it's off, you transmit a 0, "They can be switched on and off very quickly, which gives nice opportunities for connectivity and transfer the data very quickly, efficiently and accurate without any external hindrances.

How it works?

- **Visible light communication (VLC)-"A potential solution to the global wireless spectrum shortage":**
- **Data transmission using LI-FI**



As WI-FI hotspot and cloud computing are rapidly increasing reliable signal is bound to suffer. Speed and security are also major concerns. They are vulnerable to hackers as it penetrates through walls easily. LI-FI is said to overcome this. This new technology is comparable to infrared remote controls which send data through an LED light bulb that varies in intensity faster than the human eye can see. In near future we can see data for laptops, smart phones and tablets transmitted through the light in a room.

Li-Fi (Light Fidelity) is a fast and cheap optical version of Wi-Fi, the technology of which is based on Visible Light Communication (VLC).VLC is a data communication medium, which uses visible light between 400 THz (780 nm) and 800 THz (375 nm) as optical carrier for data transmission and illumination. It uses fast pulses of light to transmit information wirelessly. The main component of this communication system is a high brightness white LED, Which acts as a communication source and a silicon photodiode which shows good response to visible wavelength region serving as the receiving element? LED can be switched on and off to generate digital strings of 1s and 0s. Data can be encoded in the light to generate a new data stream by varying the flickering rate of the LED. To be clearer, by modulating the LED light with the data signal, the LED illumination can be used as a communication source. As the flickering rate is so fast, the LED output appears constant to the human eye. A data rate of greater than 100 Mbps is possible by using high speed LEDs with appropriate multiplexing techniques. VLC data rate can be increased by parallel data transmission using LED arrays where each LED transmits a different data stream. There are reasons to prefer LED as the light source in VLC while a lot of other illumination devices like fluorescent lamp, incandescent bulb etc. are available .

LI-FI technology uses semiconductor device LED light bulb that rapidly develops binary signals which can be manipulated to send data by tiny changes in amplitude. Using this innovative technology 10000 to 20000 bits per second of data can be transmitted simultaneously in parallel using a unique signal processing technology and special modulation.

Parameter	Li-Fi	Wi-Fi
Speed	***	***
Range	*	**
Data density	***	*
Security	***	**
Reliability	**	**
Power available	***	*
Transmit/receive power	***	**
Ecological impact	*	**
Device-to-device connectivity	***	***
Obstacle interference	***	*
Bill of materials	***	**
Market maturity	*	***

Comparision Between Li-Fi & Wi-Fi:

LI-FI is a term of one used to describe visible light communication technology applied to high speed wireless communication. It acquired this name due to the similarity to WI-FI, only using light instead of radio. WI-FI is great for general wireless coverage within buildings and LI-FI is ideal for high density wireless data coverage in confined area and for relieving radio interference issues, so the two technologies can be considered complimentary.

TECHNOLOGY	SPEED	DATA DENSITY
WIRED		
Fire Wire	200 Mbps	*****
USB 3.0	5 Gbps	*****
ThunderBolt	2 x 10 Gbps	*****
WIRELESS(current)		
Wi-Fi-IEEE(802,11N)	150 Mbps	*
BlueTooth	3 Mbps	*
IrDA	4 Mbps	***
WIRELESS(future)		
WiGig	2 Gbps	**
Giga-IR	1 Gbps	***
Li-Fi	>10 Gbps	****

Table : Comparison between current and future wireless technology.
Li-Fi & Wi-Fi comparison

Note: low(*) ,medium(**),high(***)

Applications of Li-Fi&
Its advantages over Wi-Fi:
1.High speed, as high as 500mbps or 30GB per minute.
2. Li- Fi uses light rather than radio frequency signals.
3. VLC could be used safely in aircraft.
4. Integrated into medical devices and in hospitals as this technology does not deal with radio waves, so it can easily be used in such places where Bluetooth, infrared, Wi-Fi and internet are banned. In this way, it will be most helpful transferring medium for us.
5. Under water in sea Wi-Fi does not work at.
6. There are around 19 billion bulbs worldwide, they just need to be replaced with LED ones that transmit data. We reckon VLC is at a factor of ten, cheaper than WI-FI.
7. Security is another benefit, he points out, since light does not penetrate through walls.
8. In streets for traffic control. Cars have LED based headlights, LED based backlights, and Car can communicate each other and prevent accidents in the way that they exchange Information. Traffic light can communicate to the car and so on.
9. By implementing the Technology worldwide every street lamp would be a free access point.
10. Li-Fi may solve issues such as the shortage of radio frequency bandwidth.

Uses:

1.**WiFi Spectrum Relief** - Providing additional bandwidth in environments where licensed and/or unlicensed communication bands are congested.
2.**Smart Home Network** – Enabling smart domestic/industrial lighting; home wireless communication including media streaming and internet access
3.**Commercial Aviation** – Enabling wireless data communications such as in-flight entertainment and personal communications
4.**Hazardous Environments**- Enabling data communications in environments where RF is potentially dangerous, such as oil & gas, petrochemicals and mining
5.**Hospital and Healthcare** – Enabling mobility and data communications in hospitals
6.**Defence and Military Applications** – Enabling high data rate wireless communication within military vehicles and aircraft
7.**Corporate and Organisational Security** – Enabling the use of wireless networks in applications where (WiFi) presents a security risk
8.**Underwater Communications** – Enabling communications between divers and/or remote operated vehicles

9.**Location-Based Services** – Enabling navigation and tracking inside buildings.

Conclusion:

The possibilities are numerous and can be explored further. If his technology can be put into practical use, every bulb can be used something like a Wi-Fi hotspot to transmit wireless data and we will proceed toward the cleaner, greener, safer and brighter future. The concept of Li-Fi is currently attracting a great deal of interest, not least because it may offer a genuine and very efficient alternative to radio-based wireless. As a growing number of people and their many devices access wireless internet, the airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, high-speed signal. This may solve issues such as the shortage of radio-frequency bandwidth and also allow internet where traditional radio based wireless isn't allowed such as aircraft or hospitals. One of the shortcomings however is that it only work in direct line of sight.