INTELLIGENCE WITH LI-FI TECHNOLOGY

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ABSTRACT

Whether you are using wireless internet in a coffee shop, stealing it from the person next door, or competing for bandwidth at a conference, you have probably gotten frustrated at the slow speeds you face when more than one device tapped into the network. As more and more people and their many devices access wireless internet, clogged airwaves are going to make it. Very Humbly we say that we come up with a solution called "data through illumination" –taking the fibber out of fiber optic by sending data through an LED light bulb that varies in intensity faster than the human eye can follow. It is the same idea band behind infrared remote controls but far more powerful. With this invention, which we call "D-LIGHT", can produce data rates faster than 10 megabits per second, which is speedier than your average broadband connection. We envision a future where data for laptops, smart phones, and tablets transmitted through the light in a room. Moreover, security would be snap – if you cannot see the light, you cannot access the data.

KEYWORDS: *LED (Light emitted diode), Wi-Fi, VLC*

I. INTRODUCTION

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. With concern to the Visible Light Communication, I would like to say that at the heart of this technology is a new generation of high brightness light-emitting diodes 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 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 ones and zeroes. The LED intensity modulated rapidly that human eye cannot notice, so the output appears constant. More techniques that are complex could dramatically increase VLC data rate. We are focusing on parallel data transmission using array of LEDs, where each LED transmits a different data stream. Other developers 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 achieved blisteringly high speed in the lab. I have reached data rates of over 500 megabytes per second using a standard white-light LED. To exchange data using light of varying intensity given off from their screens, detectable at a distance of up to ten meters.

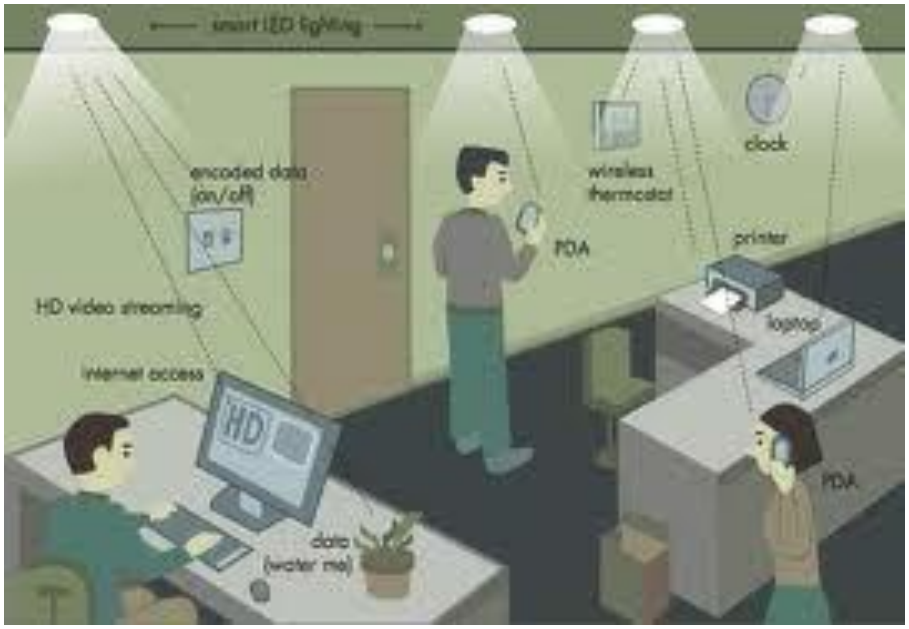


Figure (1): Li-Fi environment

II. WORKING TECHNOLOGY

I explained," Very simple, if the LED is on, you transmit a digital one; if it is off you transmit a zero. The LEDs can be switched on and off very quickly, which gives nice opportunities for transmitting data." Therefore, 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. 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 is 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 one and zero. This method of using rapid pulses of light to transmit information wirelessly is technically referred to as Visible Light Communication (VLC), though it is potential to compete with conventional Wi-Fi has inspired the popular characterization Li-Fi.

2.1 Visible light communication (VLC)-"A potential solution to the global wireless spectrum shortage"

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 components of this communication system are 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 ones and zeroes. 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 many other illumination devices, as fluorescent lamp, incandescent bulbs etc. are available.

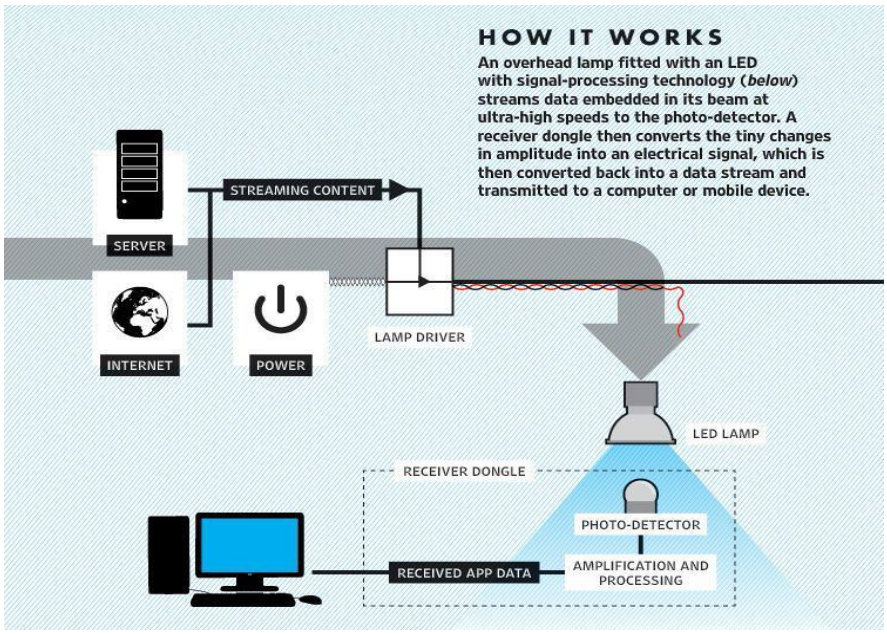


Figure 2. Data Transmission using LED

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 amplitud.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.

2.2 Some Aspects of Li-Fi

The light used to transmit the data is called D- light by the inventor of Li-Fi. In future data for laptops, Smartphone's and tablets can be transmitted through the light in a room by using Li-Fi. Security would be a snap- if you can't see the light, you can't access the data

2.3 Brightness of Li-Fi Source

The Li-Fi source has very high lumen intensity. In other words, a single source, only a few millimeters in size can produce 2300 lumens of brilliant white light. At this level of output, you will only need to use one light source per street light in most cases. This makes the mechanical and optical implementation of light much simpler and less expensive

2.4 Li-Fi Technology at a Glance

- The LED bulb will hold a microchip that will do the job of processing the data. The light intensity can be manipulated to send data by tiny changes in amplitude.

- This technology uses visible spectrum of light, a part of the electromagnetic spectrum that is still not greatly utilized.
- In fact the technology transfers thousands of streams of data simultaneously, in parallel, in higher speed with the help of special modulation using unique signal processing technology

2.5 Technology Demonstration

- It was demonstrated that table lamp that successfully transmit data at speed exceeding 10 Mbps using light waves from LED light to a computer located below the lamp.
- To prove that the light bulb was the source of the data stream, he periodically blocked the light beam, causing the connection to drop

III. COMPARISON BETWEEN LI-FI AND 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.

Table 1. Comparison between current and future wireless technology

TECHNOLOGY	SPEED	DATA DENSITY
Wireless (current)		
Wi-Fi – IEEE 802.11n	150 Mbps	*
Bluetooth	3 Mbps	*
IrDA0	4 Mbps	* * *
Wireless (Future)		
WiGig	2 Gbps	* *
Giga-IR	1 Gbps	* * *
Li-Fi	>10 Gbps	* * *

The table also contains the current wireless technologies that can be used for transferring data between devices today, i.e. Wi-Fi, Bluetooth and IrDA. Only Wi-Fi currently offers very high data rates. The IEEE 802.11.n in most implementations provides up to 150Mbit/s (in theory the standard can go t 600Mbit/s) although in practice you receive considerably less than this. Note that one out of three of these is an optical technology.

IV. HOW IT IS DIFFERENT

Li-Fi technology is based on LEDs for the transfer of data. The transfer of the data can be with the help of all kinds of light, no matter the part of the spectrum that they belong. That is, the light can belong to the invisible, ultraviolet or the visible part of the spectrum. Also, the speed of the internet is incredibly high and you can download movies, games, music etc in just a few minutes with the help of this technology. Also, the technology removes limitations that have been put on the user by the Wi-Fi. You no more need to be in a region that is Wi-Fi enabled to have access to the internet. You can simply stand under any form of light and surf the internet as the connection is made in case of any light presence. There cannot be anything better than this technology.

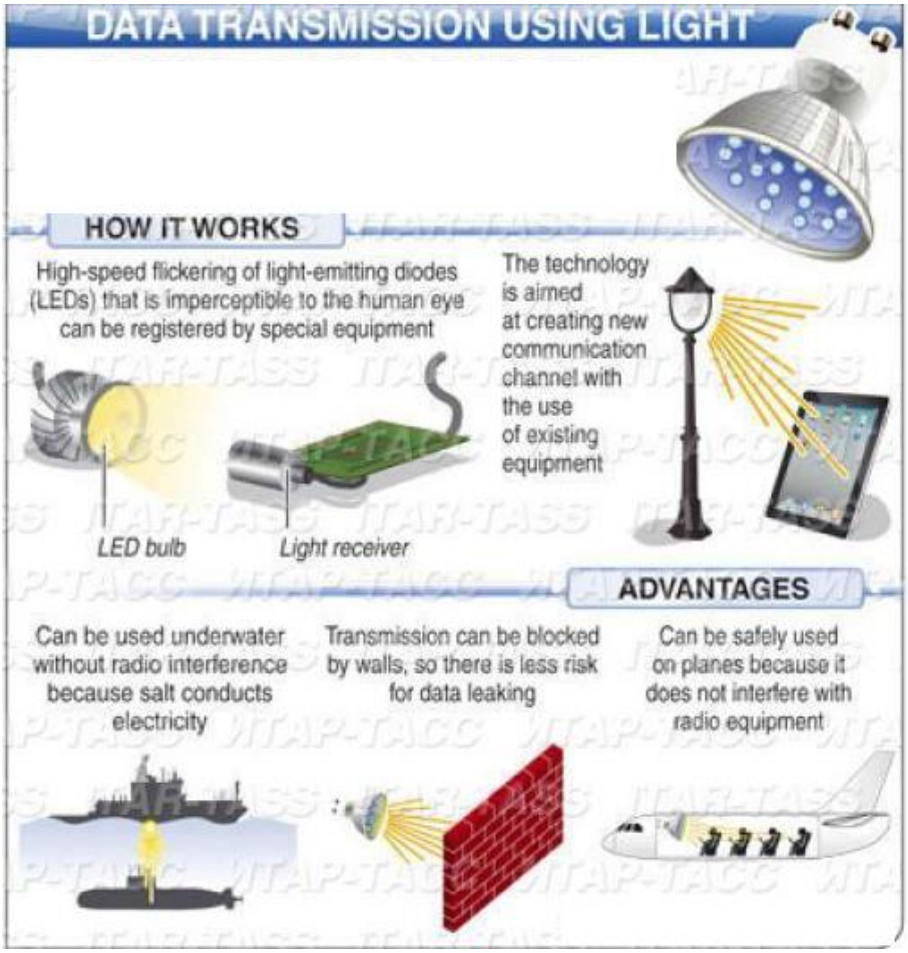


Figure 3. Working and advantages.

V. APPLICATIONS OF LI-FI

1. You might live longer

For a long time, medical technology has lagged behind the rest of the wireless world. Operating rooms do not allow Wi-Fi over radiation concerns, and there is that whole lack of dedicated spectrum. While Wi-Fi is in place in many hospitals, interference from cell phones and computers can block signals from monitoring equipment. Li-Fi solves both problems: lights are not only allowed in operating rooms, but tend to be the most glaring (pun intended) fixtures in the room.

2. Airlines

Airline Wi-Fi. Nothing says captive audience like having to pay for the "service" of dial-up speed Wi-Fi on the plane. The best I have heard so far is that passengers will be offered a "high-speed like" connection on some airlines. United is planning on speeds as high as 9.8 Mbps per plane. Li-Fi could easily introduce that sort of speed to each seat's reading light.

3. Smarter power plants

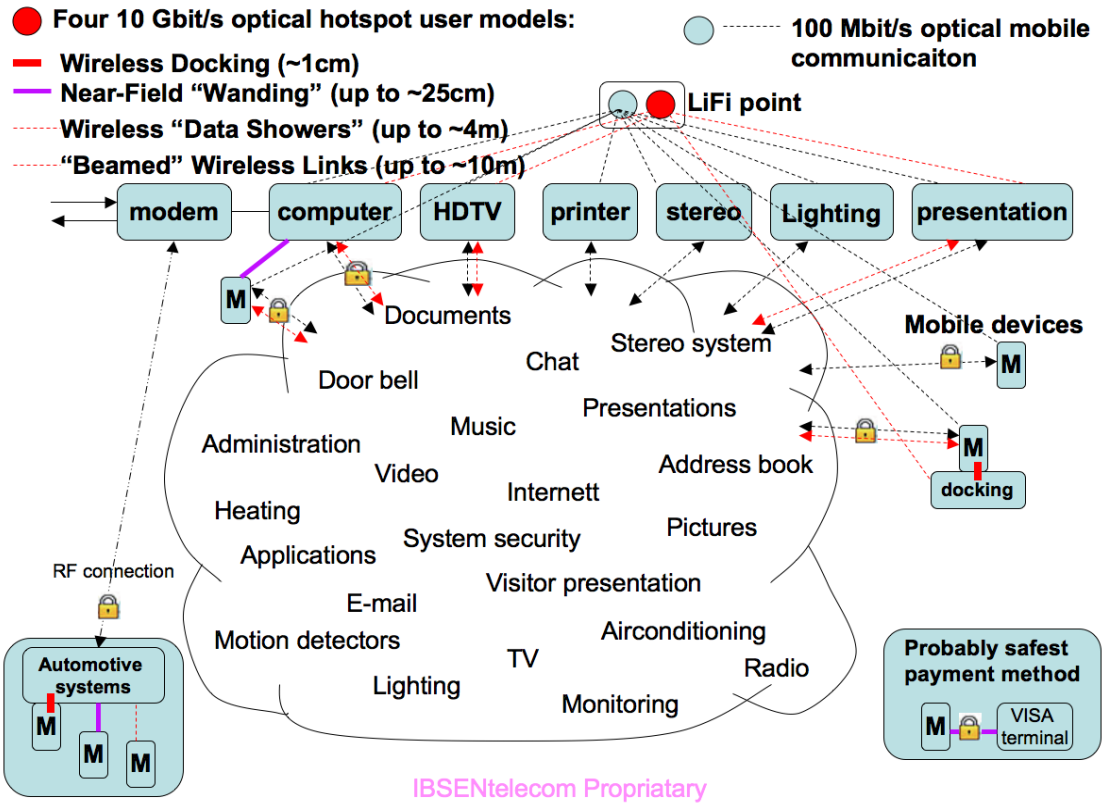
Wi-Fi and many other radiation types are bad for sensitive areas. Like those surrounding power plants. However, power plants need fast, inter- connected data systems to monitor things like demand, grid integrity and (in nuclear plants) core temperature. The savings from proper monitoring at a single power plant can add up to hundreds of thousands of dollars. Li-Fi could offer safe, abundant connectivity for all areas of these sensitive locations. Not only would this save money related to currently implemented solutions, but also the draw on a power plant’s own reserves could be lessened if they have not yet converted to LED lighting.

4. Undersea Explorations

Underwater ROVs work great, except when the tether is not long enough to explore an area, or when it is stuck on something. If their wires were cut and replaced with light — say from a submerged, high-powered lamp — then they would be much freer to explore. They could also use their headlamps to communicate with each other, processing data autonomously and referring findings periodically back to the surface, all the while obtaining their next batch of orders.

5. Future Uses in various areas

Can be used in the places where it is difficult to lay the optical fiber like hospitals. In operation theatre, Li-Fi can be used for modern medical instruments. In traffic, signals Li-Fi can be used which will communicate with the LED lights of the cars and accident numbers can be decreased. Thousand and millions of street lamps can be transferred to Li -Fi lamps to transfer data. In aircraft, Li-Fi can be used for data transmission. It can be used in petroleum.



6. GigaSpeed Technology

The Li-Fi Consortium offers the fastest wireless data transfer technology available. Our current solutions cover effective transmission rates of up to 10 Gbit/s, allowing a 2 hour HDTV film to be transferred within less than 30 seconds. Smaller files are transferred instantly. This high speed technology can be extended to several 100 Gbit/s in later versions

VI. 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

Glossary

Li-Fi	Light Fidelity
Wi-Fi	Wireless Fidelity
VLC	Visible Light Communication
LED	Light Emitting Diode

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