A REVIEW on LI-FI

(LIGHT-FEDILITY)

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Abstract:

This paper attempts to clarify the difference between visible light communication (VLC) and light-fidelity (Li-Fi). In particular, it will show how Li-Fi takes VLC further by using light emitting diodes (LEDs) to realize .This paper attempts to clarify the difference between visible light communication (VLC) and light-fidelity (Li-Fi). In particularly networked wireless systems. Synergies are harnessed as luminaries become Li-Fi auto cells resulting in enhanced wireless capacity providing the necessary connectivity to realize the Internet-of-Things, and contributing to the key performance indicators for the fifth generation of cellular systems (5G) and beyond. It covers all of the key research areas from Li-Fi components to hybrid Li-Fi/wireless fidelity (Wi-Fi) networks to illustrate that Li-Fi auto cells are not a theoretical concept any more, but at the point of real-world deployment.

1. INTODUCTION

This OWC technology uses light from light-emitting diodes (LEDs) as a medium to

deliver networked, mobile, high-speed communication in a similar manner to Wi-Fi. The Li-Fi market is projected to have

a compound annual growth rate of 82% from 2013 to 2018 and to be worth over $6 billion per year by 2018.

Visible light communications (VLC) works by switching the current to the LEDs off and on at a very high rate, too quick to be noticed by the human eye. Although Li-Fi LEDs would have to be kept on to transmit data, they could be dimmed to below human visibility while still emitting enough light to

carry data. The light waves cannot penetrate walls which makes a much shorter range, though more secure from hacking, relative to Wi-Fi. Direct line of sight is not necessary for Li-Fi to transmit a signal; light reflected off the walls can achieve 70 Mbit/s.

Li-Fi has the advantage of being useful in electromagnetic sensitive areas such as in aircraft cabins, hospitals and nuclear power plants without causing electromagnetic interference. Both Wi-Fi and Li-Fi transmit data over the electromagnetic spectrum, but whereas Wi-Fi utilizes radio waves, Li-Fi uses visible light. While the US Federal Communications Commission has warned of a potential spectrum crisis because Wi-Fi is close to full capacity, Li-Fi has almost no limitations on capacity. The visible light spectrum is 10,000 times larger than the

entire radio frequency spectrum. Researchers have reached data rates of over 224 G bit/s, which is much faster than typical fast broadband in 2013. Li-Fi is expected to be ten times cheaper than Wi-Fi. Short range, low reliability and high installation costs are the potential downsides.

PureLiFi demonstrated the first commercially available Li-Fi system, the Li-1st, at the 2014 Mobile World Congress in Barcelona.

Bg-Fi is a Li-Fi system consisting of an application for a mobile device, and a simple consumer product, like an IOT (Internet of Things) device, with color sensor, microcontroller, and embedded software. Light from the mobile device display communicates to the color sensor on the consumer product, which converts the light into digital information. Light emitting diodes enable the consumer product to communicate synchronously with the mobile device.
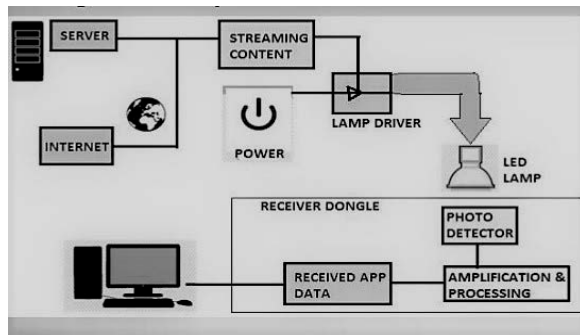

FIG: Shows working of the lifi

2. STANDARD

Like Wi-Fi, Li-Fi is wireless and uses similar 802.11 protocols; but it uses visible light communication (instead of radio frequency waves), which has much wider bandwidth.

One part of VLC is modeled after communication protocols established by the IEEE 802 workgroup. However, the IEEE 802.15.7 standard is out-of-date, it fails to consider the latest technological developments in the field of optical wireless communications, specifically with the introduction of optical orthogonal frequency-division multiplexing (O-OFDM) modulation methods which have been optimized for data rates, multiple-access and energy efficiency. The introduction of O-OFDM means that a new drive for standardization of optical wireless communications is required.

Nonetheless, the IEEE 802.15.7 standard defines the physical layer (PHY) and media access control (MAC) layer. The standard is able to deliver enough data rates to transmit audio, video and multimedia services. It takes into account optical transmission mobility, its compatibility with artificial lighting present in infrastructures, and the interference which may be generated by ambient lighting. The MAC layer permits using the link with the other layers as with the TCP/IP protocol. [citation needed]

The standard defines three PHY layers with different rates:

The PHY 1 was established for outdoor application and works from 11.67 kbit/s to 267.6 kbit/s.

The PHY 2 layer permits reaching data rates from 1.25 Mbit/s to 96 Mbit/s.

The PHY 3 is used for many emissions sources with a particular modulation method called color shift keying (CSK). PHY III can deliver rates from 12 Mbit/s to 96 Mbit/s.

The modulation formats recognized for PHY I and PHY II are on-off keying (OOK) and variable pulse position modulation (VPPM). The Manchester coding used for the PHY I

and PHY II layers includes the clock inside the transmitted data by representing a logic 0 with an OOK symbol "01" and a logic 1 with an OOK symbol "10", all with a DC component. The DC component avoids light extinction in case of an extended run of logic 0's. [citation needed]

The first VLC smartphone prototype was presented at the Consumer Electronics Show in Las Vegas from January 7–10 in 2014. The phone uses SunPartner's Wysips CONNECT, a technique that converts light waves into usable energy, making the phone capable of receiving and decoding signals without drawing on its battery.A clear thin layer of crystal glass can be added to small screens like watches and smartphones that make them solar powered. Smartphones could gain 15% more battery life during a typical day. The first smartphones using this technology should arrive in 2015. This screen can also receive VLC signals as well as the smartphone camera. The cost of these screens per smartphone is between $2 and $3, much cheaper than most new technology.

Philips lighting company has developed a VLC system for shoppers at stores. They have to download an app on their smartphone and then their smartphone works with the LEDs in the store. The LEDs can pinpoint where they are located in the store and give them corresponding coupons and information based on which aisle they are on and what they are looking at.

3. HOME & BUILDING AUTOMATION

It is predicted that future home & building automation will be highly dependent on the Li-Fi technology for being secure & fast. As the light cannot penetrate through walls hence the signal cannot be hacked from a remote location.

4. WORKING
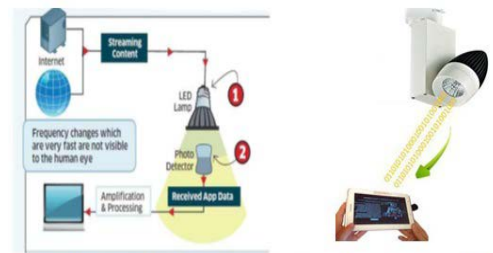
First fig shows the binary data are captured by few light receptors are required, and are installed on all types of connected devices, from computers to tablets, to phones, televisions or appliances. Matter experts make clear that the light pulses are imperceptible to the human eye, without causing damage or discomfort of any kind. In addition, any lamp or flashlight can become a First fig 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

flashlight can become a hotspot. How Li-fi works is simple: You have a light on one end (an LED), and a photodetector (light sensor) on the other. If the LED is

hotspot. How Li-fi works is simple: You have a light on one end (an LED), and a photodetector (light sensor) on the other. If the LED is ON, the photo detector registers a binary one; otherwise it's a binary zero. Flash, and very soon you are dealing with the LED enough times and you build up a message. Use an array of LEDs, and perhaps a few different colors 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.

Shows brief connection of internet with LED and information retrieved on the computer. One LED transfers data at a slower rate, so millions of LEDs with one micron size are installed in the bulb. The reduction of size of LEDs does not decrease its capability to transfer data or intensity on the opposite it increases the efficiency of one light bulb to transmit the data at an unexpectedly higher rates. Furthermore, these micro-LEDs are ultimately just pixels — and at one micron, these LEDs would be a lot smaller than those in your Smartphone's retina display. You could have a huge array of these LEDs that double up as a room's light source and a display— and provides networking capability on the side. Perhaps a next-next-generation console would communicate with your gamepad, Smartphone, and other peripherals via a Li-Fi-equipped TV. It indeed provides a highway lighting that illuminates the road, provides up-to-date traffic info/warnings, and provides internet access to your car, plus all of the devices on-board.

5. Applications

Security:

In contrast to radio frequency waves used by Wi-Fi, lights cannot penetrate through walls and doors. As long as transparent materials like windows are covered, access to a Li-Fi channel is limited to devices inside the room.

Underwater Application:

Most remotely underwater operated vehicles (ROVs) use cables to transmit command, but the length of cables then limits the area ROVs can detect. However, as light wave could travel through water, Li-Fi could be implemented on vehicles to receive and send back signals.

While it is theoretically possible for Li-Fi to be used in underwater applications, its utility is limited by the distance light can penetrate water. Significant amounts of light do not penetrate further than 200 meters. Past 1000 meters, no light penetrates.

Hospital:

Many treatments now involve multiple individuals, Li-Fi system could be a better system to transmit communication about the information of patients. Besides providing a higher speed, light waves also have little effect on medical instruments and human bodies.

Vehicles:

Vehicles could communicate with one another via front and back lights to increase road safety. Also street lamps and traffic signals could also provide information about current road situations.

6. Commercialization

There are many companies around the world developing this technology.

– PureLiFi, is a startup company based in UK. They are developing Li-Fi technology in collaboration with the French company Lucibel.

– VLNComm is a startup company in U.S. It has been funded by the US Department of Energy and National Science Foundation.

– OLEDComm is a French company working on LiFi. It provides products for indoor positioning.

– LightPointe, known for point-to-point gigabit Ethernet Free Space Optics and Hybrid Optical-Radio Bridges, are developing this technology through Firefly Wireless Networks.

– i2cat, located in Barcelona, Spain, is developing location based services.

– ByteLight, which has been quired by the LED manufacturer Acuity Brands

– Nakagawa Lab, Japan

– Basic6

– Velmenni

– Zero1

– Axrtek

Qualcomm, GE, Panasonic, Philips, Samsung, OSRAM are among the larger corporations who are entertaining this technology.

7. Conclusion

Li-Fi will make are lives more technology driven in the near future.

With its magic of light it can make our world a greener, safer, cleaner and moreover a brighter place to live

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