Perspectives in Communication, Embedded-Systems and Signal-Processing (PiCES) – An International Journal
ISSN: 2566-932X, Vol. 2, Issue 7, October 2018
Proceedings of National Conference on Knowledge Discovery in Information Technology and Communication Engineering (KITE 18), May 2018

Visible Spectrum using Optical Communication

Bharath Raj D, Rakesh B S, Avinash N, K. Balakrishnan, Basavaraju S
ISE Dept, Brindavan College of Engineering, Bangalore, India, bharathraj0489@gmail.com

Abstract: ***Li Fi stands for light fidelity. The understanding is very fresh and came to be projected with the resource of the German physicist Harald Haas in 2011 TED (technology, entertainment, design) international speak on visual light communication (VLC). LiFi is a wireless optical networking generation that makes use of light emitting diodes (LEDs) for communication of information The word LiFi refers to visual light communication exchange technology that makes use of light as intermediate to deliver excessive velocity visual exchange in a manner similar to Wi Fi and conform with the IEEE preferred IEEE 802.15.7.Also, the velocity of the internet is relatively Li-Fi generation is based totally on LEDs for the transfer of statistics. The transfer records can be with the help of all sorts of light, irrespective of the a part of the spectrum that they belong. That is, the light can belong to the invisible, ultraviolet or the visible factor of the spectrum excessive and you may down load movies, games, sound and many others in just a few minutes with the help of this technology .Li Fi offers better bandwidth, performance, connectivity and safety than Wi-Fi and has already finished excessive speeds huge than 1 Gbps beneath the laboratory conditions. The gain is the low-price nature of LEDs and lights gadgets, there are lots of possibilities to make the most this medium. LiFi is the switch of facts through light by way of taking fibre out of fibre optics and sending facts via through LED light bulb.***

Keywords: LED (Light;Emitting;Diode);WiFi (Wireless Fidelity); LiFi (Light Fidelity); VLC (Visible Communication); RF (Radio Frequency)

I. INTRODUCTION

In easy phrases, LiFi can be thought as a light based wi-fi. That is, it uses light instead of radio waves to transmit facts. And alternatively of Wi Fi modems, Li -Fi would use transceiver- equipped LED lamps that can light a room as properly as transmit and get hold of records. Given that simple light bulbs are used, there can technically be any wide variety to get right of entry to points. This technology uses a part of the electromagnetic spectrum that is nevertheless not greatly utilized the visual Spectrum. Light is in truth very a great deal component of our lives for tens of millions and thousands and thousands of years and does not have any most important sick impact. Furthermore there is 10,000 instances greater area to be had in this spectrum and simply counting on the bulbs in use, it additionally multiplies to 10,000 times extra availability as an infrastructure, globally.

II. WORKING OF LI-FI

Li-Fi is generally implemented the use of white LED light bulbs at the downlink transmitter. These gadgets are commonly used for illumination most effective with the aid of making use of a constant modern. But, by using rapid and diffused variations of the modern-day, the optical output can be made to vary at extremely excessive speeds.

This very belongings of optical contemporary is used in Li -Fi setup. The operational manner is very simple, if the LED is on, you transmit a virtual 1, if it's off you transmit a 0. The LEDs can be switched on fast and off, which offers best opportunities for transmitting records. Subsequently all that is required is some LEDs and a controller that code information into the ones LEDs. All one has to do is to vary the price at which the LED's flicker relying upon the records we need to encode .

Similarly upgrades can be made in this approach, like the usage of an array of LEDs for parallel records transmission, or the use of mixtures of red, green and blue LEDs to alter the lighting fixtures frequency with every frequency encoding a wonderful data channel. Such upgrades promise a theoretical speed of 10 Gbps – meaning you may be able to down load a entire excessive-definition film in just 30 seconds.

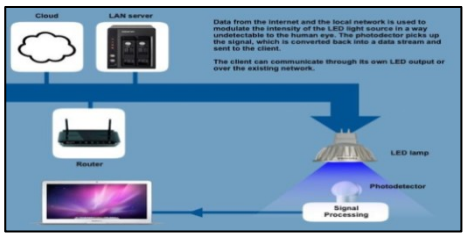

Fig 1. Block diagram of Lifi technology

To in addition get a draw close of Li-Fi recollect an IR faraway. It sends a information move of bits at the charge of 10,000-20,000 bps. Now update the IR LED with a light field containing a large LED array. This gadget, is capable of sending heaps of such streams at very speedy charge.

Light is inherently secure and can be used in places wherein radio frequency conversation is regularly deemed elaborate, as in aircraft cabins or hospitals. So visual light

communication no longer simplest has the capability to remedy the trouble of lack of spectrum space, but can additionally allow original utility. The visible light spectrum is unused, it is now not regulated, and can be used for verbal change at very excessive speeds.

Fig 2. Lifi system connecting devices in a room

Fig 3. LED light Lifi bulb

III. COMPARISON BETWEEN LIFI AND WIFI

Table 1. Differences between Lifi and Wifi

Parameter	Li-Fi	Wi-fi
Spectrum used	Visible light	Radio frequency
Standard	IEEE 802.15.7	IEEE 802.11
Range	<10m	<300m
Data Transfer rate	Very high(~1gbps)	Low(~1gbps)
Power capacity	Low	High
Cost	Low	High
Bandwidth	Unlimited	Limited

IV. FEATURES OF LI-FI

Li-Fi generation is based on LEDs for the transfer of records. The switch records can be with the assist of all varieties of light, no matter the part of the spectrum that they belong. That is, the light can belong to the invisible, ultraviolet or the prospect component of the spectrum. Additionally, the rate of the internet is distinctly high and you can download movies, games, track etc in just a few mins with the help of this generation.

Additionally, the period removes limitations that have been put on the consumer through the wireless. You no greater need to be in a vicinity this is wi-fi enabled to have get access to the internet. You may honestly stand underneath any shape of light and surf the net as the relationship is made in case of any light presence. There cannot be anything higher than this generation?

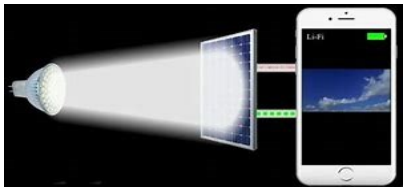

Fig 4. Data transmission in Lifi

V. VISIBLE LIGHT COMMUNICATION

The frequency spectrum that is available to us in the ecosystem is composed of many wave areas like X-rays, gamma rays, u-v rays, infrared rays, visual light rays, radio waves, and so forth. Anyone of the above waves can be used in the upcoming conversation technology but why the visible light element is selected? The motive in the back of this is the easy availability and lesser dangerous outcomes that occur due to those rays of light. VLC(visual light communication) makes use of the visual light among 400 THz (780 nm) and 800 THz (375 nm) as medium which are less dangerous for high- power applications and also human beings can without difficulty understand it and defend themselves from the harmful results while the alternative wave regions have following disadvantages:

- Radio waves are high-priced (due to spectrum costs) and less comfortable (due to interference and feasible interception and so forth.)
- Gamma rays are harmful because it may want to be dangerous dealing with it, through the human beings due to their prove adverse results on human fitness.
- X-rays have fitness problems, just like the Gamma Rays.
- Ultraviolet light can be considered for verbal exchange technology functions at vicinity without human beings, otherwise they can additionally be risky for the human body when exposed constantly .
- Infrared, because of excessive safety regulation,can only be used with low strength. Hence the visual light component(from crimson to blue) of the electromagnetic spectrum does not cause any harm to the human beings as light rays are secure to use, provide large bandwidth and also have a promising future in the communication discipline.

VI. ADVANTAGES

- Li-Fi can clear up troubles associated with the insufficiency of radio frequency bandwidth due to the fact this era makes use of visual light spectrum that has nevertheless not been substantially utilized.
- High statistics transmission charges of as much as 10Gbps may be executed For the reason that light cannot penetrate walls, it provides privateness and protection that WiFi cannot .
- Li-Fi has low implementation and renovation expenses.

- It's miles safe for human beings considering that light, not like radio frequencies, cannot penetrate human body .
- Consequently, worries of cell mutation are mitigated.

VII. DRAWBACKS OF LI-FI

- Light cannot be transmited through gadgets.
- A prime undertaking dealing with Li-Fi is how the receiving tool will transmit returned to transmitter.
- Excessive installation charge of the VLC (visual light communication) systems .
- Interferences from out of doors light resources like solar, light, normal bulbs, opaque materials.

VIII. ISSUES WITH WIFI WHICH HAS OVERCOME BY LIFI

The following are the basic issues with radio waves:

a) Capacity : Wi-fi records is transmitted through radio waves which are constrained and high priced. It has a restricted bandwidth

Li-Fi : With the rapidly developing international and improvement of technologies like 3G, 4G and so on we are jogging out of radio spectrum.

b) Energy Efficiency : There are a big quantity of cell radio base stations that consume big amount of electricity. Most of the power is used for cooling down the base station instead of transmission. Therefore, performance of such Radio base stations is very low.

c) Availability: Availability of radio waves is a big difficult. In addition, Radio waves are not really useful to be used in aero planes and at places where radio interference may also cause undesirable end result .

d) Security: Radio waves can penetrate by means of partitions. They can be intercepted. If someone has know-how and awful intentions, they might also misuse it. This reasons a primary security subject for Wi-Fi.

Fig 5. Wifi

IX. APPLICATIONS

A. *Traffic lights*

Traffic lighting can speak to the cars and with every other. Vehicles have LED-(light emitting diode)based totally based headlights, LED (light emitting diode)primarily based cack lighting and automobiles can talk with every other and prevent injuries in which the aid of replacing records. In cars and traffic lighting, lowering injuries and traffic congestion.

Fig 6. Traffic lights

B. *Airlines*

Each time we travel through airways we face the issues in communication media, due to the fact the whole airways conversation are carried out on the basis of radio waves. To accomplish over this draw back on radio waves, life has brought Lifi technology.

Fig 7. Air lines

C. *Intrinsically Safe Environment*

Visible lighting fixtures is more safe than RF(radio frequency), therefore it may be used in places wherein RF(radio frequency) can't be used inclusive of petro chemical plants.

Fig 8. Petro chemical plants

D. *Hospitals*

Can be used within the places where it is difficult to lay the optical fiber like hospitals. In operation theatre LiFi may be used for cutting-edge medical units

Fig 9. Hospital using Lifi technology.

E. On Ocean Beds

LiFi can work underneath water. Wi-Fi Fails absolutely, there by throwing open limitless possibilities for navy or navigation operations.

Fig 10. Ocean Beds

X. FUTURE ENHANCEMENT

a) In future, the LIFI generation can be utilized in vehicle to vehicle communication

b) The LCD(liquid crystal display) can be furnished with a layout of the Shopping market by which the customers can be in a position to get the precise statistics approximately the merchandise gift in special aisles. This increase user friendliness.

c) The clever trolley may want to have interaction with clients in the course of a purchasing journey.

d) For example, (passing on bargain vouchers primarily based on where in they are in the supermarket.)

e) The movement of the trolley can be made routinely with the assist of diverse sensors. On this way there may be no need to pull the heavy trolley.

XI. CONCLUSION

The opportunities are several and can be explored similarly. If this technology can be placed into practical use, every bulb can be used something like a wi-fi hotspot to transmit wireless facts and we can continue towards the cleanser, greener, more secure and brighter destiny. The concept of Li-Fi is currently attracting a first-rate deal of hobby, no longer least due to the fact it could provide a real and very green opportunity to radio-primarily based wi-fi. As a developing range of humans and their many devices access wi-fi internet, the airwaves are becoming increasingly more congested, making it an increasing number of hard to get a reliable, high-speed signal. This will clear up issues consisting of the scarcity of radio-frequency bandwidth and also allow internet where conventional radio based totally wi-fi isn't allowed which include plane or hospitals. One of the short comings however is that it most effective work in direct line of sight.

REFERENCES

A. International journals

[1] Harald Haas, Liang Yin, Student Member, Yunlu Wang, and Cheng Chen, What is Lifi ?.Journal of light wave technology.

[2] Kanchan Gupta, Kajal, Ashish Saini. International Journal of Emerging Research in Management &Technology. ISSN: 2278-9359 (Volume-3, Issued 10 2014.

[3] FN Division, Tec. Study paper on Lifi technology and its applications.

B. Online Sources

[4] From Wikipedia, The Free Encyclopedia, LIFI https://en.wikipedia.org/wiki/Li-Fi

[5] Audio holi] hdtv-formats/lifi-lamp-technology-primer https://www.audioholics.comcs, Lifi lamp technology primer