



Li-Fi Technology in Wireless Communication

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Abstract: Li-Fi is abbreviated as Light Fidelity refers to 5G Visible Light Communication systems using light-emitting diodes as a medium to high-speed communication in a parallel behavior as Wi-Fi. In the days where internet has become a major insist, people are in a search for Wi-Fi hotspots. Li-Fi or New Life of data communication is a improved a new Wi-Fi in wireless communication. This paper proposes a study on Li-Fi Technology. The Li-fi technology was made-up by Professor Harald Hass of University of Edinburgh. Li-Fi has more facility in terms of bandwidth invisible region therefore it does not poke its nose in other communications which uses radio occurrence range, without taking its frequency bands. Li-Fi has thousand times greater speed than Wi-Fi and provides security as the visible light is unable to enter through the walls, which offer a new era of wireless communication. The concept of Li-Fi is data communication on fast sparkling of light which is not detected by human eye but it is focused on photo detector which converts the on-off state into binary digital data. It has gained a huge status in two years of its innovation. Such technology has brought not only greener but safer and cheaper future of communication.

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

I. INTRODUCTION

The concept of Li-fi is currently attracting a great deal of interest, not least because it offers a actual and very efficient alternative to RF.As a increasing number of people and their modern device access wireless internet, the airwaves are becoming increasingly blocked and unavailability of free bandwidths to every device, making it more and more tricky to get a reliable, high speed signal. The opportunity to exploit a totally different part of the electromagnetic spectrum is very appealing. Light Fidelity has other advantages over Wi-Fi, such as secure to use at nuclear power plants, thermal authority stations where Wi-Fi cannot be used. In such stations RF waves can be dangerous and can cause accident, to communicate in such regions only visible radiance spectrum can be safe. Apart from adverse regions Li-fi can also be used in all places where Wi-Fi can be used. Li-fi is present wherever there is ease of use of light, in turn eradicating the necessity of having hot-spots only at preferred places. There are four criterions to judge on the effective of Li-Fi and Wi-Fi that is, capacity, efficiency, availability and security. Both Li-fi and Wi-Fi uses electromagnetic spectrum for data spread, but whereas Wi-Fi utilizes radio waves, Light Fidelity uses visible light communication in the range of 100Mbps. The present paper deals with the VLC which give a wide and fast data rate like 500Mbps.In this paper, the judgment is made between Wi-Fi and Li-Fi technology. This paper also discusses the working, implementation and improvements in Li-fi technology.

II. HISTORY AND FUTURE OF LI-FI

The technology behind Li-Fi was pioneered by German Physicist Harald Hass, currently based at University of

Edinburgh in UK. Haas coined the expression Li-Fi(Light Fidelity) in 2011 in the context of a converse presenting the new technology at the TED (Technology Entertainment and Design) Global conference. The word fast entered common parlance as an instantly recognizable alternative to Wi-Fi. Both conditions are examples of abbreviations linguists sometimes explain as clipped forms(i.e. Wi-Fi=wireless fidelity, Li-Fi= light fidelity).Haas's research project, formerly known as D-light(short for Data Light), is now set to launch a model Light Fidelity application under the name of newly-formed company VLC(Visible Light Communication) Ltd., which was complex to commercialize the technology.

In various purpose the Light Fidelity technology can be used, it matters the data transmission from side to side LEDs thus all the screens which illumine light can be served as a platform for data communication. The display of the mobile phone, television, bulbs can act as a cause of light. On the other hand, the receiving platform, the photo detector be capable of be replaced by a camera in mobile phone for scanning and retrieving data. Its other applications are Light Fidelity for desktops, smartcard Light Fidelity, Li-fi for schools, hospitals, smart guides, museums, hotels, fairgrounds, events internal and LBS(Location-based Services), access control and classification crisis, malls, airport and dangerous environments like thermal power plants.

III. OUTLOOK OF LI-FI

In figure 1 shows how the Light Fidelity cloud will get communicated with others strategy. Li-fi using visible light instead of gigahertz radio waves

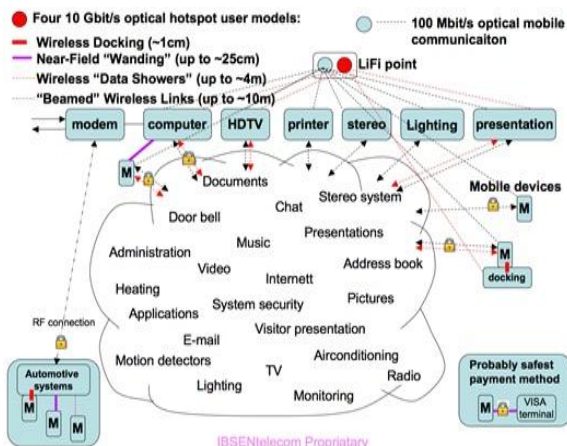


Figure.1.1 Li-Fi Communication with other devices

. Currently there are 1.4 billion base stations which use more energy and its effectiveness is less than 5 percent and we have a total of around 5 million mobile phones which move more than 600 terabytes of data every month which showcase the fact that wireless has happen to utility. Light Fidelity is free of complex system of chains and box which is installed in the case of Wi-Fi. This is a digital method that translates the typical binary talking of zeros and ones in light pulses off or on, respectively, through tiny LED bulbs on and off a million of times per second.

IV. WORKING OF LI-FI

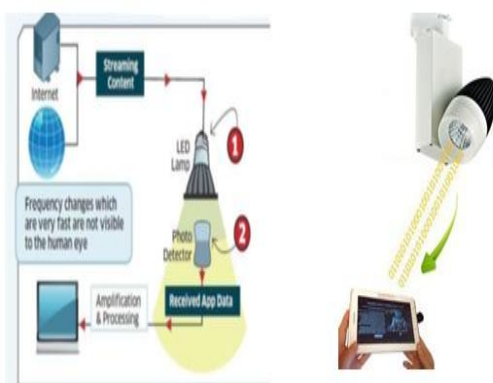


Figure 2 , Working of LI- FI Communication Figure 1.3, Connection between LED and a Computer

In Figure 2, shows the dual data are captured by few light receptors are required, and are installed on all types of associated devices, from computers to tablets, to phones, televisions or appliances. Matter experts make clear that the light pulses are invisible to the person eye, without causing break or discomfort of any kind. In addition, any lamp or flashlight can become a hotspot. Figure 1.3 shows brief connection of internet with LED and in order 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 decrease of size of LEDs does

not decrease its capability to move data or intensity on the opposite it increases the efficiency of one light bulb to transmit the data at an unexpectedly higher rates.

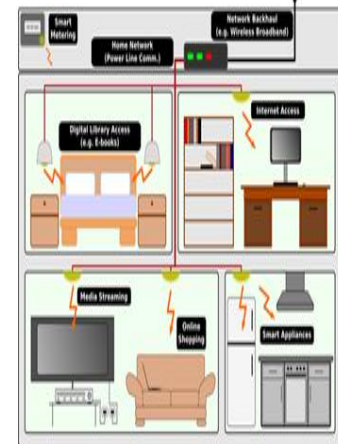


Figure 3 Model of LI-Fi Light Figure1.5Light Communication with Wireless Network Bridge

Figure 3 is the model of Light Fidelity led lights, on a more universal level; Li-Fi might be used to extend wireless networks throughout the home, workplace, and in profitable areas. Light Fidelity is controlled by line of sight, so it won't ever replace Wi-Fi, but it could expand it nicely. Instead of trying to find the great sweet spot for your home's Wi-Fi router, it would be much simpler if every light in your house simply acted as a wireless network bridge. It's shown in the figure 1.5. While Light Fidelity is still in its early stages, the technology could provide an unusual to using radio result for wireless Internet access. Currently, household Wi-Fi routers and portable telecommunication towers depend on radio signals to throw data wirelessly. But the amount of radio spectrum is limited.

V. LI-FI COMMUNICATIONS

This section deals with physical layer, inflection formats and frequency spectrum that is related with Li-Fi communication. The IEEE 802.15.7 standard defines the physical layer (PHY) and media access control (MAC) layer. The standard is able to transport enough data rates to transmit audio, video and multimedia services. It takes into account the optical transmission mobility, its compatibility with artificial lighting in attendance in infrastructures, the deviance which may be caused by interference generated by the ambient lighting. The MAC layer allows using the link with the other layers like the TCP/IP protocol. The average defines three PHY layers with different rates:

- The PHY I was recognized for outdoor purpose and works from 11.67 kbit/s to 267.6 kbit/s.
- The PHY II layer allows to achieve data rates from 1.25 Mbit/s to 96 Mbit/s.



• The PHY III is used for many emissions sources with a particular modulation method called color shift keying (CSK). PHY III can transport rates from 12 Mbit/s to 96 Mbit/s. The DC element avoids the light extinction in case of an extended line of logic 0. The device is ideal for wireless docking, data links with kiosks and mobile displays, medium-range glowing, data showers and optical cellular networks. Users will be able to benefit from a wireless RF-free user environment with data rates that can remove a 2-hour HDTV video in less than 30 seconds and wirelessly link their bus-connected heavy-lifting secondary cabinets located elsewhere in the room.



Figure 5 Li-Fi System Using Retail Components

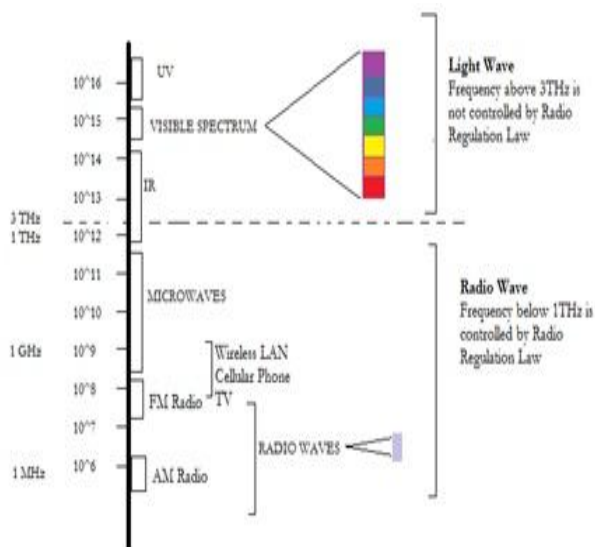


Figure 4 Light Wave and Radio wave Frequency Spectrum

For communication purpose light wave carry data in a fast manner, but in radio wave the data transfer rate is slow. So for that reason we are looking for light signal communication. It is shown by the figure 4. There is a difficulty that light does not penetrate through the walls and no communication in darkness, so if one moves from one opportunity to another he will need a wired bulb in that opportunity too.

VI. LI-FI AT RETAILER'S SHOP

OLED COMM sold the first ever commercially available products based on Li-Fi technology, causal hence to decrease the radio electromagnetic wave pollution. From your LED you can pay attention to music, play videos and ultimately connect to internet. But Fudan University showed this technology at China International Industry Fair in Shanghai by Professor Chi. This system wanted no complex Wi-Fi routers that use radio signals, but only relies on light to send and retrieve data wirelessly. The Light Fidelity system using trade components which has been designed by Chinese professor Chi Nan. Chi's system runs at 150Mbps by using small number of LED but the speed can be better to the maximum of 3.5 Gbps.

VII. COMPARISON OF WIRELESS NETWORKS

TABLE II. CHARACTERISTICS OF BLUETOOTH, WI-FI AND LI-FI

CHARACTERISTICS	BLUETOOTH	WI-FI	LI-FI
Frequency	2.4GHz	2.4 GHz-5GHz	No frequency for light
Range	10 meters	100 meters	Based on LED light falling
Primary application	WPAN	WLAN	Where ever light is available
Data Transfer rate	800Kbps	113Mbps	>1 Gbps
Power Consumption	Low	Medium	Medium
Cost	Low	Medium	Low
Security	Less secure	Medium secure	High secure
Primary Devices	Mobile phones, PDAs, consumer electronics, office and industrial automation devices	Notebook computers, desktop computers, servers, latest mobiles, iPods, etc.	Mobile phones, PDAs, consumer electronics, office and industrial automation devices Notebook computers, desktop computers, servers, latest mobiles, iPods, etc. and other latest devices with Li-Fi
Primary Users	Traveling employees, electronics consumers, office and industrial workers	Corporate campus users and homes, flats, public places	Traveling employees, Corporate campus users and homes, flats, public places and industrial areas, power plants, hospitals.
Usage Location	Anywhere at least two Bluetooth devices exist	Within range of WLAN infrastructure, usually inside a building	Anywhere where light is available like roads, public place, home, office, etc.
Standard	IEEE 802.15	IEEE 802.11b	IEEE 802.15
Operating Band	ISM Band at 2.53MHz	RF Band	Visible Light band
Maximum Members	7 members can connect at a time	Number of devices connected depends on bandwidth availability	Number of receivers present under light
Development Started	1998	1990	2011
Working Concept	Master-slave	Various Topologies	Direct binary data sending

VIII. CONCLUSION

In this paper, a survey on Li-Fi technology has been discussed. From this 5G Li-Fi technology, we can see that the Light Fidelity is an highly developed move toward on design, having the best ever design of internet by basically reducing the size of device which transfers data, execution- by capital of having more than 1.4 million light bulbs all over the world if replaced by such LEDs can present feasible access, and last but not the least enormous applications compared to any other networks in various fields which cannot be imagined by on use networks.



Although present are some disadvantages, but can be eliminated by wary further research. Li-Fi has provided a step forward invention in the world of increasing hunger communication, this is safe to all biodiversity counting humans and progressing towards a greener, cheaper and brighter potential of technologies.

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