

A Comparative study of Li-Fi , Wi-Fi and Wi-Max

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ABSTRACT

This paper represents comparative study of new technologies such as Li-Fi, Wi-Fi and Wi-Max. In computer science, these technologies play a very significant role in today's world. These are easy to use and can access data from internet at a very high speed. Our paper perform comparison among these new technologies i.e., Li-Fi, Wi-Fi and Wi-Max and able to know which one provides us better results .Our main objective is to make life simpler by increasing speed of internet .So that people can access internet at very high speed and saves their time .

Keywords: *Li-Fi, OWC, VLC, Wi-Fi, Wi -Max.*

I. INTRODUCTION

The term given by Herald Hass in 2011. Defacto his discovery is very helpful for data transmission in a secured manner i.e., Li-Fi. Light fidelity is a bi-directional, high speed and fully networked wireless communication technology similar to Wi-Fi. It can be a compliment of RF communication (Wi-Fi or circular network), or a renewal in case of data broadcasting . It uses visible light communication or infrared and near ultraviolet (instead of radio frequency waves) spectrum, part of optical wireless communication technology, which carries much more data, and has been proposed as method to the RF bandwidth limitations.

We can use Li-Fi underwater also where Wi-Fi can't work. Visible light communication and image sensor are used to transfer data. In result we will get fast internet speed .We are able to transfer data at the time of natural calamities also.

Wi-Fi is the abbreviation of wireless fidelity. It is a technology that uses radio waves for connecting the network. A Wi-Fi connection is established using a wireless adapter to create hotspots - areas in the neighborhood of a wireless router that are connected to the network and allow users to get at internet services. Once configured, Wi-Fi provides wireless connectivity to your devices by emitting frequencies between 2.4GHz - 5GHz, based on the amount of data on the network ^[2]. Wi-Fi uses radio waves whereas Li-Fi uses light bulbs so it is much better than Wi-Fi.

Wi-Max is the abbreviation of "Worldwide Interoperability for Microwave Access". It is an IP based Wireless Broadband Access Technology utilizing IEEE 802.16e-2005 standard as the air interface. Range of Wi-Max: 15 Km/s for Rural area. 4 Km/s for Urban area but Li-fi can be accessed everywhere where wi-fi and Wi-Max can't work. Wi-Max is most suitable for home users, individual, small office and home office. Those who want to use internet at home and in the office but want to subscribe only one connection can use this facility. Those who don't have personal homes can also use Wi-Max Connection.

Wi-Max supports IEEE 802.16a Wi-Max specifications and will continue to developments as the specifications evolve. But Li-fi supports IEEE 802.15.7. Li-fi is 100 times faster than Wi-Max. Microwave technology used by Wi-Max whereas Li-Fi is purely based on light. It uses LEDs. Figure shows how data is transmitted using light

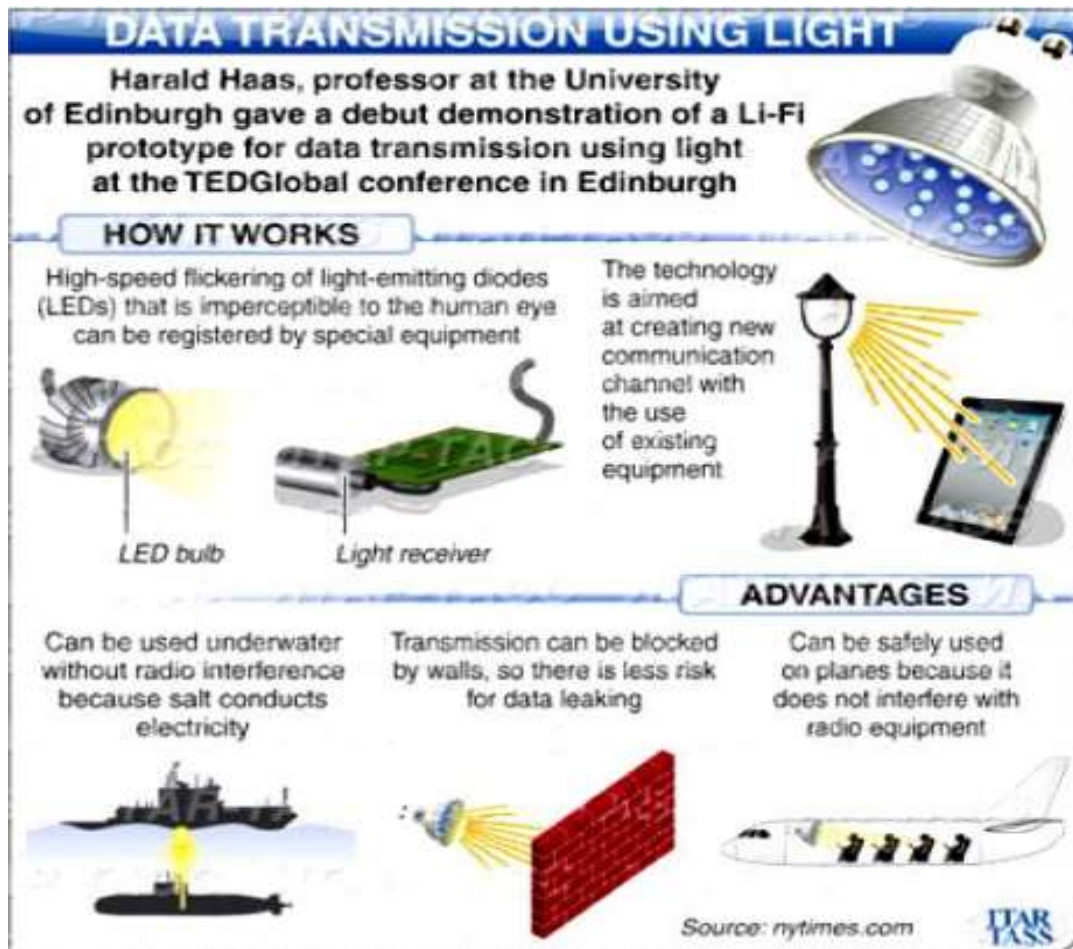
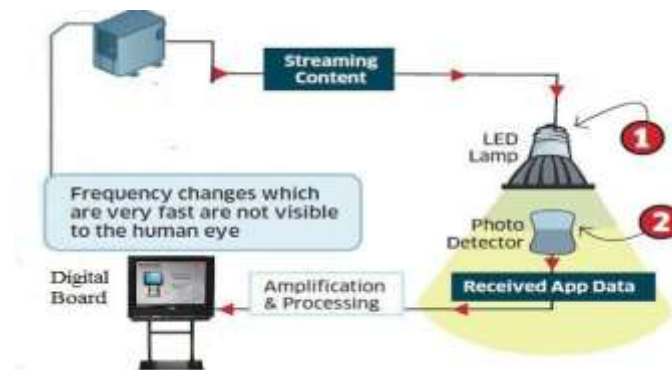


fig.1 data travel through light

II. HOW LI-FI WILL WORK

Figure2 shows how Li-Fi works so that we get privacy in network. When the system starts a constant current is applied to an LED light bulb then from the bulb a constant stream of photons are emitted, that light is called as visible light. But if the current is varied slowly the output intensity of the light dims up and down. Data transmission begins when LED starts glowing, light sensor on computer will find light and return true, otherwise return false. The photo detector registers a binary one when the LED is on; and a binary zero if the LED is off. Brightening a LED many times to build up a data for transmission. Flashing of light is detected by the photo detector or light sensor and it will receive a data and that data will display over the smart board with the help of the projector attached to the computer and smart board. Further enhancements can be made in this method, like using an array of LEDs for parallel data transmission, or using mixtures of red^[9].



III. TECHNOLOGY DETAILS AND METHODS

This new technology uses LEDs as a medium to transmit data, mobile, with very high speed communication as same as 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.

VLC works by switching the current to LEDs off on at a very high rate, too quick to be noticed by the human eye. The light waves cannot penetrate walls which makes much shorter range, through more secure from hacking, relative to Wi-Fi. Light reflected through to achieve 70Mbits/s.

VLC indulged with a photo-detector to receive light signals and a signal processing element to convert the data into stream of bits.

An LED is a semi-conductor light source i.e., the constant current of electricity supplied to an LED light bulb can be dimmed and dimmed, up and down at extremely high speeds, without being visible to the human eye. Li-Fi gives extremely high speeds, upto 3.5 gigabits per second over 5 cm.. So far, the fastest Wi-Fi speed has been recorded as 100 gigabits per second. Li-Fi demonstrates great potential.

IV. UNDERWATER COMMUNICATIONS

Remotely operated underwater vehicles or ROVs work well except in situations when the tether is not long enough to fully explore an underwater area or when they get stuck. If instead of the wires, light were used then the ROVs would be freer to explore. With Li-Fi, the streetbulbs can also be used to transmit data. Radio waves cannot be used in water due to strong signal absorption. Acoustic waves have low bandwidth and disrupt marine life. Li-Fi offers a solution of producing underwater communications e.g.[4], data is supplied into an LED light bulb (with signal processing technology), it then sends data (embedded in its beam) at rapid speeds to the photo-detector (photodiode).

The tiny changes in the rapid dimming of LED bulbs are then converted by the 'receiver' into electrical signal. The signal is then converted back into a binary data packets that recognize as web multimedia applications that run on internet enabled devices.

V. DIFFERENCE BETWEEN LI-FI AND WI-FI

Here we give the difference between Li-Fi and Wi-Fi by two ways i.e., in terms of frequency and features by given fig 3A and fig 3B respectively.

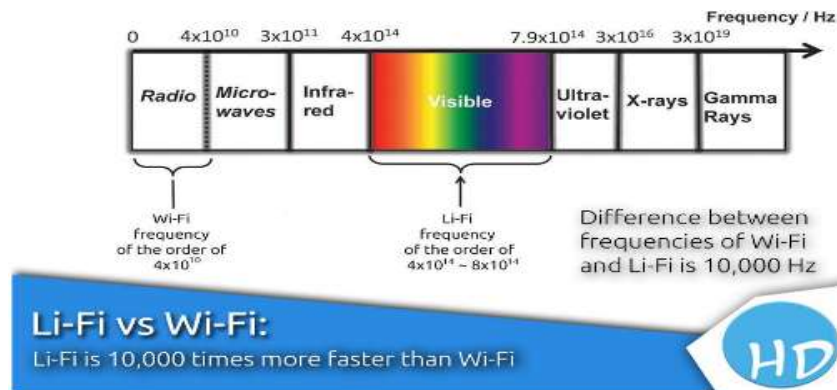


fig.3.a frequency of li-fi and wi-fi



fig 3.b speed of li-fi and wi-fi

Table 1.Li-Fi and Wi-Fi Technologies Comparison

Features	Li-Fi	Wi-Fi
Full Form	Light Fidelity	Wireless Fidelity
Operation	Data transfer through LEDs	Data transfer through radio waves with the help of Wi-Fi router.
Applications	It can be used in airlines, undersea explorations, operation theaters in the hospitals, office and home premises for data transfer and internet browsing	Used for internet browsing with the help of Wi-Fi kiosks or Wi-Fi hotspots
Advantages	Interference is less, can pass through salty sea water, works in dense region	Interference is more, cannot pass through sea water, works in less dense

Features	Li-Fi	Wi-Fi
		region
Security	In LiFi, light is blocked by the walls and hence will provide more secure data transfer	In Wi-Fi, RF signal can not be blocked by the walls and hence achieve secure data transfer.
Data transfer speed	About 1 Gbps	WLAN-11n offers 150Mbps, About 1-2 Gbps can be achieved using WiGig/Giga-IR
Data density	Works in high dense environment	It can be applicable in less dense areas due to interference related issues
System components	Lamp driver, LED bulb(lamp) and photo detector will make up complete LiFi system.	requires routers to be installed, subscriber devices like laptops
Coverage Distance	About 10 meters	About 32 meters (WLAN 802.11b/11g), vary based on transmit power and antenna type

VI. STANDARDS OF LI-FI

Li-Fi is wireless and uses similar 802.11 protocols, but it uses VLC (visible Light Communication) technique, in place of Radio frequency Waves as same as Wi-Fi.

One part of VLC is modeled after communication protocols established by the IEEE 802 workgroup. Li-Fi has the advantage of being useful in electromagnetic sensitive areas such as in aircraft cabins, hospitals, nuclear power etc.

VII. HOW LIFI IS BETTER TO WI-MAX

Wi-Max (802.16) (Wireless Interoperability for Microwave Access) is a 4th Generation mobile access technology for high speed access. The current version of this technology can provide around 40 Mbps in reality and the modified version is expected to deliver 1Gbps in fixed endpoints.

Wi-Max falls under IEEE 802.16 family and 802.16e (Wi-Max expected wave 1, 1x2 SIMO) gives 23 Mbps download and 4 Mbps upload and 802.16e (Wi-Max expected wave 2, 2x2 MIMO (Multiple Input and Multiple Output) offers 46 Mbps downlink and 4 Mbps uplink. 802.16m is the expected version to be delivered around 1Gbps in fixed endpoints.

Table2. Li-Fi and Wi-max technologies comparison

	Li-Fi	Wi-Max
IEEE Standard	802.15.7	802.16A
SPEED	100 times faster than Wi-Max	100 TIMES FASTER THAN WI-FI
RANGE	10 METERS	30-100 meters
FREQUENCY BAND	100 times of THz	2-11 GHZ
TECHNOLOGY USED	Light Fidelity	MICROWAVE
NETWORK TOPOLOGY	Point-to-Point	POINT-TO-MULTI POINT
SPECTRUM RANGE	10000 times than WI-FI	10-66 HZ

In Li-Fi light is blocked by the walls so that provide more secure data transfer, In Wi-Fi RF signal can not be blocked by the walls and hence need to apply techniques to achieve secure data transfer. Speed is 100 times faster than Wi-Fi and Wi-Max.

VIII. APPLICATION AREAS OF LI-FI

8.1. MEDICAL: The successful transmission means brain activity could soon be read without the use of wires.

“It’s a very much friendlier means of transmitting biomedical signals in a hospital.”

8.2. UNDERWATER: Li-Fi devices have a system of blinking lights that are used for transmitting data. In navy we can also use of Li-Fi to modify submarine communication systems. They are using a slow and very old system for underwater communication that does not quite jibe well with the poor acoustics that lie underwater. Radio waves also do not travel efficiently underwater.

8.3.SCHOOLS AND OTHER ACADEMICS ORGANISATIONS: Being that many individuals maintain a busy schedule, technology makes life much easier plus less time consuming for all people, and in every occupational field. As the years progress, technology will be something that will impact everyone especially teachers, parents and students.

In a location within a school/college where network access is required occasionally. It can be located in areas where group work is taking place. As connection with the network, documents and files can be shared, and access to the Internet is available, enhancing group project work.

8.4.AIRCRAFTS: it can be very useful in airplanes. Use of Li-Fi we have a good alternative, in place of Wi-Fi tends to interfere with onboard electronics. The future applications that the government has in mind for Li-Fi could serve a much more vast purpose than just for underwater, airplane, and chemical plant usage.

8.5.AT THE TIME OF NATURAL CALAMITIES: The disasters in India are mainly managed by the government. The government at central level, state level, district level has various roles to play during the disaster

situation. Now the voluntary sectors like non-government organizations are also becoming increasingly important because of the various functions they can perform [11]. Effective and reliable communication is vital for disaster reduction. Communication technologies, skills and media are essential for the various important roles they perform in disaster management. Those roles are:

- To Link scientists, disaster mitigation officials, and the public
- To educate the public about disaster preparedness
- To check approaching hazards
- To alert authorities
- To warn the people most likely to be affected
- To assess damage
- To collect information, supplies and other resources
- To coordinate resource and relief activities
- To account for missing people
- To motivate public, political and institutional responses.

8.6.ENTERTAINMENT: As designers continue to explore the possibilities, kids may use technology to nurture their relationship with nature. Someday, they may bring their iPad outdoors to see what the bee does. The possibilities within our children's reach, the future of our child is bright.

IX. CONCLUSION

To transfer data in a secure way then this technology is helpful at that time. Transmission of data at the time of natural calamities also like disaster, flood, earthquake etc..we have secure and fast internet so that one can easily transfer data by using white LEDs, image sensors etc. with the increased use of Wi-Fi, the existing radio frequency is getting blocked, ergo it is better to use Li-Fi so that one who wants to connect to the internet can overcome by the problem of slow speed and fear of hacking.

In last we can say that we have a good technology which will help people in a very significant way in future to transform their life in achieving fast and secure internet.

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