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Comparison of LI-FI with Wireless Media

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Abstract – *Light Fidelity, also known as Li-Fi, designates the Visible Light Communication type of systems which uses light-emitting diodes that are a means for ensuring high-speed communication as the Wi-Fi does. In this research, the concept of Li-Fi will be thoroughly analyzed. First, Light Fidelity is a new developing notion in the realm of the present technology. In order for this to function, there are a lot of elements which are gathered together and they create one final product which facilitates communication simply using only a light. The purpose of this paper is to describe each component of the Li-Fi, the Working Principles, as well as the advantages and the disadvantages which come with Li-Fi. Although it is a remarkable appreciated concept, Li-Fi has its own advantages and disadvantages. It sustains the NOFN, which is the Digital India program (it enables a faster access to data), and it has 1000 times much more consistency than Wi-Fi along with enhanced speed. However, Li-Fi cannot go beyond walls, meaning that it is not as easily intercepted as the Wi-Fi signal. This is a part of its limitations.*

Key Words: **Li-Fi, NOFN, Wi-Fi, VLC**

1. INTRODUCTION

Professor Harald Hass, at the University of Edinburgh, is the one who devised Li-Fi technology. This innovative product enables data transmission and can unlock capacity which is 10,000 times bigger than the one reachable by means of radio spectrum. The notion of Li-Fi is based around data communication with the means of light that cannot be perceived by human eyes, and which is focused on a photo signal which will transform this on-off condition into binary digital data. [1]

This notion of Li-Fi is very effective in the present world, because it represents a real productive alternative to data delivery. With our current technology and devices people get to connect to wireless internet, but unfortunately there is less and less accessibility to free bandwidth, and that is how Li-Fi is very helpful in this situation. In other words, Li-Fi can be used instead of Wi-Fi.

Li-Fi includes a photo detector which gets light signals and a signal processing device in order to transform the data into "stream-able" matter. Then, the data will be found in a LED light bulb (which includes a signal processing capability), then it transmits the data (integrated in its beam) at fast speeds to the photo-detector (photodiode).

The small change in the fast dimming of LED bulbs is afterwards changed by the "receiver" into an electrical signal. This signal in its turn will be transformed into a binary datastream which the user will perceive as web, or video and audio services that run on internet.

First of all, it is necessary to have the correct information about what is Li-Fi and its basic aspects. Its functionality is not so difficult to understand. Here, we explain its functionality and the various elements included in the Li-Fi, as well as models of implementation in usual objects which everybody use daily. Much research and different evaluations have already been done on Li-Fi.

It is important to know that Li-Fi can be utilized for common objects, as this will be useful for everyone. In order to include Li-Fi in an object, the whole structure will have to be modified and certain products supporting this system will be used.

The next step is to understand how the various components used in Li-Fi work and how they are interconnected so as to support each other and to function properly. That is why each element will be described in turn for a clear understanding of this process.

One of the most important parts refers to its applicability and different ways in which Li-Fi is useful for people. Li-Fi can be implemented for various products and this will make communication much easier.

Each new technological development has its advantages and disadvantages in today's society. This is the case with Li-Fi, because it brings some positive elements in our society, and at the same time some negative effects as well. [2]

2. WORKING PRINCIPLE

Li-Fi is defined as Visible Light Communication (VLC) system which enables data delivery. A common VLC system includes two elements:

1) There must be at least one component with a photodiode which can get light signals.

2) The second element is a light source equipped with a signal processing element.

A VLC light element might be a fluorescent light bulb or a light emitting diode bulb (which is a LED). A Li-Fi device requires high levels of light output and that is why LED bulbs are most suitable for an implementation of Li-Fi. A LED is known as a semiconductor light source, and this fact means that the LED light bulbs can increase light intensity and can switch very fast. That is why, LED cells can accommodate lots of signals without being caught by the human eye. [3-5]

Then, the modifications in the light force from the LED light source are received and changed as electrical current by the photodiode device. When this electronic signal is received, it is modified into an uninterrupted stream of binary data which may include audio, video, web content and information that is available on any Internet device

Li-Fi is also known to be working as a bidirectional system for communication. For this, the visible light and the infrared light from a photo device detector are going to be interchanged, and thus a mobile device which is linked to the photo detector will be able to transmit the data back to the light source.

There are similar points in regards to Li-Fi and Wi-Fi as they both send data by means of electromagnetic processes. The most important difference is that Wi-Fi makes use of radio waves and Li-Fi functions with visible light.

Li-Fi, as we have already found out, is a Visible Light Communications system (a VLC). The system uses a photo-detector in order to get light signals and a signal processing component for changing the data into "stream-able" content.

Even though it is an important innovation, there is still much to be done in the Li-Fi realm. Similarly to Wi-Fi and broadband, Li-Fi can work as a bidirectional communication process as well. In this way, the visible light and the infrared light from a photo detector are interchanged, and then a mobile component which is linked to that photo detector can transmit the data back to the light source for uplink. [6-8]

Moreover, a multi-colored RGB (which might be Red/ Green/ Blue) LEDs could be used for sending and receiving a much bigger range of signals than the phosphor-coated white LEDs which have a single color as depicted in figure 1.

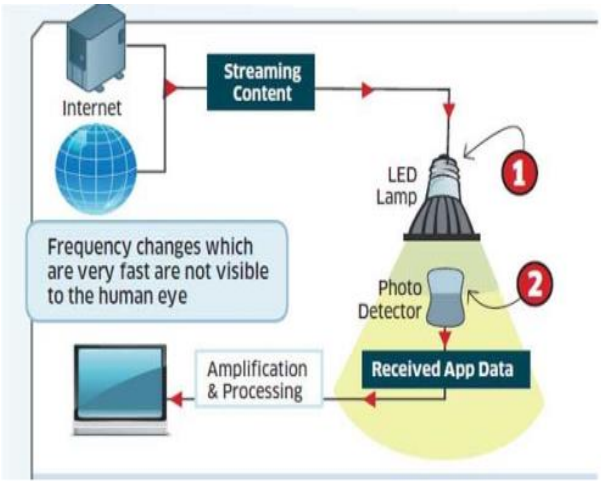

Fig -1: Block Diagram of LI-FI

3. LI-FI COMPONENTS

1) Photodiode

A photodiode is defined as a semiconductor element which changes light into current. The electrical current will be generated when photons are received in the photodiode. Only a smaller quantity of current is generated when no light is present. Photodiodes might include optical filters, lenses which are built-n and also they may have small or large surface areas.

2) LED Lamps

A LED lamp is defined as a light-emitting diode (LED) system which takes the form of a lamp (that is, light bulb) and it is used for lighting fixtures. LEDs are capable to come to perfect brightness without requiring any warm-up period. However, the lifespan of this fluorescent lighting reduces due to the constant switching on and off. It is known that lighting for common purposes needs white light. LEDs release light in a narrow band of wavelengths, and this light which is emitted has the color of the semiconductor material used to produce the respective LED. Thus, white light will only be released by mixing light coming from red, green and blue LEDs or by using phosphor to change some of this light to other colors.

3) RF Power Amplifier circuit

The A RF amplifies, that is a radio frequency amplifier, is used to enhance the high-frequency signals which are used for radio communication. The frequency is an RF amplifier can vary depending on the inductance or capacitance of this tuned circuit. It is possible for an RF amplifier to tune over the required range of incoming frequencies. The derivation of capacitance enables high gain for radio frequencies as it modifies the gain of a resistance-capacitance coupled amplifier. Nevertheless, the power gain of RF amplifiers will be reduced at high radio frequencies.

4) Printed circuit board

A printed circuit board or the so-called "printing wiring cards" refers to a type of electronic circuit which includes fine strips of a material like copper, this having conducting properties. These strips are engraved on a layer which is assembled on a kind of insulating sheet.

4. APPLICATIONS OF LI-FI

1) Vehicles & Transportation

Li-Fi is currently used to produce LED headlights and taillights. Likewise, street lamps, traffic signals are using more and more LEDs. These elements can be used for vehicle-to-vehicle and vehicle-to-roadside type of communication

and can be implemented for traffic management and circulation safety.

2) Hospitals & Healthcare

Li-Fi can be safely used in hospitals because it does not release any electromagnetic waves and as a consequence it does not distort the functionality of medical tools, and it does not interfere with MRI scanners as well.

3) Toys

LED lights are a lot used by toy manufacturers because their cost is low, and an efficient communication between interactive toys is very much appreciated.

4) Connectivity

One of the uses of Li-Fi is found in everybody's homes as these have been widely implemented. The use of Li-Fi enabled devices helps change these applications, the interconnectivity of the devices like TV sets, computers, and they also help connect home appliances like washing machines, microwave ovens, vacuums, fridges.

5) Mobile Connectivity

Li-Fi is also used for the interconnectivity between smart phones, tablets, laptops, and all kinds of mobile devices. Short range links offer very high data processing and also ensure security.

6) Smart Lighting

In private or public locations lighting such as street lamps can offer Li-Fi hotspots and this same type of communication and infrastructure based on sensors can be used in order to monitor and manage lighting as well as data.

7) Underwater Communication

RF use under water conditions is impossible. This is because acoustic waves have very low bandwidth and they affect marine life. Therefore, Li-Fi offers a solution only for short-range communications.

8) Traffic Control

The Li-Fi technology can be useful in managing traffic conditions and that is why this can be used in the LEDs of vehicles or airplanes as well.

9) Augmented Reality

Specific lighting is used nowadays in museums and galleries. If Li-Fi is used then this can offer localized information. Thus, a visitor can retrieve information referring to a specific object from that light, just using a camera or a mobile phone and download that information.

Table -1: Comparison of Wireless Media

Comparison of Wireless Media			
Characteristics	**Bluetooth**	**WI-FI**	**LI-FI**
Frequency	2.4 GHz	2.4 - 5 GHz	No Frequency
Ranger	10 meters	100 meters	Based on Led Light
Data Transfer	800 Kbps	11 Mbps	> 1 Gbps
Power Consumptions	Low	Medium	Medium
Cost	Low	Medium	Low
Security	Less	Medium	High
Standard	IEEE 802.15	IEEE 802.11b	IEEE 802.15
Development	1998	1990	2011
Primary Application	WPAN Cable	WLAN Ethernet	Both
Connection Durability	Must remain line of sight	Multi room	Where ever light is visible

5. CONCLUSION

We have compared different techonlogies to show how Li-Fi is better then the others. The comparison is perfomed on different set of parameters as dpictied in table 1.

It is well-known that pureLiFi have already brought two products for all. One of these is Li-Flame Ceiling Unit which has to be connected to an LED light fixture and the other one is Li-Flame Desktop Unit which has to be connected to a device by means of a USB. Both of them aim to give light and connectivity in the same device.

That is why, with such greater power of connectivity and data delivery this becomes a remarkable attractive space for a successful business.

Moreover, the integration of the internet of things systems with Li-Fi will offer more opportunities for retailers and various businesses as well. As an example, shop managers could send data to many customers' phones fast, in a secure way and also remotely.

At present Li-Fi is tested and analyzed in Dubai, by the UAE-based telecommunications provider. They claim that Internet, audio and video streaming have been offered successfully by means of a Li-Fi connectivity.

Advantages of Li-Fi technology

1) Efficiency

Li-Fi functions by means of visible light technology. Private locations as well as business locations already accommodate LED bulbs for lighting and that is why the same source of light will be used to send data. This is one of the greatest advantages of Li-Fi, being low in cost and energy consumption. It is true that light must be on in order for sending the necessary data, but if there's no need for light, then it can be diminished so that it will not appear anymore for the human eyes, but in fact it is still functioning and sending the data.

2) Availability

The availability can be high, because all you need is a light source, and then you can have Internet. Light bulbs are all over in this world that is shops, houses, offices, malls, trains, planes. This means that high-speed data delivery could be accessible almost anywhere.

3) Security

Another great advantage of Li-Fi is its security. That is because light cannot go beyond opaque systems and Li-Fi Internet can only be accessible to users which are in a closed space, so it can't be intercepted by users from other buildings or even from other rooms.

Disadvantages of Li-Fi technology

- One disadvantage is that Internet cannot be accessed without having a light source. That is why Li-Fi may be used only in certain locations and situations.
- Another disadvantage is that Li-Fi only makes use of visible light and that light cannot go beyond the walls, so the signal will be limited by such physical obstacles.
- There can be a problem when other sources of lights interfere with that signal. One big low point for using Li-Fi is the interception of signals which are found outdoors. For example, sunlight will disturb these signals and thus Internet will be disconnected.
- This technology is not suitable for widespread usage. This technology requires an entire infrastructure in order to function properly.

REFERENCES

[1] http://en.wikipedia.org/wiki/Li-Fi.

[2] Haas, Harald (July 2011). "Wireless data from every light bulb". TED Global. Edinburgh, Scotland.

[3] Iain Thomson (18 October 2013). "Forget Wi-Fi, boffins' get 150Mbps Li-Fi connection from a light bulb: Many (Chinese) hands make light work". The Register. Retrieved 22 October 2013.

[4] http://lificenter.net/solutions/lifi-solutions.

[5] http://lighting.com/led-lights-lifi.

[6] https://www.newscientist.com/article/mg21128225-400-will-Li-Fi-be-the-new-wi-fi/.

[7] Li-Fi – Internet at the Speed of Light, by Ian Lim, the gadgeteer, dated 29 August 2011.

[8] Tony Smith (24 May 2012). "WTF is... Li-Fi? Optical data transfer's new leading light. The Register. Retrieved 22 October 2013.