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EFFECTIVE ANALYSIS FOR ESTABLISHING A NETWORK ARCHITECTURE USING LUXIM'S LI-FI TECHNOLOGY

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ABSTRACT

Presently, Internet has become a basic need for everyone and with the shortage in radio spectrum, the slow speed of network leads to limited connectivity and long processing hours. This new epoch of wireless communication being called as Li-Fi (Light fidelity) opens an entire new world of possibilities. Li-Fi is the latest technology in which light is the main issue through which the data is passed. Its data rate is more than 10 Mbps, which is much faster and secure than average broadband connection. Moreover, Li-Fi is equivalent to Wi-Fi, but it uses light waves instead of radio signals. It can be used in electronic devices like computers, laptops, smartphones, printers, televisions, speakers, headphones and even running shoes to wirelessly connect to the Internet. But in conventional Li-Fi system the efficiency of light is reduced by using LED light. For this reason, to increase the efficiency as well as the data rate, Luxim's Li-Fi technology with its network architecture is proposed in this paper. In Luxim's technology it can be observed that if the power of light is increased then the luminance of light is also increased simultaneously. That's why the light efficiency is also increased. Furthermore, if the efficacy of light is improved, the data rate will be raised significantly, which will produce better performance than the conventional LED light system. A Matlab based simulation is used to measure the efficiency and data rate by using our proposed technology.

Keywords—LED, Li-Fi, Luxim's technology, wireless communication

INTRODUCTION

The demand for wireless data is increasing day by day and man is depended on the wireless technology. The available wireless technologies are well-acquainted by Wi-max, Wi-Fi, Li-Fi etc. From these Li-Fi is the most latest wireless technology (Ekta and Kaur 2014). It is a light fidelity communication systems. Dr. Herald Hass, Professor, University of Edinburgh, invented Light fidelity for the very first time (Haas 2011). In October 2011 a number of companies and industry groups formed the Li-Fi consortium, to promote high-speed optical wireless systems and to overcome the limited amount of radio based wireless spectrum available by exploiting a completely different part of the electromagnetic spectrum. Li-Fi is a wireless optical networking technology and it uses light-emitting diodes (LEDs) for data transmission. The transmission of data through illumination by taking the fiber out of the fiber optics and send that data through the LED light is called Light fidelity (Sharma *et.al*. 2014). Light- emitting diodes can be switched on and off faster than the human eye can detect, causing the light source to appear to be on continuously. This invisible on-off activity enables a kind of data transmission using binary codes: switching on an LED is a logical '1', switching it off is a logical '0'. Information can therefore be encoded in the light by varying the rate at which the LEDs flicker on and off to give different strings of one and zero. This method of using rapid pulses of light to transmit information wirelessly is technically referred to as Visible Light Communication (VLC), though it is potential to compete with conventional Wi-Fi has inspired the popular characterization Li-Fi (Sridharan *et.al*. 2014). It can be used in airplanes, smart museum, smatter power plants, on ocean beds and so on (Simmi *et.al*. 2013). But the efficiency of Li-Fi technology by using LED light is not better. So the data rate is decreased in compared to the theoretical data rate.

In this paper we propose that using a bulb made by Luxim technology will increase both the light efficiency and data rate. Architecture is established in an area to create a Li-Fi zone. In this zone we use the bulb which is made by Luxim technology so that the light efficiency is increased. However the luminance of light is also measured, which is efficient to increase the data rate. A Matlab based simulation is used to measure the efficiency and data rate by using our proposed technology.

The main objective of this research is to use the Luxim technology in the bulb. This bulb is

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implemented in the Li-Fi architecture so that the efficiency of light and the data rate can be increased.

MATERIALS AND METHODS

The architecture of Li-Fi technology will be a novel architecture if we successfully establish it in a Li-Fi zone. This architecture will provide a better internet services than other wireless technology. In this architecture, we use the bulb made by Luxim technology which can be more efficient for providing a high data rate transmission probability. It emphasis on three terms. These are the MLU, AL and Li-Fi cloud. MLU means the Main LED Unit and AL means agent LED. The MLU is extended to the ALs where every AL has their own Li-Fi cloud to provide internet and other services connectivity through light. In this scenario the coverage area from a MLU to the multiple nodes are in the form of agent LEDs (AL). The main line is connected to the MLU and further it is extended to small nodes. The small nodes are LED bulbs or lamps e.g. AL1, AL2, AL3 and AL4. The whole building is covered by these small nodes and provides wide coverage through light which are made by Luxim technology. The user can access the internet with little mobility inside the building as shown in Figure 1. The number of agent LED (ALs) depends on the requirements and internal structure of the buildings or area.

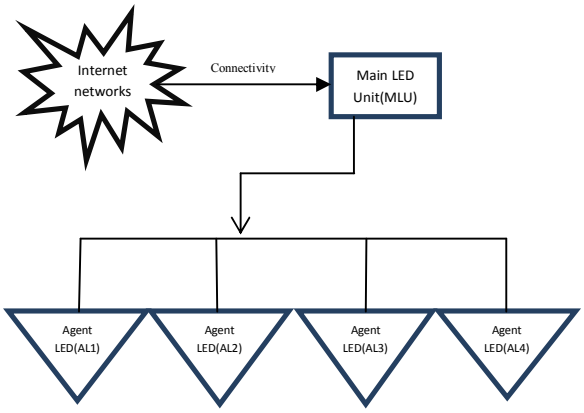

Figure 1. Architecture of Li-Fi technology

a) Luxim Li-Fi Technology: An energy-efficient, reliable and high performance lighting solutions is called LUXIM's Li-Fi technology.This technology is used for high-intensity applications. Bulbs of LUXIM's Li-Fi technology relay on solid state electronics rather than metal electrodes to drive power, which is leading to higher efficiency and a longer lifespan.Using Luxim technology a tiny light bulb can produce as much light as a street lamp. So if we use the bulb made by luxim technology for Li-Fi communication system than it can give better light efficiency rather than other conventional LED light.

b) Working Principle of Luxim's Li-Fi Technology: Li-Fi bulbs rely on solid state electronics. For this reason it leads to higher efficiency. Luxim technology suggests better efficiency and it also give a longer lifespan for Li-Fi. In terms of energy efficiency, Luxim technology provides over 50% savings when compared to traditional lighting system. Furthermore, the lifespan which is expected is three times that of other fixtures. A radio frequency signal is generated by the solid-state power amplifier and is guided into an electric field about the bulb. The contents of the bulb are vaporized by the high concentration of energy in the electric field which is then converted into the plasma state at the bulb's center. This controlled plasma generates an intense source of light. Figure 2 shows how Luxim's Li-Fi technology works.

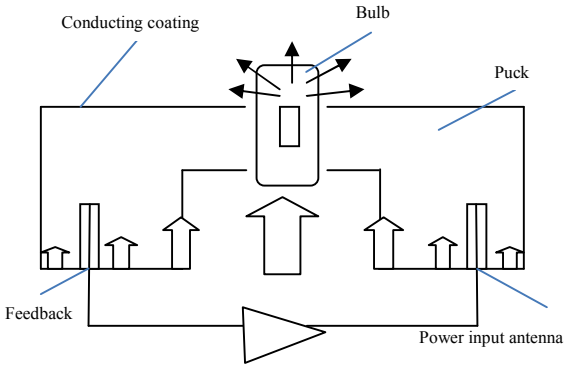

Figure 2. Luxim's Li-Fi technology

c) The Bulb Using Luxim's Technology: The bulb mainly contains gas and metal halide material. An electric lamp that produces light by an electric arc is called metal-halide lamp. The most common metal halide material is sodium iodide. Using of metal halide material provides most of its light from the electric arc. It has good quality white light which efficiency is high. When it is turned on, an electric field ionizes the gas molecules and then creating gas plasma. The gas plasma then vaporizes the metal halides. After that the metal halides completely join to the gas plasma, thus emitting a bright white light. Figure 3 shows a Li-Fi hybrid light source.

RESULTS AND DISCUSSION

Li-Fi is an innovative idea in information technology, one that aims at eventually replacing radio frequency wireless signal with those that come from light sources. This technology can be used to transmit a data faster than 100 Gbps. Normally Li-Fi technology uses LED light as a

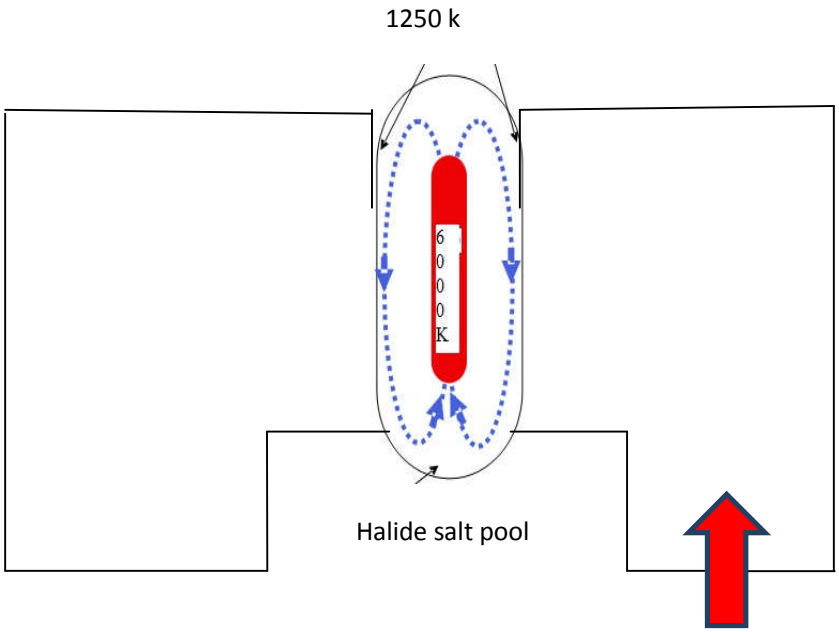

Figure 3. Li-Fi hybrid light source

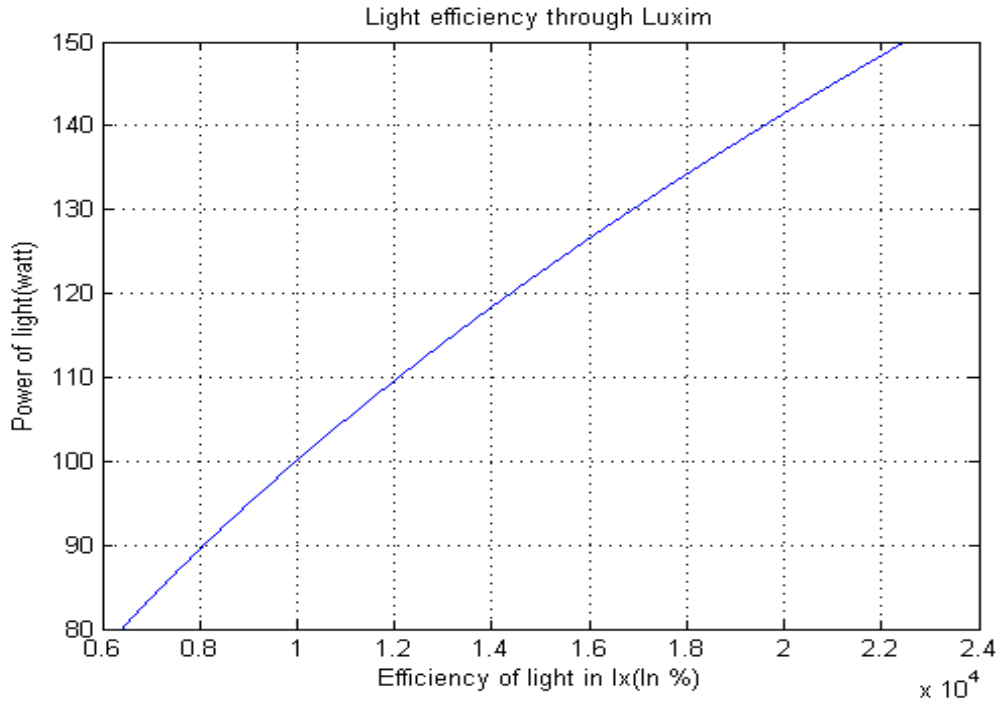

Figure 4. Light power versus light efficiency

light source but its efficiency is low in compared to our proposed Luxim's technology. Through this Luxim's technology the efficiency of light can be increased. And by increasing the power, the data rate will be increased simultaneously. When the power of light is increased the data rate will be improved as well and the coverage area will also be increased. From Figure 4 it can be observed that when the power of light is 80 W then the light efficiency is 0.6%. Furthermore, by increasing the power of light to 150 W, the efficiency of light will be increased contemporaneously and it will be 2.25%. So, from the below figure it can be concluded that by using Luxim's technology, when the power of light is increased, the efficiency of the light as well as the data rate will be increased in the

same rate and our proposed technology provide better efficacy than the conventional LED light system.

CONCLUSION

Light is the main issue of Li-Fi technology because through the light data will be passed. So the efficiency of light must be higher and it will be increased through the proposed Luxim's technology. The conventional LED light cannot produce as much light as the bulb making by Luxim's Li-Fi technology. Its efficiency is better than the other conventional LED light. From the simulation result it can be observed that by using this technology, the power of light is increased with the increasing efficiency of light. That's why the data rate will also be improved.

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