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A STUDY ON VISIBLE LIGHT COMMUNICATION

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Abstract: Wi-Fi is a technology for wireless local area networking with devices compatible to connect internet through WLAN network and a wireless access point. The hotspot coverage of Wi-Fi can be as small as a single room with walls that block radio waves, or as large as many square kilometers achieved by using multiple overlapping access points. Nowadays as our modern technology is developing, people use a huge number of data to accomplish their work through wire or wireless network. In order to make easy transmission of data a new technology, Li-Fi has been evolved, where it transmits a data through LED lights in such a way that it is undetectable to human eyes. Li-Fi is a unique technology which is used in progression with WIFI (wireless fidelity) technology. Visible light communication (VLC) is a method of wireless communication using visible light where it contains visible light as a source, air as a medium, and photodiode as receiver. This paper enhances an overview of Wi-Fi, Li-Fi applications, working and principle, also about VLC with other communication technologies has been presented.

Keywords: Wi-Fi, Li-Fi Wireless, VLC, LED Lights and Fiber optics.

1. Introduction

LIGHT FIDELITY (Li-FI) is invented by, a German physicist professor Harald Haas at University of Edinburgh. The term Li-fi was coined by Hass when he astonished people by the movement of high transmission video from a LED lamp, at TED Global Talk on July 2011.Dr.Hass gave an idea, about "data through illumination" where the fiber optics transforming data through a LED light bulb that varies intensity. Li-fi is typically implemented using white LED light bulbs these gadgets are generally used for illumination by applying a constant current through LED. The optical output can be made to vary at extremely high speeds which are unseen to the human eyes. Nearly around 600TB of data will be transmitted by cell phones, However there are more than 5 billion mobile phones, accordingly have 1.4 million cellular mast radio wave base stations which have been deployed. Prof. Haas also introduced the idea of "Wireless data from every light".

In Present scenario wireless communication uses radio waves. Spectrum is necessary for wireless communication. With the modern technology and the number of users, the existing radio wave spectrum fails to resolve the issues of durability, availability, scalability and security. We have come up with new technology of transmitting data wirelessly through LEDs, which is called as Li-Fi. Li-Fi is a modern technology which helps in the transmission of data much more faster and flexible than Wi-Fi technology.Visible light communication (VLC) is a modern method of wireless communication using naked light. Typical transmitters are visible light LEDs and receivers are photodiodes and sensors. Location-based services are preferred for visible light communication applications. An indoor visible data transmission system using LEDs is proposed. In this system, devices are used for illuminating rooms and also for optical wireless communication system.

2. Principle and Working

Light Fidelity is a study of light which deals about optical wireless communication. Li-Fi is a fast and low cost optical version of Wi-Fi related to Visible Light Communication (VLC).VLC ranges visible light between 400THz (780nm) and 800 THz (375 nm) as optical carrier for transmission and illumination of data. Since its a data communication medium.It uses fast pulses of light to transmit information wirelessly. Basically Li-Fi technology deals about the transmission of data through illumination by sending data through a LED light bulb that varies in intensity. In 2012 after four years of research, Haas set up company called PURELIFI with the aim to be the world leader in visible light Communication technology. Li-Fi is a VLC system running wireless Communication travelling at very high speeds, Li-Fi uses common household LED to enable data transfer, boasting Speeds of up to 224gigabits per second.

Li-Fi and Wi-Fi are quite similar as both transmit data electromagnetically, However WiFi uses radio waves while Li-Fi runs VLC WiFi is mainly for general wireless coverage within buildings where as Li-Fi is for large density wireless data coverage in restricted areas and also for resolving the issues of radio interference. Li-Fi provides better efficiency, durability, availability and security than of WiFi. As an such there are more

opportunities to exploit this medium from public internet access through street lamps to automobile vehicles that communicate through head lights.

The Li-Fi emitter system contains of four primary sub-assemblies.

a) Bulb
b) RF power amplifier Circuit (PA)
c) Printed circuit board (PCB)
d) Enclosure

The electrical inputs and outputs of the lamp is controlled by micro controller of PCB used to manage different lamp functions of Li-Fi. The solid state PA will generate the Radio Frequency and is guided into an electric field in bulb. The high concentration of the bulb to a plasma state at the bulb centre its controlled then the plasma generates an instance source of light where All of these sub-assemblies are contained in an aluminium enclosure.The main component of LiFi is the bulb whereas sealed bulb is embedded in a dielectric material. This design is more reliable than conventional light sources that insert degradable electrodes into the bulb. The dielectric material serves two purposes first as a waveguide for the RF energy transmitted by the PA and second as an electronic field concentrator that focuses energy bulb.

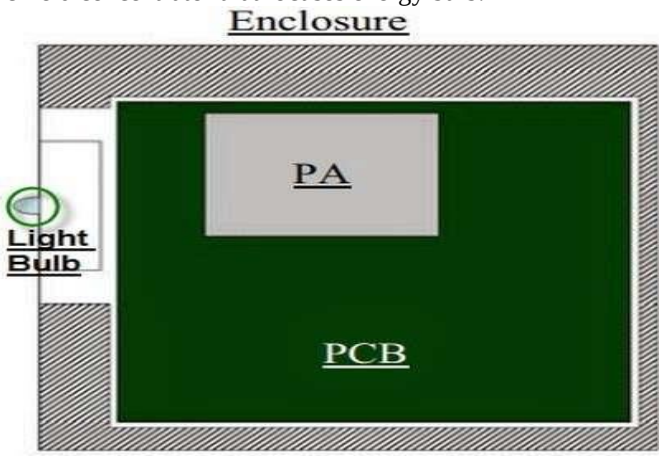

Fig.1.Li-Fi bulb sub-assembly

The main requirement for a light source is to turn on and off repeatedly for the communication purposes.Due to their ability to be switched on and off rapidly, LEDs are suitable light sources for Li-Fi. LEDs offer many benefits over fluorescent lamps and incandescent lamps such as higher efficiency, environment-friendly manufacturing, and flexibility of design, longer useful lifetimes and improved spectrum performance.The LED consists of a semiconductor diode chip mounted in the reflector cup of a lead frame that is connected to electrical (wire bond) wires, and then encased in a solid epoxy lens. The variations in data rate with the size of LEDs are very important in Li-Fi technology. Different data rates can be achieved with different sized LEDs. Normal sizedLED bulbs can be reduced to micro-LEDs which handle millions of variations in light intensity. A micro-LED light bulb can transmit 3.5 Gbps and data rates of more than 10 Gbps are possible. The micro LED bulbs allow the light stream to be beamed in parallel thereby transmitting huge amounts of data in terms of Gbps.

3. VISUAL LIGHT COMMUNICATION

3.1 Comparison of VLC over Radio Waves

VLC is compared with radio frequency using five main concepts:

In Radio spectrum the radio capacity to support the demand of wireless data transmissions for media applications is difficult.The radio waves are expensive and limited, infrastructure of LED-based lights installed has a potential for VLC as transmitters. Radio waves consume more energy than VLC. VLC transmitters and receiver devices are very less in cost, there is no need of using RF units. Radio wave creates Electromagnetic Interference (EMI), VLC uses light instead of radio waves, which is intrinsically safe and does not create EMI known to interfere with airplanes instruments and equipment in hospitals, and is potentially hazardous Hence, this technology can be used in many places. VLC data is transmitted where the light is because light does not penetrate through walls, hence VLC provide a secure data communication. The transmission power of radio waves cannot be increased over a certain level because there are serious health risks for humans.

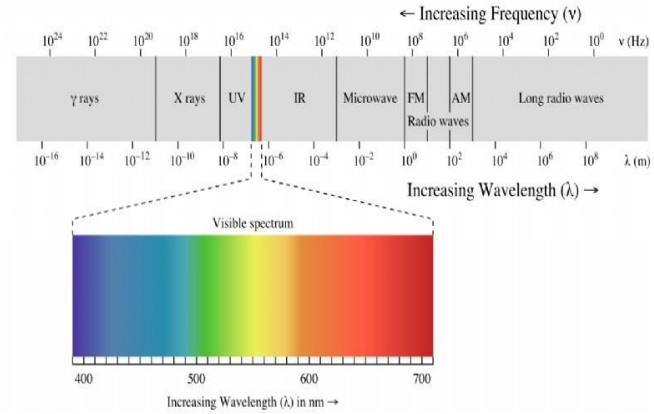

Fig.2.Electromagnetic spectrum

3.2 VLC versus Infrared Communication

Infrared Technology is a safe and widely used technology. The differences between VLC and infrared communication are:

The data rate of Infrared Communication is 20Mb/s where VLC can send data up to 100Mb/s. The distance for transmission of VLC is possible up to several meters due to its illumination requirement. The noise sources will be differentt Due to the wavelength of the light source. For infrared communication, noise will exists from the ambient light containing infrared light. In VLC, the sunlight and other illumination light are the noise sources. Infrared Technology is mainly used in remote control and point-to-point connection of VLC based transmissions.

4. LIMITATION OF LI-FI

If there is any block in the receiver, then the signal will be cut out as Li-Fi technology uses light as transmission medium. External light interference from sources such as sunlight, normal bulbs and opaque materials results in decreased reliability. And Sunlight disturbance may occur, because Li-Fi works in line of sight directly.

5. APPLICATIONS

Some of the applications of Li-Fi are:

As Wi-Fi contains radiations waves is not allowed since it blocks the signals, which can cause hazardous to the patients in OT (Operation Theatres) while radioactive operations. An interfere with the navigational systems of the pilots in Aircrafts Wi-Fi cannot be used Thus Li-fi Can be used for data transmission. Li-Fi can work underwater where Wi-Fi fails, thereby providing open opportunities for military operations. Li-F can be powerful means of communication in times of earthquakes or hurricanes.so it will be helpful in disaster management.li-fi can provide much safer connectivity in sensitive area such as plants compare to Wi-fi also Li-fi can be used in petroleum or chemical plants where it will be help full. In traffic signals Li-Fi can be used to communicate with the Led lights of the car which help in traffic management. Also helps in reducing the chances of accidents through LED car lights that can alert drivers when other vehicles are too close.

CONCLUSION

A study on visible light communication and li-fi has been presented. With the growing technology and increasing use of the internet services, it is very essential that every bulb will be replaced by Li-Fi bulbs and might be used like a Wi-Fi hotspot for the transmission of data. The use of Lifi technology gives a golden opportunity to replace or to give alternative to the radio based wireless technologies For future short range applications and VLC present a viable and promising supplemental technology to radio wireless systems. Although there are many challenging issues, VLC remains one of the most promising technologies in the future.

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