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A Survey on Audio Communication for Location Information by Using Visible Light Communication

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Abstract: Visible Light Communication (VLC) is a technology that may be consider as better option for 5G in wireless communicationsin the future. The technology may be used in many indoor applications. The specific presentation of VLC in this study is with the use of light emitting diodes (LEDs) as the medium for transmission. Digital information will be sent through the LEDs as light pulses, and then a receiver will be able to collect the light pulses as a code and translate it to a corresponding audio data.VLC has strengths in energy efficiencyand ultra wide bandwidth, but also has weakness in transmission range andobstacles in transmission paths.This paper gives idea about VLC and their working principle.

Key words- *Light EmittingDiode (LED), Light Fidelity (Li-Fi), Visible Light Communication (VLC).*

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I. INTRODUCTION

In this, introduction of the Audio Communication for Location Information by using Visible Light Communication is discussed. It gives a brief understanding of the technologies used by the system and the relevant literature and the environment to be considered. This gives the overall idea about the technologies used. With the advent of the high brightness light emitting diode (LED), which produces incoherent light, it is logical to consider the light spectrum for pervasive wireless communication which can be achieved with LiF.LiFi extends the concept of visible light communication (VLC) to achieve high speed, secure, bi-directional and fully networked wireless communications. It is important to note that LiFi supports user mobility and multiuser access. The key advantages of a LiFi wireless networking layer are: i) three orders of magnitude enhanced data densities; ii) unique properties to enhance physical layer security; iii) three order of magnitude improvements in energy efficiency; iv) use in intrinsically safe environments such as petrochemical plants and oil platforms where RF is often banned; v) with the advent of power over ethernet (PoE) and its use in lighting, there exists the opportunity to piggyback on existing data network infrastructures for the required backhaul connections between the light sources with its integrated LiFi modem and the Internet.

A. Concept of VLC

Visible light communication is a new way of wireless communication using visible light. Typical transmitters used for visible light communication are visible light LEDs and receivers are photodiodes and image sensors. Figure 1 gives idea about visible light communication technology.In this system, new applications present which will be made possible by visible light communication technology. Location-based services are considered to be especially suitable for visible light communication applications. White LEDs have recently been used as efficient light sources replacing incandescent light bulbs and fluorescent lamps.

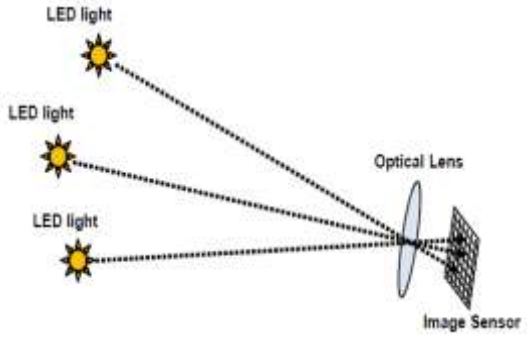

Figure 1
Concept of VLC

System introduce an emerging wireless technology that may possibly expand the availability of wireless communication mediums. This fairly new technology is known as Visible Light Communication (VLC), or can specifically be referred to as Light Fidelity (Li-Fi). Visible light is a form of electromagnetic radiation that can be perceived by human eye.Its spectrum covers the wavelengths from 380 nm to 780 nm—visible violet light has the wavelength of about 380 nm and visible red light has the wavelength of about 780nm .Visible light is constantly available in places like the supermarket, and the school, which increases its efficiency,

because it will not only be used as light source, but also as data transfer medium through VLC. The visible spectrum utilized by VLC has a frequency 10,000 bigger than that of the radio spectrum, given that the visible frequency is at Tera hertz while the radio frequency is only at Giga hertz. There are also current studies about how fast the speed VLC can have a speed that can be greater than 500Giga bits per second.It is also advantageous that this technology has line-of-sight properties that can provide security to the users. Given that visible light cannot pass through solid objects and walls, confidential information can be kept in an enclosed area.Many public places are not visually impaired friendly. There are instructions anddirections that are not in Braille, nor in audio. The blind relies on people in their surroundings to tell them where they are and give them verbal locations. This system proposes indoor location-based system instructions that can aid the visually impaired to manoeuvre around the area with the use of Light Emitting Diode (LED) light sources. One of the main reasons for replacing incandescent and fluorescent lighting with LED is its low energy cost. To fully explore this feature and further improve the energy efficiency,the illumination system should be capable of brightness control.Specifically, the brightness of LED should be adaptive to the brightness of the environment. However, when illumination is combined with communication, this adaptation must consider the effect on the performance of communication,because low brightness leads to low signal transmission power,which directly decreases the SNR. Therefore,VLC calls for new brightness control techniques to determine the trade-off between illumination and communication.In, two brightnesscontrol methods are developed based on pulse widthmodulation (PWM) and changing modulation depth. The simulations demonstrate that it is able to control the brightness from 0 to 87.5 percent maintaining the communication performance with PWD over 60 kHz frequency. Besides, the best performance can be achieved from 12.5 to 87.5 percent.Instead of Braille instructions, there will be LED light sources which will be called the central device, that will send or transmit digital codes that correspond to specific audio location information. The central device uses light pulses to transmit the code, and then the end device, which consists of the receiver and the smart device, accepts the light and translates the code to its corresponding location information. The audio can be heard directly from the receiver or from the smart devicethat is connected to the receiver. There can be multiple end devices that can simultaneously accept the codes from the central device.

II. VISIBLE LIGHT COMMUNICATION(VLC)

Light source is substantial in VLC such as antenna to RFbased communications. Its propagation pattern affects not only the quality of communication, but also the illumination.With the rapid development of high-brightness light emitting diode (LED) materials in the context of solid-state lighting,particularly white LEDs, LED-based illumination devices area promising replacement to traditional incandescent-basedand compact fluorescent-based illumination devices in the
near future. Due to the advantages of LEDs, such as goodlight quality, low energy consumption, small size, and longlifetime, they have been deployed in many countries aroundthe world as indoor illumination, display devices, and trafficlights. Nowadays, some of the attractive properties of LEDmake it particularly proper for wireless communication.Onthe transmitter side, the signal is easy to modulate by on-offkeying modulation to achieve high data rate. On the receiverside, photodiodes are able to convert the optical signals toelectrical signals at very high rates. In addition, due to thefeature of diffusion, it is more widespread than a narrowbeamwidth lighting source to provide ubiquitous wireless communication.Basic working system diagram is shown in figure 2. First block is of storage where location information is stored in audio format.

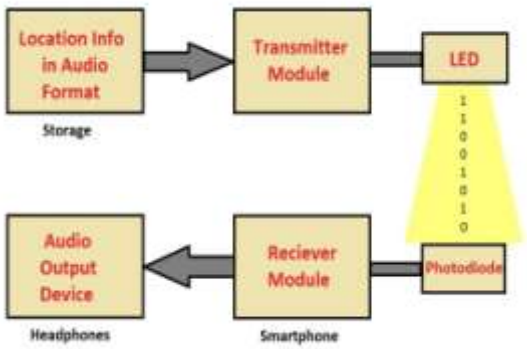

Figure 2 Basic Working of VLC System

This data is transferred to transmitter module. Transmitter module will first encode this data in binary format and transmit through LEDs in the form of light pulses. This light pulses are detected by photodiode. Received data is transferred to receiver module. Receiver module will compare thisdata with Look-up-Table data which is stored in storage of receiver module.

The system has three devices that communicate through multicasting. It consists of a central device which acts as a transmitter and two end devices acting as receivers. The end devices have LEDs that send a request and receive an acknowledgement to and from the central device. The central device upon receiving a request continuously sends data while the end devices checks if the bits sent correspond to a set of code in its look up table. Increasing security and

for personalization purposes, the end device is where the audio information is kept, specifically in an SD memory card. Communication between devices is possible by using the light emitted by the LEDs as medium and modulating it. This medium will continuously carry the signals from the devices. Interruption of transmission occurs through the use of the Android application developed to control the sending of request of the receiving end device.

In line with the study's objectives to be able to transmit at an elevation of 100cm and in different lighting conditions, the optoelectronic characteristics were modified.Optical filters and secondary lenses were added to satisfy the aforementioned objectives. The filters allow specific wavelengths, cancelling out interference of unwanted light sources. The lenses focused the light diffusion of the LEDs, increasing the light intensity and reach of the transmission.

III. LIFI OPPORTUNITIES

LiFi is a disruptive technology that is poised to impact a large number of industries. LiFi can unlockthe IoT, drive Industry 4.0 applications, enablelight as a service (LaaS) in the lighting industry,contribute to the 5th generation of cellular systems (5G) and beyond, enable new intelligent transport systems, enhance road safetywhen there are more and more driverless cars,create new cyber-secure wireless networks, enablenew ways of health monitoring of aging societies,and offer new solutions to close the digitaldivide.

IV. CONCLUSION

So we can transmit Location information in the form of audio signals using LED as the communication medium. The group implemented audio multicasting using visible light communication that is used to send location information to aid the visually impaired. The project was executed using light emitting diodes, which has the capability to transmit fast light pulses. The central device is able to transmit using LED as the communication medium to two end devices simultaneously. The end devices can receive the information successful after being placed 1 meter below the central device. The system is also able to function in both dark and bright lighting environments. If this technology can be put into practical use, every bulb can be used something like a Wi-Fi hotspot to transmit wireless data and we will proceed toward the cleaner, safer and brighter future.

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