RECENT DEVELOPMENTS IN COMMUNICATION TECHNOLOGY: LI FI
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ABSTRACT:
Abstract—Need of high speed communication system had led to the advancement in the visible light communication system (VLC). Though Wi-Fi provides speed up to 150 megabytes per sec as per IEEE 802.11n, which is not adequate to accommodate number of desired users. To overcome this boundary of limitation of Wi-Fi, new concept of Li-Fi technology is introduced. Light Fidelity or Li-Fi, is an exciting breakthrough in 5G visual VLC systems and the upcoming bright future of wireless Internet access. Li-Fi, technology developed by a team of scientists including Dr. Gordon Povey, Prof. Harald Haas and Dr Mostafa Afgani at the University of Edinburgh is a bidirectional, fully networked high speed wireless communication technology similar to Wi-Fi. VLC along with light emitting diodes (LED’s) are used to create fully networked wireless system of communication known as Li-Fi. Li-Fi has the advantage of being useful in electromagnetic sensitive areas such as in hospitals, aircraft cabins and nuclear power plants without causing electromagnetic interference. Li-Fi is ideal for removing discomfort of radio interference issues and for high density wireless data coverage in confined area. Li-Fi provides better efficiency, bandwidth, availability and security than Wi-Fi and it has already achieved fastidiously high speed in the laboratories. By utilizing the advantage of the low-cost nature of LEDs and lighting units there are many opportunities to exploit this medium, from public internet access through street lamps to auto-piloted cars that communicate through their headlights. A future where data for smart phones, tablets, laptops will be transmitted through the light in a room has been envisioned by the scientists who are still working on it. This paper discusses the upcoming fully networked wireless technology, advantages and its shortcomings.

Keywords: Wireless fidelity (Wi-Fi), visible light communication, light fidelity (Li-Fi), advantages, shortcomings.

[1] INTRODUCTION

All of us are actively engaged on the internet some way or the other. We are using the internet for a variety of purposes, chief among them being sharing of data. It is becoming impossible to think of a day in our lives, when we are not connected to internet. In these scenarios where we want to transmit data at excellent speed and efficiently, low internet speeds can be quite tiresome and annoying.

LiFi is transmission of data through illumination by using fiber optics by sending data through a LED light bulb that varies in intensity extensively. Li-Fi is the term which has been used to label the cheap and fast wireless-communication system, which is the optical version of
Wi-Fi. The term was first used by Harald Haas in his TED Global talk on Visible Light Communication. “At the heart of this technology is a new generation of high brightness light-emitting diodes”, says Harald Haas from the University of Edinburgh, UK. Simply, if the LED is on, digital 1 is transmitted, if it is off digital 0 is transmitted. They can be switched on and off very quickly, which gives nice opportunities for transmitting data. The LED intensity is modulated drastically so that human eye cannot notice, hence the output appears constant. It is possible to encode data in the light by varying the rate at which the LEDs flicker on and off to give different strings of 1s and 0s. More sophisticated techniques could rapidly increase VLC data rate.

[II]. HOW IT WORKS

It is implemented by using a light bulb at the downlink transmitter. Normally the bulb glows at a constant current supply however subtle and fast variations in current can be made to produce the optical outputs since it just uses the light, hence can be easily applied in aircrafts or hospitals or any such area where radio frequency communication is often problematic.

The operation is very simple, if the LED is on digital 1 is transmitted, if it is off 0 is transmitted. The LED has a speciality of switching on and off very quickly hence providing data transmission opportunities. Hence some LEDs are needed and a controller that has the capability of coding data into those LEDs flicker depending upon the data we want to encode. The more LEDs in lamp, the more data it can process and transmit. To get clear idea of what is said above considering a IR remote which sends data stream at rate of 10000-20000 bps. Now replacing the IR LED with a light box having a large LED array which is capable of sending thousands of such streams at very fast rate. LEDs are found in traffic and car brake lights, remote control units, street light and countless other applications. So visible light communication not only solves the problem related to lack of spectrum space but also provide novel application because this spectrum is unused and unregulated thus it can be used for very high speed communication. This method of utilizing fast pulses of light to transmit data and information wirelessly, technically is referred to as visible light communication (VLC) having a potential to compete with Wi-Fi and hence inspired the characterization of Li-Fi.
[III] TRANSFER MEDIUM (FIBER OPTIC)

Fiber optic cables are wires that transmit data through a extremely thin layer of plastic fiber threads or glass. The relation between Li-Fi and fiber optic thread is that light signals in the form of light travel through these fibers and then translated to 1’s and 0’s, the digital data part. Though fiber optics are extremely expensive but heavy bandwidth availability can overcome this disadvantage and hence may soon replace most existing wired cables and the change has already started initiating the same.

[IV] RECENT ADVANCEMENTS IN LI-FI

Using a standard white-light (LED), at the Heinrich Hertz Institute in Berlin, Germany, researchers have reached data rates of over 500 megabytes per second. Using a pair of Casio smart phones, the technology was demonstrated at the 2012 Consumer Electronics Show in Las Vegas to exchange data using light of varying intensity given off from their screens, detectable at a distance of up to ten meters. An association called Li-Fi Consortium was formed in October 2011 by a group of companies and industry groups to promote high-speed optical(data transmission) wireless systems and overcome the limited amount of radio based wireless spectrum. According to the Li-Fi Consortium, it is possible to achieve more than 10 Gbps of speed, theoretically which would allow a high-definition film to be downloaded in just 30 seconds. At the University of Strathclyde in Scotland researchers have begun the task of bringing high-speed, widespread, Li-Fi technology to market.

[V] ADVANTAGES OF LI-FI

Li-Fi technology is based on light source for the transfer of data basically LEDs. The transfer of the data can be made possible with the help of all kinds of light, no matter which part of the spectrum they belong. That is, the light used for data processing can belong to the invisible, ultraviolet or the visible part of the spectrum. Also, the speed of the communication is more than sufficient for downloading movies, games, music and all in very less time. Also, Li-Fi removes the limitations that have been put by the Wi-Fi to the users.

- **Capacity**: Light has 10000 times wider bandwidth than radio waves. Also, light sources are already installed. So, Li-Fi has got better capacity and also the equipments are already available.
- **Efficiency**: Li-Fi provides very cheap and efficient Data transmission. LED lights consume less energy and are highly efficient.
- **Availability**: Availability is not a problem as light sources are present everywhere. Billions of light bulbs present worldwide need to be replaced with LEDs for proper transmission of data.
- **Security**: Light waves do not penetrate through walls. It becomes advantageous as they can not be intercepted and misused. With the advent of Li-Fi, now it is not mandatory to be in a region that is Wi-Fi enabled to have access to the internet. One can simply stand under any form of light and surf the internet as the connection is made if light is present. Thus increasing the range of use too.

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[VI]. DISADVANTAGES OF LIFI

One of the major demerits of this technology is that the artificial light cannot penetrate into walls and other opaque materials but radio waves can do. So a Li-Fi enabled end device will never be as fast and handy as a Wi-Fi enabled device in the open air. Also, another disadvantage is that it only works in direct line of sight. Still, Li-Fi could emerge as a boon to the rapidly depleting bandwidth of radio waves. And it will certainly become the first choice for accessing internet in a confined room at cheaper cost.

[VII] CONCLUSION

The possibilities are numerous and can be explored further. If this technology can be practically used, every bulb can be used like a Wi-Fi hotspot to transmit wireless data and information and we will certainly move toward the safer, greener, cleaner and brighter future. The concept of Li-Fi is currently attracting a great deal of interest, because it may offer a high speed genuine and very efficient alternative to radio-based wireless communication system. As a growing number of people having enormous devices accessing wireless internet, the airwaves are becoming increasingly obstructed, making it more and more difficult to get a reliable, high-speed signal. With the use of Li-Fi system these problems may be solved such as the shortage of radio-frequency bandwidth and also allow internet where traditional radio based wireless is not allowed such as aircraft or hospitals. One of the shortcomings however is that it only work in direct line of sight. The concept of Li-Fi is attracting everyone because it offers a genuine and very efficient alternative to radio based wireless system. It has a bright chance and enormous advantages to compete with Wi-Fi and to replace the traditional Wi-Fi because as an ever increasing population is using wireless internet, the airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, efficient, high-speed signal. This concept promises to solve these problems such as the shortage of radio-frequency bandwidth and boot out the disadvantages of Wi-Fi. Li-Fi is the upcoming and on growing technology acting as competent for various other developing and already ongoing invented technologies previously. Hence the future applications of the Li-Fi can be predicted because of its efficiency and extended to different platforms for various applications and different walks of human life.
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