Opportunities and Challenges to Implementation of LIFI

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July 22, 2020

Opportunities and Challenges to Implementation of LIFI
A Review

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Abstract- LIFI was first introduce by Professor Harald Haas on July 2011. Light fidelity (LI-FI) is a technology which uses light as a medium to travel from one place to another. It uses Light like Light Emitting Diode (LED) Visible Light Communication (VLC) for data Transferring and Internet connection. LIFI is a technique which uses light as a medium because it uses light to travel it is 20 times faster than any WIFI in the world. In this paper we talk about things like what is LIFI and how it is better then WIFI why We need LIFI and What changes did bring LIFI in our Future LIFI. How it will make IOT devices much better than before The Technique to implement LIFI and the problem we face of implementation of LIFI.

Keywords: LIFI, WIFI, VLC, LED, IOT

I. INTRODUCTION

LIFI is a wireless based system which uses Light Emitting Diode (LED) and visible Light communication (VLC) for travel from one place to another. In simple words LIFI uses light as a medium to travel from one place to another. LIFI was first introduce by Professor Harald Haas [1].In the upcoming Future where automobile devices Bicycle Motor bike Cars and even Doors are using Technologies which use Internet to operate like ever car and motor bike has a digital map on it which help him to travelled any unknown places easily. In 2019 Up to 10 billion Mobile devices exchange data and these are just mobile devices. Think if there was included BIG Data IOT devices and Other things. According to a research in 2020 the number of things exceed up to 20 billion so you can see how much is LIFI is important in up comings days. As we Know WIFI uses radio active waves for transmission and LIFI uses light as a transmission medium so IT was much faster than WIFI. In WIFI there is a limit of how much we can send data at a time but in LIFI it was nearly unlimited for data transfer in LIFI. In WIFI we use modem and wires for using of internet so when we are far from modem it made our file transferring so problematic but in LIFI we use LED light bulbs and tubes for as a replacement of modem in short, every light bulb tube or any other light is a source of Internet provider.

II. LI-FI

Light fidelity (LI-FI) you can say that it was the same as WIFI if you say in simple terms because both are working on wireless principle both are used for transferring data and use of internet. LIFI was first introduce in 2011 by a professor of Harald Haas. They first introduce a concept where they use light to travel data from one place to another. In the research they show that the light can be used to travel data and it is 20 times faster and more stable than a normal WIFI system. In our up coming daily life where time is money and we need to work faster then before 1 seconds can cause us so much loose so there we need a connection a service which is more reliable and faster which is more fascinating and who is more stable than any other service we have.

Visible light communications (VLC) was introduced by Tanaka, et al. [2] and uses high brightness white light-emitting diodes (LEDs) for data communication. A limitation of LEDs is that the phase of the optical signal is not available for data encoding. Therefore, VLC is limited to intensity modulation (IM)/direct detection (DD). Historically, this has limited the attainable transmission speeds. However, high speed data transmission with LEDs at low computational complexity was enabled by modifying multilevel and multicarrier modulation techniques [3].

LI-FI is based in LED light. LED light can travel at a speed which in undetectable to human naked eye to transmit data. In facts it's been demonstrated that information can be transmitted at as much as 224 gigabits per second [4], the equivalent of 18 movies of 1.5 GB each being downloaded every single second in lab conditions. You can say that the heart of Li-fi technology is high brightness LED's LED can be switched on and off very quickly. You can say in binary when LED in on it was 1 and if LED was off it was 0. And the on off speed of a LED blub is one mini second $1\mu s$. The importance of using VLC is that frequency above 3THz is not regulated by radio regulating laws.

WIFI which uses radioactive waves are also harmful to human. On the other hand LED Give us light take lesser energy than normal light bulb and they are more brighter. Wi-Fi effects which have been found by multiple Wi-Fi studies and have been previously confirmed by non-thermal exposures to other microwave frequency EMFs. The 1971/72 U.S. Office of Naval Medical Research study (Glaser, 1971) reported the following changes related to testis or sperm [5].

Fig 1.0 The Figure tell us about the LIFI system Work with the help of LED lights and blub. [6]

III.   INTERNET OF THINGS (IOT)

As we learn about LIFI lets talk about a little IOT internet of things. In this all the things are connected to one another with the help connection and they can be control by the help of a sensor. The Automatic door Fig 2.0, Automatic lights are the example of IOT. IN IOT we controlled all these things through internet or with the help of other wireless connection like Bluetooth. IOT devices make our life much easier and suitable for us and it also help us to not use extra energy for example when we are not home all doors are automatically. So we don't need to go to every door to lock it.

Fig 2.0 A censoring door which detect the person in front of him and open Automatically
 with the help of sensors.

LIFI IN INTERNET OF THINGS (IOT)

 AS above mention IOT devices uses sensor and an internet connection and you can make your whole house automatic like Dexter Laboratory cartoon I usually watch when I was kids. So when you make your whole house automatic if you are using WIFI it will also effect your health like above mention WIFI uses radio active waves and EFM wave which are so harmful for human bodies internally and externally. So

LIFI is the best Option in IOT. LIFI is environment friendly. As mention where comes advantages there are disadvantages are also there LIFI uses light transmission so it can not passes through wall and in day there is a chance when you send signals it got distracted in SUN light on the way and it also difficult for him to travel in normal bulbs or lights.

LIFI based automated shopping assistance application in IoT introduce by Sharmin Akter in 2018 [6]. Where they use LIFI base system in IOT device which helps the customer to find there item easily and find the most things easily. It was created with two different version one web and second mobile apps. Automatic billing system using LIFI was introduce by Zubin Thomas [7]. Where he uses LIFI fir better connection in billing there product and System.

IV.   IMPLEMENTATION OF LI-FI

There are many possibilities Where WIFI is better then LIFI but future lies in LIFI. Where LIFI is very useful and it travel with fastest speed in whole world with the speed of light it was also hard to implement everywhere and it's not an easy task. LIFI communication system involve full duplex communication mode. The downlink in LIFI use the visible light spectrum for transmission of by intensity modulation of LEDs in Solid State lightening system [8]. It uses A transmission where the main signals are coming from and then they travel through LED lights like a Modem in WIFI. When LIFI was first introduce it was nearly impossible to implement LIFI immediately. So they make it progress slowly.
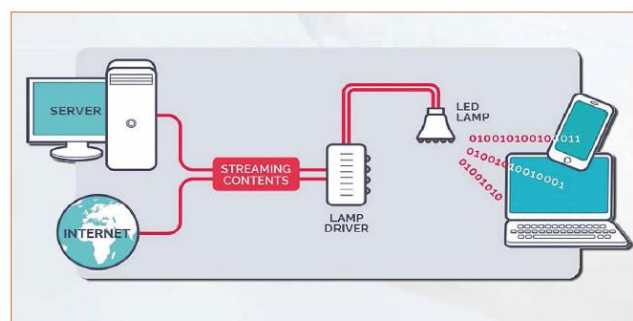

Fig 3.0 implementation of LIFI [6]

LIFI technology is very simple from a functional point of view. The majority of applications exchange data in digital form. A transmitter, essentially an LED, sometimes a laser, emits light and information simultaneously. We then find the standard elements of a data chain transmission: data, coding and a network. These digital networks modulate the LED transmitter which then allows the transposition of the electrical signal into a light signal. Then the light signal is freely diffused into a room or outside. Depending on the distance, there is a greater or lesser reduction and according to the various environmental disturbances (rain, sun, other lighting, etc.).A receiver, made up of a photodetector or a camera upon arrival is responsible for re-transcribing the luminous signal into an operational electrical signal. Coupled with this conversion it is quite frequent especially for high speed links to find the pre-ampLIFIcation level adapted to the specificities of the chain. The modulations used are essentially power modulations; the LED is therefore piloted

by a switch circuit based on simple electronics. The selected rates of modulation are sufficiently high so as to ensure that the flickering is not visible to the human eye (> 200 Hz) [9].

In the experiments performed by Herald Haas and his team, LEDs exhibited a potential to work even when the receivers were partially shadowed. The experiments hint the viability of such systems in practical deployment and
that they can be used for communication at great speeds peaking to 1Gbps under clear conditions and more than
100 Mpbs in fog [8]. A complete LIFI network is composed of handover, multiple access, and co-channel interference (CCI) coordination, as shown in Fig. 4.0 There are two types of handover: horizontal handover and vertical handover. Horizontal handover refers to a change of the serving AP from within the same radio access technology (RAT). Vertical handover refers to a change of the serving AP belonging to a different RAT. For example, mobile users may be transferred from a LIFI AP to a Wi-Fi AP when none of the LIFI APs are able to offer a reliable link or the speed of the user is too high so that the dwell time in a cell is too short to establish a meaningful communication link. When the user slows down and enters the coverage of a lightly loaded LIFI AP, it may be best to handover to that LIFI AP to relieve the Wi-Fi network for more efficient operation (e.g, ensuring less packet collisions). [10]

V. Problem and solution in Different LIFI System

In 2019 Ardimas Andi purwita introduce OFDM-base LIFI system in which they tells that how the FDM LIFI system work in indoor system [8]. MOHAMMAD DEHGHANI SOLTANI also work on OFDM error system in 2019 they analyze the device orientation and assess its importance on system performance. The reliability of an OWC channel highly depends on the availability and alignment of line-of-sight (LOS) links. In this study, the effect of receiver orientation including both polar and azimuth angles on the LOS channel gain are analyzed [11].in an another article S. Jayasudha also talk about the lifi effect on 5g technology in that paper the tell us about a experiment A two minutes video is captured for each BER measure- ment to increase the BER reliability. In this proof of- concept experiment, only a single moderate brightness white-light LED is used, and the transmission distance at ~500 lux is 26 cm. The transmission distance can be further enhanced by using higher brightness LEDs. The sensor cannot record any signal during the transfer time [see Fig. 1(b)], and this time in our camera is 14.29 ms (~40% of an image frame). Hence, each data packet will be transmitted 3 times successively to ensure each image frame captured by the camera contains a complete data packet including both header and payload. Finally, the net data rate is ~1 kbit/s with deducting the duplicated data packets [12].

VI. Conclusion

Wireless communication Fast speed internet file transferring calling, video calling, and entertainment stuff now a days everything is related to mobile phone internet and wireless devices. As mention above there will be 20 billion mobile device in 2020 and its only mobile devices its not include laptop computer and other things. So we need fast speed and bigger network of internet. But wifi uses radio active waves and radio active waves are not only harmful for human health

its also harmful for other animals trees and other living things so we need a network which is more less harmful for living things and that is LIFI LED and VLC base system which is Ecofriendly and 1000 times more faster then any wifi network available right now and it was the best solution and it was the future. We discussed some way to implement LIFI and see why it is difficult until now to implement it.

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