A Study on LiFi – Light Fidelity Technology

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Abstract— As man's birth has taken place on earth he is developing. He has made considerable progress in the fields of science and technology. He has made technology for his comforts that ultimately resulting in saving his time. Even for data transferring and sharing between two or more machines he has invented technologies and techniques which give maximum throughput by consuming minimum time or having very low time complexity. His developments varies from wired communication to wireless communication to communication using transparent fiber made of glass or optical fiber. In this plethora of developments in wireless communication he has gone one step ahead and invented a technology of LiFi – Light Fidelity technology that enables data to be transferred through light as a medium of communication. It is also called as optical wireless technology or visible light communication. This paper aims to explore this technology and give a comparative study of LiFi with other wireless communication technologies.

Index Terms— Internet of Things, LiFi, Light Sensor, Optical Wireless, Visible Light Communication, Wireless Fidelity.

1 Introduction

LiFi or Light Fidelity is a high speed, bidirectional and fully networked subsets of visual light communications (VLC). It uses visible light communication instead of radio frequency (RF) waves which carry more information. Thus LiFi is an emergent technology that has the potential to deliver enormous bandwidth. As data transmission through radio waves approaches its limits, a new medium presents itself. Most of us are familiar with WiFi (Wireless Fidelity) uses 2.4-5 Ghz RF to deliver wireless data, information or internet access around. It can cover up a large area, but it fails to cover up all the area as its bandwidth is typically limited to 50-100 megabits per second (Mbps). This is a good match to the speed of internet services, but insufficient for moving large data files like HDTV movies, music libraries and video games. The bandwidth and speed is directly proportional medium of communication. Therefore RF-based technologies such as today's Wi-Fi are not the optimal way. In addition to that Wi-Fi fails to provide new desired capabilities such as precision indoor positioning and gesture recognition.

To this a new trend has come in technology that overcomes these flaws, that is LiFi or Light Fidelity. Which is also called as visible light communication and informally known as optical wireless technology, a vivid permutation of speed, reliability, flexibility and usability.

LiFi is transmission of data through illumination by taking the fiber out of fiber optics by sending data through a LED light bulb that varies in intensity faster than the human eye can follow. LiFi is the term some used to label the fast and cheap wireless communication system which is the optical version of WiFi. 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 0s and 1s. The LED intensity is modulated so rapidly that human eye cannot notice, so the output appears constant. More sophisticated techniques and ways could dramatically increase visible communication data rate.

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2 Modus-Operandi of LiFi

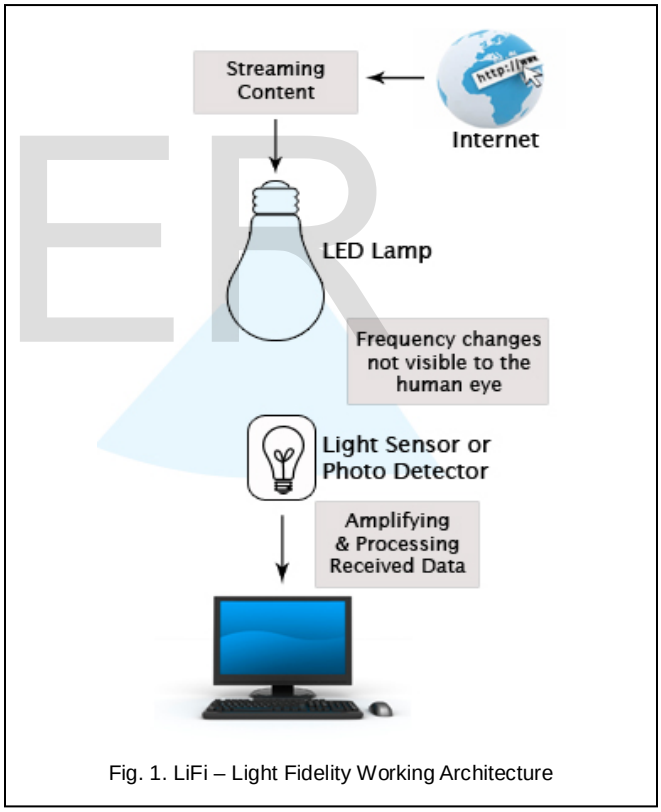

Fig. 1. LiFi – Light Fidelity Working Architecture

The Fig. 1. Above illustrates the working of LiFi technology. The information that is to be sent for example through Internet is being given to the LED Lamp. Whenever the device having the Photo Detector comes in contact with the LED Lamp's light, it automatically receives the information designated to the machine. Basically it is construction consists of a regular LE bulb with a microchip. This enables to transmit wireless data with an LED light bulb and a sensor. By turning lights on and off at a very high speeds the LED bulb can send out high bandwidth wireless data. Data is converted into pulses of light which is directed at a photo detector or light sensor that picks

up minute changes in light intensity and duration. This light signal is then converted back into data formats for output from a computer.

Prof. Haas Harald, invertor of this technology claims the advantage of this medium of transmission is that, visible light has 10,000 times the spectrum of radio frequencies allowing faster data with far higher volumes in a single data stream. This medium can be made available anywhere that light bulbs can be found and the only infrastructure required are regular bulb sockets fitted with the modified LED lamp and the photo detector or light sensor to read the data. No other massive infrastructure need to be constructed to roll out this technology.

3 Comparison With Other RF Technologies

LiFi has a unique advantage over Radio Frequency (RF) transmission. WiFi is a great for general wireless coverage within buildings and LiFi is ideal for high density wireless data coverage in confined area and for relieving radio interferences issues, so the two technologies can be considered complimentary. The comparison parameters of any two transmission technology is speed, range, data density, security, reliability, power available, transmit/receive power, ecological impact, device-to-device connectivity, obstacle interference, bills ot materials, market maturity. LiFi is a step ahead against any RF Technology in all aspects or parameters mentioned above.

LiFi Technology is based on LEDs for the transfer of data. The transfer of the data can be with the help of all kinds of light, no matter the part of the spectrum that they belong. That is, the light can belong to the invisible, ultraviolet or the visible part of the spectrum. Also, the speed of the internet is incredibly high and we can download movies, games, music etc. in just a few minutes with the help of this technology. Also, the technology removes the limitations that have been put on the user of WiFi. It does not need to be in a region that is WiFi enabled to have access to the internet.

LiFi can also be a superset of 'Visible Light Communication' (VLC). This VLC represents only a fraction of what appears to be a much larger movement towards optical wireless technologies in general. LiFi comprises several optical wireless technologies such as optical wireless communication, navigation and gesture recognition applied for natural user interface. Thus, it provides a completely new set of optical technologies and techniques to offer users add-on as well as complementary functionalities compared to well-known and established RF services. This could read from a new user experience regarding communication speeds in the gigabit-class to bridge the well-known spectrum crunch, over to precise indoor positioning or controlling video games, machines or robots with entirely new natural user interface.

This is mainly where conventionally RF transmission is considered hazardous as in petro-chemical plants, aircrafts and hospitals. There has been an idea proposed that to convert the 14 billion light bulbs in use today into 14 billion LiFi's for a cleaner, greener and brighter future.

4 Applications

LiFi can be used in Internet of Things (IoT). It refers to uniquely identifiable objects and their virtual representations in an internet like structure. LiFi can be made to connect these identifiable objects.

LiFi can be used in traffic control where data can be exchanged between cars and traffic lights to enhance road safety.

One application of the LiFi is in underwater ROVs, those favorite toys of treasure seekers, operate from large cables that supply their power and allow them to receive signals from their pilots above. ROVs work great, except when they tether isn't long enough to explore an area or when it gets stuck on something. If their wires were cut and replaced with light – say from submerged, high-powered lamp – then they would be much freer to explore just like using LiFi technology over here. This could use headlamps to communicate with each other, processing data autonomously and referring findings periodically back to the surface, all the while obtaining next batch to orders. This is one of the applications where in LiFi can be used.

4 Conclusion

The possibilities are numerous and can be explored further. If this technology can be put in to practical use, every bulb can be used something like a WiFi hotspot to brighter future. Although there are some barriers as in how the data would be transmitted over vast distances. At this point we're left with more questions than answers. But given the implications and implementations in the given time by of such a promising technology, it is only a matter of time before we find out the answers to this next generation LiFi or Light Fidelity Technology.

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