

Evaluation of Li-Fi

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Abstract: Light Fidelity (Li-Fi) is transmission of data through illumination, sending data through a LED (light emitting diodes) light bulb that varies in intensity faster than human eye can follow. Light Fidelity (Li - Fi) evaluation that evaluates the Li – Fi terminologies and VLC prototype. The first phase of evaluation report focuses on the light fidelity terminologies such as capacity, efficiency, cost, safety and security. In addition, the report shows the complete research on the terminologies. As Light Fidelity uses the light waves, they is no harm for people. This notion gives strong recommendation for light fidelity. The second phase of the evaluation focuses on VLC prototype. The visible light communication prototype is used for Light Fidelity because the VLC uses LED light for transmission. The report recommends to develop the prototype for Li – Fi transmission.

I. INTRODUCTION

Nowadays, new internet connectivity researches are carried by the engineers and scientists for demand for higher bandwidth wireless internet technology[5]. Among various internet technology, Light Fidelity is getting its importance nowadays. The light fidelity (Li – Fi) technology needed to be researched with the existing prototype and internet terminology.

The existing technologies are GSM, GPRS, EDGE, LTE, and Wi – Fi and they has higher cost, limited coverage area, limited bandwidth and limited sources. The term light fidelity (Li – Fi) was coined by Professor Harald Hass at the University of Edinburgh. The light fidelity is the process of transmitting wireless data through LED lights[3,1]. The recent research interprets that Li – Fi technology can able to contribute 100Gbps at the end user side (Savage, N., 2015). Li – Fi may addresses the problems in previous technologies. Li – Fi technology elevate the bandwidth, rate of the speed, and lower interrupt rate.

II. LITERATURE REVIEW

Revathi Ganesan et al, Light Fidelity using light-emitting diodes as a medium to high-speed communication in a similar manner as Wi-Fi. In the days where internet has become a major demand, people are in a search for Wi-Fi hotspots. Li-Fi or New data communication is a better alternative to Wi-Fi in wireless communication[4]. Alberta et al, Ad hoc network is used to car to car communication by sending the data through light emitting diode.

A. Purpose

There are four factors have to be considered for the process of Li – Fi evaluation. They are capacity, efficiency, cost and safety. In addition, the evaluation of Li – Fi technology should also consider the security of the wireless data communication. There are two tasks for the Li-Fi evaluation. They are examining terminologies and examining prototype. To exam the Li – Fi terminologies, capacity, efficiency, cost, safety, security and privacy were considered for the report. To exam prototype, Ultra Parallel Visible Light Communication prototype

was considered as an effective prototype for the analysis purposes[6].

B. Scope

There are two factors that are limited in the process of evaluating Li – Fi. They are limited material resources for Li – Fi, limited prototypes. In the evaluation of Li – Fi, these two factors delayed the research for the report. Furthermore, Li – Fi is on the research. So the reliability of Li – Fi is hard to determine. However, the basic and complete research were carried over for this report.

III. EVALUATION OF LI-FI

The evaluation of Li – Fi technology was carried out in two phases[1]. They are evaluation of Li-Fi terminologies and the evaluation of prototypes.

Li – Fi terminologies Evaluation

Characteristics	Bluetooth	Wi – Fi	Li – Fi
Data transfer rate (Capacity)	800Kbps	11Mbps	>1Gbps
Efficiency	Medium	Low	High
Cost	Low	Medium	Low
Security	Less Security	Medium Security	High Security
Safety	Less safety	Medium safety	Higher safety

Table 2.1.1 Comparison of terminologies of wireless technologies (Ganesan, R., 2014) k,mmmmThe report focuses on the Li – Fi data communication capacity, efficiency, cost, safety and security. The following table shows the comparison of various wireless technologies.

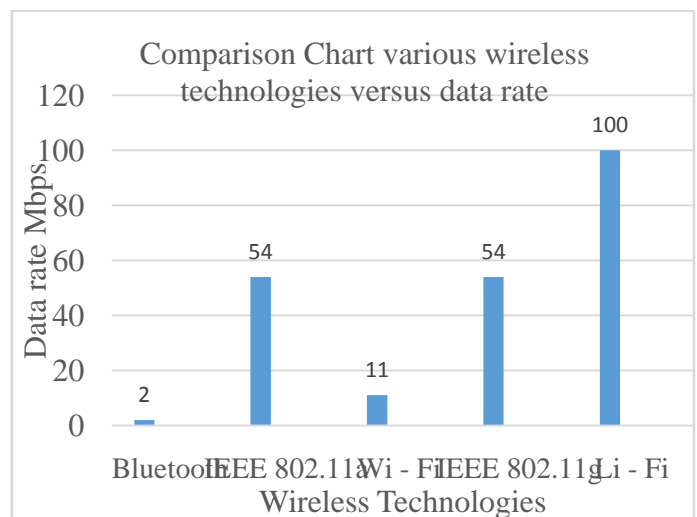


Figure 2.1.2 Comparison – various technologies (Ultra – Wibeband: Multimedia Unplugged, 2003)

Capacity

Li – Fi wireless communication can be achieved by transmitting wireless data through the LED lights. The transmission of signals has done by light waves through light ON and OFF. The internet streaming was done by LED lamp. The application installed in the computer or phone able to detect the photons to get the wireless data through LED lamp. The amplification and processing process helps to strength and increase the bandwidth of the data communication. Since the light waves are not affected by electro-magnetic waves, Li-Fi has higher capacity than earlier technologies. The typical bandwidth of Li-Fi varies from 3.5Gbps to 10Gbps. The bandwidth of the Li-Fi is higher than Wi – Fi, which is typical rating of 100Mbps (Villinger, S., 2012). The table 2.1 shows that the average capacity of data rate is greater than 1Gbps. The range of bandwidth may elevate to 100Gbps in the future.

Efficiency

The band rate greater than 1Gbps is impracticable before Li – Fi. Li – Fi has higher efficiencies than the earlier technologies. The earlier technologies like Wi – Fi, EDGE, LTE and Bluetooth use radio waves for the data transmission. Subsequently, there will be an accountable distortion and data loss. The earlier technologies are less efficient considered to Li – Fi. The data transmission of Li – Fi is with the help of light waves. So there will be negligible amount of distortion and data loss. Eventually Li – Fi can increase the bandwidth and efficiency. The table 2.1 shows that the Li – Fi is considered to be high efficient. The efficiency of Li – Fi allows the end user to switch to Li – Fi easily[2].

Cost

Li – Fi may be implemented in a cost effective way. The Li – Fi technology can be implemented with the already exist servers and external photo detector. The installation and implementation may be easier and lower cost. The reports suggest that the photo detector is the only device needed for the Li – Fi implementation. Furthermore, the major advantage is Li – Fi makes use of the server for the previous technologies. Even though the special characteristic LED are needed for Li – Fi technology, it is enough to use dim lights (LiFi – Light based broadband puts Wi-Fi in shades, 2013).

Safety and Security

The awareness of radiation makes the people to think about safety concerns. Since the earlier technologies uses radio waves, they are not advisable to use in the places like hospital and radioactive places. The radio waves can harm the less immune patients in the hospital like people surviving by cancer. On the other hand, Li – Fi uses light emission, which does not have any radiation. Li – Fi can be used in hospitals. The light waves does not interfere with electro-magnetic force or induction, the patients under radioactive conditions can access the internet. There is no possible adverse health effects due to Li – Fi technology.

The security occupies the important position while analyzing any broadband technology. The world of internet has major benefits and minor problems such as hacking, identity theft and theft of banking information. Since the light waves could not penetrate the solid objects and the individual photo detector, the problems of internet issues can be eliminated for the

end user satisfaction. The cybercrime may be eliminated by the higher security of the light fidelity broadband technology.

In addition, to the analyzed terminologies, the higher expectancy of speed welcomes the Li-Fi for more research. The following Chart shows the various characteristics for different technologies. The table 2.1.2 clearly explained that Li – Fi will be the better adoption for the future wireless network.

Evaluation of VLC prototype



Figure 2.2.1 Fraunhofer VLC prototype (Researchers create 3Gbps Lifi network with LED bulbs, 2013).

The figure shows the prototype called VLC prototype. The Visible Light Communication is an emerging broadband technology that used to transmit broadband data. The VLC prototype consists of transmitter and receiver as shown in figure. The visible light communication is the process of data transmission using the visible light as an optical carrier to transmit data. The transmission of data is done by transmitting zero's and ones by the transmitter. The bits are transmitted to LED lights in the receiver. The typical data rate would be 500Mbps over 4 meters (Fraunhofer Heinrich Hertz Institute, 2015). The visible light communication prototype uses LED lights for the transmission of broadband data. The incorporation of visible light communication for the Li – Fi broadband communication makes possibility of low bit rate ad hoc networking.

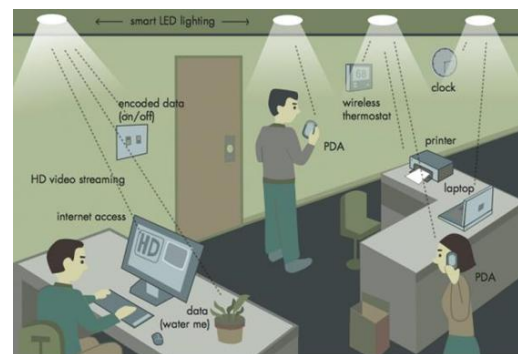


Figure 2.2.2 Typical Li – Fi system (kampinga, O. & Alberda, W. Visible Light Communication)

The typical Li – Fi system shown in figure 2.1. The Li – Fi network is a point to point network. The VLC prototype is powered by wall receptacle. The carrier is visible light used for the Li – Fi data communication. The data is transmitted over the visible light as zeros and ones to receiver end. The zeros and ones transmit to the LED lights to switch ON or switch OFF the

LED lights to decode the transmitted data. The photo detector detect the data and amplify the signal and send to the receiver end. The range of the Li – Fi signal may travel long distance as the carrier medium is light.

The most admirable advantage is Ad-hoc network, enables the user to develop infrastructure less network. The ad-hoc network is useful in Li – Fi as it is point to point network. Furthermore, the VLC prototype is simple to design and the infra – red controls are simple to configure.

CONCLUSION

Li – Fi will be the best adoption as the future wireless technology. The light fidelity technology involves the data transmission over light waves. The findings shows that Li – Fi also has increased bandwidth greater than 1Gbps which is much higher than the earlier technologies like Bluetooth and Wi – Fi. The analysis of efficiency proves that Li – Fi have efficiency than before. Li – Fi is also a cost effective wireless technology. The safety and security measures also makes the light fidelity technology more reliable. It is studied that the absence of radio waves makes the Li – Fi internet access can be available at the hospitals. The evaluated VLC prototype is an effective prototype to use LED lights for data transmission. The ad – hoc technique will be more beneficial for the point to point Li – Fi data communication.

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