Analyzing Functionality of LiFi in Comparison with WiFi

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Abstract—In network communication technology, WiFi is a popular term but along with that another fastest technology "LiFi" is being introduced.The purpose of this paper is to analyze the functionality of LiFi technology and analyze it's performance in comparison with WiFi .To find out which technology serves better, we systematically selected 12 articles published on different platforms. And after case studying those articles,we found which technology provides better operation,application,privacy,non-interference,data transmission speed, coverage distance,data density etc.

Index Terms—Network technology, Communication, WiFi, LiFi, Articles, Data transmission, Data density

I. INTRODUCTION

LiFi which is known as Light Fidelity is a network technology which uses light-emitting diods(LEDS) for transmitting data. And WiFi known as Wireless Fidelity uses electromagnetic waves to transmit data.For easier access and fastest contact WiFi is used all over the world but it still has some lackings and for getting a faster and reliable way of communication, better technologies are being searched by researcher.LiFi is a rapidly growing technology that is based on transmitting 0s and 1s trough visual lights[1]. As WiFi transmits through radio frequency, while LiFi transmits through LED light, LiFi can transmit faster but it's coverage area is smaller than WiFi[2].This paper focuses on evaluating the better technology between LiFi and WiFi.It was observed if LiFi is better than WiFi and if it is not then what does it lacks. We went through some papers that has information regarding these two technologies and their impacts on networking. To find out which technology has better service, we tried to find the answers of some research questions and after that we studied and analyzed those results. Thus after comparing their speed, distance coverage, operation,data density, noninterference,and other characteristics, we found that in many terms LiFi provides better output than WiFi but it has some disadvantages.

Using the service of LiFi technology our modern life can be more reliable and easy. As home, office, colleges use LED bulbs, LiFi can be easily applied there.In future this technology will be energy efficient as it will be used for both lighting and communicating purpose.

II. RESEARCH METHODOLOGY

A. Method used

In this study we used systematic literature review (SLR) method and case study. After designing the system we case studied and gathered data through systematic review method.

systematic review is a systematic method where research questions are formulated that are short listed and synthesizes studies related to those questions[3]. Designing a system implies to construct the system with all its components in a way that the experiment can provide desired results. And case study research is dened by investigation of a phenomenon.

B. Relevance of case study and systematic review

This research is implemented by designing the LiFi system and observing it by case studying and after that it's feature's datas are collected through systematic review method. Because to compare it's features with WiFi , first we need to test the system and observing or studying the system, we can find its characteristics which are than compared with WiFi's features. And to compare these two technologies characteristics we collected more data in a systematic review method.

C. Constructions of LiFi and WiFi Systems

For internet based system light fidelity and wireless fidelity is used.these two are most important in wireless network technology.

1) *LiFi:* Mejor components that requires for constructing LiFi is Internet, LED bulbs and LiFi dongle.

At first, some LED bulbs are placed in an area depending on the requirement for multiple number of users.In one side a lamp driver is connected to the LEDs and on the other side it is connected with internet.Streaming data coming from the internet is inserted through lamp driver software to LEDs.LiFi dongles provide internet service to multiple users.Inside a LiFi dongle there is a photodetector,amplification and processing and applications for many types of data.There is a power button connected to the lamp driver that is useed for switched ON and OFF the LED bulbs[4].

When a LED is turned On,a digital signal 1 is produced and later transmitted. When turned OFF 0 is transmitted.Photo detector inside dongle,registers 1 while LED is ON.LED is flashed multiple times in order to generate a data and used an array of LEDs of different colors to obtain data of hundreds of megabites per second.Datas are encoded in light by varying flickering rate.The LED flickers ON and OFF to create different strings of 1 and 0.It's intensity is modulated so fast that human eye can not detect.In human eye the light seems continuous as it is switched ON and OFF so rapidly.By controlling the flicker rate, informations are encoded to different combinations of 1s and 0s to the light.This method is called visible light communication(VLC) as here rapid pulse of light transmits
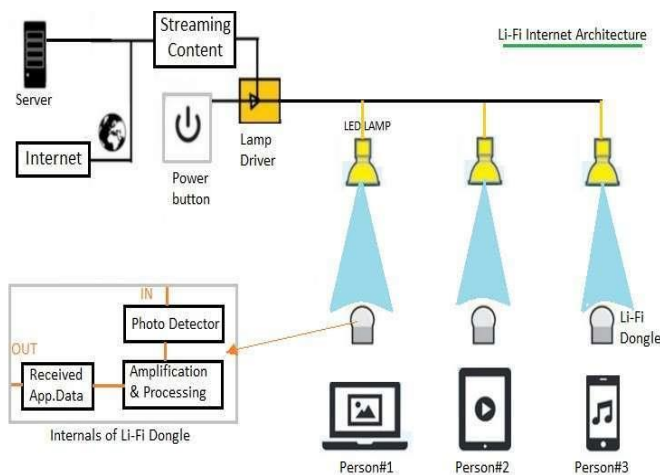
data[5].

2) *WiFi:* WiFi router and WiFi dongles or WiFi stations are the main parts of a WiFi system.Cable modem connected to router and that modem is connected with an internet service provider or network at the same time.WiFi dongles receive electromagnatic waves connected with Ip compliant devices.WiFi router can transmit data of multiple bands on demand.It converts data at different bands into WiFi compliant signals.WiFi router receives signal in radio frequency from a physical device and decodes it.Router sends the decoded data to the internet service provider through an ethernet connection.transmits At the same time multiple number of clients can use the network[6].
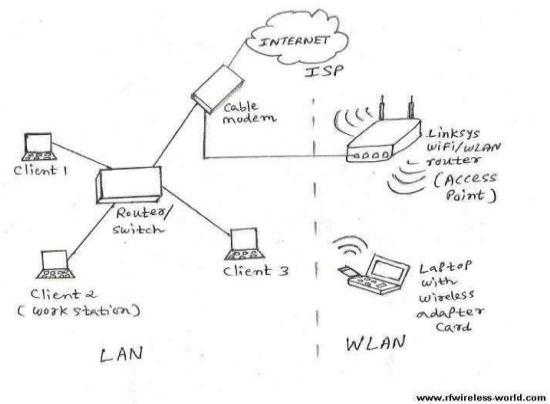

Fig 2: WiFi Internet

D. Systematic literature review

In this method, our review motivation is defined first. Then we set some research questions.Next part is article selection where articles are searched from relevant venues or through automated keyword search.Through manual selections only a few articles are short-listed.Thus we got our final set of articles.Then attribute is generalized and final attribution is set. At last, research questions are answered in article assessment section after some steps[7]. Here are the research context that we attempted to achieve our target in Table I

Fig 1: LiFi internet

Category	Research questions	Main motive
Speed	which technology can transmit data faster	To explore fastest way of transmitting data
privacy	Which technology can provide secure communication	To ensure that data remains intact
Interference	Which one has interference issue	To transmit data without interference
Distance coverage	Which one can cover maximum area for transmission	To transmit within larger area
External power	Which system need external power	To ensure power efficiency
Data density	Which one can reuse frequency	To provide better performance in high density
Bill of Materials	Which technology is budget friendly	To minimize cost
Frequency range	Which one has better frequency range	To have multiple user

III. RESULTS AND ANALYSIS

After going through all selected articles, we are going to answer the Research questions and analyze them as follows

A. Speed

RQ1:Which technology can transmit data faster?
For transmitting data quickly, LiFi has better speed as it transmits in light's speed which is the fastes medium. LiFi transmits data in 1 Gbps where WiFi's data transfer speed ranges from 150 Mbps to maximum 1 Gbps[8]

B. Privacy

RQ2: Which technology can provide secure communication? LiFi provide communication through visual lights which can be blocked by walls hence data communication is secure but WiFi ueses radio wave which can not be blocked by walls.So it requires technique to keep data secure.[9]

C. Interference

RQ3: Which one has interference issue?
WiFi has near access points such as router which creates frequency interference. Any device not related to WiFi may emit microwave and that device and router may work on same frequency. But LiFi has no interference issue as it does not use radio waves.[10]

D. Distance coverage

RQ4: Which one can cover maximum distance for transmission?
In LiFi data can be transferred within 10m range.Depending on transmitter power, WiFi can transmit upto 32m. So, WiFi has more distance coverage than Lifi.[11]

E. External power

RQ5:Which system needs external power supply?
LiFi does not need any exrenal power supply. It just needs enough power for LED bulbs. But WiFi needs external power supply for it's Radio frequency(RF) technology.[12]

F. Data density

RQ6: Which one provides more data density?
As LiFi does not face interference, it can work even in dense region by reusing frequency. But WiFi has interference issue hence it's multiple number of nodes does not provide data density[13].

G. Bill of materials

RQ7: Which technology is budget friendly? LiFi does not require expensive components such as antenna and RF devices.WiFi must have routers, antenna, RF devices. That is why LiFi is cheaper than WiFi.

H. Frequency range

RQ8 : Which one has better frequency range?
Frequency range of LiFi is ten thousand times of WiFi's frequency range.WiFi can only transmit frequency spectrum 2.4 GHz,4.9 GHz,5GHz.And LiFi can use frequency range of 400-800 terahertz of visible light.[14]

IV. DISCUSSION

After evaluating different features of LiFi and WiFi,both these these technology should co-exist together depending on their unique features.LiFi provides faster data transmission,non-interference,better frequency range,data density but WiFi has better distant coverage.Based on their features we found some advantages and disadvantages of both these technologies.

A. Advantages

1) Lifi: -For communication, main feature of LiFi is visible light.LED bulbs are now used in home,office,schools in any

constrained area as a source of light.So it is efficient because at the same time lighting and data transmission will work.

This technology is very much secure as it light can not cross walls.within an area surrounded by walls transmitted data will be safe from intruder.

LiFi provides high speed of transmission.it saves time. At a time multiple number of user can access the network as LiFi has huge frequency range.

2) WiFi: WiFi has better distance coverage compared to LiFi.As electro-magnetic wave can go through walls data transmission is possible for larger area.

WiFi allows transmission even in open space or daylight.But LED bulbs can not be carried outside hence even outside a building wifi provides service.

Wireless devices can be moved anywhere.

B. Disadvantages

1) LiFi: LiFi can not cover network for larger area.it has a very small distance coverage.It can be only used in interior space.This technology can not provide service in sunlight and always need LED bulbs to emit light as without light it cannot provide service.

2) WiFi: In wireless fidelity privacy is at higher risk.It has interference issue due to which it does not work well in dense region.It has selected frequency band for data transmission.

C. Application

As LiFi is confined to small space, it is used in military tent to secure data from hackers.LiFi can be used in traffic signal to provide drivers update about traffic and weather.It is now being used underwater for communication.At urban area where artificial lights are used instead of that LiFi can be used to provide people high speed internet.It can be used also in augmented reality at museum for giving customers better experiance.[15]

WiFi is used for mobile, home, business and other computerized application, for internet browsing,video conference.

V. CONCLUSION

On conclusion, it can be said that in many terms LiFi technology surpasses WiFi but WiFi can not be replaced by LiFi. Based on their application and requirement they can be implemented in different environment.LiFi has better scope in future due to it's fastest data transmission and safety.But for outside network and larger distance coverge WiFi is the ideal communication way.

In upcoming days usage of LiFi should be highly increased as it has simple hardware modification and as an efficient wireless technology it can be used in offices,home,working places.Light is used everywhere, so using LED bulb can turn places into WiFi hotspot.LiFi will provide eco-friendly environment.LiFi will provide easy,cheap and free access to high speed internet.

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