Li-Fi (Light fidelity)-LED Based Alternative

N.Navyatha, T.M.Prathyusha, V.Roja, M.Mounika

navyareddy94@gmail.com,prathyu.murali123@gmail.com,roja.coolgal@gmail.com,mounikamadavaneri@gmail.com

Abstract— With the vast growing gadgets, their usage and their developments led to the advancement in the Wi-Fi which provides a technology so called Li-Fi.Li-Fi is a technology that makes use of LED light which helps in the transmission of data much more faster and flexible than data that can be transmitted through Wi-Fi.Light reaches nearly everywhere so communication can also go along with light freely. Light Fidelity is a branch of optical wireless communication which is an emerging technology. By using visible light as transmission medium, Li-Fi provides wireless indoor communication. The bit rate achieved by Li-Fi cannot be achieved by Wi-Fi.. Dr herald Haas ,the professor of mobile communications at the university of Edinburgh school of engineering ,first time publically displayed the proof of Light Fidelity(Li-Fi) ,a method of Visible Light communication(VLC). Li-Fi is the transfer of data through light by taking fiber out of fiber optics and sending data through LED light.

1 INTRODUCTION

Li-fi basically known as "light fedility" is an outcome of twenty first century. The basic ideology behind this technology is that the data can be transmitted through LED light whose intensity varies even faster than the human eye. As the transmission of the data takes place through the light emitting diodes (LED's) the amount is comparatively small .In modern times, it is called as the optimized version of WI-FI .The advantageous thing is the wireless communication which decreases the cost enormously. HARALD HASS, who is considered to be the father of Li-fi from university of Edinburgh, UK says that the heart of this technology lies in the intensity and the potential of the light emitting diodes. The major reason which lead the modern man through this invention is that the confinement of Wi-Fi to comparatively small distance. As there are more and more devices coming up day-by-day the signals are being clogged up due to heavy traffic, there arised a need for an error free transmission technology.And the solution to this problem was the Li-fi technology.. It has been designed in such a way that it overcomes the disadvantages that occurs during the usage of wi-fi. In general terms, Li-fi works even under water thereby causing a great benefit to the military operations.

The phycists envisions that this technology would make a great difference between the assumption and the proof in this case .The demonstration took place using two Casio smart phones. The data was made to exchange between the phones using light. Even though the distance was nominal, it is sure that there would be a rapid increase in the distance of transmission.AS there is a limited amount of Radio based wireless spectrum available, a number of companies formed a consortium called Li-fi consortium in order to promote high speed optical wireless systems .The members of this consortium believes that a speed of 10 Gbps can be achieved in no time. If this would be possible then a high clarity image would take about 30 seconds to download!!

2 HISTORY

Haraald haas continues to hit the world that there is a possibility for communication through light.LI-FI technology has the possibility to change how we access the internet, stream videos, receive emails and much more. The technology truly began during the 1990's in countries like Germany, Korea, and Japan where they discovered LED's could be retrofitted to send information. This type of light would come in familiar forms such as infrared, ultraviolet and visible light.

Research into VLC has been conducted in earnest since 2003, mainly in the UK, US, Germany, Korea and Japan. Experiments have shown that LEDs can be electronically adapted to transmit data wirelessly as well as to provide light. VLC is faster, safer and cheaper than other forms of wireless internet, advocates say -- and so could eliminate the need for costly mobile-phone radio masts.

Fig1: Haraald haas

Haas has a small lab stuffed with equipment, including the now-famous table lamp and its box of electronics. It was here in 2007 that his research assistant, Mostafa Afgani, first sent data using light signals. Haas's invention centres on how these signals are modulated: the information, embedded within visible light emitted from the LEDs, is transmitted by means of many subtle changes made to the intensity of the light at the ultra-high rate of 100 million cycles per second (100MHz). The photo-detector in Haas's box monitors these tiny variations and converts them back into a digital signal, from which the transmitted information is extracted.

In October 2011 a number of companies and industries formed the Li-Fi Consortium, to promote high-speed optical wireless system sand to enhance the limited bandwidth provided by radio-based

wireless spectrum available. The consortium believes it is possible to achieve more than 10Gbpsspeed using this optical wireless technology also known as Li-Fi. The communication is done by deploying transmitter and receiver in direct line of sight manner. It gets affected if line of sight is not used, the speed of data transmission will reduce or data transmission will stop. It is also more secure than other wireless networks as only photo receptors are used, which can receive data within transmitted cone of light signals.

3 WORKING OF LI-FI

: In order to know the working of Li-fi we need to know the necessity for Li-fi .With the vast development in living the use of gadgets and invention of new gadgets is increasing which lead to the technological developments

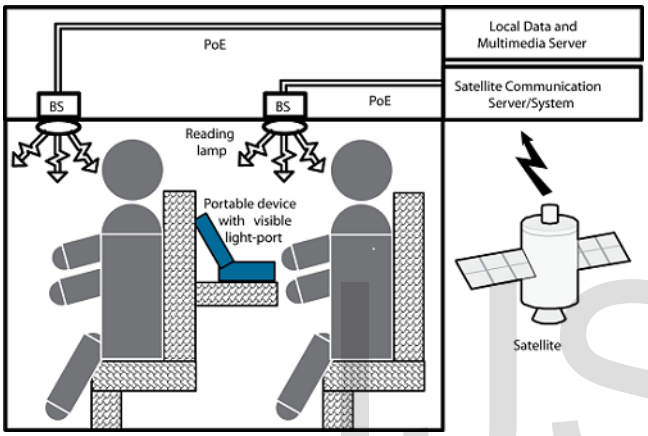

Fig2: Construction of lifi technology

There are many situations in which people get frustrated with the dull performance signals of Wi-Fi at a place with many network connections in seminars conferences etc. Li fi fulfills these needs .this fantabulous idea first striked the mind of Harald Haas from University of Edinburgh, UK, in his TED Global talk on VLC.His idea was very simple that if the LED is “on” then the digital 1 can be transmitted and if the led is “off” then the digital 0 can be transmitted.Led’s can be switched on and off very quick.For transmitting data this way all that we require is LED’s and controller that code data into LED’s.Parallel data transmission can be done by using array of LED’s or by using red, green, blue LED’s to alter light frequency with the frequency of different data channel. Advancements and enhancements in this field generate a speed of 10 gbps! But amazingly fast data rates and lowering band widths are not the only reasons that enhance this technology.Lifi usually is based on light and so it can be probably implemented in articrafts and hospitals that are prone to inference from radio waves.unlike Wi-Fi Li-Fi can work even underwater which makes it more advantageous for military operations. Radio waves are replaced by light waves in data transmission called Li- Fi.
Light emitting diodes can be switched on and off very much faster than the human eye allowing the light source to appear continuously. The data transmission is done through binary codes which involve switching on LED can be done by logic 1 and switch off using logic 0.The encoding of information in light can therefore be identified by varying the rate at which the LED’s flicker on and off to give strings of 0’s and 1’s.visible light communication is this method of using rapid pulses of light to transmit information wirelessly.

3.1 Visible Light Communication

VLC is a data communication
Medium, which uses visible light between 400 THz (780 nm)
and 800 THz (375 nm) as optical carrier for data transmission and illumination. Fast pulses are used for wireless transmission. Communication system components are:
1. A high brightness white LED which acts as a communication source
2. Silicon photo diode which shows good response to visible wavelength region.

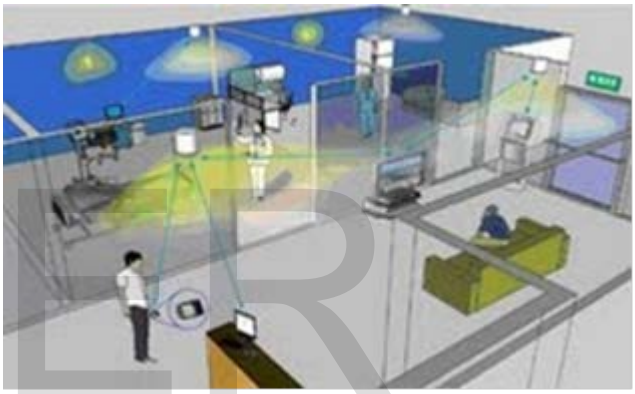

Fig3: overview of visual light communication

LED illumination can be used as a communication source by modulating the LED light with the data signal. The LED light appears constant to the human eye due to the fast flickering rate. The high data rate can be achieved by using high speed LED’s and appropriate multiplexing techniques. Each LED transmits at a different data rate which can be increased by parallel data transmission using LED arrays. Many different reasons exist for the usage of LED light in spite of fluorescent lamp, incandescent bulb etc which are available.

Fig 4: Transfer of data in the form of 0's and 1's

4 APPLICATIONS

There is a wide necessity for data transfer and by the end of the day every field involves the use of technologies.one such technology is Li-Fi which can have its applications extended in areas where the Wi-Fi technology lack its presence like medical technology,powerplants and various other areas where Li-Fi proved it excellence of the undersea awesomeness.

4.1 Future applications

4.1.1 Education systems

As with the advancement of science the latest technology is the LIFI which is the fastest speed internet access service.so this will leads to the replacement of WIFI at institutions and at companies so that all the people can make use of LIFI with same speed intended in a particular area.

4.1.2 Extends our life span

As operation theatres do not allow WIFI due to radiation concerns.usage of WIFI at hospitals interfere with the mobile and pc which blocks the signals for monitoring equipments.Therfore the replacement for this Wi-Fi is Li-Fi as Hass has mentioned in his TED TALK that LIFI has 10,000 times the spectrum of Wi-Fi.Because the lights are not only allowed in operation theatres but also the most dazzling fixtures in the room.

4.1.3 Reduction in accident numbers

At traffic signals, we can use LIFI inorder to communicate with LED lights of the cars by the number of accidents can be reduced. Data can be easily transferred by making use of LIFI lamps with the street lamps.

4.1.4 Replacement for others technologies

This technology doesn't deal with radio waves, so it can easily be used in the places where Bluetooth, infrared, WIFI and Internet are banned. In this way, it will be most helpful transferring medium for us.It includes other benefits like:
*A very wide spectrum over visible wave length range.
* Extremely high colour fidelity.
*Instant start time.
*Easy terminal Management.
*Dynamic dark i.e. brightness Modulation of lamp output to enhance video contrast.
*Trouble-free integration into existing light engine platform.

Li-Fi is the upcoming and on growing technology acting as competent for various other developing and already invented technologies. Since light is d major source for transmission in this technology it is very advantageous and implementable in various fields that can't be done with the Wi-Fi and other technologies. Hence the future applications of the Li-Fi can be predicted and extended to different platforms like education fields, medical field, industrial areas and many other fields.

5 CONCLUSION

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