

Li-fi Technology

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Abstract- Lightweight Fidelity (Li-Fi) may be a biface, high speed and absolutely networked wireless technology the same as Wi-Fi. Li-Fi includes a good vary of frequencies and wavelengths from the infrared through visible and all the way down to the spectrum. It includes sub-gigabit and gigabit-class communication speeds for brief, medium and long ranges, and simplex and biface information transfer victimisation line-of-sight or diffuse links, reflections and far additional. it's wireless and uses visible radiation communication or infra-red and close to ultraviolet (instead of frequence waves) spectrum, elements of optical wireless technology, that carries abundant, additional info, and has been planned as an answer to the RF-bandwidth limitations. it's not restricted to junction rectifier or optical maser technologies or to a selected receiving technique. Li-Fi may be a framework for all of those providing new capabilities to current and future services, applications and finish users.

Keywords- Wireless-Fidelity (Wi-Fi), Light-Fidelity (Li-Fi), lightweight Emitting Diode (LED), Line of Sight (LOS), visible radiationCommunication(VLC),photodiode,wirelesscommunication,Microcontroller,Microphone.

I. INTRODUCTION:

Li-Fi is transmission of data through illumination by taking the fibre out of fibre- optics by causing data through light-emitting diode light-weight bulbs that varies in intensity quicker than the human eye will follow. Li-Fi is that the term some have accustomed label the quick and low cost wireless-communication system, that is that the optical version of Wi-Fi. The term of Li-Fi Technology essentially is named Visible Light Communication (VLC). This technology will transmit the information through high illumination light-emitting diode devices that varied the intensity is extremely quicker than the human eyes. The light-emitting diode bulb will cycle OFF and ON uncountable times per second. Figure-1 shows the look of light-emitting diode Bulb.



Figure -Design of light-emitting diode bulb.

The actinic ray spectrum is 10,000 times quicker than the frequence spectrum. The information is encoded and send to the sunshine transmission devices that is driven the high illumination light-emitting diode. It's possible to code the information that the light-emitting diode bulbs on and off to allow completely different reasonably strings of 1s and 0s. The light-emitting diode bulb intensity is ever-changing terribly quicker that that the human eyes can not be notice.

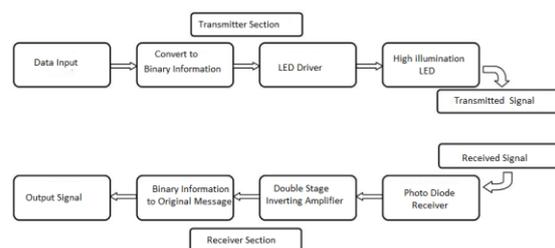


Figure- The diagram of Li-Fi design.

In transmitter section the information input is changing to binary info and light-emitting diode driver circuit drives the high illumination light-emitting diode. In receiver section , the photograph detector receives the first info and obtaining amplified by the inverting electronic equipment. The binary

info is born-again to the initial information message and given to the signal. The term was 1st employed in this context by Harald Haas in his plug-ugly international speak on actinic radiation Communication. "At the center of this technology may be a new generation of high brightness LED's", says Harald Haas from the University of Edinburgh, UK,"Very merely, if the semiconductor diode is on, you transmit a digital one, if it's off you transmit a zero,"Haas says, "They will be switched on and off terribly quickly, which provides nice opportunities for transmitted information."It is feasible to encrypt information within the light-weight by varied the speed at that the LEDs flicker on and off to offer completely different Strings of 1s and 0s.The semiconductor diode intensity square measure modulated therefore speedily that human eye cannot notice, therefore the output seems constant. additional refined techniques might dramatically increase VLC rate. Terms at the University of Oxford and also the University of Edingburgh square measure that specialize in parallel information transmission mistreatment array of LEDs, wherever every semiconductor diode transmits a special information stream. alternative cluster square measure mistreatment mixtures of red, inexperienced and blue LEDs to change the sunshine frequency secret writing a special information channel.Li-Fi, because it has been dubbed, has already Achieved blisteringly high speed within the research lab. Researchers at the physicist Institute in Berlin,Germany,have reached information rates of over five hundred megabytes per second employing a normal white-light semiconductor diode. The technology was incontestible at the 2012 shopper physics Show in Las Vegas employing a combine of Casio sensible phones to exchange information mistreatment light-weight of varied intensity given removed from their screens, detectable at a distance of up to 10 metres.

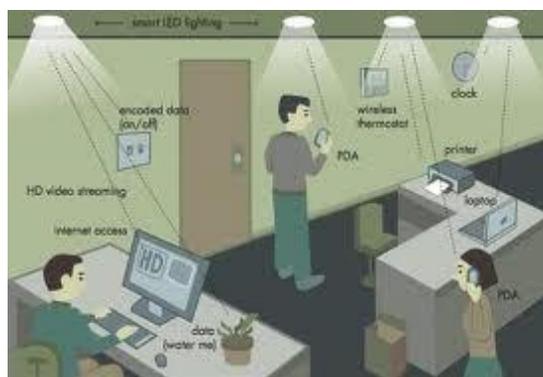


Figure- Li-Fi surroundings

In October 2011 variety of corporations and business teams shaped the Li-Fi association, to market high-speed optical wireless systems and to beat the restricted quantity of radio primarily based wireless spectrum out there by exploiting a very completely different a part of the spectrum. The

association believes it's doable to realize quite ten Gbps, on paper permitting a high-definition film to be downloaded in thirty seconds.

Why it's referred to as Li-Fi ?

The word Li-Fi is appears the same as the Wi-Fi however dueto its development of information transmission through the wireless optical networking technology that uses light-emitting diodes (LEDs). not like Wi-Fi, Li-Fi .Signals aren't subject to magnetism interference and might be employed in airplanes, hospitals and underwater. However, Li-Fi will need line of sight from transmitter to receiver.

Genesis or history of LI-FI:

Haraldhass a academic of the university of capital WHO begin his analysis within the field in 2004,gave a debut demonstration of what he decision a LI-FI model at the plug-ugly international conference within the capital on 12thjuly 2011.He used a lamp with a semiconductor diode bulb to transmit the radio of video of blooming flower that was then projected onto a screen behind him. throughout the event he sporadically blocked the sunshine from lamp to prove that the lamp was so the supply of incoming information. At TEDGlobal ,Haas incontestible the info rate of transmission of around 10Mbps.Comp rateable to a reasonably sensible GB broadband association . once the 2 months later he achieved speed of 123Mbps. Back in 2011 in German scientists succeeded in making the 800 Mbps(mega bits per second) Capable wireless network by mistreatment nothing quite traditional red,green,blue and white semiconductor diode bulbs, therefore the concept has been around for for a while and varied alternative international groups also are exploring the chances.

Operating Technology:

Li -Fi is extremely quicker and also the cheaper technology than Wi-Fi. The technique is quicker means that the speed is ten Gbps, downloading the complete high definition film in barely thirty. Wi-Fi is mistreatment frequency that is harmful to the chassis, conjointly some space illegal for these waves. therefore Li-Fi will complementary technology than existing communications technologies.

II. CONSTRUCTION OF LI-FI SYSTEM

The main element of the Li-Fi technology :

LED: At the causing aspect controller that code the info into LEDs, all the one should do is to vary the speed at that semiconductor diode is flicker betting on the info needs to encrypt. the speed of aflicker is extremely high so cannot distinguish light-weight for the human eye. during this mistreatment array of semiconductor diode for parallel information transmission or mistreatment mixtures of the red, green, blue LED's to change the lights frequency with every frequency secret writing of various information channel.

Silicon Photodiode: At the receiver aspect photodiode is employed, it shows smart response to the visible wavelength region. For acceptive the unsteady light-weight nothing however completely different string of coded information, junction rectifier on suggests that binary "1" and junction rectifier off suggests that binary "0".The Li-Fi electrode system consists of four primary sub assemblies:

- Bulb
- RF power electronic equipment circuit (PA)
- computer circuit board (PCB)
- Enclosure

All of those sub assemblies ar contained in AN metallic element enclosure. Inputs and outputs of the lamp controlled by the PCB and for managing completely different lamp functions embedded microcontroller is employed. For generating the frequency waves, Solid state power electronic equipment is employed and this radio-controlled into the electrical field concerning the bulb. At the bulbs centre a plasma state high concentration of energy within the field of force vaporizes the contents of the bulb ANd This controlled plasma generates an intense supply of sunshine.In Li-Fi electrode, bulb assembly is that the main half. It consists of a sealed bulb that is housed in a very stuff material. This style is a lot of reliable than typical light-weight sources that insert degradable electrodes into the bulb. The stuff uses for 2 purposes:-

1. It acts as a wave guide for the RF energy transmitted by the PA.
2. It additionally acts as an electrical field concentrator that focuses energy within the bulb. The energy from the electrical field apace heats the fabric within the bulb to a plasma state that emits light-weight of high intensity and full spectrum.

LI-FI WORKING:

In this Li-Fi system for the development needed junction rectifier bulbs, semiconducting material photodiode, lamp driver electronic equipment and lots of wireless devices like Mobile Phones, laptops,PDA. This methodology of uses actinic radiation Communication (VLC) nothing however the transmit data wirelessly that is fast pulses of sunshine, and additionally technically grasp as Li-Fi .The overhead lamp fitted with AN junction rectifier with signal process technology, steam information embedded in its beam at immoderate high speed to the image detector. A receiver electronic device then converts the small changes in amplitude into AN electrical signal that is then reborn back to coded information and transmitted stream and also the transmitted to the pc or mobile.

DATA TRANSMISSION:

A. Li-Fi information transmission:

Figure-shows that diagram for Li-Fi information Transmissions. pc one is provides the information input to the junction rectifier Driver Circuit. Then junction rectifier Driver Circuit drives the high illumination junction rectifier. The illumination level is detected by image Detector in receiver aspect. currently signal gets amplified and given to the FPGA Kit. FPGA Kit receives and transmits the serial data to the junction rectifier Driver Circuit. Then the junction rectifier Driver circuit drives the high Illumination junction rectifier. currently the image sightor detect the data and given to pc a pair of.

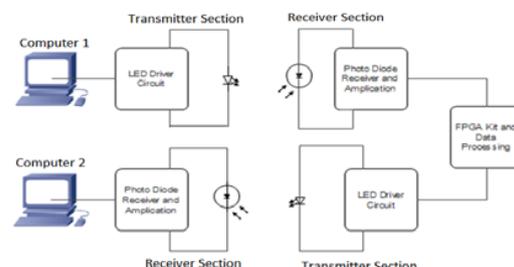


Figure- diagram for Li-Fi information transmission.

B. junction rectifier driver circuit for information transmission:

Figure- shows that junction rectifier Driver circuit for information transmission. In junction rectifier Driver circuit,

ULN2803 is employed for the motive force IC. The eight NPN Darlington transistors are connected during this IC. It's directly compatible to TTL families. Absolutely the most rating of output voltage is 50V. The IC will handle the output current is 500mA. The information input is directly given to ULN2803 IC. Junction rectifier Anode terminal is directly connected to positive power offer. Junction rectifier cathode terminal is connected to output of the ULN2803 IC.

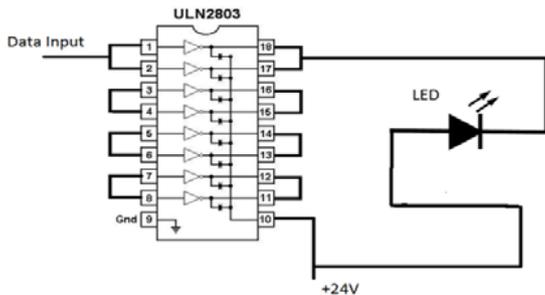
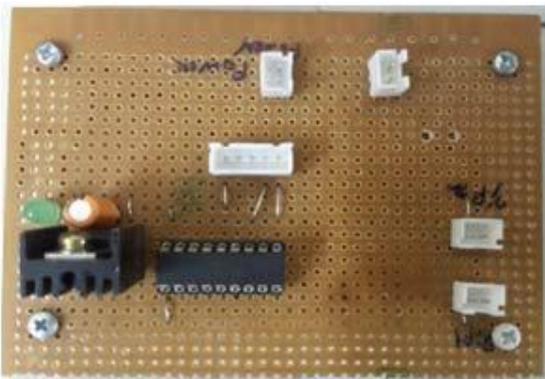


Figure-LED driver circuit for information transmission.

Figure- shows that hardware model of Li-Fi Data Transmitter.



C. pic diode receiver circuit for knowledge transmission:

Figure-shows that pic diode receiver circuit

for knowledge transmission. In pic Diode Receiver circuit, LM339 is employed as a comparator. LM339 had high gain and wide information measure. It's AN open collector comparator. Therefore it is often compatible to all or any logic levels like TTL, DTL, ECL, and CMOS Logic. If the sunshine illumination varies pic diode current conjointly changes. In receiver have 2 stages. 1st stage pic detector

current converts to voltage level. In second stage inverting electronic equipment inverts once to urge original info.

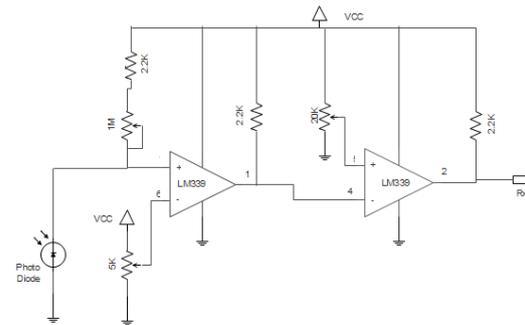


Figure-Photo diode receiver circuit for Li-Fi knowledge transmission.

Figure- shows that hardware model of Li-Fi knowledge Receiver.

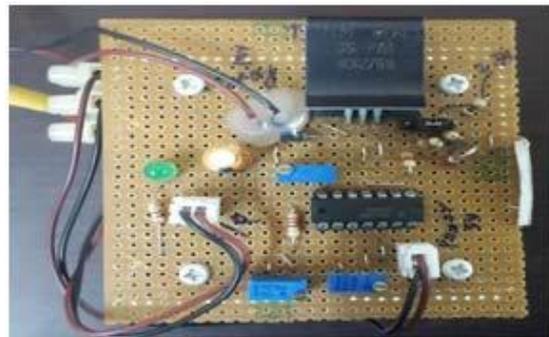


Figure-Hardware model of the Li-Fi knowledge receiver.

Figure- shows that Real Time Implementation of Li-Fi knowledge Transmissions.

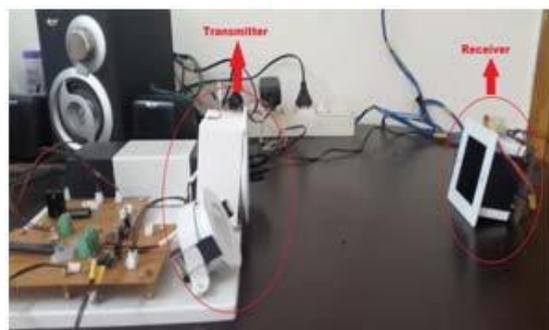


Figure-Real Time implementation of Li-Fi knowledge transmission.

D. UART:

UART stands for Universal Asynchronous receiver/transmitter. The operations of the UART are controlled by a clock which might run the multiple knowledge rates. principally eight times the bit rate are utilized in the UART. Initially begin bit at high, whereas begin bit going low the UART method can begin. once the eight bits received the stop bit are going to be a high. Figure-shows the wave form illustration of the UART.

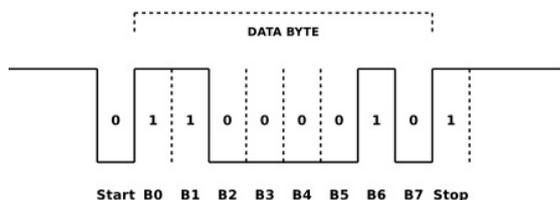


Figure-UART wave form presentation.

III. COMPARISION BETWEEN WI-FI & LI-FI:

| Parameter | Li-Fi | Wi-Fi |
|-------------------------------|-------|-------|
| Speed | *** | *** |
| Range | * | ** |
| Data density | *** | * |
| Security | *** | ** |
| Reliability | ** | ** |
| Power available | *** | * |
| Transmit/receive power | *** | ** |
| Ecological impact | * | ** |
| Device-to-device connectivity | *** | *** |
| Obstacle interference | *** | * |
| Bill of materials | *** | ** |
| Market maturity | * | *** |

* low ** medium *** high

IV. ADVANTAGES:

- Capacity: a thousand times a lot of spectrum than radio waves. Light box is gift. It contains 1000s of semiconductor diode creating it attainable to transfer 1000s of information stream parallel at a awfully high speed.

- Efficiency: semiconductor diode lights consume less energy, therefore it's extremely economical.
- Availability: it's obtainable in any respect places wherever light-weight is gift.
- Security: light-weight waves don't penetrate through walls & thus can not be intercepted & abused by anyone having any dangerous connotation.

V. LIMITATIONS:

The biggest disadvantage is that it desires direct line of sight to transmit information therefore one would not be ready to have one router in his/her house and also the information goes through walls etc.

VI. SCOPE AND CHALLENGES OF LI-FI TECHNOLOGY:

Although there area unit plenty of benefits of LI-FI, there area unit still bound challenges which require to be overcome.

- LIFI needs Line of Sight.
- If the equipment is ready up outdoors, it'd got to wear down ever-changing weather.
- If the equipment is ready up inside, one wouldn't be ready to shift the receiver.
- the matter of however the receiver can transmit back to the transmitter still persists.
- light-weight waves will simply be blocked {and willnot|and can't} penetrate thick walls just like the radio waves can.
- we have a tendency to become captivated with the sunshine supply for web access. If the sunshine supply malfunctions, we loss access to the web.

VII. APPLICATIONS OF LI-FI:

- In hospitals, it's troublesome to put the glass fiber cables. Li-Fi may be used for contemporary medical instruments operative theatre.
- In traffic signals Li-Fi may be used, which is able to communicate with the semiconductor diode light-weight of the cars and so occurrences of accidents may be reduced.
- Thousands and several street lamps square measure deployed round the world. every of those street lamps can be a free access purpose.

4. Li-Fi will work beneath ocean water wherever Wi-Fi fails fully, thereby throwing endless opportunities in military/navigation operations.

5. In craft Li-Fi may be used for information transmission.

6. It may be employed in rock oil or manufacturing plant wherever different transmission or frequencies can be venturesome.

VIII. CONCLUSION:

Li-Fi is on no account useless, however it's sure inherent limits for the technology. Li-Fi might not be ready to replace typical radios altogether, however it might turbo charge the event of wireless tv and create it easier to throw a wireless signal across a complete house. At present, finding the perfect position for a wireless router are some things of a divine art. If the signal can be passed via VLC from purpose A to purpose B within a home, tiny native routers at each points might produce native fields with less likelihood of overlapping and meddlesome with one another. giant scale square measureas that are saturated with radio signals or that doesn't allow them for security reasons might use Li-Fi as AN alternate high-speed wireless network answer.

IX. FUTURE ENHANCEMENT:

Further enhancements may be ma during this technique, like victimization AN array of LEDs for parallel information transmission or victimization mixture of red, inexperienced and blue LEDs to change the light's frequency with every frequency encryption a unique information channels. Such advancements promise a theoretical speed of ten Gbps - that means one will transfer a full high definition film in only thirty seconds.



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