



Audio Transmission using Li-Fi Technology

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ABSTRACT :

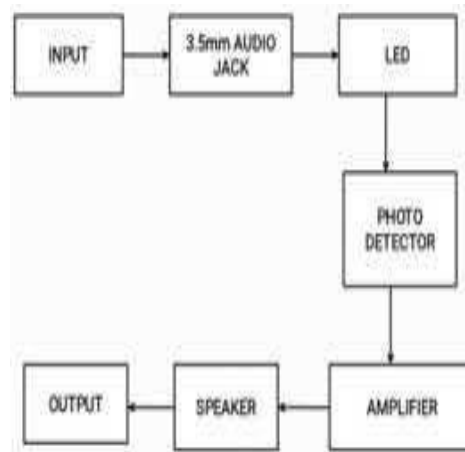
The term Li-Fi stands for "Light Fidelity", the next generation of internet, where Light will be used as a medium to transmit the data and has higher speeds than Wi-Fi as the speed of light is much faster than the radio waves which is used in Wi-Fi. In Wireless communication, Wi-Fi is the most versatile and effective technology which compact with radio frequencies for data transmission. But because of multiple accesses, Wi-Fi is facing many challenges namely capacity, availability, efficiency and security. The Wi-Fi emits radio waves which are very harmful to the patients and the radio waves interpret the medical instruments. This project focuses on developing a light fidelity (Li-Fi) based system and analyzing its performance. This protocol can be adapted where radio waves are restricted, such as airplanes hospitals, and in some research facilities. Li-Fi is a novel technology for high-density wireless data transfer relieving no radio interferences in confined areas so it can be used in biosensors to measure various health parameters. This technology envisions a future where data for laptops, smartphones, and tablets will be transmitted in an economic and eco-friendly medium of light in a room[1].

Keyword: Audio Input from source , LEDs ,Photodetector , Amplifier Circuit , Speaker ,Amplified Audio at Destination

Introduction:

Over the past few years there has been a rapid growth in the utilization of the RF region of the electromagnetic spectrum. This is because of the huge growth in the number of mobile phones subscriptions in recent times. This has been causing a rapid reduction in free spectrum for future devices. Light-fidelity (Li-Fi) operates in the visible light spectrum of the electromagnetic spectrum i.e. it uses visible light as a medium of transmission rather than the traditional radio waves. Li-Fi stands for Light-Fidelity. Li-Fi is transmission of data using visible light by sending data through an LED light bulb that varies in intensity faster than the human eye can follow. If the LED is on, the photo detector registers a binary one; otherwise it's a binary zero. The idea of Li-Fi was introduced by a German physicist, Harald Hass, which he also referred to as "Data through Illumination". The term Li-Fi was first used by Haas in his TED Global talk on Visible Light Communication. According to Hass, the light, which he referred to as „DLight“, can be used to produce data rates higher than 1 Giga bits per second which is much faster than our average broadband connection. The high speed achievement of Li-Fi can be explained using frequency spectrum of Electromagnetic Radiations. From the electromagnetic spectrum we can see that the frequency Band of the visible light is in between 430THz to 770THz and that of Radio Frequency Band is in between 1Hz to 3THz, Hence the Frequency Bandwidth of the visible light is about 400 Times greater than the Radio Frequency Bandwidth. So more Number of bits can be transferred through this Bandwidth than in the radio frequency bandwidth. Hence Data rate will be higher in the Li- Fi and higher speed can be achieved. Using Li-Fi we can transmit any data that can be transferred using conventional Wi-Fi network. That can be Images, Audio, Video, Internet connectivity, etc..but the advantages over the Wi-Fi Network are High speed, Increased Security, More Number of Connected Devices, and Less cost. In coming years number of devices that support Li-Fi will hit the Market. It is estimated that the compound annual growth of Li-Fi market will be of 82% from 2015 to 2018 and to be worth over \$6 billion per year by 2018.[2]

Circuit Diagram



Working:

On the transmitter side, when we connect 3.5mm jack to audio source LED will glow but there is no fluctuation in the intensity of light when the audio source is OFF. As soon as you play the audio, you will see that there is a frequent change in the intensity of light. When you increase the volume, LED's intensity is changing faster than the human eye can follow. A solar panel is so sensitive that it can catch small intensity change and correspondingly there is a change in the voltages at the output of the solar panel. So, when the light of LED falls on the panel, voltages will vary according to the intensity of light. Then voltages of solar panels are fed into an amplifier (Speaker) which amplifies the signal and giving the audio output through the speaker connected to the amplifier. The output will come as long as the solar panel is in contact with LEDs. You can put the LEDs at max. 15-20cm distance from the solar panel to get clear audio output. You can further increase the range by increasing the area of solar panel and higher wattage Power LED.[3]

- **Advantages:** Li-Fi technology is based on LEDs or other light source 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 communication is more than sufficient for downloading movies, games, music and all in very less time. Also, Li-Fi removes the limitations that have been put on the user by the Wi-Fi.
- **Capacity:** Light has 400 times wider bandwidth than radio waves. Also, light sources are already installed. So, Li-Fi has got better capacity and also the infrastructures are already available. 5.1.2 EFFICIENCY Data transmission using Li-Fi is very cheap. LED lights consume less energy and are highly efficient and long lasting.
- **Availability:** Availability is not an issue as light sources are presents everywhere. There are billions of light bulbs worldwide, They just need to be replaced with LEDs for proper transmission of data. [4]
- **Security:** Light waves do not penetrate through walls. So, they can't be intercepted and misused.
- **No Limit For Connectivity:** The High speed capability of Li-Fi enables large number users can be connected, since speed will not be throttled or slowed down.

Conclusion:

The possibilities are numerous and can be explored further. If his technology can be put into practical use, every bulb can be used something like a Wi-Fi hotspot to transmit wireless data and we will proceed toward the cleaner, greener, safer and brighter future. The concept of Li-Fi is currently

attracting a great deal of interest, not least because it may offer a genuine and very efficient alternative to radio-based wireless. As a growing number of people and their many devices access wireless internet, the airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, high-speed signal. This may solve issues such as the shortage of radio-frequency bandwidth and also allow internet where traditional radio based wireless isn't allowed such as aircraft or hospitals. The main shortcoming however is that it only work in direct line of sight. [1]

Future Scope

Li-Fi is an emerging technology and hence it has vast potential. A lot of research can be conducted in this field. Already, a lot of scientists are involved in extensive research in this field.. If this technology can be used efficiently, we might soon have something of the kind of WI-FI hotspots wherever a light bulb is available. As the amount of available bandwidth is limited, the airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, highspeed signal. The Li-Fi technology can solve this crisis. Moreover, it will allow inter access in places such as operation theatres and aircrafts where internet access is usually not allowed. The future of Li-Fi is Gi-Fi. Gi-Fi or gigabit wireless refers to wireless communication at a data rate of more than one billion bits (gigabit) per second. It will allow wireless transfer of audio and video data at upto 5 gigabits per second, ten times the current maximum wireless transfer rate, at one-tenth the cost.[4]

References

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- [1] <https://www.slideshare.net/MuhammedAnazPK/lifi-audio-transmission-project-report>
- [2] <https://www.irjet.net/archives/V5/i4/IRJET-V5I487.pdf>
- [3] <https://en.wikipedia.org/wiki/Li-Fi>
- [4] <https://www.slideshare.net/ShivamKumar828/lifi-project-report>
- [5] <https://nevonprojects.com/lifi-data-transfer-system/>
- [6] <https://www.instructables.com/LiFi-Experiment-Audio-Transmission-Through-Light/>