Audio Transmission with Li-Fi Technology

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Abstract - *Light may be used to communicate any type of information. This work focuses on constructing a system for delivering audio signals utilizing the LI-FI technology, in which Visible Light Communication (VLC) is a method of transmitting data using light (VLC). LI- FI is a brand-new light-based technology. It transmits data using light rather than regular radio waves. Wi-Fi is currently the most effective method for transmitting data over radio waves in the electromagnetic spectrum. Wi-Fi employs radio waves, which are extremely damaging to humans, and radio waves have the power to penetrate through medical instruments, causing harm to patients. The concept of LI-FI is gaining traction as a novel kind of data transfer that employs light waves rather than radio waves to deliver data. When it comes to data transmission, choosing a light source is crucial. The Light Emitting Diode (LED) can be used as a light source, but it has a number of disadvantages, such as overheating, shorter lamp life, less distance coverage, non-directionality, low intensity, and so on, so we are using Laser in replacement with LED. Because, when compared to LED, laser provides greater benefits. High intensity, single wavelength, application optimized, directionality, monochromaticity, constant output, greater value, high intensity, focuses on a specific spot. As a result, the suggested system uses "LASER" as a light source. So that data transmission is as efficient as possible. Low latency, high efficiency, accessible spectrum, and high data transmission are all features of LI-FI. The data can't be hacked because it's well-protected. This technology provides a secure interface transmission and will play a critical role in the future of communication.*

Key Words: **Visible Light Communication, Li-Fi, Wi-Fi, Radio-waves, Light Emitting Diodes (LED), LASER**

1.INTRODUCTION

A representation of sound is an audio signal. Frequencies in the audio range of 20 to 20000 Hz are used in audio signals. The mechanism by which audio signals are routed and processed is known as an audio transmission system. The audio signal was transmitted via microphones, and the signal was routed to a single output channel. Microphones will send and process audio signals, but the light in this article will function as a transmitter, transporting data.

The acronym LI-FI refers for 'Light-Fidelity'. Harald Hass, a German physicist, invented the phrase LI-FI. This is the next generation of the internet, in which data is sent using light as a medium. LI-FI is a novel and efficient kind of wireless Light-based communication. LI-FI isa new and efficient wireless communication technology that sends data using light. It's the same light we use in our homes and offices, but with a few changes, it can convey data to all of our internet-connected devices. To transfer audio data, VISIBLE LIGHT COMMUNICATION (VLC) is employed, and LI-FI (Light Fidelity) technology has been developed. LI-FI is a one- of-a-kind method of sending data across small distances in a quick and effective manner. The operating principle of LI-FI is to communicate data in a standardized manner using the AM of the sunlight source. We can transfer data at speeds more than 10Gbps with this method, and its operational frequency ranges from 400THz to 800THz.

It is a part of the IEEE standard IEEE 802.15.7. Wireless LI-FI technology in the future might attain data speed of up to 100Gbps. WI-FI is now used around the world; but, because of its speed and security, LI-FI will supplant WI-FI in the future years. With the aid of the electromagnetic spectrum, high-speed data transfer utilizing LI-FI may be described. Because visible light has a frequency in the range of 430THz to 770 THz on the electromagnetic spectrum, a high number of bits may be sent over this bandwidth.

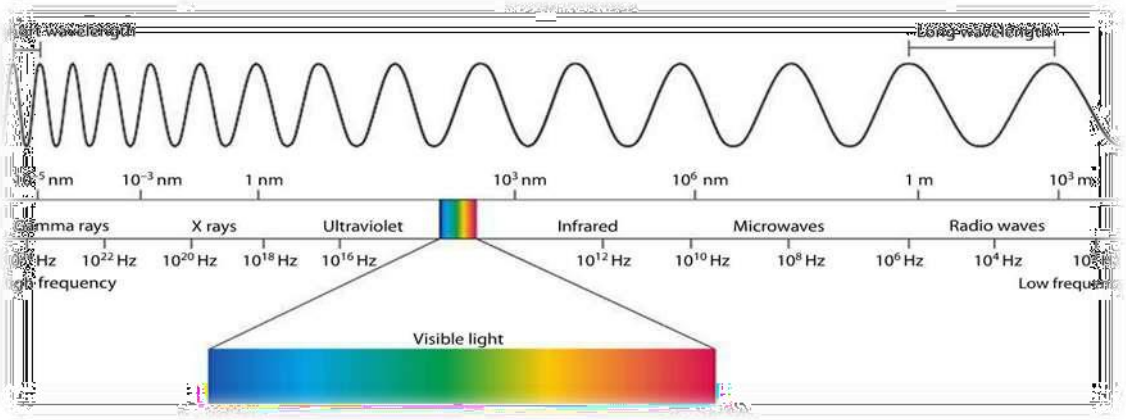

Figure 1.1. Electromagnetic spectrum showing visible light portion

As a result, the rate inside the LI-FI will be greater, and faster speeds will be obtained more frequently. We can send many sorts of data over a Wi-Fi network utilizing LI-FI. The main goal is to design a transmitter and receiver for audio using a LI-FI configuration. LI-FI isn't only about light and LEDs; it's a platform with a wide range of benefits and features. This LI- FI subject is about pulling the fiber out of fiber optics and transmitting data through an LED.

This study provides an objective overview of LI-FI's operation, benefits, and applications. The goal of this article is to provide a method for data transfer that is both quicker and more secure.

The major goals of this project are to develop and build a LI-FI-based wireless data transmitter and receiver. VLC is used to convert audio files. The use of light as a carrier to send and receive audio data. The goal of this project is to create a data transmission system that is both quicker and more secure.LI-FI technology offers the following benefits: faster data transmission than WI-FI, easier and less expensive to implement, faster data transfer due to greater speed of light emitted by the laser, high security due to light restrictions, safe from electromagnetic interferences, cheap cost, portability. The data throughput for internet applications is higher, there is a large lot of energy reduction in industry that utilizes LI-FI based equipment, and it runs on optical bands that are not hazardous like RF spectrum. As a result, the LI-FI-based technology poses no health risks. This method has a wide range of uses Because operating rooms do not allow WI-FI because it emits dangerous signals, LI-FI may be utilized in a variety of sectors, including hospital automation. Where the usage of radio spectrum is highly hazardous, LI-FI audio transmission is commonly used in petrochemical industry automation. Because WI-FI and many other forms of radiation are harmful to such vital places, LI-FI can be utilized in power plants. Localized advertising is frequently done by broadcasting over the LI-FI channel into smaller distances, and it may also be utilized in underwater systems for voice communications and device management. Secure networked medical equipment,patient accounts, and other information can all benefit from LI-FI. This system may be utilized in places such as workplaces, hotels, and other places that demand strong illumination. As a result, lasers and high-intensity LED lights may both be employed.

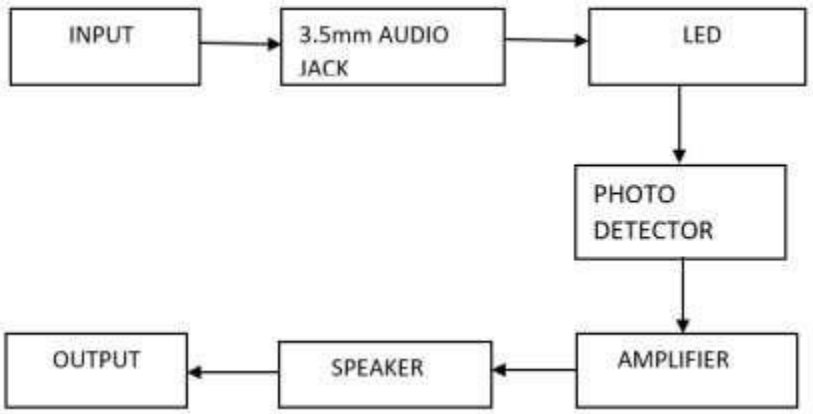

Figure 1.2. Electromagnetic spectrum showing visible light portion

This article dives into the transmitter and receiver parts of audio transmission using LI-FI technology. The rest of the paper is arranged in the following manner: A description of the current system and a block diagram may be found in Section 2. The

suggested system is shown in Section 3 as a block diagram. Section 4 is where you'll find the conclusion and future scope. Section 5 contains a list of sources.

2. EXISTING SYSTEM

The LED on the transmitter will flash whenever a 3.5mm audio jack is attached to an audio source, such as a smart phone, but the intensity of the light will not change when the phone is switched off. As soon as we start listening to the audio, we'll notice that the intensity of the light changes frequently. When we turn up the volume on our phone, The intensity of the LED light varies at a pace that is quicker than the human eye can process. LEDs have a wavelength range of 275 to 950nm, hence they will only reach a small distance. At the receiver end, a solar panel is installed that is so sensitive that it can detect slight changes in intensity and, as a result, the voltages at the solar panel's output vary. As a result, when the LED hits the panel, the voltage varies depending on how bright the light is. The voltage from the solar panel is then routed into an amplifier, which amplifies the audio signal and outputs it through the speaker. The audio signal is amplified using the IC LM386 audio amplifier. As long as the solar panel is in contact with the LEDs, output will be achieved.

To get clear audio output, we can keep the LED at a maximum distance of 15-20 cm from the solar panel.. Because LEDs are inexpensive and widely available, this system can be implemented; nevertheless, the main disadvantage/drawback of employing LEDs is that their range is limited, which necessitates a large solar panel area and greater wattage power. Data transmission requires a near or perfect line-of-sight, which can be affected by LED, natural light, sunlight, and conventional electric light. As a result, in the suggested system of this research, laser light is used instead of LEDs.

3. PROPOSED SYSTEM

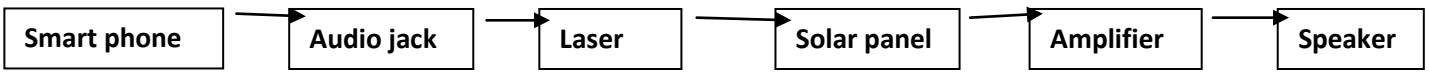

Figure 2. Audio transmission using Li-Fi by LASER

The following are the list of the circuit's components

Input is an analogue audio stream from a smart phone connected to the laser light via an audio connection on the transmitter side. A solar panel is installed at the receiver end to collect the signal, which is then connected to an audio amplifier to amplify the audio data received. Finally, a speaker is attached to the amplifier's output so that the analogue audio output can be heard.

Figure 3.1. LASER Light

Figure 3.2. Set up of circuit

Figure 4 depicts our circuit's configuration. Let's have a look at how our circuit now operates. We're using the audio port on the transmitter end to send audio from a smart phone, and the audio jack's output is connected to the laser light. When the laser is connected to the audio input, it will begin to glow, and the emitted light will be collected by the solar panel on the receiving end. The output of the solar panel is supplied into the audio amplifier circuit as an input, and the output of the LM386 amplifier is connected to a speaker to allow the amplified analogue audio output to be received. The audio jack is used since the audio is

being delivered via a smart phone. This audio jack converts the digital input audio from the phone to analogue. Right, left, and neutral is the three output terminals on this audio jack. These lines carry the audio output signal. In our proposed work, we have replaced the LED lighting with a laser source, which removes the drawback of using LED by spanning larger distances of up to 15m.

As a consequence, audio signals are transmitted free of interference and noise/disturbance, while data transfer speeds surpass 10Gbps. As a consequence, a laser is employed as a light source in this study to convey audio data via light. Some of the advantages of using LI-FI technology for audio transmission are as follows: The data rate in LI-FI will be enhanced, resulting in a quicker speed. We will use LI-FI to send any data that would usually be sent over a regular WI-FI network. High speed, enhanced security, more connected devices, cheap cost, low bit error rate, high efficiency, immune to electromagnetic interferences, and because laser is used, data transfer is considerably faster due to its high intensity, brightness, and directionality, with the light reaching up to long distances.

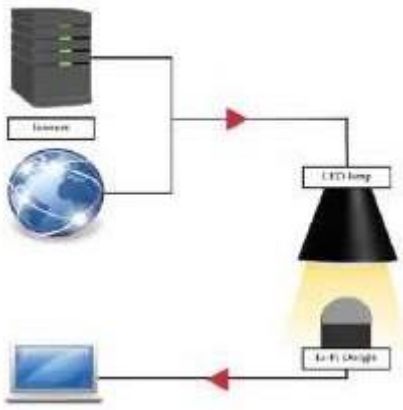

Figure 3.3: Real time applications of Li-Fi

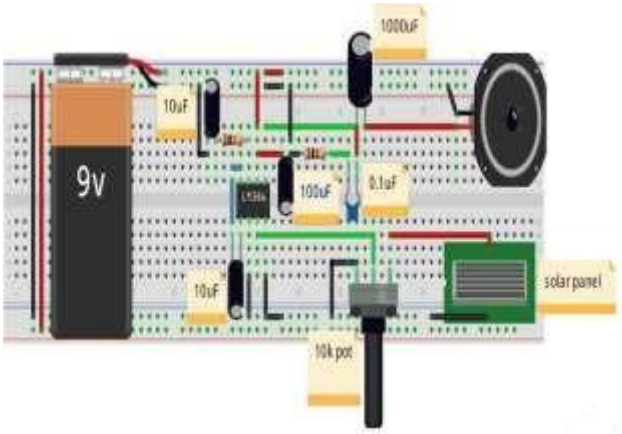

Figure 3.4: Circuit of Proposed System

The following are some examples of LI-FI applications in various fields: WI-FI and other forms of radiation are dangerous to such sensitive areas in a number of situations, including hospitals and power plants. LI-FI can be utilized in these environments. LI-FI can also be used for audio communications and device control in underwater systems. Localized advertising is possible by broadcasting on the LI-FI channel over shorter distances. LI-FI can also be utilized in traffic control systems to decrease vehicle-to-vehicle communication-related accidents. It has use in pharmacies and the pharmaceutical industry. LI-FI can assist shops in directing customers from the moment they enter the store. It can also be used in aero-planes. In times of calamity, such as earthquakes or hurricanes, LI-FI is frequently used as a reliable means of communication. This technology is employed in augmented reality, and it is highly useful in military and naval applications, as well as underwater applications and crypto-currency.

4. FUTURE SCOPE

This technology has a lot of potential in the future. Because LI-FI is a new technology, it has a lot of potential. During this field, numerous studies are frequently carried out. In this work, we proposed a real-time high-quality audio signal transmission and receiving system. LI-FI is a low-cost and fast wireless communication technology.

The rising need for larger bandwidths, quicker and safer data transmission, as well as equipment that is both ecologically and demonstrably human-friendly, heralds the start of a dramatic change in wireless technology from RF to optical. Although VLC is still in its early stages, it is a promising technology with a wide range of applications. VLC is becoming increasingly popular throughout the world, and we may soon see a plethora of real-world applications. This device can send data at a rate of about 100 gigabits per second (100 Gbps) utilizing lasers, which are far faster than radio waves. This work is regularly improved in the future by adding high-intensity LEDs or focusing lenses in order to extend the range of communication. Adding a noise termination circuit to the receiver end can help reduce output noise.

5. CONCLUSION

This document provides a thorough overview of the audio transmission system that employs LI-FI technology. The concept of LI-FI is currently generating a lot of buzz all around the world. This system is frequently used with this infrastructure and does not require significant adjustments. Within the sphere of wireless communications, visible light communication may be a rapidly

emerging technology. The VLC is still in its early phases, but with the great advances in technology being made step by stage, it will soon be integrated into our daily life. LI-FI is a quick and low-cost wireless data transport technology. The rising need for higher bandwidths, quicker and safer data transfer, as well as technology that is both ecologically and demonstrably human-friendly, heralds the start of a huge wireless revolution. This type of recent invention is frequently promoted as a safe and environmentally friendly technology. It can also be used in hazardous environments, such as thermal and atomic power plants, without creating electromagnetic interference. As a result, LI-FI can take the place of Wi-Fi.

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