

Faster and Safe Wireless Communication Network Using LiFi

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Abstract— **LIFI- "LIGHT FIDELITY"**. It is a progression for remote correspondence between IoT devices utilizing light to transmit information. In-specialized term we can state that ,LIFI is an obvious light correspondence framework that is equipped for transmitting information at high speeds over the noticeable light range, bright and infrared radiation. The idea of lifi is information correspondence on quick gleaming of light which isn't distinguished by human eye yet it is centered around photodetector which changes over the on-off state into parallel computerized information. This happens in the form of a binary transmission of data, where '0' is the LED in its 'off state' and '1' is the LED in its 'on-state'.

Keywords—OOK, VISIBLE LIGHT COMMUNICATION, DATA TRANSFER, LIGHT EMITTING DIODE, LIGHT DEPENDENT REGISTER..

I. INTRODUCTION

The LED light in our homes, offices, cars, and even street lights connect to us with high speed wireless internet. LiFi is high speed, bidirectional fully networked wireless communication allowing transfer of data through the light that we use. LiFi enabled LED light modulate illumination level to send data like morse code that modulation happens so fast the eye can't perceive it.

LiFi is where light becomes data. Every year the world consumes 60 percent more wireless data, almost all of this is consumed indoors using wireless internet connection that utilize radio frequencies. The space for radio frequencies is becoming oversaturated resulting in which what is known as the spectrum crunch. Eventually radio frequency technology like WiFi will no longer keep up demand , however, LiFi does not use radio frequency, it uses the light spectrum which can open up 1000 times more spectrum than radio frequency. LiFi will be an integral part of the future of wireless networks such as 5G and further.

1.1 ARCHITECTURE

A. how LiFi works

LiFi and WiFi are electromagnetically transmitting information. Nevertheless, wifi uses radio waves where as lifi uses light spectrum. LiFi utilizes photodetector to get light flag, and a pennant preparing fragment to change over the information into 'Stream-capable' content. An LED light is a semi-transport light source suggesting that the steady of intensity gave to a LED light can be changed at high speeds without being discernible to the human eye. Data is reinforced into a LED light with banner taking care of

development, it by then sends data which is embedded in its bar at quick to the photo detector.

Figure1 explains that from internet resources it will transmit streaming content to drivers then it goes on lit led lamp. There will be an on-off state to control, where 0 is for off and 1 is for on. Using a detector connected in any particular system can detect the data emitted through an LED lamp which is then amplified and processed later it passed on to the system.

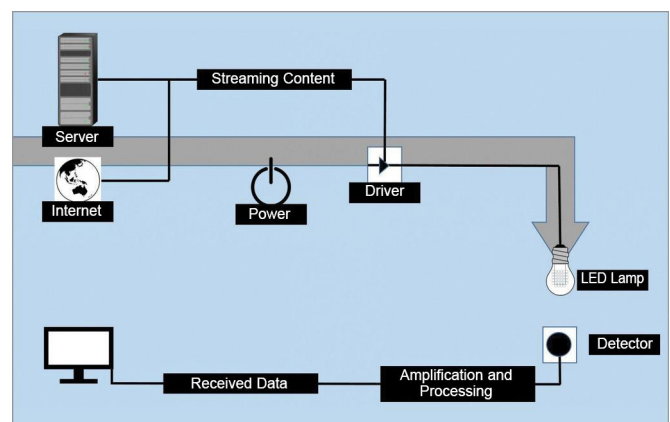


Figure1 LiFi Architecture

B. Features

LiFi highlights the advantages of a remote framework's limit and security with various key advantages over WiFi. In any case, it is important to note that LiFi is not planning to be an immediate trade for wifi and cell organizations, it is an integral innovation that in certain circumstances will work admirably.

Harald Haas, the individual who begat the term LiFi, anticipate that LiFi will open the third mechanical upset. The innovation appears to be encouraging and many significant key jobs for considering in future.

"Microsoft is executing the lifi arrangement of Lucibel in its advancement focus in France"

"There have been reports that Apple is trying different things with lifi remote information for future Iphones and IpadS."

LiFi innovation offers various advantages, yet there are as yet imperative difficulties that must defeat before it turns into a basic piece of regular remote correspondence.

1.2 METHODOLOGY

LiFi can be used for transmission of audio signal, text files, music and videos. LiFi can also be used for providing internet.

This paper is focus on transmission of audio data and text data and application that can be used with the help of LiFi.

We have transmitted audio data to one source to another. studied topologies and different characteristics and variations observed in the data being transmitted at the setup. We have also transmitted of text data using a setup of Arduino boards, LED. and Photo-detectors.

We will also saw that how Application can be used using LiFi.

LiFi can also be used to transmit images and videos or any kind of data and eventually even provide internet by using modulation techniques like OFDM. LiFi when combined with WiFi, provides an ideal setup where the drawbacks of LiFi are covered up by the handoffs of the devices to WiFi.

A. AUDIO SEGMENT

The transmission of audio data/signals was done through a Phone, PC or any device that can play audios at the transmitter end, provide Audio signal through a 3.5mm jack that would convert the digital signal to analog signal. A power supply is likewise given to the LED. This power supply is given by a 9V battery that is associated with the 3.5 mm jack and the LED.

However, this variation in light intensity is captured on a photodetector - like solar panel. It captures all the variations and sends to the pre-amplified speaker that receive signal.

This audio signal, generated while reading the text, was transmitted as mentioned above through the fluctuation of LED and captured on a solar panel. This was then heard by a pre - amplified speaker.

B. TEXT SEGMENT

The text transmission segment was done from the Arduino. Text transmission between two Arduino using LDR (Light Dependent register) .

1.3 DATA TRANSMISSION

A. AUDIO TRANSMISSION USING LiFi

The audio signal was transmitted via a smartphone or pc or any other device at the end of the transmitter, providing the audio signal through the 3.5 mm jack or Aux cable. The 3.5 mm audio jack or Aux cable from the phone or pc input audio are converted from digital to analog. A typical 3.5 mm audio jack and Aux cable has three output lines, i.e. right, left and ground. The right and left have the audio output signal, which is connected to the 9 V battery's negative. The ground of the 3.5 mm jack or Aux cable is given to the negative of the LED bulb and the positive of the 9 V battery is given to the resistors in arrangement with the LED bulb.

However, this variation in light intensity is captured on a photo detector that is solar panel. It captures all the variations and sends to the pre-amplified speaker that received signal. The analog signal transmitted to the solar panel via the fluctuating LED array is amplified in the pre-

amplified speaker and emits the speaker's sound waves. The sound intensity received from the speaker varies depending on the distance from the LED bulb and solar panel. This shows that can receive the information from the LED bulb in a line of sight. As the distance between the LED bulb and the solar panel increases, the light intensity decreases, making the light more dispersed, making it difficult for the solar panel to detect all the light rays are emitted. It is shown in figure 3 and 4.

According to the effective voltage difference, this circuit effectively modulates the light intensity of the LED bulb, which acts as a carrier wave. The fluctuations take place at very high speed, which is invisible to the naked human eye. The human eye therefore does not realize the variation in light intensity from the LED bulb.



Figure 2 Audio Transmission Model

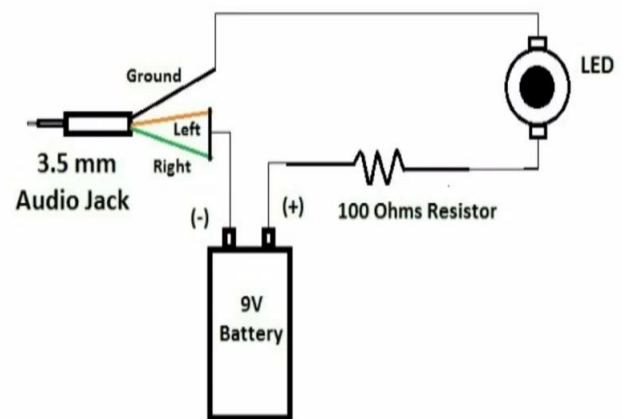


Figure 3 Circuit Diagram of Audio Transmitter

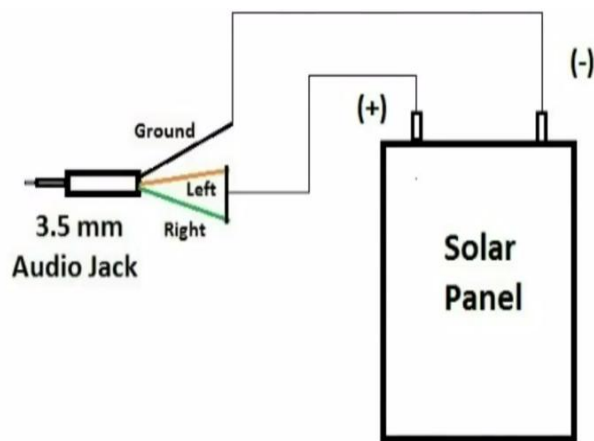


Figure 4 Circuit Diagram of Audio Receiver

B. TEXT TRANSMISSION USING LiFi

A circuit is structured to such that the LED and a photodetector (LDR) are interfaced with an Arduino. On the Arduino is embedded an code. The LED flickers when transmitting data to the Arduino using the serial monitor. The photodiode (LDR) captures these flickers, which is then decoded to the original data. For each alphabet or character to be entered, the code consists of different binary values. These are based on the binary values that switches the LED bulb in on state and off state.

When entering the data to be transmit, the LED blinks according to the characters or numbers entered. The photo-diode decodes these blinks based on the code's. In this way, the data is transmitted by a single micro controller and received on another serial port.

Figure.6 shows that the Arduino board is connected to a PC using the COM ports of the PC. On the transmitter side, the text is entered on Arduino's serial monitor once the program is compiled and uploaded to the board. This data is processed in an Arduino Uno board in the Atmega 9600, microprocessor. This flickering is captured in the receiving side that is LDR receiver, which is interfaced with an Arduino board connected on a COM port of PC. The receiver accepts the transmitter's binary values.

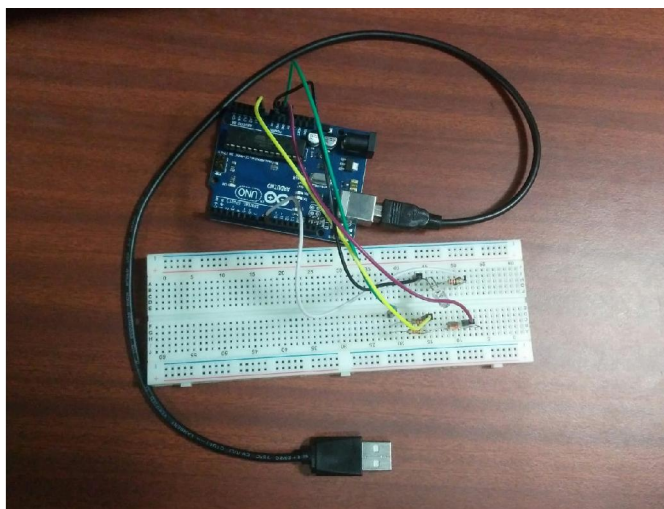


Figure 5 Text Transmission Model

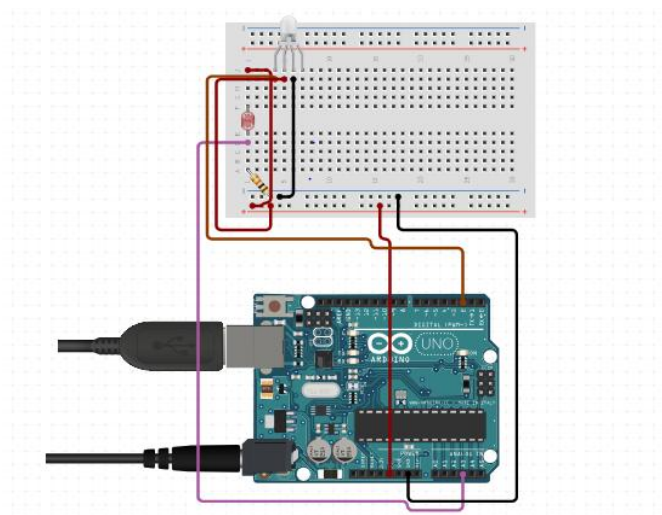


Figure 6 Circuit Diagram of Text Transmission

2. APPLICATION USING LiFi

Blind Indoor Navigation System

Indoor navigation is suitable for all and it is particularly crucial for visually impaired people. LED lights emit visible light, with location data and the data is received by the built in system or the phone. The build-in system or phone calculates the optimal path to a designation and speaks via a headphone to a visually impaired person. LED lights emit visible light with location data and using build-in systems or phones instead of Arduino with a visible light receiver to receive the data. The LiFi enabled text to speech can be utilized as an option for the visually impaired. The built - in system and phone calculates the best possible way to a designation and speaks with a headphone to the visually impaired. The signal from the nearest LED would be detected by a receiver in the headset and play the relevant message that shown in Figure 8. In Figure 7 The implementation has been done to show the working of blind indoor navigation system.

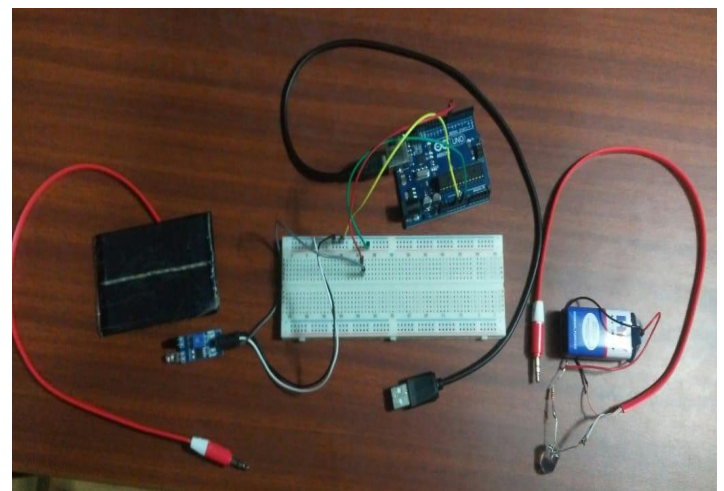


Figure 7 Blind Indoor Navigation System Model



Figure 8 Blind Indoor Navigation System

3. FUTURE INTERPRETATION OF LIFI

LiFi is suggested as a complimentary device to be used close by Wi-Fi, anyway later on, LiFi will be the transcendent web affiliation device around. Current devices must be redesigned and future gadgets must be incorporated with the innovation before it can turn out to be excessively well known, this won't be an issue for enormous names like Apple , HP , Dell and other gadget dealers."We should basically fit a little microchip to every potential lighting up and lighting gadgets and this would then join two basic functionalities: enlightenment and remote information transmission," says Harold Haas, the creator of this astounding advancement. Envision having extraordinary web association in autos, quick and secure associations at home and access to the web with a light source anyplace. That is LiFi 's splendid future.

CONCLUSION

This paper is based on LiFi technology and its application. In the first section audio transmission using Lifi is implemented and that explain working audio transmission. It is shown that audio transmission can be achieved with a distance up to 30cm

and improvements can be made by adding a focusing lens between the transmitter and the receiver. Second phase deals this text transmission. For this Arduino Uno to transmit data using an LED. In the data transmission prototype, the code has give to Arduino to transmit character or number. On the third phase Lifi is implemented based on application that can solve the real world problems of visually impaired peoples.

REFERENCES

- [1] What is LiFi?(Harald Haas), Member, IEEE, Liang Yin, Student Member, IEEE, Yunlu Wang, Student, IEEE, and Cheng Chen, Student, IEEE.
- [2] LiFi: Conceptions, Misconceptions and Opportunities (Harald Haas). LiFi Research and Development Centre, The University of Edinburgh, Edinburgh EH9 3JL, UK, h.haas@ed.ac.uk.
- [3] Coexistence of WiFi and LiFi Toward 5G: Concepts, Opportunities, and Challenges (Moussa Ayyash, Hany Elgala, Abdallah Khreishah, Volker Jungnickel, Thomas Little, Sihua Shao, Michael Rahaim, Dominic Schulz, Jonas Hilt, and Ronald Freund).
- [4] An Indoor Hybrid WiFi-VLC Internet Access System :- Sihua Shao*, Abdallah Khreishah*, Michael B. Rahaim†, Hany Elgala†, Moussa Ayyash‡, Thomas D.C. Little†, Jie Wu§ *Department of Electrical and Computer Engineering, New Jersey Institute of Technology †NSF Smart Lighting ERC, Department of Electrical and Computer Engineering, Boston University ‡Department of Information Studies, Chicago State University §CIS Department, Temple University.
- [5] Gurbinder Singh, "Li-Fi (Light Fidelity) - An Overview to future Wireless technology in Field of Data Communication".
- [6] Yingjie He, Liwei Ding, Yuxian Gong, Yongjin Wang, "Real-time Audio & Video Transmission System Based on Visible Light Communication", June 2013.