Audio And Data Transmission Using LI-FI Technology

Rohit Sanjay Bobade
Department of Electronics and Telecommunication Engineering, Savitribai Phule Pune University
Pune Maharashtra, India
rohitbobade24@gmail.com

Sarvesh Sanjay Mali
Department of Electronics and Telecommunication Engineering, Savitribai Phule Pune University
Pune Maharashtra, India
sarveshmali31@gmail.com

Yashodeep Dnyaneshwar Deshmukh
Department of Electronics and Telecommunication Engineering, Savitribai Phule Pune University
Pune Maharashtra, India
yashodeepdeshmukh888@gmail.com

Abstract— **As the demand for high-speed data in wireless communications increases day by day with the significant increase of the number of users, Radio Frequency (RF) spectrum become one of the scantest resources in the world. RF technologies have limitations of the regulated spectrum, spectrum congestion, expensive licensing, low bandwidth and low-speed broadband connection. The available huge visible light communication (VLC) spectrum band ranges from 428 THz to 750 THz. So the new wireless technology known as light fidelity (Li-Fi) has become a new source for communication of data and it has been identified as a powerful and promising complementary and/or alternative to the existing radio frequency(RF) wireless communication technology which uses visible light as a medium to deliver high-speed data communication. Li-fi is an optical wireless communication technology which utilizes light emitted from Light-emitting diode bulb for simultaneous transmission of text and audio signals which is discussed in this paper. Continuous improvements in wireless communication systems, e. g. 3G, 4G, etc.., require higher bandwidth and due to the lack of sufficient Radio Frequency spectrum, we should adopt a wireless system which will support wide bandwidth. So the new technology of Li-Fi came into the aid. Light fidelity (Li-Fi) is a new short range optical wireless communication technology which provides data transmission like text, audio, video by using Light-Emitting Diodes (LEDs) to transmit data depending on light illumination properties. It uses the visible light spectrum which is 10,000 times larger than the entire radio frequency spectrum.**

Keywords— Optical wireless communication (OWC), VLC, LED, Li-Fi, Solar panel, Arduino, Bluetooth, radio frequency, high speed data.

l. INTRODUCTION

As the demand for high-speed data in wireless communications increases day by day with the significant increase of the number of users, Radio Frequency (RF) spectrum become one of the scantest resources in the world. RF technologies have limitations of the regulated spectrum, spectrum congestion, expensive licensing, low bandwidth and low bandwidth and low-speed broadband connection. So the new wireless technology known as light fidelity (Li-Fi) has become a new source for communication of data. which uses visible light as a medium to deliver high-speed data communication. It Uses available huge visible light communication (VLC) spectrum band ranges from 428 THz to 750 THz. Li – Fi Can be understood as the optical form the Wi – Fi. It actually refers to the 5G Visual Light Communication System where we use LED as a transmission medium to achieve the High Speed Communication among the devices just like the Wi – Fi. The utilization of Visual Spectra provides us the capability to transmit the data with speed of light but at the same time, brings its all limitations to it that it can't penetrate an opaque object like wall. But in the positive way it can utilized as the privacy and security tool or feature for the transmission.

I. METHODOLOGY

[1] The main goal of this project is to Transfer Audio And Data Using Visible Light Communication (VLC), Light Fidelity (Li-Fi) Technology Has Been Designed. This Project Aims To Develop a System For Faster And More Secure Transmission of Data [2]. If the LED is on, we transmit a digital 1, if it's off you transmit a 0. The LED can be switched on and off very quickly, which gives nice opportunities for transmitting data. Hence all that is required is some LEDs and a controller that code data into those LEDs. All has to do is to vary the rate at which the LED's flicker depending upon the data we want to encode. The flashing of the light actually happens much faster that human eyes cannot detect, so the output appears constant, allowing for a Li-Fi data connection to resemble a simple LED bulb When LED is ON microchip convert digital data in form of light. On the other end this light is detected by the photo detector. Then this light is amplified and fed to the device. If the LED is ON, transmit a digital 1, if it's OFF you transmit a digit 0.

II. LITERATURE REVIEW

[1] Visible Light Communication (VLC) is the term which was the method that uses visible light for Data transmissions. Due to the insufficient Radio Frequency (RF) resources, and the limitations in bandwidth, the demand for faster data transmission becomes a big problem to be solved. This problem is rectified by the emerging Li-Fi technology which provides faster data transmission with a more secure environment. Therefore, VLC became an emerging technology and was included in 5g. This paper focuses on audio and video transmissions in VLC methodology using Li-Fi (light fidelity) module. A real-time transmitter and receiver system to check the performance and verify the audio and video transmission using Li-Fi under varying

conditions such as distance, intensity, and quality. The main Objective is to design a transmitter and receiver using a Li-Fi setup for audio and video transfer and to test the setup under varying conditions. The use of VLC has gained particular interest due to its fast data rates and traffic overloading techniques. The main advantage of VLC is quick data rates with minimum power consumption. and small setup cost makes it as an emerging technology that can be included and used in upcoming technologies such as 5g networks.

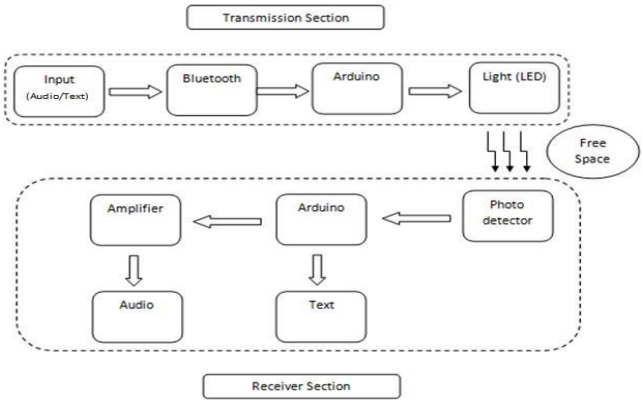
[2] As the demand for high-speed data in wireless communications increases day by day with the significant increase of the number of users, Radio Frequency (RF) spectrum become one of the scantest resources in the world. RF technologies have limitations of the regulated spectrum, spectrum congestion, expensive licensing, low bandwidth and low bandwidth and low-speed broadband connection. The available huge visible light communication (VLC) spectrum band ranges from 428 THz to 750 THz. so the new wireless technology known as light fidelity (Li-Fi) has become a new source for communication of data and it has been identified as a powerful and promising complementary and/or alternative to the existing radio frequency (RF) wireless communication technology which uses visible light as a medium to deliver high-speed data communication. Li-fi is an optical 12 AISSMS IOIT PUNE wireless communication technology which utilizes light emitted from Light emitting diode bulb for simultaneous transmission of text and audio sign.

[3] Continuous improvements in wireless communication systems, ex 3G, 4G, etc.., require higher bandwidth and due to the lack of sufficient Radio Frequency spectrum, we should adopt a wireless system which will support wide bandwidth. the new technology of Li-Fi came into the aid. Light fidelity (Li-Fi) is a new short range optical wireless communication technology which provides data transmission like text, audio, video by using Light-Emitting Diodes (LEDs) to transmit data depending on light illumination properties. It uses the visible light spectrum which is 10,000 times larger than the entire radio frequency spectrum.

[4] The light fidelity technology refers to visible light communication that uses light as a medium to deliver high speed data which is much greater than that of Wi Fi. Li Fi data is transmitted in several bit streams and the receiver side consisting an IR detector decodes the message. The transmission happens in the form of binary data where 0 means LED in OFF state and 1 means that the LED is in the ON state. Transmitter and receiver sections contain Arduino which is programmed using Arduino IDE. High power intensity led are used in the Li Fi transmitter. In receiver section photodiode module is used to detect the light signal generated by the Li Fi transmitter. In this we are transmitting the 2 different data using light they are Audio signal and Text Signal.

[5] Wireless-fidelity (Wi-Fi) and Bluetooth are examples of current wireless communication technologies that utilize the radio waves as primary source for data transport. Despite the widespread use of these technologies, there is a pressing need to investigate new methods for transmitting data wirelessly and efficiently. The reason for this is due to the band of radio frequency (RF) present limits, which has overpopulation and disturbance signals from other RF applications. More research work has been done to prove that visible light may be used as a wireless source for data transport in order to investigate alternatives. As a result, a German physicist named Harald Haas presented a new technology called light-fidelity (Li-Fi).

III. BLOACK DIAGRAM



A. Explanation of Block Diagram

The mode of communication discussed in this paper is through visual light. VLC based system uses wavelength ranges between 380nm to 750 nm that means 430 THz to 790 THz frequency for communication. As it supports larger bandwidth so it overcomes bandwidth limitation of RF communication and it works when both transmitter and receiver are in the line of sight. VLC based system can not be intercepted by any other from another room and as information is transmitted through light so it is not affected because of electromagnetic radiations. So can be said that VLC provides secured communication than RF-based systems. The block schematic of the transmission is depicted in Fig. 1. The input is given in the form of text through 4*4 Keyboard and the data is transmitted through BT to Arduino Uno. The BT HC-05 is easy to use Serial Port Protocol (SPP) module. The data is transferred by compiling and uploading to Arduino. This way tangle-free connection is being got. The data transmitted to Arduino Uno is further transmitted to the photodiode through the LED. The transmitting data is in the form of binary and the LED blinks too fast to be seen by naked eyes. Further, in the receiver section, the photodetector receives the flickers in the form of binary data and then again it is sent to the Arduino on the receiver section for the conversion of data into ASCII value. At last, the receiver side has a dictionary in form of codes. The dictionary converts the ASCII value to the alphanumeric character where the alphanumeric characters are displayed on the 16*2 LCD.

Component specification

A. Input: The input is given in the form of text via 4*4 Keyboard and here Bluetooth have been used to transfer data by compiling and uploading to Arduino**.**

B. Bluetooth: The Connection Between Input (audio/text) And Arduino Is Takes Place by Bluetooth. Because of Bluetooth There Is Wireless Connection (no cables are used).

C. Arduino: The data transmitted to Arduino Uno is in the form of Alphanumeric value. The alphanumeric value is converted to a binary value. The binary values from Arduino being sent to the LED.

D. LED: The main purpose of the LED here is to transmit the received values from Arduino to the photodiode. The LED's transmit data by flickering.

E. Photo Detector: Further, in the receiver section, the photodetector receives the flickers in the form of Binary data.

F. Amplifier: to amplify the weak signals which is received by photo detector.

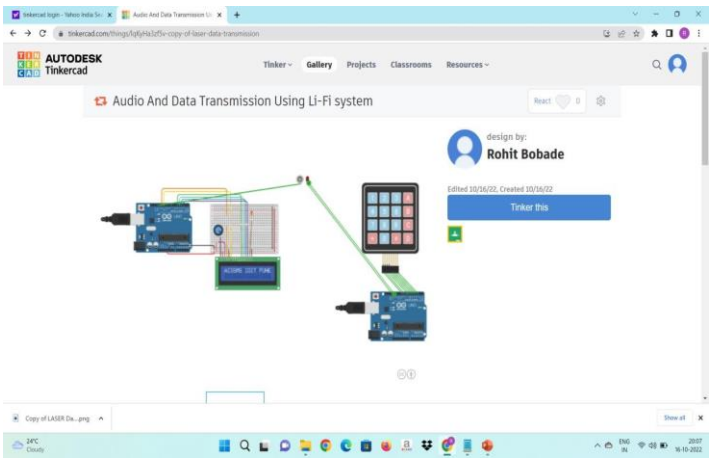
G. Receiver Arduino: then again it is sent to the Arduino on the receiver section for conversion. Here the binary data is converted to ASCII value. At last in the receiver side has a dictionary in form of codes which converts the ASCII value again to alphanumeric character.

H. Speaker (Audio output): The audio output we can get on speaker. The purpose of speaker is to convert the electrical signal into sound signal.

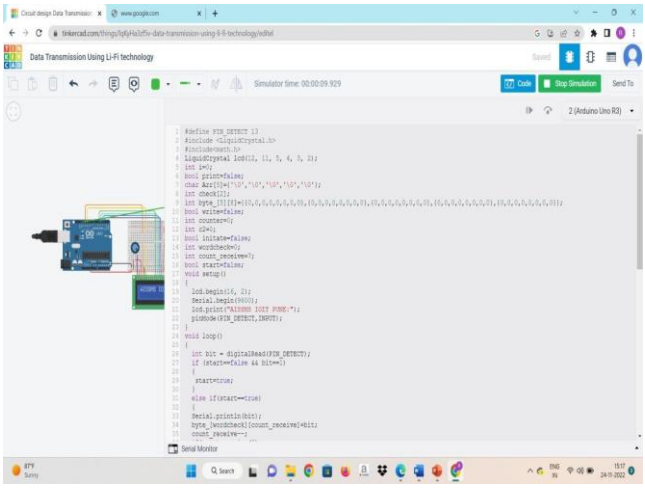
I. LCD (Text output): For text output we can use 16*2 LCD. The purpose of 16*2 LCD is to display alphanumerical values

IV. SOFTWARE DESIGN

A. Circuit Simulation of the system:



B. SIMULATION RESULT OF THE SYSTEM :

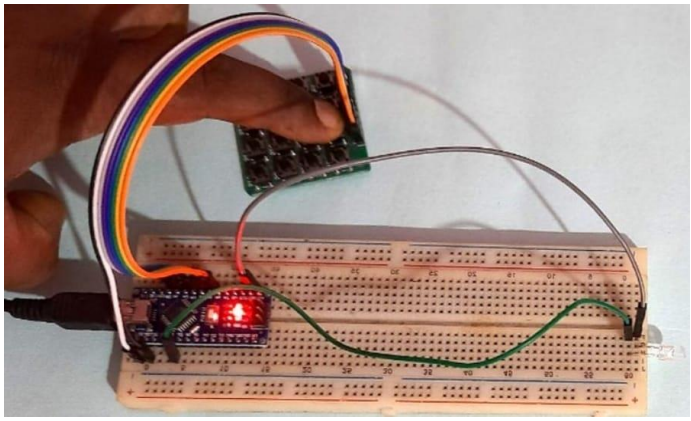


V. SOFTWARE DESIGN

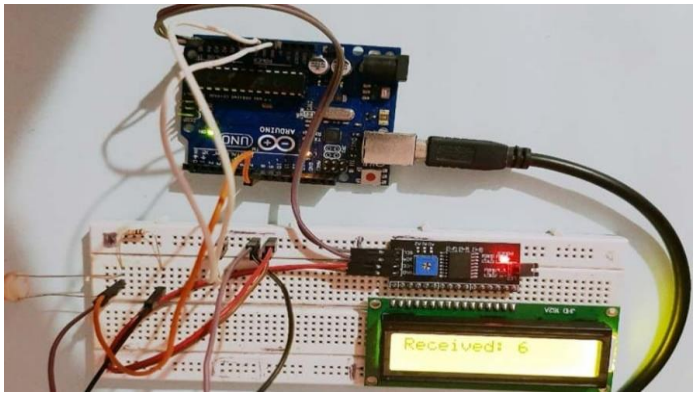
The simulation is expected to demonstrate the feasibility of using Li-Fi technology for audio and data transmission, and to provide insight into the key factors that affect the performance of the system. The simulation may also be used to optimize the system design and to compare the performance of Li-Fi with other wireless communication technologies.

V. Project Module

Transmission Section:



Receiving Section:



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