AUDIO TRANSMISSION THROUGH LI-FI TECHNOLOGY

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ABSTRACT

Due to the radio wave problem with the medical instruments the “Wi-Fi” technology become a problem facing this challenges due to the interference of radio waves which may be harmful for the patient. Multiple accesses “Wi-Fi” is have many challenges starting from the capacity, availability, efficiency and security. Moreover WiFi transmit radio waves that may affect on medical instruments. In this paper a proposed transmitter and receiver based on “Li-Fi” technology communication by using “LEDs” which is line of sight only was done. A simple design to the “Li-Fi” is represented.

Key words: Li-Fi (Light-Fidelity), LED (Light Emitting Diode), LDR (Light Dependent Resistor), Audio Power Amplifier.


1. INTRODUCTION

Communication can be defined as the transmission of data, audio and signals from the source to distention or multi destination points, a huge number of technology develop to handle this process with high capacity, free of errors, reliability and serve multi users at the same time with respect to the overall performance.

“Li-Fi” based on the visible light communication technology and it is a system that is considered wireless communications with high speed. “Li-Fi” uses common uses “LED” for sensing data, at a high speed reach “224” Gbps.

“Li-Fi” and “Wi-Fi” are similar both transfer data electromagnetically but “Wi-Fi” uses radio waves in state of “Li-Fi” that uses visible light to send data. An “LED light” based on semiconductors that uses a direct power direct current supply. It can dimed up and down at very high speeds, and invisible for human eye.
Li-Fi Working Mechanism
Data can be transferred through LiFi by fed into an LED light using signal processing technology; it then sends data rapidly to the photo detector. The small variation of the density of LED light is transformed by the “receiver” to electrical signal. The signal is then transformed back to binary data stream that recognized as “web”, “video” and “audio applications”.

Li-Fi Limitations
The “Li-Fi” limitations that unable to pass through obstacles (such as walls). Moreover the “LiFi” requires the light is on all the time for connectivity, that is mean the LEDs Light is required to be on at 24 h a day.

Disadvantage of Wi-Fi Technology
- Unsecured communication through, wireless communication based on radio frequency.
- Radio frequency based on EMF can easily make and interference with medical interments.
- Health problems due to the daily usage of radio frequency communication.

Aims and Objectives
The aim from this paper is to design and implement a wireless data transmitter and receiver device based on Li-Fi Technology and Arduino UNO.

2. PROPOSED METHOD AND MATERIALS

Block Diagram
Figure 1 below shows the method proposed in this paper. Transmitter circuit via the computer is connected to the Arduino Uno circuit, which contains the microcontroller. The Arduino Uno will output 3 LED which are the 3 main colors that send the Li-Fi, while the receiver will receive via the detector. The audio signal is output directly from the computer from the sender and the Li-Fi, the detector receives it and goes analog to the second computer.

Figure 1 Proposed System Block Diagram
Transmitter and Receiver Section
Figure 2 shows a block diagram of how data is transmitted from the transmitter section to the receiving section.

![Figure 2 Block Diagram of Transmitter and Receiver section.](image)

Project Structure
The project consists of hardware, software and a fabricated arm, in the software written in C language and it’s burned inside the microcontroller.

Hardware Block
The hardware block consist of atmega16 control board to monitor the sound pass its situation to the atmega16 as shown in Fig.3.

![Figure 3 Atmega16.](image)
Software Block
It is the microcontroller which has a memory block the program is burned into to control the hardware.

The Prototype Structure
The prototype that fabricated using low voltage output for prototype.

The above figure represents the LIFI smart lighting covers the room, to serve several kinds of applications such as computers, HD video, Voice over IP Calls, Wireless Printers.

Computer model

Circuit diagram
In figure 6 the circuit diagram is represented the transmitter and receiver, the transmitter is based on LED controlled through Arduino Board, the Arduino convert each character into binary number in order to be transmitted through LEDs, each character is converted to 8 bit
code with a start and end character such as # and these characters used to detect the start and the end of the transmitting of the bits of the character.

![Circuit Diagram](image)

**Figure 6** Circuit Diagram

**Arduino Board**
The following figure illustrates Arduino Uno used.

![Arduino Uno Front View](image)

**Figure 7** Arduino Uno Front View

**Led with Resistor**
The following figure illustrates the led connection to the Arduino board.

![Interfaced resistor to LED and Arduino Board](image)

**Figure 8** Interfaced resistor to LED and Arduino Board

**Photo-Detector**
The photo detector was used to convert the light received into electrical signal; the photo detector is nonlinear so 100k-ohm was used as a voltage driver to the output in order to convert the received signal to the Arduino Board.
Working Mechanism
Even if the LiFi is working with a speed of light, the sensors may have limitations in their bandwidth, maximum speed and wavelength thus a problem occurs using limited speed sensors will limit the speed of the transition.

Moreover the distance requires high power, and a problem with interference with white lights occurs, thus the invisible light is more accurate.

In addition to the serial communication, the serial requires a single source and multi distention or single distention, but the parallel uses a multi LED and Detectors, the problem occurs if a miss alignment of one of the LEDs to the detector happens.

3. RESULT AND DISCUSSIONS
The audio transmission group was tested to be about 13-20 m. Because after this distance it gets scattered from the light and then it does not fall correctly on the photodiode. Table 1 below shows a comparison between Li-Fi and Wi-Fi and table 2 shows that increasing the intensity of the LED light in watt will increase the transmission distance and affect the diameter by increasing.

<table>
<thead>
<tr>
<th>No.</th>
<th>Feature</th>
<th>Li-Fi</th>
<th>Wi-Fi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Full form</td>
<td>Transmits data using light with help of LED bulbs.</td>
<td>Transmits data using radio waves with help of Wi-Fi router.</td>
</tr>
<tr>
<td>2</td>
<td>Operation</td>
<td>Do not have any interference</td>
<td>Will have interference</td>
</tr>
<tr>
<td>3</td>
<td>Interference</td>
<td>Used in airlines, underwater explorations, hospital, office and home, and internet browsing.</td>
<td>Used for internet browsing with the help of Wi-Fi kiosks or Wi-Fi hotspots.</td>
</tr>
<tr>
<td>4</td>
<td>Cost</td>
<td>Less than Wi-Fi</td>
<td>More than Li-Fi</td>
</tr>
<tr>
<td>5</td>
<td>Applications</td>
<td>Interference is less</td>
<td>Interference is more</td>
</tr>
<tr>
<td>6</td>
<td>Advantages</td>
<td>Interference is less</td>
<td>Interference is more</td>
</tr>
<tr>
<td>7</td>
<td>Security</td>
<td>Interference is less</td>
<td>Interference is more</td>
</tr>
<tr>
<td>8</td>
<td>Data speed</td>
<td>1 Gbps</td>
<td>About 150 MBps</td>
</tr>
<tr>
<td>9</td>
<td>Frequency</td>
<td>10,000 times frequency spectrum of the radio</td>
<td>2.4 GHz, 4.9 GHz and 5 GHz</td>
</tr>
<tr>
<td>10</td>
<td>Data density</td>
<td>Works in high dense environment</td>
<td>Works in less dense environment</td>
</tr>
<tr>
<td>11</td>
<td>Converge distance</td>
<td>About 13-20 meters</td>
<td>About 32 meters</td>
</tr>
<tr>
<td>12</td>
<td>System components</td>
<td>Lamp driver, LED and photo detector</td>
<td>Router, subscriber devices (laptops, PDAs, desktops)</td>
</tr>
</tbody>
</table>

Table 1: Comparison between Li-Fi and Wi-Fi
CONCLUSION

Due to its shorter range, Li-Fi is more secure than Wi-Fi and it's reported that embedded light beams reflected off a surface could still achieve 70 megabits per second. Since the LiFi has a boundaries and cannot pass through walls compared to Wi-Fi but it has a secure connection. The problem of this project was the Unsecured communication through, wireless communication based on radio frequency and Radio frequency based communication may affected by EMF interference also Health problems due to the daily usage of radio frequency communication. In this project a design and implementation of wireless data transmitter and receiver device based on Li-Fi Technology and Arduino was done and successfully tested.

REFERENCE


[4] Li-Fi internet solution from Russian company attracting foreign clients, Russia and India Report, Russia Beyond the Headlines, 1 July 2014


