LIFI TEXT COMMUNICATION

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ABSTRACT

In many countries around the world, wireless technology is essential for communication since it can reach even the most remote places. Wi-Fi, often known as Wireless Fidelity, is a popular method of text and multimedia communication. A Wi-Fi transmission speed of 450 Mbps is possible when three antennas are utilized, but there is a trade- off in terms of bandwidth, security, upkeep, network switching, etc. We are gradually moving toward a new technology called Li-Fi as a result of technological improvement. Visible Light is used by Li-Fi, or Light-Fidelity, for communication. Since Li-Fi offers a faster rate of transmission, more security, and less interference, it has achieved significant advancements in every area of communication. As a result, a vast amount of remote information transfer is now feasible. The goal of this research is to use light as a carrier to send text in the form of hexadecimal characters. This takes use of the Internet of Things using Arduino, and the LED's intense flashing light is employed as a source to transport text data to the location where the photodiode receiver will receive and interpret the data. Data transmission is accelerated and improved as a result.

Keyword : - *Light Internet, Network, LIFI, WIFI, etc.*

1. INTRODUCTION

Through the years, technology has advanced at an astonishing rate, starting with the postal service, telegraphs, telephones, and finally the age of computers, when everything is digitalized and accessible via the internet. Wi-Fi is utilized more frequently than LAN in today's society, however both technologies are employed for communication. Although it is thought to be the most effective method of communication, it too may be enhanced. Wi-Fi employs radio waves for data transmission, however excessive use can have negative effects like leukemia and cancer. The development of a new technology known as Li-Fi is discussed in this study as a means of using light waves for communication.

2. METHODOLOGY

A. DTMF (Dual Tone Multiple Frequency) Technology Each symbol is represented by the sum of the two frequencies that intersect the digit, the row frequencies are in a low band, below 1 kHz, and the column frequencies are in a high band, between 1 kHz and 2 kHz. The digits are displayed as they would appear on a telephone's 4x4 matrix keypad (on standard telephone sets, the fourth column is omitted). The user should note that there are a number of different algorithms possible for generation and detection of DTMF tones; this application note simply describes one manner of doing so.

B. Decoding a DTMF signal involves extracting the two tones in the signal and determining from their value the intended DTMF digit. Tone detection is often done in analog circuits by detecting and counting zero-crossings of the input signal. In digital circuits, tone detection is easier to accomplish by mathematically transforming the input time-domain signal into its frequency-domain equivalent by means of the Fourier transform, or through use of tone-

specific digital filters. The general approach taken by this algorithm for DTMF tone detection is to take the Fourier transform of the observed signal and search for energy at the frequencies of interest. Since the algorithm is implemented by Discrete Fourier Transform (DFT). The analysis frame must be long enough to resolve the DTMF frequencies, but short enough to detect the minimum length tone. A 12.75 ms frame at a sampling rate of 8 kHz is a good choice. In calculating the DFT, the Goertzel algorithm, a method for calculating any single coefficient of a DFT, is chosen over a fast Fourier transform (FFT) algorithm. There are two reasons for this. In order to obtain the required frequency resolution at an 8 kHz sampling rate, a 256-point FFT would be required. Since the algorithm for tone detection requires knowledge of the energy at only 16 frequencies, it is more efficient to execute the Goertzel algorithm for these frequencies. In addition, the Goertzel algorithm is recursive, eliminating the need to store 256 samples for the FFT for each DTMF detector. This saves both time and data memory in the simulation and the real time applications.

3. STANDARDS AND POLICIES

Li-Fi is wireless and uses a similar 802.11 protocol, but also uses ultraviolet, infrared, and visible light communication. Nevertheless, the IEEE 802.15.7 standard defines a physical layer (PHY) and a medium access control (MAC) layer. This standard can provide data rates sufficient to transmit audio, video, and multimedia services. The mobility of light transmission, compatibility with artificial lighting present in the infrastructure, and possible interference generated by ambient lighting are taken into consideration. The MAC layer can use connections with other layers such as the TCP/IP protocol.

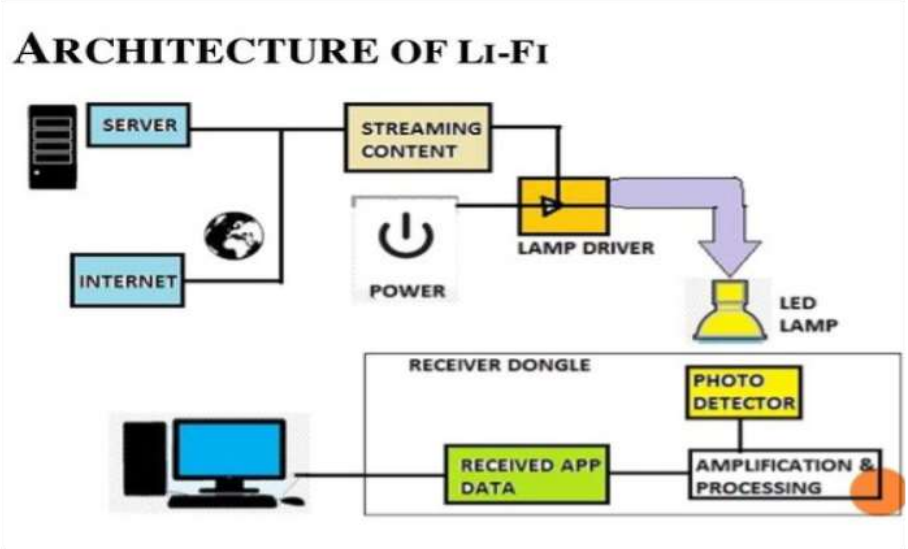
The standard defines three PHY layers with different rates:
• The PHY 1 was established for outdoor application and works from 11.67 kbit/s to 267.6 kbit/s.
• The PHY 2 layer permits reaching data rates from 1.25 Mbit/s to 96 Mbit/s.
• The PHY 3 is used for many emissions sources with a particular modulation method called color shift keying (CSK). PHY III can deliver rates from 12 Mbit/s to 96 Mbit/s

S.No	Layer	Rates
1	PHY1	11.67kbit/s to 267.6kbit/s
2	PHY2	1.25Mbit/s to 96Mbit/s
3	PHY3	12Mbit/s to 96Mbit/s

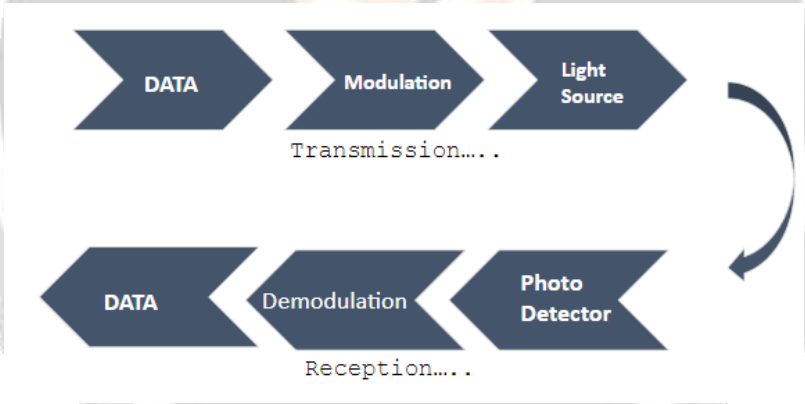
The modulation formats recognized for PHY I and PHY II are on-off keying (OOK) and variable pulse position modulation (VPPM). The Manchester coding used for the PHY I and PHY II layers includes the clock inside the transmitted data by rep- resenting a logic 0 with an OOK symbol ”01” and a logic 1 with an OOK symbol ”10”, all with a DC component. The DC component avoids light extinction in case of an extended run of logic 0’s.

4. SYSTEM ARCHITECTURE

To use the Li-Fi technology we need a transmitter typically considered as LED light and a receiver made up of a photo detector material. The transmitter is connected to the network to modulate digital data along with the flickering light which emits from the LED light source. The receiver then receives such light and decodes the information modulated with the corresponding light rays.



LEDs are switched on and off to generate digital strings of combination of 1s and 0s. To generate a new data stream, data is encoded in the light by changing the flickering rate of the LED, which is used as the source. The LED output appears constant to the human eye by the fast flickering rate of the LED.



5.DESIGN PHASE

• Modulator

In electronics and telecommunications, modulation is the process of varying one or more properties of a periodic waveform, called the carrier signal, with a separate signal called the modulation signal that typically contains information to be transmitted.A modulator is an electronic circuit that superimposes a low- frequency (information) signal onto a high-frequency (carrier) signal for the purpose of wireless transmission.

• Transmitter

A Transmitter is a device that produces radio waves radiating from an antenna. In the world of process control, a Transmitter is a device that converts the signal produced by a sensor into a standard instrumentation signal representing a process variable being measured and controlled.

• Demodulator

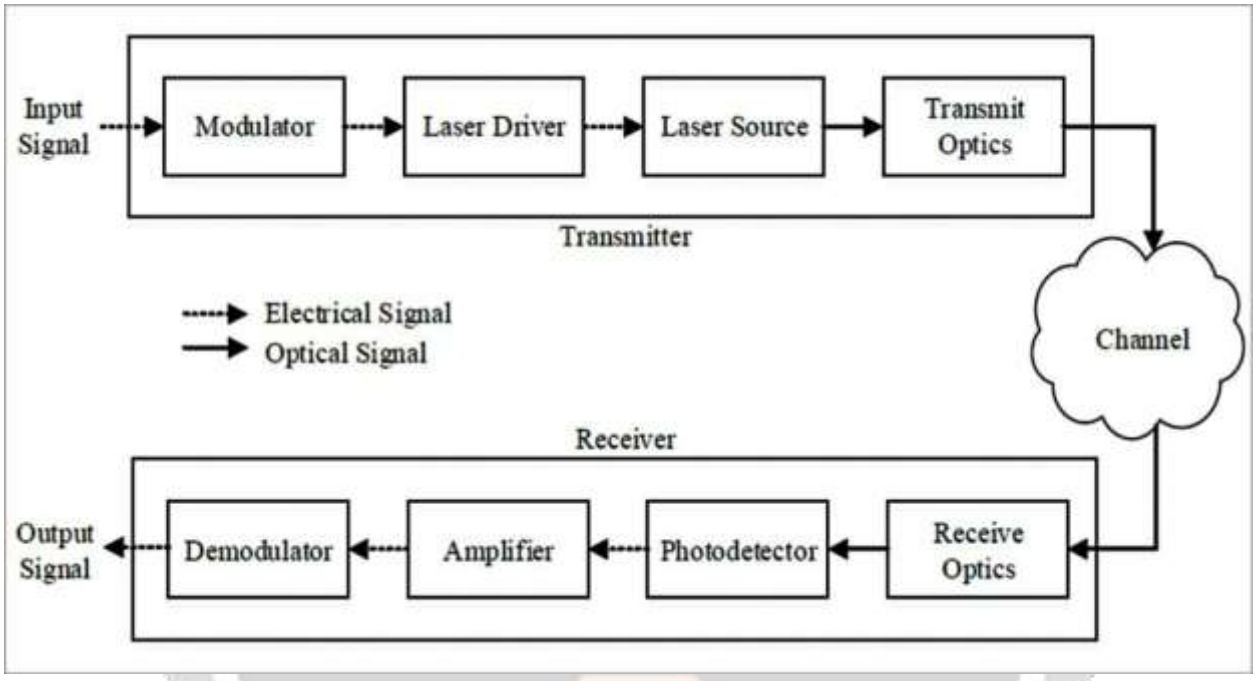
Demodulation is defined as extracting the original information-carrying signal from a modulated carrier wave. A demodulator is an electronic circuit that is mainly used to recover the information content from the modulated

carrier wave.A demodulator is a device which extracts an arbitrarily varying information carrying signal from a signal formed by varying a characteristic of a repetitious electrical or electromagnetic wave of less than infrared frequency in accordance with this information carrying signal.

• Receiver

In the communication process, the ”receiver” is the listener, reader, or ob-16 server—that is, the individual (or the group of individuals) to whom a message is directed. The receiver is also called the ”audience” or decoder.

5.DATA FLOW DIAGRAM



At first the text will be typed to the source like computer /laptop/palmtop/mobile, etc in order to keep the thing to be transmitted ready. Then the transmitting side will work in accordance with the text that is needed to be transferred. The text will be sent to the microcontroller of the transmitter side. The text will be coded in a form to proceed for the further processing. Once the code is ready, it will be transferred to the converter where the text that is in coded form is converted to the light form. Then the data is transferred to the receiver side when it is being placed within the range of the light. From there the coded text is decoded and then sent to the receiver output. And then the output is obtained on the source present on the receiver side. The text data which is optical signal transmitted from the LED falls on the photodiode, it detects the optical signal and detects the flickering led which represents the data in binary code. The data will be sent into the microcontroller of the receiver module. It will be transferred to the converter where the light forms to text form. Then the data gets decoded shows in the display or computer. The recorded voice is coded into the light in the transmission side and it is transmitter in the form of light, it falls on the receiver called photodiode. Here the light is decoded into text.

6.SPEED COMPARISON

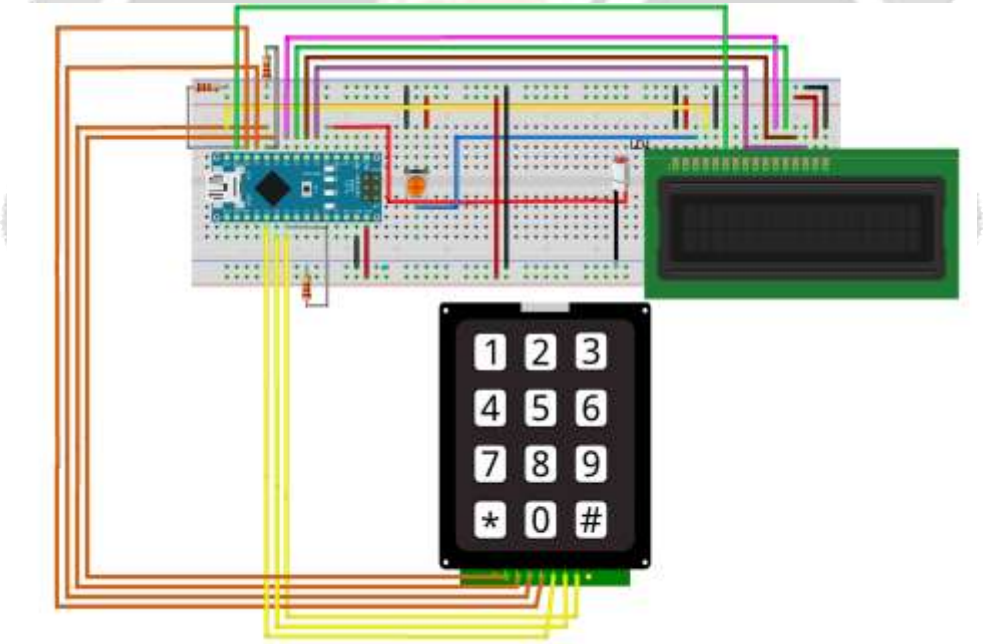
Li-Fi can transmit data at a peak speed of more than 1 Gbps, which is estimated to reach 10 Gbps, due to low interference, exceeding all current RF technologies (Wi-Fi of 150 Mbps, Bluetooth of 3 Mbps, and IrDA of 4 Mbps).

S.No	Technology	Speed
1	Wi-Fi - IEEE 802.11n & ~150Mbps	150Mbps
2	IrDA	1Mbps
3	Bluetooth	3Mbps
4	NFC	124Kbps
5	Li-Fi	1Gbps

7. CIRCUIT DIAGRAMS

7.1 Transmitter

In the transmitter part of Li-Fi communication, the keypad is used as input here. That means we'll be selecting the text to be transmitted using the keypad. Then the information is processed by the control unit which is nothing but Arduino in our case. Arduino converts the information into binary pulses which can be fed to an LED source for transmission. Then these data are fed to LED light which sends the visible light pulses to the receiver side.



7.2 Receiver

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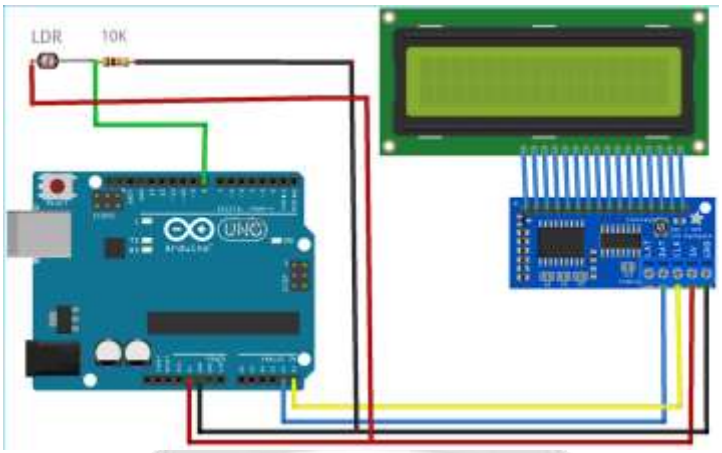
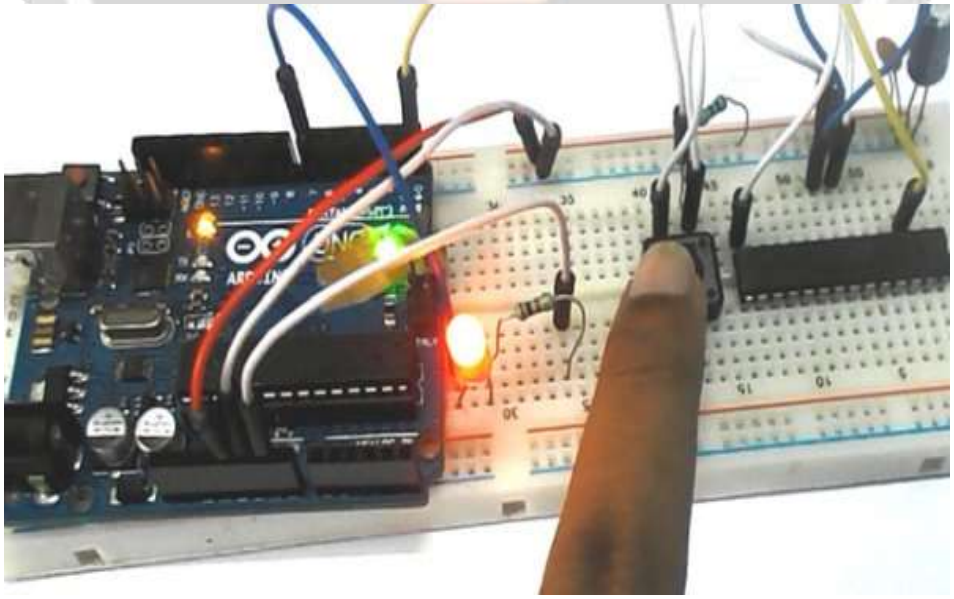


8. INPUTS AND OUTPUTS

In the Transmitter side, Arduino Nano is used with 4x4 Keypad acts as input medium where the user can input with alpha numeric inputs. The output can be made visible with the use of LCD's.

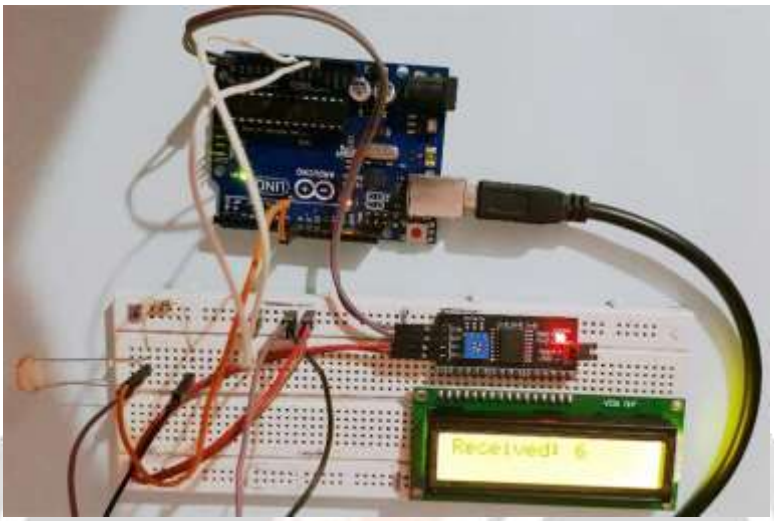
8.2 Input Design

Set up the keypad and initialize various required values for each button in the keypad, then set up the required functions to interact with LCD, LED, keypad and Arduino.Prepare and initialize any values to be displayed in the LCD if required Take input from a keypad. Display on LCD for reference, binary conversion occurs and then transmit to the receiver end via LED.



8.2 Output Design

Receive the flickering light by the photodiode and reverse binary conversion occurs to obtain analog data. Arduino microcontroller is used to process the data obtained then display analog data on LCD as output.



9. FUTURE ENHANCEMENTS

Each of our devices will be connected to the internet, as we move into the Internet of Everything era. Is Wi-Fi up to the task of handling all that internet traffic alone?
The short answer is no. With the ever-growing demand for connectivity, LiFi would be able to combine illumination and wireless data transmission to accelerate the relay of data across the globe. It can be considered as an incredible companion of wifi technology.

10. CONCLUSIONS

By the end of the next decade, Wi-Fi usage will have significantly increased, which could be bad for human health given the high radio frequency exposure. As a result, Li-Fi technology can be utilized as a replacement for Wi-Fi because it increases Wi-data Fi's transmission capabilities while being more safer in big doses. Every light bulb and light tube might be utilized as an internet connection point if this technology were to be developed further and put into use.

11. REFERENCES

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