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LIFI BASED SMART LIBRARY SYSTEM

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Abstract - *Imagine a world where every light could connect you to the internet. Lights that illuminate our offices, homes, cars and our streets also connecting us to data and powering our growing demand for connectivity. A smart library system is designed based on eco-friendly data transmission using LiFi. LiFi is high speed bi-directional networked and communication of data using light. LiFi comprises of multiple light bulbs that form a wireless network, offering a substantially similar user experience to Wi-Fi except using the light spectrum. For data transfer LED (Light emitting diode) has been used in both transmitting and receiving end. From one PC to another PC data can be transferred through light. In early research the light will blink and flash during the time of data transfer that may irritate to the user during the data transfer. Also the upload speed is not getting match with the download speed, so that low data transfer rate will occur. These problems can be overcome in our system like, light will not flash during the time of data transmission, and continuous light emission will transfer the data. Also upload speed is equal to the download speed; through this method data transfer rate will be higher.*

Key Words: **Lifi transmitter, Lifi receiver , proteus simulation, text to speech technology, Lifi application software**

1. INTRODUCTION

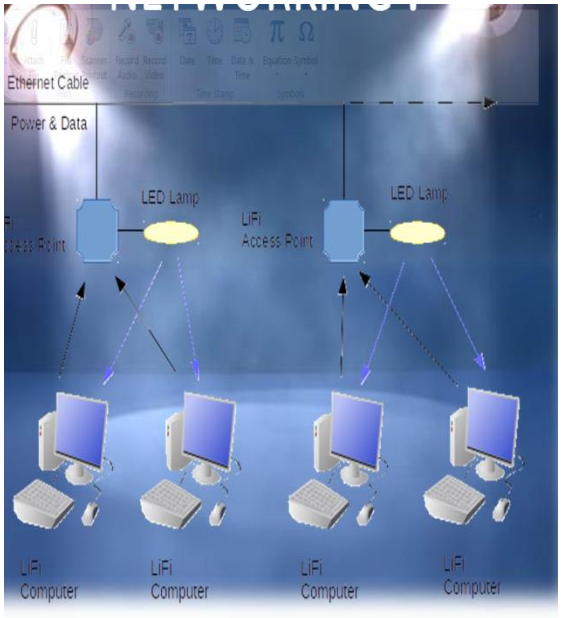
Wireless communication schemes like Wi-Fi especially uses radio/micro wave frequencies for data transmission, primarily because of the possibility of high sensitivity receivers and ability to provide broad coverage at low frequencies and high frequency line of sight communication. But, radio frequency can support only a finite bandwidth due to confined spectrum availability. The idea behind this communication scheme is transmission of 'Data through illumination'. The intensity of the LEDs is varied by alternating the current passed through them at very high speeds. However, the human eye cannot recognize this change and the LEDs appear to have a constant intensity. This ON-OFF activity of LED lights facilitate data transmission using binary codes i.e., when the LED is ON, logical '1' is transmitted and when the LED is OFF, logical '0' is transmitted. In today world communication between the devices are much common. Radio wave spectrum is very small part of spectrum available for communication. But with increase in advanced technology and number of user the network becomes overloaded which results in failure to provide high data rate. Visible light acts as rival to the present wireless radio frequency communication by achieving larger bandwidth and high data rate. Because with larger frequency spectrum it is possible to provide a larger portion of the bandwidth to each user to transfer information.It is desirable to achieve more than 10Gbps speed using this optical wireless technology also known as Li-Fi. The communication is done in direct line of sight manner by deploying transmitter and receiver .The speed of data transmission will reduce or data transmission will stop if line of sight is not used. As only photo receptors are used it is also more securethan other wireless networks , which can receive data within transmitted cone of light signals. LED lights a particularly popular choice, because they can flicker quickly enough to transmit a meaningful amount of data and are widely used for illumination purposes. In this paper, data transmission between two devices is done by using the medium of visible light of electromagnetic spectrum. LIFI is always a greater technology providing greater speeds for communication. In this LIFI image transmission works based on a simple technology. When LED light is ON digital data bit stream of one is transmitted. When LED light turns off, digital bit stream of zero is transmitted. Based on this simple technique data transmission was done with minimum flickering for continuous transmission without any interruption through visible light communication.

2. LITERATURE REVIEW

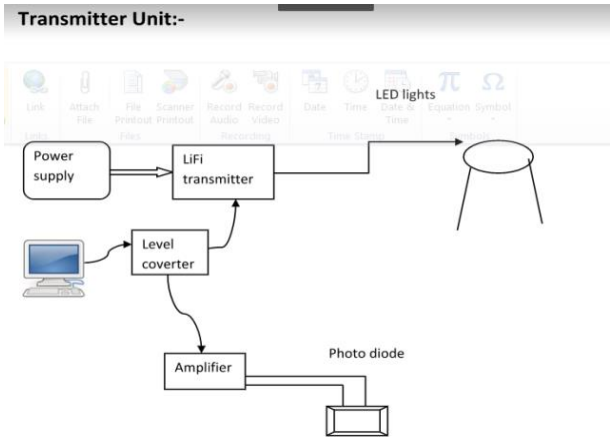
Communication is the process of sharing a message between devices by neither wire nor wireless. To reduce complexity of extending wired communication recently people are using wireless with the help of radio waves. The radio waves are dangerous to use which creates a problem to the user who are using signal frequency as much as possible. Compare to radio waves, light waves are more efficient and the transmission of data requires negligible additional power. Radio technology cannot support in some places, for example transmission of RF spectrum in underground water is not possible but the Li-Fi can propagate through water so it is adaptable for every environment. Radio technology requires more number of components but the Li-Fi technology requires less number of components so Li-Fi has low cost. Li-Fi can break the bandwidth barrier which is suffered by existing wireless systems. Li-Fi uses the light source area of the electromagnetic spectrum 10,000 times more than RF of the electromagnetic spectrum. Li-Fi has the tight illumination, Hence in this more amount of data can be stored. It has capable of 1000 times more than data density than Wi-Fi. Because of tight illumination it does not cause any interference often, so it has low interference. Due to this low interference speed of the Li-Fi technology is more and it

provides high data rates. Light waves are nonhazardous so this technology is safe and health free. Light waves which are transmitted from LED bulbs are not penetrates through wall. So it is difficult to theft data from Li-Fi signals. It eliminates the risk of signal leakage. If the light source is in available condition then there is also the internet is available. Wherever you use lights, there will be an option to connect internet.

3. OVERALL NETWORKING PROCESS:

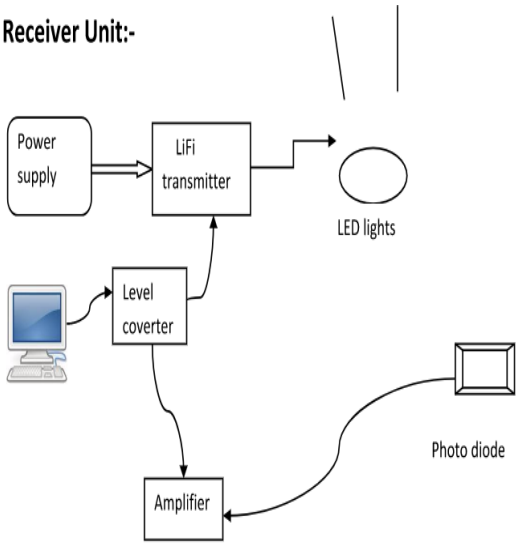


BLOCK DIAGRAM FOR TRANSMITTER:



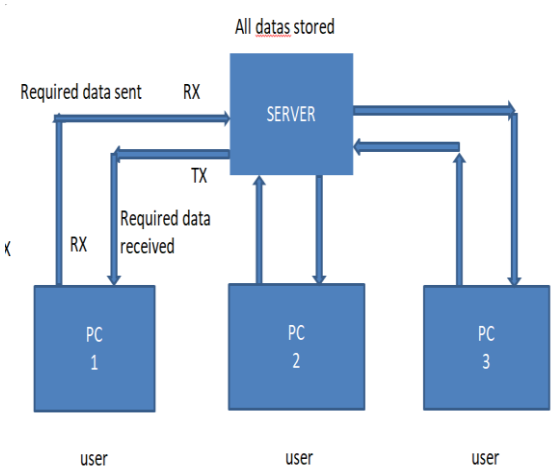
Here the user sends the required data to be fetched to the server by means of lifi transmitter through level converter. The data is then transmitted through an LED lights to the server and the photo diode which is the receiver used to receive the data required by the user by means level converter.

BLOCK DIAGRAM FOR RECEIVER:



The required data sent by the user is received by the server by means of photodiode and level converter. The server reads the data required by the user and then transmits it by means of lifi transmitter to the user by using LED lights.

OVERALL BLOCK DIAGRAM FOR SMART LIBRARY:



In this smart library system, the user sends the required data through LIFI transmitter by means of level converter. On the receiving end, the data is received by means of photodiode and sent to the source where data is to be fetched through level converter. Once the data is fetched, the data is again transmitted from the source to the receiver through LIFI transmitter by means of level converter. The data transmission and receiving process is done by simulation by means of proteus simulation software.

Once the data is received, the user can access various features as,

- A text to speech (TTS) software will convert any kind of text format into speech, is a computer based system

that can read text aloud automatically, regardless of whether the text is introduced by a computer input.

- User can directly access the specified content / page number required , in a book so that time is not wasted.

TEXT TO SPEECH TECHNOLOGY:

A text-to- speech (TTS) system converts normal language text into speech; other systems render symbolic linguistic representations like phonetic transcriptions into speech. A text-to- speech system (or engine) is composed of two parts: a front-end and a back-end. The front-end has two major tasks. First, it converts raw text containing symbols like numbers and abbreviations into the equivalent of written-out words. This process is often called text normalization, pre-processing, or tokenization. The front-end then assigns phonetic transcriptions to each word, and divides and marks the text into prosodic units, like phrases, clauses, and sentences. The process of assigning phonetic transcriptions to words is called text-to-phoneme or grapheme-to- phoneme conversion. Phonetic transcriptions and prosody information together make up the symbolic linguistic representation that is output by the front-end. The back-end—often referred to as the synthesizer—then converts the symbolic linguistic representation into sound. In certain systems, this part includes the computation of the target prosody (pitch contour, phoneme durations), which is then imposed on the output speech. In this paper this technology is implemented.

SIMULATION RESULTS:

PROTEUS SIMULATION :

Proteus (processor for text Easy to use) is a fully functional, procedural programming language created in 1998 by Simone Zanella. Proteus incorporates many functions derived from several other languages: C, BASIC, Assembly, Clipper/dBase; it is especially versatile in dealing with strings, having hundreds of dedicated functions; this makes it one of the richest languages for text manipulation.

Proteus owes its name to a Greek god of the sea (Proteus), who took care of Neptune's crowd and gave responses; he was renowned for being able to transform himself, assuming different shapes. Transforming data from one form to another is the main usage of this language.

Proteus was initially created as a multiplatform (DOS, Windows, Unix) system utility, to manipulate text and binary files and to create CGI scripts. The language was later focused on Windows, by adding hundreds of specialized functions for: network and serial communication, database interrogation, system service creation, console applications, keyboard emulation , ISAPI scripting (for IIS). Most of these additional functions are only available in the Windows flavour of the interpreter, even though a Linux version is still available.

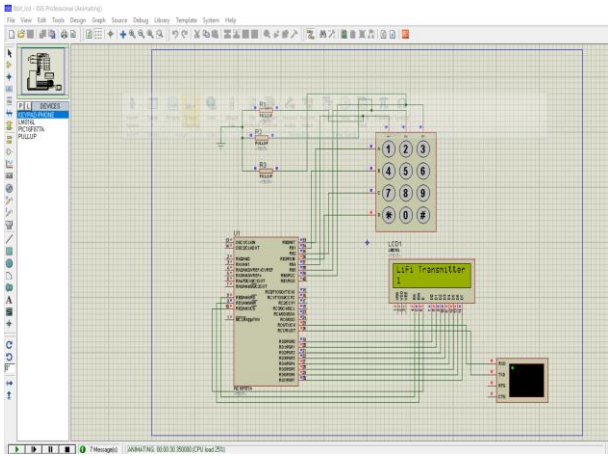
Proteus was designed to be practical (easy to use, efficient, complete), readable and consistent.

Its strongest points are:

- powerful string manipulation;
- comprehensibility of Proteus scripts;
- availability of advanced data structures: arrays, queues (single or double), stacks, bit maps, sets, AVL trees.

The language can be extended by adding user functions written in Proteus or DLLs created in C/C++.

SIMULATION FOR LIFI TRANSMITTER :

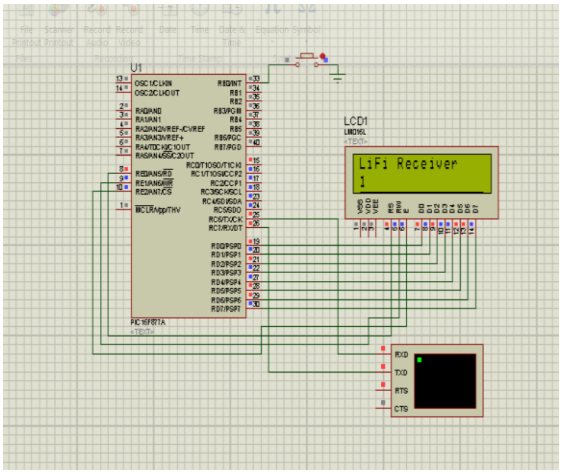


The components used for transmitting data ,

- PIC Microcontroller
- Keypad
- LIFI Transmitter
- Pull-up resistor

The input from the user is given through keypad to the microcontroller and then the microcontroller access the input and the received data from the user is sent to the source through LIFI transmitter. The simulation for data transmission is shown above.

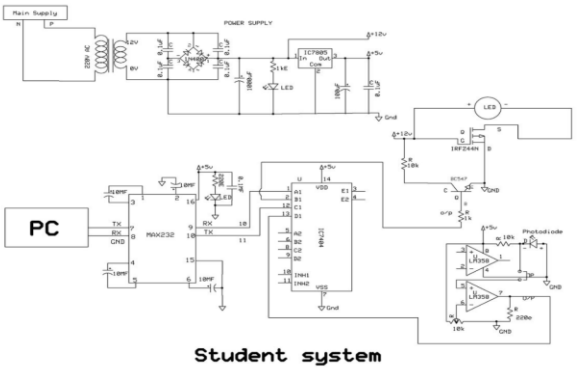
SIMULATION FOR LIFI RECEIVER:



The data which is transmitted from the user through LIFI transmitter is received to the source by means of LIFI receiver. The required data is fetched from the source and again it is sent to the user by the same means of transmitting and receiving process. The simulation for data receiver is shown above.

CIRCUIT DIAGRAM FOR STUDENT SYSTEM:

LIFI TRANSMITTER AND RECEIVER:



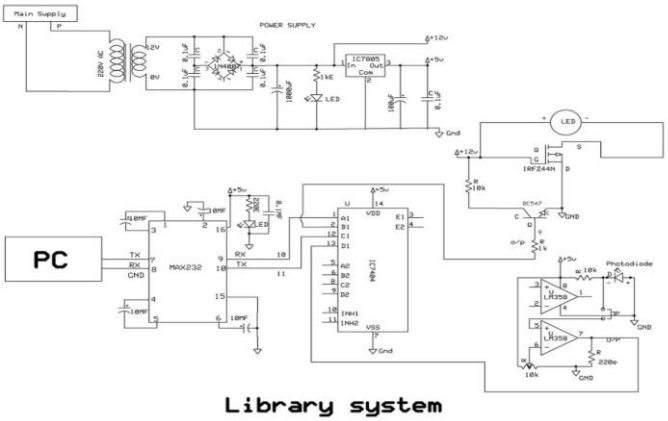
EXPLANATION:

The user sends the required data from the PC to the LIFI transmitter through level converter(MAX232) which serially involves sending a series of digital pulses back and forth between devices at a mutually agreed-upon rate. The sender sends pulses representing the data to be sent at the agreed-upon data rate, and the receiver listens for pulses at that same rate, the MAX232 will continually read the voltage that the sender is putting out, and every 1/9600th of a second, and it will interpret that voltage as a new bit of data. If the voltage is high, it will interpret that bit of data as a 1. If it is low, it will interpret that bit of data as a 0.When a MAX232 IC receives a TTL level to convert, it changes a TTL Logic 0 to between +3 and +15V, and changes TTL Logic 1 to between -3 to -15V, and vice versa for converting from RS232 to TTL. .

By interpreting several bits of data over time, the receiver can get a detailed message from the sender. A relay driver which is useful to switch on and off a light bulb (or anything else) ,this circuit will drive a relay coil from a low power output, usually from a TTL/CMOS. It is used to switch on the led and the data is transmitted.

CIRCUIT DIAGRAM FOR LIBRARY SYSTEM:

LIFI TRANSMITTER AND RECEIVER:

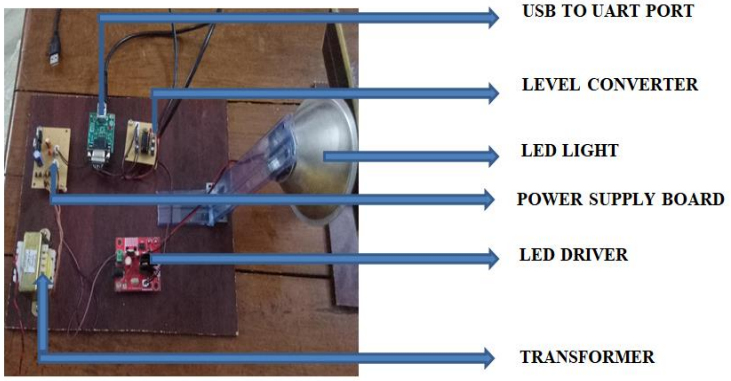


EXPLANATION:

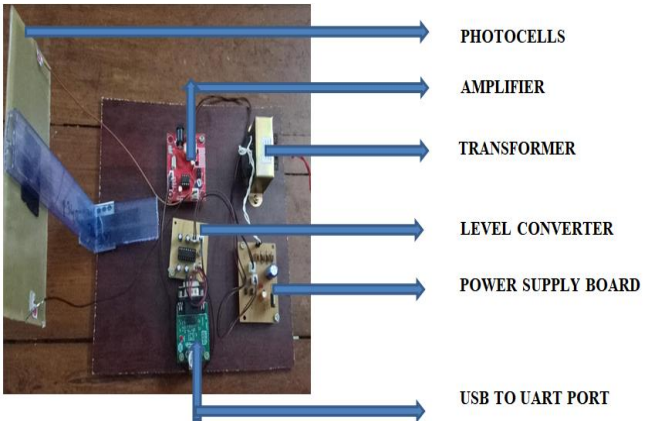
The data sent from the user through led light is received by photodiode where the data in the form light is converted into electric signals (Voltage levels) which is received by MAX232 and convert the logic signals according to the system. Once the data is received ,again it is transmitted back to the user by the same process through LIFI transmitter. In both transmitter and receiver , a high power LED is used for the data transmission , also consume a fraction of power of an incandescent bulb making them extremely energy efficient, and the flickering time is reduced by reducing the delay time which is set and allows continuous data transmission which equals upload speed and download speed.

HARDWARE IMPLEMENTATION:

LIFI TRANSMITTER:



LIFI RECEIVER:



DESIGN OF LIFI LIBRARY APPLICATION:

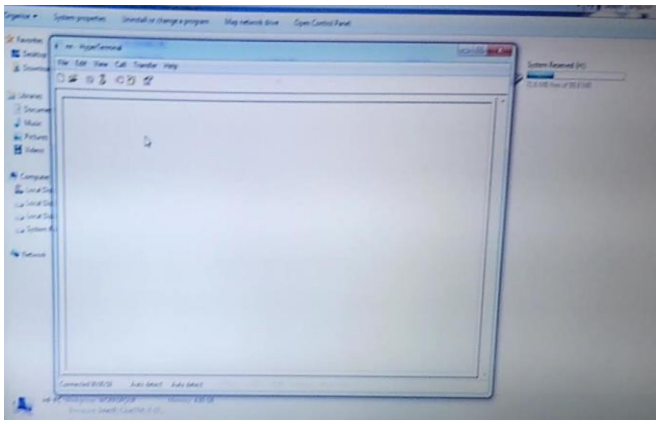
VISUAL STUDIO APP:

This app is created at both the user and library side to create a webpage required by the user and the library system. And a text to speech software is also installed at both the student system and library system for much more easier access.

TEXT TO SPEECH TECHNOLOGY:

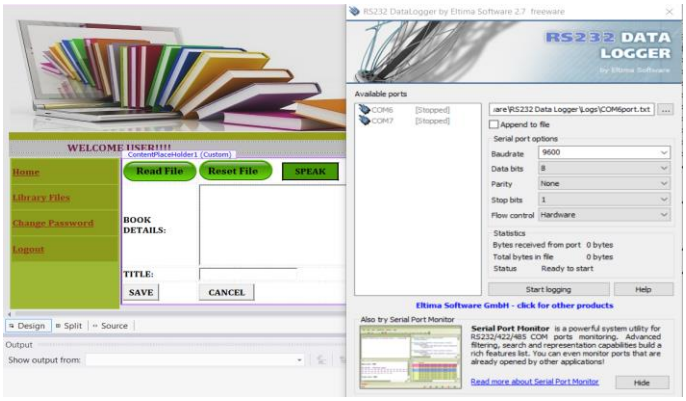
A text-to- speech (TTS) system converts normal language text into speech; other systems render symbolic linguistic representations like phonetic transcriptions into speech. A text-to- speech system (or engine) is composed of two parts: a front-end and a back-end. The front-end has two major tasks. First, it converts raw text containing symbols like numbers and abbreviations into the equivalent of written-out words. This process is often called text normalization, pre-processing, or tokenization. The front-end then assigns phonetic transcriptions to each word, and divides and marks the text into prosodic units, like phrases, clauses, and sentences. The process of assigning phonetic transcriptions to words is called text-to-phoneme or grapheme-to- phoneme conversion. Phonetic transcriptions and prosody information together make up the symbolic linguistic representation that is output by the front-end. The back-end—often referred to as the synthesizer—then converts the symbolic linguistic representation into sound. In certain systems, this part includes the computation of the target prosody (pitch contour, phoneme durations), which is then imposed on the output speech. In this paper this technology is implemented.

STUDENT SYSTEM:



In this student system, a hyper terminal software is installed at user side PC through which the data required by the is user is given as input and it is sent to the library system by means of Lifi transmitter through USB to UART converter. Once the data is received by the user a text to speech technology is implemented where the data can be read by the user.

LIBRARY SYSTEM:



In this library system, a RS 232 Data Logger app is installed at the library side PC to correctly read and fetch the data required by the user in the proper manner. In the same way the data is transmitted from library system to the user by means of LIFI transmitter and LIFI receiver.

CONCLUSION:

This paper describes the characteristics and working of LIFI based data communication system. LED does not cause any health hazards thus this communication through LED is safe

to use. It provides wider range of bandwidth so availability increased anyone can access service, where light source is present. It also provides secure link due to line of sight, no any intruder standing outside the room can hack the data. In this proposed system, the modulation and detection methods used are easy to design and implement. Thus in this smart library system ,the continous data transmission is achieved without any blink and flash that occur during data transfer so that the upload speed equals the download speed to achieve higher data transfer rate and the user is also benefited with the additional features added.

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