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Prototype Model of Li-Fi Technology using Visible Light Communication

Rashmi.T[1], Rajalaxmi.R[2], Mr.Balaji.V.R[3]
[1,2]UG Student, [3]Assistant Professor
Department of ECE, St. Joseph's Institute of Technology
Chennai, INDIA

Abstract: The aim of this project is to provide network availability in the coverage range of lamp. A reading lamp i.e. led, as an access point for visible light communication (VLC). LI-FI is the optical form of WI-FI. The optical signal power distribution over the coverage range has been accomplished using Monte Carlo Ray Tracing Algorithm.

I. INTRODUCTION:

Li-Fi is a wireless optical networking technology that uses light-emitting diodes (LEDs) for data transference. Li-Fi is designed by using LED light bulbs similar to those currently in use in many energy-conscious homes and offices. However, Li-Fi bulbs are equipped with a chip that modulates the light imperceptibly for optical data transmission. Li-Fi data is transfused by the LED bulbs and received by photoreceptors. Li-Fi's early developmental models can accomplish 150 megabits-per-second (Mbps).Some commercial kits enabling that speed have been released. Li-Fi has the influence of being able to be used in electromagnetic sensitive areas as such in nuclear power plant, aircraft cabins and hospitals which may not cause any electromagnetic interference. The pair Wi-Fi and Li-Fi transfuses data over the electromagnetic spectrum, but whereas Wi-Fi employs radio waves, Li-Fi benefits visible light. While the US Federal Communications Commission has warned of a potential spectrum crisis because Wi-Fi is close to full capacity, Li-Fi has almost no bounds on input capacity. The visible light spectrum is 10,000 times more than the entire radio frequency Spectrum Researchers have reached data rates of over 10 Gbps, which is larger than 250 times quicker than superfast broadband.

Fig. 1, Data transmission from LED

Li-Fi is expected to be ten times cheaper and more environmentally friendly than Wi-Fi. In the suggested system, the optical signal distribution over the coverage area has been implemented using Monte Carlo Ray Tracing Algorithm. It diminishes the retardation and also increases the baud rate by using RGB LEDs lamps and ASIC devices. It promotes larger data rate transmission with good quality. The data loss is reduced by the above stated algorithm. The data is broadcasted through serial communication using wireless light medium i.e.VLC.

Fig.2, Overall view of visible light communication

DESIGN OF LI-FI TECHNOLOGY:

The li-fi technology is designed by using the micro-controller i.e. PIC 16F877A micro-controller using embedded c programming. This works on the principle of interfacing the LED and LDR. The optical signal circulation is done by using MONTE CARLO RAY TRACING ALGORITHM. In the transmitter section led is connected whereas in the receiver section LDR is connected. The led supports light energy according to the data sent from the hyper terminal (i.e. via desktop). The LDR attains the light from the led i.e. from transmitter section, it converts light energy into electrical energy. Hence this electrical energy is vitality sent to micro-controller, it provokes the pulse signal in order to display the data transferred from the transmitter section using LCD. In short the micro-controller interfaces all these components specified above. A short list of it as follows:

- PIC (16F877A)
- LCD (for display)
- LDR (for receiver section)
- LED/ LASER DIODE (for transmitter section)

1. PIC (16F877A):

Various micro controllers offer different kinds of memories FLASH, EEPROM, EPROM etc. are some of the memories of which FLASH is the most currently developed. Technology that is used in PIC 16F877A is flash technology, so that data is detected even when the power is switched off. Easy Programming and Erasing are other attributes of PIC16F877A.

2. ADVANTAGES OF USING PIC MICROCONTROLLER:

• The memory used is permanent memory i.e. 256 x 8 BYTES of EEPROM, 368 x 8 BYTES of RAM and 8K x 14 WORDS of FLASH MEMORY.

• It has inbuilt ADC

• Supports the pair of serial communication and parallel communication.

• Provides master clear option (MCLR).

• Facilitate more interpose, frequency, erase and write cycle.

IV. IMPLEMENTATION PROCEDURE:

The project is divided into two major blocks (transmitter and receiver). In the transmitter section the data from the source is fed in to microcontroller with a synchronous clock pulse. The interface is made by using RS232 (serial communication) from source to microcontroller (USART). The PIC micro-controller transfuses the data with the help of Analog to Digital converter. Then it provides the bits of information to LED. In the receiver part the light signal from LED is obtained by LDR. The output of LDR is given to the PIC to reconstruct the data transmitted. The transmitted data is displayed in the LCD. Therefore the data is broadcasted through serial communication using Visible Light Communication (VLC).

1. BLOCK DIAGRAM:

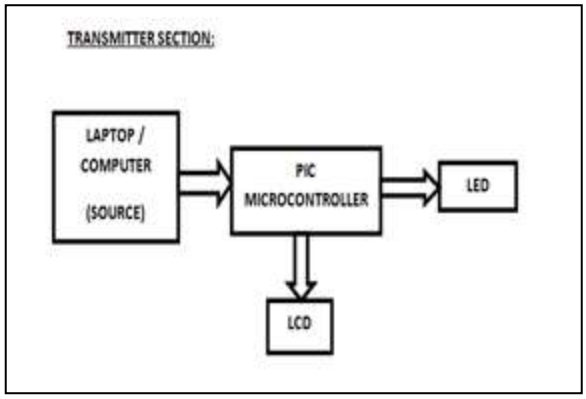

Fig. 3, Transmitter Section

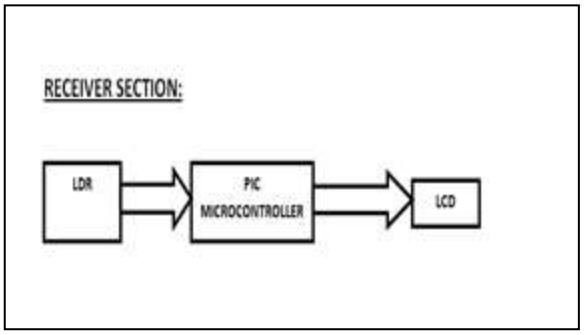

Fig. 4, Receiver Section

V. SOFTWARE IMPLEMENTATION:

The software components for li-fi technology are given below:

1. MP LAB (for programming)
2. PROTEUS (for hardware implementation).

1. MP LAB:

MPLAB® X IDE is a software program that runs on a PC (Windows®, Mac OS®, and Linux®) to develop applications for Microchip microcontrollers and digital signal controllers. It is known as an Integrated Development Environment (IDE), because it provides a single integrated "environment" to develop code for embedded microcontrollers.The following work has been implemented by using MP LAB:

Fig.5, Programming Section for both transmitter and receiver section

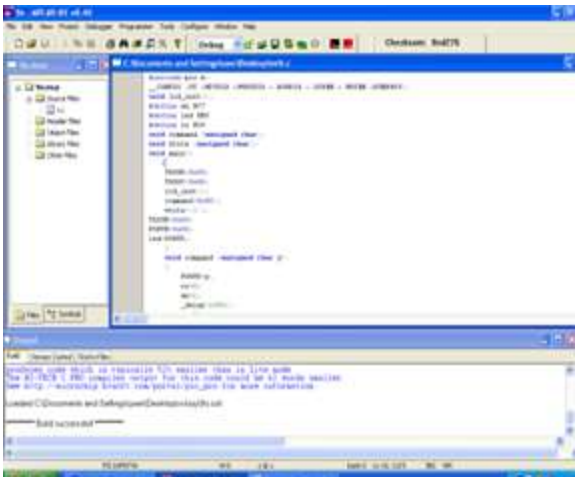

Fig.6, Program Result

2. PROTEUS SOFTWARE:

Proteus is software for printed circuit board (PCB) design, microprocessor simulation and schematic capture. It is developed by Lab center. Proteus is a software technology that allows creating clinical executable decision support guidelines with little effort. The simulation result for transmission section is obtained.

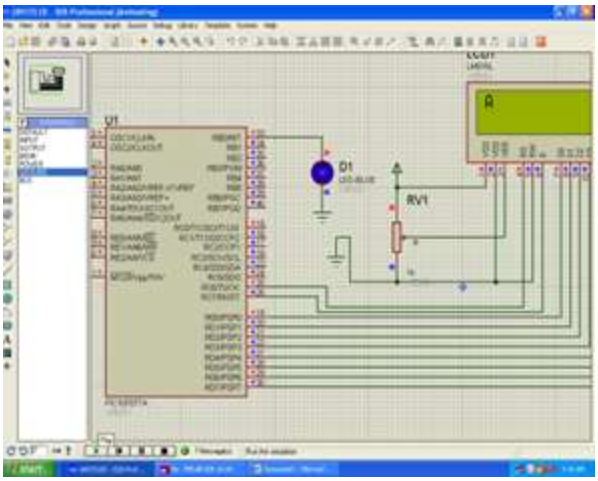

Fig.7, SIMULATION OUTPUT
(FOR SERIAL COMMUNICATION)

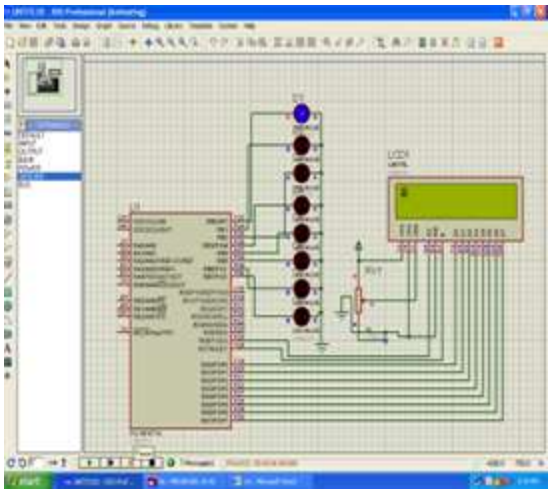

Fig.8, SIMULATION OUTPUT (FOR PARALLEL COMMUNICATION)

VI. APPLICATION:

Li-Fi has the influence of being able to be used in electromagnetic sensitive areas such as

- Aircraft cabins
- Hospitals
- Nuclear power plant without inducing electromagnetic interference.

VII. RESULT OBTAINED:

Fig.9, Transmitter Section

Fig.10, Receiver Section

Fig.11, Data Transmitted via Light medium is displayed in LCD

Fig.12, Data Transformation

Fig.11, Overall View of the Hardware Circuit

VIII. CONCLUSION:

Thus the Data communication has been taken place via Li-Fi technology. The transmitted data is displayed in the LCD. Therefore the data is broadcasted through serial communication using Visible Light Communication (VLC).

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