Eco-Friendly Data Transmission Using Visible Light Communication(Li-Fi)

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ABSTRACT: A Li-Fi is a new wireless technology to provide the connectivity within network environment. Li-Fi stands for light-fidelity and Li-Fi proposed by the German Physicist Herald Haas.Visible Light Communication (VLC) has a promising future and it acts as a complement to the presentRF communication by achieving larger bandwidth and high data rate.It provides transmission of data through illumination by sending data through an LED light bulb that varies in intensity faster than the human eye can follow.It can be produce data rates faster than 10 megabits per second, which can faster your average broadband connection.. Hence, our project presents about ecofriendly data communication through visible light which consists of the white LEDs that transmit data signals to the receiver. The receiver circuit having pc to display the received data.
Keywords-Arduino pro-mini,LM 35,Li-Fi

Transmitter and Receiver,LCD Display.

1. INTRODUCTION

Li-Fi is the term used to label the wireless communication system through an optical source that makes the system fast and cheap. Li-Fi is based upon Visible Light Communication technology where data transmission is made through a light bulb whose intensity varies at a rate faster than the human eye can follow. The fiber out of the fiber optics is replaced by an LED source for the data transmission. The term Li-Fi was introduced by Harald Hass in his TED Global talk on VisibleLight Communication "At the heart of this technology is a new generation of high brightness light-emitting diodes".

Hass says. Hass also included the transmission process as "Very simply, if the LED is on, a digital 1 is transmitted, if it's off 0 is transmitted. They can be switched on and off very quickly, which gives nice opportunities for transmitted data."
The data to be transmitted is first encoded in to the light through varying the rate of flickering that generates different strings of 1's and 0's. Generally the modulation rate of LED is so rapid that the human eye cannot detect the variation and the output is generated continuously.

Li-Fi was mainly designed to overcome the drawbacks of Wi-Fi usage. White LED is expected to replace fluorescent and incandescent lights in future and can be regarded as text generation lighting source.

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LED can support high speed on and off which can help in acquiring high data rate. Since in case of Li-Fi system optical source of light been used as a data transfer medium it can be safely used at the places where radio waves can harm the environment. Hospitals and Aircraft that are prone to the interference made by the radio waves can now make use of LED light as a safe mode of data transmission with no interference of waves. Unlike the Wi-Fi system, Li-Fi can be used in under water environment which increases the scope to be used in military operations.

VLC = Illumination + Communication

**Fig 1 Diagram for Visible light communication**

2. RELATED WORK

- Notable work has been done by WANG Jia-yuan, ZOU and group mates in [1]. In the paper Experimental study on visible light communication based on LED paper they have talked about the data rate of LI-Fi i.e. 111.607 kbps and communication distance i.e. 1.5m. Also it is known that Li-Fi is based on VLC through the paper.

- In 2012, the paper published by Jyoti Rani and teammates was Li-Fi- The future technology in wireless communication [2]. Through this paper it is understood that transmission is done by taking fibre out of fibre optics and data is sent through LED light.

- Raunak and group published the paper Li-Fi technology [4].Due to the low cost nature of LEDs and lighting units, there are many opportunities to exploit from public internet access through street lamps to auto- piloted cars.

- Another paper published in 2014 by was by Vitthal and group by name of Next of Wi-Fi - a future technology in Wireless Networking Li-fi using LED over Internet of Things [6]. Li-Fi idea is same as that of infrared remote controls but is more powerful hence called D-LIGHT.

- In 2015, GagandeepKaurVirk published the paper Li-fi: A New Communication Mechanism [7]. Li-Fi is more secure as light waves cannot penetrate through walls and cannot be intercepted by anyone outside the illumination of LED.

3. EXISTING METHOD

Here they introduce a passive transponder for visible light identification using a solar cell. The solar cell in the transponder receives reader light and generates current for the transponder to respond. The ac component of the solar cell current is used for detecting the interrogating signal from the reader and the dc component is used for supplying electric power to the devices in the transponder.
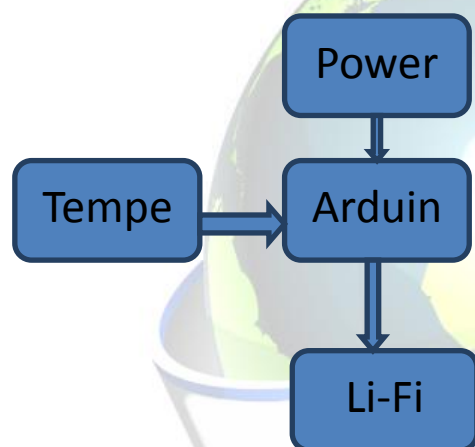
(a) Reader   (b) Transponder
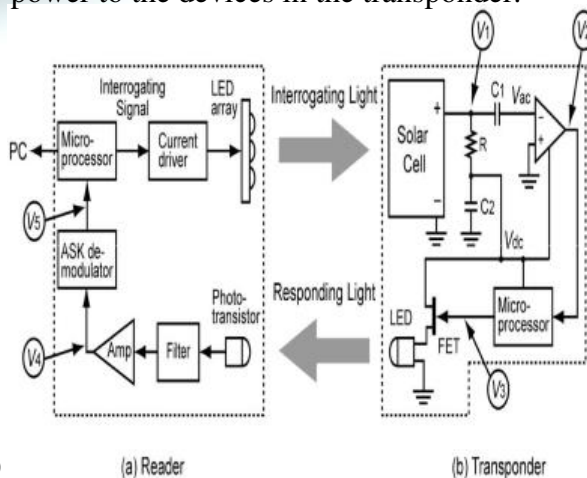
Fig 2 Block diagram for system configuration

In experiments, with the interrogating light from a 3 × 3 visible LED array in the reader, the maximum read distance of the transponder with an 11 cm × 16.5 cm silicon solar cell was 1 m.

4. PROPOSED METHOD

TRANSMITTER SECTION

Fig:3 Block diagram for Transmitter

ARDUINO(Atmega328):

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read-while-write capabilities,1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. [8] discussed about Improved Particle Swarm Optimization. The fuzzy filter based on particle swarm optimization is used to remove the high density image impulse noise, which occur during the transmission, data acquisition and processing. The proposed system has a fuzzy filter which has the parallel fuzzy inference mechanism, fuzzy mean process, and a fuzzy composition process. In particular, by using no-reference Q metric, the particle swarm optimization learning is sufficient to optimize the parameter necessitated by the particle swarm optimization based fuzzy filter, therefore the proposed fuzzy filter can cope with particle situation where the assumption of existence of "ground-truth" reference does not hold. The merging of the particle swarm optimization with the fuzzy filter helps to build an auto tuning mechanism for the fuzzy filter without any prior knowledge regarding the noise and the true image. Thus the reference measures are not need for removing the noise and in restoring the image. The final output image (Restored image) confirm that the fuzzy filter based on particle swarm optimization attain the excellent quality of restored images in term of peak signal-

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to-noise ratio, mean absolute error and mean square error even when the noise rate is above 0.5 and without having any reference measures.

Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

- Cross-platform
- Simple, clear programming environment
- Open source and extensible software

Li-FiTRANSMITTER AND RECEIVER:

Light Fidelity is a high speed wireless communicating device which uses visible light as a medium. LIFI set up comprises a transceiver unit. LIFI data input (i.e. serial data input) is given to the transmitter section by means of a personal computer from which the data is transmitted and gets received in a LIFI receiver. The data which received gets amplified and get by means of TTL output.

Li-Fi Data
FEATURES:

Transmitter Specification

- Power supply: DC +12V

- Data input: UART(TTL)

Receiver Specification

- Power supply: DC +5V

- Data Output: UART (TTL)

TEMPERATURE SENSOR:

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearlyproportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin.

- Operates from 4 V to 30 V
- Less than 60-μA Current Drain
- Low Self-Heating, 0.08 °C in Still Air
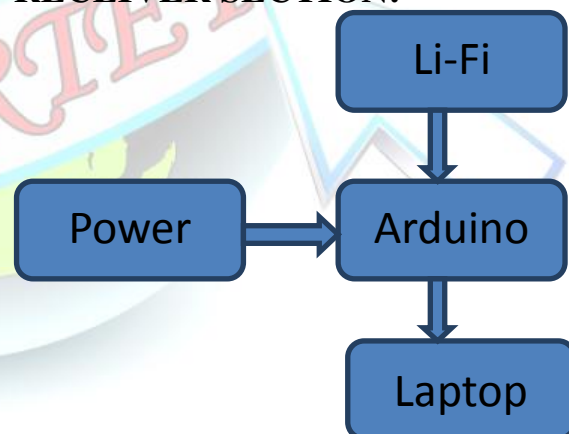
RECEIVER SECTION:

**Fig:4 Block diagram for Receiver**

Li-Fi RECEIVER:

The Arduino IDE has so many functions which help one to interface the four bit LCD module. There are functions to initialize the LCD module and to write character characters in the LCD module and it

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isdisplays it on the LCD module. The functions used in the coding of this projects are lcd.begin(), and lcd.print().

LCD
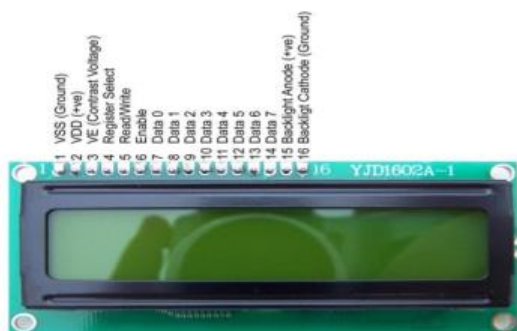
TEMPERATURE SENSOR
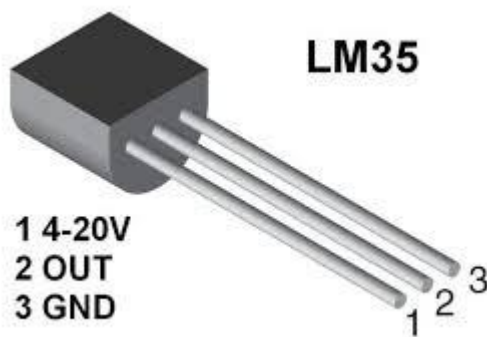
5.APPLICATIONS:

1. Li-Fi wireless communication is High speed, as high as 500mbps or 30GB per minute.
2. Li- Fi uses light rather than radio frequency signals.
3. VLC could be used safely in aircraft.
4. Integrated into medical devices and in hospitals as this technology does not deal with radio waves, so it can easily be used in such places where Bluetooth, infrared, Wi-Fi and internet are banned. In this way, it will be most helpful transferring medium for us.

5. Under water in sea Wi-Fi does not work at where Li-Fi will work.
6. There are around 19 billion bulbs worldwide, they just need to be replaced with LED ones that transmit data. We reckon VLC is at a factor of ten, cheaper than WI-FI.
7. Security is another benefit, he points out, since light does not penetrate through walls.
8. In streets for traffic control. Cars have LED based headlights, LED based backlights, and Car cancommunicate each other and prevent accidents in the way that they exchange Information. Traffic light can communicate to the car and so on.
9. By implementing the Technology worldwide every street lamp would be a free access point.
10. Li-Fi may solve issues such as the shortage of radio frequency bandwidth.

Fig:5Data Transmission using LED Data Streams

6.CHALLENGES WITH LI-FI:

Still there are some backdrops like it can only transmit when in the line of sight well it can besorted out someday. I hope.

"There has been a lot of early hype, and there are some very good applications".

7.CONCLUSION:

Data communication through visible light consists of the white LEDs that transmit data signals to the receiver has been implemented. The receiver circuit consists of laptop to display the received data. Thus a transmission distance of 25 feet in dark room and15 feet in bright room has been achieved using Visible Light Communication. In future, data for laptops, smart phones & tablets can be transmitted through light in room by using Li-Fi. Researchers are developing micron sized LED which are able to flicker on & off around 1000 times quicker than larger LED.We can be sure that the future for Li-Fi is bright.

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