<table>
<tr><td colspan="2">FORM 1
THE PATENTS ACT, 1970
(39 of 1970)
&
THE PATENTS RULES, 2003
APPLICATION FOR GRANT OF PATENT
[See sections 7,54 & 135 and rule 20(1)]</td><td>(FOR OFFICE USE ONLY)

Application No.: ....
Filing Date: ....
Amount of Fee Paid: ....
CBR No.: ....
Signature: ....</td></tr>
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1. APPLICANT(S):

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(a) Date: -----

(b) Signature(s) of the inventor(s): ....

(c) Name(s): Dr. N. MYTHILI,M. G. AYYAPPA SRINIVASAN,Dr. B. UMA MAHESWARI,G. MANIMALA,Dr. S. VIJAYANAND,K. SRINIVASAN,Dr. T. PONNARASI,S. GAYATHRI,Dr. S. SUBBURAM,Dr. JEN JACOB

(ii) Declaration by the applicant(s) in the convention country

I/We, the applicant(s) in the convention country declare that the applicant(s) herein is/are my/our assignee or legal representative.

(a) Date: -----

(b) Signature(s) : ....

(c) Name(s) of the singnatory: Dr. N. MYTHILI,M. G. AYYAPPA SRINIVASAN,Dr. B. UMA MAHESWARI,G. MANIMALA,Dr. S. VIJAYANAND,K. SRINIVASAN,Dr. T. PONNARASI,S. GAYATHRI,Dr. S. SUBBURAM,Dr. JEN JACOB

(iii) Declaration by the applicant(s)

- **The Complete specification relationg to the invention is filed with this application.**
- **I am/We are, in the possession of the above mentioned invention.**
- **There is no lawful ground of objection to the grant of the Patent to me/us.**

10. FOLLOWING ARE THE ATTACHMENTS WITH THE APPLICATION:

Sr.	Document Description	FileName
1	REQUEST FOR EARLY PUBLICATION(FORM-9)	form 9.pdf
2	FORM 1	signed form 1.pdf
3	COMPLETE SPECIFICATION	complete specification.pdf
4	DRAWINGS	drawings.pdf
5	STATEMENT OF UNDERTAKING (FORM 3)	form 3.pdf
6	POWER OF AUTHORITY	signed poa.pdf
7	DECLARATION OF INVENTORSHIP (FORM 5)	form 5.pdf

I/We hereby declare that to the best of my/our knowledge, information and belief the fact and matters stated hering are correct and I/We request that a patent may be granted to me/us for the said invention.

Dated this(Final Payment Date): ------------

Signature: ....

Name: SHRI. SENTHIL KUMAR .B.

To The Controller of Patents

The Patent office at CHENNAI
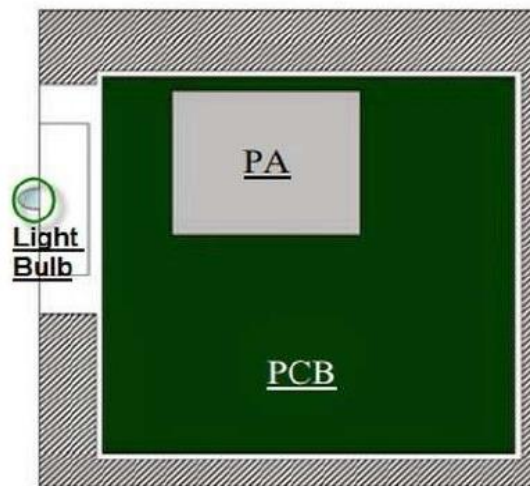
Dr. N. MYTHILI, M. G. AYYAPPA SRINIVASAN, Dr. B. UMA MAHESWARI, G. MANIMALA, Dr. S. VIJAYANAND, K. SRINIVASAN, Dr. T. PONNARASI, S. GAYATHRI, Dr. S. SUBBURAM & Dr. JEN JACOB
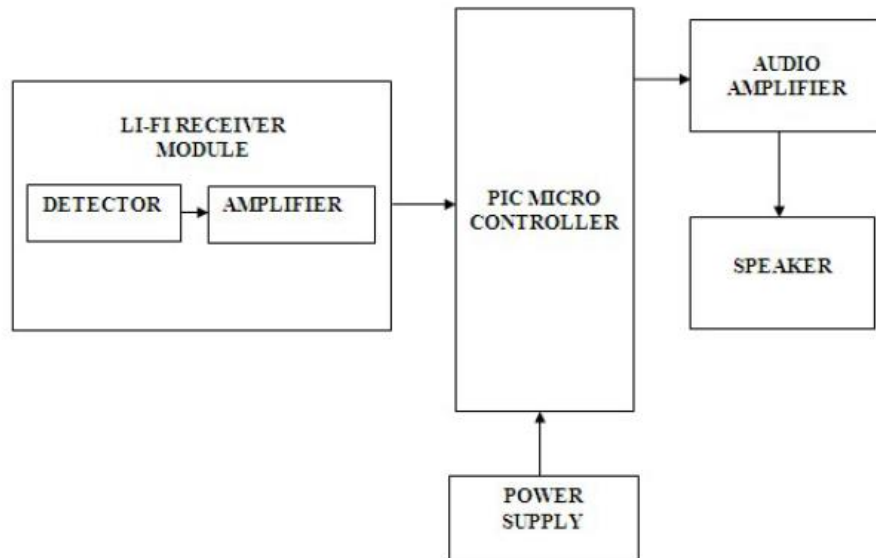
Fig 1 : Elements of Li-Fi Technology

Dr. N. MYTHILI, M. G. AYYAPPA SRINIVASAN, Dr. B. UMA MAHESWARI, G. MANIMALA, Dr. S. VIJAYANAND, K. SRINIVASAN, Dr. T. PONNARASI, S. GAYATHRI, Dr. S. SUBBURAM & Dr. JEN JACOB
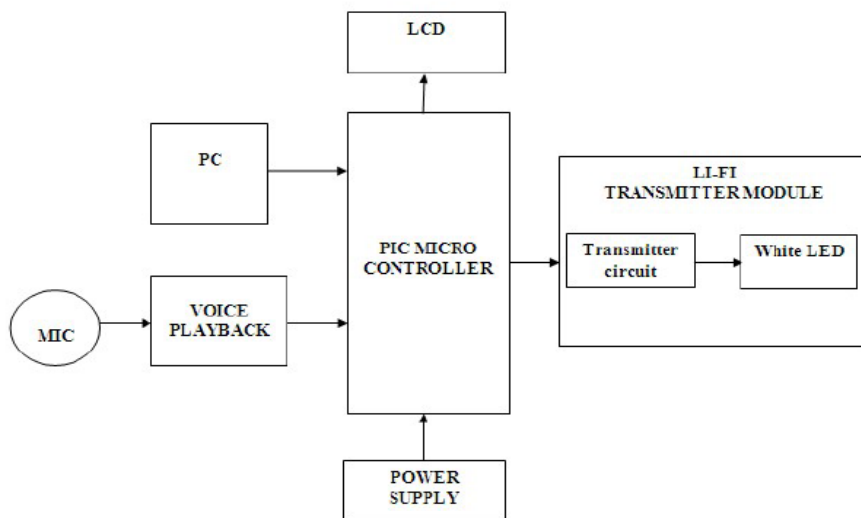
Fig 2 :Block Diagram of Li-Fi Transmitter

Fig 3 : Block Diagram of Li-Fi Receiver

Dr. N. MYTHILI, M. G. AYYAPPA SRINIVASAN, Dr. B. UMA MAHESWARI, G. MANIMALA, Dr. S. VIJAYANAND, K. SRINIVASAN, Dr. T. PONNARASI, S. GAYATHRI, Dr. S. SUBBURAM & Dr. JEN JACOB

Fig 4 : Li-Fi Transmitter and Receiver Module

Dated on 20th November 2020

Senthil Kumar B
Agent for the applicant
IN/PA-1549

FORM 2

THE PATENTS ACT, 1970
(39 of 1970)
&
THE PATENT RULES, 2003

Complete Specification

(See section 10 and rule 13)

1.Title of the Invention :   LI-FI BASED STEREO AUDIO STREAMING TECHNOLOGY

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3. Preamble to the Description :

The following specification particularly describes the invention and the manner in which it is to be performed.

4. DESCRIPTION

Field of the Invention

The present invention is related to the field of electronics and communication.

5 **Background of the invention**

Light fidelity (Li-Fi) is a bidirectional, high speed and fully networked wireless communication technology. It is a form of visible light communication (VLC) and a subset of optical wireless communication (OWC) and could be a complement to RF communication or even a

10 replacement in contexts of data broadcasting.

Li-Fi is a high speed, wireless communication using visible light. It falls under the category of optical wireless communications. Data transmission takes place through LED bulbs whose intensity varies. Based on this variation, communication occurs digitally. The word Li-

15 Fi was first coined by Harald Haas at the University of Edinburgh. This technology has vast applications where the use of Wi-Fi is limited or banned. It also takes out the adverse health effects of using

electromagnetic waves. Unless light is seen, data can't be hacked and so data transmission is secure. Data transmission is typically in terms of Giga bytes per second. Communication is one of the integral parts of anybody's life for exchanging information on devices in wired or wireless networks. With the introduction of new mobile devices, wireless communications have become the basic necessity of our lives.

Detailed Description of the invention

In the prototype, if the LED is ON, the digital data 1 will be transmitted. If it is OFF, 0 will be transmitted. The main advantage on using LED is that, LED's can be turned ON and OFF very quietly, which is used for conveying data easily. The encoding of data should be in such a way that the LED's blink accordingly. The LED light is being modulated with the data signals based on the LED radiance that can be used as a communication medium. The LED's flickering rate is faster, that it appears continuous to the human eye. Data rates greater than 100 Mbps is possible using high speed LED's.

This method of using rapid pulse of light to transmit information wirelessly is technically referred to as visual light communication (VLC). The term Li-Fi has been inspired due to its potential to compete with conventional Wi-Fi. The VLC uses visible light between 400 THz
5 (780nm) and 800 THz (375 nm) as the optical carrier for data transmission and for illumination. Data rates greater than 100 Mbps can be achieved by using high speed LEDs with adequate multiplexing. Parallel data transmission using arrays of LEDs where each LED transmits a separate stream of data can be used to increase
10 the VLC data rate. Though the lights have to be kept in order to transmit data, they can be dimmed to the point that they are not visible to humans but still be capable of transmitting data. The problems faced by the existing Wi-Fi system are based on the capacity, existence, availability and security. To overcome these
15 issues Wi-Fi hotspots are being replaced by new LEDs which would transmit data at much higher rate.

Li-Fi system uses the modulation schemes such as On-Off Keying (OOK), Variable Pulse Position Modulation (VPPM), Color Shift Keying

(CSK), Sub Carriers Inverse PPM (SCI-PPM), Frequency Shift Keying (FSK), and Sub Carrier Index Modulation OFSM (SCI-OFSM).

The general term VLC includes any use of the visible light portion of the electromagnetic spectrum to transmit information. Main component of the Li-Fi technology: LED: At the sending side controller that code the data into LEDs. All one has to do is to vary the rate at which LED is flickering depending on the data one wants to encode. The rate of flickering is very high so that human eye cannot distinguish it.

In this invention we are using an array of LED for parallel data transmission or using mixtures of the red, green, blue LED's to alter the light's frequency with each frequency encoding of different data channel.

Silicon Photodiode: At the receiver side photodiode is used, it shows good response to the visible wavelength region. For accepting the fluctuating light nothing but different string of coded data, LED on means binary "1" and LED off means binary "0".

The Li-Fi emitter system consists of 4 primary sub assemblies: a) Bulb b) RF power amplifier circuit (PA) c) Printed circuit board (PCB) d) Enclosure.

In the Transmitter section, the input audio signal is given to the MIC and it is then given as the input to the voice playback. The mobile input together with the voice playback is given to the pic microcontroller. The pic controller drives the LCD to display the initialization and transmission notification. The DC power is given to the pic controller through the power supply. Then the controller is given to the Li-Fi transmitter module. The Li-Fi transmitter module comprises of a transmitter circuit and a white LED. Based on the intensity of the light from LED, transmission of audio takes place.

In the receiver section, the transmitted audio is given to the Li-Fi receiver module. It comprises of a detector and an amplifier. The detector senses the data based upon the intensity of LED light and the amplifier eliminates the noise that is transmitted along with the audio signal. Then it is again given to pic microcontroller and then the

output is amplified using audio amplifier and speaker is used to recover the audio output.

In the prototype, if the LED is ON, the digital data 1 will be transmitted. If it is OFF, 0 will be transmitted. The main advantage on using LED is that, LED's can be turned ON and OFF very quietly, which is used for conveying data easily. The encoding of data should be in such a way that the LED's blink accordingly. The LED light is being modulated with the data signals based on the LED radiance that can be used as a communication medium. The LED's flickering rate is faster, that it appears continuous to the human eye. Data rates greater than 100 Mbps is possible using high speed LED's.

RESULT AND PERFORMANCE ANALYSIS

The proposed system is fully based on the intensity of light from LED. It acquires an accuracy of 80%. It sends 10 to 50 times of data compared to Wi-Fi, and the LED even boost as high as 100 times. According to our sources, the LED empowered communication transferred data at a speed of 1 Gbps, as against Wi-Fi's average

speed of 3.4 Mbps. Using intensity modulations, Li-Fi has even achieved data transfer rate of 4 Gbps.

CONCLUSION

The audio transmission takes place from mobile phone to loud speaker in the proposed system through VLC. In the near future internet data communication will be changed from radio wave spectrum to visible light spectrum. Li-Fi technology will replace Wi-Fi technology markets as a result of data rate, data security and free spectrum of unlimited band width and the power consumption.

Description of Drawings

Fig 1 : Elements of Li-Fi Technology

Fig 2 :Block Diagram of Li-Fi Transmitter

Fig 3 : Block Diagram of Li-Fi Receiver

Fig 4 : Li-Fi Transmitter and Receiver Module

CLAIMS

We Claim :

1. A Li-Fi based stereo audio streaming system comprising:

    a transmitter subsystem that includes a Mic, PC, Voice playback device, PIC Microcontroller, LCD, and Li-Fi Transmitter module, wherein said transmitter module includes a Transmitter circuit and LED;

    a receiver subsystem that includes a PIC Microcontroller, Audio Amplifier, Speaker, power supply and Li-Fi receiver module, wherein ,the Li-fi receiver module includes a Detector and an amplifier.

2. The Li-Fi based stereo audio streaming system, as claimed in claim 1, wherein, the transmitter module includes an array of LED for parallel data transmission using combinations of red, green and blue LEDs to alter the light's frequency, wherein each frequency encodes a different data channel.

3. The Li-Fi based stereo audio streaming system, as claimed in claim 1, wherein the transmitter subsystem includes a Li-fi emitter system consisting of Bulb, RF power amplifier circuit, Printed circuit board and an enclosure.

4. The Li-Fi based stereo audio streaming system comprising, as claimed in claim 2, wherein, photodiode is used in the receiver module.

5. The The Li-Fi based stereo audio streaming system, as claimed in claim 2, wherein the transmitted audio is passed to the Li-fi receiver and the detector senses the data based on the intensity of the LED light and the amplifier eliminates the noise transmitted along with the audio signal and forwards it to PIC microcontroller, and the output from the microcontroller is amplified by the audio amplifier and passed to the speaker to obtain the audio output.

ABSTRACT

LI-FI BASED STEREO AUDIO STREAMING TECHNOLOGY

5   The present invention is based on Visible Light Communication (VLC) which is emerging as a next generation data transmission method for short-range communication applications. This invention implements and characterizes two prototype stereo audio streaming methods utilizing VLC. Software architecture is developed to process and

10   stream data. The software architecture is bridged with a hardware section, which facilitates free-space VLC channel, over a Universal Serial Bus (USB) to serial interface. A particularly attractive feature is that it uses commonly available, low-cost components which enable its implementation in everyday applications. The prototype includes

15   transmitter and receiver unit. The transmitter unit consists of voice playback with a pc input from which the voice is transmitted via lift transmitter and the voice gets received in a lift receiver and amplified in voice amplifier.