ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 6, June 2017

Indoor Navigation System to the Visually Impaired People using Visible Light Communication Technology

Marita R. Miranda

P.G. Student, Dept. of Electronics & Communication Engineering, NMAMIT, Nitte, Udupi, Karnataka, India

ABSTRACT: Indoor navigation is opportune for everyone, and it is particularlya requisite for the visually impaired. The paper proposes an indoor navigation system for the Visually Impaired to attain audio output through Visible Light Communications (VLC).The transmission of data occurs after identifying the person who has entered the room and the technology Light Fidelity (Li-Fi) is used for presenting information to the user. Li-Fi technology is used by the proposed system for the wider range of transmission of data. The usage of visible light for transmitting the data encompasses a wide variety of advantages and eliminates most problems of communication caused by the electromagnetic waves outside the visible spectrum.Li-Fi is an evolving branch of Optical Wireless Communication and can be beneficial in coming years for indoor communication because it can afford higher data rate transmission along with the capability to utilize additional users since it uses a broader spectrum bandwidth.

KEYWORDS: Light Fidelity; Visible Light Communication; Light Emitting Diode

I. INTRODUCTION

Visible Light Communication has been broadly studied as a promising technology, predominantly in the indoor environments. The systems for navigation using Global Positioning System (GPS) fail to proficiently obtain GPSsignals in indoor areas and are unable of distinguishing between several floors in a multi storeyed edifices.VLC is an optical wireless communication technology for shorter range which is used for both illumination and datacommunication. Excellent features such as larger bandwidth, robustness to electromagnetic interference, security andlow cost are offered by the VLC systems [1]. These systems have the shortcomings of multipath distortion due todiffusion of the optical signal produced by reflections from different sources inside a room.

II. RELATED WORK

The visible light communication built on LEDs is an innovative emerging technique in the field of optical wireless communication.Substantial research and effort is being made,concerning the development of Li-Fi based indoor system. One of the most important step towards standardization was made with the establishment of the Visible Light Communications Consortium, a group of mostly Japanese based companies that agreed on sharing information towards the development of this new technology. For an indoor system the LED is affirmed as most power effective illuminating device for upcomingindoor lighting system [3]. In [4] researchers examine how the distance between LEDs canalter the performance of indoor communication system. The effect of multipath reflections on two-dimensional indoor positioning is studied in [5]. In this paper an indoor navigation system using Li-Fi Technologyis proposed for the Visually Impairedto attain audio output thus helping in indoor location estimation.

III. METHODOLOGY

Li-Fi technology is based on LEDs for the transfer of data. The block diagrams for the Li-Fi transmitter section and receiver section are shown in the Fig. 1. And Fig. 2 respectively. Li-Fi Technology operates by sending the data over

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 6, June 2017

light. In order to generate light signals LED (Light Emitting Diode) light bulbs, can be flashed on and off speedily. A Light Receiver is used for receiving the LED signals. The intensity of light can be employed to send data by the minute changes in amplitude. The technology focuses on light bulb being flickered up to billions of times a second and the particular phenomenon is unnoticeable to the human eye. If the LED is ON, a digital string of 1 is transmitted, if it's OFF then a string of 0 is transmitted. It can be switched ON and OFF very rapidly.

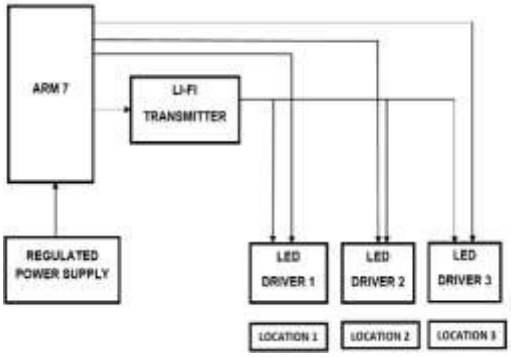

Fig.1. Block diagramof Li-Fi transmitter circuit

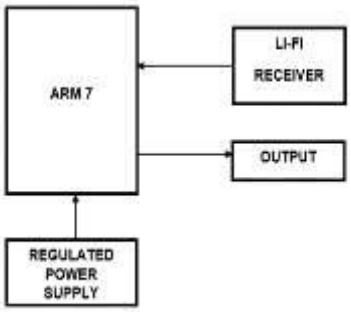

Fig.2.Blockdiagram ofLi-Fireceiver circuit

IV. SYSTEM IMPLEMENTATION

The input data from Personal Computer (PC), is first encoded into a series of electrical pulse signals by microcontroller unit through the interface circuit. Here the serial communication is employed for the transmission of the data along the circuit. Then, the electrical signals drive LED source directly through a LED driver circuit, with which electronic to optical conversion is achieved. Because of the high speed characteristic of LEDs, people cannot perceive the twinkling phenomena and hence the lighting and information transmission cannot be realized. The generated optical signals carrying original information then delivered into the indoor wireless channel. A system model by means of LED lights based on Visible Light Communication is shown in Fig. 3.

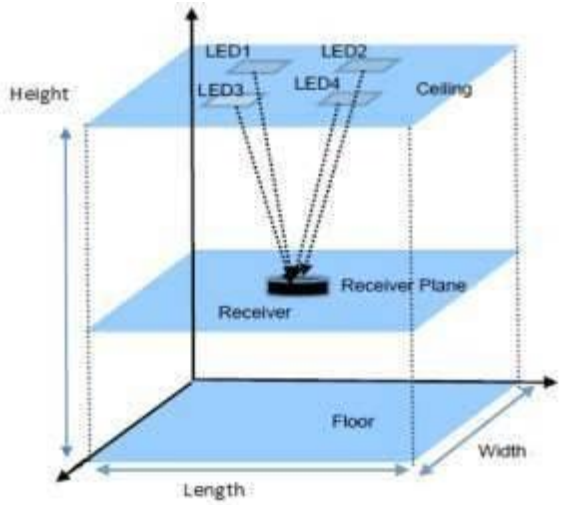

Fig.3.System modelbasedonVisibleLight Communication[6].

At the receiver, photodiode will identify the optical signal and perform the optical to electrical conversion. The weak electrical signals that are identified are provided to a preamplifier for signal amplification. The output data from receive circuit will be decoded into primary signal. A constant voltage is provided by the voltage regulator to the level

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 6, June 2017

converter by maintaining constant DC voltages and eluding undesirable spikes in current. The electrical data from the computer is converted into optical information using LEDs and transmitted through light, the optical information is taken by the receiver, converted into electrical data by the photodiode and sent it to processor for the required application [8].

A. Transmitter Section

The transmitters used in VLC are used in inside areas to provide illumination. The transmitter part comprises of the data input which is provided to a switching circuit. Based on the data, the switching circuit creates a string of 1s and 0s thereby encoding the data in binary. The arrangement of LEDs turn OFF and ON at extremely high speeds because of the output obtained from the switching circuit. This ON OFF modulation of the LED light transfers the data. LED is the optimal for light source because it consumes very low power when compared with the fluorescent lamp or a light bulb. LEDs switch faster with good perceptibility.

B. Receiver Section

The receiver involves of an optical section to perceive and confine the radiation onto the receiver photo detector. The photodiode converts visible light into an electrical signal biased the photodiode operates in the photoconductive mode generating a current proportional to the light that is received. The current obtained is of a smaller value and a preamplifier converts it into a voltage. The final voltage signal should resemble to the received light pulses which are then demodulated, to obtain the digital data [9]. The data is further processed by the microcontroller LPC 2129 and given to the voice playback circuit. This circuit will help the visually impaired user in indoor navigation by providing an audio output. Fig. 4 shows the overall system implementation for the Li-Fi transmitter and receiver circuit.

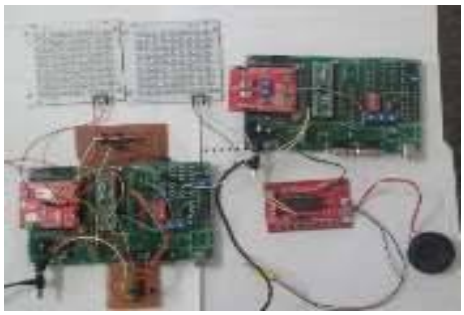

Fig.4. Overall system implementation for theLi-Fi transmitter and receivercircuit

V. EXPERIMENTAL RESULTS

Figures shows the results for the implementation of the indoor navigation system using Li-Fi system. Figs. 5 (a) shows the serial communication performed by using Philips Flash utility by loading the code into the microcontroller LPC 2129. (b) shows the implementation of the transmitter circuitry. (c) shows the light detection at the receiver end by the photodetector.

(a) (b) (c)

Fig.5Implementationoftheindoornavigationsystemusing Li-Fisystem(a)PhilipsFlashUtility(b)TransmitterCircuitWorking(c)Photo detectionatthe receiver.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 6, June 2017

A baud rate of 38400 is achieved during the transmission of the data. The location message is successfully transmitted over the LED's that is received by the receiver to provide audio message to the user thus helping in indoor navigation.

VI. CONCLUSION

The advent of larger shopping malls and complexes, has led indoor navigation to become the need of the hour. In spite of its limitations, the proposed design with further alterations is industry ready, and has the potential to become a commercially practicable and economic means for indoor navigation. VLC using LEDs would be promising technology for ubiquitous communication. The idea of Li-Fi is attracting abundant deal of attention because it can provide an unpretentious and efficient alternative to wireless technology that is radio based. VLC system can turn out to be one of the most inspiring technologies for the forthcoming generations in optical wireless communication. The proposed navigation system helps the Visually Impaired people by indicating with a voice message whenever a person enters the room.

REFERENCES

1. Madoka Nakajima, Shinichiro Haruyama, "New Indoor Navigation System for visually impaired people using Visible LightCommunication", Springer, pp. 1-10, 2013.
2. X Liu, H Makino, K Mase, "Indoor Location Estimation Using Visible Light Communication: practicality and expandability",International conference on Indoor Positioning and Indoor Navigation, pp.407-408, 2013.
3. Y. Zhao and J. Vongkulbhisal, "Design of Visible Light Communication Receiver for On-Off Keying Modulation by Adaptive Minimum-Voltage Cancelation," Engineering Journal. vol.17, October 2013.
4. Ye-Sheng Kuo, Pat Panutto, Ko-Jen Hsiao, Prabal Dutta "Indoor Positioning with Mobile Phones and Visible Light", InternationalConference on Mobile Computing and Networking, pp. 231-237, 2014.
5. M. Shahin Uddin, J. Sang Cha, J. Young Kim and Y. Min Jang "Mitigation Technique for Receiver Performance Variation of Multi-Color Channels in Visible Light Communication," Sensors Journal. vol. 11, pp. 6131-6144, June 2011.
6. Hongfei Lu, Zhen Su and Bing Yuan, "SNR and Optical Power Distribution in an Indoor Visible Light Communication Systems",Proceedings of the 7th International Conference on Image and Signal Processing, pp. 1063-1067, 2014.
7. L Hung-Huan, Y Yu-Non, "Wi-Fi based Indoor Positioning for Multi-floor Environment", TENCON 2011, IEEE Region 10 ConferenceBali, Indonesia, pp. 597–601, 21-24 November 2011.
8. N. Kim, C. Jing, Biao Zhou and Y. Kim, "Smart Parking Information System Exploiting Visible Light Communication," InternationalJournal of Smart Home. vol.8, pp. 251-260, 2014.
9. Toshiya Tanaka, Shinichiro Haruyama, "New Position Detection Method Using Image Sensor and Visible Light LED's", ICMV, pp.150-153, 2009.
10. "NXP LPC2129", http://www.datasheetdir.com/LPC2129+ARM
11. N. Kumar and N. R. Lourenco, "LED based Visible Light Communication System: A Brief Survey and Investigation", Journal ofEngineering and Applied Science, Vol. 5, No. 4, pp. 296–307, 2010.
12. M. M. S. Rahman, M. M. Haque, and K. Kim, "Indoor Positioning by LED Visible Light Communication and Image Sensors" International Journal of Electrical and Computer Engineering (IJECE), pp. 330-333, 2011.