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ANINNOVATIVE APPLICATION OF VISIBLE LIGHT COMMUNICATIONIN MOBILES

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ABSTRACT

Now a days Visible Light Communication (VLC) is seen as promising technology; which is faster, safer and cheaper than other forms of communication technology. VLC transmits data at high speed with parallel data transmission by using high speed switching LEDs. It is promising and progressive alternate technology for existing wired and wireless communication technologies. This paper explains the application of Visible Light communication to the data transmission at cheaper and more energy efficient by using LEDs in mobile flash light. In this paper, the authors tried to explain not only about VLC and its applications related to data transmission in mobiles i.e. Mobile Visible Light Communication (MVLC) but also discussed the architecture of MVLC and itsprospectives and challenges of MVLC.

INTRODUCTION

The Visible Light Communication (VLC) is a fast-growing technology to provide data communication using low-cost and omnipresent LEDs and photodiodes [1]. In VLC LEDs can be used simultaneously for illumination purpose and wireless data transmission. It offers numerous advantages such as high data rates, unlicensed large bandwidth and better data security leading to smart spaces [2]. The on-off switching speed of LEDs is less than 1µs, this high speed on-off activity enables a kind of data transmission using binary codes. Switching on an LED is a logical '1', switching it off is a logical '0'. It is possible to encode data in the light by varying the rate at which LED's flicker on and off to give different strings of 1s and 0s. A light sensitive device (Image Sensors, Photo detectors) receives the signal and converts it back into original data. This method uses rapid pulses of light to transmit information wirelessly [3]. VLC had wider applications, can be used forsmart lighting, mobile connectivity, in hazardous environment, vehicle and transportation, defence& Security, Wi-Fi spectrum relief, Hospitals & Health care, Aviation, Underwater communication and Location based servicesetc. [4]. But the major challenges to the VLC technology are difficulty in how the receiving device can send some other data to transmitting device at the same time, while communicating data obstructions may interrupt the light signals leads to disturbance or losing the data [5].With increasing distance,strength of data signals becomes weak, and it is hard to change the positions of transmitter and receiver.

Mobile Visible Light Communication (MVLC)

In this information and communication age, mobiles became highly significant in present day human life, 93% of world population are using mobiles, 35 percent of world population are internet users, 26 percent of the world population are using social networking websites using computers and laptops but now most of the users are using their mobiles as communication media [6]. Most of the available mobiles in the market contains power full LEDs which are used in flash light or a torch. Application of VLC to the transmit data in mobiles is shown in figure 1.LEDs in flashlight or torch are used as data transmission source in mobiles. The Light spectrum wavelength used in LEDs is 380nm to 780nm and has 100s of THz b and width which makes VLC10,000 times bigger than radio spectrum and unlicensed, everyone can use.

Figure 1 VLC applied to data transmission in mobiles

Architecture of MVLC

Architecture of MVLC has been shown figure 2. Data storage element in sending device or mobile contains huge data and information. Present mobiles are highly capacitated with data

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storage element includes internal and external memories. Internal memories in mobiles ranges from 512 Mb to 2 GB and external Memories are ranges from 1 GB to 128 GB. UHS (Ultra High Speed) and SDXC (Secure Digital Extended Capacity) memory cards are achieving good speed in mobiles. Data transmission process begins at data processor point. The available data processors are highly facilitative in terms of speed and cost from 500 MHz to 1.3GHz with HKMG (high K-metal Gate) processing technology by using quad and octa core processors. Data Processor in transmitting device collects the data from data storage element and encodes the data in to bits and sends to the LED driver to drive the LEDs in transmitting device [10].

LED driver synchronizes data rate between data processor and LEDs these LEDs are preprogramed by mobile processor according to stream of data bits (0s and 1s), and blinking rate of LEDs are proportional to the quantity and speed of data transmission to the image sensor of receiving device (Mobile/PC/Laptop/printer/screen). Image sensor converts optical data to electrical signals by using rolling shutter method which is a method of image acquisition in which each frame is recorded not from a snapshot of a single point in time, but rather by scanning across the frame either vertically or horizontally. Image sensortransfers to amplification and filter consequently to remove the noise and sends to signal conditioning which accurately measure the signal and filters out DC, and provides the additional gain and sends to digital interface which collect digital signals and encoding the data using encode method and finally sends to the receiving data storage element.

Prospectives and challenges of MVLC

MVLC data transmission is an alternate technology to the existing technology in terms of cost and speed. By using Bluetooth technology in mobiles data transmission to the other devices is constrained with insecure, less data transfer rate, parallel form and distance. One of the major advantages of using MVLC is that it can be possible to transmit 1GB data within 3 minutes with more efficiency and also possible to pause and continue the data transmission at the time of presence and confiscating of obstacles. Limited range of illumination, even it cannot be identified by other communication devices as existing bluetooth technologies. MVLC can transmit the data up to 100 meters of distance, and work in absence of illumination by using intensity modulation (IM) techniques, which would allow data communication even if the lights are visually off to save the battery energy. MVLC can disseminate the data accessed from the internet provider to the connected devices as shown in figure 4. In MVLC the efficiency of data transmission can be enhanced by increasing the number of LEDs in mobiles. This technology can be applied to transmit the data to any sensing device with high speed and smart place communication. It also can be used as a projector without any extra circuit and in normal mobile to watch the videos on large screen. It can be also used as security key in different applications.

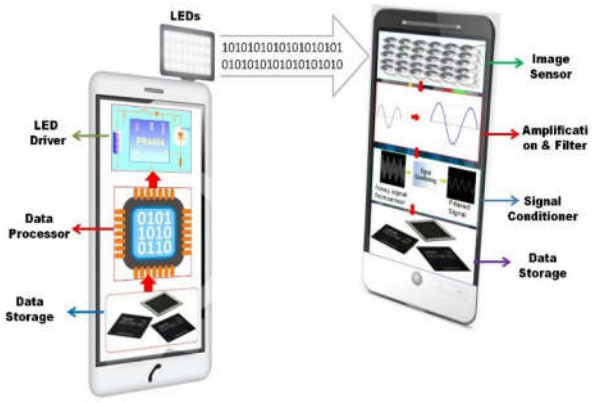

Figure 2 Architecture of MVLC

Apart from many advantages MVLC had some challenges. Mobile LEDs are limited with illumination angle, data transmission is possible up to $110^0 – 120^0$. Increased number of LEDs enhances efficiency of data transmission but will generates more heat which may in turn cause system failures.

Figure 3 Communication between MVLC and other devices

CONCLUSION

Mobile Visible Light Communication is the future technology, which is use for data transferring in mobiles in a faster and efficient way. In future, it can be the promising technology to use in mobiles rather than the Bluetooth technology. This paper tried to elaborate the significance and architecture of mobile visible light communication with LED source. This technique uses the additional LED source will enable to transmit high density data to other devices having sensors at a very fast rate. Also we showed that this mechanism will enhance the transmitting range over a wide angle.

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