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Visible Light Communication Using Android Mobile for Office

I. Satya Prasad[1], Renuka Jagdale[2], Sagar Yadav[3]

Prof. Mahesh Maindarkar[4]

[123]Dept. of Electronics and Telecommunication, JSPM'S Imperial College Of Engineering and Research, Wagholi, Pune , Maharashtra, India.

[4]Professor, Dept. of Electronics and Telecommunication, JSPM'S Imperial College Of Engineering and Research, Wagholi, Pune , Maharashtra, India.

Abstract - *LED lights are becoming widely used for homes and offices for their luminous efficiency improvement. Visible light communication (VLC) is a new way of wireless communication using visible light. Typical transmitters used for visible light communication are visible light LEDs and receivers are photodiodes and image sensors. We present new applications which will be made possible by visible light communication technology. Location-based services are considered to be especially suitable for visible light communication applications.*

Key Words: VLC, RF, MIMO,A/D,VLCC

1. INTRODUCTION

Visible light communication (VLC) refers to short-range optical wireless communication using the visible light spectrum from 380 to 780 nm. VLC transmits data by intensity modulating optical sources, such as light emitting diodes (LEDs) and laser diodes, faster than the continued existence or occurrence of the human eye. Due to the widespread deployment of LEDs for energy efficiency and recent advancements in LED technology with fast nanosecond switching times visible light optical communication has gained the attention of the scientists.

Traditional radio frequency (RF) communication below 6 GHz is rapidly running out of spectrum bandwidth for high- data-rate communication. With ~300 THz of bandwidth available for VLC, multi-gigabit-per- second data rates could be provided over short distances, for example, using arrays of LEDs in a multiple-input multiple-output (MIMO) fashion. In addition, communication is provided in conjunction with lighting providing gigabit-per- second data rates with only simple LEDs and photo detectors (PDs) compared to expensive RF solutions that require high power consumption (Watts) for transmitting, sampling, and processing gigabit-per-second data.

1.1 Literature Review

1. S. Rajagopal, R. D. Roberts "visible light communication: modulation schemes and dimming support", Visible light communication refers to short- range optical wireless communication using visible light spectrum from 380 to 780 nm. Enabled by recent advances in LED technology, IEEE 802.15.7 supports high-data-rate visible light communication up to 96 Mb/s by fast modulation of optical light sources which may be dimmed during their operation. IEEE 802.15.7 provides dimming adaptable mechanisms for flicker-free high-data-rate visible light communication

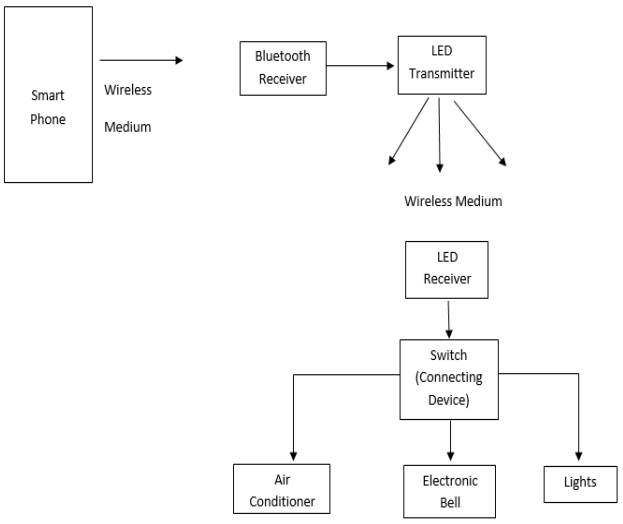
2. M. B. Rahaim, A. M. Vegni, and T. D. Little, "A hybrid radio frequency and broadcast visible light communication system."In recent years, visible light communication (VLC) has emerged as a complementary technique to overcome limitations of the crowded radio frequency (RF) spectrum. Its superior characteristics include unlicensed wide bandwidth, high security and dual-use nature. Nevertheless, mobile devices are not equipped with illuminating components, which are utilized as transmitters in downlink data transmission. Targeting a high quality and robust uplink channel, high power light sources turn to be unsuitable for mobile devices with limited battery life. Furthermore, VLC uplink requires a directional optical transmission beam that can lead to significant deterioration of throughput given the potential rotation and/or movement of devices. With the above-mentioned design challenges, the uplink mechanism becomes a fundamental problem for bidirectional VLC. In order to alleviate congestion in the RF shared medium as well as resolve the back-channel issue of VLC networking, we propose a real-time indoor hybrid Wi-Fi and VLC system for realizing Internet surfing. In this hybrid system, downstream data flow is transmitted by

light emitting diodes (LED), whereas the upstream data flow is forwarded through Wi-Fi connectivity. Our designed system utilizes flexible software defined VLC (SDVLC) to implement the unidirectional optical wireless channel. Experimental results reveal that the integrated system outperforms conventional Wi-Fi for crowded environments in term of throughput.

1.2 Project Objective

1. As radio waves are limited and with the advent of new generation technologies like 2.5G, 3G, 4G and so on, we are running out of the spectrum.
2. Availability of radio waves is another cause of concern. Radio waves penetrate through the walls . There are four major concerns that is efficiency, capacity, availability and security related with radio waves.
3. So we are representing the new technology i.e. visible light communication which is alternative to radio waves in electromagnetic spectrum.
4. Using this technology it is possible to transmit the data using simple LEDs. By varying the intensity of LED, very high speed can be achieved.
5. So we have represented the model to control the different appliances by transmitting the data through LEDs.

1.3 Block Diagram and Description



The project consists of three units, viz. smart phone unit, transmitter unit and receiver unit. We have used smart phone with Bluetooth to send data to second unit. We have to use android application for sending data. Transmitter unit consists of microcontroller PIC 16F877A along with power supply, Bluetooth module HC-06 and LED transmitter. Bluetooth is interfaced with serial pins of microcontroller. Data is received at the baud rate of 9600. The same data is transferred serially out to LED transmitter. The LED glows with bright light or blinks as per data. Receiver unit consists of microcontroller PIC 16F877A along with power supply, LED receiver, relay, bulb, buzzer and fan. The data received from LED is read from serial pin of microcontroller. As per data received, microcontroller turns ON and OFF devices (bulb, buzzer, fan) connected to it.

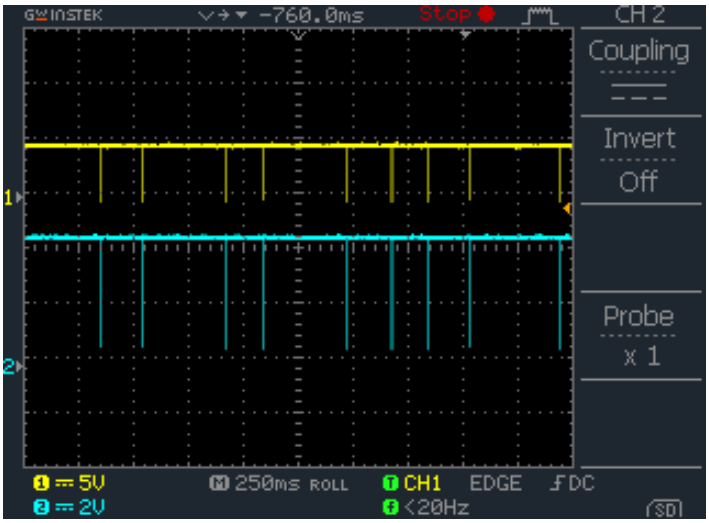
1.4 Advantages

1. Visible light spectrum is available for communication because the frequency above 3THz is not currently regulated by the Radio Regulation Law.
2. Visible light does not penetrate thick materials such as walls and partitions, which can be a security advantage.
3. Visible light usually poses no health hazards to human body and eyes.
4. Visible light can be literally visible so that human notices where the data is transmitted from.
5. In addition, since LED lighting has recently become part of a building infrastructure, making visible light communication infrastructure is fairly easy by adding communication function to LED lighting.

7.2. Applications

1. SMART LIGHTING:-Smart buildings require smart lighting. Smart lighting with VLC provides the infrastructure for illumination, control and communications and will greatly reduce wiring and energy consumption within a building.
2. MOBILE CONNECTIVITY:-By pointing a visible light at another device you can create a very high speed data link with inherent security. This overcomes the problems of having to pair or connect and provides a much higher data rate than Bluetooth or Wi-Fi.
3. VEHICLE & TRANSPORTATION:-Many cars already LED lamps. Traffic signage, traffic lights, and street lamps are adopting the LED technology so there are massive applications opportunities here.
4. DEFENCE & SECURITY:-The ability to send data quickly and in a secure way is the key to many applications. The fact that the visible light cannot be detected on the other side of a wall had great security advantages.

2. RESULT



DSO OUTPUT

Above figure shows the DSO output. First waveform (blue) shows that the data is transmitted at the transmitter side. Second waveform (yellow) shows that the data is received at the receiver side. Thus data is properly recovered at the receiver side.

3. CONCLUSIONS

Thus we have studied about the visible light technology. LED lights are becoming used for home and office for their luminous efficiency improvement. VLC is a new way of wireless communication using visible light. Typical Tx used for VLC are LEDs and Rx are photodiodes and image sensors. Thus data can be transmitted by using simple LEDS and recovered by photodiode. By using fast switching LEDs, data transmission can be further enhanced. With the help of VLC technology new applications can be designed. Location based services considered to be especially suitable for VLC applications. Visible light technology is new option for data transmission instead of radio waves. Many modernizations can be made to the existing technology. If this technology is put into practical use, every light emitting source can be used to transmit wireless data. This may solve the issues such as shortage of radio freq B.W. and also allow net. where traditional radio based wireless transmission is not possible such as aircraft or hospitals. This technology has great potential in the field of wireless data transmission.

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