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Visible Light Communication: Information Broadcast System for Product Description

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Abstract —*Visible light communication (VLC) is a technology that delivers high-speed communication which is similar to Wi-Fi. This method uses light as the medium for communication. This paper focuses on VLC, its applications, features and comparison with existing technologies like Wi-Fi etc. Wireless communications has become an asset for the communication process. Wi-Fi is of major use for general wireless coverage within buildings, whereas VLC can be used for high density wireless data coverage in smaller areas. This technique is of great use in various applications in regions where the main issue is radio interference. Hence both these technologies complement each other. Radio waves cannot support high bandwidth because of reasons like compact spectrum availability and intrusion. VLC provides better bandwidth, efficiency, connectivity and security than Wi-Fi. It provides speed greater than 1Gbps when tested under laboratory conditions. By utilizing the low-cost nature of LEDs and lighting units to their maximum advantage, there are lots of opportunities to exploit this medium. VLC is the transfer of data through light by taking fiber out of fiber optics and sending data through LED light bulb. In this project we use light as a medium for communication and transfer of data. LEDs are used at the transmitter end for collecting data with the help of Arduino and LDRs are used at the receiver end along with PIC to display the data.*

Keywords- *VLC; Li-Fi; Wi-Fi; Light Communicaton; Visible Light Communication*

I. INTRODUCTION

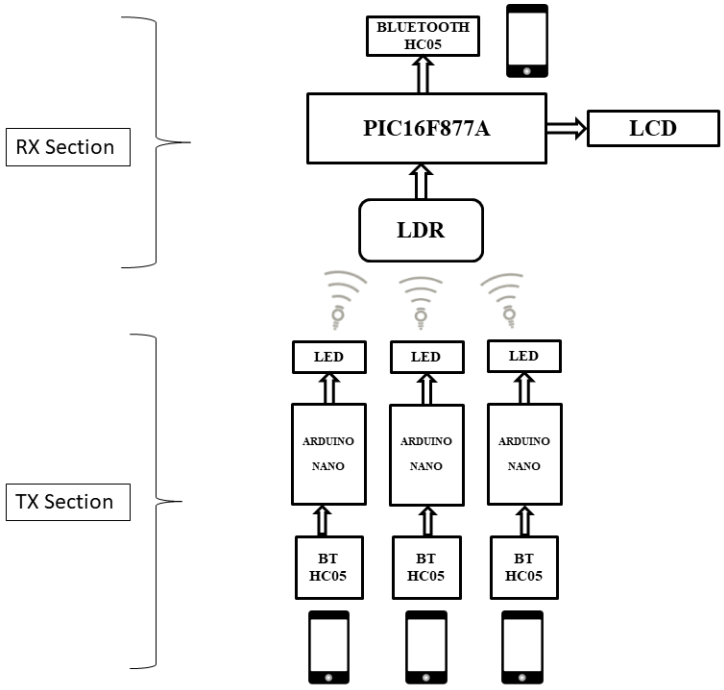
We use VLC technology to broadcast the data about a particular thing only for the people around that thing. The Transmitter will be attached on any convenient surface such as ceilings and the receiver will be connected to the mobile phone of each user. The information transmitted from the transmitter is will be received by the receiver and will be displayed on the mobile screen. Internet requires mobile network or Wi-Fi but VLC requires only a receiver. The same module can be carried to any place where VLC is implemented to receive information, for example, Museums are one of the most informative places in the cities having certain attractions. Many people try to collect information about that particular attraction or artifact which results in excessive crowds near the attraction. Hence, many people leave without complete information.

To solve this problem, we need to show the information about that particular thing directly on the mobile phone of that user. With the discovery of Electromagnetic (EM) waves, wireless telegraphy, and the invention of the radio, Wireless communication has gone through several paradigm shifts. Along the EM spectrum, with the decrease in the wavelength, the frequency as well as the energy of the waves increases. The visible light band occupies the frequency range from 400 THz to 800 THz whereas the radio wave uses the band from 3 kHz to 300 GHz. Radio Frequency (RF) has been the most widely used portion of the EM spectrum for communication, mainly due to a slight interference in the frequency band and wide area coverage. The use of visible light wireless communication began from Alexander Graham Bell, who in 1880 developed a photophone which transmitted voice data over 200 m using beams of sunlight. Several other demonstrations featuring fluorescent lights for communication with low data rates were investigated. The concept of using fast switching LEDs as well as modulating visible light for communication was presented for the first time by Pang et al. in 1999. In 2001, RONJA (Reasonable Optical Near Joint Access) used visible light beams to transmit data at 10 Mb/s over 1.4 km. Utilizing White-LED (WLED) for illumination and communication began to take shape in the early 2000s in Japan.

In this paper, Data transmission between two devices is done by using the medium of visible light of electromagnetic spectrum. VLC is always a better technology providing greater speeds for communication. When LED light is ON digital data bit stream of one is transmitted. When LED light turns OFF, digital bit stream of zero is transmitted. Based on this simple technique data transmission was done through visible light communication.

II. Block Diagram

Following shows the block diagram of the proposed VLC system:



III. Existing System versus Proposed System

There are many drawbacks of the existing Wi-Fi System. The drawbacks are mentioned below:
1) The RF waves which are used for data communication between two devices emit high radiation waves.
2) Data that is transferred is not protected. Even by using WPS key encryption the Wi-Fi can be hacked.
3) Radio waves pose a threat to human health.
4) Signals cannot travel without interference within the channel.
Advantages of the proposed system:
1) No interference on radio frequency signals as this communication totally depends on light.
2) It is based on a simple technique of illumination cum communication.
3) Moreover, data speed of this VLC is extremely fast when compared to other means of communication.
4) Since, the communication is based on visible light which is the most used part in electromagnetic spectrum for communication.

However, the proposed VLC system has some disadvantages as well:
1) Opaque objects and other very bright light sources can cause interruption in communication.
2) Speed is lesser than RF or wired as this is the evolving technology.

IV. Working

This project comprises of two sections, one is the transmitter and second is the receiver. The data is provided through a smartphone via USB cable by USB terminal Software. The data is processed by then the ARDUINO UNO and provided to LCD display and to the LED arrays. The project works on the principle of VISIBLE LIGHT COMMUNICATION. Visible light communications (VLC) works by switching the current to the LEDs off and on at a very high rate. So the LEDs flickers at high rate and the light is captured by the LDR or photodiode on the receiver side. The receiver comprises of ARDUINO NANO which processes the data in the form of light intensity and data is displayed onto the smartphone via USB cable using the software USB terminal. The data is transmitted at a rate of 9600bps.There are multiple receivers at the other end and for communication to take place transmitter and receiver should be in the LINE OF SIGHT (LOS) .The maximum distance between them is normally 3-4 feet. The data transmitted can be a letter, an alphanumeric key, a number, a symbol etc. There are certain commands used for communication. The baud rate should be fixed at both the ends at 9600bps.The receivers are given numbers like a mobile phone i.e. 1,2,3,4.

- Working of Transmitter:

The transmitter has the flasher for transmitting the data. The Transmitter gets the data from the Bluetooth. The transmitter accepts not only data but also the commands from the Bluetooth. If the received command is to save the data, The transmitter will save the character in its memory and keeps on transmitting it through Lifi interface in a particular fixed periods. The data is sent over the Light media using flasher. The flasher will turn on and off to send the actual data.

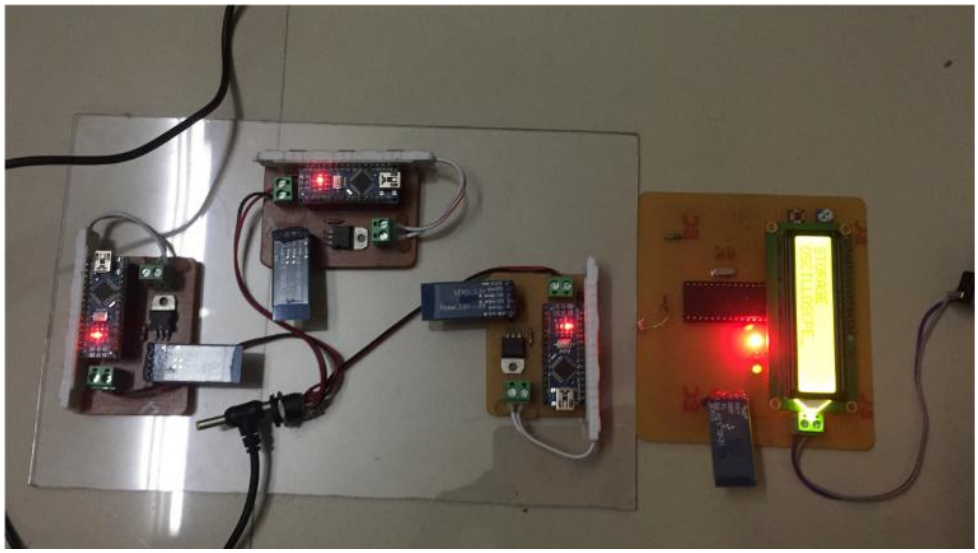
If the bit to be sent is one the flasher will go off and if bit to be sent is zero, the flasher will turn on. The state of the flasher will continue only for a single bit period. For the ideal state, the flasher will be off and the receiver will get one in ideal state. The data transmission format is similar to RS232 frame format with one start bit and one stop bit.

- Working of Reciever:

The receiver will have LDR sensor for light sensing. The resistance of LDR will change according to the light falling on it. Whenever the flasher of the Transmitter is ON, the resistance of LDR will decrease and this change will be detected by the controller to find out the change in data on the line. The receiver will always search for zero or turn on of the flasher. Once detected, The 8 bits will be received back to back. As soon as the 8 bits are received, they are sent to the user through Bluetooth. The app running on the phone will show the character received.

V. Working Model and Result

The data is successfully transferred using visible light.



VI. Applications

1) It can be used displaying the specifications of the artefacts in the museum or an art gallery.

2) It can be used for collecting taxes from vehicles at the Toll Plazas.

3) It can be used to improve the power plants and make them smarter as it offers safe and abundant connectivity for all areas in the power plant. This not only saves money, but the power consumption can also be decreased.

4) Whenever we travel in airplanes, we face the problem in communication media, because the whole airways communication is performed based on radio waves. To overcome this shortcoming of the radio waves, VLC is introduced.

5) VLC system is simple and extremely easy to implement. It can be implemented in existing structures and light sources.

6) It is not that expensive. Long distances can be covered using LASER lights and many receivers can receive the data simultaneously with the same rates.

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