



WIRELESS IMAGE DIFFUSION USING LED TO LED COMMUNICATION

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Abstract: Light Emitting Diodes (LEDs) are considered to represent the next generation of lighting and Communication technology. In this paper we proposed a system for wireless transmission of an image using LED to LED visible light Communication. In proposed methodology, we represent the LED as a both transmitter and receiver and free space as a transmission medium. This paper highlight the ability of LED to act as a light sensor and achieved very low data rate approximately 200 bps.

Keywords: LED to LED Communication, Visible Light Communication, Serial Communication, LOS, LED

I. INTRODUCTION

At the present visible light communication is a rapidly emerging area so researchers are paying attention towards it. The visible light communication defines as the technology which consists of the visible light source as a signal transmitter, air as a transmission intermediate, and photodiode or LED as a receiving element [1]. Visible light is easily available in our routine life and it can easily distinguish by human eye. The bandwidth of visible light communication system is high with respect to radio frequency. Visible light is most trustworthy for the indoor communication because it is cost efficient, power efficient and reliable communication system [2]. The scheme for Visible light communication is shown in figure 1.

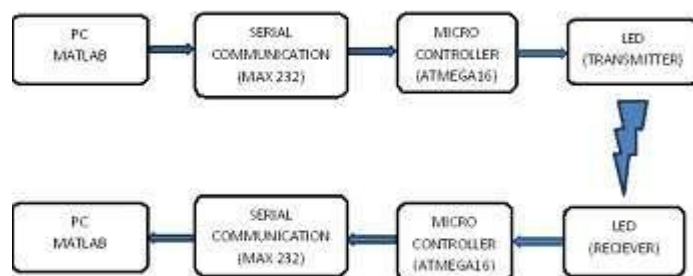


Figure 1: Visible Light Communication Model

We have developed a model in which we use one 3W Red LED light as source and receiving element. We have transmitted an image in terms of binary data using serial communication (RS-232) cable from pc to microcontroller. We use Atmega16 AVR controller to toggle LEDs at both transmitter and receiver side. To establish communication through LEDs we can turn it ON and OFF. When LEDs turns ON, "1" will be transmitted and when it turns OFF, "0" will be transmitted. This technique is known as "ON-OFF- Keying". OOK, OFDM, PCM, PWM, etc are most popular modulation schemes for visible light communication.

II. LED AS A PHOTODIODE

After reading so many literatures we came to know that we can use LED as a light receiver or photodiode. By changing the polarity of LED like connecting voltage probe of multi meter to LED's negative and ground probe to the LED's positive. After throwing some light on LED we will achieve voltage in mV.

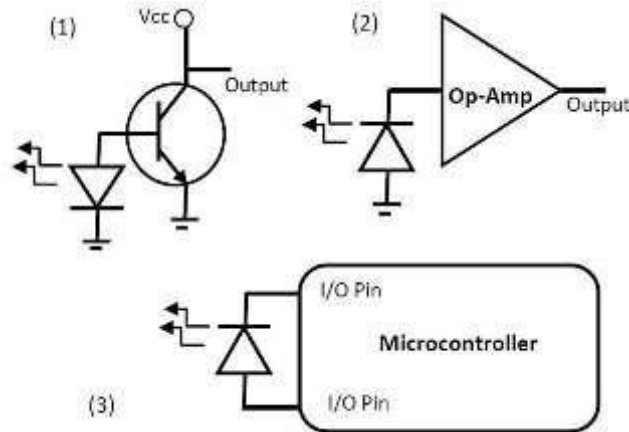


Figure 2: Various Arrangements to use LED as a sensor [2]

Here we introduce three techniques which can be used for LED sensing [2]. These techniques have their own advantages so we can use these techniques for different purposes. As shown in figure 2, In first technique LED is connecting to Transistor because it can use as a level converter. For simple application this technique is easy and very effective. In second technique LED is connecting to Op-Amp which is very popular and useful to achieve high amplification. In third technique led is connecting to LED for bi-directional microcontroller at where it will act as a capacitor. When light falls on the LED it will discharge faster so we can calculate the intensity of light. Every color LEDs sensing ability is different because of wavelength emitted by them. Red LED has higher wavelength so it can sense every color. Its wavelength is closer to infrared spectrum. Whereas Blue LED can sense only Blue and White color. Here we are using third technique to use Led as a light sensor. Due to some limitations here we do one way communication.

III. IMPLEMENTATION

Here we use 5mm Red LED as a both transmitter and receiver because it can sense every color as discussed earlier [3]. In the transmitter section image was converted into a binary data using MATLAB tool box. If one have color image then first it will be converted into the black and white image and after that binary data will be produced from that black and white image. Here we can use any format of an image like .png, .jpg, .tiff etc. The information about Colum and row size of an image is being calculated using MATLAB code. Binary data is going to feed to the microcontroller using serial port MAX 232. Max 232 is 16 pin IC which convert the signals from RS-232 serial port. Here we use AVR microcontroller which is high performance, low power and 8-bit microcontroller. Binary data will be stored in the memory of microcontroller and it will transmit it one by one using Red LED. The code for the AVR microcontroller is prepared in Micro C Pro for AVR. At the receiver side, AVR microcontroller with NPN transistor is used. Red LED receives the binary data transmitted by the LED. First it receives the row and Colum size of an image from that it calculates the size of data. Received data will be stored in the memory of AVR microcontroller and it will given to the PC through Max 232 serial port. At where image will be generated based on the received data. We kept 1 inch distance between transmitter and receiver.

IV. RESULT

After series of experiments we come to know that LEDs can be used as a sensor or photodiode. Different color LEDs has different color sensing capabilities. Red color LED can sense all the colors. At the receiver end we successfully reproduced an image for the shorter distance approximately 1 inch. We achieved lower data rate approximately 200 bps.

V. APPLICATION

The applications for this technology are infinite due to the fact that light is most likely the safest source of energy.

- It will be used in Vehicle to Vehicle communication. Every car have LED lamps so with the use of this traffic update, weather information will be transmitted [1].

- It can be used in under water communication where RF does not work under water but visible light can support high speed data transmission over short distances in this environment. This could enable divers and underwater vehicles to talk to each other.
- It can be used in petroleum or chemical plants where other transmission or frequencies could be hazardous.
- It has ability to send data speedily and in a safe way so it will be used in defense and Security. Because of the fact that visible light cannot be detected on the other side of a wall.
- It can be used for data transmission in hospitals and health care premises where mobile phones and Wi-Fi are not allowed.

VI. CONCLUSION

We have developed a system which transmit and receive an image using LED both as a transmitter and receiver. After series of experiments, we identify property of different color of LEDs that they are able to sense certain colors only. In this technique we have achieved Very low data rate which is nearer to 200 bits/sec for a distance of 1 inch. At the end of experiment we achieved successful reproduction of an image for 1 inch distance.

VII. FUTURE WORK

After so many test and experiments finally we successfully transmit and receive an image using LEDs for shorter distances due to sensing limitation of LEDs. Here we use 8-bit AVR microcontroller. One can use higher end microcontroller or DSP processor to achieve better result. High power LEDs can be used to improve range for the communication. To achieve higher data rate photodiode or photo transistor can be used. Here we established system only for one way communication in future it can be extended for bidirectional communication.

VIII. REFERENCES

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