

IR Communication based Real Time Data Transmission

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Abstract

In the present circumstances, there is a drastic increase of wireless data usage. Today everyone appears to be interested and in need of using wireless data. Because of this heavy utilization of wireless data, its capacity and speed seems to be going down. Therefore, in order to overcome this problem data needs to be transferred using IR communication. A REAL TIME DATA TRANSMISSION: A promising technology meets the light source (illumination) and the message to be transferred or the information transmission requirements in an indoor environment. The communication can be between two or more movable communication devices. Typical transferable devices include laptops, computers etc. Moreover, a technology provides secure, fast and high data rate communication. This paper highlights the infrared communication technologies and its applications. In this paper instead of visible light communication, invisible IR lights are used to transfer data. There are reports of transfer of the information between two movable devices (computers, laptops) using IR technology. The IR receiver and the receiving module brings about conversion of the harmonized beam of light into electric signals which are then decoded and optimized by another controller to get the corresponding data. The generated data is transferred to another device, which may be a computer or laptop, through serial port where receiver receives it.

Keywords: *Infra-Red, Wireless Communication, Real Time Interfacing*

1. Introduction

IR communication technology was discovered in 18th century by astronomer Sir William Herschel, in the countries like Germany, Korea and Japan where they discovered a medium of transferring data or signal through invisible led. The IR light in general is very much similar to visible light; but the only point, which makes it different, is its longer wavelength. In this networking terminology, **wireless** refers to a connection in which we are not using any physical connection between transmitter and receiver. In the comparison with other technologies, IR technology is one the cheapest and earliest type of technology. One of the limitations of IR is that it cannot pass through any opaque barriers but it can pass through transparent medium; but thereby new technologies are being also developing to overcome this limitation and IR is also providing us the advantage of secure transmission of data, which cannot be connected via any other links. The infrared spectral region provides us the advantage of unregulated and unlimited bandwidth worldwide. Wireless infrared communication system provides accompaniment to radio based system, particularly for systems, which do not require high data rates but only short ranges. In the coming decades, wireless networks requiring short range would be responsible for an increased market growth leading to a rise in wireless infrared communication system rise in many regions. Some of the researchers consider IR technology to be similar to optical technology as, the hardware used in both technologies are quite similar and the forms of energy used behaves in much same way, But at the same time the optical communication

is “visible light communication” and infrared is “invisible light communication”[1]-[4],[6].

Here VB.Net is used to manipulate data (in encrypted string form) in a laptop and transfer it through serial port to the controller of the laptop. The laptop carries out certain logical and mathematical operations as per the programmed instruction and sends the data in the form of IR joist light signal. This signal is captured by an IR receiver, which converts the received modulated joist light to thereby signal. The resulting data is sent to another device (laptop) through serial port, which is received by VB.Net.

While using VB.Net, the original signal, message or data (in the form of images of all types, GIF and video) gets converted in the base 64 format in transmission section and in receiving section we are converting the converted base 64 format back into the original signal.

2. Infrared communication

Through IR, radiation infrared wireless communication conveys information in the system. IR is that portion of actinic radiation (Electromagnetic Radiation) which has a wavelength higher than that of long wavelength (red light). Usually it is used for short distance communication as indicated in figure 1 for various applications.



Figure 1: Infrared Communication

For desired Communication, a photo LED transmitter and photo diode receiver is required. Here the photo LED transmitter conveys the original signal in the form of invisible light and after this process the signal is being transfer through air and then the photo diode captures the signal [5].

There are two variants of infrared communication; which are:

A. POINT TO POINT COMMUNICATION

A point to point communication requires line of vision between the source and destination. It is the communication in which the transmitter and receiver are been connected together directly without any obstacles between them [7]. TV remote is the best example of point to point communication.

B. DIFFUSED POINT COMMUNICATION

Diffused point communication does not require any kind of line of sight between source and destination. It is maintained by bouncing or reflecting of the transmitted signal [8]. Wireless LAN communication system is an example of diffused point communication. Figure 2 shows the diffused point communication for line of sight and non line of sight for different degree of directionality of transmitter and receiver.

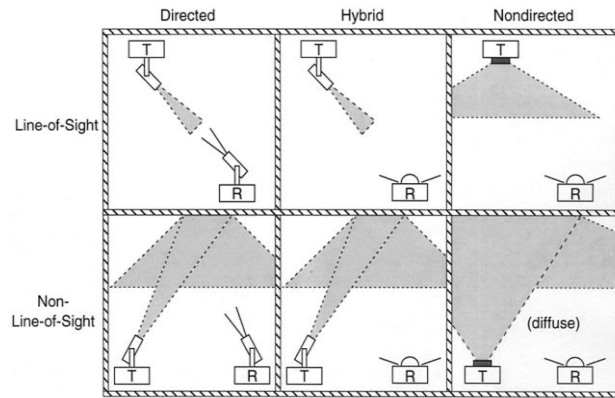


Figure 2: Classification of Simple Infra-Red Links according to the degree of directionality of the transmitter and receiver.

3. Functional block diagram

The practical functional block diagram of transmitter and receiver for IR real time data transfer is shown in figure 3 and figure 4 respectively.

An algorithm is designed for transmission and reception of the data, which consists of manipulation and analysis portion.

Transmitter

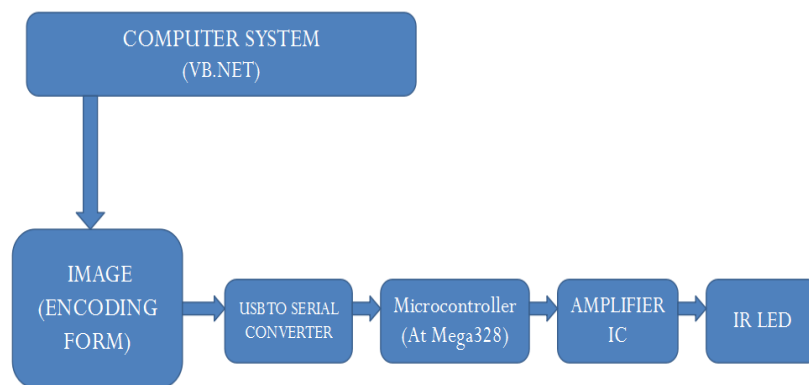


Figure 3: Transmitter Module

Receiver

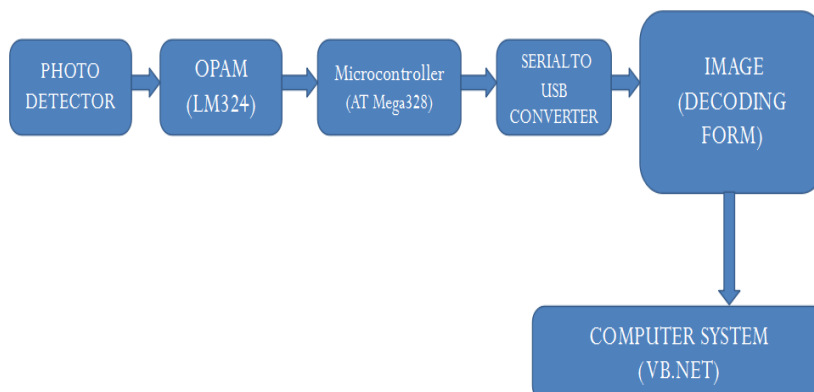


Figure 4: Receiver Module

Algorithm for transmission and reception of data:

- Step 1: Image.text or GIF is given as a Transmitter PC input consisting of a VB.NET program reserved for input image processing of input image.
- Step 2: Image processing takes place in the Transmitter PC, the output of which is processed through a serial port by a micro-controller connected to PC.
- Step 3: The IR lights connected to one of its port transmitting the data depends on the output of the micro-controller.
- Step 4: Using a Phototransistor at the receiver side photo-detection takes place at the receiver end.
- Step 5: at receiver side, micro-controller performs the binary conversion of the input data from the output of the phototransistor.
- Step 6: The receiver PC connected to micro-controller receives this data via serial port, processed the data so that the receiver side image can be reconstructed using the VB.NET program.

4. Interfacing and programming

In this research, programming is done in two phases. The first phase includes manipulation of data by VB.NET whereas and the second phase includes the analysis of operated data in the Micro-controller.

Transmitter Section:

Data Scanning Module $\Rightarrow$ Data Translation Module $\Rightarrow$ Transmitter Module

Receiver Section:

Receiver Module $\Rightarrow$ Data Reading Module $\Rightarrow$ Data Display

- Data Translation Module: It converts the data into String (Base 64) form because of which it can be depicted as a digital signal.
- Transmitter Module: It conveys the encrypted information through Infrared light.
- Receiver Module: It has a photo detector that detects the transmitter's signals.
- Data Reading Module: It converts data from string form to original format.

A. Hardware Interfacing

VB.NET is playing the major role to interface the transmitter and receiver with the hardware. Serial objects are used for externally connecting devices to the computer. Here the image file is read into a byte array using the Binary reader class object. The byte array is converted into Base-64 encoded string. In order to convert a Base64 string back to the original form, From Base64string() function is used.

Algorithm for converting image to Base64 format programming:

- Step 1: - Start
- Step 2: - Read Input variable buttons btnOpen , btnImagetoBase64 & btnBase64toImage
- Step 3: - Click btnOpen() and initialize the Image Formats like *.png, *.jpg, *.gif & *.bmp
- Step 4: - Click btnImagetoBase64() and check the format of input image with the help of If Else condition
- Step 5:- Encode the image using Image encoding command

Step 7: - Use Memory stream to save image

Step 8: - the Original Image is properly converted to String Form at transmitter output

Step 9: - Stop

Input Image:



Figure 5: Original Form of Image

Here the given picture is in “jpg” format. btnImagetoBase64 button is used to convert image in picture box to Base64 string form. String form of a given image is shown in figure 6.

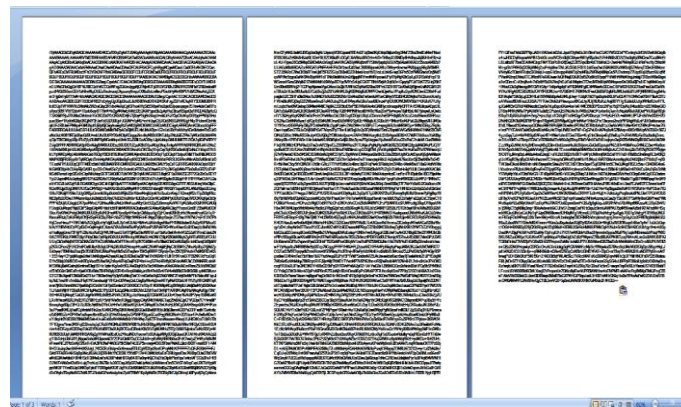


Figure 6: Base 64 Form of Input Image

Algorithm for converting image to base64 format programming:

Step 1: - Start

Step 2: - Read btnBase64toImage button

Step 3: - Click btnBase64toImage() button and get the image path from Path Browsed using Browse Button

Step 4: - Decode the image using Image decoding command

Step 5:- Assign temporary path to save the image

Step 7: - The original image gets back at the receiver

Step 9: - Stop

Output Image:



Figure 7: After converting Base 64 to Original form

B. Interfacing with Micro-controller

The Micro-controller first is ready, along with the universal synchronous asynchronous receiver transmitter, which is Input Output module, for serial communication. The controller waits for the command to receive data from the computer via the serial port when the appropriate values have been assigned to the register.

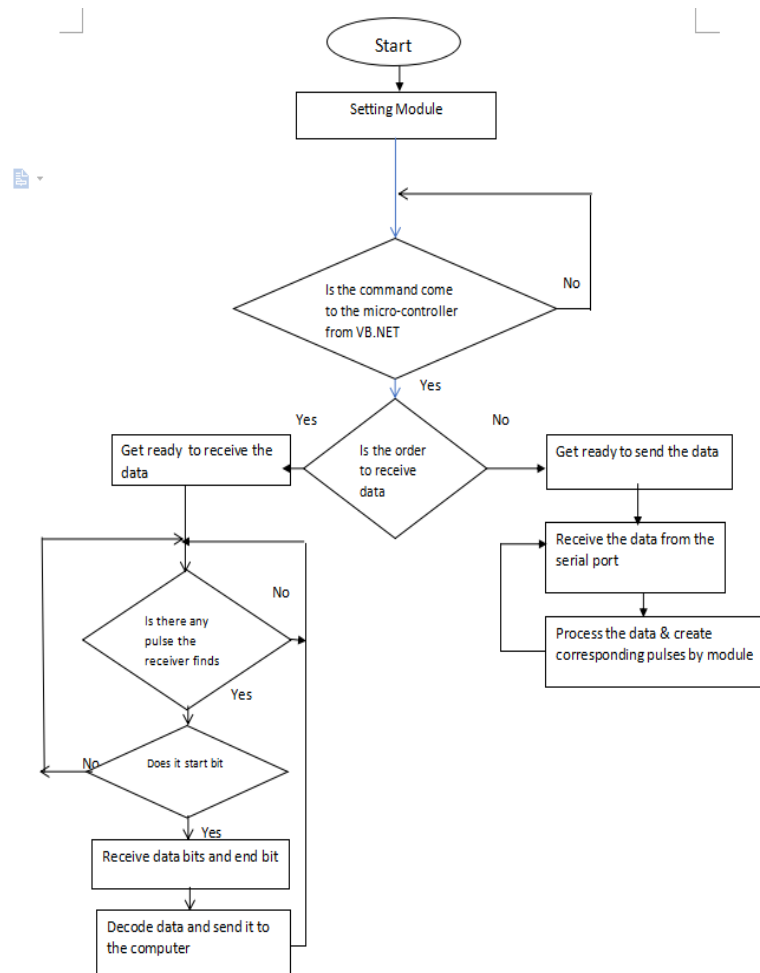


Figure 8: Flowchart of the Program for Micro –controller

Module:

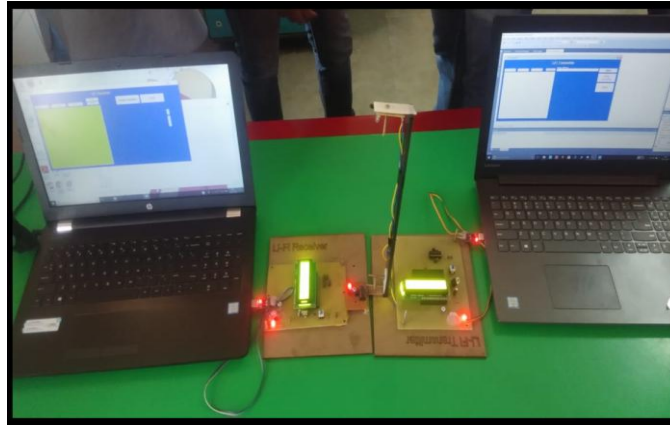


Figure 9: PC-To-PC Transmission

5. Comparative study of IR communication over Li-Fi and Wi-Fi

IR Communication is new technology that uses Infrared lights that can be used for high-speed communication. It is a better alternative as compared to Li-Fi and Wi-Fi technology. It is safer and cheaper technology because it has no radio waves or any other kind of waves. This technology provides better capacity, security and availability as compared to Li-Fi and Wi-Fi. The radio waves are expensive and very less safe. It is not possible to use gamma rays as they are dangerous. In places where humans are not found, UV rays can be used otherwise they can be harmful. Without a light source, the internet cannot be used in Li-Fi. It would be necessary to build a completely new infrastructure for Li-Fi, now Infrared is safe to use, which is not harmful.

6. Conclusion

The aim of this paper is to demonstrate the wireless communication using Infra-Red Light. This type of wireless Infrared communication system will provide communication between Computers and the main advantage of using infrared light is that no purchase or any kind of license is required. The drawback of the technology is, data cannot transfer through opaque objects like wall, so we can use Gamma rays to transfer the data. Secondly, here for transferring data serially, image and GIF can be transferred and if videos are to be transferred, it can be transferred in parallel.

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