Designing Data Transmission System With Infrared Rays

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ABSTRACT

Currently, with the rapid development of the internet exploding with the digital age, systems and devices require faster, safer and more secure data connection and transmission. Therefore, a question is posed: "How to transfer data quickly, safely, securely and without interference?". In addition to using classical wired transmission mediums from copper cables with tangled to modern cables such as fiber optic cables, or simple radio transmission mediums such as using microwave frequencies or radio that are prone to interference, they We need a simpler, more readily available and cost-effective solution.

From this fact, the authors propose to design a system using infrared rays to transmit data, this is the solution given to minimize interference to a minimum, fast, safe transmission. , confidentially and especially at no cost to rent the band.

Keywords:
Data transmission; infrared light; infrared rays; data transmission system; Data transmission via infrared.
JEL: M10, M15
Article Received: 18 October 2020, Revised: 3 November 2020, Accepted: 24 December 2020

1. Introduction

The article introduces a system with high application in agriculture such s automatic irrigation system, weather forecasti g system. In addition, the system can also b applied in automatic industrial lines to bring data to the server.

This system is derived from the idea of transmitting data by infrared. Infrared rays are electromagnetic radiation with a wavelength longer than visible light (the hu an eye can perceive colors) but shorter than microwave radiation. The name "infrared" means "beyond red", red is the color with the longe t wavelength in visible light.

The area of light visible to the hu an eye, also known as "visible light", has wavelengths between 380 nm and 700 nm or 430-790 Hz. Infrared radiation is defined with a wavelength from 700 nm (frequency 430 T z) to 1 mm (300 GHz). Some organisms can see infrared rays in proximity to normal light, as well as in some experiments someone can see up to 1050 nm infrared. [1]

Infrared rays are easily absorbed, poor penetrating ability. In infrared remote control, the infrared beam emits narrow, directional, so when retracted in the right direction. Infrared rays have important properties like light (convergence through lenses, focus, etc.). The above disadvantages are also the advantage of infrared rays when used to transmit data by using only t e area in the room but infrared rays do not penetrate the wall, avoiding signal leakage, hackers are difficult to have. data may be stolen, the sign l may not need encryption

because connected equipment must be visible. Normal light and infrared light differ very clearly in the penetration of matter. There is matter that we see it under a dull gray color but with infrared light it becomes transparent. Because the semiconductor material is "transpare t" to infrared light, the infrared ray is not weakened as it passes through the semiconductor layers to o out. [2]

Infrared rays can transmit multiple signal channels. It is widely used in industry. The amount of information can reach 16Mbps (in case of meeting the requirements and h ving enough equipment to do it, the theoretical amount of information can reach up to Gbps). The amount of information transmitted with infrared is many times greater than the electromagnetic waves that people still use.

Research literature review

Oancea (2011) mentioned that In cellular service there are two main competing network technologies: Global System for Mobile Communications (GSM) and Code Division Multiple Access (CDMA). Since its beginning in the '80s, GSM telephone system was developed using cell concept for the network topology. Each cell corresponds to a specific antenna (base station), placed on towers or tall buildings. The GSM standard has been an advantage to both consumers, who may benefit from the ability to roam and switch carriers without replacing phones, and also to network operators. GSM also has low-cost implementation of the short message service (SMS), also called text messaging, which has since been supported on other mobile phone standards as well. Because of huge coverage of distance, the GSM infrastructure can be an alternative to transmit or receive data from or to a device (sensor, actuator, complex device) near or remotely. Sood et al (2009) stated that The smart grid of the future, while expected to affect all areas of the electric power system, from generation, to transmission, to distribution, cannot function without an extensive data communication system. Smart grid has the potential to support high levels of distributed generation (DG); however the current standards governing the interconnection of DG do not allow the implementation of several applications which may be beneficial to the grid.

Then Jaber et al (2012) pointed that a new infrastructure of a combined Worldwide Interoperability for Microwave Access (WiMAX) and Dedicated Short-Range Communications (DSRC) link layer is proposed with the purpose of reducing simultaneou WiMAX connections. WiMAX offers wide area connectivity of vehicles to ground-based base stations, while DSRC offers relatively shorter com unication that allows for vehicles in proximity of each other to communicate directly. The proposed design uses the fact that WiMAX amendments support the concept of a WiMAX elay node, and substitutes the WiMAX relay nodes with nodes that are capable of both WiMAX and DSRC communications.

Hence, our research gap is a new discovery in designing infrastructure data transmission system with infrared rays.

2. Research methodology

In order for people to stop understanding and approach easily the problem of data transmission through infrared, the authors have built a simplest experimental model, built on available hardware and the design is mod lar. Detailed descriptions, applied theory and empirical research are described below:

2.1. Microcontroller an components

2.1.1. Arduino Nano

Arduino Nano is a small, complete and user friendly board based on Atmega328 (Arduino Nano 3.x). It has more or less the same functions of Arduino Duemilanove, but in a different package. It just lacks a DC power jack and works with a USB Mini-B cable instead of a standard cable.

Hình 1. *Arduino Nano*

2.1.2. VS1838B infrared receiver eye

VS1838B is an infrared receiver, commonly used to receive control signals for T s, fans, air conditioners, etc., ... This infrared receiver eye has a metal cover, anti-interference, sta le operation. Output pins can be directly connected to the microcontroller to read signals. Operates on 38Khz frequency.

Hình 2. *Infrared received eye VS1838B*

2.1.3. Infrared emitting LED HIR333C-H0

An LED emits infrared, like all LEDs, a simple diode, or semiconductor. The diodes are designed so that current can flow in only one direction. As current flows, electrons fall from o e part of the diode into the hole on the other. To all into these holes, electrons must do energy in the form of photons that produce light. The wavelength and color of the light produced depend on the material used in the diode. Infrared-emitting LEDs use materials that produce light in the infrared portion of the spectrum, that is, just below what the human eye can see. Different infrared LEDs can produce infrared light of different wavelengths, just like different LEDs produce lig t of different color. For HIR333C-H0 infrared emission with a wavelength of 850nm. [3]

Hình 3. *Led emitting infrared HII 333C-H0*

2.1.4 DHT11 temperature and humidity sensor

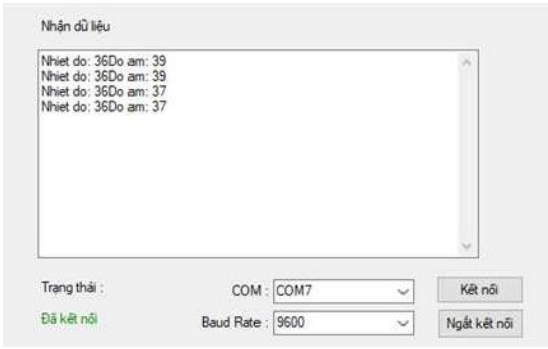
The DHT11 temperature and humidity sensor is a very popular sensor today because itis cheap and very easy to get data through 1 wire communication (digital communication 1 single data transmission line). The signal preprocessor integrated in the sensor helps users get accurate data without going through any computation. [4]

Hình 4.*Temperture and humidity DHT11*

2.2. Support software

2.2.1. Windows For s Library in Microsoft Visual

Windows Forms is a free, open source graphics class library included s part of Microsoft .NET Framework or Mono Framework, providing a foundation for writing rich client applications for desktops and laptops. hands and tablets. Use Windows Forms to create a simple application through which you can display data received through the COM port n your computer.



Hình 5. *Windows forms interface to create applications to receive data via COM port*

2.2.2. Arduino IDE What is Arduino IDE? Arduino IDE is abbre iated (Arduino Integrated Development Environ ent) is a text editor that helps us to write code to load on Arduino board. In this simple experimental model, the authors use Arduino IDE to program and load the code for 2 Arduino microcontrollers, and at the same time can test data via COM port on 2 microcontrollers.

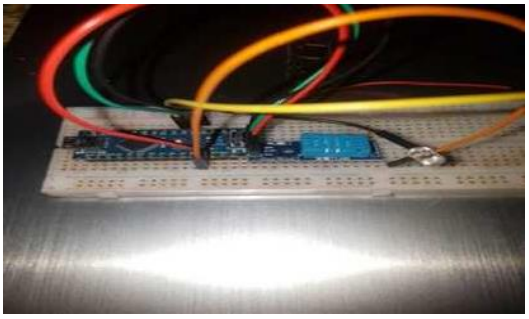
```
GuiRs
//Truyền dữ liệu Hồng ngoại
/*Chú ý : IR led  +  100 ohms điện trở sau pin 3 arduino và GND
 DTH11: S : pin 2   điện áp 5v  - GND*/
//Cài đặt cảm biến nhiệt độ. Comment nếu không dùng nó.
#include <dht11.h>
dht11 DHT11;
#define DHT11PIN 2
String Khoa = "";
int incomingByte = 0; // cái này dành cho dữ liệu nối tiếp
#include <IRremote.h>
IRsend irsend;

void setup()
{
  Serial.begin(9600);
  int i=0;
}
void loop() {
  //Lấy nhiệt độ. Comment 5 dòng tiếp theo nếu không dùng cảm biến
  int chk DHT11.read(DHT11PIN);
  String Khoa = "Nhiet do: ";
```

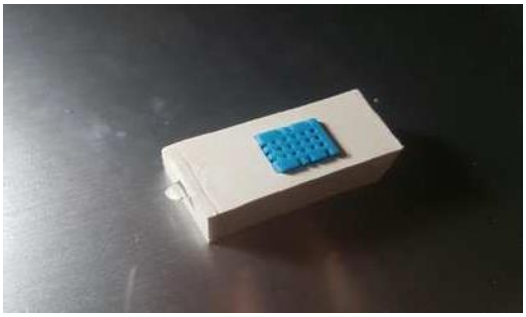
Hình 6. *Arduino IDE interface for programming and loading code into Microcontroller*

2.3. Describe the approach

Transmission issues, connectivity technical standards and layers are outlined on the IrDA (Infrared Data Association) website [5]

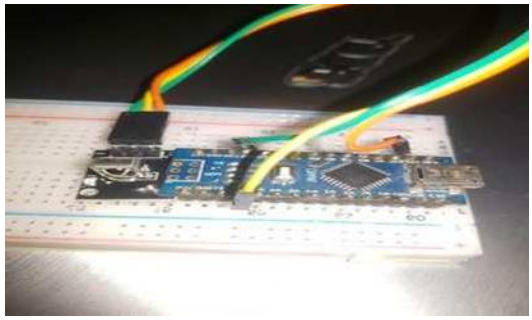
In order to send the farthest data and the receiver side to decode correctly and receive enough information, both the receiver and transmitting module need to transmit the information in a visible line (due to the linear nature of infrared rays and because it cannot penetrate all materials, except transparent materials such as hydrometeorology and mica).





Hình 7. *Module gửi dữ liệu*

The maximum distance for the module to correctly obtain data in this model is within a maximum radius of 8 meters from the transmitter module position, in case of a longer distance a false decoding will occ r due to altered data in the transmission medium (mainly due to interference from ambient infrared sources and / or intense sunlight). The problem of getting missing or corrupted data during decoding can also be caused by a change in the transmit power from the transmitter module (the power supply is changed due to the addition of a infrared LED to purposes of multicast styling).



Hình 8. *Module nhận dữ liệu*

The model created by the authors is to prove that the data transmission by infrared is practical so currently only the receiver and transmitter modules are separate, not integrated and the same unit for duplex use or semi-duplex.

3. Results and discussion

Along with the studies nd transmission principles in the process of building the model, the authors have had some conclusions as follows:

After installation and ommissioning, the results obtained including the data received from the transmitter module (data including Temperature and humidity readi gs from the DHT11 temperature and humidity sensor) were obtained. is received by the receiver Module and displayed on an application created by Windows Forms. The send and send rates are set together on the send

and receive side (usually 9600 baud). The baud rate can be adjusted from 1200 baud to 2000000 baud, however if the baud rate is too fast causing decoding errors, the results are received inaccurate and / or the transmission distance is reduced to only several centimeters.

Table1. Error rate when sending data at different speeds

Time	Error rate (%)	Sending speed (baud)	Max sending distance(m)
1	0	1200	8
2	0	2400	8
3	0	9600	8
4	1	38400	7
5	1	115200	6
6	30	230400	3
7	38	250000	2.5
8	50	500000	0.8
9	99	1000000	0.05
10	100	2000000	-

First, the transmission of data via infrared is feasible and practical, but attention should be paid to and corrected some problems arising from the transmission line, transmission speed and the ability to process decode received signals. .

Second, the range of data transmission needs to be further enhanced thereby increasing the quality of received data significantly.

Third, it is necessary to use other advanced techniques to integrate the receive and transmit module into one, progressing to full duplex and semi-duplex transmission, making it possible for users to use the module for many different purposes.

Fourth, a problem to do is to maintain a stable transmit power when adding more infrared LEDs for multicast transmission.

With this model the user can be used as nodes that receive indoor temperature and humidity data, the same nodes can also be installed in an organic vegetable growing area, the extension of the model has You can install a light sensor, use the model as a sensing device for automatic irrigation systems in greenhouses or turn on and off ventilation fans and electric lights for livestock areas. In addition, the model can also be used in factories with automatic transmission lines to bring data to the server, can expand the function of the model by installing additional infrared LEDs at the receiver or eye module. Infrared receiver at the transmitter module to carry outhalf-duplex data transmission, to support the user to control the device remotely automatically (or manually) after receiving and analyzing the received data.

The module can be extended further by installing almost any other type of sensor.

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