Software Development of Li-Fi Technology for Wireless Data Transmission

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Abstract- Li-Fi is the acronym for wireless-communication systems which uses light as a carrier for data rather than traditional radio Frequencies [1], which is Wi-Fi. The advantage of Li-Fi is it can be used in sensitive areas such as in Aircraft without causing any interference. But, there is one disadvantage that light waves cannot penetrate walls. Its implementation includes use of white LED light bulbs at the Downlink transmitter. By applying a constant current, these devices can be used for illumination. With fast variations of the current, the optical output varies at extremely high speeds, which is used to setup Li-Fi. During operation if the LED is on, a digital 1 is transmitted, if it's off a 0 is transmitted. Switching the LEDs on and off provides better way of transmitting data. Thus, we only require some LEDs and a controller that codes data into those LEDs and by varying the rate at which the LED's flicker [2] on the basis of the data we want to encode. This method can be further enhanced using an array of LEDs for parallel data transmission, or using mixtures of red, green and blue LEDs to alter the light's frequency with each frequency encoding a different data channel. Such advancements promise a theoretical speed of 10 Gbps – meaning one can download a full high-definition film in just 30 seconds

Keyword- Photodiod, ATMega16, LiFi, LM324,VB.net

I. INTRODUCTION

Li-Fi is a new wireless communication technology which enables a wireless data transmission through LED light. Li-Fi is based on a unique ability of solid state lighting systems to create a binary code of 1s and 0s with a LED flickering that is invisible for human eyes. Data can be received by electronic devices with photodiode [2] within area of light visibility. This means that everywhere where LEDs are used, lighting bulbs can bring not only The light but wireless Connection at the same time. With increasing demand for wireless data, lack of radio spectrum and issues with hazardous electromagnetic pollution, Li-Fi appears as a new greener, healthier and cheaper alternative to Wi-Fi. The term was first used in this context by Harald Haas in his TED [1] Global talk on Visible Light Communication. The technology was demonstrated at the 2012 Consumer Electronics Show in Las Vegas using a pair of Casio smart phones to exchange data using light of varying intensity given off from their screens, detectable at a distance of up to ten meters. In October 2011 a number of companies and industry groups formed the Li-Fi Consortium, to promote high-speed optical Wireless systems and to overcome the limited amount of radio based wireless spectrum available by exploiting a completely different part of the electromagnetic spectrum. The consortium believes it is possible to achieve more than 10 Gbps, theoretically allowing a high-definition film to be downloaded in 30 seconds. Li-Fi has the advantage of being able to be used in sensitive areas such as in aircraft without causing interference. However, the light waves used cannot penetrate walls [5].Later in 2012, Pure VLC, a firm set up to commercialize Li-Fi, will bring out Li-Fi products for firms installing LED-lighting systems. Moreover Li-Fi makes possible to have a wireless Internet in specific environments (hospitals, Airplanes etc.) where Wi-Fi is not allowed due to interferences or security considerations. Justification and objective of carrying out the research work.

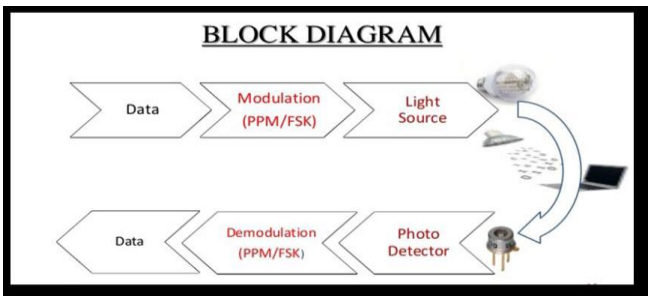

Fig.1: Block Diagram of Li-Fi Technology

Li-Fi is typically implemented using white LED light bulbs at the downlink transmitter. These devices are normally used for illumination only by applying a constant current. However, by fast and subtle variations of the current, the optical output can be made to vary at extremely high speeds. This varying property of optical current is used in Li-Fi setup. The LED lamp will hold a microchip that will do the job of processing the data.

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Fig.2: Basic Principle of Li-Fi Technology

When LED is ON microchip convert digital data in form of light. On the other end this light is detected by the photo detector. Then this light is amplified and fed to the device. If the LED is ON, transmit a digital 1, if it's OFF you transmit a digit 0.

II. SOFTWARE DEVELOPMENT OF LI-FI TECHNOLOGY

a. DESIGN OF RECEIVER AND TRANSMITTER

- Software used are: -
  1. VS.2010
  2. PCB Artist

- Language Used: -
  1. VB .net
  2. Embedded 'C'

- **EMBEDDED C:**

Embedded C is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different embedded systems. It includes a no. of features not available in normal C, such as, fixed – point arithmetic, name address spaces and basic I/O hardware addressing. Embedded C use most of the syntax and semantics of standard C, ex., main () function, variable definition, data type declaration, conditional statements (if, switch. Case), loops (while, for), functions, arrays and stings, structures and union, bit operation, macros, etc. During infancy years of microprocessor based system, programs were developed using assemblers and fused into the EPROMS. There used to be no mechanism to find what the program was doing. LEDs, switches, etc. were used to check correct execution of the program. Some 'very fortunate' developer had in circuit stimulators (ICEs), but they were too costly and were not quite reliable as well. As time progressed, use Of microprocessor – specific assembly – only as the programming languages reduced and embedded systems moved on to C as the embedded programming language of choice.

- **VB .NET:**

Visual Basic . NET is multi-paradigm, object-oriented programming language, implemented on the .NET Framework. Microsoft launched VB.Net in 2002 as the successor to its original visual basic Language. Framework and common language runtime with the productivity benefits that are the hallmark of Visual Basic. Visual Basic are programming language designed by Microsoft for creating a veriety of applications that run on the .NET

A. ALGORITHM

STEP 1: - START

STEP 2: - Define Device A and device B

STEP 3: - Make connections between device A and device B using hardware H

STEP 4: - Input the data as "Hello Sir How are You" in device A

STEP 5: - Data is send or transmitted to the hardware H

STEP 6: - Hardware convert data into binary format

If LED is ON data 1 is transmitted to device B

If LED is OFF data 0 is transmitted to device B

STEP 7: - Data is transmitted to device B through hardware H with the help of light

STEP 8: - "Hello Sir How are You" is displayed as output on device B

STEP 9: - STOP

B. CODING FOR MICROCONTROLLER

```
#include<avr/io.h>
#include<util/delay.h>
#include<lcd.h>
void main ()
{
lcd_init ();
init_uart ();
DDRA=0b00000000;
PORTA=0b11111111;
DDRC=0b11111111;
PORTC=0b00000000;
lcd_clrscr ();
lcd_goto (0,1);
lcd_prints (" Li - Fi ");
lcd_goto (0,2);
lcd_prints (" Technology ");
char rec;
_delay_ms (50);
while (1)
{
rec=uart_rec ();
////////////////Capital Letter//////////////////////
if (rec==' ')
{
lcd_clrscr ();
lcd_goto (0,1);
lcd_prints (" ");
_delay_ms (50);
uart_send (' ');
```

```
_delay_ms (50);
_delay_ms (500);
sbi (PORTC, PC6);
sbi (PORTC, PC0);
cbi (PORTC, PC1);
}
if (rec=='A' || PINA==0b11111110)
{
lcd_clrscr ();
lcd_goto (0,1);
lcd_prints("A");
_delay_ms (50);
uart_send('A');
_delay_ms (50);
_delay_ms (500);
sbi (PORTC, PC6);
sbi (PORTC, PC0);
cbi (PORTC, PC1);
}
if(rec=='Z')
{
lcd_clrscr ();
_goto (0,1);
_prints("Z");
_delay_ms (50);
uart_send('Z');
_delay_ms (50);
_delay_ms (500);
sbi (PORTC, PC0);
cbi (PORTC, PC1);
}
//////////////////////Small Letter///////////////
if(rec=='a')
{
lcd_clrscr ();
lcd_goto (0,1);
lcd_prints("a");
_delay_ms (50);
uart_send('a');
_delay_ms (50);
_delay_ms (500);
sbi (PORTC, PC0);
cbi (PORTC, PC1);
}
if(rec=='z')
{
lcd_clrscr ();
lcd_goto (0,1);
lcd_prints("z");
_delay_ms (50);
uart_send('z');
_delay_ms (50);
delay_ms (500);
sbi (PORTC, PC0);
cbi (PORTC, PC1);
}
//////////////////////Number////////////////////////////////
if (rec=='1'
{
lcd_clrscr ();
lcd_goto (0,1);
lcd_prints ("1");
_delay_ms (50);
uart_send ('1');
_delay_ms (50);
_delay_ms (500);
sbi (PORTC, PC0);
cbi (PORTC, PC1);
}
if(rec=='0')
{
lcd_clrscr ();
lcd_goto (0,1);
lcd_prints ("0");
_delay_ms (50);
uart_send ('0');
_delay_ms (50);
_delay_ms (500);
sbi (PORTC, PC0);
cbi (PORTC, PC1);
}
}
}
```

III. DATA FLOW CHARTS

A. TRANSMITTER SIDE FLOW CHART

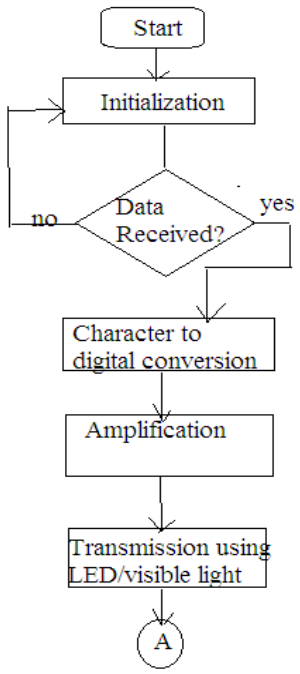

Fig.3: Flow Chart of Transmitter side

B. RECEIVER SIDE FLOW CHART

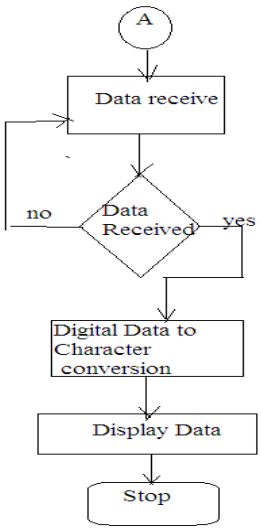

Fig.4: Flow Chart of Receiver side

C. DATA FLOW DIAGRAM OF LI-FI DATA TRANSMISSION

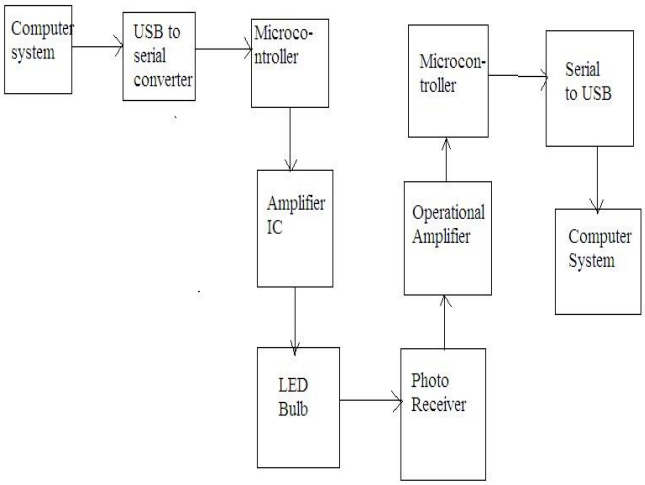

Fig.5:Data Flow Diagram Of Li-Fi Data Transmission

IV. RESULT

A. Li-Fi TRANSMITTER

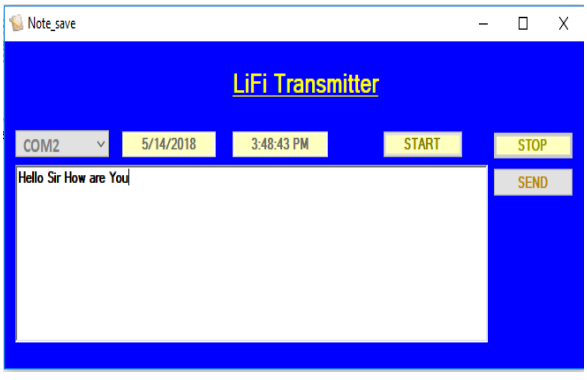

Fig.6: Screen Shot of Li-Fi Transmitter

B. Li-Fi RECEIVER

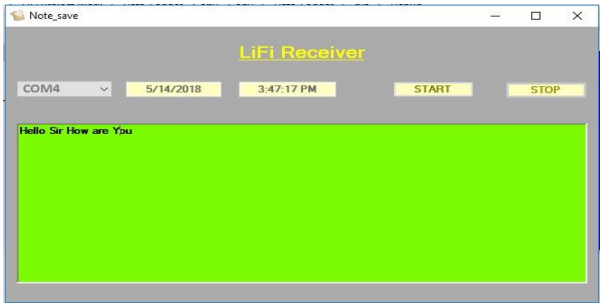

Fig.7: Screen Shot of Li-Fi Receiver

V. CONCLUSION & FUTURE SCOPE

By using Li-Fi technology information can be transmitted and received at very high rates with simply turning on and off of the LEDs. Here LED bulb is used for transmitting the data and photodiode is used to receive that data.. If Li-Fi technology can be put into practical use, every bulb can be used something like a Wi-Fi hotspot to transmit wireless data and we will proceed toward the cleaner, greener, safer and brighter future. The concept of Li-Fi is currently attracting a great deal of interest, not least because it may offer a genuine and very efficient alternative to radio-based wireless. As a growing number of people and their many devices Access wireless internet, the airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, high-speed signal. This may solve issues such as the shortage of radio-frequency bandwidth and also allow internet where traditional radio based wireless isn't allowed such as aircraft or hospitals. One of the shortcomings however is that it only work in direct line of sight.

Now a day the Li-Fi concept is great deals of the internet, because of provides alternative effected to living being using the wireless device of radio spectrum. There are numerous number of applications in light fidelity. Researchers are developing micron sized LEDs which flicker on and off 1000 times faster than larger LEDs. They provide faster data transfer and also take up less space. Li-Fi is still in its incipient stages and thus offers tremendous scope for future research and innovation.

VI. REFERENCES

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