Lifi: The Library Mobile Hotspot

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Abstract**—***Wireless communication plays a crucial role in the development of today's technology. As the number of users increases, the main problem we face during data transfer is security, data loss, speed reduction and time consumption. In order to overcome these problems, this project proposes Light Fidelity(Li-Fi). It is a new technique of transferring secured data using lights. This application is planned to be developed in a digital library. LED has been used in the transmitting end for a single mode transmission. Data can be transferred from one PC to another PC through light. Readers need only a laptop or a Tablet to view the books. The laptop/Tablet will be connected with USB device for receiving the files from the server. These received files are also converted into audio suitable to aid the visually challenged people. The text to speech conversion is done using C# as coding language, ASP.NET as front end and SQL Server as backend.*

Keywords**—** *VLC, Li-Fi, LED, Security , Bit rate, Serial port, Text to Speech conversion .*

I. INTRODUCTION

LiFi is similar to WiFi. Unlike WiFi which uses radio waves as transferring medium, here we use visible light as the medium to transfer data. The most important problem in WiFi is the security and data breaching. In case of high secured data transfer there are various limitations like, one to one communication or need one authorized person to validate the secured data and is time consuming. In LiFi the data transfer rate will be 9600 bits per second that is more time saving. In early research the light will blink and flash during the time of data transfer that may irritate to the user during the data transfer. Also the upload speed does not match with the download speed, so low data transfer rate occurs. The data is transferred by continuously emitting the light without blinking also upload speed is equal to the download speed hence increasing the transfer rate.

II. BLOCK DIAGRAM

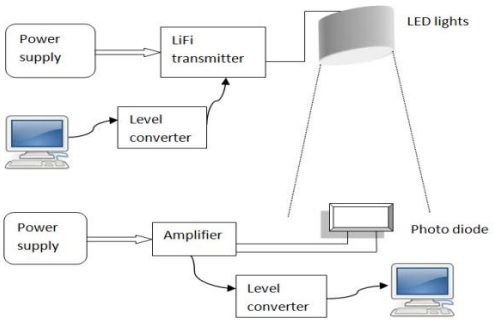

Fig 1:Block Diagram

III. IMPLEMENTATION OF LI-FI

1. POWER SUPPLY:

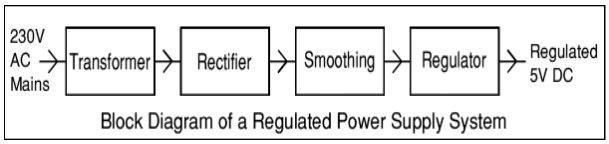

Fig 2:Block diagram of regulated power supply

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC.Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (230V in UK) to a safer low voltage.The input coil is called the primary and the output coil is called the secondary.There is no electrical connection between the two coils; instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core. Transformers waste very little power so the power out is (almost) equal to the power in. Note that as voltage is stepped down current is stepped up.The ratio of the number of turns on each coil, called the turn's ratio, determines the ratio of the voltages. A step-down transformer has a large number of turns on

its primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage.

Turns ratio=Vp/Vs=Nn/Ns and Power out=Power in

Vs*Is=Vp * Ip

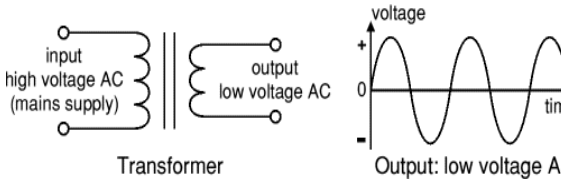

Fig 3:Stepdown transformer and its waveform

1.1 Bridge rectifier:

A bridge rectifier can be made using four individual diodes, but it is also available in special packages containing the four diodes required. It is called a full-wave rectifier because it uses the entire AC wave (both positive and negative sections). 1.4V is used up in the bridge rectifier because each diode uses 0.7V when conducting and there are always two diodes conducting, as shown in the diagram below. Bridge rectifiers are rated by the maximum current they can pass and the maximum reverse voltage they can withstand (this must be at least three times the supply RMS voltage so the rectifier can withstand the peak voltages).

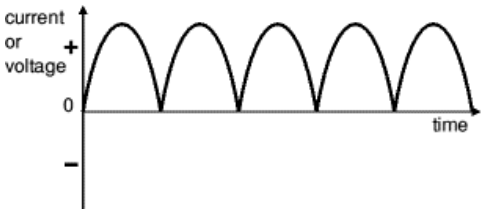

Fig 4:Waveform of rectified signal

1.2 Smoothing:

Smoothing is performed by a large value electrolytic capacitor connected across the DC supply to act as a reservoir, supplying current to the output when the varying DC voltage from the rectifier is falling. The diagram shows the unsmoothed varying DC (dotted line) and the smoothed DC (solid line). The capacitor charges quickly near the peak of the varying DC, and then discharges as it supplies current to the output.

1.3 Regulator:

Voltage regulator ICs are available with fixed (typically 5, 12 and 15V) or variable output voltages. They are also rated by the maximum current they can pass. Negative voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current ('overload protection') and overheating ('thermal protection').The LM78XX series of three terminal regulators is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation, eliminating the distribution problems associated with single point regulation. The voltages available allow these regulators to be used in logic systems, instrumentation, HiFi, and other solid state electronic equipment. Although designed primarily as fixed voltage regulators these devices can beused with externalcomponents to obtain adjustable voltages and current.

2. SERIAL RS232:

In telecommunication, serial communication is the process of sending data one bit at one time, sequentially, over a communication channel or computer bus.In order to make two devices communicate, whether they are desktop computers, microcontrollers, or any other form of integrated circuit, we need a method of communication and an agreed-upon language. The most common form of communication between electronic devices is serial communication. Communicating serially involves sending a series of digital pulses back and forth between devices at a mutually agreed-upon rate. The sender sends pulses representing the data to be sent at the agreed-upon data rate, and the receiver listens for pulses at that same rate. This is what's known as asynchronous serial communication. There isn't one common clock in asynchronous serial communication; instead, both devices have their own clock and agree on a rate to which to set their clocks.

Now, since the data rate is 9600 bits per second (sometimes called 9600 *baud*), the receiver will continually read the voltage that the sender is putting out, and every 1/9600th of a second, and it will interpret that voltage as a new bit of data. If the voltage is high (+5V in the case of Wiring/Arduino.), it will interpret that bit of data as a 1. If it is low (0V in the case of Wiring/Arduino), it will interpret that bit of data as a 0. By interpreting several bits of data over time, the receiver can get a detailed message from the sender at 9600 baud, Let's look at a byte of data being exchanged. Imagine we want to send the number 90 from one device to another. First, we have to convert the number from the decimal

representation 90 to a binary representation. In binary, 90 are 01011010.

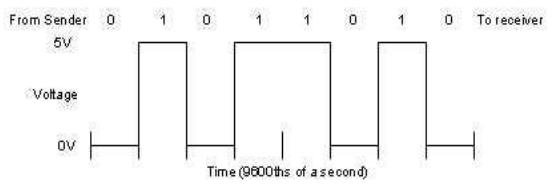

Fig 5:Transmission of binary digits

From this diagram, both devices also have to agree on the order of the bits. Usually the sender sends the highest bit (or most significant bit) first in time, and the lowest (or least significant bit) last in time. As long as we have an agreed upon voltage, data rate, and order of interpretation of bits, we can exchange any data we want serially.

For the data transmission above, a high voltage indicates a bit value of 1, and a low voltage indicates a voltage of 0. This is known as true logic. Many serial protocols use inverted logic, meaning that a high voltage indicates logic 0, and a low voltage indicates logic 1.

3. MAX 232 :

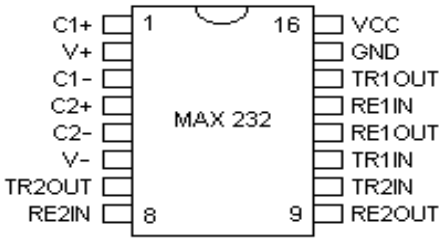

Fig 6:Pin diagram of MAX232

The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.

The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case.

The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 V TTLlevels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V.The later MAX232A is backwards compatible with the original MAX232 but may operate at higher baud rates and can use smaller external capacitors – 0.1 µF in place of the 1.0 µF capacitors used with the original device.

When a MAX232 IC receives a TTL level to convert, it changes a TTL Logic 0 to between +3 and +15V, and changes TTL Logic 1 to between -3 to -15V, and vice versa for converting from RS232 to TTL. The RS232 Data Transmission voltages at a certain logic state are opposite from the RS232 Control Line voltages at the same logic state.

IV. SOFTWARE

4.1.TEXT TO SPEECH CONVERSION:

Speech synthesis is the artificial production of human speech. A computer system used for this purpose is called a speech computer or speech synthesizer, and can be implemented in software or hardware products. A text-to-speech (TTS) system converts normal language text into speech; other systems render symbolic linguistic representations like phonetic transcriptions into speech. Synthesized speech can be created by concatenating pieces of recorded speech that are stored in a database. Systems differ in the size of the stored speech units; a system that stores phones or diphones provides the largest output range, but may lack clarity. For specific usage domains, the storage of entire words or sentences allows for high-quality output. Alternatively, a synthesizer can incorporate a model of the vocal tract and other human voice characteristics to create a completely "synthetic" voice output. A text-to-speech system (or "engine") is composed of two part a front-end and a back-end.

4.2 FRONT END:

The .NET Framework (pronounced dot net) is a software framework developed by Microsoft that runs primarily on Microsoft Windows. It includes a large library and provides language interoperability (each language can use code written in other languages) across several programming languages. Programs written for the .NET Framework execute in a software environment (as contrasted to hardware environment), known as the Common Language Runtime (CLR), an application virtual machine that provides services such as security, memory management, and exception handling. The class library and the CLR together constitute the .NET Framework. The .NET Framework's Base Class Library provides user interface, data access, database connectivity, cryptography, web application

development, numeric algorithms, and network communications. Programmers produce software by combining their own source code with the .NET Framework and other libraries. The .NET Framework is intended to be used by most new applications created for the Windows platform. Microsoft also produces an integrated development environment largely for .NET software called Visual Studio.

4.3 COMMON LANGUAGE RUNTIME

The Common Language Runtime (CLR) is the virtual machine component of Microsoft's .NET framework and is responsible for managing the execution of .NET programs. In a process known as just-in-time compilation, the compiled code is converted into machine instructions that, in turn, are executed by the computer's CPU. The CLR provides additional services including memory management, type safety and exception handling. All programs written for the .NET framework, regardless of programming language, are executed by the CLR. It provides exception handling, garbage collection and thread management. CLR is common to all versions of the .NET framework.

The CLR is Microsoft's implementation of the Common Language Infrastructure (CLI) standard. The .NET Framework provides a run-time environment called the common language runtime, which runs the code and provides services that make the development process easier. Compilers and tools expose the common language runtime's functionality and enable you to write code that benefits from this managed execution environment. Code that you develop with a language compiler that targets the runtime is called managed code; it benefits from features such as cross-language integration, cross-language exception handling, enhanced security, versioning and deployment support, a simplified model for component interaction, and debugging and profiling services.

To enable the runtime to provide services to managed code, language compilers must emit metadata that describes the types, members, and references in your code. Metadata is stored with the code; every loadable common language runtime portable executable (PE) file contains metadata. The runtime uses metadata to locate and load classes, lay out instances in memory, resolve method invocations, generate native code, enforce security, and set run-time context boundaries.

The runtime automatically handles object layout and manages references to objects, releasing them when they are no longer being used. Objects whose lifetimes are managed in this way are called managed data. Garbage collection eliminates memory leaks as well as some other common programming errors. If your code is managed, you can use managed data, unmanaged data, or both managed and unmanaged data in your .NET Framework application. Because language compilers supply their own types, such as primitive types, you might not always know (or need to know) whether your data is being managed.

The common language runtime makes it easy to design components and applications whose objects interact across languages. Objects written in different languages can communicate with each other, and their behaviors can be tightly integrated. For example, you can define a class and then use a different language to derive a class from your original class or call a method on the original class. You can also pass an instance of a class to a method of a class written in a different language. This cross-language integration is possible because language compilers and tools that target the runtime use a common type system defined by the runtime, and they follow the runtime's rules for defining new types, as well as for creating, using, persisting, and binding to types.

As part of their metadata, all managed components carry information about the components and resources they were built against. The runtime uses this information to ensure that your component or application has the specified versions of everything it needs, which makes your code less likely to break because of some unmet dependency. Registration information and state data are no longer stored in the registry where they can be difficult to establish and maintain. Instead, information about the types you define (and their dependencies) is stored with the code as metadata, making the tasks of component replication and removal much less complicated.

Language compilers and tools expose the runtime's functionality in ways that are intended to be useful and intuitive to developers. This means that some features of the runtime might be more noticeable in one environment than in another. How you experience the runtime depends on which language compilers or tools you use. For example, if you are a Visual Basic developer, you might notice that with the common language runtime, the Visual

Basic language has more object-oriented features than before.

4.4 Microsoft SQL Server:

It is a relational database management system developed by Microsoft Inc. As a database, it is a software product whose primary function is to store and retrieve data as requested by other software applications, be it those on the same computer or those running on another computer across a network (including the Internet). There are at least a dozen different editions of Microsoft SQL Server aimed at different audiences and for different workloads (ranging from small applications that store and retrieve data on the same computer, to millions of users and computers that access huge amounts of data from the Internet at the same time). Its primary query languages are T-SQL and ANSI SQL

SQL Server 7.0 and SQL Server 2000 included modifications and extensions to the Sybase code base, adding support for the IA-64architecture. By SQL Server 2005 the legacy Sybase code had been completely rewritten. Since the release of SQL Server 2000, advances have been made in performance, the client IDE tools, and several complementary systems that are packaged with SQL Server 2005. These include:

- an extract-transform-load (ETL) tool (SQL Server Integration Services or SSIS)
- a Reporting Server
- an OLAP and data mining server (Analysis Services)
- several messaging technologies, specifically Service Broker and Notification Services

4.5 C#:

C# has a unified type system. This unified type system is called Common Type System (CTS). A unified type system implies that all types, including primitives such as integers, are subclasses of the class. For example, every type inherits a method. C# is a modern, general-purpose object oriented programming language developed by Microsoft and approved by Ecma and ISO. C# was developed by Anders Hejlsberg and his team during the development of .Net Framework. C# is designed for Common Language Infrastructure (CLI), which consists of the executable code and runtime environment that allows use of various high-level languages to be used on different computer platforms and architectures.

V. CONCLUSION

The LED-to-LED communication provides a unique opportunity to provide communication capabilities that is not noticed. It is practically possible to transmit higher quantity of data along with high quality using visible light as a medium. We are transferring data via one computer to another in a room using VLC system. On the basis of transmission of data in high speed, not penetrating outside of wall, low cost of LED, economical and easily accessible to all and etc., this lot of features of this technology can be used to replace the existing RF based Wi-Fi system by the visible light technology(LiFi).

VI. REFERENCES

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