

Li-Fi Based Audio Communication and Device Switching Using Web Server

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Abstract—Powerful microcontrollers are used as parts of most home and office appliances of today. Integrating web servers to these intelligent devices will aid in controlling them over the Internet and also in creating effective user interfaces in the form of web pages. Assigning multiple functionalities to a single button on an appliance help manufacturers economize user interfaces, but, this can easily create confusion for the users. Since the cost of web-based interfaces is considerably low, they can be used to provide the infrastructure for the design of simple and more user-friendly interfaces for household appliances. Also, a web page based interface is much easier to change, when needed, as compared to a hardware interface. This paper presents a novel approach to control devices with embedded web servers over the Internet and to form device networks such that their components can make use of one another's services and functions while improving the user interfaces. The main benefits of this approach include its lightweight design, automatic configuration, and, utilization of widely available and tested network protocols of TCP/IP and HTTP. The validity of the approach has been verified through a prototype system working with real appliances. In order to control the devices on the other hand by using light fidelity and a server based technology. This is mainly designed to control the devices which needs complete monitoring throughout the day hence in order to achieve this we use light fidelity (Li- Fi). Li-Fi would use transceiver-fitted LED lamps that can light a room as well as transmit and receive information and on the other hand that is to transfer the data on a longer distance we are using a server application which decodes the data and sends it in a relative format to the receiver side where again it is decoded and this information is helpful in controlling the devices.

I. INTRODUCTION

A web server is an information technology that processes requests via HTTP, the basic network protocol used to distribute information on the World Wide Web. The term can refer either to the entire computer system, an appliance or specifically to the software that accepts and supervises the HTTP requests. The primary function of a web server is to store, process and deliver web pages to clients. The communication between client and server takes place using the Hypertext Transfer Protocol (HTTP). Pages delivered are most frequently HTML documents, which may include images, style sheets and scripts in addition to text content. A user agent, commonly a web browser or web client, initiates communication by making a request for a specific action using HTTP and the server responds with the necessary action. Communication between the web server and the device to be controlled takes place using Li-Fi which uses an LED for transmitting information.

An LDR with good response to visible light acts as the receiving element at the Li-Fi receiver. Any domestic electrical appliance can be connected as a load so that it can be turned controlled.

II. PROBLEM STATEMENT

At present, manufacturers economize user interfaces by assigning multiple functionalities to a single button on the appliance. But, this can create confusion for users. Web-based interfaces can be used to provide simple cost-effective and user-friendly interfaces for household appliances. A web page based interface is easier to change as compared to a hardware interface. Widely available and tested network protocols such as TCP/IP and HTTP can be utilized. Radio waves are harmful for human beings as they penetrate the body and may cause mutation. Therefore, Wi-Fi is not safe to be used in hospitals and other various health care sectors. In urban areas, Wi-Fi networks become congested and there is a lot of noise and interference in the signals. RF signals can penetrate through walls and hence they can be easily hacked. Radio waves cannot be used underwater due to absorption by sea water. Li-Fi technology is something that can be of immense use in such situations. Currently exists the Wi-Fi Technology. It allows computers, some mobile phones, and other devices to communicate over a wireless signal. The router is the key piece of equipment in a wireless network. Only the router is physically connected to the internet by an Ethernet cable. The router then broadcasts the high-frequency radio signal which carries data to and from the internet. The adapter in whatever device you are using both picks up and reads the

signal from the router, and also sends data back to your router and on to the internet, an up-stream and downstream activity. To make up for the Wi-Fi disadvantages a new system is used called Light-based wireless communication, coined as Li-Fi.

III. BLOCK DIAGRAMS

Below are the block diagrams of TXR and RXR

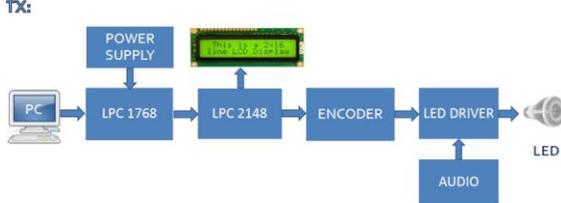


Fig. 1. [Block Diagram 1]Block Diagram of Transmitter

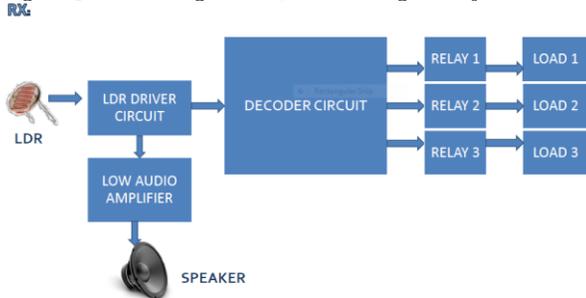


Fig. 2. [Block Diagram 2]Block diagram of receiver

IV. METHODOLOGY

Web server is implemented using CORTEX M3 LPC 1768 processor. The client accesses the web page based interface available on the web server and submits the commands over the Internet. The web server decodes these commands and passes them on to the Li-Fi transmitter using DTMF. Li-Fi transmitter uses a 1 watt LED driven by constant current. The LED is switched at high speeds to transmit data. An LDR (Light dependent resistor) with good response to visible light acts as the receiving element at the Li-Fi receiver. Any domestic electrical appliance can be connected as a load so that it can be controlled. All parameters are displayed on an LCD display.

V. LIFI CONSTRUCTION

The PCB controls the electrical inputs and outputs of the lamp and houses the microcontroller used to manage different lamp functions. A RF (radio-frequency) signal is generated by the solid-state PA and is guided into an electric field about the bulb. The high concentration of energy in the electric field vaporizes the contents of the bulb to a plasma state at the bulbs center; this controlled plasma generates an intense source of light. All of these subassemblies are

contained in an aluminum enclosure. Fig. 2. Block diagram of Li-Fi sub-assemblies The bulb sub-assembly is the heart of the Li-Fi emitter. It consists of a sealed bulb which is embedded in a dielectric material.

This design is more reliable than conventional light sources that insert degradable electrodes into the bulb. The dielectric material serves two purposes. It acts as a waveguide for the RF energy transmitted by the PA. It also acts as an electric field concentrator that focuses energy in the bulb. The energy from the electric field rapidly heats the material in the bulb to a plasma state that emits light of high intensity and full spectrum. Figure 3 shows the bulb sub-assembly. There are various inherent advantages of this approach which includes high brightness, excellent color quality and high luminous

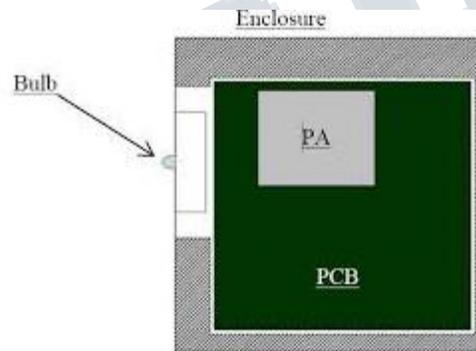


Fig. 3.

Efficacy of the emitter in the range of 150 lumens per watt or greater. The structure is mechanically robust without typical degradation and failure mechanisms associated with tungsten electrodes and glass to metal seals, resulting in useful lamp life of 30,000+ hours. In addition, the unique combination of high temperature plasma and digitally controlled solid state electronics results in an economically produced family of lamps scalable in packages from 3,000 to over 100,000 lumens

VI. LIFI WORKING

A new generation of high brightness light-emitting diodes forms the core part of light fidelity technology. The logic is very simple. If the LED is on, a digital 1 is transmitted. If the LED is off, a digital 0 is transmitted. These high brightness LEDs can be switched on and off very quickly which gives us a very nice opportunities for transmitting data through light The working of Li-Fi is very simple. There is a light emitter on one end, for example, an LED, and a photo detector (light sensor) on the other. The photo detector registers a binary one when the LED is on; and a binary zero if the LED is off. To build up a message, flash the LED numerous times or use an array of LEDs of

perhaps a few different colors, to obtain data rates in the range of hundreds of megabits per second.

VII. INTRODUCTION TO WEB SERVER

Client/Server computing is a processing environment in which clients share the resources placed at computers called servers. A web server is an information technology that processes requests via HTTP (Hypertext Transfer Protocol), the basic network protocol used. The primary function of a web server is to store, process and deliver web pages to clients. The communication between client and server takes place using the Hypertext Transfer Protocol (HTTP). Pages delivered are HTML (Hypertext Markup Language) documents, which include images, style sheets and scripts in addition to text content. A user agent, called a web browser or web client, initiates communication by making a request for a specific action using HTTP and the server responds with the necessary action.

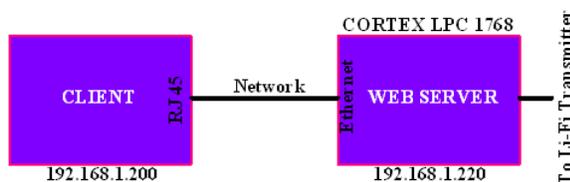


Fig. 4. Web Server Concept Illustration fig

VIII. WEB SERVER CONCEPT

As shown in Fig. 3.1, the client accesses the web page based user-friendly interface available on the web server by sending its IP address. Class C IP address 192.168.1.200 and 192.168.1.220 is used for the client and server respectively. The client submits a query to know the present status of the load and to control the device. TCP/IP and HTTP are the main protocols used for communication between the client and the server. The server decodes the commands coming from the client and passes them on to the Li-Fi transmitter using DTMF signaling. Web server is implemented using CORTEX M3 LPC 1768 processor.

IX. OVERVIEW OF WEB BASED LIFI TECHNOLOGY

A web server is an information technology that processes requests via HTTP, the basic network protocol used to distribute information on the World Wide Web. The term can refer either to the entire computer system, an appliance or specifically to the software that accepts and supervises the HTTP requests. The primary function of a web server is to store, process and deliver web pages to clients. The communication between client and server takes place using the Hypertext Transfer Protocol (HTTP). Pages

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X. CONCLUSION

The project can be extended to monitor and control the devices throughout the day requiring two-way communication. Methods to take care of interference from external light source and provide very high speed uninterrupted data transfers can be developed.

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