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# Li-Fi Communication System

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**Abstract -** Now-a-days wireless communication uses radio waves. Spectrum is the one of the most essential requirement for wireless communication. With the advancement in technology and the number of users, the existing radio-wave spectrum fails to cater to this need. To resolve the issues of scalability, availability and security, we have come up with the concept of transmitting data wirelessly through light using LED‘s. An indoor visible data transmission system utilizing LEDs is proposed. In this system, these devices are used not only for illuminating rooms, but also for an optical wireless communication system. Also with this, our project also has audio system that is well suited for use in a small confined area with many audio transmitters broadcasting different audio signals.

The transmitter of the proposed system is constructed using visible light LEDs, in which current fed to the LEDs is modulated and encoded with audio information or messages. The audio system provides audio signal transmission in a free space optical link. The receiver, combined with an ear jack, is located at some distance from the transmitters. The handheld receiver is designed to demodulate the optically transmitted audio information and reproduce the messages with the ear jack. For modulating emission of LEDs, an oscillator is used to vary the frequency of on/off periods of the LEDs. The frequency of flicker is high enough to be indistinguishable by human eye and hence the LEDs appear to be constantly illuminated.

**Key Words:** Android, Robot, Bluetooth, Robotic control, Wi-Fi, Surveillance, Artificial Intelligence, Ar-duino **Glossary:**

Artificial intelligence (AI) is the intelligence exhibited by machines or software. It is an aca-demic field of study which generally studies the goal of emulating human-like intelligence, though other variations of AI such as strong-AI and weak-AI are also studied. Major AI re-searchers and textbooks define this field as "the study and design of intelligent agents", where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success.

Arduino

Arduino is an open-source computer hardware and software company, project and user commu-nity that designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world. [1] Arduino boards may be purchased preassembled, or as do-it-yourself kits; at the same time, the hardware design information is available for those who would like to assemble an Arduino from scratch

## 1. INTRODUCTION

Li-Fi consists of both digital and audio data transmission. In this, an indoor visible data transmission system utilizing LED lights is proposed. This system of communication using Light-Fidelity can be used in critical environments, such as aircrafts or hospitals, where radio frequency (RF) based transmissions are usually prohibited or refrained to avoid interference with critical systems. Moreover, a huge amount of unregulated bandwidth is available at infra-red and visible light frequencies. This system rapidly and subtly fluctuates the intensity of LEDs to create a binary code (on=1, off=0) in a way that is imperceptible to the human eye. The light then hits a sensitive photo sensor that decodes the data. It also has an audio system that relies on visible light for transmitting audio information to a receiver located some distance away from the system. The basic idea is based on the fact that the visible light
emitted by the LEDs can be modulated and encoded with audio information. LEDs can then be used as a communication device for the transmission of audio information. The proposed system depends on a direct line of sight between the transmitter and the receiver. The proposed system allows the user to hear from one
audio source when the receiver is pointing at that appliance. Multiple users can also work in the same compact environment and the problem due to noise nuisance can be greatly reduced.

## 2. OVERVIEW OF LI-FI

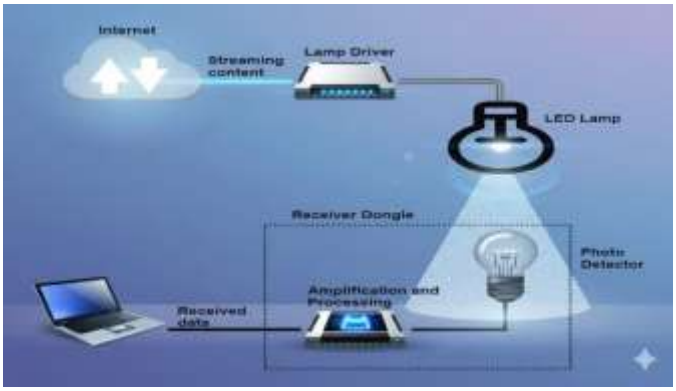
Li-Fi stands for ‗LIGHT FIDELITY‘. Li-Fi is transmission of data through illumination by taking the fiber out of fiber optics by sending data through a LED light bulb that varies in intensity faster than the human

eye can follow. Li-Fi is the term some have used to label the fast and cheap wireless-communication system, which is the optical version of Wi-Fi. Light reaches nearly everywhere so communication can also go along with light easily. Light Fidelity is a branch of optical wireless communication which is an emerging technology. By using visible light as transmission medium, Li-Fi provides wireless indoor communication. The bit rate achieved by Li-Fi cannot be achieved by Wi-Fi. Prof. Dr. Herald Haas, the professor of mobile communications at the University of Edinburgh, UK, first time publically displayed the proof of Light Fidelity(Li-Fi), a method of Visible Light communication(VLC). Li-Fi is the transfer of data through light by taking fiber out of fiber optics and sending data through LED light.

Li-Fi technology provides transmission of data through illumination by sending data through an LED light bulb that varies in intensity faster than the human eye can follow. Wi-Fi is great for general wireless coverage within buildings, whereas Li-Fi is ideal for high density wireless data coverage in confined area and for relieving radio interference issues. Li-Fi provides better bandwidth, efficiency, availability and security than Wi-Fi and has already achieved blisteringly high speed in the lab. By leveraging the low-cost nature of LEDs and lighting units there are many opportunities to exploit this medium, from public internet access through street lamps to auto-piloted cars that communicate through their headlights. Haas envisions a future where data for laptops, smart phones, and tablets will be transmitted through the light in a room.

## 3. DESIGN OF LI-FI

Li-Fi architecture consists numbers of Led bulbs or lamps, many wireless devices such as PDA, Mobile Phones, and laptops. Important factors we should consider while designing Li-Fi as following: Presence of Light Line of Sight(Los) For better performance use fluorescent light & LED As shown in figure streaming content must have proper integration with server & internet network, so that it is easily possible to work efficiently. The heart of this technology is a new generation high brightness LED‘S which VISIBLE LIGHT COMMUNICATION is. These LED‘S varies in intensity (that is gets on and off) so fast that human eye cannot detect it. If LED is on , then we transmit a digital signal 1,and if the LED is off , then we transmit a digital signal 0.A controller is connected at the back side of these LED bulbs to code data to these LED‘s.




## 4. WORKING

A Li-Fi communication system consists of a transmitter and a receiver, with the transmitter converting data into light pulses and the receiver converting them back into electrical signals. The transmitter includes a power source, a data encoder, and an LED that is modulated by an LED driver to produce light pulses representing data. The receiver has a photodiode to detect the light pulses, and an amplifier and decoder to process the signals back into usable data.

Block diagram of digital data transmission is given in the fig. This part mainly divided into two sections one is transmitter card unit and another one is receiver unit. The transmitter card unit has internal memory to store the digital codes. The data can be entered through keyboard, this data is displayed in the LCD. The controller send it to buffer amplifier through serial port and send it to receiver part through IR transmitter. The receiver part receives the data from photo receiver and sends it to microcontroller through serial port. Controller stores it in the memory and also it display the data in the LCD display. This is how the digital data can be transmitted.

## 5. METHODOLOGY

Li Fi is an emerging technology based on a wireless communication method: using visible light to transmit data. Since the Li Fi debut in 2011, Li Fi (also known by light fidelity) is the predominant light communication technology for bidirectional, high data rate transmission. Li Fi is typically described as being implemented through existing luminaries, or light-emitting sources designed primarily for illuminating spaces. The high-level concept is to use visible light from an LED light bulb to communicate data by modulating the visible light at imperceptible frequencies to human vision. As light

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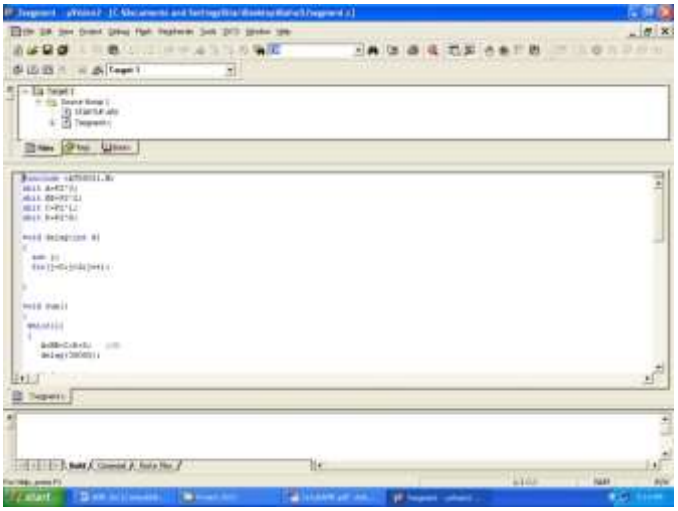
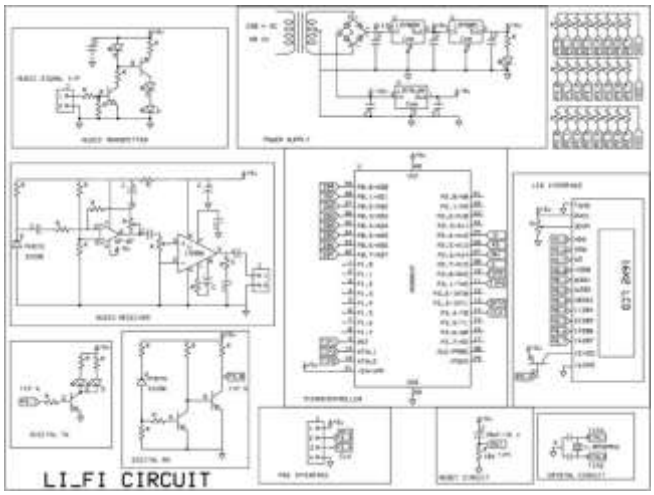
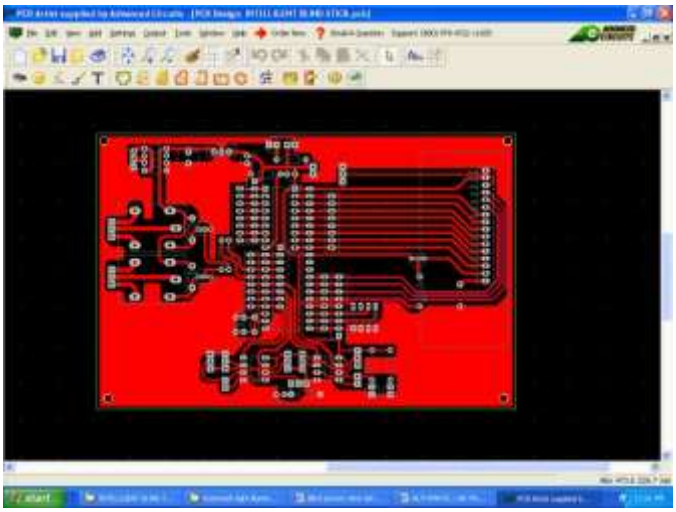
sources flicker faster than humans can see already due to supplied power, the idea is to intentionally flicker light sources to send data. Replacing a power supply-related frequency with a set modulation scheme turns (potentially) any standard light source into a data-transmitting node. The main idea of adapting luminaries into high-density data transceivers has attracted the attention of several industries, including industrial, medical, aerospace, defense, and communications. Some manufacturers are considering miniaturizing the systems to operate on personal electronics devices. Regardless of size or end application, the signal chain elements required are consistent





## 6. CONCLUSION

The whole concept is very good and allows the user to hear from one audio source when the receiver is pointing at that appliance. Multiple users can also work in the same compact environment and the problem due to noise nuisance can be greatly reduced.

## 7. FUTURE SCOPE

The Li-Fi Market was valued at USD 295.4 million in 2020 and is expected to reach USD 4157.38 million by 2026, at a CAGR of 69.7% over the forecast period 2021 - 2026. Li-Fi is a disruptive technology that is poised to impact many industries. The technology can unlock the potential of IoT, driving Industry 4.0 applications, and lead to the upcoming light-as-a-service (LaaS) in the lighting industry. The CAGR of wireless traffic has been 60% during the last decade. This growth is expected to sustain for the next 10 to 15 years, which, in the current scenario, is a reasonable assumption, due to the advent of Internet-of-Things and machine type communication (MTC). It corresponds to a demand of 12,000 times the current bandwidth, assuming the same spectrum efficiency.

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