**SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION**

***(Declared as Deemed to be University Under Section 3 of the UGC Act, 1956***

***Approved by AICTE, Accredited by NBA, NAAC ‘A+’ Grade)***

**AGALKOTE, TUMAKURU – 572107 KARNATAKA**

****

**Mini project**

**On  
 LI-FI based data transfer**

**Submitted by:**

**Srusthi.G (22ET045)**

**Thejaswini.S (22ET049)**

**Trupti.R (22ET050)**

**BACHELOR OF ENGINEERING**

**IN**

**ELECTRONICS AND TELECOMMUNICATION ENGINEERING**

**Under the guidance of:**

**Dr. Puneeth Kumar. D.N**

asso.professor

****

**SRI SIDDHARTHA INSTITUTE OF TECHNOLOGY**

***(A Constituent College of Sri Siddhartha Academy of Higher Education, Approved by***

***AICTE, Accredited by NBA, NAAC ‘A+’ Grade)***

**MARALUR, TUMAKURU-572105**

**CONTENTS:**

**Abstract**

**Chapter 1: Introduction**

1.1 Introduction

1.2 Literature survey

1.3 Problem statement and solution

* 1. Objectives

**Chapter 2: Design and Implementation**

* 1. Block diagram

2.2Methodology

**Chapter 3: requisites**

* 1. Estimated cost

**Chapter 4: Expected output**

4.1Expected output

**Reference**

**Abstract:**

Li-Fi technology, also known as Light Fidelity (Li-Fi), refers to a fresh technology that is developed as a wireless communication system which is carrying data by visible light, but not radio wave for this purpose. This article concerns the application of data transfer using Li-Fi technology toward high-speed, secure, and non-interfering communication. In the setup, the LED lamps are utilized as the transmitter to change the light's intensity quickly in order to enact the information and also, the photodiodes are used as sensors to detect the change in light and convert them into electrical signals. Next, the communication is placed via a light source of an optical fiber or a light source. This light source shall be converted and processed into useful information. The communication is also very fast and simple. Unlike Wi-Fi using radio waves that must be decoded from the transmitter, Li-Fi realizes significantly improved data transfer rates and higher security because of the low electromagnetic interference. This project involves outlining the benefits of Li-Fi, including but not limited to: higher data transfer rates, more efficiency, and higher security which are applicable in smarter home, industrial automation, medical settings, and underwater communication. However, challenges like line of sight, limited range, and the ability to standardize still remain.

**Chapter1: Introduction**

**1.1 Introduction:**

Li-Fi technology, also known as Light Fidelity (Li-Fi), refers to a fresh technology that is developed as a wireless communication system which is carrying data by visible light, but not radio wave for this purpose. This article concerns the application of data transfer using Li-Fi technology toward high-speed, secure, and non-interfering communication. In the setup, the LED lamps are utilized as the transmitter to change the light's intensity quickly in order to enact the information and also, the photodiodes are used as sensors to detect the change in light and convert them into electrical signals. Next, the communication is placed via a light source of an optical fiber or a light source. This light source shall be converted and processed into useful information. The communication is also very fast and simple. Unlike Wi-Fi using radio waves that must be decoded from the transmitter, Li-Fi realizes significantly improved data transfer rates and higher security because of the low electromagnetic interference. This project involves outlining the benefits of Li-Fi, including but not limited to: higher data transfer rates, more efficiency, and higher security which are applicable in smarter home, industrial automation, medical settings, and underwater communication.

**1.2 Literature survey:**

Over the past decade, researchers and technologists have increasingly explored Li-Fi (Light Fidelity) as a viable alternative to traditional Wi-Fi systems. The concept was first introduced by Prof. Harald Haas in 2011 during a TED Talk, where he demonstrated that LED lights could transmit data by flickering at very high speeds. This led to a surge in interest in Visible Light Communication (VLC) as a promising area of wireless communication.

[1] Prof. Harald Haas, University of Edinburgh (2011):

In 2011, Prof. Harald Haas introduced the concept of Li-Fi during his TED talk. He demonstrated a prototype that used LED light to transmit data and stream HD video. This presentation laid the groundwork for VLC systems as a practical alternative to radio-frequency communication, highlighting their potential for high-speed, secure, and interference-free data transfer using LED lighting

[2] IEEE Journals on VLC Technology:

Recent studies published in IEEE journals demonstrated that Li-Fi systems could achieve data transmission rates exceeding 10 Gbps in laboratory conditions. Researchers employed advanced modulation techniques and MIMO configurations to enable ultra-fast, low-latency communication, supporting the technology’s potential in RF-congested environments like smart homes and industrial networks.

[3] Research on Li-Fi in Hospitals (2017):

A 2017 study examined the implementation of Li-Fi in hospitals, focusing on its non-interference with sensitive medical equipment. The research proposed a model for using Li-Fi in patient monitoring and secure staff communication. It concluded that Li-Fi served as a safe, cost-effective, and high-speed alternative to Wi-Fi in electromagnetically restricted zones.

**1.3 Problem statement:**

The ever-growing demand for wireless communication has led to the overcrowding of the radio frequency (RF) spectrum, resulting in reduced bandwidth n availability, interference issues, and security vulnerabilities. Wi-Fi, though widely used, operates on limited spectrum bands and is susceptible to hacking and signal congestion, especially in dense environments like offices, hospitals, and public areas. Moreover, RF communication is not suitable in sensitive environments such as aircraft cabins, underwater communication, and medical equipment zones, where electromagnetic interference can be hazardous or restricted.

There is a pressing need for an alternative technology that:

Operates outside the RF spectrum.

Provides high-speed, secure data transmission.

Is cost-effective and easy to implement.

Li-Fi, which uses visible light for data transmission, emerges as a viable solution. However, real-world adoption remains low due to the lack of practical demonstrations and cost-effective prototypes. This project addresses this gap by building a working Li-Fi prototype using LEDs and solar panels to transmit audio signals wirelessly—showcasing the potential of Li-Fi for safer, faster, and interference-free communication**.**

address the limitations of traditional radio frequency (RF)-based communication such as bandwidth congestion, security risks, and electromagnetic interference, this project proposes the implementation of a Li-Fi (Light Fidelity) based communication system. The solution uses visible light to transmit data between devices, making it ideal for use in RF-restricted or noise-sensitive environments.

The system consists of a transmitter circuit using a high-brightness white LED, which is modulated by an audio signal. This modulated light signal is then detected by a solar panel or photodiode receiver that converts it back into an electrical signal. After amplification, the signal is output through a speaker, completing the data transfer wirelessly through light. This setup provides a low-cost, energy-efficient, and interference-free method of communication—showcasing the feasibility and potential of Li-Fi technology for real-world applications.

**1.4 Objectives:**

1. To understand the concept and working of Li-Fi technology.
2. To compare its advantages and disadvantages with Wi-Fi.

**Chapter 2: Design and Implementation**

**2.1 Block Diagram:**

DATA SOURCE

DEVICE

OUTPUT

PHOTODIODE

RECEIVER

LIGHT

SIGNAL

LED

TRANSMITTER

**Figure 1.1: Block diagram of li-fi based data transfer**

The figure 1.1 illustrates the working principle of a Li-Fi-based data transmission system. The process begins with a data source, such as a mobile phone or audio device, which provides the original signal (e.g., music or voice). This signal is sent to the LED transmitter, which modulates the light emitted by the LED based on the variations in the input signal. This modulated light, although flickering at high speed and invisible to the human eye, carries encoded data in the form of light signals.

**2.2 Methodology:**

The methodology of this project involves the design and implementation of a basic Li-Fi system that transmits audio signals using visible light. The system is divided into two sections: a transmitter and a receiver. The transmitter section consists of a mobile phone connected via an aux cable that sends an audio signal to a white LED. This LED is powered by a 9V battery and modulates its brightness in response to the audio input. Although the LED’s flickering is not visible to the human eye, it effectively encodes the audio signal in the form of light intensity variations.

On the receiver side, a small solar panel is used as a photodetector to capture the modulated light. The solar panel converts the varying light signals into weak electrical signals. These signals are then passed through an amplifier circuit to boost the voltage level and remove any noise or distortion. The amplified signal is finally fed into a speaker, which reproduces the original audio that was sent through the LED.

Throughout the development process, various conditions were tested—such as distance between the LED and solar panel, ambient light interference, and clarity of the transmitted sound. Adjustments were made to optimize signal strength and fidelity. The entire system is mounted securely on a project board, with clear connections between components to ensure safety and functionality. The project successfully demonstrates real-time, short-range audio communication using visible light, validating the potential of Li-Fi as a secure and effective alternative to conventional wireless systems.

**Chapter 3: Requisites**

**3.1Estimated cost:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Components | Quantity | Estimated cost (INR) | Total Cost (INR) | |
| LED | 9 | 10 | 10 | |
| 220-ohm Resistor | 1 | 30 | 30 | |
| Solar panel | 1 | 100 | 100 | |
| 9v Battery & connector | 1 | 80 | 80 | |
| Speaker | 1 | 300 | 300 | |
| Mobile phone | 1 | - | - | |
| Bread board | 1 | 80 | 80 | |
| Total cost | | | 600 |

TABLE 1.1

**Chapter 4: Expected Outputs**

**4.1 Expected output:**

The proposed Li-Fi system is expected to successfully demonstrate wireless audio transmission using visible light as a medium. The outcome includes the development of a functional prototype that uses an LED to transmit

modulated light signals and a solar panel or photodiode to receive and decode those signals into audio output. Users will be able to play a song or voice note from a mobile phone, and the sound will be clearly heard from the speaker connected to the receiver—without using any wires or radio frequency.

The project is also expected to show that Li-Fi can provide secure, interference-free, and low-cost data transmission, especially in environments where traditional wireless Technologies are restricted. It will help validate the potential of visible light communication (VLC) for future applications, and serve as educational prototype for understanding next-generation wireless communication systems.

**Reference:**

1. Harald Haas, “Wireless data from every light bulb,” TED Talk, 2011. https://www.ted.com/talks/harald\_haas
2. Haas, Harald, et al. “What is Li-Fi?” Journal of Lightwave Technology, IEEE, 2015.
3. M. N. Bairagi, A. Das, “A Review on Li-Fi Technology,” International Journal of Scientific and Research Publications (IJSRP), 2017.
4. S. Rajagopal, R. D. Roberts, and S. K. Lim, “IEEE 802.15.7 Visible Light Communication: Modulation Schemes and Dimming Support,” IEEE Communications Magazine, March 2012.
5. Prof. S.S. Dhonde, Sayli V. Suryawanshi, “Li-Fi Technology Data Transmission through Visible Light,”

International Journal of Compute Applications, 2014.

1. “Light Fidelity (Li-Fi) Technology,” ScienceDirect https://www.sciencedirect.com
2. T. Komine and M. Nakagawa, “Fundamental Analysis for Visible-Light Communication System using LED Lights,” IEEE Transactions on Consumer Electronics, 2004.
3. Li-Fi Project Tutorials & Demonstrations – YouTube, https://youtube.com