Data Transmission Using Li-Fi

[1]Shrusti Biradar, [2]Bhakti Jadhav, [3]Rajeshri Bakkanwar, [4]Dr. S. M. Lambe
[1,2,3]Student of EN& TC KIT, Shelve, Pandharpur, India
[4]Assistant Professor of Computer Science and Engineering, KIT Shelve, Pandharpur, India.

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Abstract

Light Fidelity (Li-Fi) is a modern wireless communication method that employs the visible light spectrum to deliver data swiftly and securely, outperforming traditional Wi-Fi systems. This study explores a smartphone- based Li-Fi setup that seeks to optimize data transmission rates using the device's flashlight. The proposed model utilizes the smartphone's built-in flashlight for data transfer, while reception is handled through ambient light sensors and external detectors connected to an Arduino UNO. This configuration aims to analyze the accuracy and efficiency of Li-Fi in real-time communication scenarios.

1. Introduction

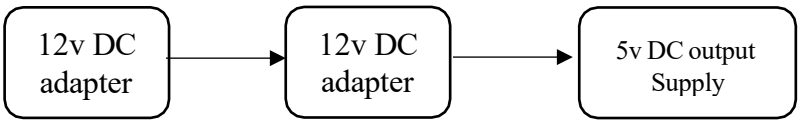
Li-Fi, or Light Fidelity, is a cutting-edge technology that enables wireless data exchange using visible light. As radio frequency bands face increasing congestion, Li-Fi presents an innovative alternative by utilizing light waves emitted from various sources, including LED lamps, for communication. Unlike conventional Wi-Fi, which depends on radio signals, Li-Fi transmits information through fluctuations in light intensity.

Professor Harald Haas introduced the concept of Li-Fi at the University of Edinburgh during a TED Global conference in 2011, where he demonstrated the potential of LED bulbs for high-speed data transmission. By controlling light pulses, he successfully streamed a video, showcasing the practicality of this approach.

Modern smartphones, equipped with a range of sensors and powerful processing units, serve as ideal platforms for implementing Li-Fi. These devices not only support basic tasks like calls and messaging but also handle complex applications, media playback, and network connectivity, making them suitable for testing Li-Fi-based communication systems.

2. Block Diagram

2.1 Block diagram of Power Supply



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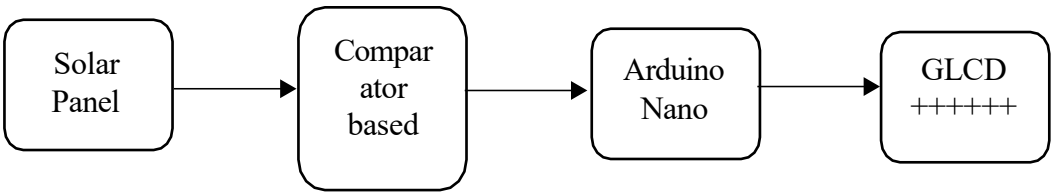
2.2 Block diagram Receiver Section



2.3 Block diagram of the Transmitter Section

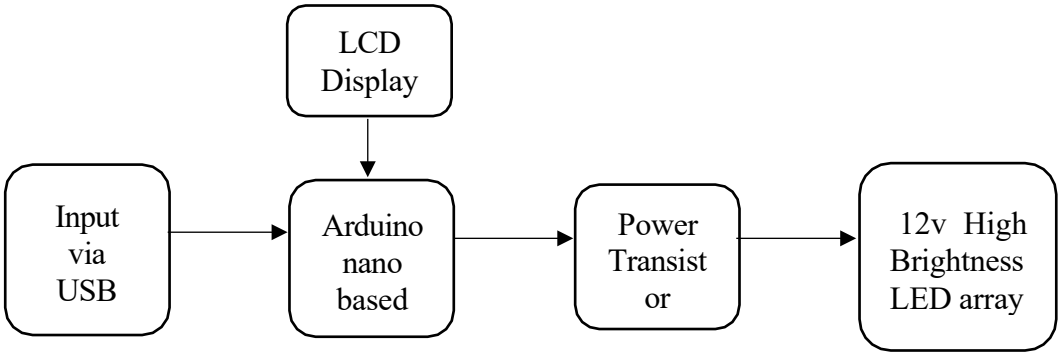


Figure 1. Block Diagram of System.

2.4 Block Diagram Description: Data Transmission Using Li-Fi

1. **Block Diagram of Power Supply**
   - **12V DC Adapter:** Provides initial 12V DC power.
   - **Voltage Regulation:** Converts/stabilizes 12V to 5V DC.
   - **5V Output:** Powers components like Arduino Nano safely.

   Purpose:
   To provide a regulated 5V DC supply for low-voltage electronics.

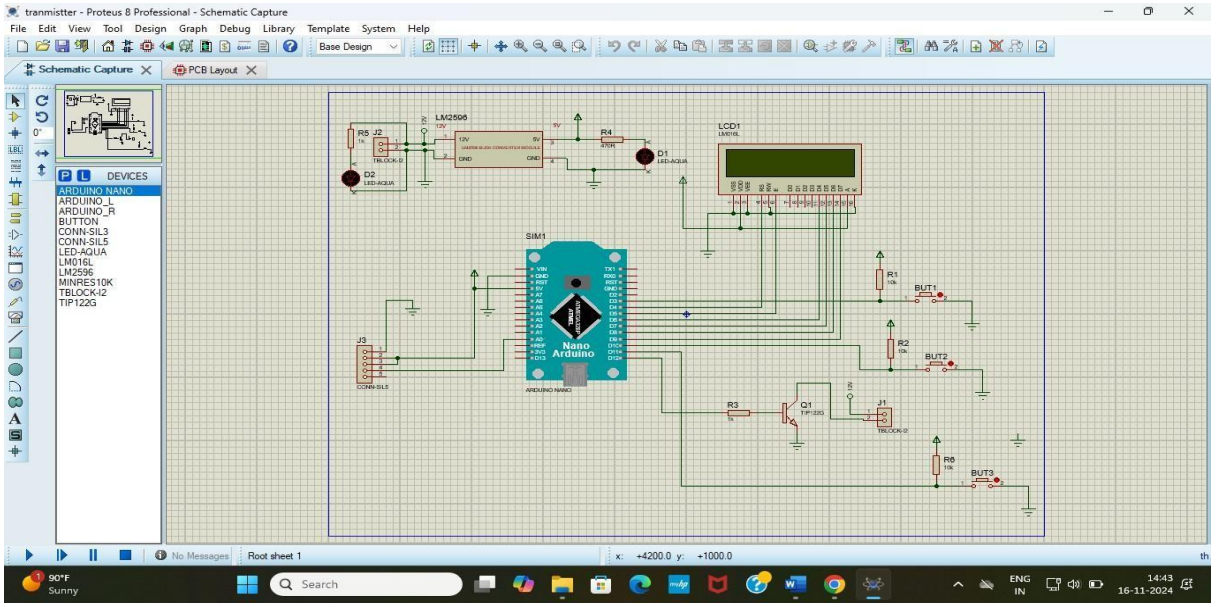
2. **Block Diagram of Receiver Section**
   - **Solar Panel:** Generates voltage based on sunlight.
   - **Comparator Circuit:** Compares solar voltage with a reference and outputs a digital signal.
   - **Arduino Nano:** Reads the comparator signal, processes data.
   - **GLCD:** Displays solar status, voltage, battery info, etc.

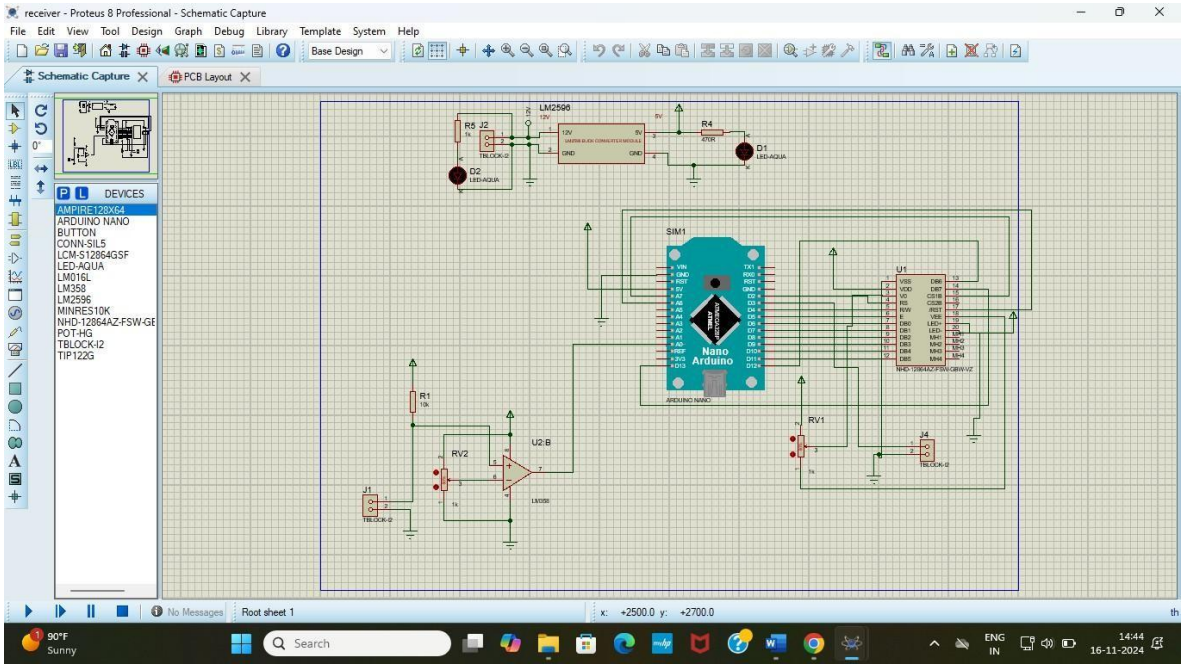
   Purpose:
   To monitor solar panel performance and display real-time status.

3. **Block Diagram of Transmitter Section**
   - **USB Input:** User sends commands via PC.
   - **Arduino Nano:** Interprets commands and controls outputs.
   - **LCD Display:** Shows system or command status.
   - **Power Transistor:** Controls high-power devices.
   - **12V LED Array:** Operated based on user input.

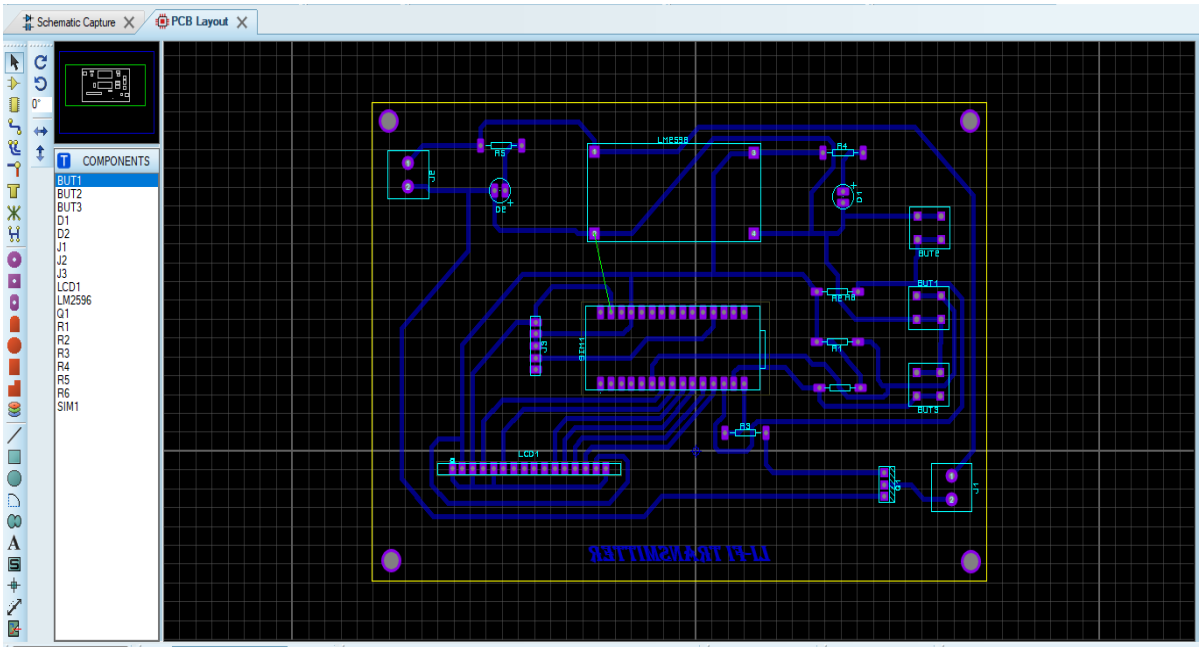
   Purpose:
   To control high-power devices like LED arrays via user commands.

3. Schematic Diagram

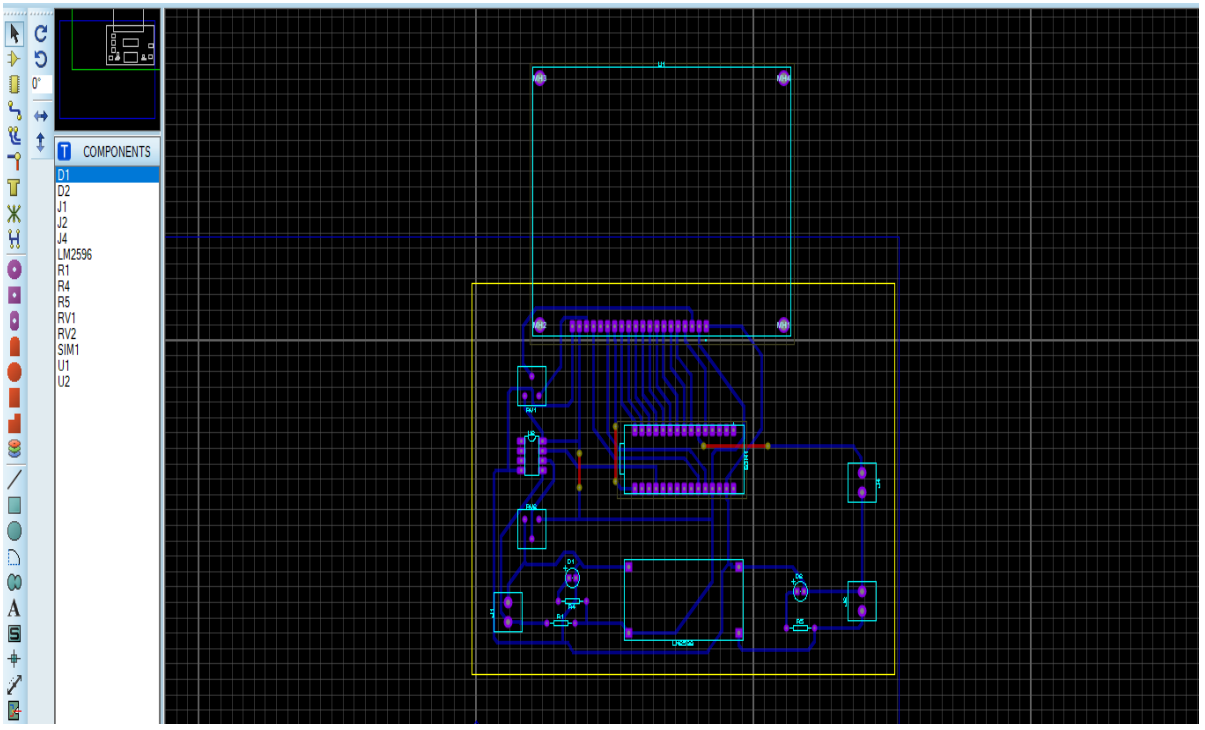




4. PCB Layout



PCB of Transmitter



PCB of Receiver

5. Conclusion

Li-Fi offers a compelling solution to the limitations of radio-based wireless networks by enabling fast and secure data transmission using visible light. As demonstrated in early experiments, simple LED lights can act as data carriers. By integrating this with modern smartphones and sensor technology, Li-Fi has the potential to revolutionize short-range communication, offering a more efficient and interference-free alternative to traditional Wi-Fi.

6. Conflict of Interest

The authors declare that they have no conflict of interest.

7. Funding Declaration

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8. References

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About Author

Shrusti Suryakant Biradar is currently pursuing a Bachelor's degree in Electronics and Telecommunication Engineering at Dr. Babasaheb Ambedkar Technological University. Her academic and research interests are focused on emerging technologies such as machine learning, artificial intelligence, and healthcare technologies. She is passionate about applying intelligent systems to real-world problems, particularly in the healthcare domain, and aspires to contribute to innovations that enhance the quality of life and improve medical diagnostics through smart technology solutions.