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LI-FI BASED DOOR LOCK SYSTEM

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Abstract: This project focus on designing and implementing Li-Fi based door lock system. By utilizing Li-Fi technology the system aims to enhance security and provide reliable method for door access control. The expected outcome includes a fully functional prototype. That demonstrate the applications of Li-Fi in secure communication and door control mechanism. This project aims to deepen understanding of wireless communication technologies and their practical application in security system

I. INTRODUCTION

With the rapid advancement in wireless communication technologies, there has been significant interest in exploring new method for secure and efficient data transmission. Li-Fi, a wireless communication technology using light to transmit data offers high speed and secure communication capabilities. This project explores the application of Li-Fi technology in designing a door lock system providing and alternative to traditional RF-based system

The objectives of the project are:

1. To design and develop a door lock system that uses Li-Fi technology for secure access control.
2. To ensure system is reliable, efficient, and easy to use.

To provide hands on experience in integrating Li-Fi technology with practical security solutions

II. LITERATURE REVIEW

1. Harald Haas et al “wireless Data from every Light Blub:”
    - Discusses the fundamental principle of LI-Fi technology and its potential application
2. Navin Kumar et al “Li-Fi a new paradigm in wireless communication”:
    - Emphasis the advantages of Li-Fi over tradition wireless communication technologies
3. Xianxian Li et al “Design and implementation of Li-Fi Transceiver”:
    - Provides insights into the Design and optimization of Li-Fi Transceiver

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III. METHODOLOGY

1. **Requirement analysis:** Identify the key requirement for the door lock system, including security protocols, communication range and power consumption
2. **System Design:** Develop the schematic diagram of the Li-Fi based door lock system, incorporating the necessary components such as LDR Module, Microcontroller, door lock mechanism
3. **Hardware Implementation:** Assemble the hardware components base on the design schematic. Ensure proper integration and functionalities of each component.
4. **Software Development**: Write the code to control the system, including data transmission and reception, signal processing and door lock control logic
5. **Testing and Validation:** conduct comprehensive testing to validate the system performance under various conditions. measure key performance parameters such reliability and security

6. **Optimization:** Iterate on the design to optimize performance metrics such as power consumption, response time and user interface

IV. KEY INSIGHT

1. Himanshu "Li-Fi project Using Arduino"
    - Contribution: Focuses on how to transmit data through Li-fi
    - Key Points: Demonstrate how to transmit data through mobile flash light

V. IDENTIFIED GAPS AND FUTURE DIRECTIONS

Technology implementation: Further research needed on how to implement the technology on security system and adopt the technology accordingly.
Practical Implementations; Emphasis on more real-world application.

VI. PROPOSED SYSTEM

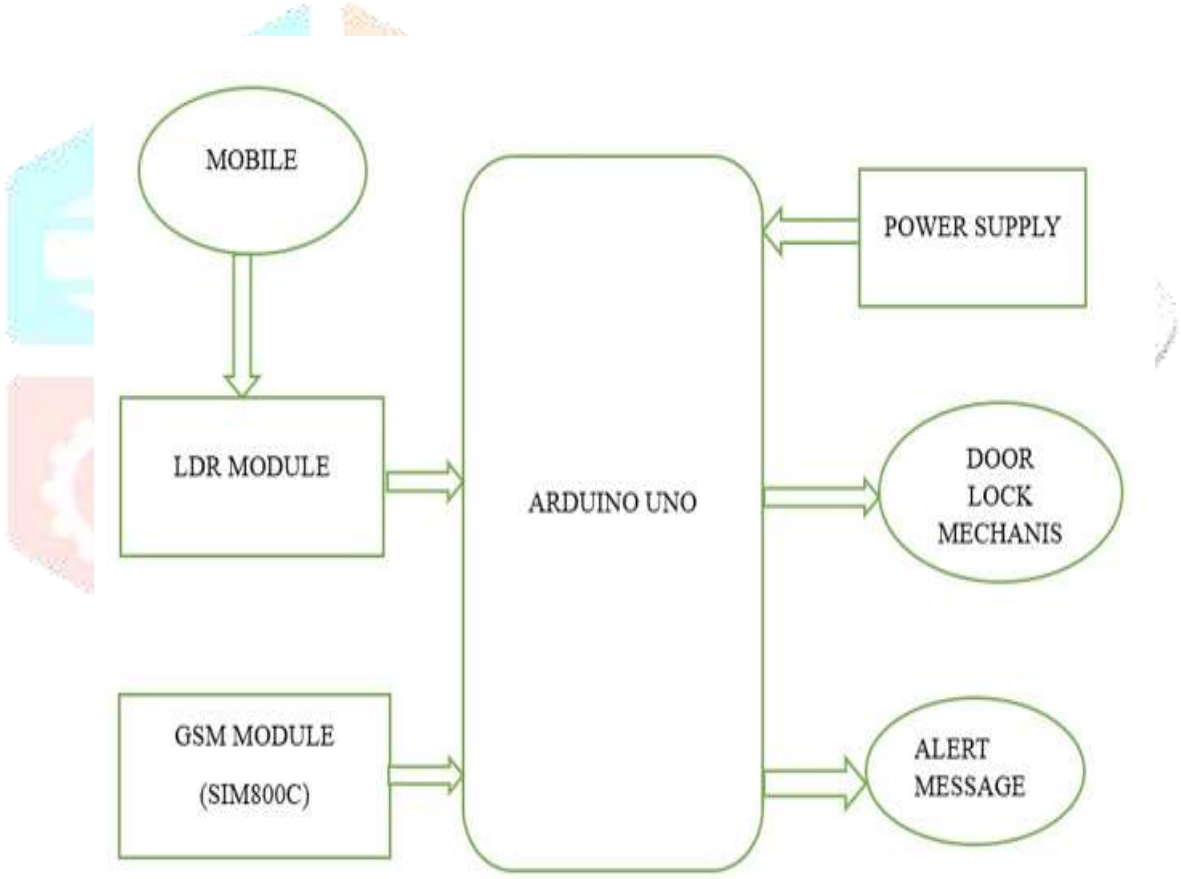

Fig 1 block diagram

This diagram illustrates a security system using an Arduino Uno. It integrates an LDR module, GSM module (SIM800C), door lock mechanism, and mobile communication. The Arduino Uno controls the system, powered by a supply, to send alerts and manage door locks based on inputs from the LDR module.

IV. FLOWCHART

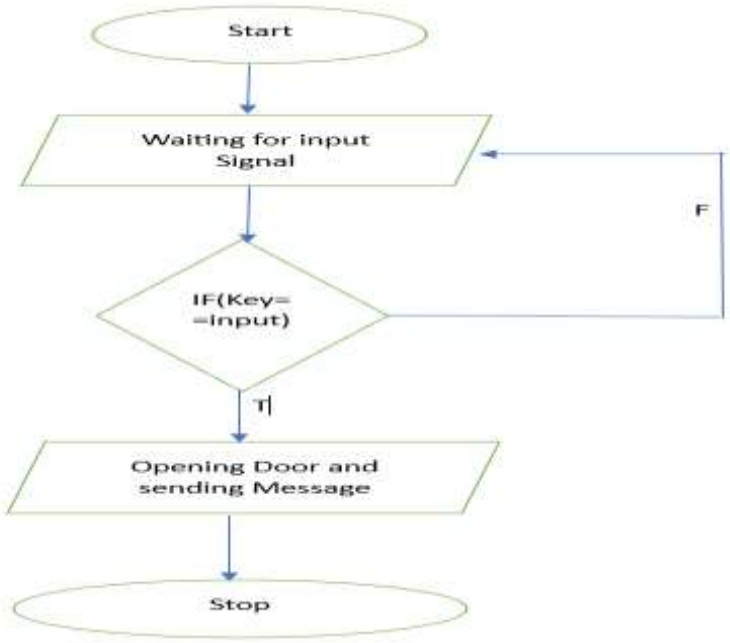

Fig 2 flowchart of the model

The diagram depicts a flowchart for a system that waits for an input signal. Upon receiving the correct key input, the system proceeds to open a door and send a message. If the key input is incorrect, the system continues to wait for the correct input signal.

V. HARDWARE IMPLEMENTATION

i. **Arduino Uno:** Arduino Uno is a widely-used microcontroller board renowned for its versatility and accessibility. Powered by the ATmega328P microcontroller, it operates at 5V and is typically powered by 7-12V input. Featuring 14 digital I/O pins, including 6 capable of PWM output, and 6 analog input pins, it offers ample flexibility for various electronic projects. With 32KB of flash memory (0.5KB used by the bootloader), 2KB of SRAM, and 1KB of EEPROM, Arduino Uno provides sufficient resources for prototyping and developing applications. Its 16 MHz clock speed ensures robust performance across a range of tasks, from basic LED control to complex sensor interfacing and communication protocols.

ii. **LDR MODULE:** Light Dependent Resistor module detects the input light signal. It varies resistance with light intensity providing digital l and analog signal to micro controller making it idea for light sensing application and project.

iii. **GSM MODULE:** The GSM 800C module I a versatile GSM/GPRS communication device. It supports voice calls SMS and internet access making it ideal for IoT projects and remote monitoring applications compatible with various microcontroller like Arduino

iv. **POWER SUPPLY:** For any system to work power supply is very essential. 12V power supply is needed to turn on the system. a power supply provides the necessary voltage and current to operate the Arduino board and connected components. Commonly used power supplies include USB from a computer or wall adapter (5V DC), batteries (7-12V DC), or external power sources regulated to 5V or 3.3V DC, ensuring stable operation of the microcontroller and peripherals.

v. **DOOR LOCKING MECHANISM:** For locking and unlocking the door a 12V push pull device is used when combined with the power MOSFET it gives the desired output.

vi. **IRF 740:** The IRF740 is an N-channel power MOSFET designed for high-speed switching applications. It features a drain-source voltage rating of 400V and a continuous drain current of 10A.

This MOSFET is commonly used in power supplies, motor control, and DC-DC converters due to its low on-resistance and efficient performance. A power MOSFET IRF 740 is used to control the push pull device.

VI. SOFTWARE IMPLEMENTATION

i. **ARDUINO IDE:** The Arduino IDE is a user-friendly platform for coding compiling and uploading programs to Arduino boards. It supports multiple language primarily C and C++ and offers a range of libraries and examples making it ideal for beginner and experience developers.

ii. **Li-Fi PROJECT APP:** This app is the one of the basic building blocks of the project. It helps to transmit the Key/Data through mobile Flash light making it one of the feasible ways to transmit the KEY

VII. RESULT

The system prompts the user to send the key through a app which uses flash light of the mobile device to create secure transmission of key. Arduino board utilizes LDR module to receive the key from the smart phone. The Arduino board verifies the received key against prerecorded key that have been set during the setup. If the key matches the system will grant access by unlocking the door or activating the electronic lock mechanism.

The system securely stores the key ensuring that they are not easily accessible to un authorize individuals. The system sends a message for every successful opening of door and notifies the owner about that. This can be useful for monitoring and restricting and taking quick action during some kind of suspicious activity. This is achieved through a dedicated mobile application. The overall success of the Li-Fi based wireless locking system will depends on the implementation quality security measures and reliability of the hardware and software components involved .It's important to thoroughly test and validate the system to ensure its effectiveness and robustness

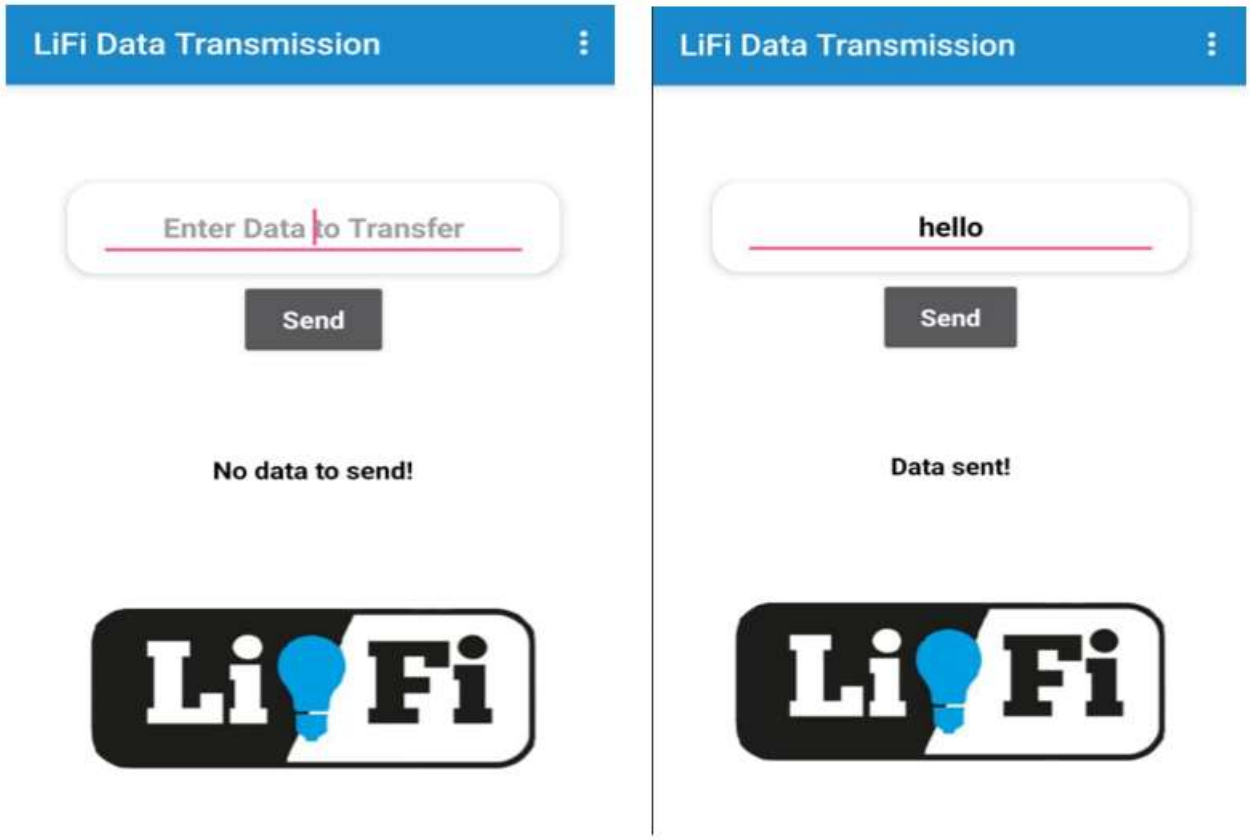

Fig 3 app interface

VIII. CONCLUSION

Many times, we forgot to carry the key of our home or sometimes we come out of house and door locks by mistake. In this really difficult condition, its easy-to-get access to the house with the help of this system. The Li-Fi based door lock system aims to demonstrate the feasibility and advantages of using Li-Fi technology for secure access control. By achieving the project objectives, we intend to provide a reliable and efficient alternative to traditional door locking mechanisms. Future work may involve further optimization, scalability, and the integration of additional features such as remote monitoring and control

IX. FUTURE SCOPE:

By implementing this system along with IoT implementation we can give guest access. By integrating Camera technology and facial recognition we also increase the security by having double verification technology. Through this we can remove the Wireless technology that are currently used worldwide which are very much prone to the attack though Radio waves.

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