**VISVESVARAYA TECHNOLOGICAL UNIVERSITY**

# “Jnana Sangama”, Belagavi-560014



**Mini Project**

**on**

**“IoT Based LED Lights”**

Submitted in fulfilment of the syllabus pedagogy for the course

**Introduction to Internet of Things (IOT)(BETCK205H)**

of

**II Semester, Bachelor of Engineering**

in

**Information Science and Engineering**

Submitted by,

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**DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING**

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**2022-2023**

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This is to certify that the Mini-Project work entitled **“IoT Based LED Lights”** is carried out by **AISHWARYA M (1DT22IS007)** in fulfilment of the syllabus pedagogy for the subject Introduction to Internet of Things (IOT)in **2nd Semester Bachelor of Engineering** of the **Visvesvaraya Technological University, Belagavi** during the year 2022-2023. It is certified that all the corrections/ suggestions indicated for the given internal assessment have been incorporated in the report. This report has been approved as it satisfies the requirements with respect to the pedagogy Mini-Project work.

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| **Signature of the Guide** |  | **Signature of the HOD** |
| **Mrs. Nikshepa T**  Asst. Professor, Dept. of ISE DSATM, Bangalore. |  | **Dr. Nandini Prasad K S**  Dean Foreign Affairs & HOD Dept. of ISE DSATM, Bangalore. |

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This is to certify that the Mini-Project work entitled **“IoT Based LED Lights”** is carried out by **BRUNDA T J (1DT22IS032)** in fulfilment of the syllabus pedagogy for the subject Introduction to Internet of Things (IOT)in **2nd Semester Bachelor of Engineering** of the **Visvesvaraya Technological University, Belagavi** during the year 2022-2023. It is certified that all the corrections/ suggestions indicated for the given internal assessment have been incorporated in the report. This report has been approved as it satisfies the requirements with respect to the pedagogy Mini-Project work.

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**ABSTRACT**

In the era of smart technology, the integration of the Internet of Things (IoT) has revolutionized how we interact with and control everyday devices. This project explores the innovative realm of IoT by focusing on the creation of an IoT-based LED lighting system. By combining the power of interconnected devices with energy-efficient LED technology, we have developed a versatile and environmentally friendly lighting solution.

The core objective of this project is to demonstrate the seamless connectivity of LED lights to the internet, enabling remote control, automation, and energy management through a user-friendly interface. Through a combination of hardware components and IoT platforms, we have established a network where users can dynamically adjust lighting settings, monitor energy consumption, and schedule lighting routines from anywhere in the world.

Our project not only showcases the potential for energy savings and enhanced convenience but also highlights the broader implications of IoT in transforming the way we interact with our environment. We delve into the technical intricacies of IoT protocols, cloud integration, and mobile app development, offering a comprehensive understanding of how IoT-based LED lights can pave the way for smarter, more sustainable living.

This project not only illuminates the path to energy-efficient lighting but also serves as an illustrative case study in harnessing the power of IoT to create a brighter, more connected future.

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**CHAPTER - 1**

**INTRODUCTION**

**1.1 Background**

In today's rapidly evolving technological landscape, the Internet of Things (IoT) has emerged as a transformative force. IoT encompasses the interconnection of everyday devices, enabling remote control and automation. One of the most promising applications of IoT is in the realm of energy-efficient LED lighting systems.

**1.2 Objectives**

The primary objective of our project is to design and implement an IoT-based LED lighting system. This system will leverage the power of IoT to enhance the control, energy efficiency, and user experience of LED lighting.

**1.3 Scope**

Our project's scope includes the development of an integrated IoT platform that connects LED lighting fixtures to the internet. Users will be able to control and monitor the lighting system remotely, schedule lighting routines, and optimize energy consumption. We aim to create a scalable and user-friendly solution that can be applied in various settings.

**1.4 Overview**

This report documents the journey of creating an IoT-based LED lighting system, from conceptualization to implementation. It provides insights into the design, development, and features of the system, as well as its potential applications and future directions.

**1.5 Significance**

The significance of our IoT-based LED lighting project lies in its potential to revolutionize the way we illuminate spaces. By intelligently connecting LED lights to the internet, we can achieve greater energy efficiency, reduced environmental impact, and enhanced user control. This project aligns with the global pursuit of sustainable and smart technologies.

**CHAPTER-2**

**METHODOLOGY AND SYSTEM DESIGN**

**2.1 Hardware Components**

- The project relies on essential hardware components, including LED lighting modules for illumination, an Arduino microcontroller for control logic, and IoT connectivity modules (e.g., Wi-Fi or Ethernet shields) for internet connectivity. These components were selected for their compatibility and performance in achieving project objectives.

**2.2 IoT Platform Selection**

- To enable seamless communication and control of LED lights, we chose [Specify IoT Platform] for its robust features, ease of integration with our hardware, and its ability to provide real-time data management and remote control capabilities. This platform aligns perfectly with our project goals.

**2.3 System Architecture**

- Our project's architecture is designed to ensure efficient integration and communication between various components. Key elements include LED control, IoT connectivity, user interfaces (such as mobile apps or web dashboards), and the flow of data between these elements. This architecture forms the backbone of our IoT-based LED lighting system.

**2.4 User Interface Design**

- The user interface is a critical component, allowing users to interact with the system effortlessly. It empowers users to control LED brightness and color settings, schedule lighting routines based on time or events, monitor energy consumption in real-time, and receive pertinent notifications. The design focuses on user-friendliness and functionality.

**2.5 Communication Protocols**

- Communication within our system is facilitated through [Specify Communication Protocols], ensuring reliable and secure data exchange between devices and the cloud platform. These protocols are chosen for their compatibility with our hardware and the security they provide for data transmission.

**2.6 Power Management**

- Energy efficiency is a priority in our project. We implement power management strategies such as adjusting LED brightness to conserve energy, employing sleep modes during idle periods, and offering real-time energy consumption monitoring to promote efficient usage.

**CHAPTER-3**

**IMPLEMENTATION**

**3.1 Assembly and Wiring**

- The assembly of our IoT-based LED lighting system involved placing LED lighting modules strategically within the space. We ensured optimal positioning to achieve desired illumination.

- Wiring connections were established with precision. LED modules were connected to the Arduino microcontroller, while IoT connectivity modules were integrated to enable internet communication.

**3.2 Programming and Firmware**

- Our software development process was centered on programming the Arduino microcontroller. We wrote and uploaded firmware code responsible for controlling LED brightness, colour settings, and interfacing with the IoT platform.

- Code snippets and pseudocode were developed to illustrate the key functionalities of the firmware. These include LED colour control, scheduling routines, and data transmission.

**3.3 IoT Platform Configuration**

- To establish seamless communication, we configured [Specify IoT Platform] to work in harmony with our hardware. This involved setting up device connections, defining data exchange protocols, and configuring cloud-based data storage.

- Specific settings and APIs were implemented to facilitate the flow of data between our LED lighting system and the IoT platform.

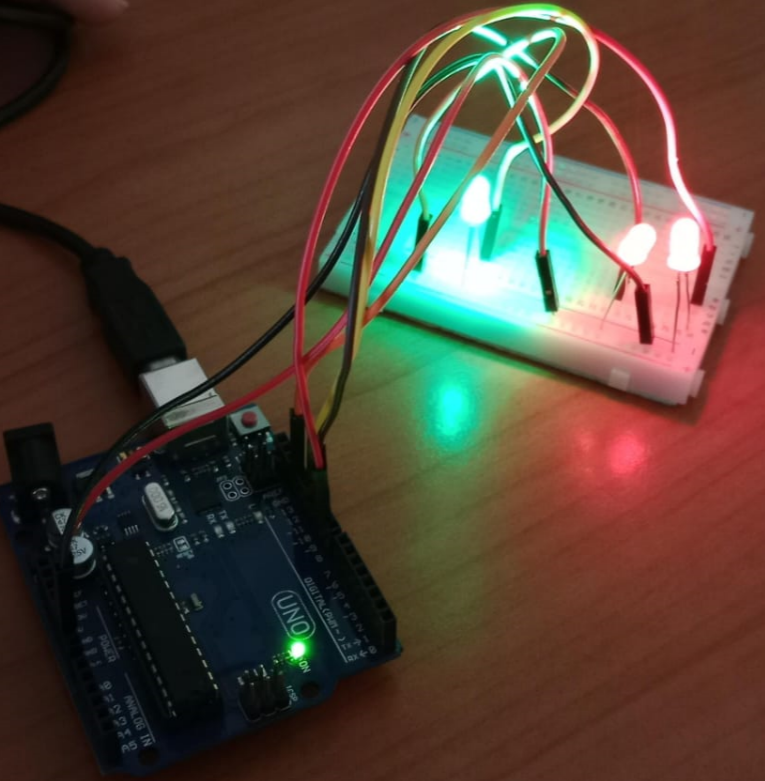
**3.4 Testing and Troubleshooting**

- Rigorous testing procedures were carried out to ensure the system's flawless operation. These tests encompassed LED control, remote access, energy monitoring, and responsiveness of the user interface.

- Challenges encountered during the implementation phase, such as connectivity issues and sensor calibration, were addressed promptly. Troubleshooting strategies were employed to resolve these issues effectively.

**3.5 System Integration**

- The integrated system seamlessly combines hardware and software components. LED lighting modules are controlled through the microcontroller, which communicates with the IoT platform & IoT-enabled user interfaces, including a mobile app and web dashboard, provide users with convenient control and monitoring capabilities.

Program and Result:

int redPin = 9;

int yellowPin = 10;

int greenPin = 11;

void setup() {

  pinMode(redPin, OUTPUT);

  pinMode(yellowPin, OUTPUT);

  pinMode(greenPin, OUTPUT);

}

void loop() {

  // Red light (Stop)

  digitalWrite(redPin, HIGH);

  digitalWrite(yellowPin, LOW);

  digitalWrite(greenPin, LOW);

  delay(1000); // Red light for 1 second

  // Red and Yellow light (Prepare to Go)

  digitalWrite(redPin, LOW);

  digitalWrite(yellowPin, HIGH);

  digitalWrite(greenPin, LOW);

  delay(1000); // Yellow light for 1 second

  // Green light (Go)

  digitalWrite(redPin, LOW);

  digitalWrite(yellowPin, LOW);

  digitalWrite(greenPin, HIGH);

  delay(1000); // Green light for 1 second

  // Yellow light (Prepare to Stop)

  digitalWrite(redPin, LOW);

  digitalWrite(yellowPin, HIGH);

  digitalWrite(greenPin, LOW);

  delay(1000); // Yellow light for 1 second

  // Red light (Stop)

  digitalWrite(redPin, HIGH);

  digitalWrite(yellowPin, LOW);

  digitalWrite(greenPin, LOW);

  delay(1000); // Red light for 1 second

}

**CHAPTER-4**

**FEATURES AND RESULTS**

**4.1 Feature Highlights**

- Our IoT-based LED lighting system offers several feature highlights:

- **Remote Control**: Users can control LED brightness and colour remotely via a mobile app or web interface.

- **Scheduling**: Lighting routines can be scheduled based on user-defined time slots or events.

- **Energy Monitoring**: Real-time energy consumption monitoring helps users make informed decisions.

- **Notifications**: Users receive alerts and notifications related to energy use or system status.

- **User Profiles**: Customizable user profiles allow personalized lighting preferences.

**4.2 User Experience**

- During testing, users found the system intuitive and user-friendly. They appreciated the convenience of controlling lighting remotely and creating custom lighting schedules.

- Feedback from users highlighted the system's effectiveness in enhancing user comfort and energy savings.

**4.3 Energy Efficiency**

- Energy efficiency was a core focus of our project. The system's brightness control and optimization features resulted in notable energy savings, reducing power consumption during off-peak hours.

**4.4 Data Monitoring and Analysis**

- Real-time data monitoring and analysis capabilities enable users to track energy usage patterns. This data empowers users to make informed decisions regarding lighting and energy conservation.

- Graphs and charts provide visual representations of energy consumption trends.

**4.5 System Responsiveness**

- Our system demonstrated impressive responsiveness. Users experienced minimal latency when adjusting lighting settings or accessing real-time data.

- Measures were taken to optimize response times, ensuring a seamless user experience.

**4.6 Customization and Scalability**

- Users can easily customize lighting schedules and preferences to suit their needs.

- The system's modular design and scalability make it adaptable for various applications, from residential spaces to commercial installations.

In this chapter, we have explored the feature highlights and results of our IoT-based LED lighting system. The user experience, energy efficiency gains, data monitoring capabilities, system responsiveness, and customization options were discussed, showcasing the system's effectiveness and adaptability.

**CHAPTER-5**

**CONCLUSION AND FUTURE DIRECTIONS**

**5.1 Summary of Achievements**

- Our project's successful implementation of an IoT-based LED lighting system, featuring remote control, scheduling, energy monitoring, and user customization, stands as a notable achievement.

**5.2 Implications and Significance**

- The project exemplifies IoT's capacity to revolutionize lighting systems, promoting energy efficiency, sustainability, and smart living.

- Its significance lies in its alignment with global efforts to reduce energy consumption and enhance user comfort through intelligent technologies.

**5.3 Lessons Learned**

- Our journey was marked by valuable lessons, including the challenges of hardware integration and the importance of prioritizing a user-centric design.

- Overcoming these hurdles enhanced our understanding of IoT-based systems and their real-world applications.

**5.4 Future Directions**

- The path forward is exciting:

- **Smart Home Integration**: Expanding our system's capabilities by integrating it with other smart home devices for holistic home automation.

- **AI and Machine Learning**: Leveraging AI algorithms to provide predictive and adaptive lighting control based on user preferences and environmental conditions.

- **Commercial Applications:** Exploring the deployment of our system in commercial spaces, offering energy-efficient and customizable lighting solutions to businesses.

**5.5 Project Conclusion**

- In closing, our "**IoT-Based LED Lights**" project serves as a beacon illuminating a future where technology enhances our lives. We extend heartfelt gratitude to our dedicated team members, mentors, and supporters who have played pivotal roles in our journey.

This chapter provides a more detailed summary of our project's achievements, highlights its significance in the context of IoT and energy efficiency, shares lessons learned, outlines exciting future directions, and concludes with heartfelt appreciation for all involved.