IoT Project Proposal

Project Title:
Intelligent Lighting and Temperature Control System

Group Members:

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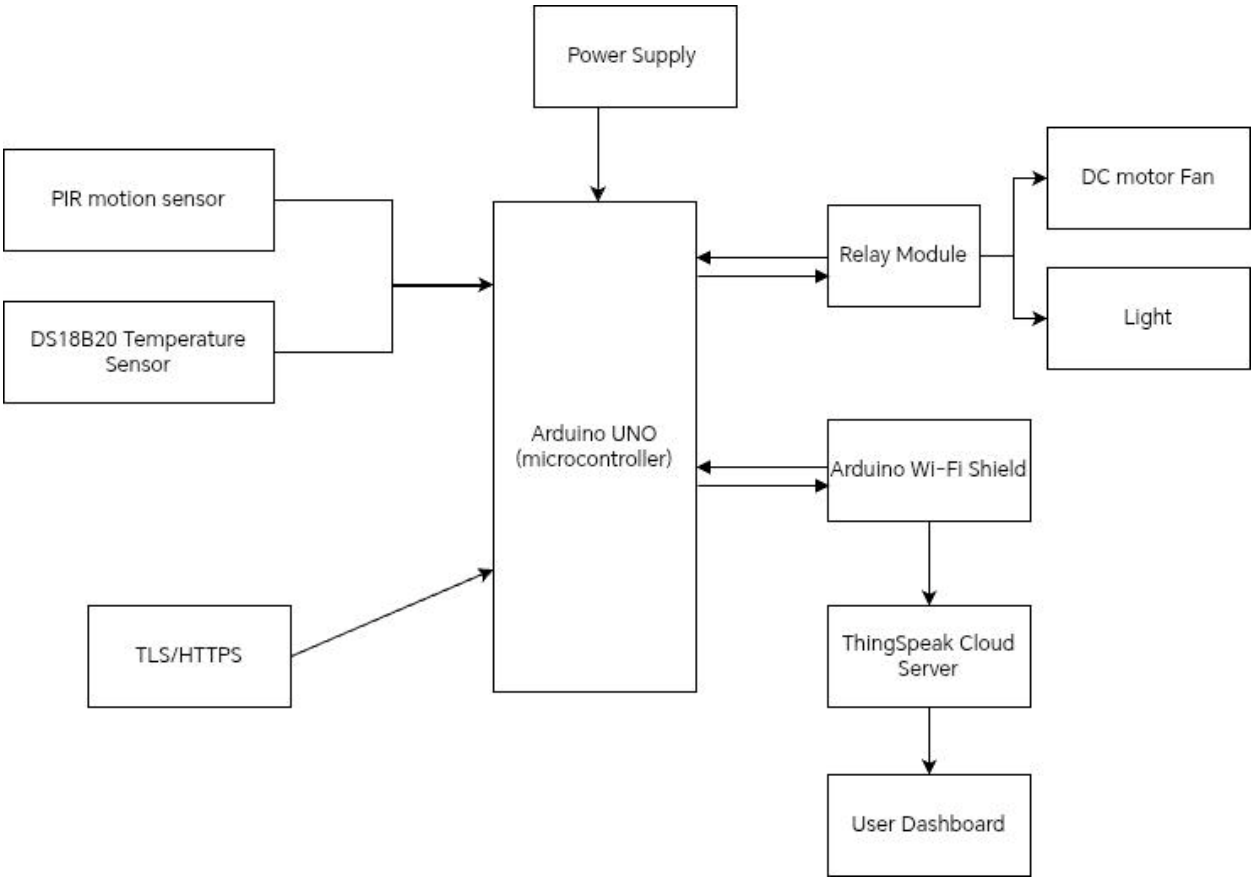
Problem Statement and Motivation
Modern homes and buildings face increasing challenges in managing energy efficiency, security, and convenience. Conventional systems rely heavily on manual operation, which often leads to energy wastage, higher maintenance costs, and reduced comfort for occupants. As urban populations grow and sustainability becomes a global priority, there is a pressing need for smarter solutions that can optimize resource usage while enhancing safety and living standards. The proposed Smart Home and Building system addresses these needs by integrating Internet of Things (IoT) technologies, automation, and intelligent monitoring. Through real-time data collection and automated control of lighting, temperature, and security systems, the application aims to create an environment that is energy-efficient, safe, and responsive to users' preferences. This project is both relevant and innovative, as it contributes to sustainable living, supports the development of smart cities, and demonstrates how technology can improve the overall quality of life in modern society.

Objectives

- Design and implement a smart home automation system using an Arduino Uno microcontroller integrated with light, temperature, and PIR motion sensors to monitor environmental conditions and detect human presence in real time.
- Establish wireless connectivity and remote data monitoring by integrating the Arduino Wi-Fi Shield with ThingSpeak over HTTPS for secure data transmission and cloud-based visualization.
- Develop automated control mechanisms using relays, LEDs, and a DC motor fan to optimize lighting, temperature, and energy usage based on sensor feedback.
- Enhance system security by implementing encrypted communication protocols to protect data exchange between IoT devices and the cloud platform.

System Architecture

Provide a labelled **block diagram** showing the four layers:
Perception → Network → Application → Security.
Include sensors, controllers, communication links, data paths, and security features.



Hardware and Software List

Component	Purpose
Controller	Arduino Uno
Networking Module	Arduino Wi-Fi Shield
Sensor	Light, Temperature, PIR Motion
Actuator	Relay (Automatic control), LED, DC motor Fan
Power Source	Power Supply
Connection Accessories	Jumper Wires, Breadboard, Resistors
Security Feature	Encrypted communication
Software	Arduino IDE, ThingSpeak, HTTPS

Networking Design

Protocol used: HTTP with nodes sending POST requests for data uploads and GET for fetching commands, enabling straightforward client-server interactions suitable for periodic updates.

Communication direction: Client/Server. Arduino nodes act as clients making HTTP requests to the Raspberry Pi server, which processes and responds with control instructions.

Topology: Single node. The Arduino-based sensor/actuator node connects directly via Wi-Fi to a cloud service, eliminating the need for a local gateway. This simple point-to-point topology is efficient for a single-room prototype, reduces hardware complexity, and leverages cloud resources for scalability and remote access.

Data Management Approach

We will use a Cloud Service (e.g., ThingSpeak or similar) for data storage and processing. Sensor data will be collected via HTTPS POST requests every 5-10 seconds, processed for thresholds (e.g., if temperature > 28°C, activate fan locally on Arduino), and visualized on the cloud's web-based dashboard showing real-time graphs, room status, and alerts.

Security Implementation

To ensure the safety and privacy of user data, the Smart Home and Building system will implement several key security measures. All communication between devices and the central server will use encrypted data transmission (HTTPS) to prevent unauthorized access or interception. Additionally, user authentication and access control will be enforced to ensure that only verified users can access or modify system settings. Sensitive information, such as user credentials and device configurations, will be securely stored using encryption techniques to protect against data breaches. In the future, a basic anomaly detection feature may also be integrated into the gateway to identify unusual device behavior or unauthorized access attempts, enhancing the overall system security and reliability.

Expected Outcomes

a. Real-time monitoring of environmental conditions such as temperature, light intensity, and motion through the integration of light, temperature, and PIR sensors.
b. Automated control of appliances using relays, LEDs, and a DC motor fan to regulate lighting and airflow based on sensor feedback, reducing unnecessary power usage.
c. Wireless data transmission and cloud connectivity through the Arduino Wi-Fi Shield, enabling live data updates and remote control via ThingSpeak.
d. Secure communication using HTTPS encryption to ensure data privacy and protect IoT device interactions from unauthorized access.
e. Cloud-based data visualization, allowing users to view and analyze sensor readings and system activity through an online dashboard.
f. Improved energy efficiency and comfort, demonstrating how automation can support sustainable living and user convenience in a smart environment.

Tentative Timeline

	Week							
Activities / Tasks	7	8	9	10	11	12	13	14
Topic Selection and Proposal Preparation	✓							
Hardware Integration and Setup		✓	✓					
Networking and Communication Setup			✓	✓				
Data Management and Cloud Visualization				✓	✓			
Security Implementation					✓	✓		
Implementation and Testing							✓	
Final Report and Presentation								✓