Smart Home Control Unit for Energy Optimization

- Group: SDDEC25-08
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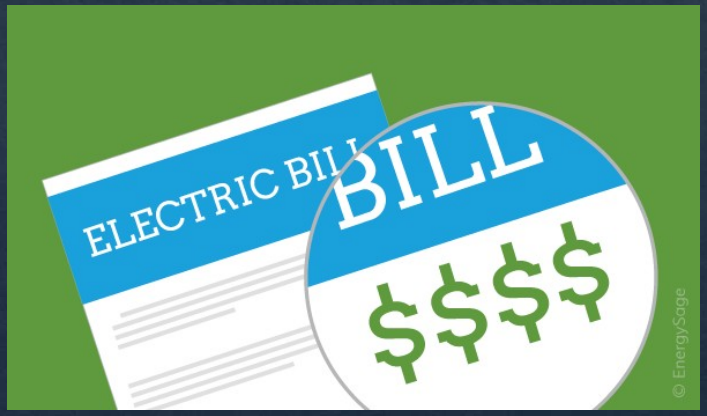
Project Overview

- Project focused on smart home automation
- Goal: Improve energy efficiency and reduce utility costs
- System uses sensors and automation to control lighting and HVAC
- Includes a central control hub and web interface
- Designed for ease of use and affordability

Problem Statement

- High energy bills strain household budgets
- Existing systems are costly and require professional installation
- Low-income families often lack access to smart home solutions
- Energy waste contributes to environmental impact



Intended Users

Homeowners – Want simple, cost-saving comfort.

Property Managers – Need energy tracking for long-term savings.

Business Owners – Reduce energy costs, boost efficiency.

Tech Enthusiasts – Value customization and integration.

Environmentalists – Monitor and minimize energy use.

Requirements

Functional

Resource

Physical

Aesthetic

Environmental

User Experience

Constraints

Cost Efficient

The product must be affordable for the user.

The hardware components we use must be low cost.

Time

The project must be completed within the year (timeframe of the course).

SE0

Design

- Diagrams
- Prototypes
- Hardware design
- Software design
  - User interface

Slide 7

SE0

PCB KICad
3D CAD Model
Circuit Diagram

Sensor Prototype
Functional Demo
Show Home Assistant... Make a Couple of Cards that at least show the data, and what everything does.
Schmidt, Erik K, 2025-05-03T18:28:46.538

Hardware Design

IEEE 802.11 - WiFi

IEEE 802.15.4 - Zigbee

ISO Standards for Information Security Management

ISO Standards for Energy management


Wi-Fi 6
Zigbee 3.0
ESP32-C6
Bluetooth 5
Bluetooth 5
Thread 1.3


ESP32-C6

ESP32

Furnace Controller

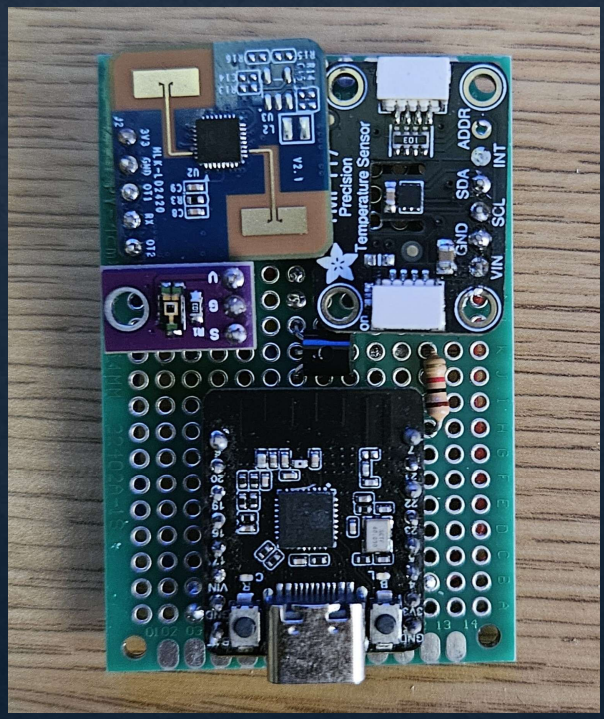
- ESP32-C6-EVB
  - ZigBee
  - 4 Inputs
  - 4 Relay outputs

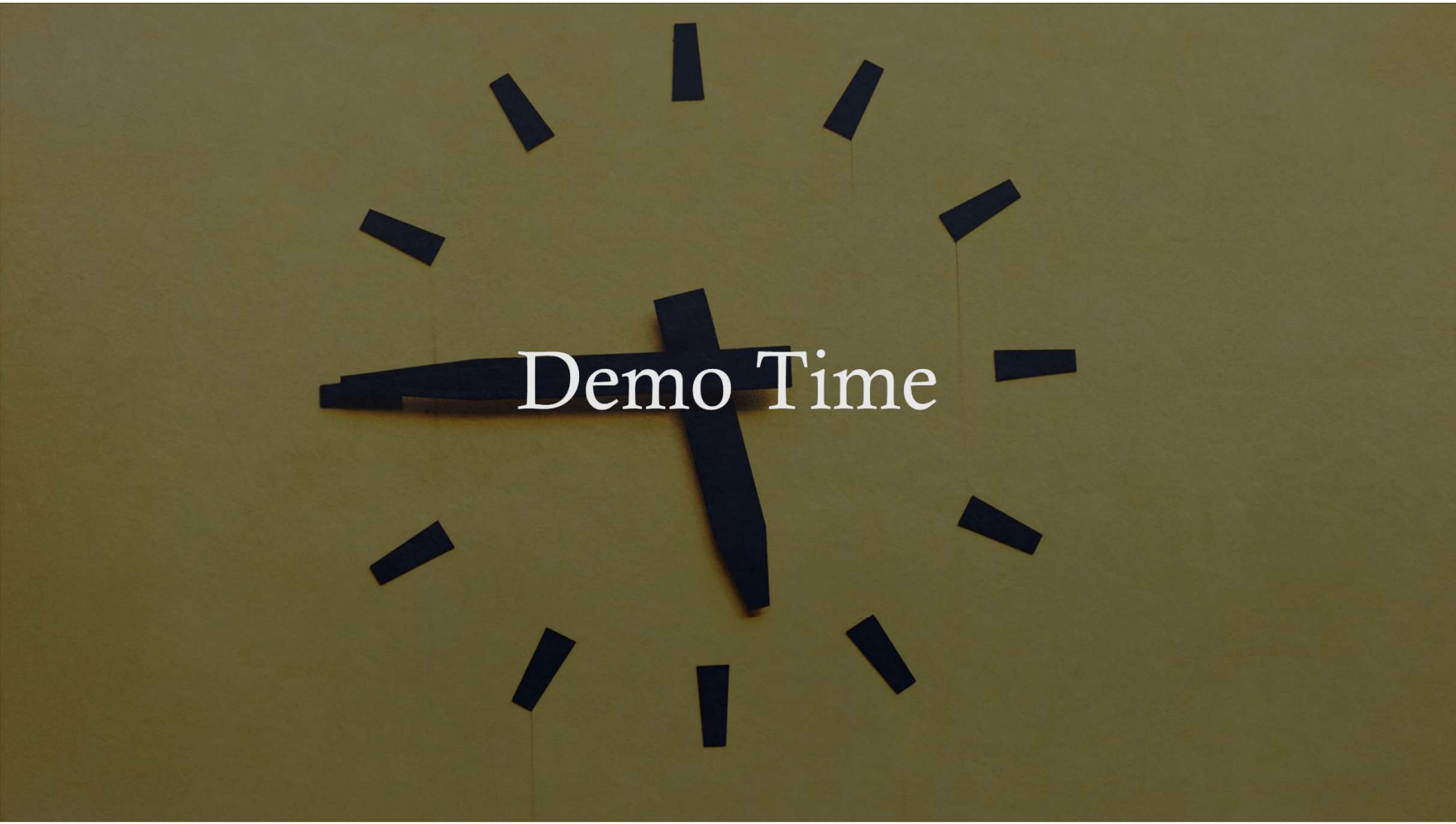
Light Dimmer

- 120 Volt
- ESP32-S3
- FL5160MX AC Dimmer Controller Chip

Multi-Sensor

- SOC: ESP32-C6
- Sensors:
  - Temperature: TMP 117, SHT41x
  - Illuminance: TEMT 6000, VEML 7700
  - Occupancy: HLK 2420, 2410S




Demo Time

Software Design

IEEE 830 – Software requirements specification

IEEE 829 – Software Testing

React Standards

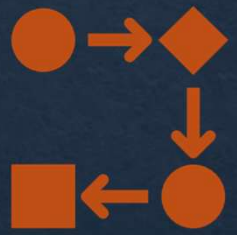
Home Assistant API

WCAG (Web Content Acessibility Guidelines)

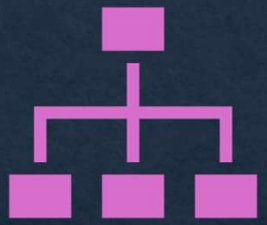
Testing

Unit Tests

Integration Tests



Regression Tests



System Tests

User Tests

- **Unit Tests** test an individual component.
- **Integration tests** assess how those components perform their functions in concert.
- **Regression tests** ensure that individual components correctly perform their basic function after being integrated together.
- **System tests** assess how well the system works in its entirety and performs all its necessary tasks simultaneously.
- **User tests** are vital to making sure that people can use the system with ease and that it meets their expectations.

Questions