

EE / CprE / SE 492 Weekly Report

April 10 - April 17, 2025

sddec25-08

Smart Home Control Unit for Energy Optimization

Faculty Advisor / Client: Md Maruf Ahamed

Team Members:

- Seth Proctor - Designer
- Alexander Ryan - Software
- Jacob Carnesi - Project Manager
- Arie Kraayenbrink - Client Relations
- Gamage Binula Karunaratne - Hardware
- Erik Schmidt - Embedded Systems

Summary

We connected various ESP components and Home Assistant and conducted in-depth battery life testing, and began optimizing sensor code for power efficiency. We researched and ordered parts to implement our LED dimmer and developed a baseline furnace control algorithm. We also worked to get TailScal access to use as a VPN.

Work Period Accomplishments:

- Achieved Zigbee connectivity between various ESP boards/sensors and Home Assistant.
- Conducted in-depth battery life testing.
- Started optimizing sensor code for power efficiency.
- Researched and ordered necessary components for a DIY LED dimmer.
- Developed a baseline furnace control algorithm in Home Assistant.
- Collaborated with ETG and IT Solutions to obtain TailScale VPN access.
- Progressed on programming and integrating the furnace controller.

Plans for Coming Week + Action Items:

- Seth Proctor- I plan to start developing and implementing the dimmer using the parts ordered from ETG.

- Alexander Ryan- Finished up the furnace control algorithm and posted it to the git repository. Make a power optimization algorithm. Make unit tests for the controller if possible.
- Jacob Carnesi- Update the team website with current content. Continue working with ETG to get TailScale access for our accounts to finish configuring the VPN. Work on the design document as needed.
- Arie Kraayenbrink- Planning to continue working on the furnace controller to get it programmed and connected to the hub. Continue learning Zigbee and ESP SDK.
- Gamage Binula Karunaratne- Work with Seth on making the light dimmer. Work with Arie on attaching a bridge rectifier to the furnace control unit.
- Erik Schmidt- Work on improving battery life, look at MOSFETs or transistors for power delivery. Test each component's power draw during duty and sleep cycles. Modify the protoboard to avoid the temperature sensor overheating issue. Research how sleep and duty cycling are handled in industry.

Pending Issues:

- Seth Proctor- No issues
- Alexander Ryan- No issues
- Jacob Carnesi- ISU doesn't seem to use TailScale in the way I thought.
- Arie Kraayenbrink- No issues
- Gamage Binula Karunaratne- No issues
- Erik Schmidt- Initial battery life was a lot worse than expected.

Individual Contributions:

Team Member	Contribution	Weekly Hours	Total Hours
Jacob Carnesi	Worked on the design document. Worked with ETG and IT Solutions to get TailScale access. Worked on the design document. Started updating the website.	4	27
Seth Proctor	Researched the components we will need to create a DIY LED Dimmer. Ordered the list of parts from ETG and plan to start development when they arrive.	4	34.5
Arie Kraayenbrink	Continued learning more about Zigbee and the ESP Zigbee SDK. Continued working with the furnace controller.	5	41

Binula Karunaratne	Researched light dimmer options and ways to rectify the AC current of the furnace control.	3.5	30
Erik Schmidt	Consistently able to get multiple sensors and ESP boards to connect to Home Assistant Server via Zigbee. Performed more advanced battery testing, implemented a sensor into Home Assistant with ZHA. Started to improve code to lower power consumption. Working on design for the 2nd prototype, or the final sensor. Fixed logarithmic scaling issue with Illuminance Sensor.	7	40
Alexander	Created baseline for furnace control algorithm on Home Assistant and started looking into energy optimization algorithm and calculations.	3.5	20.5