

EE/CprE/SE 491 – sdmay26-08

GridSAFE

Week 7 Report

Start date - End date: 11/5/25 – 11/11/25

Client: Nellie Leaverton

Advisor: Julie Rursch

Team Members:

Nellie Leaverton – Hardware & Architectural Design Lead

Jason Di Giovanni – Software and Security Lead

Brant Gicante – Software and Security Assistant

Evan Booze – Hardware & Architectural Design Assistant

Kyle Maloney – Testing Lead & Design Assistant

Anthony Nehring – Software and Security Assistant

Weekly Summary:

This week, the GridSAFE team continued splice and 3D printing multiple prototypes of new skyscraper models. The hardware team tested new LEDs and verified single-LED circuit functionality. During testing, it was discovered that the current Raspberry Pi died, prompting research and selection of a new Raspberry Pi 4 as an upgrade from the previous Pi 3B. The software and cyber team continued to design their IT/OT network and research malicious logs and datasets. The team also progressed on the LED software and the Proxmox simulation network, which will be used to run attacks and signal alerts.

Past week accomplishments:

3D Modeling and Printing – Nellie Leaverton

- Continued 3D splicing and printing of models
 - Picked up 3D prints from SIC
 - Broke off print supports
- Tested new LEDs received from ETG
 - Tested a single LED to verify power supply and circuit functionality
 - Attempted to test other LEDs, but they did not turn on
 - Hypothesized that LEDs required a Raspberry Pi to operate
- Tested Raspberry Pi 3B with LEDs
 - Raspberry Pi 3B stopped working during testing
- Researched Raspberry Pi 4 vs Raspberry Pi 5 vs Raspberry Pi 3B
 - Selected Raspberry Pi 4 as replacement (cost-effective, met requirements, upgrade from 3B)

AI Training Datasets – Jason Di Giovanni

- Looked at the Datasets and logs within from the Canadian Institute for Cybersecurity.
 - CSE-CIC-IDS2018 and CIC-DDoS2019 appear good for pretraining
 - Modbus 2023 and CIC IIoT 2025 seem the closest to power grid control systems
 - CIC IoT-DIAD 2024 and CICEVSE2024 appear useful for testing adaptability to mixed IoT+grid data
 - Whis this amount of data, the logs the software team has created so far will be used for testing/demo purposes rather than training.

Modeling and Printing – Brant Gicante

- Fixed up and created 3d Prints and models to be printed
 - Looks ad misconfigurations on old prints and revised the prototype
 - Managed/dealt with complications of software version
 - Sent models ready to be printed over to hardware team
 - Assisted in the testing of LED and Raspberry pi
- Connected raspberry pi to hardware/circuits
 - Assisted and learned with the group the connection
 - Failure of the raspberry pi ended our development early

3D Modeling and Printing – Evan Booze

- Made modifications to 3D models for printing
 - Added additional windows
 - Modified extrusions for a cleaner print
- Tested new LEDs received from ETG
 - Attempted to test LEDs but they did not turn on
- Tested Raspberry Pi 3B with LEDs
 - Connected Raspberry Pi 3B to a computer for testing
 - Raspberry Pi stopped working during testing

Finalizing Network Diagram for IT/OT logs – Anthony Nehring

- Finalized IT/OT network diagram covering all project requirements.
 - Added external attacker host (outside perimeter) for red team simulation
 - Added perimeter devices: firewall, DMZ, possible VPN.
 - Defined OT zone: HMI/SCADA master, PLCs/RTUs, OT historian, PLC programming workstation.

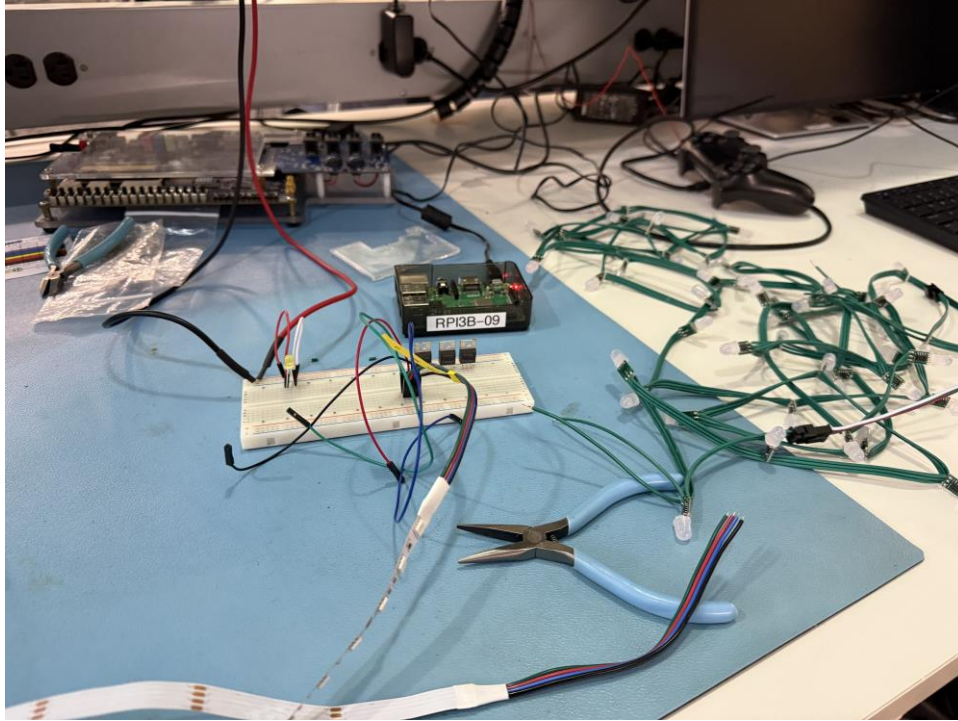
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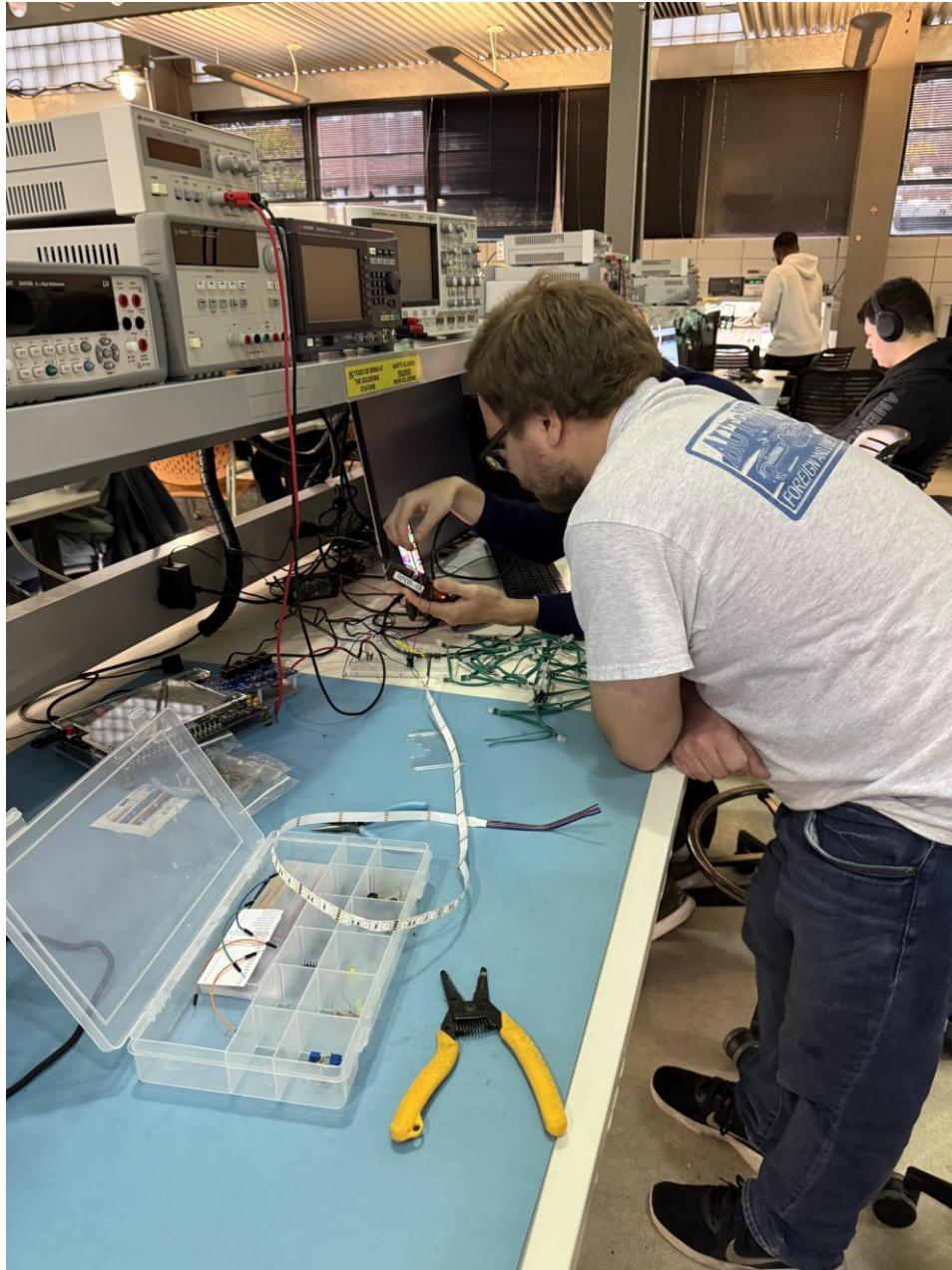
Designing backend to host communication between project sections – Kyle Maloney

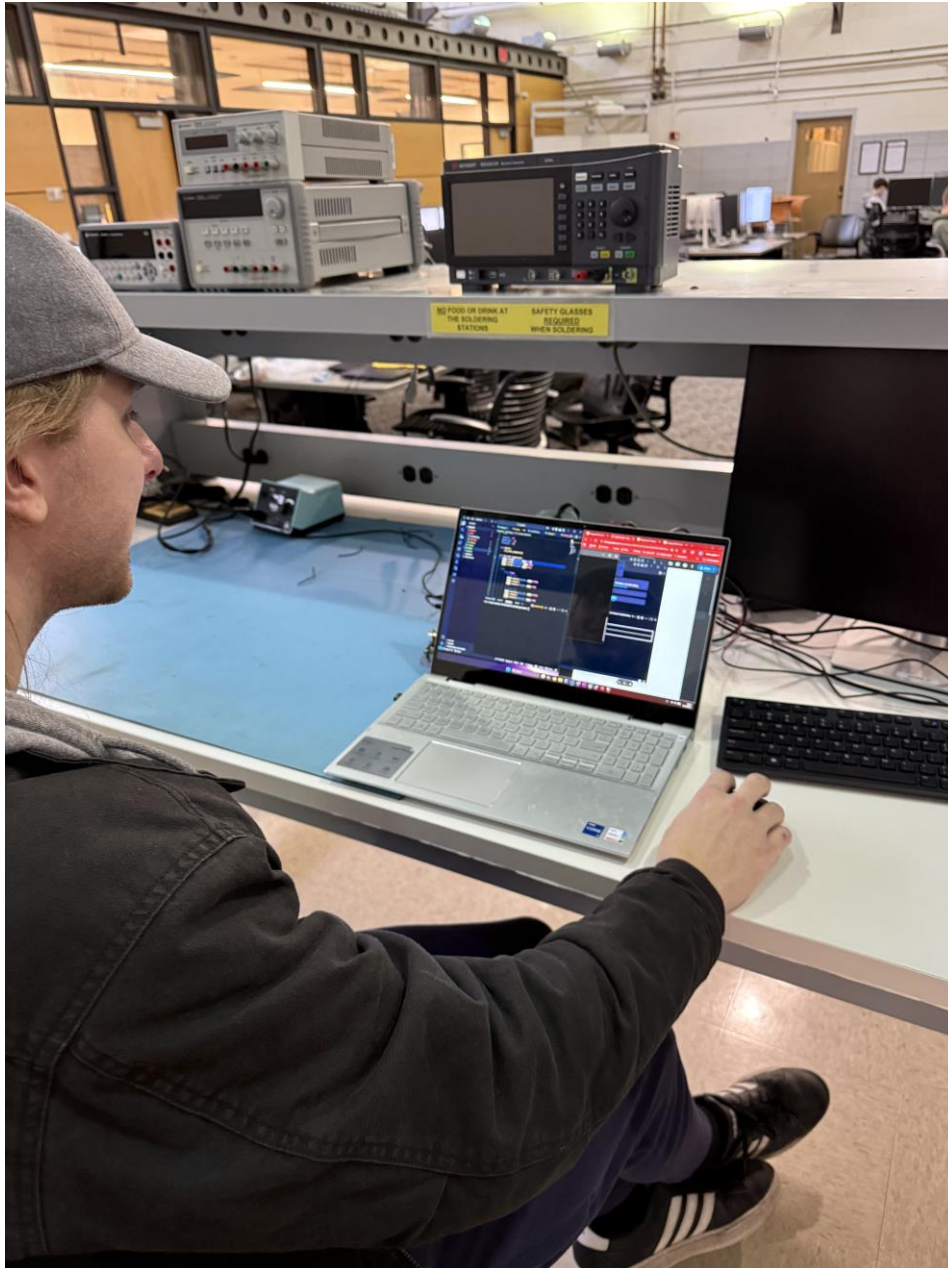
- Started implementing APIs to use for the lighting software that will control our visual display
- Implemented communication between the Proxmox server and raspberry pi to communicate and control the lighting

Citations/Research:

Pictures of simple circuit prototype/working on testing LED's and Raspberry pi:







New Raspberry Pi Resources/Materials Researched:

https://www.amazon.com/Raspberry-Model-2019-Quad-Bluetooth/dp/B07TD42S27/ref=sr_1_1?crid=1N0WR3Q82U3NB&dib=eyJ2ljojMSJ9.HEqjugt6NtfqFHpStRN_SrlhvbDQZqu7RRWhQBresV0hC3tTHTLhOYVdjowONRCydt5ASq4x1MtYzjYh3V9rrZwIK1L4tONgGysNx1gmKPBa64vtzYlYroB5EhYf215BT96cOHS5vs3UkuYZrmm3BbUJslOGn2jiv8iXGfvsGfllolsZdIHlhEYV5ebFH8sexNnavXNuJsQN8Xf1i7FST6NOQFvh9P2iF7xuLu8JNxxw.p9gMsuL8IL9MBZMHMGU0E55nAtuj_UemusFs31OAFes&dib_tag=se&keywords=raspberry%2Bpi%2B4&qid=1762889134&sprefix=rasb%2Caps%2C202&sr=8-1&th=1

Original pi 3B model reference: <https://www.raspberrypi.com/products/raspberry-pi-3-model-b/>

Raspberry Pi 3 Model B vs Raspberry Pi 4 Model B (2GB)

Processor:	Quad-core ARM Cortex-A53 @ 1.2GHz	Quad-core ARM Cortex-A72 @ 1.5GHz
Architecture:	64-bit ARMv8	64-bit ARMv8-A
RAM:	1GB LPDDR2	2GB LPDDR4 (faster)
Networking:	10/100 Ethernet, 2.4GHz WiFi, BT 4.1	Gigabit Ethernet, Dual-band WiFi, BT 5.0
USB Ports:	4 × USB 2.0	2 × USB 3.0 + 2 × USB 2.0
Video Output:	HDMI (1080p)	2 × micro-HDMI (dual 4K)
GPU:	VideoCore IV	VideoCore VI
Power Supply:	5V / 2.5A (Micro-USB)	5V / 3A (USB-C)
GPIO Pins:	40-pin (same layout)	40-pin (compatible)
Storage:	microSD card slot	microSD (faster)
Thermals:	Runs cooler under light load	Runs hotter – cooling recommended
Use Case:	IoT, sensors, light projects	Desktop, media, networking, heavy projects

Places to Buy PI4B:

<https://www.raspberrypi.com/products/raspberry-pi-4-model-b/>

<https://vilros.com/products/raspberry-pi-4-model-b-1?variant=40809478750302> : 4GB

Raspberry Pi Cases:

https://www.amazon.com/ElectroCookie-Raspberry-Aluminum-Cooling-Changing/dp/B09QG349ZL/ref=sr_1_15?crid=DABJR5NF68FC&dib=eyJ2IjojMSJ9.LgD49wd0I7yrBTb7KnRg5kOufiW8xIV-FsHtXeXqLWLKhIWfmTVjLebJG5-7hFLfSX14JOe15zbPtgs5fn8A1_eY1ljbLx9rHlPf1p6df2oNfGgq2C9f7drAL5ToztT5tLDcmFgHDhuXsQZayJaCdOjLRbaZ87DNNDkwZYC1E_xgYUlhISry5lqkWH7ff5DAUQDOQL9o81U4eQPxyQ_cA-kSi-cC_1GXEtQMhPI_LLLQ.xF3bPHwxezqVdv4CTsr8bGtqADpFA0QosFa8JHdJHX4&dib_tag=se&keywords=raspberry+pi+4+case&qid=1762890041&srefix=raspberry+pi+4+ca%2Caps%2C273&sr=8-15

https://www.amazon.com/Components-Raspberry-Model-Clear-Case/dp/B07W72KL1W/ref=sr_1_16?crid=DABJR5NF68FC&dib=eyJ2IjojMSJ9.LgD49wd0I7yrBTb7KnRg5kOufiW8xIV-FsHtXeXqLWLKhIWfmTVjLebJG5-7hFLfSX14JOe15zbPtgs5fn8A1_eY1ljbLx9rHlPf1p6df2oNfGgq2C9f7drAL5ToztT5tLDcmFgHDhuXsQZayJaCdOjLRbaZ87DNNDkwZYC1E_xgYUlhISry5lqkWH7ff5DAUQDOQL9o81U4eQPxyQ_cA-kSi-cC_1GXEtQMhPI_LLLQ.xF3bPHwxezqVdv4CTsr8bGtqADpFA0QosFa8JHdJHX4&dib_tag=se&keywords=raspberry+pi+4+case&qid=1762890041&srefix=raspberry+pi+4+ca%2Caps%2C273&sr=8-16

Mini BOM:

What we NEED:

Rasberry pi \$ 40-60

Rasberry pi Power Supply \$10

MICRO SD Card \$ 20

Pending issues:

- May not be able to test LEDs in a timely manner depending on how long it takes to get the new raspberry pi.

Individual contributions:

<u>NAME</u>	<u>Individual Contributions</u>	<u>Hours this week</u>	<u>HOURS cumulative</u>
Nellie Leaverton	<ul style="list-style-type: none">Continued 3D splicing and printing of modelsPicked up 3D prints from SIC and removed print supportsTested new LEDs received from ETGTested Raspberry Pi 3B with LEDs (stopped working during testing)Researched and selected Raspberry Pi 4 as replacement (cost-effective, meets requirements, upgrade from 3B)	5	43
Brant Gicante	<ul style="list-style-type: none">Network Design drawing completeMore models finished/fixedPrototype adjustments as neededSample networks configurations in testbeds	4	31
Evan Booze	<ul style="list-style-type: none">Made modifications to second and third 3D modelTested LEDs ordered from ETGTested Raspberry Pi 3B	4	25
Jason Di Giovanni	<ul style="list-style-type: none">Helped Hardware Team test RPI 3BLooked further at datasets for AI	4	31
Kyle Maloney	<ul style="list-style-type: none">Continued prototyping Proxmox serverContinue designing the LED library to use in our city structure	6	26
Anthony Nehring	<ul style="list-style-type: none">Network Diagram FinalizationDefined and relationships and machines in network with security team	4	28

Plans for the upcoming week:

- **Brant Gicante:**
 - Put the network map into a real setting/environment (awaiting servers still)
 - As Raspberry Pi is down and connections can't be made till supplies are in, I instead plan to write down the vulnerabilities and executable malware we plan to use for the environment
 - List CVE vulnerabilities for version
 - Mockup a phishing example for mail service
 - Designate an open port for “testing” like some networks have
 - Assist in hardware as needed
- **Evan Booze:**
 - Print modified 3D models at SIC.
 - Program LEDs for testing once a new Raspberry Pi is ordered
 - Take Metal & Wood Shop Makerspace training at SIC in preparation for making city baseboard
 - Print more 3D models at SIC.
- **Nellie Leaverton:**
 - Continue printing more 3D models, including different types of skyscrapers
 - Purchase a new Raspberry Pi and create a Bill of Materials (BOM) for it
 - Work on setting up a simple circuit to test lighting (LEDs) received from ETG, pending a new raspberry pi
- **Kyle Maloney:**
 - Meet with the software team to discuss MITRE attacks to analyze and create logs.
 - Finish designing the LED library we will use for our physical city
 - Continue setting up Proxmox server if we receive the resources we need
- **Jason Di Giovanni:**
 - Finish downloading and looking at the datasets from the Canadian Institute for Cybersecurity to check use cases
 - Start pretraining AI
- **Anthony Nehring:**
 - Get input on the Network Diagram Finalization from security team
 - Look into how this current network diagram can be reflected in our synthetic logs with the security team