EE/CprE/SE 491 – sdmay26-08

GridSAFE

Week 8 Report

Start date - End date: 11/11/25 – 11/18/25
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 and verified 12V RGB LEDs that are integrated with the Raspberry Pi and change color depending on the Python code. 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 LEDs with Raspberry Pi and python Code (Personal Raspberry Pi)
    - Tested 12V RGB LED strip with power supply
    - Controlled RGB LEDs with Raspberry Pi and Python code.
- Sent ETG Raspberry Pi Team Purchase
    - Will wait on shipping
- Created/Started GridSAFE User Manual for Teachers
    - Started the Introduction, appendix, and Setup Instructions

AI Training – Jason Di Giovanni

- Selected large labeled intrusion and DDoS datasets from the Canadian Institute for Cybersecurity as the main source for pretraining the model
- Parsed raw logs from CSE CIC IDS2018 and CIC DDoS2019 into a consistent tabular format that XGBoost can use with one row per event or flow
- Performed feature engineering on log fields such as timestamps, protocol, source and destination information, ports, packet counts, and payload statistics to capture traffic behavior
- Encoded categorical fields into numeric form and handled missing or noisy values so that the training data was clean and compatible with XGBoost
- Split each dataset into training, validation, and test sets to measure generalization and avoid overfitting while tuning the model
- Trained XGBoost classifiers to distinguish normal, anomalous, and malicious events, using the validation sets to tune depth, learning rate, number of trees, and regularization
- Evaluated the pretrained models on Modbus 2023 and CIC IIoT 2025 to see how well they transfer to traffic that is closer to power grid and industrial control environments
- Used CIC IoT DIAD 2024 and CICEVSE2024 as additional test sets to check how adaptable the pretrained model is to mixed IoT and grid style data
- Chose the best performing XGBoost configuration based on accuracy, precision, recall, and false positive rate across the held out test sets
- Saved the trained XGBoost model and preprocessing steps so they can plug into the GridSAFE pipeline, with our own generated logs reserved mainly for testing and demo runs rather than initial training

Modeling & Testing– Brant Gicante

- Fixed up and created 3d Prints and models to be printed
    - Redesigned a 3D model not meant for 3D printing
    - Managed/dealt with complications of software version
    - Sent models ready to be printed over to hardware team
    - Regression tested a protype building
- Connected raspberry pi to hardware/circuits
    - Assisted in the testing of LED and Raspberry pi
    - Assisted and learned the connection and communication from the raspberry pi to lights
    - Got one set of lights turning on and changing color

    - Could not turn on our high-powered LED's

3D Modeling and LED Testing – Evan Booze

- Made modifications to 3D models for printing
    - Added additional windows
    - Modified extrusions for a cleaner print
- Tested Christmas light-style LED strips, but they burnt out during testing
- Tested different Raspberry Pi with a different set of LEDs
    - Connected different Raspberry Pi to LEDs to test
    - Code to turn on LEDs was modified and LEDs turned a solid color

Updated network diagram based on advisor's feedback and researched VM selection for the perimeter and IT zones
– Anthony Nehring

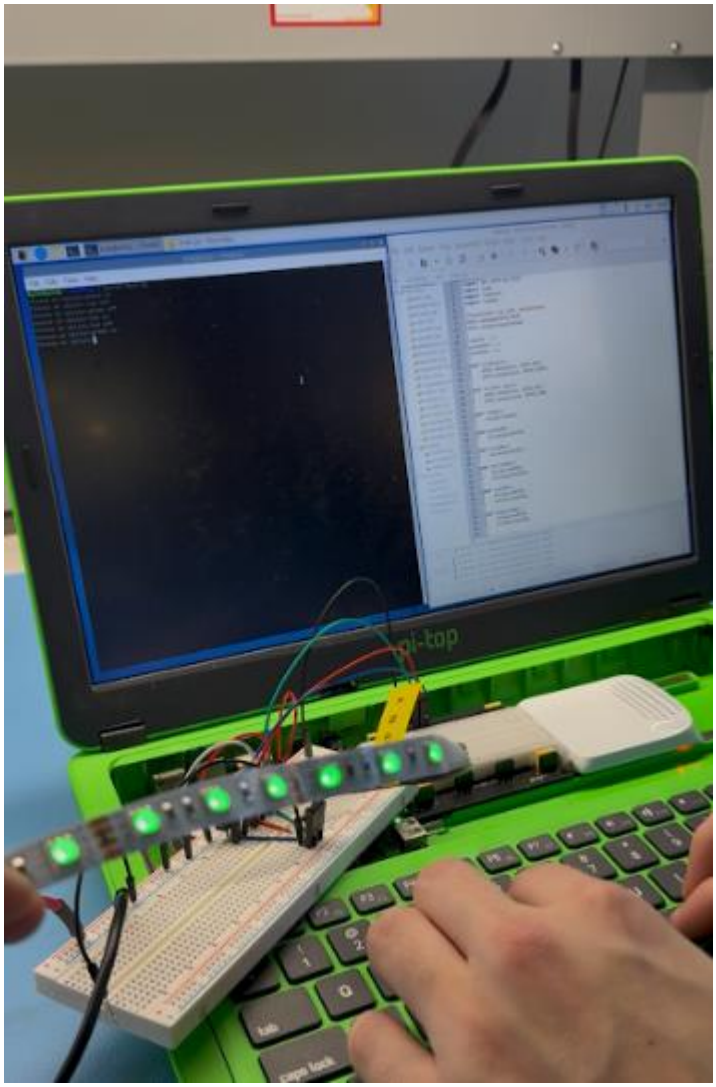
- **Added IPs**
- **Added ISOs / OS for perimeter and IT**

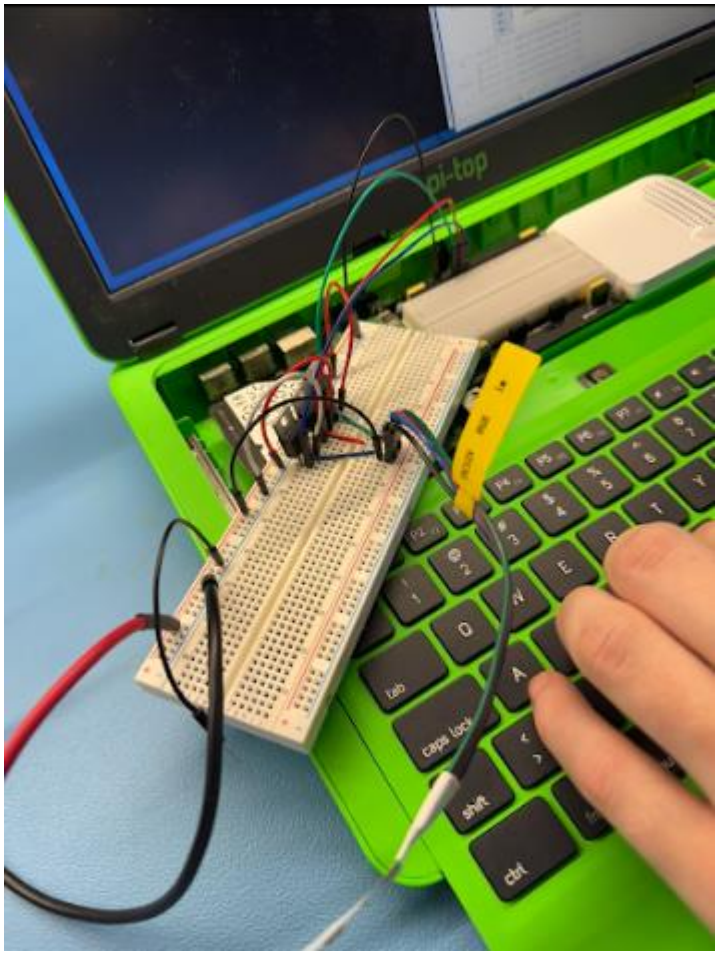
Designing backend to host communication between project sections – Kyle Maloney

- **Continued implementing APIs to use for the lighting software that will control our visual display**
- **Continued prototyping the AI model we will use to train our model with provided malicious logs**
    - **Used provided logs from database with known attacks to determine parameters that should be provided during training**

Citations/Research:

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





User Manual Link:

https://docs.google.com/document/d/1vQCfOkvRV9Vcqn-nKZsOg7-zt3JYoHKRxWj5Q3miv4k/edit?tab=t.i9enyqpjqt9

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:

NAME	Individual Contributions	Hours this week	HOURS cumulative
Nellie Leaverton	• Continued 3D splicing and printing of models • Picked up 3D prints from SIC and removed print supports • Tested Raspberry Pi with LEDs • Sent ETG Purchase Request • Created GridSAFE user Manuel	4	48

Brant Gicante	• More models finished/fixed • Prototype adjustments DONE • Wrote down usable CVE's to demo with • Sample communication between pi and lights	6	37
Evan Booze	• Made modifications to church model • Tested different set of LEDs • Tested different Raspberry Pi	5	30
Jason Di Giovanni	• AI Training	5	36
Kyle Maloney	• Continued prototyping Proxmox server • Continue designing the LED library to use in our city structure • Continued to prototype AI model to classify attacks	5	31
Anthony Nehring	• Updated Network diagram • Researched and implemented ISOs / OS	4	32

Plans for the upcoming week:

- **Brant Gicante:**
  - Put the network map into a real setting/environment (awaiting servers still)
    - Use my drawn-up plans for CVE and Phishing
  - Assist again with the LED and Pi testing
    - Helping setup connections
    - Assisting with PI pin documents
    - Going to ETG for supplies
  - Assist in hardware as needed
    - More models?
- **Evan Booze:**
  - Find a school model to print
  - Finish making modifications to the last of our 3D models
  - Program LEDs for testing once a new Raspberry Pi is and LEDs are ordered
  - Continue 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
  - Tape/glue working LEDs into 3D Model prototype and connected Raspberry Pi
  - Continue to fill out GridSAFE user Manuel
- **Kyle Maloney:**
  - Finish designing the LED library we will use for our physical city
  - Start working on setting up and building the Proxmox server now that we have been provided resources
  - Work on tuning the AI model training with our current logs to figure out how to improve accuracy
- **Jason Di Giovanni:**
  - Continue training AI
  - Integrate AI with checker program
- **Anthony Nehring:**
  - Further polish the network diagram
  - Go into Proxmox / ISElLab to start importing ISOs / setting up VMs