

## *EE/CprE/SE 492 GROUP PROGRESS REPORT #4*

*Group number: sdmay22-36*

*Project title: AI-VVO (Artificial Intelligence Volt-VAR Optimization)*

*Client: Dr. Gelli Ravikumar*

*Advisor: Dr. Gelli Ravikumar*

*Team Members: Jaden Alamsya, Demetrius Christou, Evan Dinnon, William Dulaney, Rachel Owens, Megan Phinney, Derrick Vang*

- **Project Summary:** *(Short summary about the project. What are the design goals? Have the direction or scope of the project changed? This should be about a paragraph in length.)*

The goal of this project is to develop a machine learning application that optimizes the power delivered across a smart electric power distribution system. We are designing and developing a software tool that utilizes AI-based Volt-VAR optimization (VVO) for ensuring the voltage profiles are within the prescribed threshold bands, particularly in the case of grids in which there are high penetration of Distributed Energy Resources (DERS) integrated into modern, smart electric power distribution systems.

- **Accomplishments** *(Please describe/summarize as to what was done, by whom, when and, collectively as a group since the last report. This should be about a paragraph or two in length. Bulleted points are acceptable as well. Please keep only your technical details related to your project. Figures, schematics, flow diagrams, pseudocode, and project related results are acceptable, but please ensure that they are legible (clear enough to read) and to provide an explanation. If researching a topic, please add a few details about what was learned and how it is relevant to the project. If two or more people worked on a single task, be sure to distinguish how each member contributed to the task. Specific details relating to the assistance provided to other members may be included here.)*
  - Jaden Alamsya: This week I created some new custom images for use on our map display. I continued to update the about us page with more information on how to use the app.
  - Demetrius Christou: I created a python http server that will run on the Windows Vm in order to export openDss data to our frontend client. I also worked on increasing the amount of unit testing in the backend to ensure no new bugs are created when adding new features. I also worked on exporting the voltage, power, and current information to the frontend utilizing the openDss server.
  - Evan Dinnon: This week I worked on creating the environment that will be used for the machine learning algorithm. This environment determines the action space and observation space that the algorithm needs to learn. It also specifies how the algorithm steps through the environment and determines a reward. I also adjusted some of our other scripts to retrieve data from the capacitors dss file and transformers dss file needed

for the action space. Finally, I refactored some of the file names and file structure to better represent the content.

- William Dulaney: I wrote the script entitled ExportNodeData.py that takes all currents, powers, and voltages for all nodes in the OpenDSS model and exports them to be processed by the backend and displayed on the frontend. I established functional communication between the various components. I updated the algorithm on the Gitlab and updated the scripts to allow for the action space to be adjusted. The control mechanisms such as the switch states, capacitor banks, and transformer taps can be altered using the machine learning model.
  - Rachel Owens: I implemented the LayerControl and GroupControl for the Grid Map on our website for showing and hiding markers and lines. I updated the SwitchNode button to a checkbox for a more user friendly appearance, making it clear when the switch is on versus off. I also researched how to update the polylines appearance based on when the switch is on/off. I tried to implement changing the color or line pattern when the checkbox is clicked. I researched implementing this with ReactJS and how to dynamically update one line on the grid map. I learned that there is not a good way to only update one line on the map without re-rendering the whole page so we decided to instead implement two more Layers for lines switched on and lines switched off.
  - Megan Phinney: This week I updated two of the Dockerfiles from multi-stage build to a single-stage build. I also reworked it to remove redundancies in the files. Now Docker build commands are significantly reduced. I also added documentation to explain exactly what is happening for each Dockerfile to increase readability and help out next years team.
  - Derrick Vang: This week I implemented more search features to the LayerControl component on the front-end. I added the ability to see nodes based on their type. I also implemented the user interface for our algorithm page. At the moment it has no functionality but it will eventually display data from our machine learning application.
- **Pending issues** *(If applicable: Were there any unexpected complications? Please elaborate.)*
- There are no pending issues or unexpected complications.
- **Advisor Input: It is very important that you meet regularly with your advisor. Please have your advisor select one of the options below.**
- \_\_\_\_\_ I am pleased with the progress the team is making.
- \_\_\_\_\_ The teams progress could use some minor improvements.
- \_\_\_\_\_ The team's progress has some major concerns.

**Your advisor's selection must be confirmed by either an email attached to this report (merge files into a single pdf) or a physical signature obtained from an in person meeting.**

**Please provide this report to your advisor at least 1 week before the due date so that they have time to respond.**

**Signature:** \_\_\_\_\_



**Gelli, Ravikumar [E CPE]**  
to Rachel, me, sdmay22-36@iastate.edu ▾

Thu, Apr 21, 10:52 PM (19 hours ago)



Dear Students,

Thanks for the report. Here is my response "I am pleased with the progress the team is making."

Best,

Gelli