

## EE/CprE/SE 492 GROUP PROGRESS REPORT

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

o **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.

o **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.)

- **Derrick:** Got the bus nodes and bus connections to display onto the map-based grid display. Worked with Demetrius to get the back-end API call working to retrieve the data for the nodes and connections. Changed the bus node icons to be green nodes and the bus lines to be red.
- **Evan:** This week I worked on creating a script to parse the protections.dss file and lineunder.dss. This allows us to read in the line connections between each node to show the connections. We also can see data such as the phase and length of the line. The protections file provides us with the switch states at a given line. If a certain line does not have a switch the entry shows as NULL.
- **Jaden:** I worked on creating an about us page that tells the user about the application, how to navigate the application, and how to use it.

- **Will:** This week I worked on creating a script that can modify switch states in the OpenDSS model. The control signal of the machine learning algorithm will be if the sum of all reactive powers in the grid has increased or decreased. If it's decreased, the algorithm will continue in the same fashion. If it's increased, the algorithm will try a different approach. The protection.dss file's contents will be modified by the machine learning algorithm in order to find the optimal switch positions that ensure the power delivery with the power factor closest to unity. The switch state positions will be determined by the ML algorithm.
- **Megan:** I finalized the documentation, specifically the README. I formatted it so user information was toward the top and the developer information was towards the bottom. I also created a format that was used throughout the entire document to help with readability. I added information that I found to be helpful to get started with this project as well as adding the funding source section. Hopefully this documentation will help the next senior design groups understand what this project is with more ease.
- **Rachel:** I worked on updating the svg files for the custom icons for the nodes to display on our custom map. I got these working on the map grid display. I got these working for switching between icons. I also worked on sending data to the back end on a marker click by using the axios post function. I also worked on making POST and GET template functions that other screens can use to get and send data to and from the backend.
- **Demetrius:** Created a new Neo4j database that holds the bus nodes along with the connections between them. Created Python scripts that would allow someone to automatically parse the given csv files that contain node data and the connections between them and upload them to the database. I also created an API endpoint that allows the frontend to do a get request to grab bus nodes and another endpoint that allows the frontend to grab connections. I also created an endpoint that allows the frontend to toggle the switch nodes from on to off on the grid showing all the nodes.

- Pending issues (If applicable: Were there any unexpected complications? Please elaborate.)
  - There are no pending issues.

○ **Advisor Input/Signature:**

Please select one of the options below and sign.

- \_\_\_\_\_ I am pleased with the progress the team is making.
- \_\_\_\_\_ The teams progress could use some minor improvements which I will discuss with them.
- \_\_\_\_\_ The team's progress has some major concerns that I will discuss directly with Dr. Bigelow  
bigelow@iastate.edu , 515-294-4177

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

○ **Client Input/Signature:**

Please select one of the options below and sign.

- \_\_\_\_\_ I am pleased with the progress the team is making.

\_\_\_\_\_ The teams progress could use some minor improvements which I will discuss with them.  
\_\_\_\_\_ The team's progress has some major concerns that I will discuss directly with Dr. Bigelow  
bigelow@iastate.edu , 515-294-4177

Signature:



**Gelli, Ravikumar [E CPE]**

to Rachel, sdmay22-36@iastate.edu ▾

Dear Students,

Thanks for the report. Here is my response -

I am pleased with the progress the team is making.

Best,

Gelli

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**From:** Rachel Owens <[reowens@iastate.edu](mailto:reowens@iastate.edu)>

**Sent:** Thursday, March 24, 2022 8:35 AM

**To:** [sdmay22-36@iastate.edu](mailto:sdmay22-36@iastate.edu) <[sdmay22-36@iastate.edu](mailto:sdmay22-36@iastate.edu)>; Gelli, Ravikumar [E CPE] <[gelli@iastate.edu](mailto:gelli@iastate.edu)>

**Subject:** Fwd: sdmay22-36 Email Response Needed for Group Report #3

