

EE/CprE/SE 491 WEEKLY REPORT 7

10/2/2024 – 10/9/2024

Group number: 42

Project title: GridGPT 2.0

Client &/Advisor: Gelli Ravikumar

Team Members/Role:

Luke Eitzmann -OpenDSS-Lead

Ian Louis - Power Co-lead

Scott Rininger - Power Co-lead

Aditi Nachnani - Full Stack AI Co-Lead

Ian Bussan - Full Stack AI Co-Lead

- **Weekly Summary**

This week, we met with our advisor Dr. Gelli to present our research from the previous week. The grid team also looked into different models for grouping DERs and predicting DER load and generation. The Grid team also looked into the applications of OpenDSS and how we can use it to integrate with GridAI. The Grid team also researched distribution system operators. The AI team learned more about how to connect our GPT models to external databases like Neo4j. The AI team also learned more about the electrical grid by researching more about Smart-DS and Gsgrid. In addition to learning more about GPT from OpenAI documentation.

- **Past week's accomplishments**

- **Luke Eitzmann:** I started my practice for OpenDSS. I was watching YouTube videos and implementing their practices into my own script in an attempt to learn how to use OpenDSS.
- **Ian Louis:** I researched another optimal aggregate DER model called Virtual Power Plants (VPP). I also found an objective function and several constraint formulas to optimize the VPP. I also brainstormed different applications of gridGPT to VPPs.
- **Ian Bussan:** This week I learned about implementing ChatGPT with DataBases. Specifically,

I have researched connecting ChatGPT to SQL databases and Neo4j. For SQL databases focused on methods: Text-to-SQL using LLM & Context Injection with RAG and Text-to-SQL LangChain. For the Neo4j used the method NeoDash for external data.

- **Aditi Nachnani:** I got the account set up for OpenAI and received the key from ETG. I researched how to automate DSS models into LLMS (OpenAI). Specifically, I looked into Smart-ds, dsgrid, and NSRDB, and looked into how these datasets can be used as context for LLM models.

- **Scott Rininger:** I researched what distribution system models are and how they are different across the world. I made a presentation to display how DSOs across the world operate.

- **Pending issues**

- No issues

- **Individual contributions**

<u>NAME</u>	<u>Individual Contributions</u> <i>(Quick list of contributions. This should be short.)</i>	<u>Hours this week</u>	<u>HOURS cumulative</u>
Luke Eitzmann	Learned and practiced using OpenDSS	6	24
Ian Louis	Researched Virtual Power Plants (VPP) and how to determine the optimal combination of DERs to form a VPP	6	24
Scott Rininger	Researched distribution system operators and made a client presentation to show my findings	6	24
Aditi Nachnani	Researched the different types of databases and APIs provided by Smart-DS, dsgrid, and NSRDB and how they can be used with OpenAI	6	24
Ian Bussan	Created fine-tuned data for LLM, Researched finetuning, Researched RAG	6	24

- **Plans for the upcoming week**

- **Scott Rininger:** I am going to create diagrams to show the interactions between the multiple actors in a DSO. I am also going to create different DSO schemes for the United States of America.

- **Ian Louis:** I am going to work on coding the optimization problem to optimize a VPP. I will

use Python and the Gurobi Library to create a Python script to determine optimal DER groupings. I will then use test data to demonstrate how the script works.

· **Luke Eitzmann:** This week I plan to continue what I've been doing and try to learn more about OpenDSS. I will continue to watch YouTube training videos, and Professor Gelli said he will provide me with a workshop to learn about OpenDSS

· **Ian Bussan:** I will learn more about connecting ChatGPT with Neo4j as that is GridGPT's main database. I am going to local host NeoDash implemented with ChatGPT. In addition, learn about connecting FluxDB. Also implementing docker with some of our microservices with connecting to Databases.

· **Aditi Nachnani:** The plan for next week is to get hands on experience with OpenAI since we now have the account and key set up. Specifically, I want to learn how I can convert the .dss files into JSON or CSV files (since that is what OpenAI accepts) so I can use that as context to train an LLM model.

○ **Summary of weekly advisor meeting**

This week we discussed our individual progress with Dr. Gelli. The Grid team presented the research we did this week about our special topics. Scott researched distribution system operators, Luke researched and practiced the use of OpenDSS software, and Ian researched the DER grouping model known as virtual power plants and how gridGPT can apply to VPPs. The AI team researched automating DSS models using LLMs. Aditi looked into Smart-DS (distributes synthetic grid datasets from various US regions), Dsgrid (open source Python toolkit for electricity load modeling), and NSRDB (provides real-time solar radiation data). Ian looked into using Neo4j and traditional SQL DB into LLMs.