

## **EE/CprE/SE 491 WEEKLY REPORT 4**

**Feb 21 – Feb 27**

**Group number: 20**

**Project title: GridGPT**

**Client &/Advisor: Gelli Ravikumar**

**Team Members/Role:**

- **Tin Ngo -> AI Integration Specialist**
- **Jackson Phillips -> AI Integration Specialist**
- **Emma Heithoff -> Power Systems Specialist**
- **Eddy Andrade -> Frontend Lead**
- **Nick Doty -> Backend Lead**

### ○ **Weekly Summary**

- This past week, we met with the team that is currently working on the project and getting it ready for us to work with. We learned a lot about what the project contains, and other unique features that the project contains. We were given a quick demonstration of what the application would look like when we're working on it. Afterwards, we gave an update on what we've been working on over the past week which was a lot of research about AI models.

### ○ **Past week accomplishments**

- Tin Ngo: After meeting with our team, we talked about training models. We will be using a pre-trained AI model for generating code, so I researched how to fine-tune that model. I explored fine-tuning because training one would be computationally heavy. The process of fine-tuning a model involves having a dataset, trainer, framework, and model.
- Jackson Phillips: This past week we were asked to do more in-depth technical research on the process of training AI models with hugging face. So this week, I read about and took notes on the Accelerate Library, which helps us run training tasks on multiple GPUs and some of the training classes that Hugging Face provides. The one that seems the most relevant is the SFTT because it is a trainer built on accelerate and optimized for transformers models like Llama-2.
- Emma Heithoff: I gained clarification from our client on the usage of a python package to learn from the static information given in a .dss file for a certain grid model. I explored how previous Python tests on the data from DSS operated more specifically due to this clarification from our client/advisor. Additionally, I benefited from seeing work so far on the larger project that houses our design project.
- Eddy Andrade: This past week, we met up with the other team that is working on the GridGPT project and getting it ready for us to develop our AI model. On my side of things, I got to meet with the Frontend Lead of the project and was told that the project will be using the Next.js framework. With that in mind, I began doing research and reading the documentation of Next.js on their website. At the same time, I was continuing to familiarize myself with React, getting a much better understanding on how the language works. I feel confident that I can do some basic functions in React.
- Nick Doty: After meeting with our client, I was able to get a better understanding at what route exactly I needed to take in my research. Due to this, this week I have been continuing to focus on Flask architecture research as well as beginning research on Influxdb and Neo4jdb. Specifically on the databases, I have been examining how exactly they will be implemented within the backend and

taking time to understand how our eventual collected data can be presented within the databases.

○ **Pending issues**

- Tin Ngo: I tried training the model with my laptop. I thought that my laptop was very powerful but I was quickly humbled by how much computational power is needed to train a model. I could not begin training a model and seeing the output of it so I was very limited to only do research
- Jackson Phillips: I have no real issues currently. The only thing I am having trouble with is not getting hands-on experience with any of this, as we have not gotten our HPC testbed or VMs that we will be using yet.
- Emma Heithoff: I don't have pressing issues at the moment. At times, I am having trouble with seeing the project clearly as we research so many moving parts. However, this week I felt more aware of the work needing to be done - our last meeting helped. Questions are frequently present for me and I will continue to bring those to the client and graduate students.
- Eddy Andrade: I don't have any critical issues as of now. Since I know some basic skills with React, I need to know how different Next.js will be compared to the Node.js framework (which is what I've been using to understand React).
- Nick Doty: As of now, I have no issues. I was able to get much clarification at this week's meeting on what I need to focus on. However, if questions do arise, I will make sure to bring them up with our client as well as the graduate students working on the project.

○ **Individual contributions**

<b><u>NAME</u></b>	<b><u>Individual Contributions</u></b> <i>(Quick list of contributions. This should be short.)</i>	<b><u>Hours this week</u></b>	<b><u>HOURS cumulative</u></b>
Tin Ngo	Model training research	6	27
Jackson Phillips	Model Training Research.	6	26
Emma Heithoff	Grid Model Event Testing	6	26
Eddy Andrade	React development & Next.js research	6	26
Nick Doty	Flask, Influxdb, and Neo4jdb research	6	26

○ **Plans for the upcoming week**

- Tin Ngo: I plan on continuing my research on how to use AI models. I want to start working on a small application that uses an AI model that can be trained
- Jackson Phillips: If I can get access to my VM this week I will start trying to get more hands-on experience with models and model training. If not, I will likely continue researching training and datasets.
- Emma Heithoff: I will bring questions to the AI specialists to implement my researched common grid occurrences and the model training. I will reciprocate to fill gaps in their research if possible or continue to search for the solution. I will ask the client about what is needed at the Wednesday meeting in order to meet the goal to have a prototype of some capacity within 7 weeks. My priority this week is to make sure I ask both my client and group more questions.

- Eddy Andrade: I'll keep reading up on Next.js, and possibly mess around with code that goes alongside it. Also potentially speak with the Frontend Lead to discuss what is needed to be done to implement our AI model. Also ask for tips or advice on how to understand the Next.js framework.
- Nick Doty: I will continue to research Flask as well as Influxdb and Neo4jdb. I did find a tutorial to learn Influxdb with python so I plan on going through that so I can further understand how Influxdb operates and give me potential ideas or methods to implement the database into the backend. If necessary, I will also go to the project's backend lead with any questions or clarifications.

### ○ Summary of weekly advisor meeting

Met with the grad students and saw the current infrastructure of the project. Then we talked about...

#### Understanding the System

- Grid Pilot: This component seems to handle general grid data (not real-time) and can interpret DSS scripts to either generate entirely new grid models or modify existing ones (submodels).
- GridGPT: Acts as a grid planner, generating DSS scripts for Python. It could potentially offer solutions for grid management, such as identifying which parts of the grid can be safely shut down for repairs.

#### Tasks and Learning Objectives

- Learn how to train models: Focus on understanding the basics of machine learning model training, including data preparation, model selection, training algorithms, and evaluation metrics.
- Familiarity with technologies:
  - Transformers & Code Llama: These are related to the architecture used in models like GPT. Understanding how transformers work is crucial for working with models like GPT-4.
  - DSS Scripts: Learn how to generate and interpret DSS scripts, which are crucial for simulating electrical distribution systems.
  - Training Techniques: Explore various techniques for training AI models, focusing on the inputs required for effective training.
- Training Process & Tools:
  - Hugging Face: A platform offering many pre-trained models and tools for training and deploying AI models. Look for training courses here.
  - PyTorch: The preferred framework for model training and development in this project, known for its flexibility and dynamic computation graph.
  - API Exploration: Investigate APIs from Gemini and GPT-4 for potential integration into your project.

#### Development Environment and Tools

- Visualization and Data Analysis: Tools like Neo4j for graph databases and InfluxDB for time-series data can be useful for analyzing and visualizing grid data.
- Python Version: Use Python 3.11 for development to ensure compatibility and leverage the latest features.