Generator Model Verification Result
Analysis System

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Statement of Need

At ISO New England, there are numerous power system dynamic models that need to accurately represent the actual behavior of the bulk power system (BPS). The importance of these models is to help in planning to identify and mitigate potential criteria violations, determine transfer capability, and develop transmission system reinforcement plans. The models consist of many components and their baseline model structure and parameters are derived from the manufacture data and field-test during initial commissioning. North American Electric Reliability Corporation (NERC) requires that a periodic reverification of the generator dynamic models is conducted to ensure that these models reflect a reasonable representation of the equipment in the field.

The Power Plant Model Verification (PPMV) is based on dynamic disturbance recording data from sensors such as phasor measurement units (PMUs) which can serve as a recurring test to ensure model accuracy. A playback simulation is done from the measurements and is compared to real data to determine whether the modeled response to the system events matches the actual response of the power plant. ISO created an online tool, Automatic Power Plant Model Verification (APPMV), that runs as a service 24/7 to automatically perform the task of power plant model verification using real-time power system disturbances. In the past, this tool has accumulated substantial results. The problem at hand is finding a way to manage, analyze, and quantify these results automatically.

The main requirement of this project is to find a way to manage, analyze, and quantify the results from the APPMV tool. This will need to be done with the development of a database (Task 1) and a user interface and smart engineering analysis engine which can help ISO effectively perform the model verification task (Task 2). With regards to the database and web-based GUI design and implementation, the team needs to understand the overall structure of the ISO developed APPMV tool and its results. With that information, the team will then be able to design and implement a generic event database that stores rich information about each event and make it easily accessible to data mining tools.

With regards to the engineering analysis of power plant model performance, in addition to the information above, the team will have the improve the quantitative metrics that ISO has developed, analyze the previous APPMV results, and then develop a scoring system based on the model performance to identify inaccurate models. If time permits, the team will explore techniques to narrow down the root cause of bad model performance to individual components.

Preliminary Requirements

To complete the electrical engineering portion of this project, we require access to examples of the reports that the APPMV tool generates and sends to ISO-NE engineers. These
will be used to develop the system as well as to test the performance of the system. We will also need a specification of what metrics the APPMV already has available in order to develop the scoring engine. Additionally, in order to develop a scoring system based on the model performance to identify inaccurate models, we will need access to reports from a wide array of times. For example, if we had access to reports during a few of the major storms and from surrounding days, we could compare and contrast the reported metrics to create an accurate scoring system.

To complete the CSE potion of this project, access to the aforementioned reports is also necessary. Creating the database requires a large sample size of reports to ensure we can categorize the reports effectively. Additionally, coordination between CSE and ECE team members will be crucial in developing the scoring engine. ECE members will be able to design a system on which to score models and provide these requirements to the CSE members to implement. ECE members will also be able to assist in UI design as they will be able to assist in determining important information to be displayed.

Basic Limitations

A major limitation that may hinder progress on the project is access to the APPMV reports. These are kept on a single machine at ISO New England in Holyoke, Massachusetts. In order to use these reports, we would either need to conduct our work in Holyoke or have an engineer send a few samples to us. Additionally, the APPMV tool is an ISO-developed tool. Before learning about the project, we were required to sign a confidentiality agreement.

Other Data

We will be working with two engineers at ISO New England: Qiang Zhang and Xiaochuan Luo. We will be using the data provided to the engineers at ISO New England via the APPMV system. During the first semester we are working on the planning aspect. The second semester will be focused on implementing the system.

Questions

During the project introduction, we had a few questions that cannot be answered until later in the design process. We were confused about how to access the APPMV reports. Since they are stored on a local computer at ISO New England, we were unsure if we had to visit the facility every time we wanted to work on the project. Since every person in the group has a different schedule, this would create significant complications. An additional question that was raised relates to the final product. We were unsure about what could be presented as a final product at the Demonstration Day. Because reports are kept at ISO New England and are restricted under confidentiality agreements, we are unsure of what we will be able to present.
Additional Information

For task 1, the database and web-based GUI design and implementation, strong programming skills is required. For task 2, engineering analysis of power plant model performance, good engineering analytical skills is required. In addition to that, a good knowledge of systems analysis and circuit design is needed to.