Research Design- Draft

Utsav Sharma

April 2021

1 Project Description

1.1 Project Aim

The aim of my research project is to discuss about different scenarios that might occur in a microgrid and then run a simulation of each scenario and check how the microgrid reacts on those situations.

1.2 Project Scope

1.2.1 Project Goals

The scenarios I'm discussing about in my paper are mostly concerns regarding a microgrid. The goal of my project is to run simulations based on these scenarios and research different solutions for those scenarios.

1.2.2 Project Deliverables

- Answer each research question.
- Run each simulation and observe the results thoroughly.
- A solution for the if scenarios being discussed in the paper.

1.2.3 Project Tasks

- Find a suitable simulation software to run the different if scenarios.
- Read research papers based on the simulation software being used.
- Learn how to use the simulation software and enhance my skills.
- Search for data that will be used in the simulations.

2 Research Questions

2.0.1 What are the different issues occurring in a Microgrid

- Discuss problems within the microgrid (efficient scheduling, enhancing performance, failure response, solar energy management, energy storage in critical facilities, supply-demand, Security)
- Different technologies used in tackling these issues (Digital Twin. Machine Learning, Deep Learning, IoT)

2.0.2 What scenarios can occur in a Microgrid and run various simulations to observe the microgrid's reaction

- Discuss the scenarios that might occur in a microgrid
- Discuss the results of simulation

3 Research Resources

3.1 Microgrid Simulation Software

The simulation tool is required to run each scenario in a realistic way and observe how the microgrid reacts on different situations.

3.2 Research Papers

Relevant papers will help in learning more about the microgrid and the different technologies being used in it. Additionally, the concerns related to a microgrid can also be learnt.

4 Research Methodology

4.1 Conceptual Framework or Theory applied

4.1.1 Matlab with Simulink

Matlab software helps in predicting the behaviour of a system. This simulation software can evaluate a new design, diagnose problems.

4.1.2 Machine Learning

Machine Learning is essential in Microgrids as it has the ability to streamline operations in order to build self-sustaining grid systems. Also, AI and Machine Learning algorithms are able to process large amounts of data collected by digital twins.

4.2 Experiments set up

The Microgrid Simulation tool will be set up. The microgrid will have solar power generation system, an electricity network and a storage battery. The storage battery absorbs extra energy and provides the surplus energy when there's power shortage. The goal is to run a simulation with no errors and obtain a viable output.

4.3 What questions are answered after the experiment

- If the simulation runs successfully, then we can learn and observe how a fully functional microgrid works.

4.4 What data will be acquired from the experiment and how will that data relate to the experiment's achievement

- Not know at the moment.

5 Project Risks

5.1 Not finding a suitable simulation software/tool

This is the most important part of my project. I will discuss about different scenarios in a microgrid and will then simulate those scenarios in a suitable microgrid simulation tool.

5.2 Not gaining knowledge about the simulation tool

Learning on how to work on the simulation tool is necessary. With no prior knowledge, I won't get favourable outcomes and will remain stuck on the same part.