# Project Plan: Grid Frequency Control with 5G

## 1. Introduction

This project aims to control the grid frequency in a simulated environment using distributed generation (DG) units and 5G communication. With the increasing penetration of renewable energy sources (RES), there is a critical need for a flexible, low-latency communication infrastructure. This project utilizes a Power-Hardware-in-the-Loop (PHIL) laboratory setup involving real-time computers and 5G communication modules to demonstrate efficient frequency control.

## 2. Splitting the Project into Tasks

| Subsystem | Function | Task ID | Task Description |
| --- | --- | --- | --- |
| A: Familiarization & Setup | Understand the demo setup including PHIL lab components, RTCs, DG units, and the Matlab/Simulink environment. | TA1 | Study the PHIL lab documentation and hardware setup. |
|  |  | TA2 | Explore the Matlab/Simulink models used for system control. |
|  |  | TA3 | Test individual DG units and RTC integration. |
| B: 5G Communication Customization | Implement and validate the 5G communication interface for the demo setup. | TB1 | Study the 5G module interface and configuration. |
|  |  | TB2 | Test 5G network slicing setup for communication. |
|  |  | TB3 | Defining the variables to be communicated from the RTCs by using topics |
|  |  | TB4 | Test the 5g network setup after adding delay blocks |
| C: System Integration and Control | Integrate all components and test the overall frequency control loop. |  |  |
|  |  | TC1 | Implement frequency control scheme across distributed RTCs. |
|  |  | TC2 | Integrate communication and control systems. |
| D: Evaluation and Documentation | Analyze and compare results, and prepare documentation. | TD1 | Evaluate system performance with both communication systems with and without delays in both Simulation and Hardware |
|  |  | TD2 | Evaluate different topologies like Centralized, Localized and Distributed Systems |
|  |  | TD3 | Document setup, testing procedures, and findings. |
|  |  | TD4 | Prepare final project report and presentation. |

## 3. Task Organization

Task Ordering by Subsystem:

- Subsystem A: TA1 → TA2 → TA3

- Subsystem B: TB1 → TB2

- Subsystem C: TC1 → TC2 → TC3

- Subsystem D: TD1 (after TC3), TD2, TD3

Subsystem Dependencies:

- Subsystem A & B can be done in parallel.

- Subsystem C depends on the completion of A and B.

- Subsystem D follows Subsystem C.

## 4. Working Plan

| Task | Duration | Assigned To | Start | End |
| --- | --- | --- | --- | --- |
| TA1 | 5 days | Santhosh Kumar | Day 1 | Day 5 |
| TA2 | 4 days | Santhosh Kumar | Day 6 | Day 9 |
| TA3 | 5 days | Santhosh Kumar | Day 10 | Day 14 |
| TB1 | 5 days | Lubna Basha Mohammed | Day 1 | Day 5 |
| TB2 | 5 days | Lubna Basha Mohammed | Day 6 | Day 10 |
| TC1 | 6 days | Santhosh Kumar | Day 16 | Day 21 |
| TC2 | 5 days | Santhosh Kumar | Day 22 | Day 26 |
| TC3 | 5 days | Santhosh Kumar | Day 27 | Day 31 |
| TD1 | 3 days | Santhosh Kumar | Day 32 | Day 34 |
| TD2 | 3 days | Lubna Basha Mohammed | Day 35 | Day 37 |
| TD3 | 5 days | All | Day 38 | Day 42 |

Each student focuses on a primary subsystem to ensure efficiency and minimize task switching. Coordination meetings are planned at the end of each major subsystem phase to align integration and testing efforts.

## Final Notes

- Time buffers can be added if needed based on progress.

- Integration testing is crucial and should start as soon as Subsystem C is functional.

- Final presentation and report compilation span the last week.