**Project Initialization and Planning Phase**

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| Date | 15 March 2024 |
| Team ID | Team-740034 |
| Project Title | Predicting the energy output of wind turbine based on weather condition |
| Maximum Marks | 3 Marks |

**Project Proposal (Proposed Solution) template**

This project proposal outlines a solution to address a specific problem. With a clear objective, defined scope, and a concise problem statement, the proposed solution details the approach, key features, and resource requirements, including hardware, software, and personnel.

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| **Project Overview** | |
| Objective | Wind power generation differs from conventional thermal generation due to the stochastic nature of wind. Thus wind power forecasting plays a key role in dealing with the challenges of balancing supply and demand in any electricity system, given the uncertainty associated with the wind farm power output. Accurate wind power forecasting reduces the need for additional balancing energy and reserve power to integrate wind power. For a wind farm that converts wind energy into electricity power, a real-time prediction system of the output power is significant. In this guided project, a prediction system is developed with a method of combining statistical models and physical models. In this system, the inlet condition of the wind farm is forecasted by the auto regressive model. |
| Scope | Accurately predict the energy output of a wind turbine based on real-time and forecasted weather conditions. |
| **Problem Statement** | |
| Description | The energy output of wind turbines fluctuates significantly due to variations in weather conditions such as wind speed, wind direction, temperature, air pressure, and humidity. Current methods for predicting wind turbine energy output are often limited in their accuracy and responsiveness to real-time weather changes. This unpredictability poses challenges for grid operators, wind farm managers, and energy market participants in terms of planning, scheduling, and maximizing the use of wind resources. |
| Impact | * Identify key weather variables affecting turbine performance. * Improve operational efficiency and maintenance scheduling. * Enhance understanding of the relationship between weather patterns and energy production. |
| **Proposed Solution** | |
| Approach | 1. Data Collection 2. Data Preprocessing 3. Model Development 4. Model Evaluation 5. Deployment |
| Key Features | 1. Variable wind speed and direction 2. Past and Real-Time Data |

**Resource Requirements**

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| **Resource Type** | **Description** | **Specification/Allocation** |
| **Hardware** | | |
| Computing Resources | CPU/GPU specifications, number of cores | 2 x NVIDIA V100 GPUs |
| Memory | RAM specifications | 8 GB |
| Storage | Disk space for data, models, and logs | 1 TB SSD |
| **Software** | | |
| Frameworks | Python frameworks | Flask |
| Libraries | Additional libraries | Sklearn  Pandas  Numpy  Seaborn  Matplotlib |
| Development Environment | IDE, version control | VSCode |
| **Data** | | |
| Data | Source, size, format | Kaggle dataset, 4,446 records |