Project Design Phase
Solution Architecture

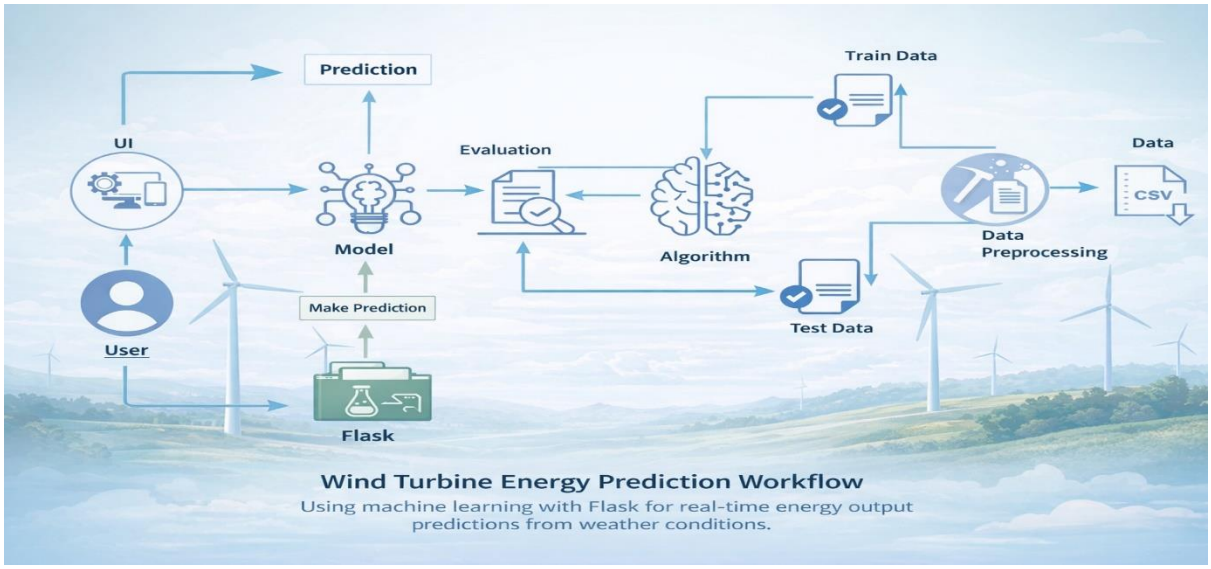
Date	14 February 2026
Team ID	LTVIP2026TMIDS90282
Project Name	Weather-Based Prediction of Wind Turbine Energy Output: A Next-Generation Approach to Renewable Energy Management
Maximum Marks	

Solution Architecture:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.

Solution Architecture Diagram:



The solution architecture of the project follows a modular design that separates the system into distinct layers: data layer, model layer, and application layer. This structured approach ensures clarity, scalability, and maintainability of the system.

In the data layer, historical wind turbine and weather datasets are collected and preprocessed using Python libraries such as Pandas and NumPy. The cleaned data is then used to train the Random Forest regression model. The trained model is stored as a serialized file for future use.

The application layer consists of a Flask web framework that interacts with users. The Flask application loads the trained model and processes user inputs to generate real-time predictions. The results are displayed through an HTML-based user interface, completing the end-to-end flow from data input to energy output prediction.