VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

OFFICE OF STUDENTS' WELFARE
CENTRAL HACK - YANTRA'26

YANTRA

FURIOUS FIVE

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Problem Statement Code	**HECEE001**
Problem Statement	AI Enabled Smart Grid Management with Renewable Energy Prediction

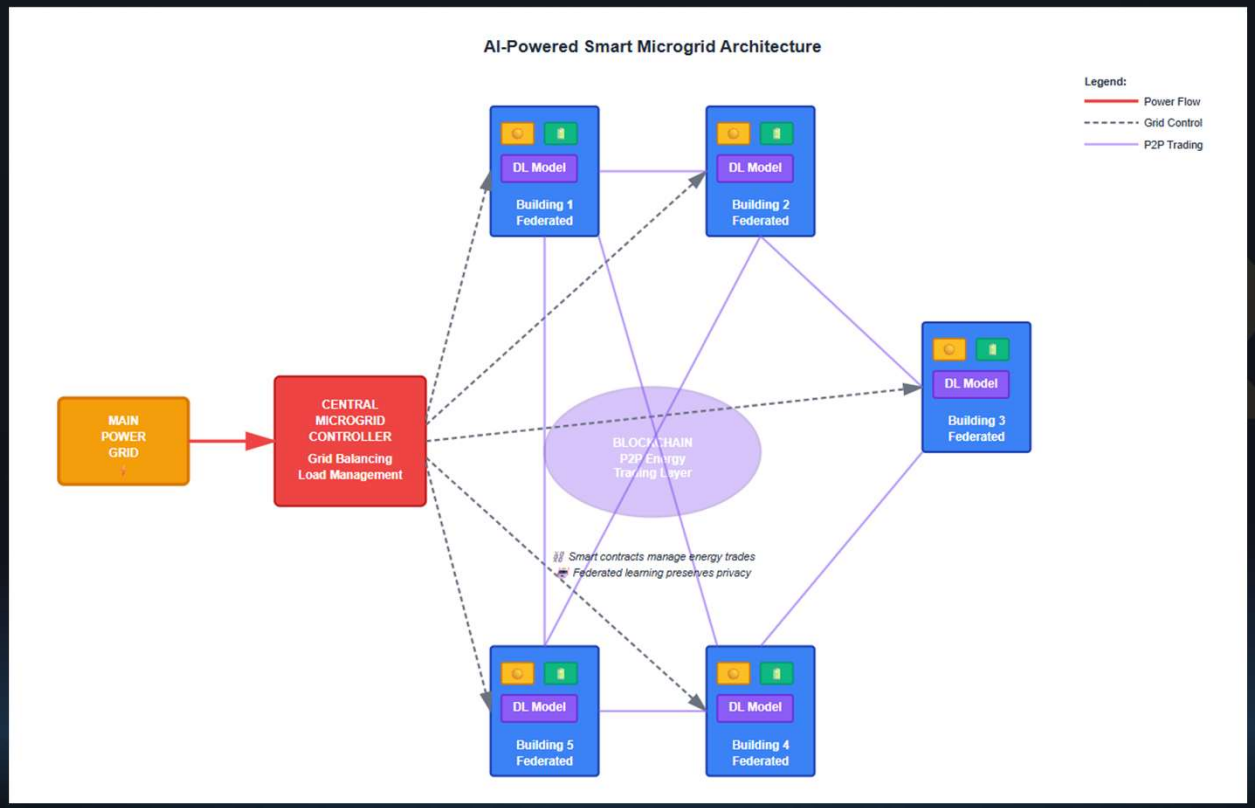
Proposed Solution:

Our proposed solution is an AI-enabled smart microgrid designed for a small cluster of buildings, each equipped with solar panels and battery storage. Every building runs a local deep learning model to predict its short-term energy demand and renewable generation. These models are improved collaboratively using federated learning, ensuring better predictions without sharing raw energy data. Based on these predictions, buildings with surplus energy can directly trade with deficit buildings through blockchain based peer-to-peer energy trading, ensuring transparent and secure settlements. When no immediate local demand exists, surplus energy is temporarily stored at a central mini-grid controller instead of being instantly exported to the main grid. The mini-grid uses a global prediction model to forecast overall area-level demand and intelligently decides whether to retain energy locally or interact with the main power grid. This predictive, cost-aware energy management approach prioritizes local renewable usage, reduces dependency on the main grid, and enables an efficient, decentralized, and resilient energy ecosystem.

Novelty/Uniqueness:

The novelty of our solution lies in its AI driven forecasting and intelligent multi-level architecture. Unlike traditional smart grid systems that responds to real time surplus or deficit, our system forecasts future energy needs using local and global deep learning models before deciding when and where energy should flow. Federated learning enables buildings with different usage patterns to effectively improve predictions without sharing raw data, while blockchain is used for transparent peer-to-peer energy trading. This combination transforms a group of buildings into an intelligent local energy economy that prioritizes renewable utilization, reduces grid dependency, and makes time aware intelligent energy decisions.

Block Diagram/Flow Chart:



Five interconnected buildings leverage federated deep learning for energy optimization and blockchain-enabled P2P trading, while maintaining grid connectivity for resilience.

Tech Stack:

- **AI/ML:** Python, TensorFlow/Keras, Pandas, NumPy
- **Federated Learning:** Central weight aggregation
- **Blockchain:** Ethereum, Solidity, Remix, Web3.js
- **Backend:** FastAPI, REST APIs, PostgreSQL,Typescript
- **Frontend:** React.js, Chart.js/Recharts, Tailwind CSS,Vite,
- **Tools:** GitHub, Docker, Postman, Figma

Business Model:

Our business model is based on providing an AI-driven smart microgrid management platform for residential complexes, campuses, and local energy communities. We generate revenue through subscription fees for energy optimization services, small transaction fees on peer-to-peer energy trading, and optional performance-based savings sharing. By prioritizing local renewable usage and reducing dependence on the main grid, our system delivers measurable cost savings while enabling transparent energy trading and sustainability tracking, making it both economically viable and environmentally impactful.

Hardware Requirements

If you require any electronic components, please prepare an Excel sheet with two columns (Item and Quantity) and submit it through the Google Form provided below. Please note that sophisticated or high-value components will not be entertained.

All electronic components issued on the day of the event must be returned to the Purchase Committee in proper working condition and without any damage. Teams will be held fully responsible for any loss or damage to the components.

https://forms.gle/E6WsCBWEC9Aft1vB6

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Thank you!!

Kindly rename the file in the below format:

<Team_Code>.pptx