**Hackathon Evaluation Report - Round 1**

1. Team information

Dude-devs

Team Members (for 3 Members)

Yash Prajapati

Role: Project Lead & Hardware Design

Responsibilities:

Oversee project management and coordination.

Lead the design and integration of hardware (if applicable in future phases).

Ensure alignment with project goals and timelines.

Charmi Padh

Role: Software Architect & Algorithm Development

Responsibilities:

Design the architecture of the software solution.

Develop the core algorithms (such as solar position, energy calculation, and shading analysis).

Ensure seamless integration of different modules in the software.

Vraj Suthar

Role: Data Analysis & User Interface Development

Responsibilities:

Handle data collection, processing, and analysis (terrain data, solar irradiance, shading effects).

Implement data visualization (3D visualizations, energy vs. tilt plots, etc.).

Develop and maintain the user interface for easy interaction with the system.  
  
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2. Problem Statement Understanding

Problem Statement:

Optimizing solar panel placement in India to address urban challenges (limited rooftop space, shading, high costs) and rural barriers (unsuitable rooftops, farmer reluctance, policy gaps), while maximizing energy efficiency and accessibility.

Key Challenges Identified:

Urban Areas:

Limited rooftop space and shading from high-rise buildings.

Suboptimal tilt causing 10–30% efficiency loss.

High costs for automated tracking systems.

Rural Areas:

Unstable rooftops (clay, thatch) unfit for solar mounting.

Farmer reluctance due to lack of awareness and fear of crop failure in agrivoltaics Policy gaps in land-use classification and subsidy allocation

Common Issues:

Grid instability and water scarcity for panel maintenance

Lack of skilled technicians for installation and upkeep.

3. Proposed Solution Approach

Solution Overview:

Sun-Adapt is a dual-mode solar solution combining manual tilt brackets (urban) and ground-mounted agrivoltaics (rural). Key features include:

Dynamic Shading Analysis: Identifying shadow-free zones using terrain and object modelling.

Dual Tilt Modes:

Manual: Precomputed monthly tilt angles based on latitude.

Auto: Brute-force tilt optimization for maximum energy.

Agrivoltaic Integration: Ground-mounted solar with crop recommendations for rural areas.

Technologies/Tools:

MATLAB: Core simulations, 3D surface/contour plots, shadow simulation.

Data Sources: NASA SRTM (terrain), NSRDB (solar irradiance).

Visualization Tools: MATLAB’s surf, scatter3, patch.

Free Tools: QGIS (terrain preprocessing),Lucid Chart (UI mock-ups).

Technologies/Tools Planned to Be Used:

Free Tools:- Lucid chart