Problem Statement 10 - *Solar Panel Efficiency Optimizer – AI-Powered Smart Monitoring System*

🌼 Problem Background

The adoption of solar energy has increased dramatically across India, yet efficiency losses remain a major barrier to maximizing output. Factors like dust accumulation, shading, ambient temperature, panel tilt, and poor maintenance often reduce the performance of solar PV systems by 10–30%.

Despite technological progress, most solar systems—especially in residential, institutional, and rural setups—lack real-time performance analytics or predictive maintenance systems. There is a growing need for smart, affordable, and data-driven solutions that can monitor and optimize solar panel performance automatically.

🚩 Problem Statement

Design and develop an AI-powered Solar Panel Efficiency Optimizer that can:

1. Monitor real-time data such as energy output, sunlight intensity, temperature, and dust levels using sensors or simulated inputs.

2. Predict performance degradation or energy loss due to environmental and operational factors.

3. Recommend optimal maintenance actions — such as cleaning schedules, tilt adjustments, or performance alerts — to maximize energy generation.

The solution should be cost-effective, scalable, and suitable for deployment in small or medium solar installations (e.g., educational institutions, households, or rural microgrids).

💡 Key Objectives

Participants are expected to:

- Integrate IoT sensors or virtual data feeds for real-time monitoring.

- Use machine learning or predictive analytics to estimate efficiency losses.

- Design a dashboard or mobile app interface for visualizing performance trends and maintenance suggestions.

- Ensure the system works offline-first or with minimal internet dependency (ideal for rural or remote areas).