Technical Product Documentation

Product Requirements Document (PRD)

Problem Statement
Solar PV plants lose 5–25% of energy yield due to soiling (dust, debris). Manual cleaning schedules are often inefficient, leading to unnecessary costs or energy loss. Operators need AI-driven insights to balance yield optimization and cleaning costs.

Objectives & Goals

1. Increase energy yield by 10% through optimized cleaning schedules.
2. Reduce operational costs by 15% via cost-benefit-driven recommendations.
3. Achieve 95% accuracy in soiling loss detection and yield forecasting.

Feature Scope

- **User Roles**:
  - *Operators*: Monitor dashboards, approve/reject cleaning schedules, receive alerts.
  - *Analysts*: Adjust AI model parameters, validate predictions, generate reports.
- **Key Functionalities**:
  - AI-driven soiling detection (SCADA + weather data).
  - Daily/weekly yield forecasts with variance analysis.
  - Cost-benefit-based cleaning schedules.
  - Real-time SMS/email alerts for critical soiling levels.

Data Flow Description

1. **Data Sources**:
   - SCADA: Real-time solar panel performance metrics.
   - IoT Sensors: Soiling levels and panel tilt data.
   - Weather APIs: Historical and forecasted weather (rain, dust storms).
2. **Interaction**:
   - Data ingested into cloud storage → AI model processes data → Generates yield forecasts and cleaning recommendations → Output displayed on dashboards.

Acceptance Criteria

- 10% improvement in energy yield after 3 months.
- 15% reduction in cleaning costs.
- AI model accuracy ≥95% (validated against historical data).