

Autonomous Solar Farm Inspection Rover – Virtual Prototype & Simulation

Project Brief – Phase 0

Mission Objective

Design, simulate, and optimise an autonomous rover capable of navigating a solar farm to inspect panels for damage or misalignment, while avoiding obstacles and operating efficiently in outdoor conditions.

Environment

Outdoor solar farm with gravel and dirt access paths, occasional puddles, and panel rows spaced 2–3 m apart.

Key Capabilities

- Autonomous navigation between panel rows.
- Obstacle detection and avoidance using LiDAR and camera simulation.
- Path planning to maximise coverage with minimal time and energy usage.
- Basic panel fault detection in simulation (e.g., using visual markers or simplified anomaly logic).

Sensors (Simulated)

- **LiDAR** - 360° environment mapping for obstacle detection and path planning.
- **RGB Camera** - for visual inspection / fault detection.
- **GPS/IMU** - for position estimation.
- **Ultrasonic sensors** - for close-range obstacle detection (redundancy).

Mobility System

- Skid-steer 4-wheel configuration.
- 15 cm ground clearance.
- Designed for stability on light gravel and small inclines ($\leq 10^\circ$).

Success Criteria

- Navigate a 50 m inspection route with obstacles in <90 s.
- Detect and log all simulated faults within the panel rows.
- Maintain $\geq 95\%$ uptime (no getting stuck) in 10 consecutive simulation runs.