

SOIL DATA COLLECTION SYSTEM WITH FIELD ROBOT FOR CANAL - BASED LIME ORRCHARDS



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Infomation

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Description & Objective



NAVIGATION

- Navigate narrow orchard paths
- Avoid obstacles & uneven terrain



IoT MONITORING

- Transmit sensor data remotely
- Support data-driven decisions



SOIL DATA COLLECTION

- Measure moisture, temperature, pH & EC
- Collect real-time soil data



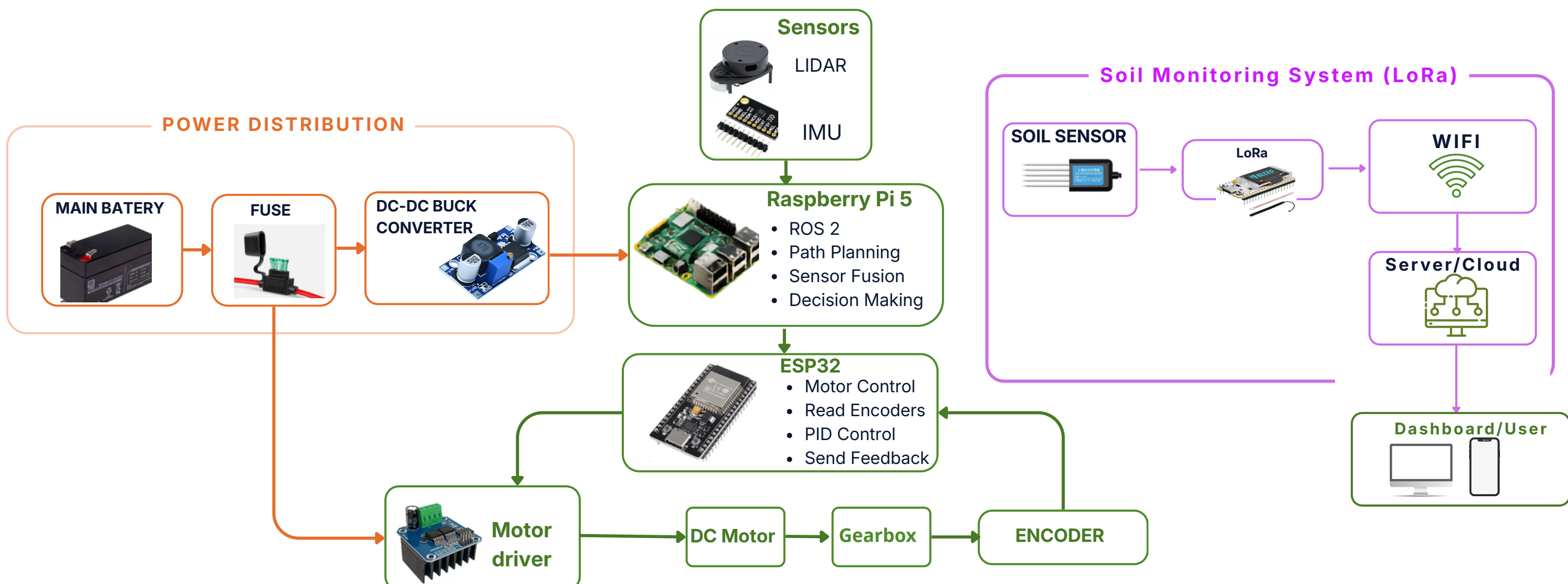
EXPECTED TARGETS

- Path Tracking: ± 10 cm
- Obstacle Avoidance: $\geq 90\%$
- Navigation Success: $\geq 80\%$
- Data Transmission: $\geq 95\%$
- Sampling Interval: 5-10 s

SYSTEM OVERVIEW

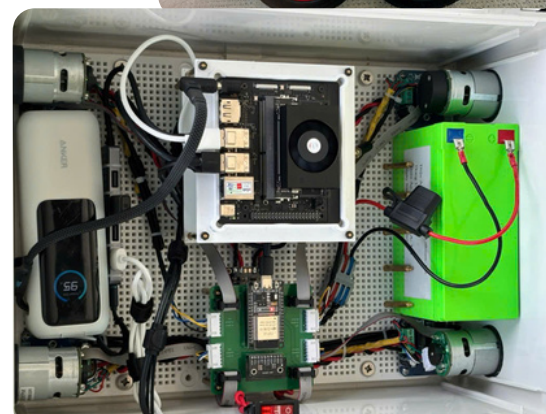
- ROS2 / Nav2 — Navigation
- LiDAR + IMU — Environment Sensing
- ESP32 + Encoder — Motor Control
- Raspberry Pi 5 — System Processing
- Soil Sensor — Soil Data Collection
- LoRa + Wi-Fi — Data Transmission

MAIN SYSTEM FLOW



Process & Result

- Simulation & Navigation: 5 × 10 m Gazebo orchard, ROS2 Nav2 + LiDAR
- Multi-Robot Mapping: 2-robot simulation & map merging
- Motor & Control: Motor, encoder & telemetry testing
- Soil & IoT: 4-in-1 sensor assembled & tested
- Hardware: Core robot components assembled & tested



FUTURE WORKS

- System Integration: Complete integration of ROS2, ESP32, sensors and motor control.
- Field Testing: Validate navigation and soil data collection in the orchard.
- IoT Validation: Complete LoRa data transmission and dashboard monitoring.
- Solar Power: Implement a solar-powered sensor box.
- Navigation Improvement: Improve canal-edge detection and obstacle avoidance.