

UGV Assisted Navigation

UGV Assisted Navigation is a next-generation solution built to make UGVs smarter, safer, and more efficient in challenging off-highway environments, from plantations and construction sites to mining quarries and critical operations like search and rescue or border patrol. Our integrated system combines accurate localisation, optimised path planning, and intelligent control technologies to deliver autonomous movement with confidence. From rugged terrains to remote job sites, it empowers UGVs to achieve maximum productivity, operational efficiency, and unmatched reliability even in the toughest conditions.



Technology Overview

- **Controller:** MIMOS-developed system managing drive, steering, and precise dosage control.
- **Navigation & Control:** Centimetre-level GPS RTK accuracy integrated with IMU, odometry, and vision sensors.
- **Communication:** Flexible connectivity via TVWS, 5G, Wi-Fi, and LoRa Meshtastic to suit diverse terrains.
- **Simulation & Digital Twin:** Realistic 3D environment for safe testing, AI model training, and route optimisation.
- **Application System Integration:** Automated granular application with intelligent task coordination.

Technology Benefits

- **Accuracy:** Tree-specific targeting minimises wastage.
- **Efficiency:** Optimised use of time and manpower.
- **Cost Savings:** Reduced fertiliser usage, better return of investment (ROI).
- **Sustainability:** Lower environmental footprint.
- **Risk Reduction:** Digital twin prevents costly breakdowns.
- **Scalability:** Expandable from pilot projects to full plantations.
- **Versatility:** Applicable beyond agriculture.
- **Traceability:** Dashboard enables monitoring, reporting, and data-driven decisions.

Key Features

1. Responsive Control Mechanism

- MIMOS-developed controller for **driving, steering, braking, and dosage control.**
- Works with diverse **sensors, motors, actuators.**
- **Low-latency** performance with real-time motor & sensor handling.
- **Modular & scalable**, adaptable to varying robot complexity.
- Built-in **safety, fault tolerance, and emergency stop.**
- **Simple configuration** for quick setup and customisation.

2. Accurate Navigation

- **Sensor Fusion Localisation:** Combines **GNSS RTK, IMU, odometry, vision** → centimetre-level precision, even in **GNSS-denied areas.**

- **Resilience:** Reliable under dense canopy, steep terrain, or low light.
- **Fast Cartographer:** Converts **aerial imagery into high-resolution occupancy maps** in seconds.
- **Obstacle Detection:** Identifies trees & terrain features for safe routing.
- **Navigation Planning:** Optimised path planning for efficiency, smooth trajectory generation, and **real-time recalculation** to avoid obstacles.
- **Safety Assurance:** Collision avoidance and fail-safe mechanisms ensure safe operation.

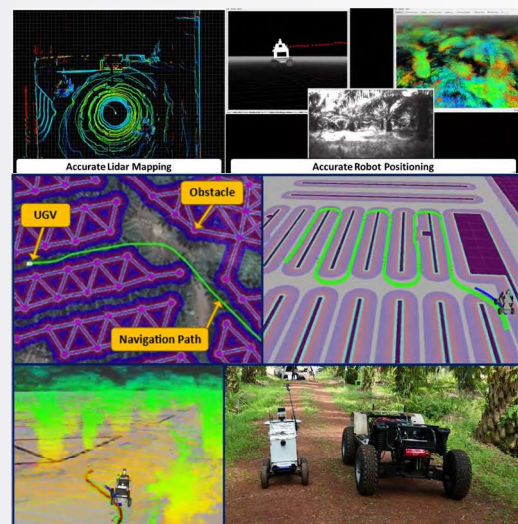


Figure 1:
Autonomous Path Planning and Obstacle Avoidance for UGV Navigation in Plantations

3. Adaptive Connectivity

- Supports multiple communication options: **Wi-Fi, 5G, TV White Space (TVWS), and LoRa Meshtastic.**
- Provides **reliable, low-latency** links across diverse terrains and field conditions.
- Ensures UGVs remain **connected, responsive, and coordinated** in real-time.
- Flexible design allows **seamless integration with future network technologies.**

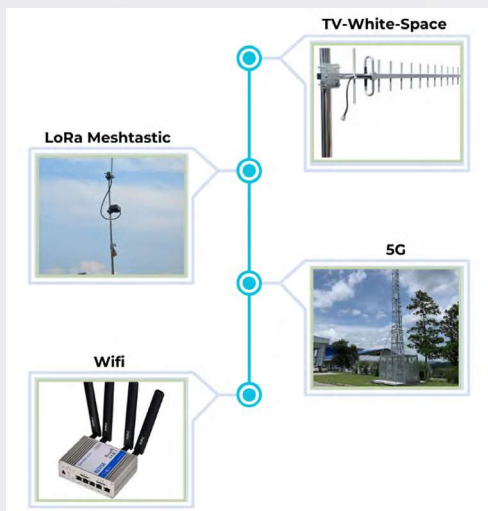


Figure 2:

Adaptive Connectivity with LoRa Meshtastic, TV White Space, 5G, and Wi-Fi ensures reliable, real-time communication across diverse terrains.

5. Autonomous Precision Application System

- Differential drive UGV with autonomous navigation.
- Precision dosage control ensures tree-level accuracy.
- Tree locator via GPS coordinates for targeted application.
- Smart controller automates delivery at each tree.
- Enables data-driven, efficient plantation operations.



Figure 4:

Autonomous UGV with precision control system delivers efficient, accurate, and data-driven operations across plantation environments.

4. Digital Twin & Simulation

- High-fidelity 3D models powered by GIS data.
- Integrates terrain, roads, drainage, plantation boundaries.
- Supports VR visualisation, AI training, and route optimisation.
- Safe platform for UGV, UAV, and automation testing.



Figure 3:

High-Fidelity Digital Twin with terrain and tree-level visualisation enables accurate mapping, navigation, and operational planning in plantations

Applications

Primary: Agriculture

- Oil palm plantations – autonomous fertiliser spreading at tree level.
- Other crops – adaptable to precision agriculture

Extended

- Search & Rescue – navigating hazardous terrain.
 - Border Patrol – autonomous surveillance.
 - Construction – automated transport in rugged sites.
 - Mining – off-highway operations and navigation.
- Measures blood sugar through the skin without painful finger pricks or strips, safe and eco-friendly.

