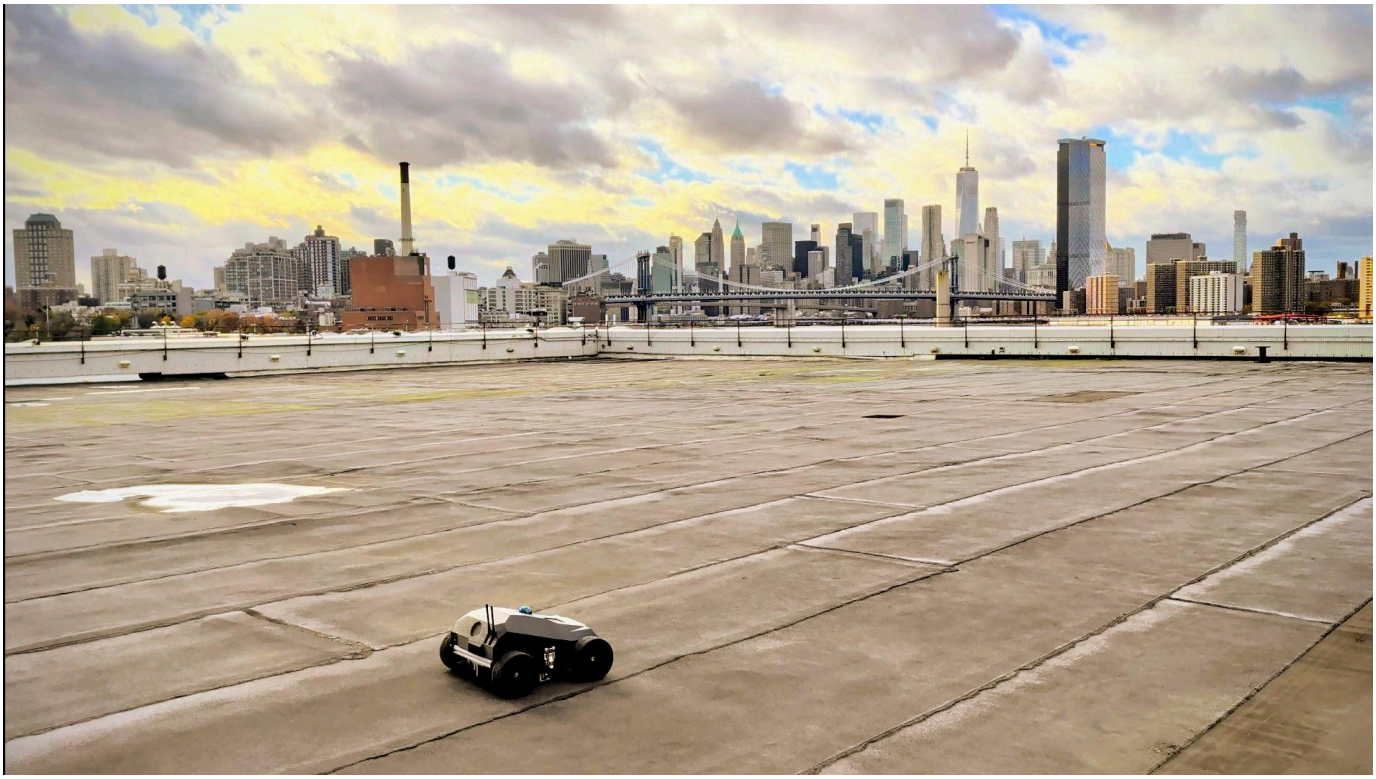
ROOFUS MULTIMODAL ROOF/CONCRETE INSPECTION SYSTEM
PRODUCT OVERVIEW & TECHNICAL DOCUMENTATION



Product Summary

Roofus™ is an autonomous, four-wheeled mobile robot designed to identify and map moisture and related anomalies in roofing and horizontal concrete assemblies. Deployed directly onto the surface under investigation, Roofus follows a planned lawn-mower–style scan path while synchronously collecting ground-penetrating radar (GPR), thermal, 3D LiDAR, and high-resolution visual data. All signals are co-registered in a common reference frame and processed by a multimodal deep learning pipeline to produce actionable moisture and anomaly maps

Key features:

- Autonomous, repeatable coverage with minimal on-roof labour
- High-density, georeferenced GPR, thermal, LiDAR, and RGB data
- Multimodal deep learning for moisture and anomaly localization
- Plan-view deliverables aligned with roof plans and core locations
- Applicable to roofs, plaza decks, podium slabs, and other horizontal assemblies

System Architecture & Technical Specifications

Robotic Platform:

- **Form factor:** Four-wheeled mobile robot optimized for flat roofs and slab-type surfaces.
- **Drive system:** Two brushless DC (BLDC) motors with closed-loop control.
- **Motor controllers:** ODrive S1 motor controllers for precise, smooth motion and speed regulation.
- **Traversal capacity:** Tested for approximately 5 miles of scanning per deployment, subject to surface conditions and scan density.

Compute & Control:

Onboard computer: LattePanda Sigma high-end single-board computer.

Onboard responsibilities:

- Robot localization and navigation
- Real-time coordination and logging of sensor data
- Telemetry, communications handling, and health monitoring

Sensor Suite (Multimodal Data Collection):

- **Ground-penetrating radar (GPR):** Proceq GP8800 GPR for subsurface moisture and anomaly detection.
- **LiDAR:** Livox Mid-360 LiDAR for 3D mapping and point cloud generation.
- **Thermal imaging:** Seek Thermal camera for surface temperature mapping and identification of thermal irregularities.
- **RGB imaging:** Industrial-grade See3Cam cameras for high-resolution visual documentation.

All modalities are acquired synchronously during robot motion so that each position on the surface can be associated with a consistent set of data (GPR trace, temperature, LiDAR point, and RGB context).

Power & Runtime:

- Battery: 20 Ah onboard battery pack.
- Runtime: Tested for up to approximately 4 hours of scanning under typical operating conditions.

Communications:

- Communication link: Radio-frequency (RF) data link designed for non-line-of-sight communication between Roofus and a base station.
- Typical throughput: Up to approximately 10 Mbps.
- Usage: Live monitoring of status, optional teleoperation, telemetry, and coordination of data offload.

Operating Principle

Deployment & Scan Workflow:

1. Setup: Roofus is placed within the area to be inspected and system initialization and checks are performed.
2. Localization: The robot performs an initial exploration to localize itself and understand the available workspace.\
3. Systematic scanning: Roofus executes a lawn-mower–style, overlapping path across the defined area, continuously collecting data from all onboard sensors.
4. Co-registration: Each recorded position is assigned a unified 3D coordinate, enabling co-registration of GPR, thermal, LiDAR, and visual information for every location on the surface.

Moisture Detection & Data Processing:

The collected multimodal dataset is processed offline by a deep learning pipeline that has been trained to interpret combined GPR, thermal, LiDAR, and visual signatures. The system identifies regions with a high likelihood of elevated moisture content or other subsurface anomalies and aggregates these findings into plan-view maps.

Deliverables typically include:

- Moisture likelihood maps showing spatial distribution of suspected wet areas
- Anomaly overlays on roof plans or CAD backgrounds
- Data products to support core selection, scope refinement, and capital planning

Applications

Roof Systems:

- Low-slope commercial roof systems (single-ply, BUR, modified bitumen, etc.)
- Multi-layered assemblies with various insulation and cover board combinations
- Post-storm or hail damage assessments
- Pre-replacement investigations to refine tear-off extents

Basements & Below-Grade Waterproofing (Accessible Surfaces):

- Horizontal plaza decks over occupied space
- Accessible podium decks and similar assemblies where the walking surface can be scanned

Horizontal Concrete & Slab Surfaces:

- Parking decks and podium slabs
- Elevated concrete slabs with roofing or waterproofing layers
- Industrial floor slabs exposed to water ingress

Manufacturer & Compliance

Manufacturer:

- Product name: ROOFUS Multimodal Roof/Concrete inspection system
- Manufacturer: Building Diagnostic Robotics (BDR) / Tall Wall Robotics.
- Country of manufacture: United States.
- Supply chain: Components sourced from the United States, China, Switzerland, Canada, and Japan. Final assembly, integration, and testing are performed in the U.S.

Company Background:

BDR / Tall Wall Robotics specializes in robotics and artificial intelligence for building diagnostics, with a focus on moisture detection and condition assessment of roofs and slabs. The company has developed Roofus through multiple years of R&D, field pilots, and collaboration with building envelope consultants and owners of large building portfolios.The team combines expertise in robotics engineering, deep learning, signal processing, and building science to deliver practical tools that integrate directly into the workflows of engineers, consultants, and roofing contractors.

Technical Certifications:

- Electronic components: Most core electronic modules used on Roofus carry applicable CE certifications, where required.
- Communications hardware: The RF data links used for communication between ROOFUS, and the base station is FCC, ISED, Japan MIC, KC, and CE certified and is NDAA compliant.

Warranty & Service

Standard Warranty Period	Two (2) years from the date of delivery.
Coverage	Defects in materials and workmanship for the Roofus robotic unit, including drive, compute, integrated sensors, and communications hardware under normal operating conditions.
Warranty Remedies	At BDR's discretion, issues covered under warranty will be resolved through replacement of the unit or repair (which may include on-site servicing where applicable).
Service Response Times	Support tickets and technical queries are acknowledged on the same business day. Remote troubleshooting, configuration support, and log review are provided as part of standard support.

Repairs and maintenance:

- Covered repairs: Failures related to normal operation and covered under warranty are resolved at no additional charge within the warranty period.
- Accidental damage and non-warranty issues: Accidental damage to critical components and other non-warranty issues are reviewed after inspection, and BDR provides a recommended repair plan and cost estimate before proceeding.

- Service commitment: If an issue affects the ability to perform inspections as intended, BDR will work with the customer to diagnose, repair, or replace the system as quickly as reasonably possible to keep projects on track.

Contact Information

Primary representative:
Name: Bilal Sher
Role: CEO & Co-Founder, Building Diagnostic Robotics / Tall Wall Robotics
Email: bilal.sher@buildingdiagnosticrobotics.com
Phone: (510) 514-9518