# Item 1: Ground Robot

A mobile robot platform with specifications, components, and configuration outlined below. All components shall be fully integrated and supported with the necessary hardware, software, and documentation to ensure complete operational readiness. The supplier shall deliver the system within a maximum period of three (3) months from the date of contract award.

| Item No. | Item | SPECS |
|---|---|---|
| 1 | Mobile Robot (base unit) (1x) | • 4x wheel ground robot with ROS 2 operating system.<br>• 4x Brushless Motor with planetary gearbox<br>• Ip66 protection<br>• Rechargeable Li-ion battery, minimum capacity 700<br>• Dimensions: (approximately 809x848x356 mm) for L, W, and H<br>• Payload: up to 80kg.<br>• Integrated onboard computing unit: Quad-core 64-bit processor (≥1.5 GHz) with ≥4 GB RAM.<br>• Integrated communication router supporting: dual-band Wi-Fi (2.4/5 GHz), access-point and client modes, 4G/LTE connectivity, Bluetooth LE, and GNSS (GPS + multi-constellation).<br>• Inertial navigation unit providing 3-axis accelerometer, 3-axis gyroscope, and 3-axis magnetometer.<br>• Support for wireless gamepad/manual control (compatible with standard multi-axis controllers). |
| 2 | Manipulator arm (1x) | • 6-DOF robotic arm suitable for mobile platform integration.<br>• Weight approximately 15 kg.<br>• Payload capacity ≥5 kg.<br>• Working radius ≈850 mm.<br>• Repeatability ±0.05 mm or better.<br>• Maximum TCP speed ≥ 2 m/s |
| 3 | Gripper (1x) | • Adaptive 2-finger gripper compatible with the robotic arm.<br>• Payload capacity ≥5 kg.<br>• Adjustable gripping force, minimum range approx. 15-240 N<br>• Weight ≤1 kg.<br>• IP40 or better protection. |
| 4 | Computing unit (1x) | • High-performance embedded computing unit for AI and perception tasks.<br>• Integrated RTK-enabled GNSS receiver (e.g., multi-band, multi constellation RTK). |

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| | | • CPU: 8-core ARM architecture or equivalent.<br>• RAM**:** ≥32 GB.<br>• GPU: Dedicated parallel processing unit with at least 1024 CUDA-class cores and tensor processing capability.<br>• Internal storage: ≥1 TB SSD. |
| 5 | LIDAR Sensor (1x) | • 3D LiDAR sensor with a minimum effective range of 50 m.<br>• Range accuracy approximately ±1.5–5 cm.<br>• Vertical FoV ≈ 90° with ≥32 channels.<br>• 360° horizontal field of view with high angular resolution (≈0.2°).<br>• IP68 protection or equivalent. |
| 6 | Cameras (1x) | • Industrial-grade stereo vision cameras.<br>• Dual global shutter image sensors, resolution ≥1920×1200.<br>• Integrated color sensors and built-in IMU.<br>• IP66 protection or equivalent. |

## Item 2: Quadruped Robot

A quadruped robot platform with the specifications, components, and configuration outlined below. All components shall be fully integrated and supported with the necessary hardware, software, and documentation to ensure complete operational readiness. The supplier shall deliver the system within a maximum period of three (3) months from the date of contract award.

| Item No. | Item | SPECS |
|---|---|---|
| 1 | Quadruped robot for R&D (1x) | The quadruped robot platform shall be designed for research and development applications, supporting advanced perception, locomotion, and AI workloads. The system must include:<br><br>Perception Sensors<br>• Depth camera for 3D sensing.<br>• 360° 3D LiDAR for environmental mapping and obstacle detection.<br>• Secondary short-range 4LiDAR module for near-field detection.<br>• High-definition RGB camera for vision-based tasks.<br><br>Manipulator Arm<br>• Lightweight robotic servo arm compatible with the quadruped platform. |

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| | | Computing and Control<br>• Integrated high-performance CPU with ≥ 8 processing cores.<br>• High-performance AI computing module capable of 50–100 TOPS for deep learning and real-time perception.<br>• Real-time joint sensing and control, including joint state feedback sensors and foot-end force sensors for improved stability and locomotion.<br>• Voice interaction / audio module for basic command and feedback functions.<br><br>Communication Modules<br>• Wi-Fi and Bluetooth wireless communication.<br>• 4G/LTE connectivity module with integrated GNSS (GPS).<br>• RJ45 /Ethernet debug port for development and diagnostics.<br><br>Navigation & Autonomy<br>• Intelligent object detection and obstacle avoidance capability using fused sensor data.<br><br>Battery & Power<br>• Rechargeable battery with a minimum capacity of 15,000 mAh.<br><br>Mechanical & Performance Characteristics<br>• Approximate standing dimensions: 70 cm × 31 cm × 40 cm (L × W × H).<br>• Maximum joint torque approximately 45 N·m.<br>• Supported payload capacity 8 to 12 kg. |

## Item 3: Hyperspectral Imaging System

A Hyperspectral imaging system with the specifications, components, and configuration outlined below. All components shall be fully integrated and supported with the necessary hardware, software, and documentation to ensure complete operational readiness. The supplier shall deliver the system within a maximum period of three (3) months from the date of contract award.

| Item No. | Item | SPECS |
|---|---|---|
| 1 | Hyperspectral Imaging System (1x) | The system shall be a push-broom hyperspectral imaging (HSI) scanner suitable for laboratory and robotic-platform data acquisition. The system must include:<br><br>Hyperspectral Camera<br><br>• Spectral range covering 400–1000 nm (visible to near-infrared). |

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| | | • Minimum 342 spectral bands or equivalent high spectral resolution.<br>• 1024 spatial pixels or higher.<br>• High-speed data acquisition with up to 400 Hz maximum frame rate.<br>• USB 3.x interface for high-bandwidth data transfer.<br>• Compact with approximate dimensions ≤ 70 × 55 × 40 mm.<br>• Camera weight (without lens) ≤ 0.5 kg.<br>• Comprehensive SDK and APIs for integration with custom software (C/C++, Python, MATLAB, etc.).<br><br>Camera lens<br>• C-mount VNIR lens with focal length approximately 12 mm.<br>• Maximum aperture f/1.8 or faster to support low-light hyperspectral imaging.<br>• Broadband optical design supporting 400–1700 nm transmission range.<br>• Apochromatic or low-aberration optics suitable for hyperspectral applications.<br><br>Scanning Stage<br>• Motorized or manually controlled translation stage compatible with push-broom imaging.<br>• Suitable for laboratory samples and automated robotic scans.<br><br>Illumination System<br>• Two halogen light banks, approximately 100 W each, providing uniform illumination over the VNIR spectral range.<br><br>Software<br>• Developer software for calibration, data acquisition, and hyperspectral analysis.<br>• Runtime API for integration in robot-based and laboratory workflows. |

## Item 4: Near Infrared Spectrometer

A Portable Near-Infrared Spectrometer system with the specifications, components, and configuration outlined below. All components shall be fully integrated and supported with the necessary hardware, software, and documentation to ensure complete operational readiness. The supplier shall deliver the system within a maximum period of **two (2) months** from the date of contract award.

| Item No. | Item | SPECS |
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| 1 | Near-Infrared Spectrometer (1x) | A compact, portable, handheld NIR spectrometer suitable for field and laboratory use, providing rapid non-destructive spectral measurements. The system shall include the following features and performance requirements:<br><br>Optical Performance<br>• Wavelength range: approximately 900–1700 nm<br>• Measurement mode: Diffuse reflectance, suitable for materials, food products, agricultural samples, and solid surfaces.<br><br>Illumination System<br>• Integrated illumination module optimized for diffuse reflectance measurements.<br>• Includes two low-power broadband halogen lamps (~1 W each).<br>• Illumination angle approximately 45° relative to sample surface.<br><br>Communication & Connectivity<br>• USB interface for data transfer and device control.<br>• Bluetooth Low Energy (BLE) for wireless communication with mobile devices.<br><br>Power Options<br>• Powered via USB connection and via a built-in rechargeable Li-ion battery for portable operation. |