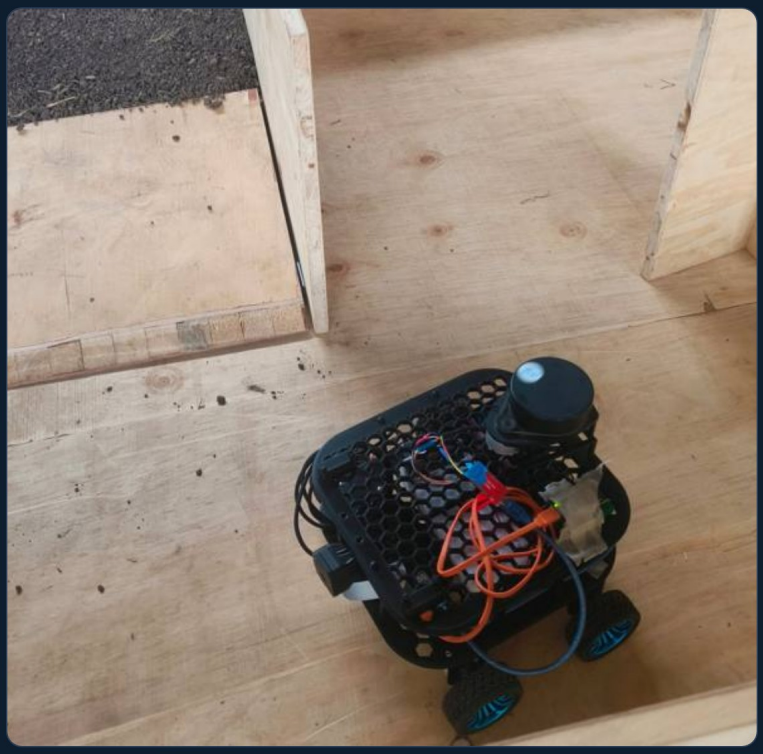
[JICA / AFRICA-ai-JAPAN] [ROBOTICS DOJO]

ROBOTICS DOJO COMPETITION 2026 · MUNICIPAL & INDUSTRIAL WASTE MANAGEMENT

Autonomous waste sorting across sand, gravel & ramps.



TECHNICAL OVERVIEW

Compute: Raspberry Pi 4 B (ROS 2 Jazzy), Pi Pico (micro-ROS), Arduino Nano 33 BLE
Sensing: RPLiDAR A1, Camera Module 3, LSM9DS1 IMU, wheel encoders
Drive: 12 V DC motors via TB6612FNG
Power: 12 V Li-Ion pack + isolated 5 V power bank
Body: 3D-printed PLA, 250 × 250 × 240 mm
Offload: MG90S servo tilting dump bed

[ANNOTATED CAD: LiDAR · Camera · Pi 4 · Pico · IMU · motors · dump bed]

98%
traversal success on 15° sand ramps with sensor fusion (35% without)

<1.2°
drift per turn, down from 18.4° with raw odometry

30/30
dump-bed trials landed fully in the target zone

TECH INSIGHTS

Mapping & navigation – Cartographer SLAM builds the map; Nav2 with the MPPI controller drives over loose terrain.

Dynamic gate routing – a closed gate for 5 s triggers an automatic reroute over the terrain ramps.

Waste classification – a ROS 2 camera service identifies the waste type by color in HSV space.

Sensor fusion with EKF – IMU and encoder data cancel wheel-slip drift on sand and gravel.

Behavior Tree control – PyTrees sequences the whole task and handles fallbacks.

Payload offloading – servo dump bed delivers into the color-coded bin.

TESTING & RESULTS

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murtazaleelwala
hamza bharmal
ibrahim deesawala