

UNIVERSITY ROBOTICS  
EDUCATION & RESEARCH



**Robotics Dojo**  
Innovation at its finest

SIMULTANEOUS  
LOCALIZATION & MAPPING

# ROBOTICS DOJO 2025

RULEBOOK

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# 1. History of Robotics Dojo



Robotics Dojo was established in May 2022 at JKUAT under the AFRICA-ai-JAPAN Project to build robotics research capacity in Kenya. The first internal training and competition events were held the same year, with support from JICA and Nagasaki University

Over the years, the Dojo has grown steadily:

- 2022: Inaugural training and JKUAT-only competition.
- 2023: Expanded to include PAUSTI students.
- 2024: Introduced advanced tasks like LiDAR-based navigation; welcomed DeKUT as the first external university participant. Partnership with Afribot.

The program now attracts over 40 students annually, focusing on practical robotics challenges using ROS, LiDAR, and autonomous navigation. Looking ahead, the Dojo aims to become a national platform for robotics research and inter-university collaboration.

## 2. Eligibility and Team Composition

The Robotics Dojo Competition is open to students currently enrolled in accredited Kenyan universities. Participation is limited to student teams in order to promote hands-on learning, innovation, and collaboration within the academic community.

### 2.1 Eligibility Criteria

- All participants must be actively enrolled as students in a Kenyan university throughout the entire duration of the competition.
- Each team must consist of a minimum of three (3) and a maximum of five (5) members.
- Each team is required to appoint one (1) team captain who will serve as the official point of contact with the Organizing Committee. The team captain is responsible for ensuring the team's compliance with all competition rules and communications.

### 2.2 Faculty Involvement

- Teams may consult with faculty members, engineers, or industry experts for guidance and technical advice.
- However, such individuals may not be listed as team members or participate in the hands-on design, engineering, programming, or operation of the robot.

### 2.3 Diversity and Inclusion

- The Organizing Committee encourages the formation of gender-balanced teams to promote diversity, equity, and inclusion within the competition.

## 3.Challenge Overview

The Robotics Dojo Competition challenges university students to design and develop a semi-autonomous ground robot capable of completing a sequence of agricultural and logistics-inspired tasks in a structured game field. The robot must demonstrate environmental awareness, terrain adaptability, object classification, and coordinated communication.

### 3.1 Game Field Description

The competition field consists of several distinct zones that simulate a real-world agricultural and operational environment:

- Weeding Area
- Terrain Zones: Grass (soft), Gravel (uneven), Sawdust (low traction), Ramp (inclined)
- Loading Area
- Depositing Area: With color-coded bins (D1 and D2)
- Obstacle Course

### 3.2 Competition Objectives

The competition evaluates the robot's ability to:

- Create and utilize a digital environmental map
- Classify objects (e.g., crops vs. weeds) using vision-based systems
- Navigate various terrain types with different traction and elevation
- Avoid static and dynamic obstacles
- Communicate with a robotic arm to coordinate item loading
- Accurately sort and deposit items based on bin color
- Reach a defined final position upon completion

## 4. Competition Structure

The challenge consists of two timed phases conducted on the same field: Mapping Phase and Autonomous Phase.

### 4.1 Mapping Phase (3 minutes)

In this phase, the robot is manually operated by the team to scan and build a digital map of the environment using onboard sensors such as LiDAR and cameras. Human control is permitted only during this phase.

Robots will be judged based on:

- Completeness of environmental coverage
- Accuracy of mapped features

### 4.2 Autonomous Phase (3 minutes)

Once the mapping phase concludes, all tasks must be completed autonomously without human intervention. These tasks include:

#### a) *Weeding Task*

- Navigate through crop rows
- Identify and photograph weeds
- Submit image processing output highlighting:
  - Crops in green
  - Weeds in red

#### b) *Terrain Navigation*

- Successfully traverse all designated terrain types:
  - Grass
  - Gravel
  - Sawdust
  - Ramp

## 4.Competition Structure

### c) *Obstacle Avoidance*

- Detect and navigate around obstacles introduced after the mapping phase
- Obstacles may be static or dynamically controlled by judges
- Collisions will result in penalties

### d) *Loading Operation*

- Navigate to the loading area
- Initiate communication with the robotic arm via a specified protocol
- Receive and secure an item for delivery

### e) *Depositing Task*

- Deliver the item to the correct color-coded bin (D1 or D2)
- Execute accurate placement inside the bin
- Navigate to the designated finish position

## 5.Competition Schedule

Stage	Date	Activity
Registration	July 18–30, 2025	Team sign-up via Google Form
Notification of Qualified Teams	August 3, 2025	Notification sent to selected teams via email
Training Session	August 4–31, 2025	Series of training and mentoring sessions facilitated by the Organizing Team & volunteered participants
Robot Design	August 4–12, 2025	Teams to design robots using Computer-Aided Design (CAD) tools
Bill of Materials (BOM) Submission	August 12, 2025	Submission of BOM via email in Excel format

## 5.Competition Schedule

Stage	Date	Activity
Technical Poster and Paper Submission	September 26, 2025	Teams submit technical documentation for evaluation by judges
Technical Poster Presentation	October 6, 2025	Teams present their posters before the judging panel
Final Competition	October 8, 2025	Live demonstration and evaluation of robots on the official game field



## 6. Scoring System

The competition will be evaluated out of a total of 90 points, distributed across six key task areas.

### 6.1 Task Breakdown

Task	Maximum Points	Scoring Criteria
Mapping	10	Map completeness (4), accuracy (4), usability for navigation (2)
Weeding	15	Weed detection (6), image processing accuracy (6), navigation (3)
Terrain	20	Grass traversal (4), gravel traversal (6), sawdust traversal (5), ramp (5)
Obstacles	15	Obstacle detection (6), avoidance (6), path efficiency (3)
Loading	10	Positioning for loading (4), communication with robotic arm (4), item securement (2)
Depositing	20	Color detection (6), correct bin selection (6), item placement (6), final position accuracy (2)

**Total : 90 Points**

# 6. Scoring System

## 6.2 Scoring Notes

- Judges will use a standardized rubric to evaluate each criterion based on objective and observable performance indicators.
- Partial credit may be awarded for incomplete or partially correct task execution.
- All tasks in the Autonomous Phase must be completed without human intervention. Any manual override will result in disqualification from that task.

## 6.3 Penalties and Disqualifications

- Collisions with the field infrastructure or judge-controlled obstacles may result in deductions.
- Robots that fail to operate autonomously beyond the mapping phase may be disqualified from scoring in applicable categories.
- Failure to comply with competition rules, including safety or eligibility requirements, may result in disqualification from the event.

# 7. Robot Requirements

All competing robots must adhere to the following specifications. Any robot that does not meet these requirements may be disqualified from participation or limited in task eligibility.

## 7.1 Physical Specifications

- **Dimensions:** Must not exceed 60 cm (L) × 60 cm (W) × 50 cm (H) at any point.
- **Power:** Must be powered by a self-contained system, with a maximum voltage of 24V.

## 7.2 Functional Requirements

- **Autonomy:** Robots must operate fully autonomously during the Autonomous Phase. Manual control is only allowed during the Mapping Phase.
- **Sensors:** Robots must be equipped with sensors to support environmental mapping and object detection (e.g. LiDAR, cameras, ultrasonic sensors).
- **Communication:** Robots must implement the specified communication protocol for coordination with field systems (e.g. loading mechanisms).
- **Safety:** Robots must be designed to operate safely without causing damage to the game field, other robots, or posing any risk to participants and spectators.

## 8.Competition Rules

These rules govern team participation, use of the game field, robot operation, and the judging process. Teams are expected to read and understand all rules before the competition day.

### 8.1 Team Composition

- Teams must consist of 3 to 5 members.
- All members must be currently enrolled students in a recognized Kenyan university.
- Each team must appoint a Team Captain responsible for all communications with the Organizing Committee.

### 8.2 Game Field Regulations

- The game field will include multiple terrain types, weeding zones, a loading area, depositing bins, and obstacle placements.
- No physical modifications to the game field are permitted.
- Obstacles may be repositioned between rounds at the judges' discretion.
- Teams will be allowed to inspect the game field prior to their competition run.

# 8.Competition Rules

## 8.3 Robot Operation Rules

- Manual control is only permitted during the Mapping Phase.
- During the Autonomous Phase, no external control or communication is allowed.
- One restart is permitted per round; a time penalty will apply.

## 8.4 Judging and Scoring

- A panel of two (2) judges will oversee all evaluation.
- Scoring will be based on both objective performance metrics and subjective evaluations of technical execution.
- Judges' decisions are final and not subject to appeal.

## 8.5 Disciplinary Provisions

- Cheating, including unauthorized control during the Autonomous Phase, will result in immediate disqualification.
- Participation is mandatory for all registered teams. Any withdrawal must be communicated and approved in advance.
- Any disrespectful behavior toward fellow participants, coaches, organizers, or the public will be reported. The organizing body reserves the right to issue warnings, suspend team members, or disqualify entire teams.
- Any damage to competition facilities or another team's equipment will be investigated, and appropriate action will be taken, including possible disqualification and financial liability.

## 9. Budget Allocation

Each team will receive an allocated budget to support their design and development process:

- **Base allocation:** KES 20,000 per team
- **Emergency fund:** KES 5,000, accessible only after the initial procurement stage is completed and justified.

Teams are expected to manage their budget responsibly and maintain procurement records for transparency.

# 10. Awards and Categories

To recognize excellence across different aspects of the competition, the Robotics Dojo Committee will confer awards in the following categories. Each category will have a Winner and a Runner-Up, announced during the award ceremony following the final round of the competition.

## 10.1 Game Award

This award recognizes teams that demonstrate outstanding overall performance on the competition field. Judging will be based on cumulative task scores, successful navigation, task execution, and final position accuracy during the autonomous phase.

## 10.2 Technical Award

Awarded to the team with the most innovative and well-executed engineering solution. Evaluation includes the mechanical design, software architecture, system integration, and presentation of the robot's technical documentation and poster.

## 10.3 Knowledge Sharing Award

This award celebrates the team that best embodies the spirit of open collaboration and mentorship. Judges will consider peer feedback, engagement during training sessions, willingness to assist other teams, and clarity in presenting ideas and design decisions.

# 11. Technical Poster Submission

All teams are required to submit a technical design poster and paper, which will form part of the overall evaluation process. These documents must clearly communicate the team's design process, engineering trade-offs, system components, testing methodology, and innovation aspects.

- Submission Deadline: September 19, 2025
- Presentation Date: September 24, 2025

Teams must use the official Technical Design Paper Template, available here:

 [Download Template \(MS Word, 62KB\)](#)

This template has been adapted from RobotX.org and serves to standardize the evaluation process and documentation quality.



## 12. Organizing Committee

This competition is organized by the Robotics Dojo – JKUAT, under the College of Engineering and Technology in partnership with the AFRICA-ai-JAPAN Project and other institutional collaborators.

For inquiries, contact:

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# 13.Appendix

