KFUPM

ROBONEXUS

Saudi Arabia's Flagship Robotics Festival

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RoboNexus Advanced Sumo Guidelines

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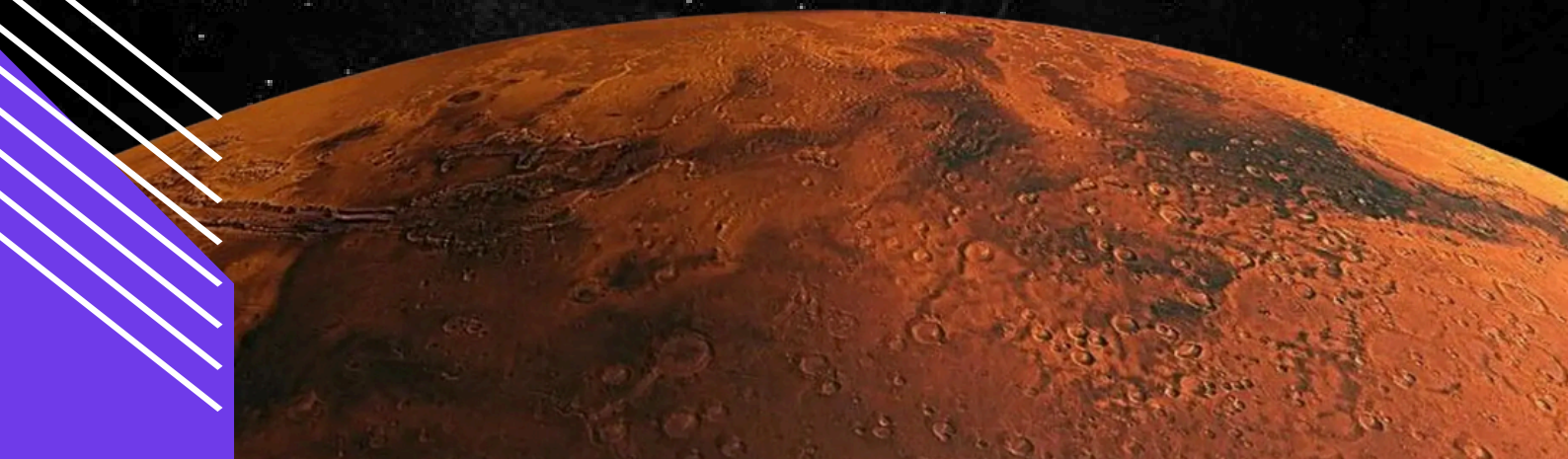

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1. Introduction

1.1 Purpose

The ROBONEXUS Advanced Sumo Challenge is a robotics competition that tests mechanical design, programming intelligence, strategic thinking, and driver skill. Competitors aim to dominate the arena by outmaneuvering, outsmarting, and outperforming opponents in a series of physically and tactically demanding matches

1.2 Overview

Each match takes place in a specially designed circular arena where two robots compete to score points or push the other out of the ring ("Ring-Out"). Matches consist of three timed phases, combining autonomous operation and driver-controlled challenges.
The competition encourages innovation in:

- Robot engineering and control systems
- Sensor integration and precision movement
- Tactical decision-making and strategic gameplay

2. Match Format

Each match lasts up to 4 minutes, divided into three distinct phases:

Phase	Duration	Control Type	Objective
A: Classic Sumo	1:30	Autonomous	Push opponent out of the ring
B: Sumo + Skill Challenges	1:30	Switch/Manual	Continue Sumo battle while completing disk-placement challenges
C: Block Push Challenge	1:30	Switch/Manual	Win using the central block to push or eject the opponent

3. Arena Specifications

3.1 General Layout

- Shape: Circular
- Diameter: 4.00 meters
- Surface: Matte black finish to reduce glare and light interference
- Border: 5 cm wide white boundary line
- Edge: 10°–15° sloped perimeter

3.2 Marked Zones

- **Placement Zones**: Marked circles (20cm diameter) will be placed around the arena, where teams will receive extra points when placing the disks exactly on the marked zones.

(IMPORTANT NOTICE: Each team can only score if they place the disk in the opponent's placement zones)

- **Dead Zone**:Red-marked central area — staying inside this zone for more than 4 seconds consecutively results in a -5 point penalty

(IMPORTANT NOTICE: Pushing and blocking the opponent in the zone is permitted)

-The time spent in the zone will be precisely measured and counted aloud to ensure fairness and transparency during the match

- **Pit**: A square recess in the floor that causes immobilization if a robot falls in (no points awarded)
- **Block** (Phase C only): A central cube-shaped object used for indirect pushing

4. How to Win

A robot wins a match by either:
(Point scoring is explained in details in Section 5)

1. **Ring-Out Victory:** Opponent slides or exits the sloped edge (instant win at any phase)

2. **Reaching 12 Points:** Through cumulative scoring actions

3. **End-of-Match Points Lead:** If time expires, the robot with more points wins

4. **Instant 3-Disk Placement**: Placing all three disks successfully grants automatic match victory (As each disk is 4 points)

In the event of a **tie**, referees use the following tiebreakers:
1. Fewer fouls committed: the robot that broke rules less will win the round
2. Faster achievement of legal advantage

5. Scoring System

Goal: First to reach 12 points or cause a Ring-Out

Action / Event	Points	Phase	Notes
Successful Disk Placement	+4	B	3 disks = instant 12 pts = win
Legal Ejection using Block	+6	C	Must use the Block; no direct contact
Dead Zone Dwell ≥ 4s (cumulative)	-5	B/C	Penalty per occurrence
Illegal Direct Contact (Phase C)	-6	C	Major foul + reset
Pit Fall (Self)	0	B/C	Robot immobilized until extraction
Referee Style/Control Bonus	+1 (max +2/match)	All	Awarded for precise, safe, controlled edge-play
Ring-Out (Any Phase)	Instant Win	All	Opponent exits arena or slides onto slope

6. Robot Specifications

6.1 Dimensions & Weight

- Must fit within designated competition class limits (weight and footprint defined by event inspectors)
- Expansion after match start is allowed if it remains within safety and fairness limits

6.2 Power & Batteries

- All power systems must be safely fused.
- On-site charging stations must be approved

6.3 Actuation & Mechanisms

- Wedges, lifters, and linear actuators are allowed
- Prohibited: entangling mechanisms, sticky substances, liquids, flames, explosives, or projectiles.

6.4 Control & Autonomy

- Phase A: Fully autonomous operation (no driver input).
- Phases B & C: Manual control allowed via approved wireless controller or switch control.
- Emergency Stop (E-Stop): Required on all robots for instant disable.

7. Match Procedure

7.1 Pre-Match

- Robots undergo inspection and weigh-in
- Teams are given a short calibration window for sensor testing.

7.2 Start Sequence

- Robots are placed in their designated start zones.
- Referees confirm readiness.
- Countdown: “3…2…1…SUMO!” - Match begins.

7.3 Phase A: Classic Autonomous Sumo

- Flat arena, no obstacles.
- Objective: Push opponent out of the ring.
- Direct ring-out results in instant victory

7.4 Phase B: Controlled + Skill Missions

- Continue Sumo combat while completing disk-placement tasks in opponent's half.
- ·Each disk placed correctly = +4 points.
- ·Entering Dead Zone for ≥4 seconds = -5 penalty.
- ·If a robot falls into the Pit, it remains immobilized until reset.

7.5 Phase C: Block Push

- ·Direct robot-to-robot contact is forbidden.
- ·Use the Block to push or eject the opponent.
- ·Illegal bumper/body contact = -6 points and reset.
- ·Stalemates longer than 10 seconds may trigger a referee reset.

7.6 Pauses, Faults & Restarts

- ·Allowed for mechanical entanglement, safety issues, or arena fault.
- Restart from last safe position

7.7 End-of-Match

- Match ends at 12 points, ring-out, or time expiry.
- Scores confirmed by referees and displayed publicly

8. Fouls & Penalties

type	Description	Penalty
Warning	Minor unsafe or unsportsmanlike conduct	none
Minor Foul	Rule violation without impact on safety	-1 point
Major Foul	Safety breach, illegal contact, or repeated offense	-6 points
Disqualification	Severe or repeated misconduct	Match forfeited

9. Refereeing & Review

- Referees have full authority over match flow, scoring, and disputes.
- Video Review: Permitted for ring-outs, disk placements, or Dead Zone penalties (limited to 2 minutes).
- Score Sheets: Official forms must be signed by both teams and referees.
- Sportsmanship: All participants must maintain professionalism; misconduct may result in suspension or disqualification

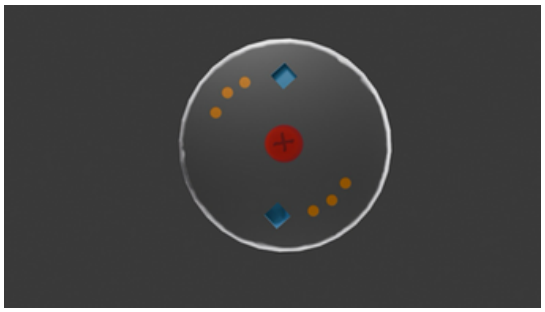
10. Safety & Inspections

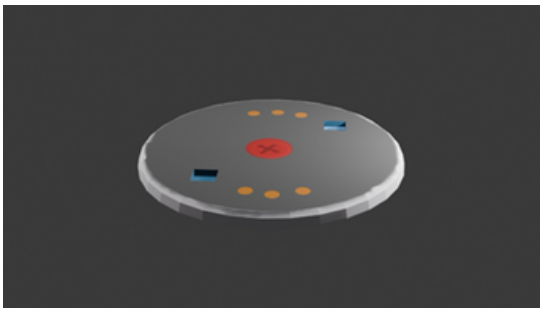
- All robots must pass inspection before their first match.
- Post-inspection modifications require re-approval.
- Failing re-inspection = disqualification.
- Safety equipment, including E-Stop and shields, must be fully operational.

11. Appendices

A. Arena:

1. 3D design





2. Disk dimensions:
Diameter: 20 cm
Height: 7 cm

F. Referee Flowcharts: For fault and reset procedures

To ensure consistent and fair decision-making during matches, referees will follow predefined procedures in response to faults, disconnections, or unexpected behavior. The following flowchart logic applies:

- **F-A. Fault & Reset Triggers**

  A referee may initiate a pause or reset under any of the following conditions:

  - Robot Disconnection:

  A robot loses wireless connection or becomes unresponsive to control.
  → Referee pauses match. Robot is allowed one reconnection attempt per match, and the match will be delayed (10 to 20 minutes).

  - Both Robots Are Immobile (Stalemate):

  Neither robot moves for more than 10 seconds, and no pushing or control is occurring.
  → Referee initiates a reset to previous positions, or moves to next phase (if near time limit).

  - Robot Falls into Pit:

  The robot is immobilized.
  → No reset; opponent continues match

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  - Dead Zone Penalty:

  Robot remains inside the Dead Zone for ≥ 4 seconds consecutively.
  → Time is counted aloud; -5 points applied.

  - Illegal Contact (Phase C):

  Robot makes direct contact instead of using the block.
  → Immediate -6 point penalty and no reset.

  - Mechanical Entanglement:

  Robots are locked and cannot disengage.
  → Referee pauses match and repositions both to last safe positions.

  - Hardware Malfunction / Arena Fault:

  Any issue with the field, referee system, or robot hardware that affects fairness.
  → Referee pauses, documents the issue, and resets accordingly.

- **F-B. Reset Procedures**

1.Referee issues verbal “Pause!”

a. Time is frozen; issue is identified and logged
b. Robots are repositioned to the last known fair position
c. Countdown resumes: “3…2…1…SUMO!”

Each team is allowed a maximum of 2 resets per match unless triggered by mutual entanglement or official fault.

G- Inspection Checklist: For technical review

INSPECTION CHECKLIST

Team Name: ..... **Robot Name: .....**

Inspector: .....

Date: .....

1. Size, Weight & Fit

Check Requirement	Pass (✓)	Notes
☐ Robot fits within 50cm × 50cm footprint (without extending parts)		
☐ Robot weight ≤ 20Kg		
☐ Weight does not change post-inspection		
☐ No part of the robot extends outside the 50cm boundary before match start		

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2. Power & Safety

Check Requirement	Pass (✓)	Notes
☐ Battery securely mounted and enclosed		
☐ No exposed wiring or short risk		
☐ Emergency Stop (E-Stop) present and functional		

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3. Mechanical Systems

Check Requirement	Pass (✓)	Notes
☐ No entangling devices (e.g., ropes, nets)		
☐ No sticky substances or adhesives		
☐ No flames, sparks, explosives, liquids, or gases		
☐ Any wedges or lifters are smooth and safe		
☐ Wheels, treads, or mechanisms do not damage the arena		
☐ Any magnets or suction are non-damaging and pass impact test		

4.Control & Autonomy

CheckRequirement	Pass (✓)	Notes
☐ Robot operates autonomously in Phase A		
☐ Manual control systems function in Phases B & C		
☐ Wireless controller complies with allowed frequencies		
☐ Robot can switch control modes safely		

5.Sensors & Navigation

Check Requirement	Pass (✓)	Notes
☐ Robot can detect edge markings (5cm white line)		
☐ Obstacle and proximity sensors calibrated		

6.Disk Handling (Phase B)

Check Requirement	Pass (✓)	Notes
☐ Robot can carry 3 × 20cm disks		
☐ Gripper/mechanism does not damage disks		
☐ Placement mechanism allows precise release		

7.General Safety & Arena Compatibility

Check Requirement	Pass (✓)	Notes
☐ Robot does not scratch, dent, or mark the arena		
☐ All parts are secured (no loose parts/screws)		
☐ Safe for referees and audience		

8.Final Check

Check Requirement	Pass (✓)	Notes
☐ Robot passed full checklist with no critical issues		
☐ Team received a Pass / Conditional Pass / Fail result		

Inspector Signature: _____

Team Captain Signature: _____