United Academy

United Academy Group

Robotics Association of Nepal
[between human and machine]

URC
United Academy Robotics Club

UNITED ROBO FEST 4.0
Future of work

United Robo Fest 4.0

Rule Book for Robo Soccer

Theme Description:

Robo Soccer in Nepal is an exciting remote-controlled robotics competition where human skill meets engineering innovation. Participants design and build powerful robots and control them in real time to compete on the field. The event highlights precision driving, teamwork, mechanical design, and strategic gameplay, combining the thrill of football with the creativity of robotics and technology.

Task:

Here's your mission: Design 2 robots that can play soccer against other robots, with a cool shooting feature. It's like giving your robots superpowers for the match!

Scoring Criteria:

- Goals are only counted when the ball fully crosses the goal line.
- The competition begins with a league stage, where teams play group matches.
- The top two teams from each group will proceed to the quarterfinals.
- In the league phase, a win earns 3 points, a loss earns 0 points, and a draw earns 1 point to each team.
- From the quarterfinals onward, the competition follows a knockout format — one defeat and you're eliminated!

Prizes and Recognition: (ROBO SOCCER)

Prizes:

- Winner: Rs. **32000.00**
- Runner-up: Rs. **21000.00**
- Second Runner-up: Rs. **10500.00**
- Certification and Medals for outstanding performance.
- Certificate of Participation: All participants receive digital certificates.

Note: Prize money is subject to applicable government taxes.

Certification Policy:

1. Winners will receive a certificate of appreciation, medals, and a trophy for their outstanding performance.
2. All teams will receive a digital certificate of participation.
3. Sponsors will also receive a special certificate/recognition.
4. If a team plays unfairly or misbehaves, including disrespecting others, during or after the event at the premises, their certificates may be canceled or invalidated.

Rule Book:

General Rules

5. **Voltage Limitation:** The potential difference between any two points within the robot or any external components must not exceed 12 volts.
6. **Team Composition:** Each team can have a maximum of 5 members, inclusive of a mentor.
7. **Age Group:** Participants must be currently studying in Class 10 or below to be eligible for the competition.
8. **Robot Verification:** Robot verification shall be done before the competition.
9. **Safety Precautions:** Throughout the event, all participants must follow safety guidelines and precautions.
10. **Fair Play and Sportsmanship:** Unsportsmanlike conduct, unfair play, or misbehavior, including disrespecting others, during or after the event at the premises, is unacceptable.
11. **Identity:** Bots and pilots must always be clearly identifiable through team tags, uniforms, or markings for effective coordination and fair play.
12. **Robot:** Each team fields 2 robots per match. Participants may bring up to 4 robots and are allowed to make up to 1 substitution during a match.
13. **Referee's Decision:** Decisions made by the event referees are final and binding.

Robot Specifications

14. **Control:** Each robot must be manually wirelessly controlled.
15. **Dimensions:** The robot's size must not exceed 30 cm (length) x 30 cm (width) x 30 cm (height).
16. **Components:** The use of ready-made toy cars or Lego in robot construction is not allowed.
17. **Weight:** The robot's weight must not exceed 3 kg with a 3% tolerance.
18. **Shooting Mechanism:** A functional shooting mechanism is mandatory; failure to include one will result in disqualification.
19. **Keeper Robot Extension:** In a 2v2 format, one robot per team may be designated as the keeper. The keeper robot is allowed to extend its structure or mechanism by up to 7 cm only during gameplay.
20. **Drive Motor:** Motors such as planetary motors, brushless motors, hybrid motors, or any kind of modified stepper or high-gear motor are not allowed.

Game Play Rules

21. **Match Duration:** Each match consists of two halves, with each half lasting 3 minutes, for a total match time of 6 minutes.
22. **Half-Time:** A 2-minute half-time break is provided between the two halves, allowing teams to perform quick repairs on their robots if needed.
23. **Extra Time and Penalty Shootout:** Extra time and penalty shootouts apply during the knockout phase, starting from the quarter-finals. Extra time lasts 3 minutes, divided into two halves of 1.5 minutes each. If the match remains tied

after extra time, a penalty shootout is held — with no goalkeepers allowed during the shootout.

24. **Kick-Off:** Each half begins with a kick-off from the center circle. The team that wins the coin toss chooses which goal to defend and starts the game.
25. **Goal Scoring:** A goal is scored when the entire ball crosses the goal line between the goalposts and beneath the crossbar. The team with the most goals at the end of regulation time, extra time, or the penalty shootout is declared the winner.
26. **Out of Bounds:** If the ball goes out of bounds, the opposing team receives either a throw-in or a corner kick, depending on where it exited. The robot that last touched the ball before it went out must remain inactive until the ball is back in play.
27. **Pushing Goalkeeper:** In a 2v2 match, only one bot at a time may push the goalkeeper. Simultaneous pushing of the goalkeeper by both bots is not allowed.
28. **Fouls:** Standard soccer fouls, such as pushing and tripping, come into play. Depending on the placement and extent of the foul, the opposing side is awarded a free kick ora penalty kick.
29. **GoalKeeper:** The goalkeeper robot is not allowed to cross the halfway line of its own side of the field. In case only one bot remains on the field for a team, that bot is allowed to cross the line.
30. **Robotic Interference:** If a robot disrupts the movement or activity of an opposing robot in a way that affects gameplay, the referee can award a free kick or penalty kick to the affected team.
31. **Player Ejection:** For repeated or severe fouls or unsportsmanlike behavior, a player may be shown a red card and removed from the match, as determined by the referee. Note: In a 2v2 match, an ejected robot reduces the team to 1 robot.
32. **Referee's Decision:** Decisions made by the event referees are final and binding.

Event Rules

33. **Ball Handling:** Robots are not allowed to drag or pick up the ball. They must use their designated shooting mechanisms to interact with the ball during gameplay.
34. **Air Blowing Mechanism:** The use of air-blowing mechanisms for kicking or handling the ball is not allowed under any condition. Robots must rely solely on their shooting and kicking mechanisms.
35. **Ball Out of Arena:** If a robot throws the ball out of the arena, the opposing team will be awarded a throw-in or a corner kick, based on the location where the ball exited the field.
36. **Free Kick Distance:** During a free kick, the robot taking the kick must maintain a minimum distance from any defending robot. The exact distance will be determined by the referee based on the position of the kick.
37. **Penalty Kick:** Penalty kicks, awarded for fouls committed within the penalty (D) area, will be taken from the center of the field to ensure fairness for both the kicker and the goalkeeper.
38. **Penalty Shootout:** A robot will have 15 seconds to shoot for a goal during a penalty shootout. Both robots from each team take turns, and the team scoring the most goals wins.

39. **Yellow and Red Cards:** A yellow card is a warning for foul play. Repeated offenses or significant violations can lead to a red card, and the team or robot gets disqualified.
40. **Physical Damage:** A robot that causes physical damage to an opponent robot on the field will be immediately disqualified. Safety is a top priority.
41. **Strict Adherence to Schedule:** Teams must arrive on time for scheduled games. A 5-minute grace period is allowed for unavoidable delays. Delays after this duration will result in a warning for the first offense; repeated delays will have a 3-point deduction from the total score of the team.
42. **Disqualification for Persistent Violations:** Repeated violations of timing rules, failure to inform organizers of delays, or attempts to manipulate match timings may lead to immediate disqualification from the competition.
43. **Team Identification:** Bots and pilots must always be clearly identifiable through team tags, uniforms, or markings for effective coordination and fair play.

Arena Specifications

44. **Arena Size:** The arena is a **12ft x 16ft** rectangle with a boundary wall, standing at a height of 30cm.
45. **Markings:** All markings within the arena are consistent with those found on a standard football field.
46. **Ball Size:** The soccer ball used in the competition is approximately 10-15 cm in diameter.
47. **Goalkeeper Area:** A designated goalkeeper area, often referred to as the "D area," is marked within the arena. Pushing the goalkeeper is not allowed in the D area.
48. **Referee’s Station:** A designated referee’s station is set up adjacent to the playing arena.

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Rule Book for Robo Sumo Wrestling

Robot Sumo Wrestling - a thrilling robotics competition inspired by the ancient Japanese sport of sumo wrestling, where strategy, engineering precision, and raw pushing power determine the champion!

What is Robot Sumo?

Robot Sumo is an intense one-on-one robotics competition where two autonomous or radio-controlled robots face off in a rectangular space called an "arena." The objective is elegantly simple yet incredibly challenging: push your opponent out of the ring while staying inside yourself. Like traditional sumo wrestling, the match is won through superior strategy, positioning, power, and technique - but instead of human wrestlers, brilliantly engineered robots battle for supremacy.

The Concept

Two robots enter the arena, a raised rectangular platform with a distinctive white border marking the edge. When the match begins, robots must detect their opponent, maneuver for advantageous position, and use pushing power, wedges, or strategic design to force the opposing robot over the edge. The first robot to touch the ground outside the ring, or to be lifted and removed from the ring, loses the round.

This competition tests the full spectrum of robotics skills: sensor integration for opponent detection and edge detection, motor control for power and precision, mechanical design for stability and offensive capability, and strategic programming or piloting for real-time combat decisions. Every match is a dramatic showdown where milliseconds and millimeters make the difference between victory and defeat.

Prizes and Recognition: (SUMO WRESTLING)

Prizes:

- Winner: Rs. **16000.00**
- Runner-up: Rs. **10500.00**
- Second Runner-up: Rs. **5500.00**
- Certification and Medals for outstanding performance.
- Certificate of Participation: All participants receive digital certificates.

Note: Prize money is subject to applicable government taxes.

Categories of Competition

Robot Sumo competitions typically feature multiple weight classes and control types to accommodate different skill levels and design philosophies:

Weight Class:

- Standard Sumo: Robots up to 3 kg - the classic category with maximum intensity

Control Type:

- Radio-Controlled (RC) Sumo: Human-piloted robots for real-time strategy

Tournament Structure

Competitions follow a bracket-style elimination format:

- **Preliminary Rounds:** All teams compete, best performers advance
- **Quarter Finals:** Top 8 teams battle for semifinal spots
- **Semi Finals:** 4 teams compete for championship match position
- **Finals:** Top 2 robots face off for the championship
- **Third Place Match:** Consolation match determines third place

Each match consists of three rounds (best 2 out of 3 wins). This ensures that the best robot advances, not just the luckiest.

1. ROBOT SPECIFICATIONS

1.1 Weight Classes

STANDARD SUMO

- Maximum weight: 3 kilograms (3000 grams)
- Target: Advanced competitors, championship level
- Arena size: 8 feet × 4 feet rectangular

1.2 Size Restrictions

Maximum Dimensions (at start of match):

- Length: 20cm (maximum)
- Width: 20cm (maximum)
- Height: 20cm (maximum)

Tolerance: 5cm

Expansion Rules:

- Robots may expand AFTER the match starts
- No maximum size after expansion
- Expansion must occur within 5 seconds of match start
- Robot must fit within size limits during pre-match inspection

Measurement Method:

- Measured with robot in starting configuration
- Any protruding sensors, weapons, or decorations included
- Wheels and treads included in measurements

1.3 Weight Requirements

- Maximum weight includes all components, batteries, and decorations
- Weight measured with all systems installed and ready to compete
- No minimum weight requirement
- Ballast weight may be added to reach maximum (must be securely fastened)

1.4 Control Systems

RADIO-CONTROLLED (RC) CATEGORY:

- Standard RC radio systems (2.4GHz spread spectrum)
- No autonomous features during match
- Human pilot must control all movements
- Fail-safe required (robot stops if signal lost)

- One pilot per robot

1.5 Power Systems

Batteries:

- Any commercially available battery allowed
- Maximum voltage: 12V DC
- LiPo batteries must be in fire-resistant bags
- Batteries must be securely mounted
- No exposed battery terminals

Motors:

- Any DC motors allowed within voltage limits
- No compressed air, hydraulics, or pneumatics
- No internal combustion engines
- No explosive or pyrotechnic propulsion

Power Switch:

- Easily accessible external power switch required
- Switch must completely disconnect power
- Switch location marked clearly
- Must be operable without tools

1.6 Prohibited Features & Components

ABSOLUTELY NOT ALLOWED:

- Jamming devices (radio, infrared, etc.)
- Projectiles or thrown objects
- Liquids, gels, adhesives, or sticky substances on contact surfaces
- Suction devices (vacuum cups, fans creating downforce)
- Magnets or magnetic materials that affect the opponent

- Devices that damage the arena surface
- Sharp edges or points that damage the opponent or the arena
- Rotating weapons or blades
- Pyrotechnics, flames, or heating elements
- Nets, ropes, or entanglement devices
- Any hazardous materials

ALLOWED WITH RESTRICTIONS:

- Wedges and angled surfaces (must not damage arena)
- Pushing surfaces (must be smooth, no sharp edges)
- Decorative elements (must not interfere with match)
- LED lights (must not blind opponent sensors)

1.7 Required Safety Features

For All Robots:

- Emergency stop mechanism (remote or physical button)
- Stable design (doesn't tip easily during normal operation)
- Securely fastened components (nothing falls off during match)
- Insulated electrical components
- Smooth external surfaces (no sharp edges when powered off)

For RC Robots:

- Fail-safe function (stops when signal lost)
- Emergency stop on controller
- Power indicator visible from outside

2. THE ARENA

2.1 Standard Sumo Arena Specifications

Dimensions:

- Overall arena size: 8 feet × 4 feet (243.84cm × 121.92cm) rectangular shape
- Border width: 3.5cm (white boundary line)
- Inner black area: 236.84cm × 114.92cm (after subtracting border on all sides)
- Height above ground: 5cm minimum
- Material: Wood, metal, or rigid plastic

Surface:

- Color: Matte black for the inner area
- Border color: White (high contrast)
- Finish: Smooth but not slippery
- Paint: Non-glossy to avoid sensor confusion

Border Marking:

- White boundary line 3.5cm wide around the full perimeter of the rectangular arena
- Sharp contrast with black interior
- Edge clearly visible to sensors
- No gaps or irregularities in the border

Structure:

- Raised platform 5cm(Minimum) above floor
- Sturdy construction (no flex during match)
- Level surface (no tilt or warping)
- Rounded or beveled outer edge (prevents robot damage)

2.3 Starting Lines

Location:

- Two brown lines on the arena surface
- Lines face each other across the center along the long axis of the arena
- Distance from center: 10cm on each side
- Line width: 1-2cm
- Line length: 20cm

Purpose:

- Robots start behind these lines, facing the opponent
- Ensures fair starting distance
- Allows momentum buildup before contact

2.4 Surrounding Safety Area

- Minimum 50cm clear space around arena perimeter
- Padded floor or mat recommended
- No obstacles within safety zone
- Spectator barriers at least 1m from arena edge

2.5 Environmental Conditions

Lighting:

- Bright, even overhead lighting
- Avoid direct spotlights on arena
- No flickering or strobe effects
- Consistent lighting for sensor reliability

Surface Conditions:

- Clean arena before each match
- Remove dust, debris, or residue

- No moisture on surface
- Room temperature environment (18-25°C)

3. MATCH PROCEDURES

3.1 Pre-Match Procedures

Technical Inspection (15 minutes before the match):

- Size verification with measuring device
- Weight verification on official scale
- Safety feature inspection
- Power system check
- Confirmation of competition category
- Approval stamp/sticker applied to robot

Match Preparation (5 minutes before match):

- Teams called to arena area
- Robots placed in designated pit area
- Final adjustments permitted
- Controller/programming check
- Team confirms readiness

3.2 Match Start Sequence

Standard Start Procedure:

Robot Placement (60 seconds):

- Referee calls teams to arena
- Robots placed behind starting lines
- Robots must face opponent
- Robots must be entirely behind starting line

- No part of robot crosses center line

Final Checks (30 seconds):

- Teams confirm robot configuration
- RC pilots test controls (without moving robot)
- Autonomous robots remain inactive
- Teams return to designated positions

Activation (10 seconds):

- RC Category: Pilots may power on controllers
- Autonomous Category: Teams activate 5-second start delay
- Referee confirms both robots ready

Countdown:

- Referee announces: "Robots ready"
- Referee counts: "3... 2... 1..."
- Referee signals: "Go!" (begin) or whistle blast

Match Begin:

- Robots may move immediately after signal
- Autonomous robots wait for 5-second delay, then activate
- Match clock starts

3.3 During the Match

Match Duration:

- Maximum time: 3 minutes per round
- Clock stops for judge decisions or technical issues
- Clock continues during brief repositioning

Legal Actions:

- Pushing opponent toward edge
- Using wedges to lift opponent
- Strategic positioning and blocking
- Speed-based attacks and rams
- Spinning to gain momentum

Illegal Actions (result in penalties):

- Deliberately damaging opponent robot
- Interfering with opponent sensors (beyond normal operation)
- Leaving arena to avoid opponent (tactical retreat)
- Pilot/team interference during match

Referee Intervention:

- Referee may pause match for safety concerns
- Referee may separate locked robots (counts as restart)
- Referee calls "matta" to stop action if needed
- Referee final authority on all rulings

3.4 Winning a Round

Victory Conditions:

A robot wins the round when:

- **Opponent exits arena:** Any part of opponent robot touches ground/floor outside arena
- **Opponent disabled:** Opponent robot becomes immobilized on arena for 10+ seconds
- **Opponent fault:** Opponent violates match rules

Special Situations:

- **Simultaneous Exit:** Both robots leave at same time = round restart
- **Mutual Destruction:** Both robots disabled = round restart

- **Time Expiry:** If neither robot scores, judges determine winner by:
    - Aggression (most attacks/pushes)
    - Control (best positioning)
    - Technical merit (strategic execution)

3.5 Match Conclusion

Best of Three Format:

- First robot to win 2 rounds wins the match
- Maximum of 3 rounds per match
- Brief pause (30-60 seconds) between rounds for repairs/adjustments

End of Match Procedures:

- Referee declares winner
- Teams retrieve robots from arena
- Teams show respect (handshake/bow)
- Winner advances in bracket
- Robots may be re-inspected if modifications made

3.6 Restarts

When Restart is Called:

- Robots not properly positioned at start
- Technical malfunction before meaningful contact
- Both robots exit simultaneously
- Both robots disabled simultaneously
- Unclear situation requiring referee judgment

Restart Procedure:

- Robots returned to starting positions
- No repairs or adjustments during restart

- Quick restart (no full preparation sequence)
- Clock resets for new round attempt

4. SCORING & ADVANCEMENT

4.1 Round Scoring

Point/Round Win:

- Forcing opponent out of ring: 1 round victory
- Opponent disabled/immobilized: 1 round victory
- Opponent rules violation: 1 round victory
- Judge decision at time expiry: 1 round victory

Match Victory:

- First to 2 round victories wins match
- Winner advances in tournament bracket

4.2 Tournament Bracket System

Single Elimination Tournament:

- All teams seeded into bracket
- Seeding based on: registration order, previous results, or random draw
- Loser eliminated (no second chances in standard format)
- Winner advances to next round

Alternative: Double Elimination (if time permits):

- Teams get second chance in "losers bracket"
- Must lose twice to be eliminated
- Finalists from each bracket meet for championship

4.3 Advancement Through Rounds

Typical Tournament Structure (16 teams):

- Round 1 (Round of 16): 8 matches → 8 winners
- Quarter Finals: 4 matches → 4 winners
- Semi Finals: 2 matches → 2 winners
- Finals: 1 match → Champion
- Third Place Match: 2 semi-final losers → 3rd place

4.4 Tie-Breaking Procedures

If Match Tied After 3 Rounds (rare but possible):

- Sudden Death Round: Next robot to score wins match
- Weight Advantage: Lighter robot advances (rewards efficiency)
- Judge Panel Decision: Technical merit, design innovation
- Coin Toss: Last resort only

5. RULES VIOLATIONS & PENALTIES

5.1 Technical Violations

Minor Violations (Warning → Point Penalty):

- Late to match (less than 2 minutes)
- Robot slightly oversize/overweight (if caught after inspection)
- Minor interference with opponent sensors
- Unapproved modifications between rounds

Penalty: Warning first offense, round loss for repeated violations

5.2 Major Violations

Immediate Round Loss:

- Robot leaves arena intentionally
- Pilot interference during RC match

- Manual adjustment to autonomous robot during match
- Using prohibited features discovered during match

Immediate Disqualification:

- Intentional damage to opponent robot
- Damage to arena surface
- Unsportsmanlike conduct (verbal abuse, violence)
- Cheating or deception (hidden illegal components)
- Refusal to follow referee instructions
- Safety violations putting others at risk

5.3 Equipment Malfunctions

Robot Failure:

- If robot stops working during match: opponent wins round
- Teams may request timeout for repairs (1 per match, max 3 minutes)
- Timeout costs 1 round loss
- Robot must be repaired within timeout or match is forfeit

Controller Failure (RC category):

- Signal loss for 5+ seconds: round loss
- Controller battery dies: round loss
- Fail-safe not working: immediate disqualification

6. SAFETY REQUIREMENTS

6.1 Robot Safety

Design Safety:

- No sharp edges or points when powered off
- All wiring insulated and secured
- Batteries protected from impact
- Components won't fall off during operation
- Stable design (low center of gravity preferred)

Operational Safety:

- Emergency stop functional at all times
- Robot stops when powered off
- No hazardous materials or chemicals
- Fire-resistant battery containment (for LiPo)

6.2 Participant Safety

Required Safety Gear:

- Closed-toe shoes for all team members in pit area
- Safety glasses when working on robots
- No loose clothing near moving robot parts

Pit Area Safety:

- Designated work areas for robot preparation
- Power tools used only in designated areas
- Battery charging in approved areas only
- Fire extinguisher and first aid kit available

6.4 Emergency Procedures

Medical Emergency:

- Competition immediately stopped
- First aid personnel called
- Area cleared for medical access
- Incident documented
- Competition resumes when safe

Robot Fire/Smoke:

- Power cut immediately
- Fire extinguisher deployed
- Robot removed from arena
- Area inspected before resuming
- Robot disqualified pending inspection

Structural Failure:

- Match stopped immediately
- Arena inspected and repaired
- Match restarted once safe
- No penalty to teams for delay

7. JUDGING & OFFICIATING

7.1 Referee Roles

Head Referee:

- Final authority on all decisions
- Oversees entire competition
- Resolves disputes and protests
- Ensures safety compliance

Match Referee (1 per arena):

- Starts and stops matches
- Calls scoring
- Monitors for violations
- Maintains match flow

Technical Judges (2-3 per competition):

- Conduct pre-match inspections
- Verify size and weight compliance
- Approve robot designs
- Provide technical rulings

7.3 Judge Decisions

Time Expiry Judging Criteria:

- Aggression (40%): Number and force of attacks
- Control (40%): Ring positioning and strategy
- Technical Merit (20%): Execution quality