Unibots Rulebook

Cambridge · Southampton

Last Modified: 13/12/2021

1. Game Rules

1.1 The game will be played in the arena defined in section 3.1. The objective of this game is to have four robots collect ping pong balls and tennis balls competitively and place the ping pong balls into the red scoring zone and the tennis balls into the blue scoring zone of their respective sides.

1.2 Before a scoring run begins, four teams must place their robots in their respective blue scoring zones. The robots must be positioned such that it is entirely within the blue scoring zones, with no parts overhanging the boundary.

1.3 A match lasts 180 seconds.

1.4 There will be a maximum of four robots in the arena at any time.

1.5 Robots will be started by teams leaning into the arena to press a start button on their robot when instructed to do so.

1.6 A match may be prematurely terminated if the teams unanimously express to the match officials that they are happy for the game to end.

1.7 At the end of a match, each team's game points will be calculated. These are used to rank teams before competition league points are awarded. Game points will be awarded to each team as follows:

a. 1 point will be awarded for a robot moving entirely out of its starting area
b. 1 point will be awarded for any ball which a robot is in contact with but not in any scoring zone
c. 1 point will be awarded for each ball within a scoring zone at the end of the match. The point goes to the team that owns the scoring zone.
d. A further 2 points will be awarded for every ping pong ball present within the red scoring zone of each side, provided that the robot on the side has not introduced any tennis balls.
e. A further 4 points will be awarded for every tennis ball present within the blue scoring zone of each side, provided that the robot on the side has not introduced any ping pong balls.
f. A ball is considered to be in a scoring zone if any part of that ball is touching the arena floor within the scoring zone or any part of the perimeter tape around that scoring zone.

1.8 At the end of a game, league points will be awarded as follows: The four teams, ranking from the highest to the lowest, will be awarded 8,6,4,2 points respectively. In the event of a draw, the point for each team averages the points for the rankings they should have taken up (e.g. two teams both ranking 2nd are both awarded (6+4)/2=5 points).

1.9 Once the league competition ends, a knockout competition will begin.

a. The positions of the teams in the league will seed the positions of teams in the knockout matches. The top four teams from the league advance to the knockout matches. In the event of tied league positions, the team with the greatest cumulative game points in the league will go through.

b. Each match in the knockout competition involves two teams.
c. The team coming first in each knockout match will continue to the next round of the knockout. In the event of a tie in a knockout match, the teams will play a rematch. If the rematch produces a draw, then the team ranked highest in the league will go through.
d. If there is a tie in the final, the teams will play a rematch.
e. The organisers will announce the number of league matches on the morning of the competition.

1.10 A game may restart if all teams in the game agree to a rematch within 180 seconds of the start of the game.

1.11 Teams will complete at least four scoring runs. The scores from each run will be averaged to create a final overall ranking of the teams.

2. Regulations

2.1 The Judge's decision is final.

2.2 Any assistance from Unibots organisers is provided without guarantees.

2.3 Unibots organisers reserve the right to examine your robot software and hardware at any time.

2.4 No remote control systems may be used.

2.5 This is a non-contact sport, but accidental bumps between robots and balls are inevitable.

2.5a In the event of a collision between robots, all teams involved in the collision will switch off their robots, place them in their starting zones, and wait 30 seconds (from the time of the collision) before restarting them.

2.6 Robots must not intentionally damage anything – including the arena.

2.7 If the judges deem the robot unsafe, they have the power to withdraw the robot from the game until amendments to fix the issue are made.

2.8 The robot's power switch must be on the outside top of the robot, coloured red and easily accessible at all times – including throughout the game.

2.9 After 180s (+ 5s grace period) after the game has started, the robot must come to a complete stop. However, they need not stop in the scoring zone.

2.10 We require autonomous robots without radio transmitters or receivers. In exceptional circumstances, teams may request an exemption from this rule.

2.11 No funding is provided for building robots. Please be wise with your budget. It is recommended that clubs with large budgets enter multiple teams rather than over-spending on one robot.

2.12 At the beginning of each match, robots must fit within a cube with 300mm internal sides. However, during the match, the robot may extend beyond this size.

2.13 Li-Po batteries, if used, must be securely fixed to the robot, easily removable, and protected from accidental puncture.

3. Specifications

3.1. Arena

3.1.1 The arena floor will be a 2000mm × 2000mm square, as shown in figure 1 in appendix. The tolerance of these two dimensions is ±50mm.

3.1.2 Depending on the venue, the floor of the arena may be either smooth or textured.

3.1.3 The perimeter of the arena floor will be delimited by a raised wall, approximately 150mm tall. Each of the four walls will have a different colour (green, orange, purple and yellow).

3.2. Scoring Zones

3.2.1 There are two scoring zones in the arena, one in each of the bottom corners. Their arrangements and dimensions can be seen in appendix A.

3.2.2 Where the boundary of a scoring zone is not formed by the perimeter black tape it will be marked by 48mm wide red or blue duct tape. The tape will be placed along the inside of the edge of the zone, making it part of the zone for scoring purposes.

3.2.3. The scoring zone tape will be positioned to an accuracy of ±50mm.

3.3. Balls

3.3.1 There will be 24 balls in the arena: 16 ping pong balls, 8 tennis balls. These will be randomly but approximately rotationally symmetric, placed in the play area as shown in appendix A at the start of a match.

3.3.2 Ping pong balls will be white and may have markings on them.

3.3.3 Tennis balls shall be standard yellow tennis balls and may have markings on them.

3.3.4. Balls will not be placed closer than 100mm from the edge of the play area.

3.3.5. Balls will not be placed closer than 150mm between each other.

3.4. Tape boundary

3.4.1. A thick layer of tape (i.e. multiple tape layers) will be used in the arena to prevent balls from accidentally rolling into different sections of the arena.

3.5. Fiducials

3.5.1 AprilTags will be used as fiducial markers around the arena.

3.5.2 These tags will be 100x100mm positioned in the center of the wall behind each zone as shown in Figure 1.

3.5.3 Each tag has a unique ID. The ID of the tag which is to be used is shown in Figure 1

4. Awards

Each award includes a monetary reward, a trophy, as well as certificates. The current awards are £200/100/50 worth of Amazon vouchers for the 1st/2nd/3rd place, and the values of the other awards will be decided later once more funding is confirmed.

4.1 Competition Award

Gold, silver, and bronze awards will be given for the top three teams of the competition. These awards recognise the consistency of the team's robot.

4.2 Committee Award

The Committee Award will be given to the team that displays the most extraordinary ingenuity in the design of their robot. It will not be awarded for the complexity of design, rather the implementation of a simple and elegant solution to the problem.

4.3 Fusion 360 Design Award

The Design Award will be given to the team that is judged to have the best 3D design for their robot. The model design must be done in Fusion 360 to be eligible, and Autodesk will be responsible for the judging.

4.4 Most popular Award

All participants in the competition will take part in a poll to choose the robot they like most. Robots are assessed based on each individual's own criteria, but one can think of it as a vibe check. An edible prize will be presented to the most popular robot.

4.5 First Robot Movement

There will be an award for the team with the first robot movement. This requires a video of the robot moving and grabbing a ball, pausing for 2 seconds, turning 180◦ (±20◦), returning to its starting position (±0.5m), and come to a halt without interference being posted in the Unibots UK Discord. An edible prize will be presented to the team.

5. Clarifications

Requests for rule clarifications may be made on Unibots Discord, and this document will be updated if deemed necessary. Requests received within one week of the competition are unlikely to be processed.

Appendix A

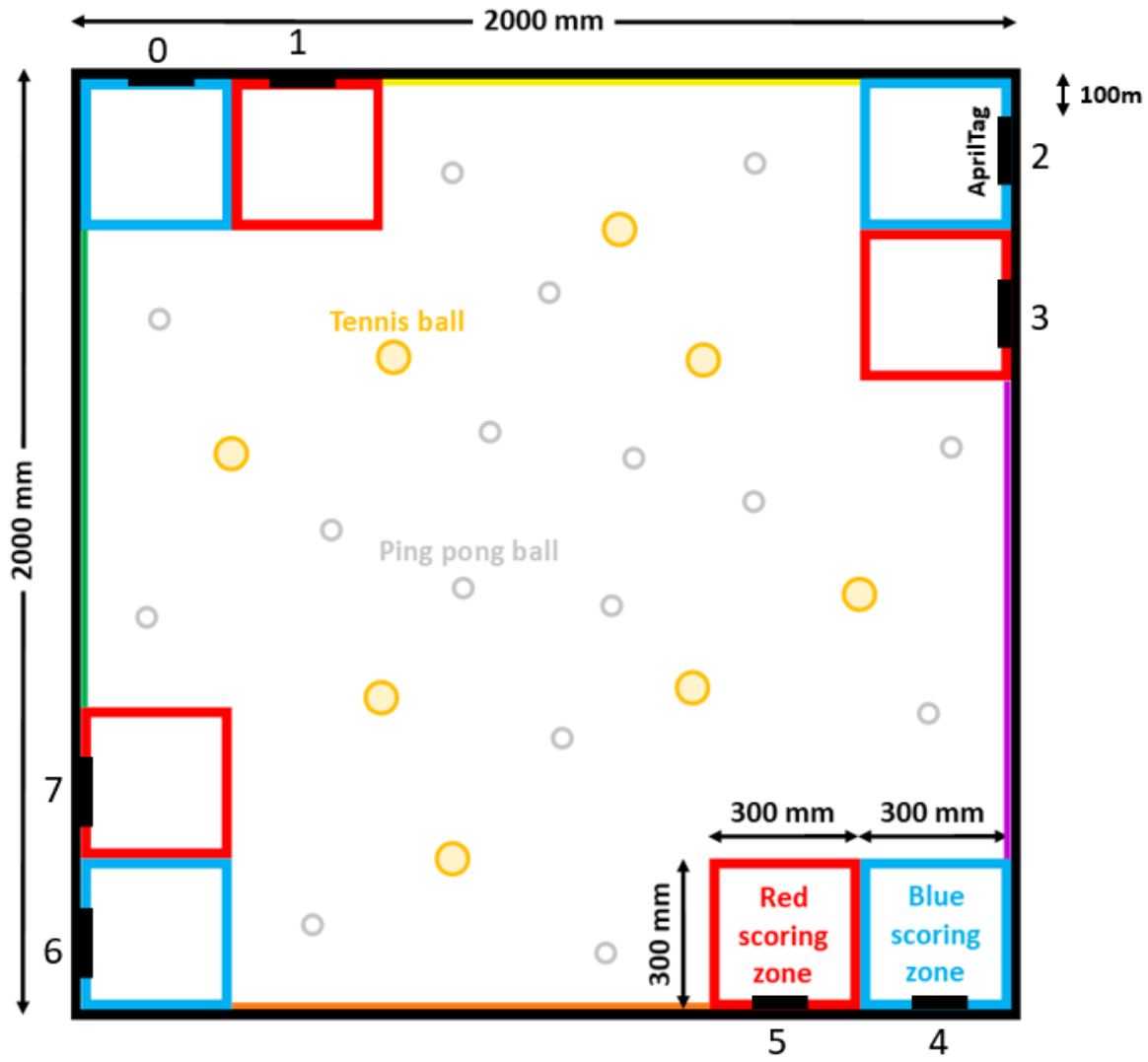

Figure 1 The arena

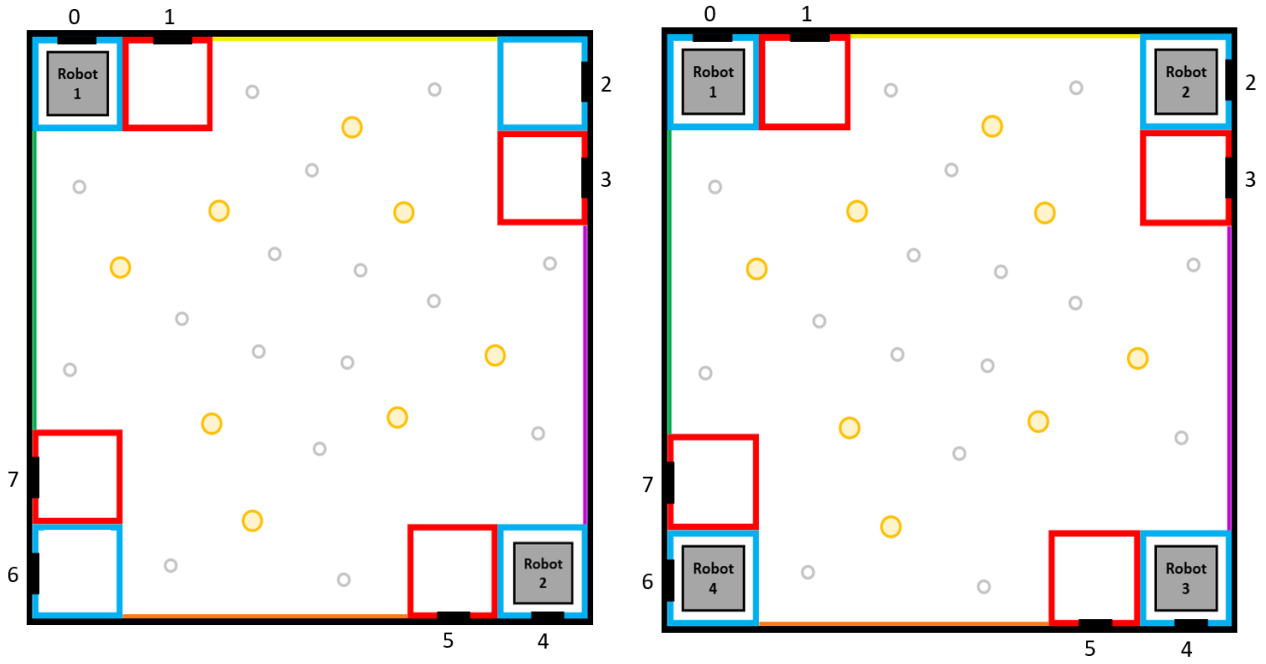

Figure 2 (a) Initial positions of the two robots in knockout competitions. (b) Initial positions of the four robots in league competitions.

Appendix B

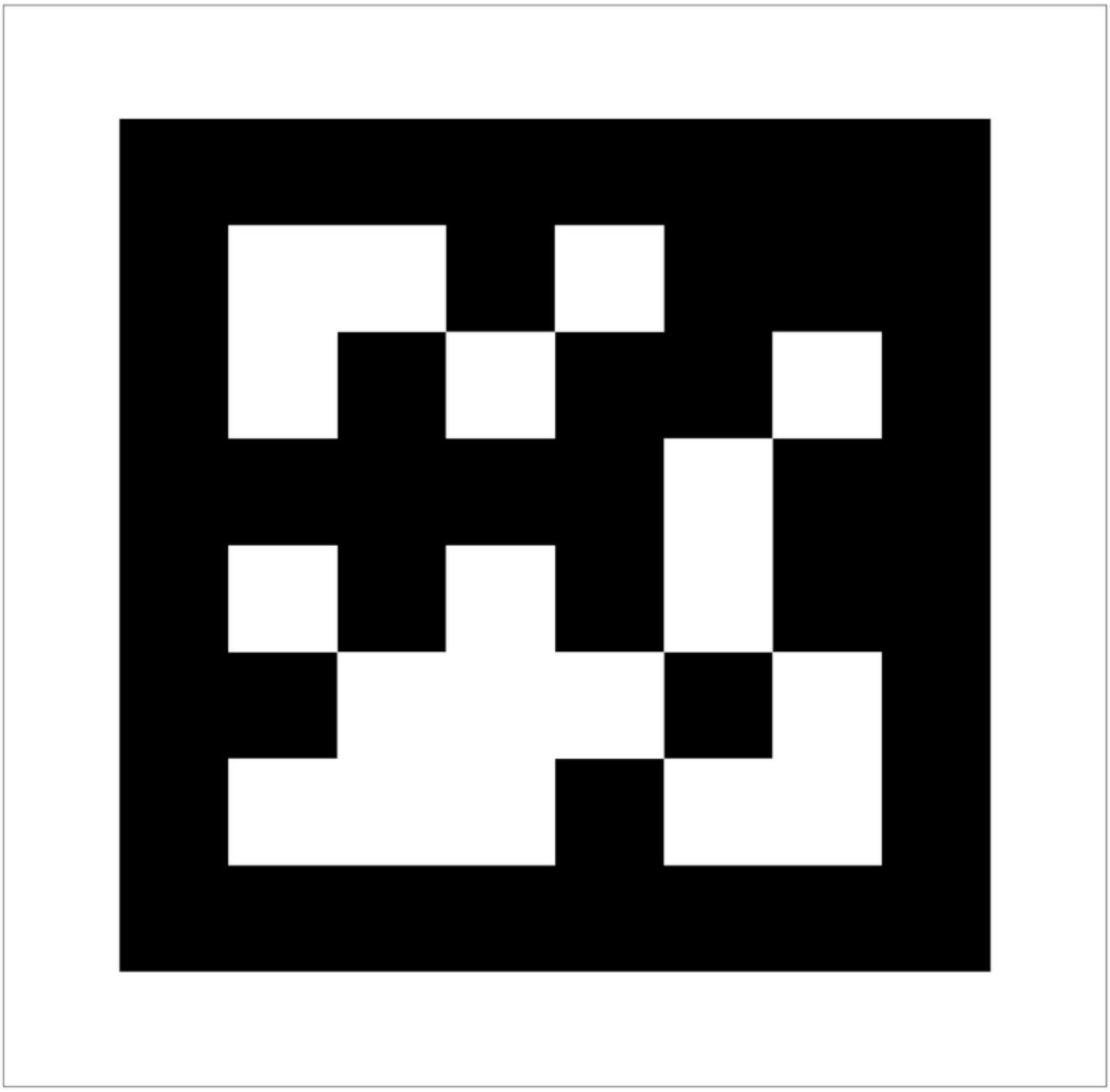

Figure 3 An example AprilTag 42 from the 36h11 family.