Hills Road Sixth Form College

ROBOCON

Tributes to the Fallen

CLARIFICATIONS

To ask any questions or for clarifications, please feel free to email robotics@hrsfc.ac.uk . In all cases, the rules on the website are updated and reflect the most recent state of the game and supersede previous versions including the hard copy. Should we feel any clarifications to the rules need to be made, they will be published to the website and we will inform all teams by email. The rules used during the competition will be the rules published on the official website: robocon.uk and these rules supersede printed copies and copies served by the RoboCon brains.

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1. AWARDS

1.1 Victors' Prizes

Prizes are given to the teams that place highest at the end of the competition. These will be These will be the teams in 1st, 2nd and 3rd place.

1.2 Game Maker's Vision

The prize that is given to the team that impresses the judges through either an ingenious technical or logical advancement.

1.3 District Presentation

The prize that is given to the team with the most robot and team flair.

1.4 Mockingjay's Choice

The team prize that is given to the team who demonstrates the most perseverance in the face of adversity.

2. SPECIFICATION

2.1. ARENA DIAGRAM

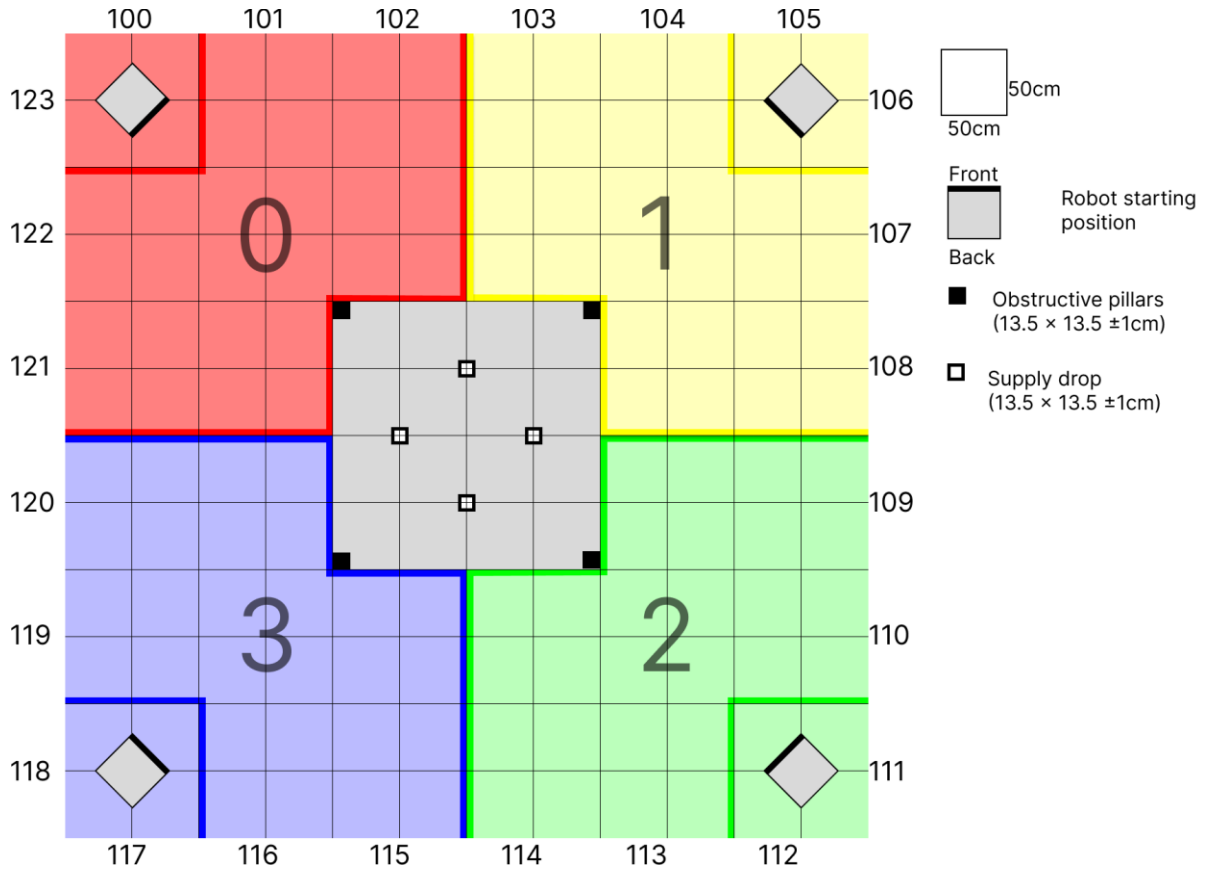

Figure 1 (top-down diagram of the arena)

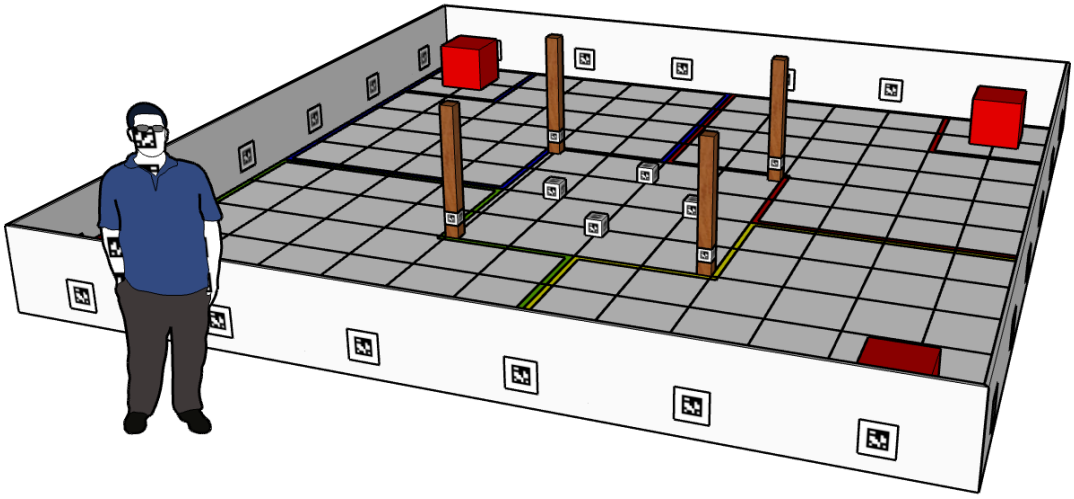

Figure 2 (3D representation of the arena)

2.2. GAME FEATURES

2.2.1. Districts

2.2.1.1. The arena is divided into 4 districts and a square zone in the centre called the 'neutral zone'.

2.2.1.2. Each district is an irregular hexagon in each quadrant, with side lengths 3, 3, 2, 1, 1, 2 m. (Refer to figure 1).

2.2.1.3. Each district, and consequently the neutral zone, is bordered by tape with width of 48mm in the district's colour.

2.2.1.4. The neutral zone is marked in white, while the districts are coded red, blue, green, and yellow.

2.2.1.5. The coloured tape is a part of the district's area.

2.2.1.6. Within each district is a 1m x 1m square 'home area' in each corner of the arena.

2.2.2. Neutral zone

2.2.2.1. The neutral zone is not considered to be a part of any district.

2.2.2.2. The neutral zone is a square of side length 2 m.

2.2.2.3. The neutral zone is located at the centre of the arena, 2m from each arena wall.

2.2.2.4. At each corner of the neutral zone is a pillar with a base of 13.5 x 13.5 cm (±1 cm) and a height of 1 m. The sides of each pillar can be identified through AprilTag markers, which are included in the RoboCon kit.

2.2.3. Cornucopia

2.2.3.1. The Cornucopia is a decorative raised platform with a horn directly above the neutral zone.

2.2.3.2. Supply drops are released from the Cornucopia into the neutral zone at timed intervals. 4 supplies are dropped over the course of the game; one is dropped each at 60, 90, 120 and 150 seconds from the game start.

2.2.4. Supplies

2.2.4.1. All supplies are cubes of side length 13.5 ± 1 cm. These are identified by AprilTag markers on each face, which are specified in Section 3.2.

2.2.4.2. Supplies consist of supply drops and supply crates.

2.2.4.3. Four supply crates can be found on the floor of the neutral zone at the start of the game, at locations specified in figure 1.

2.2.4.4. Supply drops are supplies which are dropped into the neutral zone from the Cornucopia during the game.

2.2.4.5. A supply is in a zone if its centre lies within the zone's boundary.

2.3. MARKERS

2.3.2. The arena walls, pillars and supplies involved in the game are labelled AprilTag markers. Each marker pattern encodes a number.

2.3.3. Each marker number is associated with a specific feature of the arena and has an associated size. An example AprilTag can be seen below:

2.3.3. Sample markers can be printed on a black and white printer, and their designs can be downloaded from the documentation section of the Hills Road RoboCon website https://www.robocon.uk/

2.3.4. All markers will be laminated with a matte finish.

2.3.5. The markers on the arena wall will be 200 x 200 mm in size. They will be 50 mm off the floor.

2.3.6. The markers on the pillars will be 0 mm off the floor and will be of dimensions 100 x 100 mm.

2.3.7. The markers on the supplies will be on cubes of side length 127 mm, where the supply crates will have a green AprilTag, and the supply drops will have a red AprilTag. An example cube with AprilTags is included in your kit.

2.3.8. At the start of the game, the neutral zone will contain 4 supply crates, each with their own unique AprilTag code. The supplies, arena objects and their corresponding numbers are as follows:

Feature	April tag Number range (inclusive)	Colour
Supply crates	0-23 (Of which four are in the arena)	Green
Supply drops	24-31 (Of which four will be dropped into arena)	Red
Arena pillars	76-91	Black
Arena Walls	100 -123	Black

3. REGULATIONS

3.1. The referee will be referred to as the Head Game Maker.
3.2. The Head Game Maker has the final say in any circumstance.
3.3. No remote-controlled systems are permitted.
3.4. RoboCon is a non-contact competition, and no robots should be engineered with harming other robots in mind.
3.5. Robots may not deliberately damage anything. This includes the arena, supply crates, and other robots. At the Head Game Maker's discretion, teams who engage in collisions deliberately or do not take sufficient precautions to avoid collisions may be disqualified from rounds until the issue has been resolved. The Head Game Maker decides whether or not this action was deliberate.
3.6. Robots may not deliberately leave debris in the arena.
3.7. Teams must not imitate any features of the arena in a way that could potentially confuse other teams' robots.
3.8. Hills Road RoboCon reserves the right to examine your robot software and hardware at any time, to verify that rules are being followed.
3.9. Assistance from Hills Road RoboCon is provided with no guarantees.
3.10. All kits handed out by Hills Road RoboCon remain the property of Hills Road RoboCon. The kit must be returned to Hills Road RoboCon at the end of the competition in acceptable condition.
3.11. Robots must pass a safety inspection by a Game Maker before they are permitted in the arena.
3.12. At the beginning of each round, robots must fit into a cube with internal dimensions of 400 x 400 mm on each side. During the round, the robot may extend beyond this size.
3.13. For everyone's safety, the robot's power switch must always be red and easily accessible while the robot is active – including throughout the game.
3.14. The robot is to be started in the arena using a physical start button. You must position this where a team member can reach it from outside of the arena.
3.15. You may use custom hardware to enhance your robot's electronics, but all power must be drawn from the connectors on the BrainBox.
3.16. The BrainBox and battery must not be disassembled, altered, or otherwise tampered with in any way.
3.17. All wires connected to the robot's ground (0V line) must be black. Black wires must not be used for anything else. It is strongly recommended that all wiring is neat and removable, as this will reduce the time required to debug problems, and teams may

be asked to tidy their wiring before a member of Hills Road RoboCon will approach any issues with their robot.

3.18. All electronics should be securely fixed to the robot (not able to be shaken loose) and should also be easily removable if required.

3.19. It must not be possible to injure oneself on the robot. This may be tested using a Frankfurter sausage to simulate a finger – anything that could cause harm, such as high-speed rotating parts, should be suitably shielded.

3.20. The lithium polymer battery provided in the kit must be shielded from mechanical and thermal harm. This includes ensuring that it is protected from harm in the case of accidental collision with another robot. Teams found to be in violation of this rule will have their batteries confiscated until they have demonstrably rectified the issue.

3.21. If teams wish to use batteries, chargers, or cables other than the ones provided with the kit, they must seek approval from Hills Road RoboCon through robotics@hrsfc.ac.uk first.

3.22. Robots may not include additional radio transmitters or receivers to those in the BrainBox.

3.23. Attaching a GoPro or similar small video recorder to your robot to record a round is permitted, but it must be powered by its own internal batteries and cannot be connected to any of the other electronics of the robot. It must fit within the internal dimensions defined in Section 3.1.

3.24. A USB port must remain free and accessible for the use of Hills Road RoboCon during the competition. If you want to use a USB device such as an Arduino, you will need to provide your own USB hub.

4. ROUNDS AND GAME POINTS

4.1. A round of the game lasts for 180 seconds

4.2. There will be no more than 4 robots in each round.

4.3. A round may be ended prematurely if all participating teams state to the Head Game Maker that they are happy for the round to end.

4.4. Scoring will begin 10 seconds after the end of each round.

4.5. There must be no teams in the arena during the minute before the round starts. Robots must be placed in the arena before this time.

4.6. Teams must not, under any circumstances, enter any body part or object into the arena during a round, except to press the start button on their robots at the beginning of each round.

4.7. Interfering with any robots, cubes, or parts of the arena during the round will result in the offending team's disqualification, and they will be asked to leave the arena.

4.8. At the end of a round, the Head Game Maker will total the score for each competing team. Teams must not enter the arena or touch any robots or game items in the arena during this time in order to ensure fair scoring. Touching any robot or item before the Head Game Maker 'releases' the arena may result in the offending team's league points for the round being forfeit.

4.9. Scoring is judged according to the state of the arena at the end of the round.

4.10. Robots must not be programmed to interfere with other robots. Accidental contact between robots is expected – we reserve the right to review your code to ensure it complies with this rule.

4.11. A robot is in possession of a cube if it touches or encloses the cube and can move it. If a robot possessing a cube is enclosed by another robot, then the innermost robot is considered in possession of the cube and the outer robot(s) is not.

4.12. The **base value** of a supply crate is 1 point. The base value of a supply drop is 2 points.

4.13. Scoring is as follows (note that conditions <u>not</u> specified with '**each**' refer to points conceded only once to each team upon meeting the condition):

Condition	Score
Robot leaves the home area	+1
Robot has possession of at least one cube	+1
Each cube inside your district	**Base value**
Each cube inside your district's home area	**Base value** + 1
Each cube in a stack of 2 or more	**Value after other modifiers** × 4

5. LEAGUE POINTS AND KNOCKOUT ROUNDS

5.1 LEAGUE POINTS

5.1.1. Only teams with robots present in the area at the start of a round can score league points from that round.

5.1.2. League point scoring:

Score	League points
Highest score	8 League points
Second highest score	6 League points
Third highest score	4 League points
Fourth highest score	2 League points

5.1.3. In the case of a draw, in which two or more teams score the same, each of the teams will gain the average number of points of their places. For instance, if two teams score equally and are therefore in joint first place, they will both score the mean of the first and second place scores – 7 league points.

5.1.4. Teams whose robots were disqualified from a round will earn no league points for the round.

5.2 KNOCKOUT ROUNDS

5.2.1. Once the league has been completed, a knockout competition will begin. The positions of the teams in the league will seed the positions of teams in the knockout rounds.

5.2.2. Each round in the knockout competition involves up to 4 teams. The teams that come 1st and 2nd in each knockout round will continue to the next round of the knockout.

5.2.3. In case of a tie in a knockout round, the team ranked highest in the league will go through.

5.2.4. If there is a tie in the final for first place, then a rematch may be played at the Game Maker's discretion.

6. KIT RETURN

Each team will be provided with a kit which contains a disclaimer form detailing your obligations with respect to assembly, use and return of the kit, which is lent to you for the duration of RoboCon 2025-26. Each team is issued with a kit with the following parts, which is to be returned at the end of the competition.

- Items to be returned:
  - Electronic kit:
    - 1x Brainbox
    - 1x Power switch – latching (red switch, black connector)
    - 1x Start button – momentary (black switch, green connector)
    - 1x 6-pin GPIO connector
    - 1x 2-pin 12V Accessory connector
  - Batteries:
    - 1x 3S (11.1V nominal) LiPo Battery
    - 1x Turnigy E3 Compact 2S/3S LiPo charger
    - 1x "LiPo Safe" bag for storage and charging of batteries
  - Computer:
    - Linux laptop, paired with electronics for programming and Wi-Fi download
    - Power Brick and lead
  - Other:
    - 1x 12L Really Useful Box
    - 1x Really Useful Box Lid
- Items to be returned if in working order:
    - 1x Minibot chassis
    - 2x TT motors with connectors
    - 1x Microrservo 9g SG90
    - 1x Supply crate marker
    - 1x Supply crate

If possible, the kit should be returned at the competition, but in no case should it be returned later than 14 days after the competition. If you wish to keep the kit beyond that, this must be arranged prior to the competition date via an email to robotics@hrsfc.ac.uk

THANKS

We would like to thank Will Munns, Mr Smalley, Mr Massey and the sponsors listed below, without whom we would not have been able to run this competition.

Hills Road Sixth Form College Cambridge

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“Robotics, cybernetics and artificial intelligence are some of the most rapidly changing fields of science and technology, with tremendous opportunities for future engineers. This generation of students are the ones who will write the next chapter in technology and this competition may be the starting point for their careers. Several Hills Road students who became interested in engineering and robotics through the Robotics group and entering competitions have gone on to degrees and careers in this exciting field,” says David Massey, Founder of Hills Road Robotics.