ROBOCON 2020

A GAME OF

CHICKEN & EGG

RULE BOOK

VIRTUTE ET FIDE

A Game of Chicken and Egg

Revision 1.0 October 16th, 2019

The following defines the rules and regulations of the **Hills Road RoboCon** 2020 competition.

1. GAME RULES

1A BASE RULES

1.1 'A Game of Chicken and Egg' will be played in the arena defined in section 3B. The objective of this game is to achieve as many points as possible by delivering your teams "Eggs" into some or all of the "Baskets" in the arena.

1.2 Before a round starts, the teams participating in that round will be given some time to set their robot up in the arena. During this time, they must place their robot in the zone that they are assigned. The robot must be placed such that it is entirely within this zone, with no parts overhanging its boundary. The robot **does not** need to finish within the zone at the end of three minutes.

1.3 There are five Baskets in the arena. Each basket has a specified capacity, after the capacity is reached baskets will reject eggs onto the floor of the arena. The five Baskets will be positioned as shown in Figure 1:

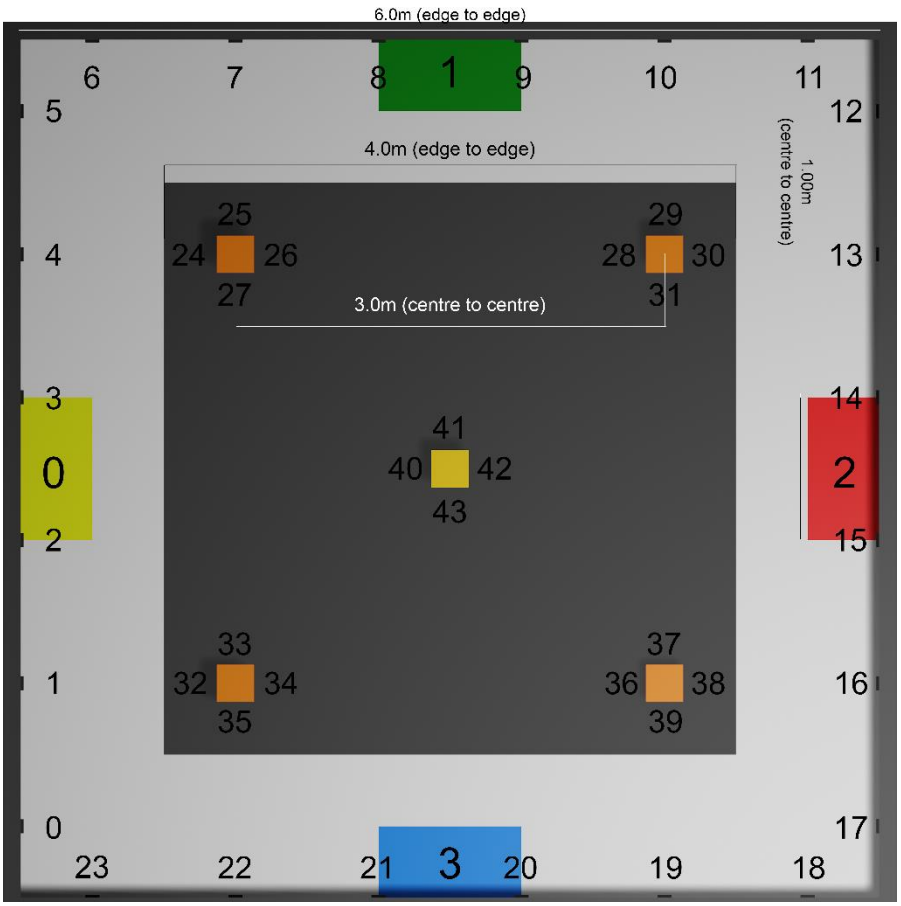

Figure 1 - Diagram of the arena with measurements and marker numbers.

1.4 There must be no team members in the arena during the 1 minute before a round is scheduled to start. Robots must be installed and oriented before this deadline. During this minute there must be no interaction with the robot. Teams that do not meet this rule may forfeit the round subject to judges' discretion.

1.5 Teams must not in any circumstances enter any body part or object into the arena during the round except to press the start switch to begin the round. Interfering with the robots will lead to forfeit of the points from the round and may lead to being asked to leave the arena.

1.6 Robots and Eggs must remain untouched in the arena until the judges "release" them. This is to allow fair scoring to happen. Any robot touched before it is released by the judges may forfeit the points from the round. Any Egg touched before it is released will cause 3 league points to be lost by the offending team.

1.7 Robots must not move between being placed in the arena and the start of the round. Robots will be started by teams leaning into the arena to press the start button on their robot when instructed to do so.

1.8 At the end of a round, each team's "**Game Points**" will be calculated based only on the final location of the eggs. Game points are use only to place 1st-4th position for each game played. Game points will be awarded as follows:

Location of Egg	**Maximum Capacity**	**Points per Egg**
Corner Basket	4	3
Centre Basket	3	5
Scoring Floor Zone	Unlimited	1
Number of corner Baskets containing at least one Egg	4	Final score multiplied by number of corners occupied

1.9 Eggs which at the end of the round remain in contact with the robot, or are outside of the scoring zone will not score any points.

1.10 One additional game point will be awarded if the robot fully leaves its starting zone as defined in section 3B, at any point in the round.

1.11 Scoring begins 10 seconds after the round ends. Should any further movement of the Eggs occur after this point, the Egg is removed from the field and does not score.

1.12 A round lasts 180 seconds.

1.13 There will be a maximum of 4 robots in a round.

1.14 A round may be terminated prematurely if all teams participating in that round state to the judge that they are happy for the game to end.

1B **ROUNDS AND LEAGUE POINTS**

1.15 At the end of a game, **League Points** will be awarded as follows:

1.16 The team with the most game points will be awarded 8 **League Points** towards the competition league. The team with the second most will be awarded 6 **League Points**. The team with the third most game points will be awarded 4 **League Points**, and the team with the fewest game points will be awarded 2 **League Points**

1.17 If teams are drawn on Game Points, they both receive the average League Points score of their two places. For instance, if two teams come joint first on Game Points, they are both awarded the average of 8 and 6 League Points, so 7 League Points.

1.18 Teams whose robot was not entered into the round, or who were disqualified from the round, will be awarded no league points.

1.19 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. 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. In the event of a tie in a knockout round, the team that ranked highest in the league will go through. If there is a tie in the final, then a rematch will be played.

2. REGULATIONS

2.1 No remote-control systems may be used during a round.

2.2 This is a non-contact sport, but accidental bumps and scrapes are inevitable.

2.3 Robots must not intentionally damage anything – including Eggs, the arena or other robots. At the discretion of the judge, teams who deliberately engage in collisions or take insufficient precautions against collisions may be disqualified from rounds until the issue is resolved

2.4 Robots may not deliberately leave any debris in the arena.

2.5 **Hills Road RoboCon** reserves the right to examine your robot software and hardware at any time.

2.6 Assistance from **Hills Road RoboCon** is provided without any guarantees.

2.7 All kit deployed by **Hills Road RoboCon** remains the property of **Hills Road RoboCon**. The kit must be returned to **Hills Road RoboCon** after the competition.

2.8 The judges' decision is final.

2.9 Robots must pass an inspection by a **Hills Road RoboCon** Inspector before competing in a round. This inspector will check that the robot complies with the rules and regulations of this game. Robots that have not passed inspection will not be permitted to compete. Inspected status may be revoked temporally if the robot is significantly altered during the competition.

2.10 At the beginning of each round, robots must fit within a cube with 400mm internal sides. During the round, the robot may extend beyond this size up to a height, width, or length of 800mm.

2.11 The robot can be pre-loaded with up to 5 Eggs.

2.12 The power switch must be easily accessible at all times – including throughout the game. This is for everyone's safety, especially your robot's.

2.13 You may use custom hardware to enhance your robot's electronics, but all power must be derived from the power board supplied.

2.14 All custom electronics that require a connection to the battery must instead be connected to the power board. There are extra connectors on the power board for this purpose.

2.15 The Brainbox and battery must not be disassembled, altered or otherwise tampered with in any way. The power cable includes a 20A fuse. Under no circumstances should this fuse fail, failure of this fuse indicates a dangerous fault in the Brain Box - **DO NOT REPLACE THE FUSE, RETURN THE UNIT IMMEDIATELY FOR REPAIR.**

2.16 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 easily removable, as this will reduce the time required to debug problems on robots (teams may be asked to tidy their wiring before a member of **Hills Road RoboCon** will approach any issues with their robot).

2.17 All electronics must be securely fixed to the robot and should also be easily removable.

2.18 It must not be possible to injure oneself on the robot. This will be tested using a Frankfurter sausage to simulate a finger. For example, high-speed rotating parts that could cause injury must be suitably shielded.

2.19 The lithium-ion polymer batteries provided in the kit must be shielded from mechanical and thermal harm. This includes mechanical protection from accidental impact with other robots. Teams found to be in violation of this rule will have their batteries confiscated until they have demonstrably rectified the identified issues.

2.20 If teams wish to use batteries, chargers or cables other than the ones provided, then they must seek approval from **Hills Road RoboCon** through *robotics@hrsfc.ac.uk* first. Additionally, if teams wish to add systems powered by separate batteries then they must seek approval through the same channel beforehand (except Cameras as specified in rule 2.22). In general, teams are encouraged to power everything off of the power board supplied with the kit. All electromechanical components must be powered through the motor rail provided by the power board.

2.21 Robots may not include additional radio transmitters or receivers to those contained within the Brainbox.

2.22 Attaching a Go-Pro or similar small video recorder to your robot to record the round is permitted, but it should be powered from its own internal batteries and may not be connected to any other electronics in the robot. It must fit within the overall dimensions contained in section 2.10.

2.23 One USB port must remain free and accessible for the use of **Hills Road RoboCon** during the competition. USB extension cables can be used to move this port to a more convenient location.

2.24 Robots must obey the Three Laws of Robotics:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

3. SPECIFICATIONS

3A MARKERS

3.1 The arena, and Baskets involved in the game are labelled with *libkoki* markers. Each marker pattern encodes a number. Each marker number is associated with a particular feature within the arena, and also has an associated size. The marker numbers and sizes are as follows:

Item	Marker Numbers	Marker Size (mm)
Arena Boundary	0 – 23	250
Basket 1	32-35	100
Basket 2	36-39	100
Basket 3	40-43	100
Basket 4	44-47	100
Basket 5	48-41	100

The markers can be printed on a black-and-white printer. Marker designs can be downloaded from the documentation section of the **Hills Road RoboCon** website.

All markers described in this document are oriented vertically such that the principal corner of the marker (which is indicated by a dark grey dot in the black marker border) is on the higher and left edge.

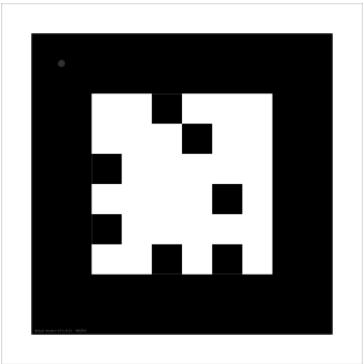

Figure 2: An example libkoki marker is given above; this one is arena-0.

3B ARENA

3.2 The arena floor, overall, is a 6m x 6m square, as shown in Figure 4. The tolerance of these two dimensions is ±0.25m.

3.3 The floor of the arena is carpeted. A close pile industrial carpet will be used.

3.4 The arena will be surrounded by 0.5m walls. No competitors or members of the audience will be allowed beyond the walls onto the arena during a round.

3.5 The arena features four zones. These areas are delineated by different coloured carpet. These extend from the barrier walls and are 2m x 0.5m and are centred. The dimensions and numbering of these zones is shown in Figure 4.

3.6 Each wall of the arena features six 250mm libkoki markers. Figure 3 shows the positioning of these markers, whilst Figure 4 shows the numbering of these markers.

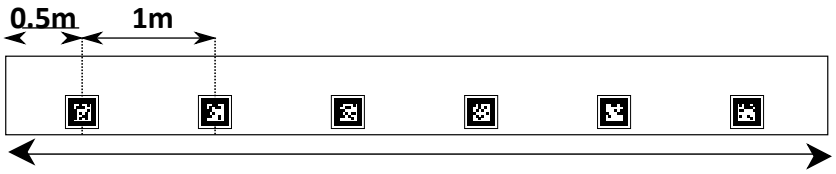

Figure 3: Six 250mm wide markers are spaced evenly along each 6m arena wall. The markers are placed 50mm above the floor.

3.7 The zones are numbered from 0, the yellow zone, and increase clockwise as shown in Figure 5.

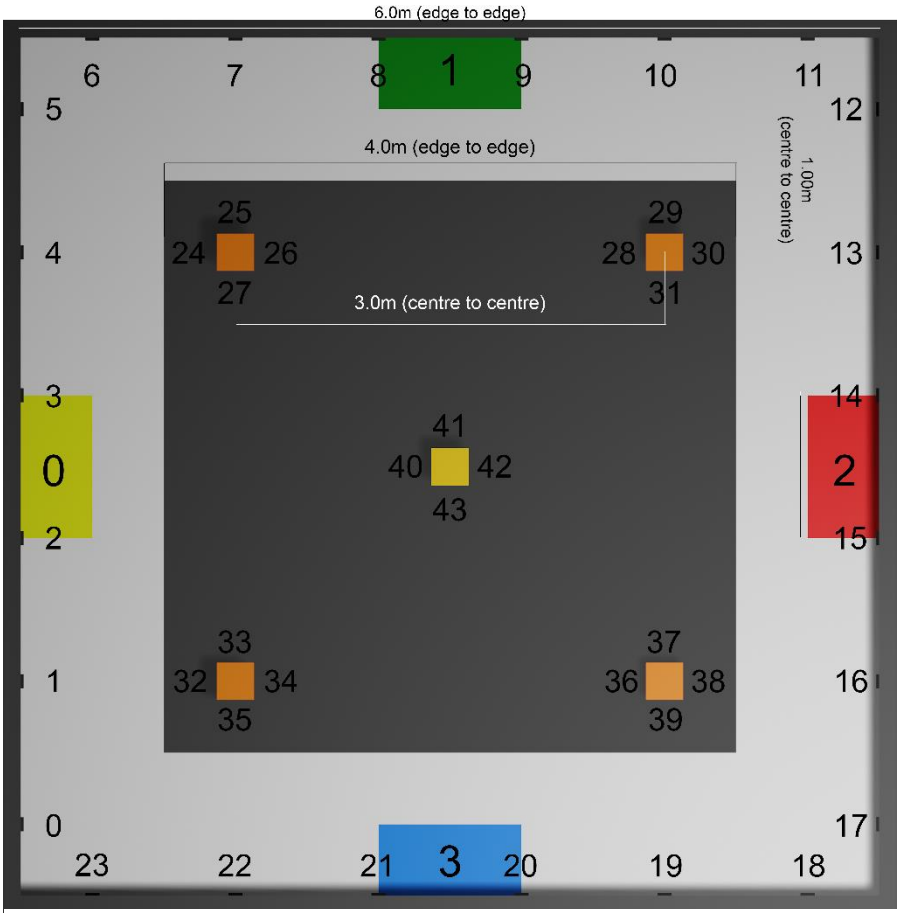

Figure 4 – Diagram to show the marker numbers around the arena

3C BASKETS

3.8 Each Basket has dimensions 260mm x 260mm x 170mm ±10mm.

3.9 The Baskets have a maximum capacity. Once this capacity has been reached, any additional Eggs will be released into the arena.

3.10 Provided in the kit is a Really Useful Box which, when standing on its own lid, is the same size when viewed end-on as a Basket.

3.11 Baskets exist in the physical realm, although designed to operate as specified in 3.9, if they do not, then points are awarded by the actual physical location of eggs at the end of the round and not where eggs should be based on ideal operation of the basket

3D EGGS

3.12 Eggs have been modelled by a physicist. They are almost perfectly spherical, quite robust, elastic, have negligible mass and bear a striking resemblance to standard Table Tennis balls, with a diameter 40mm ±2mm.

4. THE KIT

4.1 Each team will be provided with a kit, each of which is issued by **Hills Road RoboCon** and contains a manifest which lists the parts and part numbers issued to each team. Each team is responsible for ensuring that they return the items listed on their manifest.

4.2 Items to be returned:

Electronics Kit:

- 1x Brainbox
- 1x Minibot chassis
- 2x mini-DC motors with connectors
- 1x microservo 9g SG90
- 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:

- 2 x 3S (11.1v nominal) LiPo Battery
- 1 x Turnigy E3 Compact 2S/3S LiPo Charger
- 1 x "Lipo Safe" bag for storage and charging of batteries

Computer:

- Windows operating system, paired with electronics for programming and Wi-Fi download.
- Power brick and lead

Other:

- 1x 12L Really Useful Box
- 1x Really Useful Box Lid
- 3x Basket markers
- 1x Standard Egg

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

5. AWARDS

5A MAIN COMPETITION AWARDS

Prizes will be awarded to the teams that are placed highest at the end of the competition. The teams in 1st, 2nd and 3rd place will receive awards.

5B JUDGES' AWARD

The Judges' Award will be given to the team that displays the most extraordinary ingenuity in the design of their robot. This award is entirely at the discretion of the judges.

5C ROBOT AND TEAM IMAGE

The team that presents their robot and themselves in what is judged to be the most outstanding way will receive this award. Your online presence will also count towards this category.

6. CLARIFICATIONS

Requests for rule clarifications may be sent to robotics@hrsfc.ac.uk. Requests received within one month of the competition are unlikely to be processed.

THANKS

Thanks goes to the people below; without them we would not have been able to organise 'A Game of Chicken and Egg'.

Hills Road Sixth Form College Cambridge

"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, Leader of Hills Road Robotics.

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