

# Student Robotics 2011 Rulebook

September 26, 2010

The following defines the rules and regulations of the Student Robotics 2011 competition.

## 1 Game Rules

- 1.1 The game, called **Tin-Can Rally**, will be played in the arena defined in [subsection 3.1](#).
- 1.2 Before the game starts, two tokens will be randomly placed within the four corridors to be found at each side of the arena. The super token will be placed at the top of the ramp.
- 1.3 Teams will be assigned a corner of the arena that their robot will start the game in. The robot must be placed within 100mm of both of the arena walls.
- 1.4 At the end of a match a team's "**game points**" will be calculated. These are used to rank teams before competition league points are awarded.
- 1.5 Game points will be awarded as follows:
  - When a robot moves from its starting position, **1 point** will be awarded.
  - When the back of a robot passes a quadrant boundary defined in [subsection 3.1](#), **2 points** will be awarded.
  - When a robot carries a token (including the super token) over a quadrant boundary, **1 point** will be awarded.
  - When a robot finishes ascending the ramp, marked by its back passing the boundary of the ramp's plateau, **3 points** will be awarded.
  - When a robot finishes descending the ramp, marked by its back passing the end of the ramp's slope, **3 points** will be awarded.

- When a robot ends the game holding<sup>1</sup> a normal token, **2 points** will be awarded.
- When a robot ends the game holding the super token, their **total score** for that game will be **doubled**.

1.6 A robot will be considered to be carrying a token if the token is both:

- a) propelled by the robot
- b) in contact with the robot, but not with the arena floor or walls.

1.7 Points can only be scored by robots travelling anti-clockwise around the centre of the arena.

1.8 At the end of a game, the team with the *most* game points will be awarded 4 points towards the competition league. The team with the second most will be awarded 3. The team with the third most will be awarded 2 points, and the team with the fewest game points will be awarded 1 point. Teams whose robot was not entered into the round, or who were disqualified from the round, will be awarded no points.

1.9 There will be a maximum of 4 robots in a match.

1.10 A match lasts 180 seconds.

1.11 Matches will be started and stopped by the Student Robotics Infrared system<sup>2</sup>.

1.12 Teams that do not present their robot promptly for a match will forfeit that match.

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<sup>1</sup>To find out if a robot is holding a token, it will be lifted clear of any arena surfaces that may be supporting a token.

<sup>2</sup>The Student Robotics Infrared system will be connected to robots before they enter the arena for their game. It will be used for safety cut-off, start-match and stop-match signals.

## 2 Regulations

- 2.1 Robots must pass an inspection by a Student Robotics Inspector before competing in a match. **Robots that have not passed inspection will not be permitted to compete.**
- 2.2 At the beginning of each match, robots must fit within a cube with  $500mm$  internal sides.
- 2.3 The power board, including its power switch, must be easily accessible. This is for your safety, and the safety of others around you.
- 2.4 All custom electronics that require a connection to the battery must instead be connected to the motor rail. There is an extra connector on the power board for this purpose.
- 2.5 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 Student Robotics Engineer will approach any issues with their robot).
- 2.6 All electronics must be securely fixed to the robot, and should also be easily removable.
- 2.7 No remote control systems may be used, with the exception of the Student Robotics Infrared system for starting and stopping matches.
- 2.8 This is a non-contact sport, but accidental bumps and scrapes are inevitable.
- 2.9 It must not be possible to injure oneself on the robot. This will be tested using a Frankfurter sausage to simulate a finger.
- 2.10 Robots must not intentionally damage tokens, the ramp, the arena or other robots.
- 2.11 Robots must have a flagpole attached. The flagpole is the only part of the robot that may exceed the  $500mm$  height limit. See [subsection 3.4](#) for more details.
- 2.12 Robots must be entirely green along their sides and top surface, with the exception of the camera. This is to aid the vision system.
- 2.13 If teams wish to add systems powered by separate batteries then they must seek approval from Student Robotics first. In general, teams are encouraged to power everything off the SR-supplied battery through the power board. All electromechanical components **must** be powered through the motor rail provided by the power board.
- 2.14 Student Robotics reserves the right to look at your robot software and hardware at any time.

- 2.15 Assistance from Student Robotics Engineers is provided without any guarantees.
- 2.16 All kit deployed by Student Robotics remains the property of Student Robotics.  
All electronic kit **must** be returned to Student Robotics after the competition.  
See [Appendix A](#) for more details.
- 2.17 The Judge's decision is final.

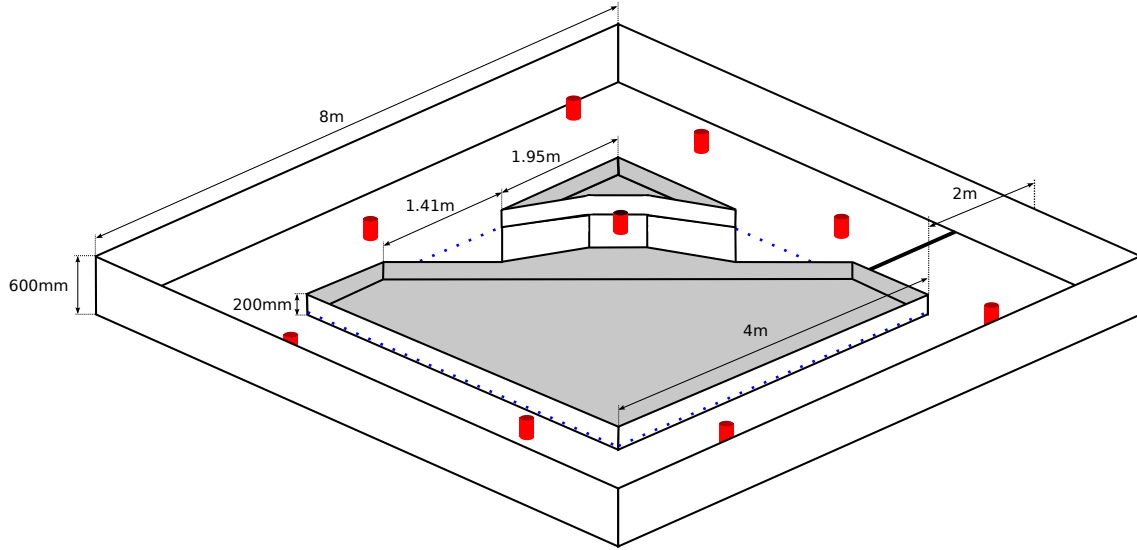


Figure 1: An overview of the arena, including baked bean tin tokens.

## 3 Specifications

### 3.1 Arena

- 3.1.1 The match arena floor, overall, is an  $8m \times 8m$  square, as shown in [Figure 1](#). The tolerance of these two dimensions is  $\pm 0.25m$ .
- 3.1.2 The width of the track is  $2 \pm 0.1m$ .
- 3.1.3 The floor of the arena is made of white plastic coated hardboard. White Gaffer tape will be in place over the joints between hardboard sheets.
- 3.1.4 The outer arena walls are  $600 \pm 30mm$  high and are made of the same material as the arena floor. The internal walls will be  $200 \pm 10mm$  high, and also white, as shown in [Figure 2](#).
- 3.1.5 Robots may not enter the areas bounded by the internal wall.
- 3.1.6 The blue squares alongside the internal wall have sides of  $50 \pm 5mm$ , and are spaced  $150 \pm 10mm$  apart (as per [Figure 2](#)).
- 3.1.7 No guarantee is offered of the colour of the area inside the internal wall (the section greyed out in [Figure 1](#)). We can guarantee, however, that anything visible within the arena above  $200mm$  and below  $600mm$  will be either white or black (as those colours are not visible to the vision system).
- 3.1.8 The boundaries of the arena's quadrants are shown in [Figure 3](#).

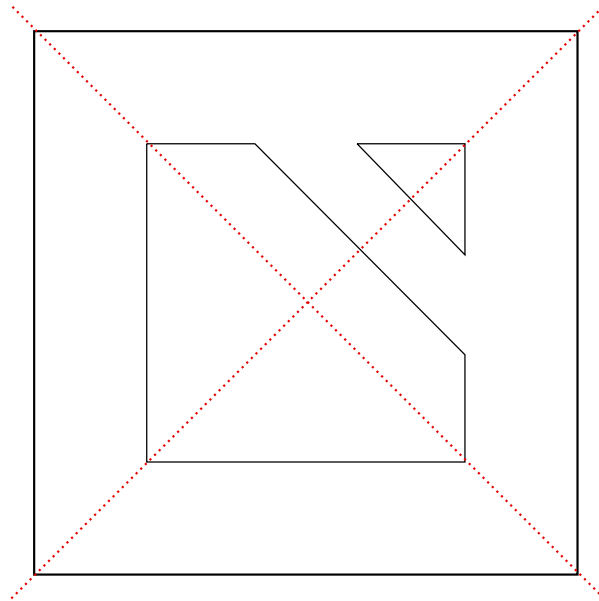
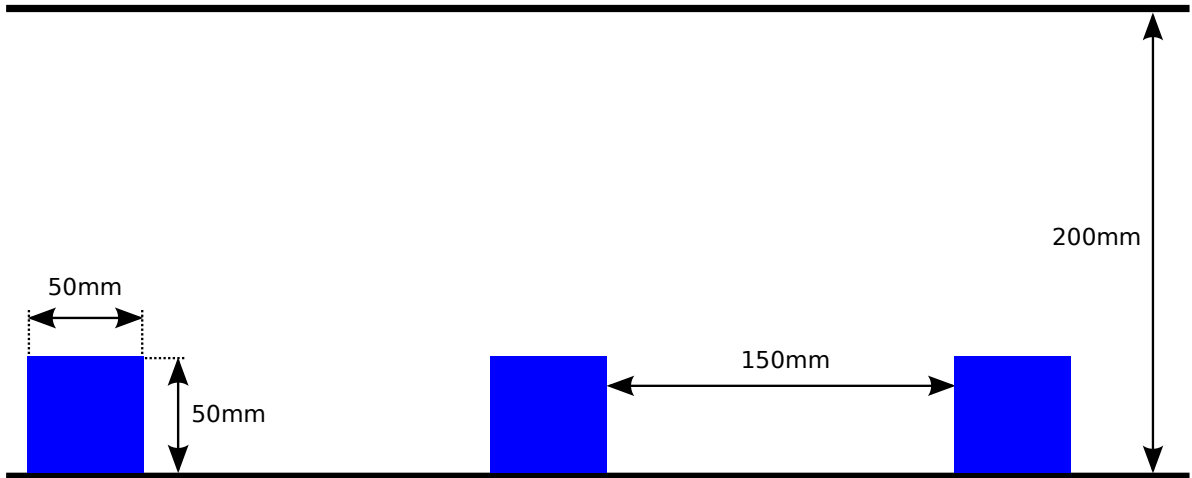


Figure 3: The arena split into quadrants. Note that the lines won't actually exist, they are just here to illustrate.

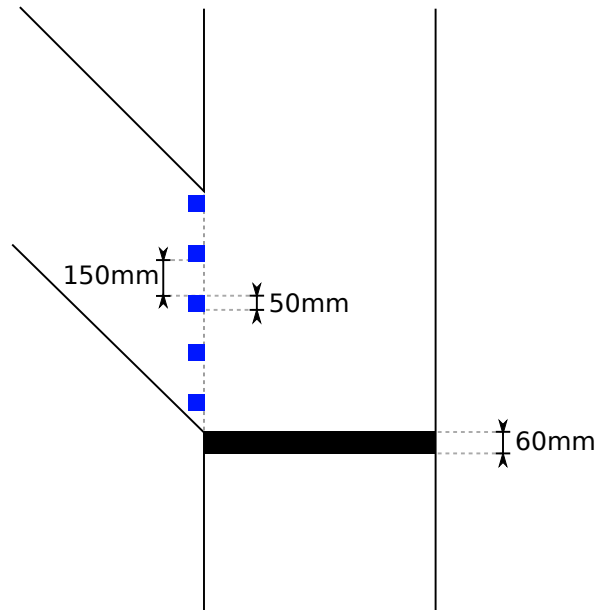


Figure 4: A bird's eye-view of the entrance to the ramp.

3.1.9 A black gaffer tape line is present across the corridor before the entrance to the ramp. Figure 4 shows the position and dimensions of this line, and the alignment of the blue squares in the ramp entrance.

## 3.2 The Ramp

3.2.1 The ramp has the dimensions and shape shown in Figure 5.

3.2.2 The ramp has a footprint of  $2.75m \times 1m$ .

3.2.3 All track-facing vertical surfaces of the ramp are painted white.

## 3.3 Tokens

3.3.1 Tokens are baked bean cans approximately  $110mm$  high, with an approximate diameter of  $75mm$ . *Each team's kit contains one of these.*

3.3.2 Tokens have a mass of  $475 \pm 30g$ . *We're using tins of ASDA "Smartprice" Baked beans. Remember that the mass on the label is the mass of the contents of the tin.*

3.3.3 Tokens will be painted red with a paint colour close to RAL 3020. *"RAL" is a colour matching system. Most serious paint vendors will take RAL numbers, such as Johnstones. B&Q do not.*

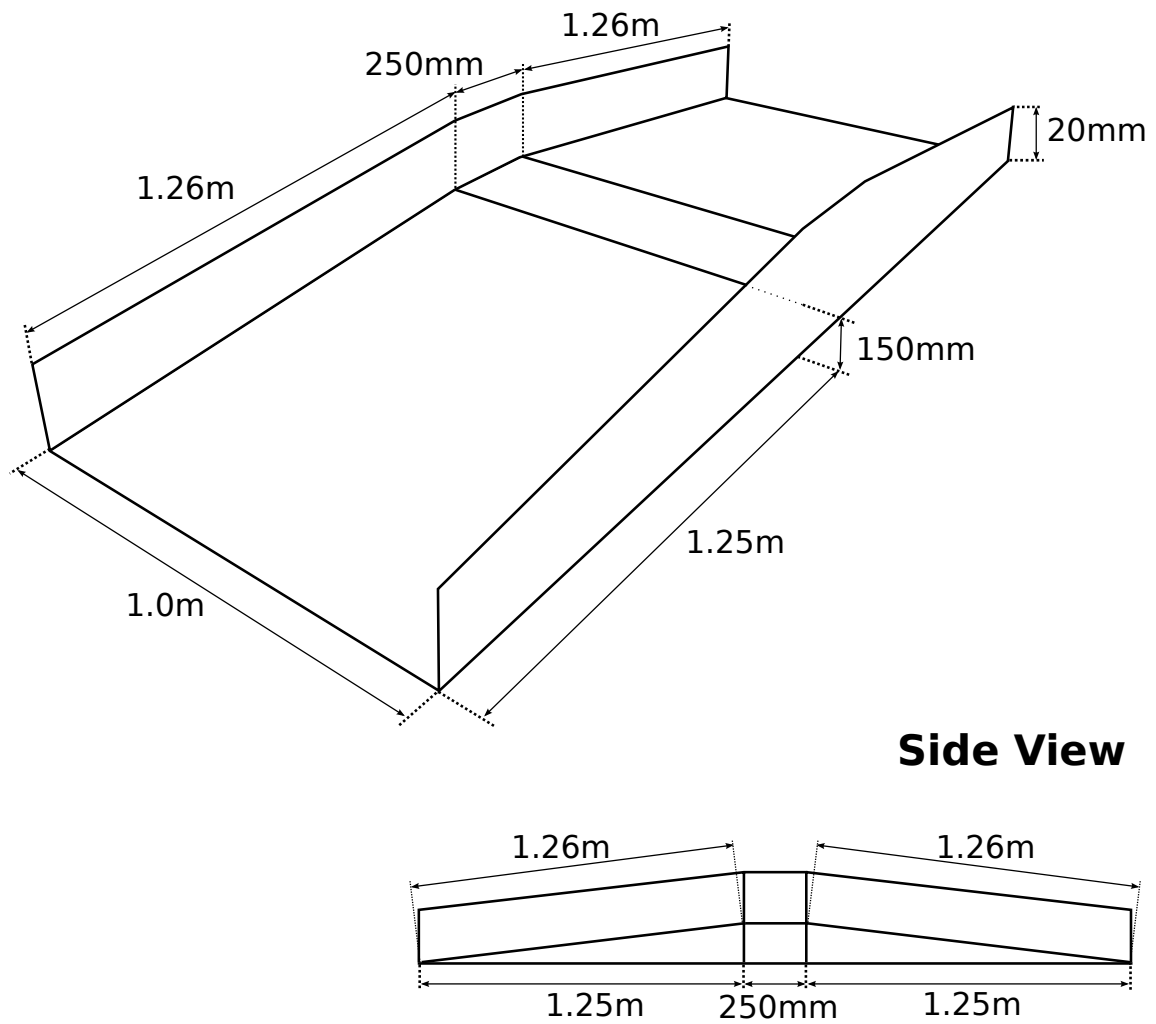


Figure 5: The ramp that cuts one of the corners of the arena, as seen in [Figure 1](#).



3.3.4 The super token is designed to be visually indistinguishable by the robots from the other tokens. It will have a small marking on it to allow a person to identify it upon close inspection.

3.3.5 All tokens will be standing up at the start of the match.

### 3.4 Robot Flags

Robots **must** have a flag pole attached. This will be used during the matches for suspending the infrared system that will be provided to robots before they enter the game. It may also be used to suspend a team flag. A diagram of the flagpole arrangement can be found in [Figure 6](#).

3.4.1 The top of the flag pole must be  $1.1m$  above the floor. A flag, of maximum size  $200mm \times 200mm$ , may be mounted  $100mm$  from the top of the flag pole. The flag **must not** sag below  $800mm$  above the floor to avoid interference with the vision system.

3.4.2 The pole must be constructed from  $25 \times 50mm$  pine, and must have a  $6mm$  diameter hole in it at the position indicated in [Figure 7](#). This hole is for mounting the infrared system during games.

3.4.3 The flag pole must be painted green, white or black to avoid interference with other robot's vision system.

3.4.4 The flagpole must be removable so that the robot can be placed within a box to check the size limit.

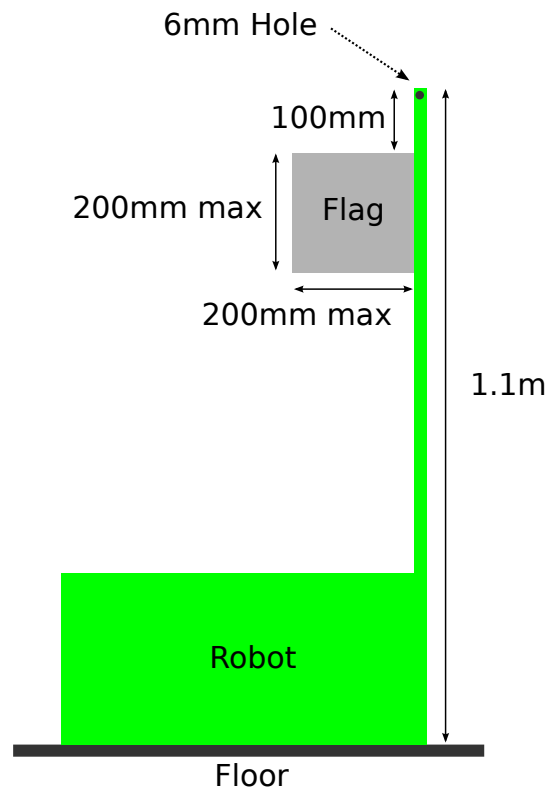


Figure 6: Flagpole Dimensions

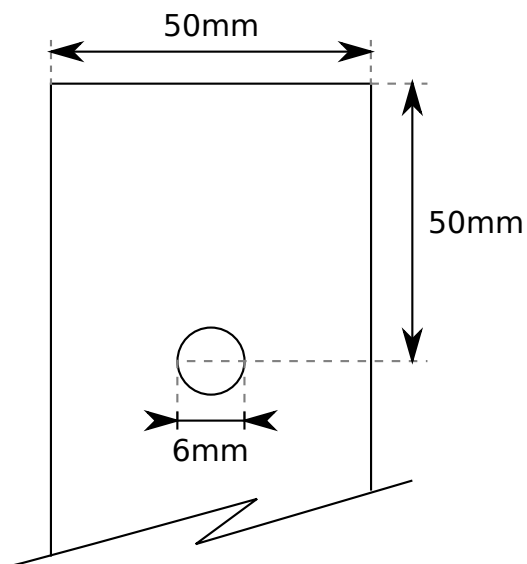


Figure 7: Infrared mounting hole position.

## 4 Awards

### 4.1 Main Competition Awards

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

### 4.2 Chairman's Award

The Chairman's 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 complexity of design, rather the implementation of a simple and elegant solution to a problem.

### 4.3 First Robot Movement

The team that demonstrates the first moving robot to the community will be awarded with an edible prize at the final competition.

4.3.1 The robot movement must be controlled by software running on the Student Robotics kit.

4.3.2 The robot must move 1 metre and come to a halt without interference.

4.3.3 Proof will be obtained by uploading a video of the robot onto a public sharing site (e.g. youtube.com, flickr.com).

### 4.4 Online Presence

The team that is judged to have the best online presence will be awarded with an edible prize at the final competition. An online presence is a publicly available set of web pages detailing the team's progress, it can involve blog posts, pictures and videos of the team and the robot. *Hint: Useful sites include blogger.com, wordpress.com, flickr.com and youtube.com*

4.4.1 When detailing activities online do not post any private information concerning yourself or others.

4.4.2 Notify your mentor or email the location of your online materials to [info@studentrobotics.org](mailto:info@studentrobotics.org)

## 5 Clarifications

Requests for rule clarifications may be sent to [info@studentrobotics.org](mailto:info@studentrobotics.org). Requests received within one month of the competition are unlikely to be processed. The following changes have been made to the rules since their initial release:

- 5.1 Changed location of IR board mounting hole in [Figure 7](#) from  $100mm$  to  $50mm$ .
- 5.2 Added that all tokens begin standing up to the [Tokens](#) specification.
- 5.3 26<sup>th</sup> September 2010: Changed rule 1.7 to clarify that points can only be scored when robots move anticlockwise around the centre of the arena.

# Appendices

## A Return of Kit

### A.1 Items to be Returned

- Power Board
- Motor Board ×2
- JointIO Board
- Servo Board
- IR Board
- CAT5 (Ethernet) Cables ×9
- USB 2.0 Hub + power and USB cable
- Charger
- Webcam

### A.2 When and How to Return Kit

The kit may be returned at the competition. If you do not wish or it is hard to dismantle your robot at the competition then you may post the kit to us. **The deadline for the return of kit is the 1<sup>st</sup> June 2011.** Keep your postage and packaging receipts and claim back the costs with your other receipts.

### A.3 Kit Return Address

Student Robotics  
School of Electronics and Computer Science  
University of Southampton  
SO17 1BJ