Student Robotics 2012 Rulebook

Revision 2

October 4, 2011

The following defines the rules and regulations of the Student Robotics 2012 competition.

1 Game Rules

1.1 The game, called **Pirate Plunder**, will be played in the arena defined in section 3.3. The objective of this game is to achieve as many points as possible by collecting tokens, placing them in buckets, and moving buckets and tokens into the team's zone.

1.2 Before a match starts, the teams participating in that match will be given some time to set their robot up in the arena. During this time, they:

a) 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.

b) May position the bucket associated with their zone to be in any legal location within their zone. The bucket must be placed such that it is entirely within the allocated zone.

c) Must ensure their robot has four robot badges attached it. These will be provided by Student Robotics officials at the beginning of the set-up time. Section 3.2 provides more information about these markers, as well as their dimensions and mounting requirements.

Once all robots and buckets have been arranged, 20 tokens will be placed in the area bounded by the bucket barrier.

1.3 A match lasts 180 seconds.

1.4 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 as follows:

- **1 point** will be awarded for each token that the robot is carrying.

- For each token that is entirely within, and in contact with the floor of the team's zone, **2 points** will be awarded.
- **5 points** will be awarded for each token that is inside a bucket that is entirely within the team's zone.
- If there are any buckets within the team's zone, the team's **total score** will be multiplied by the number of buckets within their zone. Buckets that span two adjacent zones will not be counted.

1.5 A robot will be considered to be carrying a token if the token's weight is fully supported by the robot, and the token is not in contact with any part of the arena (walls, floor, etc.).

1.6 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.

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

1.8 Robots will be started by teams leaning into the arena to press the start button on their robot[1] when instructed to do so.

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

1.10 The buckets must not be knocked over. The judge may disqualify a team from a match should their robot knock a bucket over.

[1] A wireless match-starting solution may be provided by Student Robotics

2 Regulations

2.1 No remote control systems may be used.

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

2.3 Robots must not intentionally damage anything – including tokens, buckets, the bucket barrier, the arena or other robots.

2.4 Student Robotics reserves the right to look at your robot software and hardware at any time.

2.5 Assistance from Student Robotics Engineers is provided without any guarantees.

2.6 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.

2.7 The Judge's decision is final.

2.8 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**.

2.9 At the beginning of each match, robots must fit within a cube with $500mm$ internal sides. *During the match*, the robot may extend beyond this size up to a height, width, or length of $650mm$.

2.10 The power board, including its power switch, must be easily accessible. This is for your safety, and the safety of others around you.

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

2.12 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).

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

2.14 It must not be possible to injure oneself on the robot. This will be tested using a Frankfurter sausage to simulate a finger.

2.15 Robots must feature four mountings for robot badges. These mountings must comply with the specification in section 3.2.

2.16 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.

2.17 If teams wish to use batteries other than the lithium-ion polymer batteries provided, then they must seek approval from Student Robotics through the Student Robotics forums first. Additionally, if teams wish to add systems powered by separate batteries then they must seek approval through the same channel 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.

3 Specifications

3.1 Markers

The arena, tokens, buckets, and robots 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 – 27	250
Robots	28 – 31	100
Tokens	32 – 71	100
Bucket side	72 – 75	100
Bucket end	76 – 79	100

Two sets of marker codes will be used: one for development purpose, and one for the competition itself. The competition set is only to be used inside the Student Robotics arena at the Student Robotics competition. This is so that people carrying markers past the arena do not confuse robots. The competition codes are 100 above the development codes. When run in competition mode (specifiable through the robot's GUI), the software provided by Student Robotics will subtract 100 from the detected marker codes, as well as ignore the development codes.

The markers can be printed on a black-and-white printer. Marker designs can be downloaded from the documentation section of the Student Robotics website.

Unless specified otherwise, all markers described in this document are oriented vertically such that the principle corner of the marker (which is indicated by a dark grey dot in the black marker border) is on the higher edge.

3.2 Robot Badges

3.2.1 A "robot badge" is a removable identifier that will be attached to a robot throughout a match. It features the robot's assigned marker for the match, as well as a coloured area to allow spectators to easily associate a robot with its zone. An example of one of these badges is shown in figure 1.

3.2.2 A robot must feature four of the badge mounts shown in figure 2. These mounts must permit a flat $200 \times 100mm$ panel to be attached to them. The three areas of each mount must feature the illustrated areas of hook-type Velcro to allow this panel to be fitted.

3.2.3 The four badge mounts must be on the exterior of the robot, parallel with the vertical plane, and should be perpendicular to each other about the vertical axis[2]

[2]Teams can apply for a team-specific rule alteration to the required number of badges. Clear justification must be provided by the team with such a request.

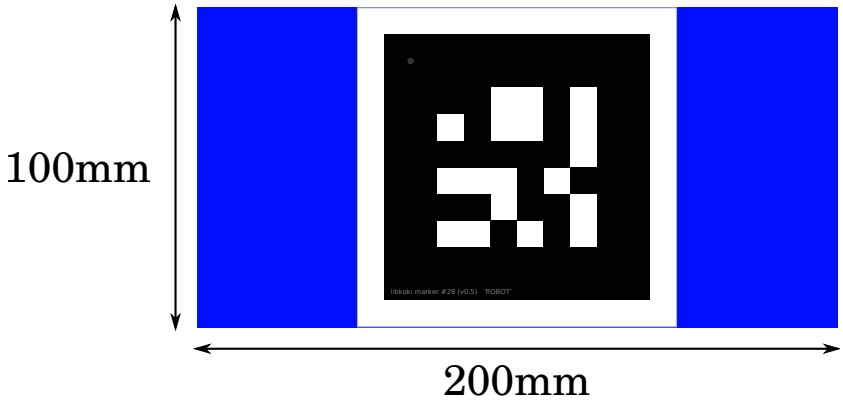

Figure 1: An example robot badge.

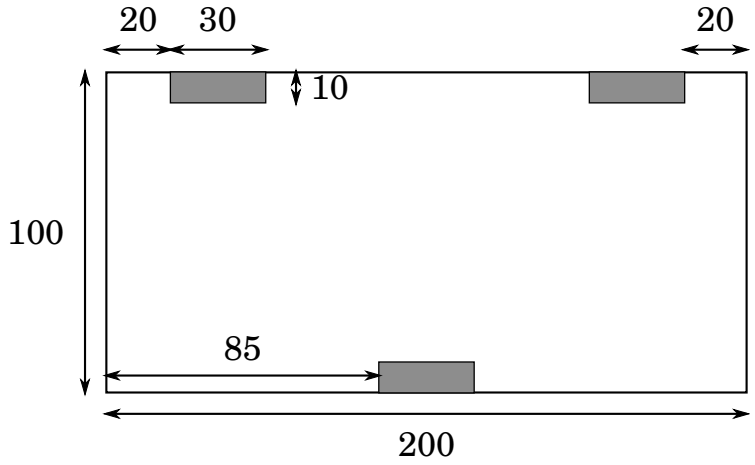

Figure 2: The dimensions of the required robot badge mountings. The shaded areas are hook-type Velcro. All dimensions are in millimetres.

The orientation of the badge mounts is unimportant, but teams are encouraged to position them horizontally as shown in figure 1.

3.3 Arena

3.3.1 The match arena floor, overall, is an $8m \times 8m$ square, as shown in figure 3. The tolerance of these two dimensions is $\pm 0.25m$.

3.3.2 The "bucket barrier" is a horizontal bar arranged in a $6m \times 6m$ square centred and aligned with the boundary of the arena. The lower edge of the barrier is $750mm$ above the floor.

3.3.3 The bucket barrier is suspended by eight legs, each of which has a maximum footprint of $150mm \times 200mm$. These footprints extend into the centre of the

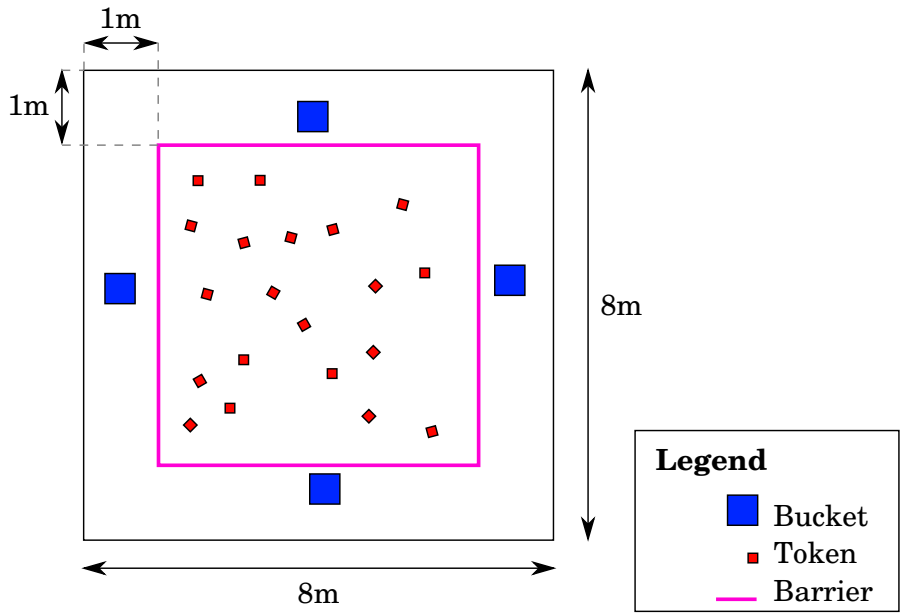

Figure 3: A bird's-eye view of the arena.

arena, and are flush with the outer side of the bucket barrier.

3.3.4 The floor of the arena is carpeted. The carpet tiles used in the arena are from B&Q, with EAN 5014957151543.

3.3.5 The arena walls are $600 \pm 30mm$ high, the interior surfaces of which are white plastic-coated hardboard.

3.3.6 The arena features four *zones*. These areas are delineated by the boundary of the arena, the bucket barrier, and lines between the corners of the arena and bucket barrier. The numbering of these zones is shown in figure 5.

3.3.7 Each wall of the arena features seven $250mm$ libkoki markers. Figure 6 shows the positioning of these markers, whilst figure 5 shows the numbering of these markers.

3.4 Tokens

3.4.1 Tokens are cubic corrugated cardboard boxes with side $110 \pm 10mm$. *Each team's kit contains four of these.*

3.4.2 Each token is associated with its own libkoki marker number. Each face of a token is labelled with six identical $100mm$ libkoki markers.

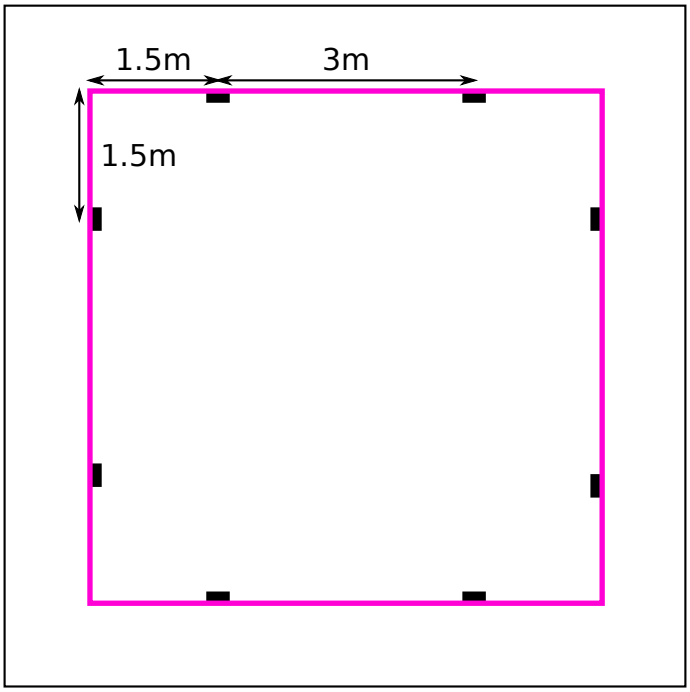

Figure 4: The positions of the posts supporting the bucket barrier.

3.5 Buckets

3.5.1 Buckets are cuboid structures with the dimensions shown in figure 7. These buckets are made from some commercially available storage boxes, bolted onto a $6mm$ thick MDF base. Casters are mounted on the underside of the buckets, allowing the bucket to be pushed or pulled around. *The walls of the bucket are not flat. A guide on how to assemble a bucket, and where to obtain suitable parts can be found on the Student Robotics website.*

3.5.2 A $900mm$ long, $15mm$ diameter wooden dowel pole extends vertically from the centre of the bucket. Combined with the bucket barrier, this prevents buckets from entering the central area of the arena. To support this pole, a block of $45 \times 70mm$ pine lies across the centre of the bucket's base – from long side to long side. The pole protrudes from the centre of this block, which has its $70mm$ face flat against the base.

3.5.3 Each bucket features two marker numbers: one which is used on the shorter sides of the bucket (a.k.a. "the bucket ends"), and one that is used on the other vertical sides of the bucket. These markers are $100mm$ in width, and are placed in the centre of the bucket faces that they occupy.

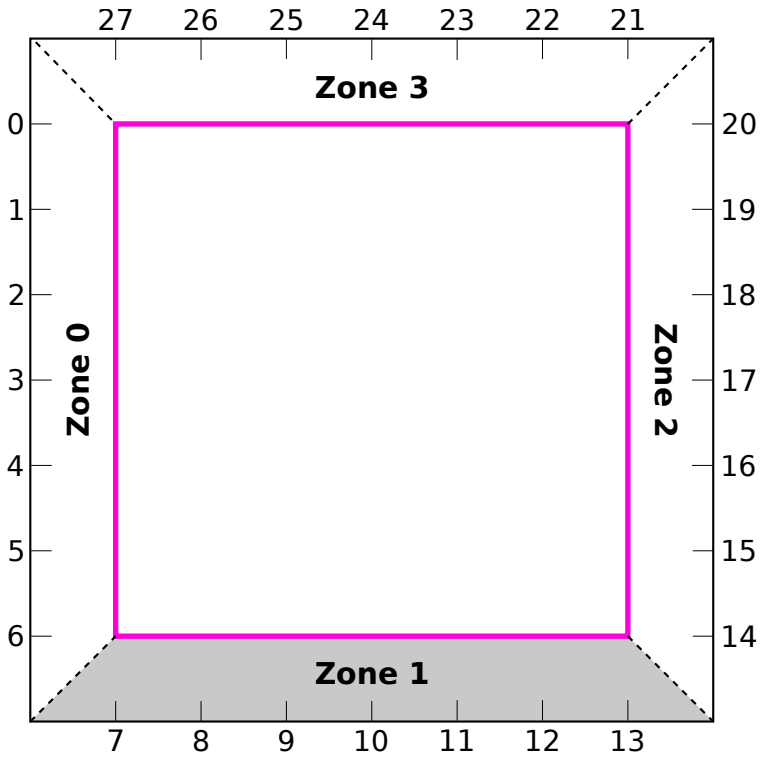

Figure 5: The positions of the four zones in the arena. The shaded area forms zone 1, and the other zones are rotationally symmetric to this. The numbers shown around the perimeter of this diagram are the numbers of the markers positioned on the wall.

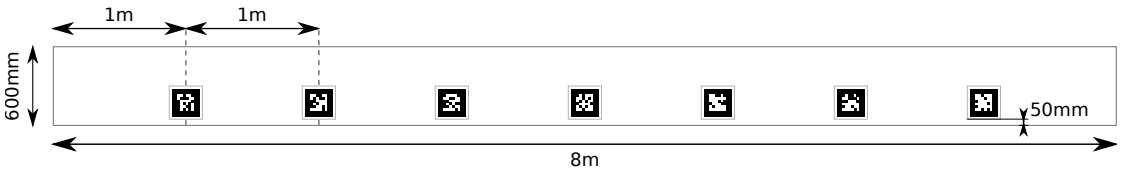

Figure 6: Seven $250mm$ wide markers are spaced evenly along each $8m$ arena wall. The markers are placed $50mm$ above the floor.

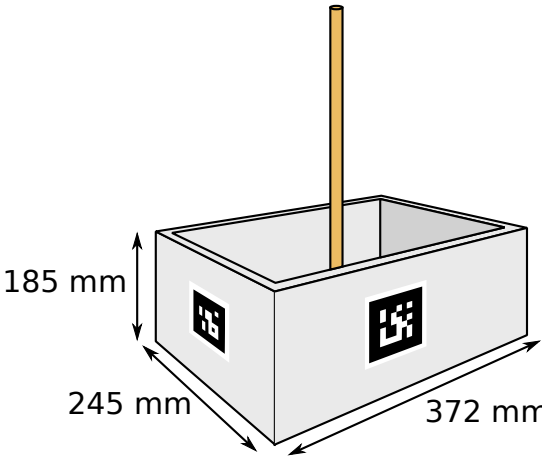

Figure 7: Dimensions of the bucket. The height shown is the height from the bottom of the casters mounted on the base of the bucket to the top of the bucket's wall.

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^{st}, 2^{nd} and 3^{rd} 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 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.

4.4 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.

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

4.4.2 The robot must move 2 metres, pause for 2 seconds, turn 180° (±20°), return to its starting position ($\pm 0.5m$), and come to a halt without interference.

4.4.3 This must be demonstrated by a video on the web (e.g. on YouTube, flickr, etc.) and linking to this video from a post on the Student Robotics forum.

4.5 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*

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

4.5.2 Notify your mentor or email the location of your online materials to info@studentrobotics.org

5 Clarifications

Requests for rule clarifications may be sent to info@studentrobotics.org. Requests received within one month of the competition are unlikely to be processed.

Appendices

A Return of Kit

Each kit issued by Student Robotics 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.

A.1 Items to be Returned

A.1.1 Containers

- Really Useful Box
- Compartment Box

A.1.2 Electronics Kit

- Power Board
- Motor Board $\times 2$
- Servo Board
- JointIO Board
- $1m$ CAT5 (SRIC) cable $\times 2$
- $0.5m$ CAT5 (SRIC) cable $\times 4$
- $0.3m$ CAT5 (SRIC) cable $\times 2$

A.1.3 USB Devices

- USB Hub
- USB Memory Stick
- Webcam
- USB A to USB Mini B lead

A.1.4 Power

- Lithium Polymer Battery $\times 2$
- Battery Cable (used for connecting a battery to the power board)
- IMAX B6 Battery Charger

- Charger Power Supply and Mains Cable
- Charger Manual

A.2 When and How to Return Kit

The kit should be returned at the competition. If you wish to keep the kit beyond the competition, then this **must** be arranged with us, before the 14th of March 2012, via email to info@studentrobotics.org.