Student Robotics 2013 Rulebook

Revision 1

November 12, 2012

The following defines the rules and regulations of the Student Robotics 2013 competition.

1 Game Rules

1.1 The game, called **A Strange Game**, 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 placing your tokens on squares and pedestals to capture them.

1.2 Before a match begins, participating teams must:

    a) Present their robot in the staging area, adjacent to the arena, at least 2 minutes before the scheduled start time. The staging area will be clearly marked on the day.

    b) Attach four robot badges. These badges will be provided by Student Robotics officials in the staging area. Section 3.2 provides more information about these badges, as well as their dimensions and mounting requirements.

    c) Place their robot in the starting zone that they are assigned. The robot must be placed such that it is entirely within this starting zone, with no parts overhanging its boundary.

    d) Place a single token in/on their robot if they so wish.

    e) Vacate the arena 40 seconds before the scheduled start time. During the 40 second period prior to the start of the match there must be no interaction with the robot.

Teams that fail to comply with this rule may forfeit the match, at the discretion of the judge.

1.3 A match lasts 180 seconds.

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

1.5 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:

    a) **1 point** will be awarded for initial movement outside the starting zone, defined as when the back of the robot passes over the boundary.

    b) For each row of squares, **1 point** will be awarded if one square is captured, **3 points** will be awarded if two squares are captured, and **6 points** will be awarded if all squares are captured.

c) For each column of squares, **1 point** will be awarded if one square is captured, **3 points** will be awarded if two squares are captured, and **6 points** will be awarded if all squares are captured.

1.6 Ownership of a square will be determined as follows:

a) If there are one or more tokens on the central pedestal, the square will be deemed to have been captured by the robot associated with the highest token in the stack.

b) Otherwise, if one robot has more tokens in the square than any other, that robot is deemed to have captured the square.

c) Otherwise, the square is deemed unclaimed.

d) A token is deemed to be in a square if the majority of the token is within the inner edge of the line delineating the square. The judges decision is final.

1.7 At the end of a game, league points will be awarded as follows. 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.

Tied robots will be awarded the average of the points that their combined positions would be awarded. Thus, three robots tied for first place would receive 3 points each (since this is $(4 + 3 + 2)/3$).

1.8 Once the league has completed, a knockout competition will begin. The positions of the teams in the league will seed the positions of teams in the knockout matches. The top 24 teams from the league advance to the knockout. In the event of tied league positions, the team with the greatest cumulative game points in the league will go through.

Each match in the knockout competition involves up to 4 teams. The teams that come 1st and 2nd in each knockout match will continue to the next round of the knockout. In the event of a tie in a knockout match, 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. The number of league and knockout matches will be announced on the morning of the competition.

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

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

1.11 A token will be considered to be on a pedestal if the token is fully supported by the pedestal, and no part of the token is in contact with a robot, or any other part of the arena.

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[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, pedestals, 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 penalised, including disqualification from rounds and deduction of league points.

2.4 Student Robotics reserves the right to examine 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. Appendix A details the parts of the kit that must be returned. After the competition, the kit that is not specified in Appendix A becomes the property of the team.

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. 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**.

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.

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

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. For example, high-speed rotating parts that could cause injury must be suitably shielded.

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.

2.18 Robots may not include radio transmitters or receivers. In exceptional circumstances, teams may request an exemption from this rule.

3 Specifications

3.1 Markers

The arena, tokens, pedestals, 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
Pedestals	$32 - 40$	200
Tokens	$41 - 64$	200

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 human-compatible areas to allow spectators to easily associate a robot with its starting location. An example of one of these badges is shown in figure 1. The markings in the human-compatible areas are intentionally not specified.

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

3.2.4 The mapping between a given robot and its robot badge is as follows:

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[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.

Zone	Marker Number
0 (NW)	28
1 (NE)	29
2 (SE)	30
3 (SW)	31

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

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

3.3.4 The arena features nine *squares*. These areas are delineated by lines marked on the arena floor with $25mm$ wide paper-based masking tape. The naming of these squares is shown in figure 3.

3.3.5 Each wall of the arena features seven $250mm$ libkoki markers. Figure 4 shows the positioning of these markers, whilst figure 5 shows the numbering of these markers.

3.3.6 Each robot will be assigned a zone number at the start of every match to indicate its starting position. The mapping of these zone numbers in the arena is shown in figure 5.

3.3.7 Student Robotics reserves the right to have up to three match officials in the arena during games.

3.4 Pedestals

3.4.1 Pedestals are cubic structures of dimensions $320 \times 320 \times 320mm \pm 15mm$. The top of a pedestal is surrounded by a $20mm$ high rim to prevent tokens falling off.

3.4.2 Pedestals will be securely attached to the floor of the arena to prevent them being moved.

3.4.3 Each pedestal features a $200mm$ marker in the centre of each vertical side.

3.4.4 The mapping between pedestal position and marker is as follows:

Position	Marker Number
NW	32
N	33
NE	34
W	35
C	36
E	37
SW	38
S	39
SE	40

3.5 Tokens

3.5.1 Tokens are cubic corrugated cardboard boxes with side $305 \pm 15mm$. *Each team's kit contains two of these.*

3.5.2 Each token is associated with its own libkoki marker number and is labelled with six identical $200mm$ markers – one on each face.

3.5.3 Tokens will be styled to match the human-compatible area of the robot badges on their associated robot, allowing spectators to follow game play. See section 3.2.

3.5.4 The mapping between a given robot and its tokens is as follows:

Zone	Marker Numbers
0 (NW)	$41 - 46$
1 (NE)	$47 - 52$
2 (SE)	$53 - 58$
3 (SW)	$58 - 63$

3.5.5 The tokens belonging to a given robot will initially be positioned to the left of the robot as shown in figure 6. Teams have the option to place any one of their six tokens in/on their robot before the start of the match.

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 1st, 2nd and 3rd place will receive awards.

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 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 $180°$ ($\pm 20°$), 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

- Really Useful Box

- Compartment Box

- Power Board

- Motor Board ×2

- Servo Board

- JointIO Board

- 1m CAT5 (SRIC) cable ×2

- 0.5m CAT5 (SRIC) cable ×4

- 0.3m CAT5 (SRIC) cable ×3

- USB Hub

- USB Memory Stick

- Webcam

- USB A to USB Mini B lead

- Lithium Polymer Battery ×2

- Battery Cable (used for connecting a battery to the power board)

- IMAX B6 Battery Charger

- Charger Power Supply and Mains Cable

- Battery charging bag

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 14$^{\text{th}}$ of March 2013, via email to info@studentrobotics.org.
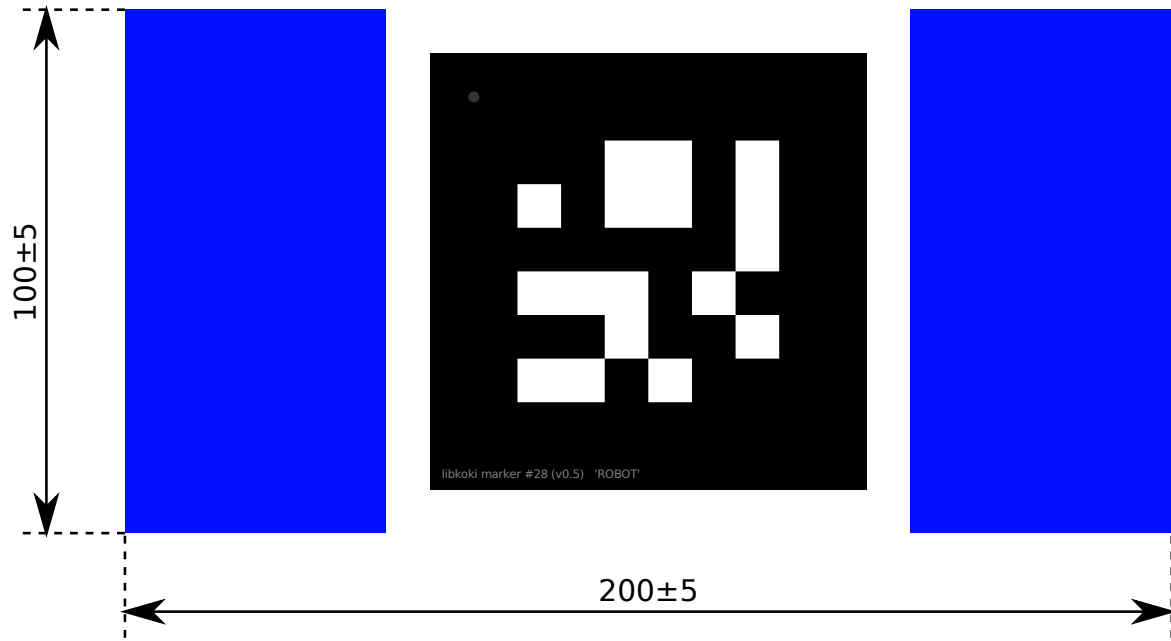
Figure 1: An example robot badge. The blue areas shown are the human-compatible areas. All dimensions are in millimetres.
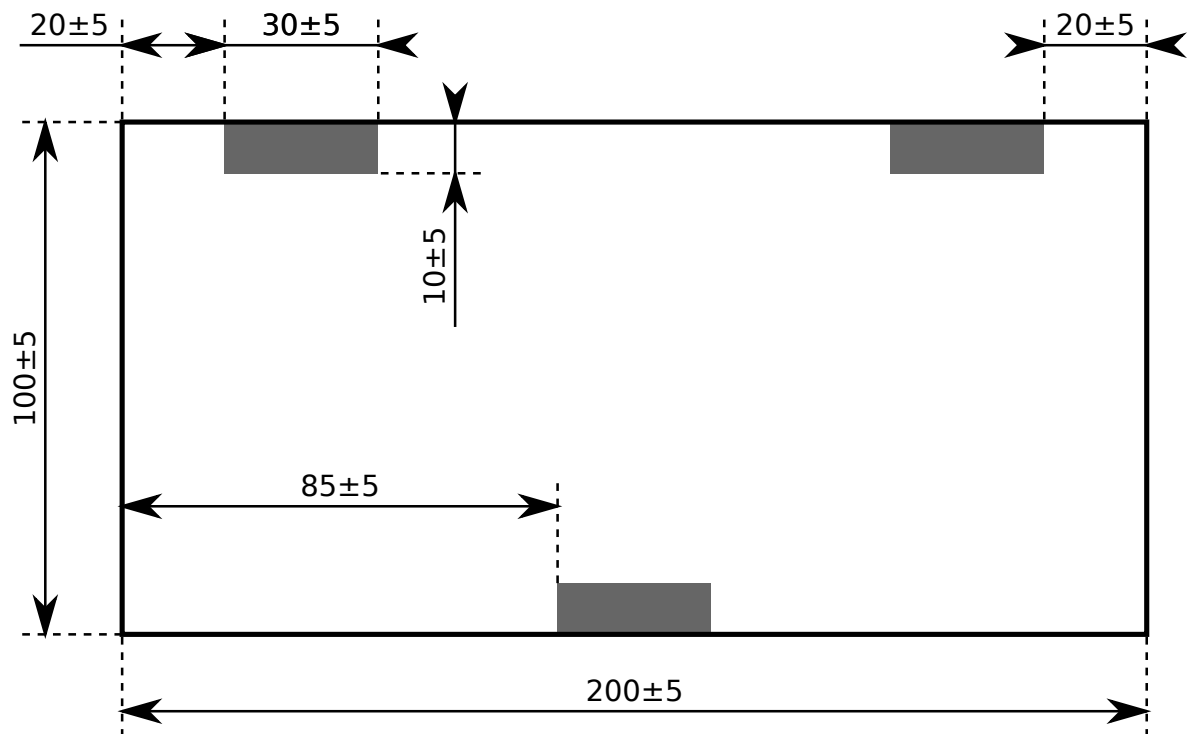

Figure 2: The dimensions of the required robot badge mountings. The shaded areas are hook-type Velcro. All dimensions are in millimetres.
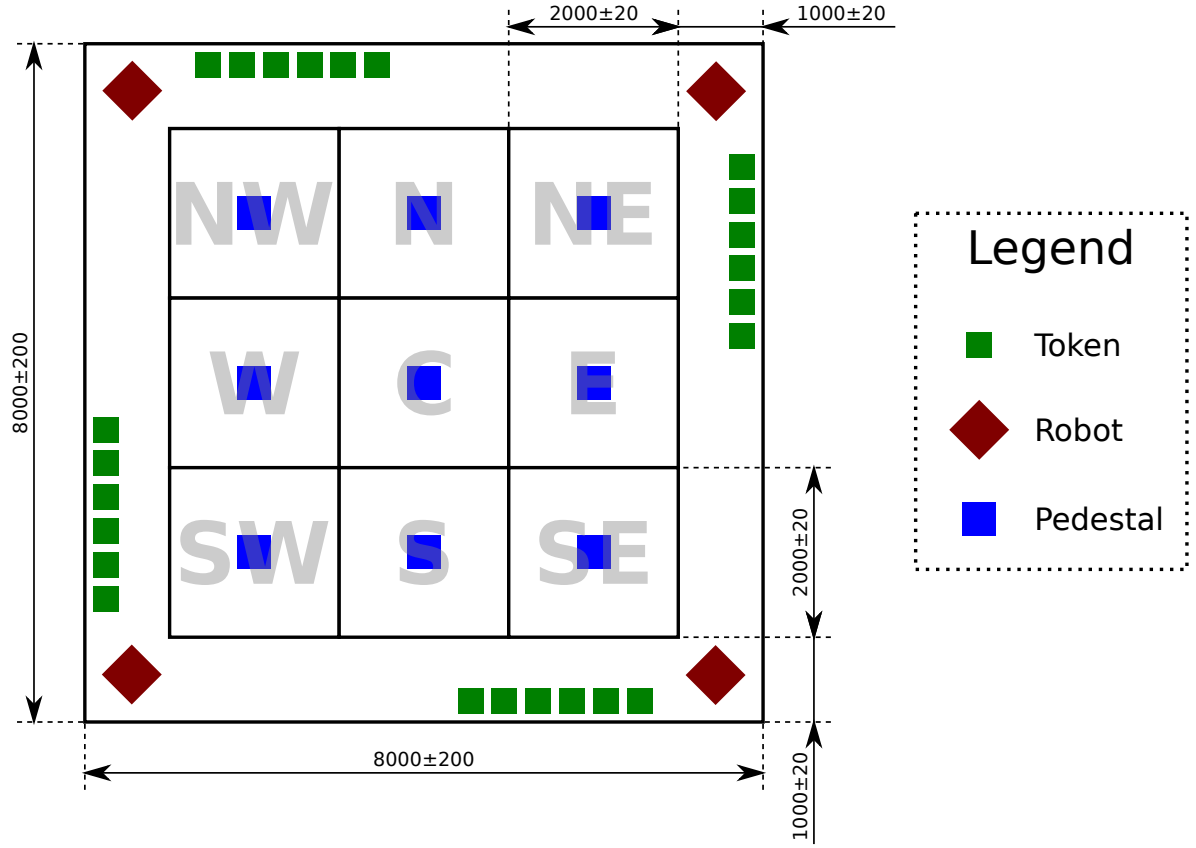
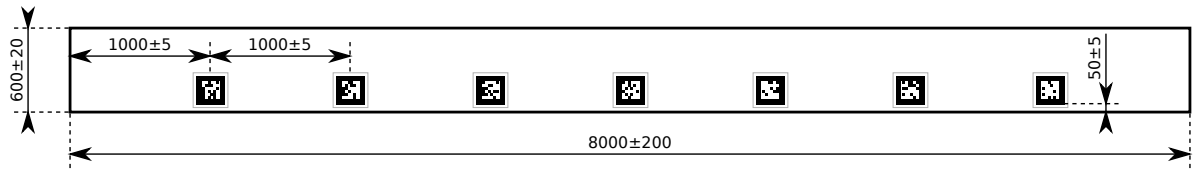Figure 3: A bird's-eye view of the arena.

Figure 4: Seven 250mm wide markers are spaced evenly along each 8m arena wall. The markers are placed 50mm above the floor. All dimensions are in millimetres.
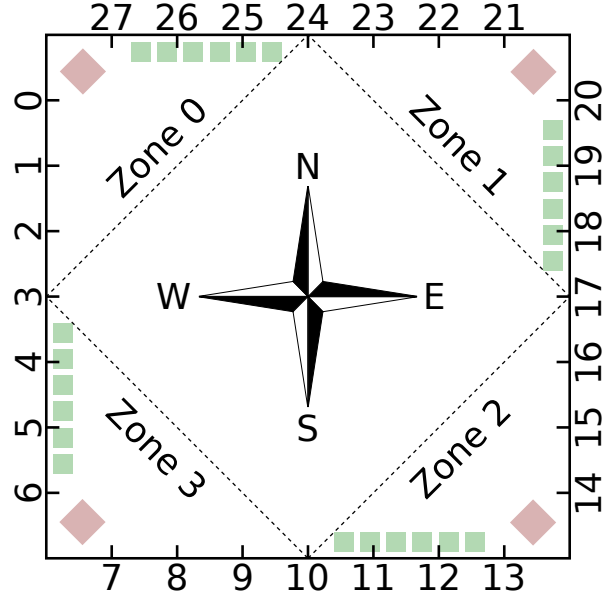
Figure 5: Twenty eight arena wall markers are positioned around the perimeter of the arena with the marker codes incrementing in an anti-clockwise fashion from the northern end of the west wall. The zones are counted from the north west corner in a clockwise fashion.
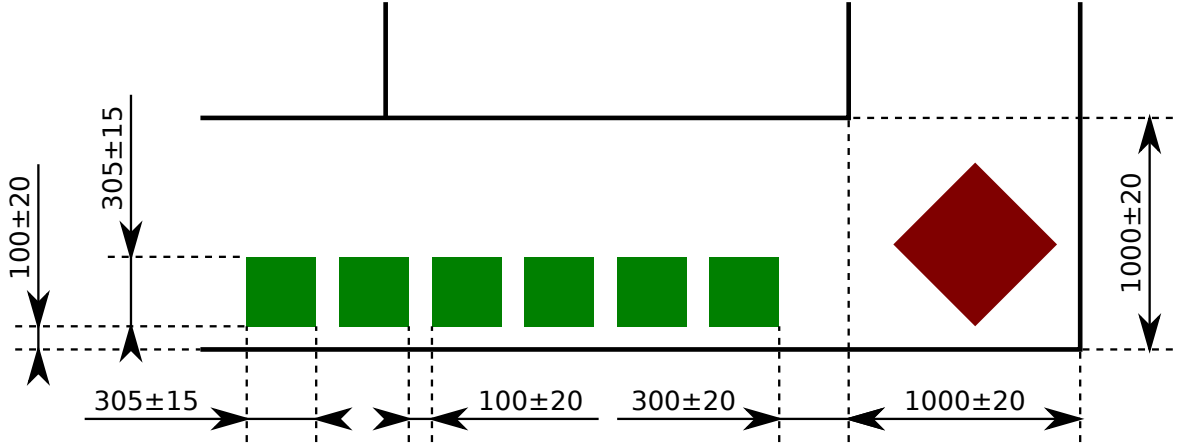

Figure 6: Six $305 \pm 15mm$ wide tokens are spaced evenly $300 \pm 20mm$ to the left of the robot, along the arena wall. The tokens are placed $100 \pm 20mm$ away from each other and the edge of the arena. All dimensions are in millimetres.