Singapore Robotic Games 2020

5 - 6 FEBRUARY 2020

RULE BOOK

V 27.1

20 SEPTEMBER 2019

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SRG Home Page : *http://guppy.mpe.nus.edu.sg/srg*
Rules in the SRG Home Page will be used eventually in the Games.

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OPEN CATEGORY

1. OBJECTIVE

The contestants are to demonstrate a robot that performs interesting tasks for applications such as in entertainment, domestic chores, industry etc.

2. BRIEF DESCRIPTION

2.1 The competing robots, which can be self-navigating or remote-controlled, will perform their capability on a 5m x 5m contest arena for a period of time.

2.2 The robots may move freely around the arena or be in a static position.

2.3 Participants are required to submit a video clip or digital photographs (up to a maximum of 2MB in total file size,) of their entry to the organiser when you submit your entry for the qualifying round. See section 4 for details on pre-qualification.

3. RULES AND GUIDELINES

3.1 The competing robots can start from any point in the contest arena.

3.2 A total duration of up to 10mins is allocated for setting up the robot and any accessory equipment and demonstration of its capability. The time duration will be measured from the moment the contestants enter the arena. If more than 10 minutes elapsed, the robot must be removed from the arena.

3.3 In the case where the contestants wish to employ radio control, they should inform the secretariat in advance. Contestants should not broadcast radio signals while another contestant's robot is performing.

3.4 In the case that a robot requires special accessory equipment or tools during its performance, the contestants will provide such items.

3.5 In the case that a robot performance is to be accompanied by music, the contestants should provide the means to reproduce this music.

3.6 There is no specific flooring material of the contest arena. The flooring will very much depend on the available contest site. However, if there is a special requirement such as carpet, the contestants will have to provide for it.

3.7 One power point of 220/230V, 50 Hz supply will be made available. However, the teams are to provide their own power adapter and extension means if it is required.

3.8 For air supply, the contestants are to provide their own air compressor units if necessary.

3.9 The designs of the competing robots must be original and unique. No two identical designs are allowed in the competition.

3.10 The expenses incurred in transportation and setup of equipment is to be borne by the individual teams.

3.11 The boundary for the area will be black or white depending on the floor.

3.12 Winning robots will not be allowed to participate in the subsequent two Robotics Games.

3.13 Robots that can, in principle, compete in other SRG events (e.g. Robot Colony Competition) should not be allowed to compete in the open category event.

4. PRE-QUALIFICATION

4.1 During the preliminary round, participants are required to submit a video clip (max 2 Mb), readable in standard MS Windows Media Player, of up to 2 minutes, or digital photos of their robot in performance sequence, (Max 2 MB in total) of their robot, by the closing date. (Refer to http://guppy.mpe.nus.edu.sg/srg/ for information.)

4.2 A panel will evaluate the entries based on the video clips submitted.

4.3 Results of the preliminary round will be announced on the web site 1 week before the competition.

4.4 Only qualified participants will be permitted to present their robots for the final round.

5. JUDGING CRITERIA

Degree of Innovation	20%
Design & Realisation	20%
Performance	30%
Content	30%

- Entertainment (e.g., audience participation)
- Applications

6. EXHIBITION

6.1 All entries will be allocated exhibition space where the robots will remain throughout the day. Contestants are to man the exhibits at all times and should be available to answer questions from judges and members of the public.

6.2 Prize winners will only be announced at the end of the day of the competition.

6.3 Judges decision is final.

LEGGED ROBOT MARATHON RACE

1. OBJECTIVE

To design a Legged Robot to travel on a designated track by either walking, running or hopping on a flat terrain for a total distance of approximately 28.9 x 6 metres.

2. SPECIFICATIONS OF ROBOT

2.1 The robot must have at least one leg. There is no limit to maximum number of legs used. The maximum length and maximum width of the robot is restricted to a 0.6m x 0.6m square area in the starting zone. There is no height restriction on the robot. There is no restriction on the dimension and geometry of the robot once it started each race attempt (ie: once any part of the robot crosses the starting line.)

2.2 The robots must be completely autonomous. It should contain both the controller and power units. The robot must not weigh more than 10 kg. In addition, the power unit attached to the robot must not exceed 1 kg. Spare power units must be identical.

2.3 Radio-frequency (RF) control is strictly prohibited in the robot design except for start/stop operation of the robot (i.e., remote push button to start and stop the operation of the robot.)

2.4 Each leg of the robot must consist of minimum two limb segments and demonstrate relative motion between the limbs to realise a walking motion.

2.5 The limbs of the robot must include some means of controlled motion to realise the walking, running, and/or hopping action for the robot. The following are some examples NOT considered as a legged robot:

- Rotating wheel with spokes or any other structure sticking out radially to represent 'feet'.
- Traction belt with studs or roller chain with ‘feet’ mounted in any orientation.
- Robot, with feet or any floor contact point, mounted with motion-assisted roller wheel(s) is strictly prohibited

2.6 Locus for every feet of the robot cannot be higher than its associated pivoting joint.

3. SPECIFICATIONS OF RACE TRACK

3.1 The race-track is a raised platform of a fixed width of approximately 0.6m wide and is approximately 28.86m in length (1 lap.)

3.2 The track comprises of straight and circular segments connected together. Each circular segment consists of a circle quadrant of radius (with reference to the retro-reflective tape) 0.5m or 1.5m. The entire track is constructed with 1/4-inch plywood with circular and/or straight segments raised about 50 mm off the ground (if 50 mm track is not available, the entire track will use 100 mm height). The top surface will be painted in mat black. It is designed to support a robot with a maximum weight of 10 kg. The joint between 2 track segments is **NOT** expected to be perfectly level and it may be uneven. Track segments at the same elevation are joined with a maximum step at the joints of 5 millimetres. There is a 50 millimetres wide retro-reflective tape (3M Scotchlite - Industrial Grade) in the middle of each path for navigation purpose.

Fig.1 shows the top view of a sample competition race-track. The actual competition track which consists of 28 curve segments and 10 straight sections. The starting position and orientation will be determined by the judges in a random manner.

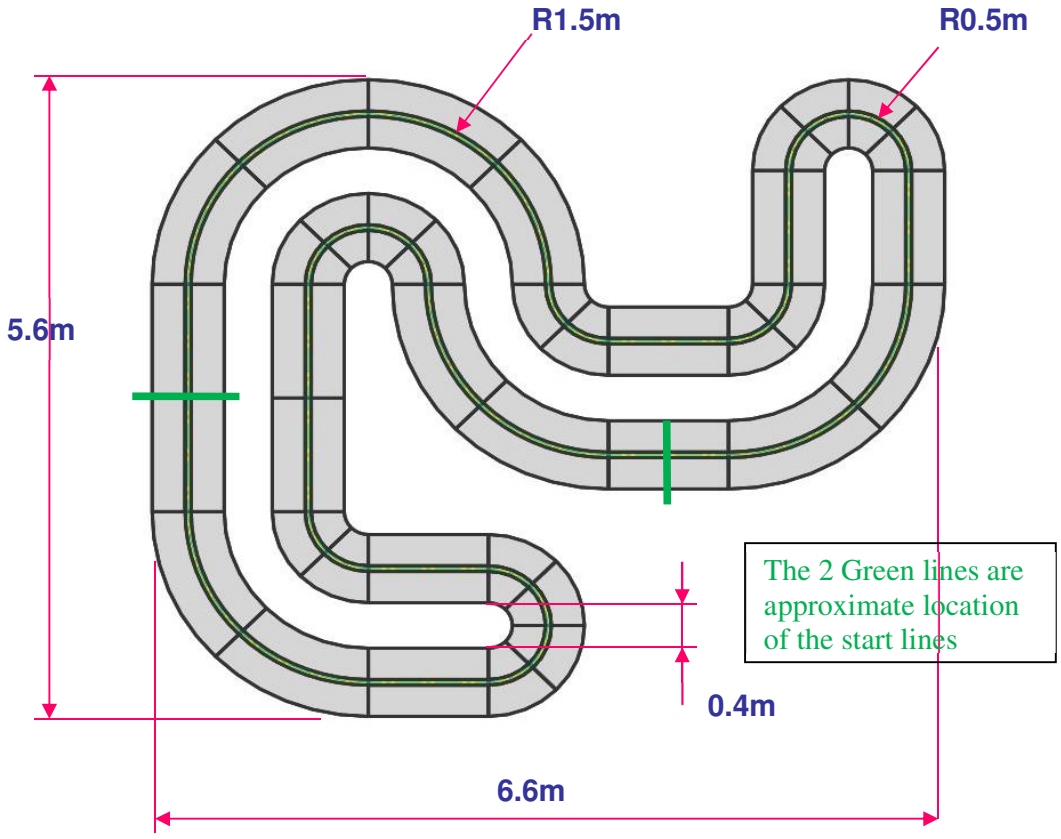


Fig. 1 The Legged Robot Race Track

4. FORMAT OF COMPETITION

4.1 2 robots will be drawn to run against each other, starting at 2 designated start lines at least 14m apart along the track. Each robot is to run 2 laps around the closed track. The starting position for the robot will be made known at the beginning of the competition. The time taken to complete the 2 laps for each robot will be recorded.

4.2 Each team will be given 5 minutes to complete at least two 2-lap runs in opposing direction, i.e. one in clock-wise and the other in anti-clock-wise direction. Each team shall start from the same assigned start lines for the run. The robot must complete at least 1 2-lap run and register a valid running time to qualify for a prize.

4.3 In the event the faster robot catches up with the slower robot till within 1m, determined by one straight segment or one large curve segment or 3 small curve segments, the slower robot shall be "knocked-out" of the race and retire to the cage-in area. Only robots managing to clock at least 1 valid time without being "knocked-out" shall qualify for a prize.

4.4 The robots with the fastest running time will be declared the winning entries, subject to the general competition prize guidelines.

5 RULES OF COMPETITION

5.1 Robot will be "caged" at least 30 minutes before the start of the competition. Once the competition starts, no individual is allowed to access the robots in the "caging" area.

5.2 The sequence of robot runs will be detrmined by drawing of lots. The robot has to complete the entire competition race-track for each race. No change of batteries is allowed during the competition. No cleaning of robot parts and tracks are allowed.

5.3 Robot is to start from a stationary starting position, with the extremity of the robot aligned to the start line. It has to travel along the track either by walking, running or hopping, or any other motion not identified as wheeled motion.

5.4 Robot must keep within the designated track during the race. The result is void if

a) any part of the robot completely touches the ground or the robot falls off the track before fully crosses the Finishing line. Or

b) any part of the robot crosses to the other track.

If any of the above situations occurs, the participant, under instruction from the judge, must remove their robot immediately.

5.5 The race and race time both starts by the blow of a whistle. A valid Recorded Time is measured from the time when the whistle is blown until the moment when any part of the robot crosses the Start/End line at the Start Zone after 2 laps. Any robot moved before the whistle is blown will be considered a **False Start**. All robots shall only be given 1 False Start warning and subsequent False Start will imply the robot has lost a race.

5.6 No parts of the robot are to be left behind on the race-track. Winning is based on the best time of a completed race for each robot. If the robot failed to achieve any single complete run, it shall be retired from the competition.

5.7 During the competition, if the robot, under any circumstance, does not demonstrates any positive action to start or complete the race (eg: always crash or run out of track for no apparent reason) may be asked to retire by the discretion of the judges.

5.8 Once the robot has started its race, the robot handler can only access the robot after it crosses the Finishing Line or the robot runs out of the track completely.

5.9 Modification of robot during competition is STRICTLY PROHIBITED. No extra parts are to be added to or removed from the robot once the competition time starts.

5.10 All robots should be returned to the caging area or a designated location after its run. The teams are not allowed to take back their robots before the whole competition is concluded.

5.11 Any violation of the rules above would result in the run being invalidated.

6. CLONING

6.1 Clones will only be awarded one prize. Clones will be identified during the "caging" procedure.

6.2 Clones are robots with substantially identical physical appearance and walking mechanism. Scaling of the same mechanism is considered as cloning.

6.3 When in doubt, the decision of the Judges will be final.

WALL CLIMBING ROBOT RACE

1. OBJECTIVE

The aim of this event is for mobile robots to demonstrate their horizontal and vertical surface climbing abilities during a race.

2. THE COMPETITION ENVIRONMENT

2.1 The wall is shown in Figure 1. It consists of three sections: a two metres long horizontal section (section A) on the ground followed by a two metres high vertical section (section B) followed by a two metres long horizontal section (section C) at the top, with each section at least 0.8 metre wide. The following tolerance will applied:

(a) length of each wall section should be 2000 mm ± 5 mm.
(b) angle formed between two adjacent wall sections should be 90° ± 0.5°.

The wall will be deemed to have satisfied criteria (a) and (b) above and be considered fit for use if each of the two distances between diagonally opposite corners (using the side view in Figure 1) lies in the range 2733 mm to 2847 mm.

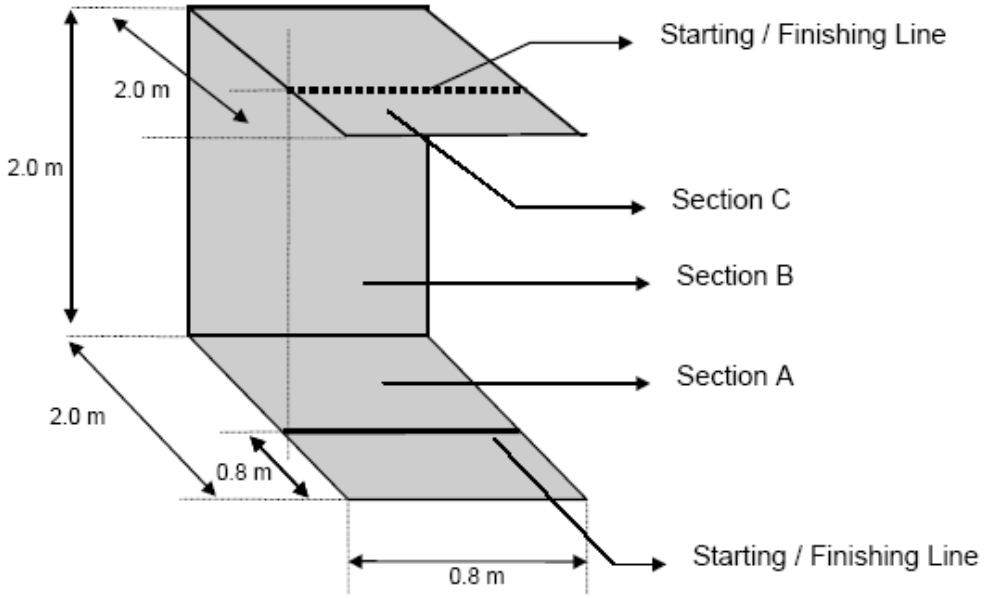


Figure 1: The wall for the wall-climbing robot race

2.2 The vertical wall section (Section B) will be covered with a transparent Polycarbonate sheet with thickness ranging between 10 to 15 mm. The 2 horizontal top (Section C) and bottom (Section A) walls will be covered with metal sheets having matt black surface finish.

2.3 Starting / finishing white lines will be located 0.8 metre from the edge of the horizontal section (section A and C.)

2.4 The supporting structure for the wall will have provision for two safety cables to be attached to the robot so that both cables can be used simultaneously during the race (not shown in Figure 1.)

3. THE COMPETITION

3.1 Robots will start from a stationary position with the front-most part of the robot lying behing the starting line in section A as view vertically from above. (see Figure 2.)

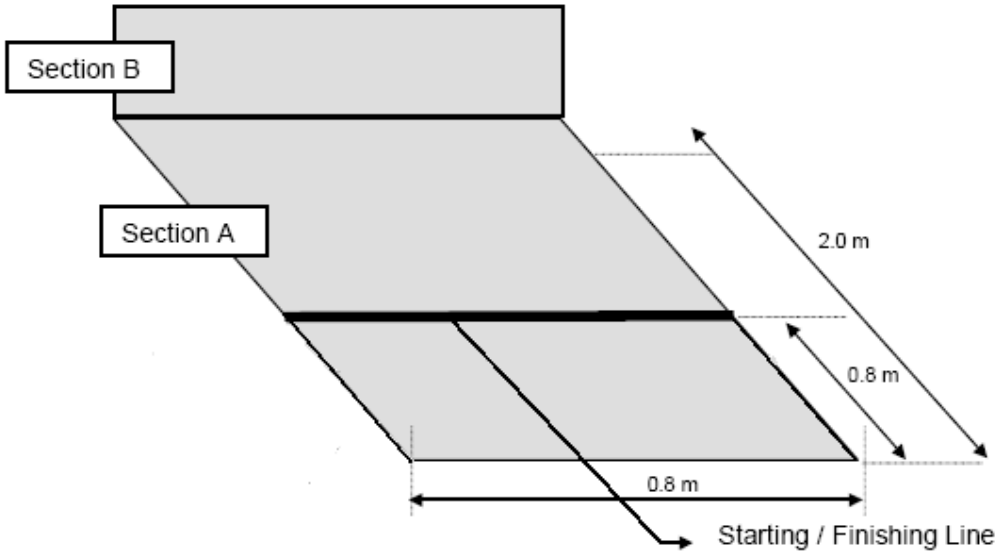


Figure 2: The starting line for the wall-climbing robot race viewed from above wall-section A

3.2 On reaching the vertical section (section B) the robots shall climb up the vertical section and subsequently climb 'upside-down' to the end of the top horizontal section (section C.)

When the trailing end of the robot crosses the finishing line, the robot shall climb back through sections C, B and A in sequence. The sequence of wall sections to be climbed from start to finish is A-B-C-C-B-A.

3.3 If applicable, each robot will have a penalty time of **6 seconds** added to the shortest time that it is able to complete its climb through the entire sequence of wall sections according to paragraph 3.2. The criterion to determine if a penalty is applicable is when the robot makes use of magnets in order to climb any wall sections.

3.4 The robot that completes the entire sequence of wall sections according to paragraph 3.2 qualifies itself for a prize. The robot that qualifies with the shortest time and in accordance with all the rules wins.

3.5 All robots are to be fully autonomous and self contained with their own power supply, control and intelligence built-in within the robot itself.

3.6 No human interference is allowed after the cage-in and during the run.

3.7 During each run, a robot is deemed to have started once any part of the robot crosses the starting line in the wall section A.

3.8 A robot is deemed to have completed its climb through a particular wall section when it fulfils all of the following conditions (a), (b) and (c) in sequence:

(a) robot touches the wall section that it is about to complete;

(b) robot simultaneously touches both the wall section that it is about to complete as well as the next wall section in the sequence of wall sections that is consistent with its direction of travel; and

(c) robot ceases to touch the particular wall section that it is about to complete and touches the next wall section in the sequence that is consistent with its intended direction of travel.

The above conditions apply to all wall sections except in the following cases:

(i) when the robot completes its climb through the wall section C for the first time in the sequence according to paragraph 3.2; and

(ii) when the robot completes the last wall section (wall section A) in the sequence according to paragraph 3.2.

In both cases (i) and (ii), the robot is deemed to have completed its climb through the wall section only when the entire robot has crossed the finishing line placed within that particular wall section.

3.9 Each team shall be given a maximum of **10** minutes to produce its best result once the robot is removed from the caging area.

3.10 After the race begins, any physical handling of the robot such as touching, pulling of cables or pushing of the robot during a climb will disqualify the result of that climb. However if a robot falls off while climbing the wall, using the safety cables to break the fall of the robot is allowed and the result of the climb will be determined as specified in paragraph 3.3 & 3.4.

4. THE ROBOTS

4.1 The dimensions of each of the competing robots must not exceed 0.75 metre in length and height, and 0.6 metre in width at all times while the robot is in operation.

4.2 The weight of each of the competing robots must not exceed 10 kilograms.

4.3 Competing robots must not have parts removed or added to them during the competition except for replacement of batteries or for repairs essential to the operation of the robot. The competing robots are not allowed to discard any part of their chassis during operation. The competing robots must not use chemical or combustion power methods.

4.4 The competing robots must not damage the competition environment including the wall and its supporting structure and the sensors in any way.

4.5 The competing robots must not endanger the judges and the spectators in any way. All competing robots must be firmly secured with two safety cables at all times during operation.

4.6 A robot will be disqualified during the competition if it endangers the judges, the participants or the spectators in any way during the competition, or if it damages the competition environment. Alternatively a robot may be banned from competing if, in the opinion of the judges, it is likely to pose a safety hazard or cause damage to the competition environment.

5. CLONING

5.1 In accordance with the spirit of the competition, clones among the winning entries will only be awarded one prize. Clones will be identified during the "caging" procedure.

5.2 Clones will be identified by the working principles of the whole robotic system, such as the sequence of operations and negotiating the wall bends.

5.3 When in doubt, the decision of the Judges will be final.

RC SUMO ROBOT COMPETITION

1. OBJECTIVE

Participants are required to build a self-contained mobile robot that is able to push its opponent out of the specified ring in according to the tournament rules. Robot handlers are to operate their robots through the radio-controlled console.

2. ROBOT SPECIFICATIONS

2.1 Dimensions and Weight

The size of the robots shall not exceed 20cm (length) x 20cm (width). There is no height restriction and it may take any shape and size once the match begins.

The weight shall not exceed 3 kg excluding the radio-controlled console used by the robot handler.

2.2 Don'ts in the Design

2.2.1 Do not disturb the opponent's radio-control by putting a jamming device in the robot.

2.2.2 Robots shall not damage the arena deliberately.

2.2.3 Robots shall not throw liquid or powder or other substances at the opponent.

2.2.4 Robots shall not employ any flammable devices as a weapon.

2.2.5 Robots should not secure itself on the ring surface by using, suction cups, diaphragms, sticky treads, glue or other such devices.

2.2.6 Projectile weapons or saw-blades are prohibited.

2.3 Radio-controlled Frequencies

2.3.1 The radio-controlled frequencies shall only be FM 27 MHz or 2.4GHz Digital Spectrum Modulation (DSM).

2.3.2 Participants who are using FM 27MHz must be capable of operating in any of its frequency bands. Participants are allowed up to two changes in frequency bands in a game. If the robot failed to proceed after the second band change, it shall be retired from the game.

2.4 Labelling

All robots must be labeled with of their team names on the front of the robot. The minimum font size is Arial 24.

2.5 Clearing of Debris

Fallen items from the robots shall be removed after each match.

3. RING SPECIFICATIONS (REFER TO FIGURE 1)

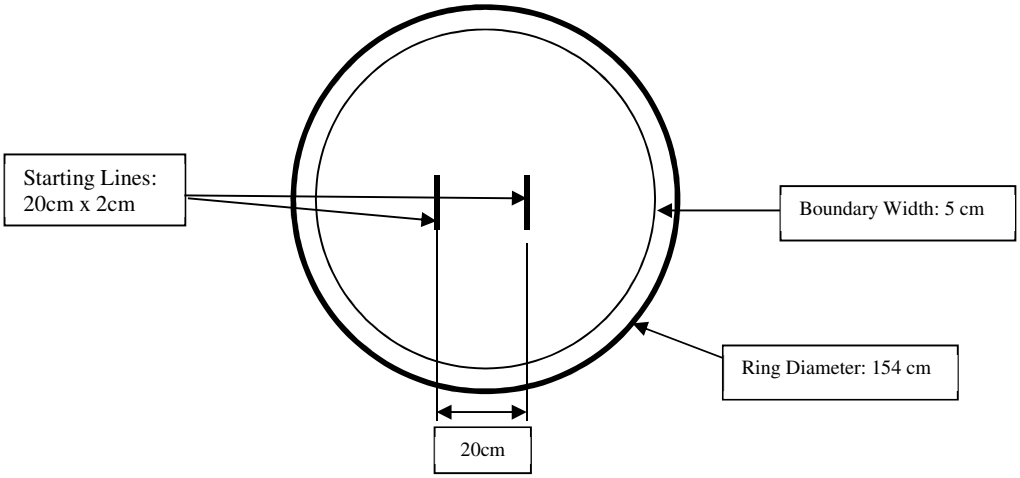
3.1 Dimensions and Materials

The ring arena is made of a single ½" MDF board and covered by a 3mm black hard rubber sheet. The diameter of the ring is 154cm including the boundary marking.

3.2 Markings

Two red-brown color starting lines (20cm x 2cm) locate at 20cm apart at the centre of the ring. They indicate the starting positions for two competing robots.

The boundary of the ring arena is marked in white color. The width is 5cm.



4. GAMES RULES

4.1 Sumo Game

The tournament shall divide the participating teams into groups of maximum 4 robots.
A game consists of 3 matches. Each match shall last for 2 minutes. One point shall be given to every match winner. Zero point shall be given to a draw or a loser.
If a game ends with no winner, a test of strength by the two robots immediately after the last match will be the decider.

4.2 Match Winner

A robot wins when any part of the opponent robot touches the floor.

4.3 Service Time

Participants will be given one minute of Servicing -Time before the start of their game. A maximum of two members are allowed to service their robots at a designated area under supervision. Only replacement of identical parts and batteries are allowed during the Servicing-Time.

4.4 Time Out

Each team will only be given one time-out of one minute within a game (of 3 matches). The time-out will apply after the match and only for the requesting team. Changing of battery is not allowed during the time-out.

4.5 Robot Handler

A participant is allowed to handle only one same robot throughout the event. Each robot should only have one same handler. The handler and robot will be identified during the registration and caging.

5. CAGING

Robots shall be inspected and caged at least 1 hour before the start of the game.

AUTONOMOUS ROBOT SUMO COMPETITION

1. OBJECTIVE

Participants are required to build an **autonomous**, self-contained mobile robot that is able to push its opponent out of the specified ring according to the tournament rules. Robot handlers are to start the robot with the press of a single button.

2. ROBOT SPECIFICATIONS

2.1 Dimensions and Weight

The size of the robots shall not exceed 20cm (length) x 20cm (width). There is no height restriction and it may take any shape and size once the match begins.

The weight of the robot shall not exceed 3 kg.

2.2 Restrictions on robot Design

2.2.1 The robot must not have a device that interferes with the sensor operation of its opponent. e.g. Jammer, strobe light, laser & etc.

2.2.2 Robots shall not damage the arena deliberately.

2.2.3 Robots shall not throw liquid or powder or other substances at the opponent.

2.2.4 Robots shall not employ any flammable devices as a weapon.

2.2.5 Robots should not secure itself on the ring surface by using, suction cups, diaphragms, sticky treads, glue or other such devices.

2.2.6 Projectile weapons or saw-blades are prohibited.

2.3 Robot Control

The robot shall be autonomous. No external form of control or any external intervention is allowed. The Robot is to be started with a single Toggle-type switch.

2.4 Labelling

All robots must be labeled with their team names on the front of the robot. The minimum font size is Arial 24.

2.5 Clearing of Debris

Fallen items from the robots shall be removed after each match.

3. RING SPECIFICATIONS (REFER TO FIGURE 1)

3.1 Dimensions and Materials

The ring arena is made of a single ½" MDF board and covered by a 3mm black hard rubber sheet. The diameter of the ring is 154cm including the boundary marking.

3.2 Markings

Two red-brown color starting lines (20cm x 2cm) locate at 20cm apart at the centre. They indicate the starting positions for two competing robots.

The boundary of the ring arena is marked in white color. The width is 5cm.

3.3 Ring Condition

The ring condition may vary slightly and participants should design and build their robots with robustness in mind.

4. GAMES RULES

4.1 Sumo Game

The tournament shall divide the participating teams into groups of maximum 4 robots.

A game consists of 3 matches. Each match shall last for 2 minutes. One point shall be given to every match winner. Zero point shall be given to a draw or a loser.

If a game ends with no winner, a test of strength by the two robots immediately after the last match will be the decider.

4.2 Match Winner

A robot wins when any part of the opponent robot touches the floor.

4.3 Service Time

Participants will be given 1 minute of Servicing-Time before the start of their game. A maximum of two members are allowed to service their robots at a designated area under supervision. Only replacement of identical parts and batteries are allowed during the Servicing-Time.

4.4 Time Out

Each team will only be given one time-out of one minute in a game (of 3 matches). The time-out will apply after the match and only for the requesting team. Changing of battery is not allowed during the time-out.

4.5 Robot Handler

A participant is allowed to handle only one same robot throughout the event. Each robot should only have one same handler. The handler and robot will be identified during the registration and caging.

5. CAGING

Robots shall be inspected and caged at least 1 hour before the start of the game.

6. CLONING:

6.1 In accordance with the spirit of the competition, clones will be identified during the "caging" procedure and shall be grouped to fight against each other during the preliminary stages.

6.2 Clones are robots with substantially identical physical appearance and working principles.

6.3 When in doubt, the decision of the Judges will be final.

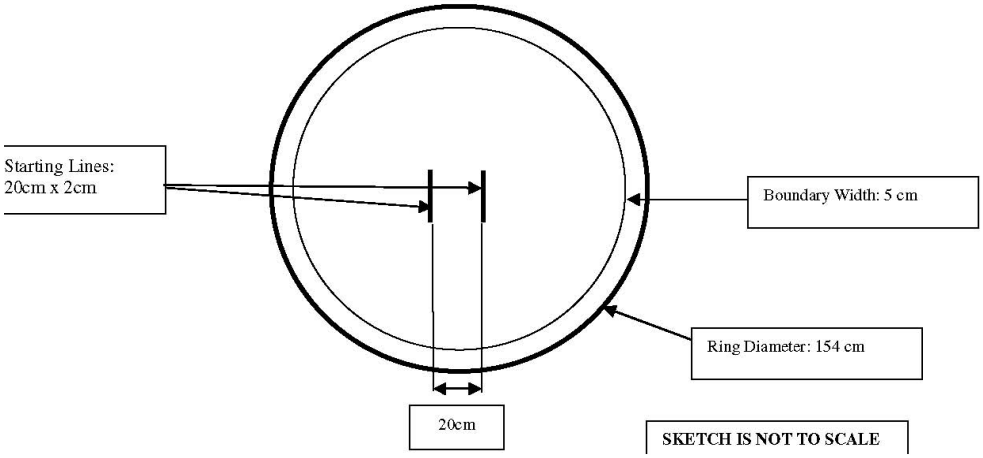


Figure 1

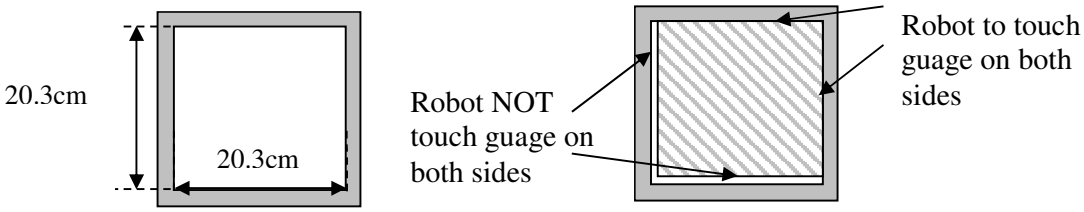


Figure 2: Caging Gauge

PICOMOUSE COMPETITION

INTRODUCTION

Picomouse is an autonomous mobile vehicle, which is able to navigate its way through an unknown maze from the start to the destination. It is also required to search for the best path between the start and the destination for the picomouse to run along this path in the shortest time.

The main challenge for picomouse designers is to build a fast moving wheel-driven robot. They need to work out the maze solving intelligence for the robot that is able to handle different maze configurations and compute the optimum path for the shortest fast-run time, and to control the robot to run at very fast speed without hitting the wall.

1. MAZE SPECIFICATIONS

1.1 The maze is be configured by placing walls along the grid-points formed by multiples of 9cm square. The squares are arranged in a 16 x 16 row-column matrix. The walls constituting the maze are in 2.5cm high and 0.6cm thick. Passageways between the walls are in 8.4cm wide. The boundary of maze is enclosed with walls.

1.2 White plastics make the maze walls. The maze platform is made by plywood and finished with black color matted paint. The maze walls shall reflect infra red light. The maze floor shall absorb it.

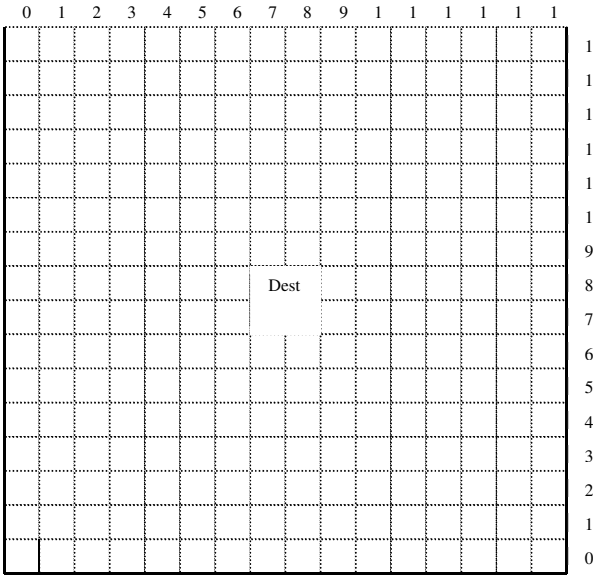


Figure 1: Start and Destination Points and Grid Lines for Maze

1.3 The starting position of the maze shall locate at one of the maze corner. There shall be three walls surrounding it. Its opening shall be towards destination that is the center of the maze, locating at the right of the starting square.

1.4 There are poles, in dimensions 0.6cm (length) x 0.6cm (width) x 2.5cm (height), locating at four Corners of each maze square. They are called lattice points. The maze shall be constituted such that there is at least one wall attached to each lattice point, except the lattice point that is locating at the center of the maze.

1.5 The accuracy of maze dimensions shall be within +/- 5% or 1cm; whichever is less. The assembly joints on the maze floor shall not involve steps of greater than +/- 0.25mm. The gaps between the walls of adjacent squares shall not greater than 0.5 mm.

2. PICOMOUSE SPECIFICATIONS

2.1 The length and width of any picomouse shall be within 12.5cm x 12.5cm. There is no limit on the height of the picomouse. The picomouse shall not change its dimensions while it is navigating along the maze.

2.2 The picomouse shall be fully autonomous and shall not receive any outside help throughout the contest.

2.3 The method of wall sensing is at the discretion of the designer, however; the picomouse shall not exert a force on any wall that is likely to cause damage. The method of propulsion is also at the discretion of the designer, provided that the energy source is non-polluted.

2.4 The picomouse shall not leave any parts on the passageway while navigating along the maze.

2.5 The picomouse shall not jump over, climb over, or damage the walls of the maze.

3. RULES FOR THE CONTEST

The crucial task of the picomouse is to navigate from the starting square to the destination square. This is called a run and the time taken is called the run time. Traveling from the destination back to the start is not considered as a run. The total time taken from the first time left the start square until the start of each run is also measured. This is called the search time. If the picomouse requires a manual assistance at any time during the contest, it is considered as a touch. A one-time penalty shall be added on those scores that are obtained after the touch. The run time, the search time and the touch penalty are to be used for the calculation of each score that the picomouse reaches the destination from the start successfully.

The picomouse competition is divided into three categories. They are the secondary schools (SSs) category, the junior colleges/institutes of technical education (JC/ITEs) category and the open (Open) category.

3.1 The Junior Category

3.1.1 The Junior Category is opened for all full time students from non-tertiary institutions (secondary schools or lower, Junior Colleges and ITE's) and must be using the picomouse kit sets available in the open market and made in Singapore. Each school shall be limit to **Four** entries. Each entry shall not be more than **Six** students and must have its own picomouse. No picomouse shall be shared by any entries neither in this category nor the Open category.

3.1.2 Each entry shall be given time limit of 5 minutes or 6 crashes to contest on the maze. The picomouse may make as many runs as possible within time limit provided the picomouse does not crash more than 5 times.

3.1.3 The score of a picomouse shall be obtained by computing a handicapped time for each run as follows:

Score of Current Run (reached the destination successfully) = Run Time + Search Penalty + Touch Penalty
Search Penalty = $1/60^{th}$ of the Search Time, in seconds
Touch Penalty = 2 seconds

For example, if a picomouse, after being on the maze for 4 minutes without being touched, starts a run that takes 20 seconds to reach the destination; the run will have a handicapped time score of 20 + $1/60^{th}$ of (4 x 60 seconds) = 24 seconds. However, if the picomouse has been touched before the run, an additional touch penalty of 2 seconds is added on giving a new handicapped time score of 26 seconds. The run with the fastest handicapped time score for each picomouse shall be the official time score of that picomouse. The accuracy of time score is to the nearest $1/100^{th}$ seconds.

3.1.4 The run time shall be measured from the moment that the picomouse leaves the starting square until it enters the destination square. A run shall be complete only if the whole of the picomouse enters the destination square.

3.1.5 A computer timing system with electronic triggering devices shall be used for measuring scores of each picomouse. The electronic triggering devices are locating at the exit and entry of the starting square and the destination square respectively. The triggering device is constructed from the infra red transceivers. They are placed about 1cm above the maze floor. Any failure on the electronic triggering devices shall be back up by a manual timing system.

3.1.6 The starting procedure of each entry shall be simple and must not offer a choice of strategies to the handler. Pressing a "Start" button/switch once shall activate the picomouse. Throughout the duration of the given time limit, the handler shall not enter any information into the picomouse (such as to change the search strategy, the speed and the maze data).

3.1.7 The handler shall be given a setup time of 1 minute to calibrate the sensors, if required. However the handler shall not select any strategies and enter the maze data into the picomouse. The search time shall be started upon the expiry of setup time if the handler still continues to calibrate the sensors. Only **One** handler shall be allowed to operate the picomouse throughout the contest.

3.1.8 When the picomouse reaches the destination square, it may stops on its own and remains at the destination or continues to navigate to other parts of the maze or makes its own way back to the starting square. If the picomouse chooses to stop at the destination, it shall be manually lifted out and restarted by the handler. Manually lifted the picomouse out shall be considered as a touch to the picomouse. Therefore a touch penalty shall be added on the scores for all subsequent successful runs.

3.1.9 If a picomouse appears to be malfunctioning, the handler may ask the judges for the permission to abandon the run and restart the picomouse from the starting square. The handler shall not require restarting only if the picomouse makes a wrong turn; the judges' decision is final. All handlers have to manage the technical problems within the time limit of 5 minutes given. No re-scheduling of the entry due to technical problems shall be allowed.

3.1.10 Before the complete maze is configured, all handlers have to register and cage their entries to the contest officials. Once the entry is caged, no replacement of any parts of the picomouse shall be allowed. Once a picomouse starts its run, no replacement of batteries shall be allowed otherwise considered as a touch to the picomouse and the touch penalty shall be added on for the subsequent scores made by the picomouse.

3.2 The Open Category

3.2.1 The Open Category is opened for all individuals from the universities, the polytechnics, the industry, and the private. **Participants who qualify to take part in the Junior Category may be allowed to take part in the Open Category if**

- **the entries are not kit sets purchased or/and subsequently modified, and**
- **the entries have participated and performed well in the Junior category in the same year, and**
- **the entries are recommended and accepted for Open Category.**

Each entry shall not be more than **Six** participants and must have its own picomouse. No picomouse shall be shared by any entries.

3.2.2 The destination zone, i.e. goal area, for the Open Category shall consist of 2x2 squares. The entry point, or entry square, refers to the one that has an opening into the destination/goal area. The entry point, or entry square, of the destination zone shall be determined individually for each competition and shall be announced on the Singapore Robotic Games website at least one month before each competition. The entry point of the destination zone

shall be indicated by a set of x-y coordinates. Only the coordinates of the entry square in the destination zone shall be announced. The direction of entry and the coordinates of the other 3 squares of the destination zone shall not be announced. (Refer to Figure 2 for an explanation on how to read the coordinates of the entry square.).

3.2.3 The maze shall have at least two different paths from the starting square to the destination.

3.2.4 Each entry shall be given a time limit of **5 minutes** to contest on the maze. Within this time limit, the picomouse may try up to a maximum of **5 runs.**

3.2.5 The score of a picomouse shall be obtained by computing a handicapped time for each run as follows:

Score of Current Run (reached the destination successfully) = Run Time + Search Penalty
Search Penalty = $1/30^{th}$ of the Search Time, in seconds

For example, if a picomouse, after being on the maze for 4 minutes starts a run that takes 20 seconds to reach the destination; the run will have a handicapped time score of 20 + $1/30^{th}$ of (4 x 60 seconds) = 28 seconds. The run with the fastest handicapped time score for each picomouse shall be the official time score of that picomouse. The accuracy of time score is to the nearest $1/100^{th}$ seconds.

3.2.6 The run time shall be measured from the moment that the picomouse leaves the starting square until it enters the destination square. A run shall be complete only if the whole of the picomouse enters the destination square.

3.2.7 The search time shall be measured from the moment that the picomouse leaves the starting square for the first time.

3.2.8 A computer timing system with electronic triggering devices shall be used for measuring scores of each picomouse. The electronic triggering devices are locating at the exit and entry of the starting square and the destination square respectively. The triggering device is constructed from the infra red transceivers. They are placed about 1cm above the maze floor. Any failure on the electronic triggering devices shall be back up by a manual timing system.

3.2.9 The starting procedure of each entry shall be simple and must not offer a choice of strategies to the handler. Pressing a "Start" button/switch once shall activate the picomouse. Throughout the duration of the given time limit, the handler shall not enter any information into the picomouse (such as to change the search strategy, the speed and the maze data).

3.2.10 The handler may calibrate the sensors, if required. However the handler shall not select any strategies and enter the maze data into the picomouse. The time spent in calibration is counted towards the total given competition time of 5 minutes. Calibration is only allowed within the starting square. The picomouse is considered to have started its run if it moves out of the starting square and triggers the electronic triggering devices. Only **One** handler shall be allowed to operate the picomouse throughout the contest.

3.2.11 When the picomouse reaches the destination square, it may continue to navigate to other parts of the maze or make its own way back to the starting square. No manual lifting of the picomouse at the destination is allowed.

3.2.12 The handler shall not touch the picomouse while the picomouse is running in the maze unless he is given permission by the judges to do so. If a picomouse appears to be malfunctioning, the handler may ask the judges for the permission to abandon the run and restart the picomouse from the starting square. The handler shall not require restarting only if the picomouse makes a wrong turn; the judges' decision is final. All handlers have to

manage the technical problems within the time limit of 5 minutes given. No re-scheduling of the entry due to technical problems shall be allowed.

3.2.13 Before the complete maze is configured, all handlers have to register and cage their entries to the contest officials. Once the entry is caged, no replacement of any parts of the picomouse shall be allowed. Once a picomouse starts its run, no replacement of batteries shall be allowed.

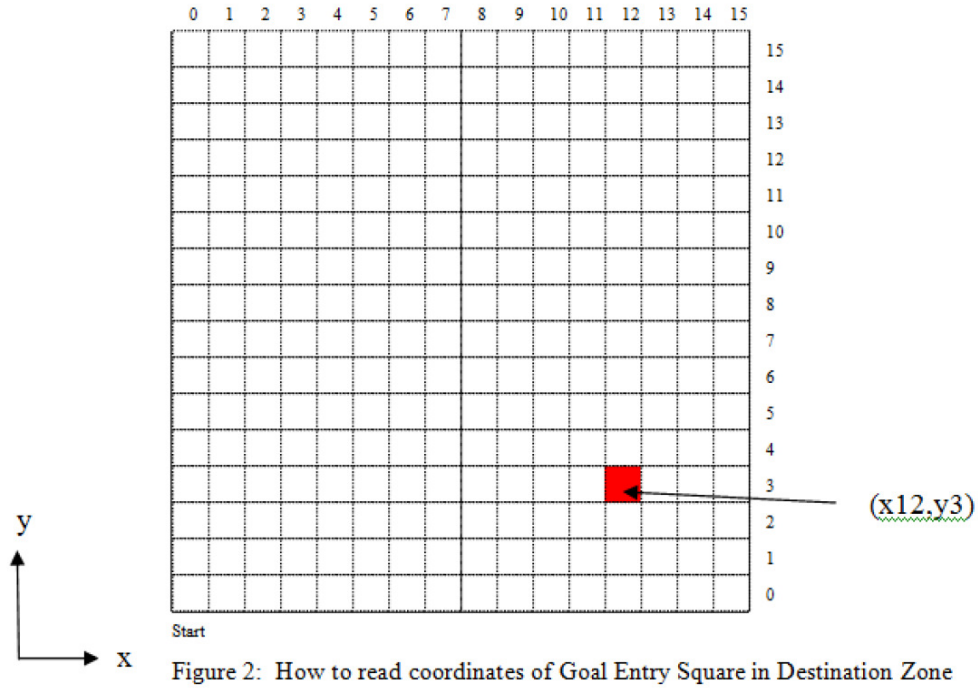


Figure 2: How to read coordinates of Goal Entry Square in Destination Zone

4. CLONING

4.1 In accordance with the spirit of the competition, clones among the winning entries will only be awarded one prize. Clones will be identified during the "caging" procedure.

4.2 Clones are robots with substantially identical physical appearance and working principles.

4.3 When in doubt, the decision of the Judges will be final.

UNDERWATER ROBOT COMPETITION

1. OBJECTIVE

Underwater vehicles are vital to port & harbour security, naval and scientific exploration, underwater cleaning etc. This fun-filled and challenging competition aims to introduce students to this fascinating world so that they can explore career opportunities in this field. The competition will spur interest and promote education in this area and motivate young and aspiring engineers and scientists to further pursue this field.

The competition aims at the following long term goals

- Address shortage of skilled individuals to support advanced marine engineering in Singapore
- Reach more students & get them interested in the industry. Help students develop the skills to support marine engineering early on through fun filled activities
- Complement & expand educators' knowledge and expertise in this field

2. BRIEF DESCRIPTION OF MISSION

2.1 The team of contestants have to design and build a remote operative vehicle (ROV) or an autonomous underwater vehicle (AUV). Robots may incorporate both autonomous and remote control capabilities, but each robot may only have a single remote control unit. Regardless of the type of robots, they will compete within the same arena but AUV will be given bonus points.

2.2 The mission involves the picking up of as many objects (cargoes, one at a time) from the middle section of the tank and dropping them in baskets at either ends of the tank. At the end of each run the number of objects in each basket ideally should be equal. For both ROV and AUV, each pair (one in each basket) gets four (4) points and remaining unpaired objects in the basket get one point each. For AUV's, they shall be awarded a bonus of two (2) points on condition that the robot(s) deliver(s) at least one (1) object into the basket.

2.3 While doing so they would have to maneuver through window frames which will be non magnetic on either sides of the tank. Hitting the windows will cause the team to loose points.

3. TANK SPECIFICATIONS

3.1 The game will be played in an L-shaped tank of dimension: 1425mm x 1425mm x 500mm. The tank has a glass of 12.5 mm thickness. See Figure 1 for details.

3.2 There shall be two rectangular window frames, 30mm thickness, and one on each section of the tank 500mm from the ends of the tank. See Figure 2 for detailed dimensions.

3.3 The centre section of the tank will have a bump which is 12.5mm in height.

3.4 In the central area of the tank there shall be a cargo holder containing 16 objects arranged in a grid. This holder will be elevated from the tank floor by about 2 cm. See Figure 1 layout.

3.5 The cargo holder will be a square of 100mm sides with the sixteen objects arranged in a grid. The cargo holder will be made from a non-magnetic material. See Figure 3.

3.6 The cargo to be lifted will be marbles in the case of ROV and nuts for AUV as shown in Figure 4. The marbles are ceramic in nature and will have a diameter of around 15 – 17 mm weighing 3 to 7 g each. The nuts will be ferromagnetic and weigh between 10g to 20g.

3.7 A black tape, 4 to 5cm wide, will run through the centre of the tank and on both sides of the tank at a height of 20cm from the bottom.

3.8 There are two basket areas at both ends of the tank. There will be a barrier of about 2cm in height separating the basket from the rest of the tank.

3.9 The water depth in the tank will be 40 cm and flush with the top of the rectangular window frames mentioned in 3.2 above.

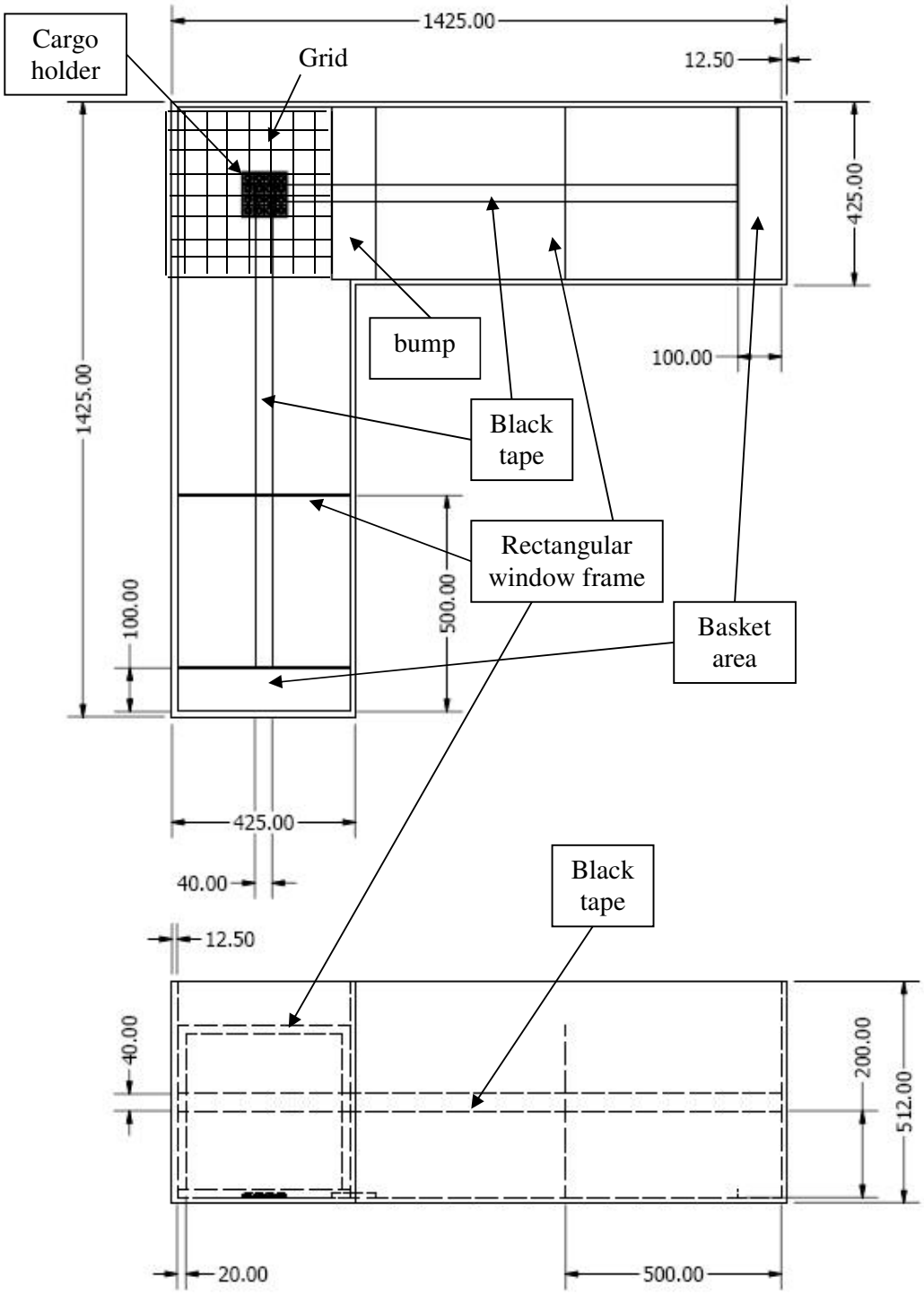


Figure 1: Tank Dimensions (in mm)

4. ROBOT SPECIFICATIONS

4.1 The robot should at the start of competition fit in a box of 30cm (width) x 30cm (length) x 30cm (height). Any vehicle found violating the dimensions shall be disqualified immediately.

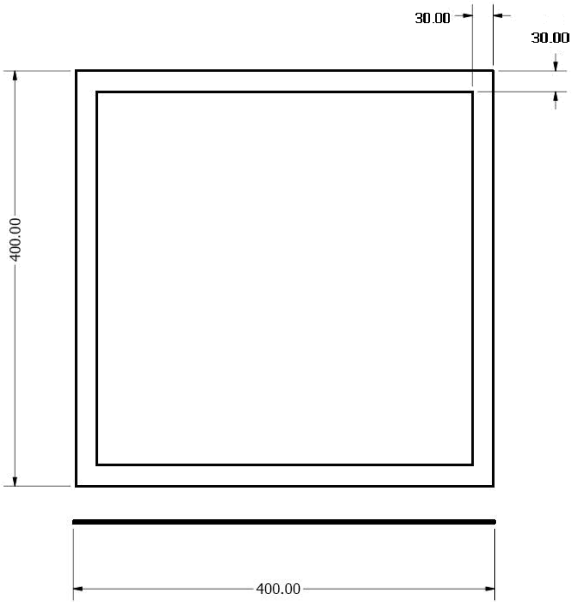


Figure 2 : Rectangular Window Dimensions (in mm)

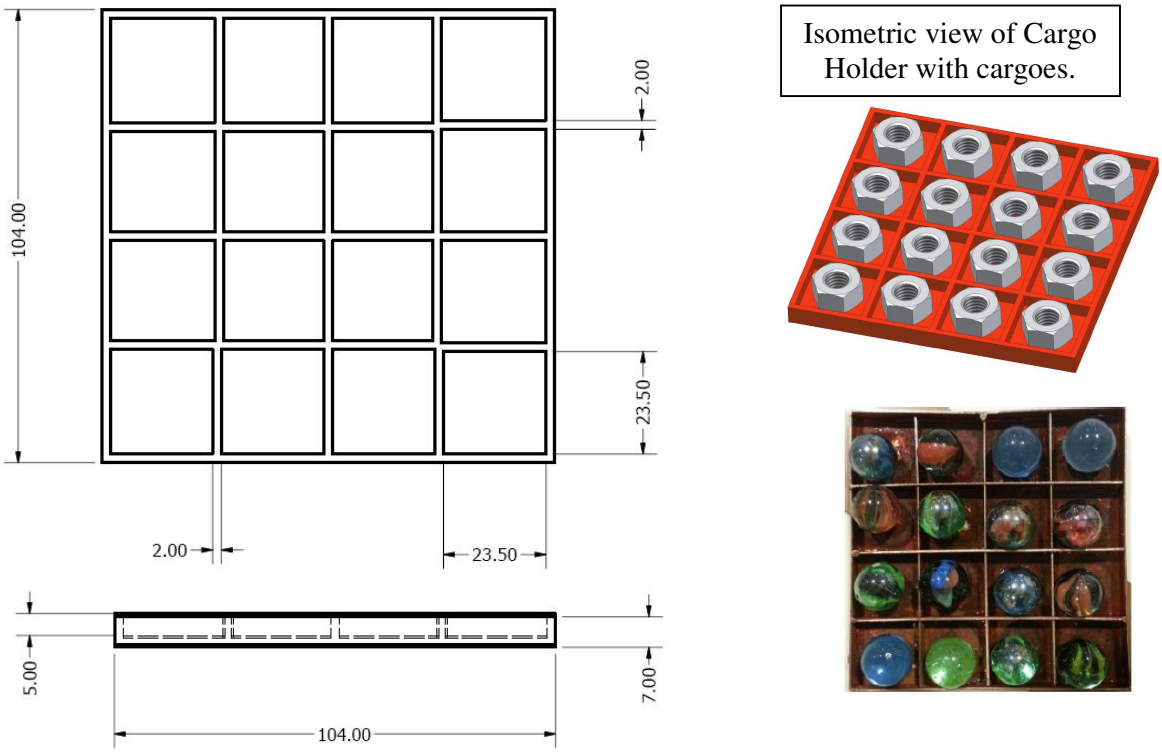


Figure 3 : Cargo Holder Dimensions (in mm)

4.2 During any match, the vehicle should not exceed 40cm in any one dimension. This specification however does not prevent the initial vehicle from splitting up into multiple parts as long as the above conditions are satisfied. The later condition above would then apply to each completely disconnected part. However, at the start of the competition, the vehicle must be assembled as a single unit.

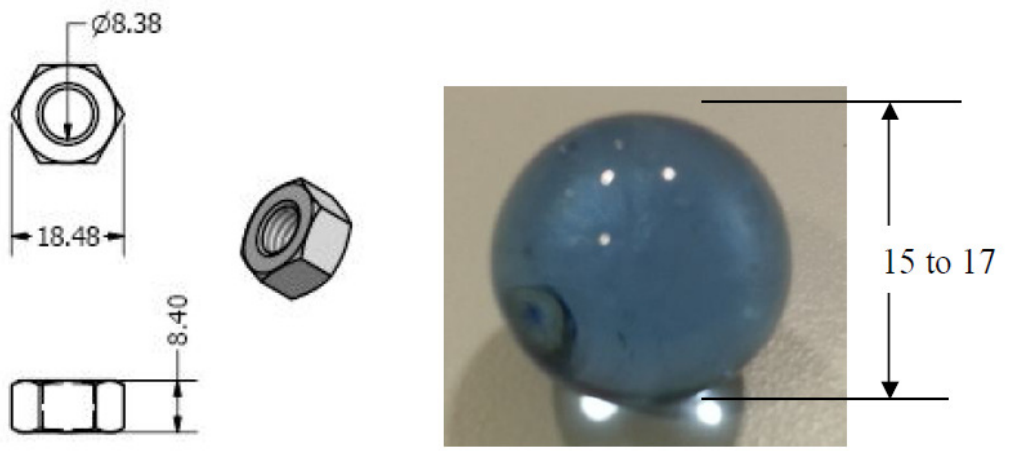


Figure 4 : Cargo Dimensions (in mm)

4.3 In case of AUV's, the method of wall sensing is at the discretion of the builder. However, the AUV must not exert a force on any wall of the tank likely to cause damage.

4.4 Wheeled or legged machines running on the tank bottom surface will not be allowed. Any other method of propulsion is at the discretion of the builder, provided that the power source is non-polluting. Use of any kind of explosive material is prohibited. Nothing may be deposited off by the machine in the tank.

5. JUDGING CRITERIA

5.1 For non-autonomous robots, points shall be awarded in the following manner:
- 5.1.1 4 points for each pair of objects (one in each basket.)
- 5.1.2 1 point for any unpaired object left in either basket.

5.2 For autonomous robots, the points scheme shall be as follows:
- 5.2.1 8 bonus points for autonomous vehicles if it drops at least one object.
- 5.2.2 6 points for each pair of objects (one in each basket.)
- 5.2.3 1 point for any unpaired object left in either basket.

5.3 The time for the first cargo to be dropped will also be recorded, and shall be used as a tie-breaker.

5.4 There are no penalties for hitting the tank walls or the window frame. For RC, only ONE participant is allowed to operate ONE robot. The handler / controller and robot will be paired and identified during registration and caging.

5.5 To be considered for prizes, at least one object should be dropped in either basket for autonomous robots, and two objects in each basket for RC robots.

6. RULES FOR COMPETITION

6.1 Each team will be given a competition time of 6 minutes, inclusive of setup time. Each robot is given a maximum of 3 starts within the competition time and one attempt is counted for scoring and is limited to a maximum of 4 minutes.

6.2 Robots shall start from either end of the competition tank. The starting line shall be 40 cm from either edge of the tank, and the robots may not be placed beyond this line at the start. Once team has chosen the starting end, all attempts shall proceed from the same position.

6.3 The attempt with maximum points will be considered as the team's final score. And the time recorded for the first cargo drop for the chosen attempt shall be used as tie breaker.

6.4 Any objections or appeals on discrepancies on points awarded must be raised within 5 minutes after the team completes its competition attempts and its points displayed on the official results board. Objections/appeals should be submitted in the official appeals form available at the Reception Counter to the event chairperson. No further appeals and objections shall be entertained after the given window.

6.5 Judges decision is final and binding to all.

6.6 All robots will be caged half an hour before competition starts and would be checked for safety and cloning. Robots found to be of unsafe nature shall be disallowed.

6.7 The objects have to clearly fall within the basket. Objects on the basket barrier shall not be counted.

6.8 Any dropped object outside the cargo holder or basket will be considered out of play.

6.9 Each vehicle can lift only one object at a time. However while picking up objects within the cargo area, if multiple objects are picked, excess objects can be dropped back within the cargo area without penalty. In other words the vehicle should be carrying only one object once it is out of the cargo area. If multiple objects are carried at one time out of the grid area, all of them will be considered out of play.

6.10 Only two handlers are allowed in the competition arena for each team and only one remote controller is allowed in case of an ROV.

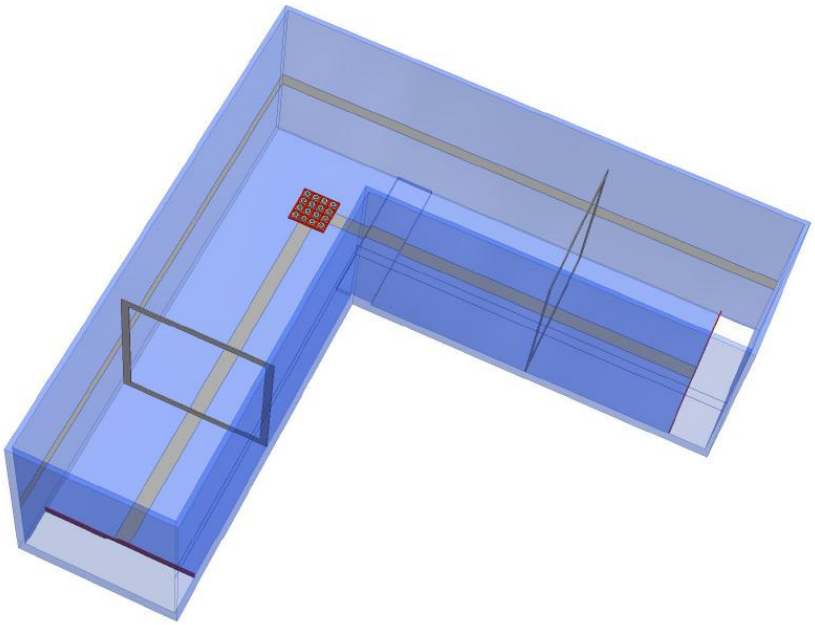


Figure 5 : Isometric view of Competition Setup

7. CLONING

7.1 In accordance with the spirit of the competition, clones among the winning entries will only be awarded one prize. Clones will be identified during the "caging" procedure.

7.2 Clones are robots with substantially identical physical appearance and working principles. This rule will be applied strictly especially for multiple entries from the same institution.

7.3 When in doubt, the decision of the Judges will be final. No arguments will be allowed on cloning issues once competition starts and such arguments may disqualify the team.

HUMANOID ROBOT COMPETITION

1. OBJECTIVE

The Humanoid Race is a competition between bipedal robots. The competition is to promote technology that allows robots to walk and run like human.

2. SPECIFICATIONS OF ROBOT

2.1 The robot has TWO legs ONLY. For each leg, the ONLY contacting area with the ground is the Foot. The diagram below shows the MINIMUM configuration for a lawful LEG.

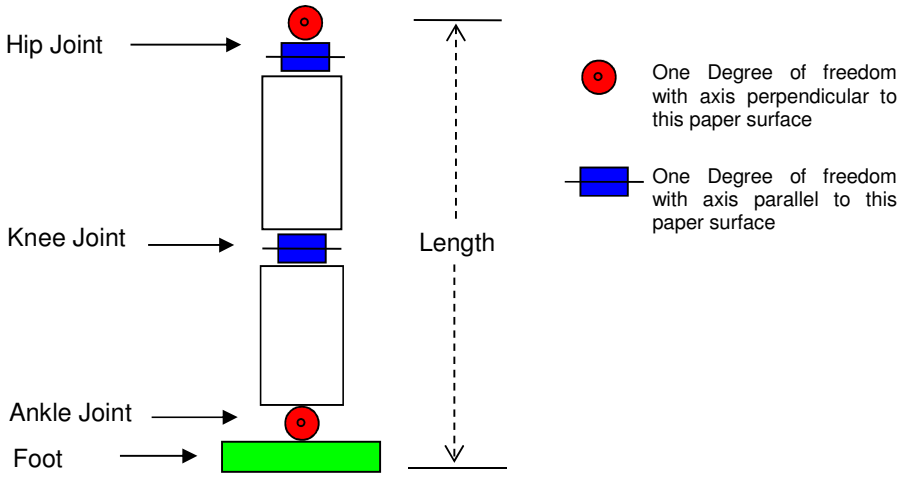


Fig. 1 – Humanoid Leg

2.1.1 Each leg should have the three joints, namely HIP joint, KNEE joint and ANKLE joint.

- HIP joint: the hip joint should have at least TWO degree of freedom as shown in the diagram above.
- KNEE joint: the knee joint should have ONLY ONE degree of freedom as shown in the diagram above.
- ANKLE joint: the ankle joint should have at least ONE degree of freedom as shown in the diagram above.

2.1.2 The **length** of leg (from HIP joint to Foot when the leg is completely extended) should not exceed 300mm.

2.1.3 The **aspect ratio** of the leg, which is defined as following

Aspect Ratio = Length of Leg / Maximum Dimension of the Foot Surface

The Aspect Ratio should be more than 1.5.

2.1.4 The maximum weight of the robot should not be more than 10kg.

2.2 The robot should be FULLY AUTONOMOUS and self-contained, i.e. there should be NO external control and power source allowed.

3. SPECIFICATIONS OF RACE TRACK

3.1 The Race Arena: There is no predefined race arena for this game. The participating robots will race using the natural floor of the competition venue. Note that since the competition venue is indoor, the floor surface can be carpet, parquet, concrete surface, etc. Participating robots are advised to be designed with tolerance with difference floor surface.

3.2 The Race Track: The Race Track shown in Fig 2 is constructed directly on the floor of the competition venue by WHITE color reflective tape of WIDTH 25mm.

3.2.1 All the track lines will be straight

3.2.2 The starting line length is 100mm

3.2.3 The STOP POINT and WAYPOINT1 are indicated by the BEACON that will be a standard table tennis ball of ORANGE color.

3.2.4 The exact location of the STOP POINT and WAYPOINT1 with respect to the center of starting line is defined by coordinate pair (X0, Y0) and (X1, Y1) respectively. The exact coordinates will be determined at the competition day. Note that X value will not be bigger than 5 meter and Y value will not be bigger than 3 meter.

Note that is reflective tape is for guiding purpose for the robot but is not mandatory for robot to follow exactly. Please refer to Section 4.3 for how the race is run.

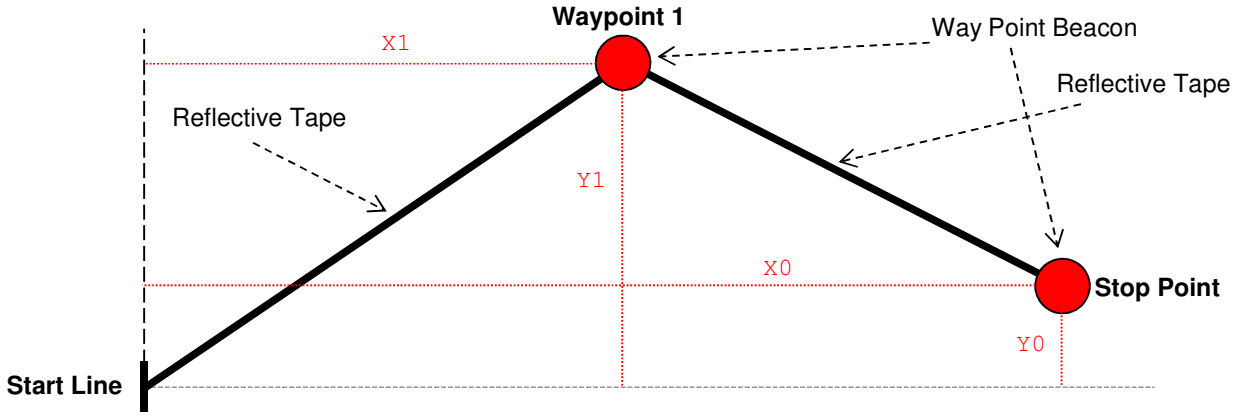


Fig. 2 - Sample Humanoid Race Track

4. RULES OF COMPETITION

4.1 The robot will be "caged" 30 minutes before the start of the competition. Once the competition starts, no individual is allowed to access the robots in the "caging" area. Charging of batteries is not allowed in the caging area.

4.2 During the caging, the humanoid robot entries will be inspected to ensure that they conform to the leg specifications. Robot handlers should demonstrate the required number of freedoms at the specified joints. Robots that are not meeting the leg specifications will be disqualified.

4.3 How the robot run the race

4.3.1 The robot is to start from a stationary position behind the Starting Line.

4.3.2 It has to reach the WAYPOINT1 and then reach the STOP POINT. The robot must touch the BEACONs at the WAYPOINT1 and STOP POINT for the race to be considered SUCCESSFUL. The robot does not necessarily follow the guiding reflective tape exactly.

4.3.3 The robot can be stopped by the handler after touching the STOP POINT.

4.3.4 There may be a few robots running in the same time.

4.4 The running time starts when the robot crosses the Start Line and ends when the robot touches/crosses the Stop Line and shall be recorded by the official timer. The robot with the shortest running time is the winner. If a robot is not able to reach the Stop Line within 10 minutes, its race shall stop and its running time shall be 10 minutes. Only robots which complete the full race course qualify for a prize.

4.5 In the competition, there will be preliminary round, semi-final round and final round. In each round, the robot entries will be grouped in group size of 2 or 3 to race together to run on different tracks in the same time. In each round, the running times of all robots will be tabulated and compared for the fastest ones. The first N fastest robots will advance to the

next round. The number N will be determined on the competition day based on the number of entries.

4.6 Between each round, the handlers of the robots are given 5 minutes to service the robot. Changing of battery is allowed. Change of robot program is strictly prohibited.

5. CLONING

5.1 In accordance with the spirit of the competition, clones among the winning entries will only be awarded one prize. Clones will be identified during the "caging" procedure and the handlers will be notified by the judges if their robot has been identified as a clone.

5.2 The decision of the Judges will be final when implementing the rules of the humanoid robot competition.

****

Frequently Ask Questions

Q1: What happens if the humanoid falls during the walk? Will it warrant a restart from start line or start from there with a penalty?

Ans: The race will continue without restart or penalty. If the robot is bale to recover by itself and reach the finish line, the race time is still valid. If it is not able to reach the finish line, the race time will be 10 minutes.

Q2: Will the waypoints co-ordinates be known before or after caging?

Ans: It will be made known after caging.

Q3: Can we align the robot with the reflective tape at the start point ?

Ans: Yes.

Q4: Will the background of the floor of the event location be conditioned to make the white tape easy to detect?

Ans: There will no guarantee on that.

Q5: Will the lighting condition be controlled to allow easy detection of the orange beacon?

Ans: There will no guarantee on that. The race will be based on the lighting condition of the actual competition venue.

Q6: Will reset be allowed?

Ans: No reset is allowed during the race. If the robot malfunctions, the race time will be maximum time of 10 min.

Q7: Does the robot have to follow the guide tape closely?

Ans: No, the robot does not have to follow the guide tape exactly. The race is successfully done once the robot touches all the waypoint in order.

Q8: As the robot is allowed to “fall” down and recover. Can the robot use “falling and recover” mode of moving to the waypoints?

Ans: No, the robot should not deliberately use “fall” and “recover” to complete the race. The judges will have the final decision on this matter.

Q9: Does the robot have to stop after reaching the finish line?

Ans: No, the robot does not have to stop by itself. The handler may remove the robot after it reaches the finish line.

JUNIOR AUTONOMOUS ROBOT SUMO COMPETITION

1. OBJECTIVE

Participants are required to program their sumo robots so the robots are able to push the opponents out of the specified ring autonomously in according to the tournament rules. Participants are NOT allowed to remotely control the robot.

All participant must be studying in a Secondary School (or its equivalent) or 16-year-old or younger at the date of the competition. Proof of studentship must be provided upon request.

2. ROBOT SPECIFICATIONS

2.1 Robot kit set

To have a fair level of competition, the robot must be built from the iSumoBot kit set from iNOVA Microsystems Pte Ltd. (http://www.inovamicro.com/isumobot.html)

The size of the robots shall not exceed 20cm (length) x 20cm (width). There is no height restriction.

The weight shall not exceed 3 kg excluding the radio-controlled console used by the robot handler.

2.2 Labeling

All robots must be labeled with of their team names on the front of the robot. The minimum font size is Arial 24.

2.5 Clearing of Debris

Fallen items from the robots shall be removed after each match.

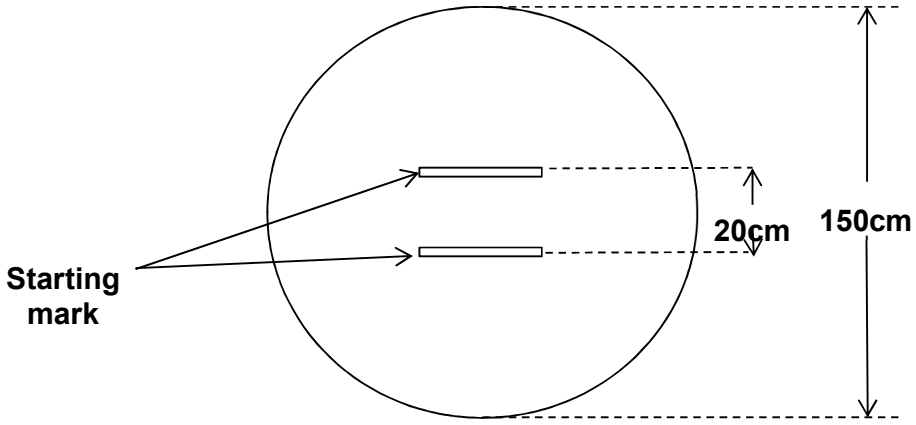
3. RING SPECIFICATIONS

3.1 Dimensions and Materials

The competition ring arena is made of aluminum sheet with natural metallic surface finishing. The diameter of the ring is 150cm. The high of the ring is at least 15mm above the floor.

3.2 Markings

There is no colored marking on the ring arena. There will be two starting lines marked physically on the surface. The marking will not alter the surface consistency overall.



4. GAMES RULES

4.1 Sumo Game

The tournament shall divide the participating teams into groups of maximum 4 robots.

A game consists of 3 matches. Each match shall last for 2 minutes. One point shall be given to every match winner. Zero point shall be given to a draw or a loser.

If a game ends with no winner, a test of strength by the two robots immediately after the last match will be the decider.

4.2 Match Winner

A robot wins when any part of the opponent robot touches the floor.

4.3 Service Time

Participants will be given one minute of Servicing -Time before the start of their game. A maximum of two members are allowed to service their robots at a designated area under supervision. Only replacement of identical parts and batteries are allowed during the Servicing-Time.

4.4 Time Out

Each team will only be given one time-out of one minute within a game (of 3 matches). The time-out will apply after the match and only for the requesting team. Changing of battery is not allowed during the time-out.

4.5 Robot Handler

A participant is allowed to handle only one same robot throughout the event. Each robot should only have one same handler. The handler and robot will be identified during the registration and caging.

5. CAGING

Robots shall be inspected and caged at least 1 hour before the start of the game.

JUNIOR RC ROBOT SUMO COMPETITION

1. OBJECTIVE

Participants are required to remotely control their sumo robots to push the opponents out of the specified ring in according to the tournament rules. Participants are to operate their robots through the radio-controlled console.

All participant must be studying in a Secondary School (or its equivalent) or 16-year-old or younger at the date of the competition. Proof of studentship must be provided upon request.

2. ROBOT SPECIFICATIONS

2.1 Robot kit set

To have a fair level of competition, the robot must be built from the iSumoBot kit set from iNOVA Microsystems Pte Ltd. (http://www.inovamicro.com/isumobot.html)

The size of the robots shall not exceed 20cm (length) x 20cm (width). There is no height restriction.

The weight shall not exceed 3 kg excluding the radio-controlled console used by the robot handler.

2.2 Labeling

All robots must be labeled with of their team names on the front of the robot. The minimum font size is Arial 24.

2.5 Clearing of Debris

Fallen items from the robots shall be removed after each match.

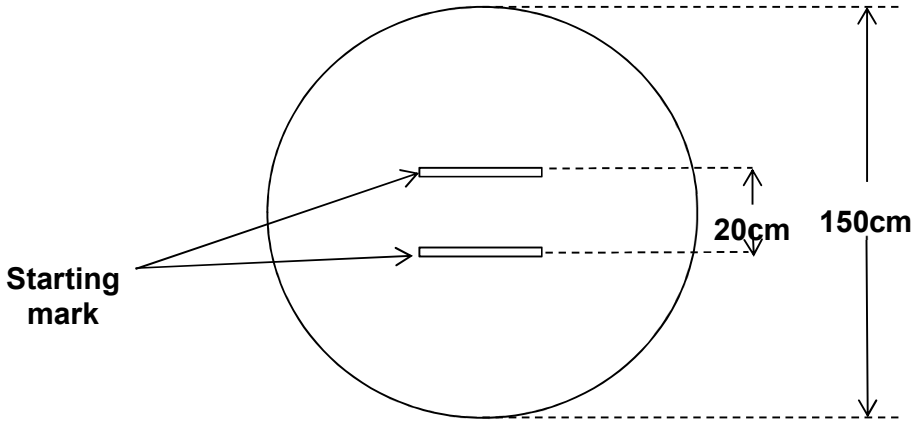
3. RING SPECIFICATIONS

3.1 Dimensions and Materials

The competition ring arena is made of aluminum sheet with natural metallic surface finishing. The diameter of the ring is 150cm. The high of the ring is at least 15mm above the floor.

3.2 Markings

There is no colored marking on the ring arena. There will be two starting lines marked physically on the surface. The marking will not alter the surface consistency overall.



4. GAMES RULES

4.1 Sumo Game

The tournament shall divide the participating teams into groups of maximum 4 robots.
A game consists of 3 matches. Each match shall last for 2 minutes. One point shall be given to every match winner. Zero point shall be given to a draw or a loser.
If a game ends with no winner, a test of strength by the two robots immediately after the last match will be the decider.

4.2 Match Winner

A robot wins when any part of the opponent robot touches the floor.

4.3 Service Time

Participants will be given one minute of Servicing -Time before the start of their game. A maximum of two members are allowed to service their robots at a designated area under supervision. Only replacement of identical parts and batteries are allowed during the Servicing-Time.

4.4 Time Out

Each team will only be given one time-out of one minute within a game (of 3 matches). The time-out will apply after the match and only for the requesting team. Changing of battery is not allowed during the time-out.

4.5 Robot Handler

A participant is allowed to handle only one same robot throughout the event. Each robot should only have one same handler. The handler and robot will be identified during the registration and caging.

5. CAGING

Robots shall be inspected and caged at least 1 hour before the start of the game.

INTRODUCTION TO NEW CHALLENGE
TREE INSPECTION ROBOT COMPETITION

1. OBJECTIVE

Participants are required to control their robots to climb a mock-up tree to a specific location and perform an inspection process by drilling a hole to a depth of 20cm while measuring the resistance force versus depth of drill.

2. SETUP SPECIFICATIONS

2.1 Robots

Robots can be autonomous or remotely controlled.

2.2 Tree

Tree trunk would be irregular in shape and would have at least 1 branch. Maximum height of the tree should not exceed 3m.

2.5 Clearing of Debris

Fallen items from the robots shall be removed after each match.

3. SCORING

3.1 Dimensions and Materials

The competition ring arena is made of aluminum sheet with natural metallic surface finishing. The diameter of the ring is 150cm. The high of the ring is at least 15mm above the floor.

3.2 Markings

There is no colored marking on the ring arena. There will be two starting lines marked physically on the surface. The marking will not alter the surface consistency overall.

4. GAMES RULES

4.1 Game

The tournament shall divide the participating teams into groups of maximum 4 robots.
A game consists of 3 matches. Each match shall last for 2 minutes. One point shall be given to every match winner. Zero point shall be given to a draw or a loser.
If a game ends with no winner, a test of strength by the two robots immediately after the last match will be the decider.

4.2 Match Winner

A robot wins when any part of the opponent robot touches the floor.

4.3 Service Time

Participants will be given one minute of Servicing -Time before the start of their game. A maximum of two members are allowed to service their robots at a designated area under supervision. Only replacement of identical parts and batteries are allowed during the Servicing-Time.

4.4 Time Out

Each team will only be given one time-out of one minute within a game (of 3 matches). The time-out will apply after the match and only for the requesting team. Changing of battery is not allowed during the time-out.

4.5 Robot Handler

A participant is allowed to handle only one same robot throughout the event. Each robot should only have one same handler. The handler and robot will be identified during the registration and caging.

5. CAGING

Robots shall be inspected and caged at least 1 hour before the start of the game.

VERSION NOTES (V27.1)

1. DESCRIPTION

This section lists the revisions made to the Rules in the current version as compared to the previous release. The list will only mention the specific sections revised and the pages the sections were located in the current rulebook, but not the detailed contents.

2. CURRENT REVISION (DATED 20 SEPTEMBER 2019)

No.	Event Name	Section	Page	Brief Description
1	Underwater Robot Competition	7	20 - 24	Revert to single robot match. Points for AUV updated.
2	Junior Autonomous Robot Sumo Competition	9	28	Age limit description amended.
3	Junior RC Robot Sumo Competition	10	30	Age limit description amended.
4	Tree Climbing Robot Competition	11	32 -	Introductory rules.