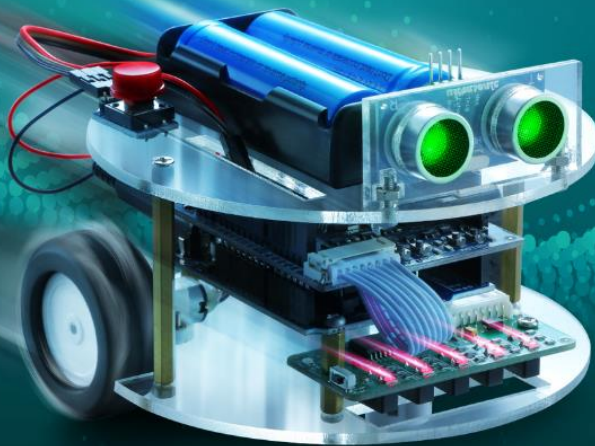


# PETROSAINS RBTX CHALLENGE 2023



## RULES AND REGULATIONS



## ROBO TRACER Advance 13 - 17 years old

It is recommended that you review the general terms and conditions prior to reading the rules for a specific category, as the general terms and conditions apply to all categories throughout the entire competition.

Version: 15 April 2023

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## 1. Introduction

As you prepared to leave for the RBTX Challenge 2023, you looked around your home and noticed the accumulated excess clutter over the years. You knew that this clutter not only made your home look messy but also made it harder for you to find things when you needed them. You also realized that this clutter was taking up valuable space that could be used for other things. Determined to make a change, you decided to start by building and stacking your belongings in a more organized manner.

**The Robo Tracer Advance category aligns with SDG 9. The efficient use of space and resources is a key component of sustainable development, and SDG 9 specifically aims to build resilient infrastructure, promote sustainable industrialization, and foster innovation. In this challenge, young innovators aged 13 to 17 years old are tasked to create a robot that collects and stacks items in a designated area, thereby creating awareness in communities of the importance of reducing excess clutter and utilizing space more efficiently.**

### Theme

**SDG 9: Industry, Innovation, and Infrastructure** - By utilizing robotics technology, industries can increase efficiency and productivity while minimizing the negative environmental impact of traditional manufacturing processes.



*Link to United Nations Sustainable Development Goals: - [Measuring progress towards the Sustainable Development Goals - SDG Tracker \(sdg-tracker.org\)](https://sdg-tracker.org)*

## 2. General Rules

### 2.1. Competition Phases

- I. **Registration:** Each team is required to register through the RBTX website. Each participant can register for one team **ONLY**.
- II. **Online Learning:** Participants are required to complete the learning modules and passed the assessment in the RBTX Portal to proceed for the next level. Passing marks is 80%.
- III. **Zone Qualifying:** The zone qualifying stage will be held physically. Participants need to attend physically at the zone qualifying venue. All costs incurred shall be borne solely by the participating teams.
- IV. **Grand Finals:** Top teams from the Zone Qualifying Stage will be selected to move on to the onsite Grand Finals. All finalists will be informed of the competition schedule right after the completion of the qualifying stage. All costs incurred shall be borne solely by the participating teams.

### 2.2. Participants

- 2.2.1. All team members except for the guardian must be between 13 to 17 years of age. (Maximum of two (2) team members).
- 2.2.2. The guardian can be a teacher, parent, mentor, or technical advisor.
- 2.2.3. The guardian is not allowed to touch or repair the robot during all phases of the competition (Refer to **2.1. Competition Phases**)
- 2.2.4. The guardian should not be involved in the programming of the robot during all phases of the competition (Refer to **2.1. Competition Phases**).
- 2.2.5. In the case of any interference by the guardian with the robot or referee decisions during any phase of the competition, the team will risk disqualification.

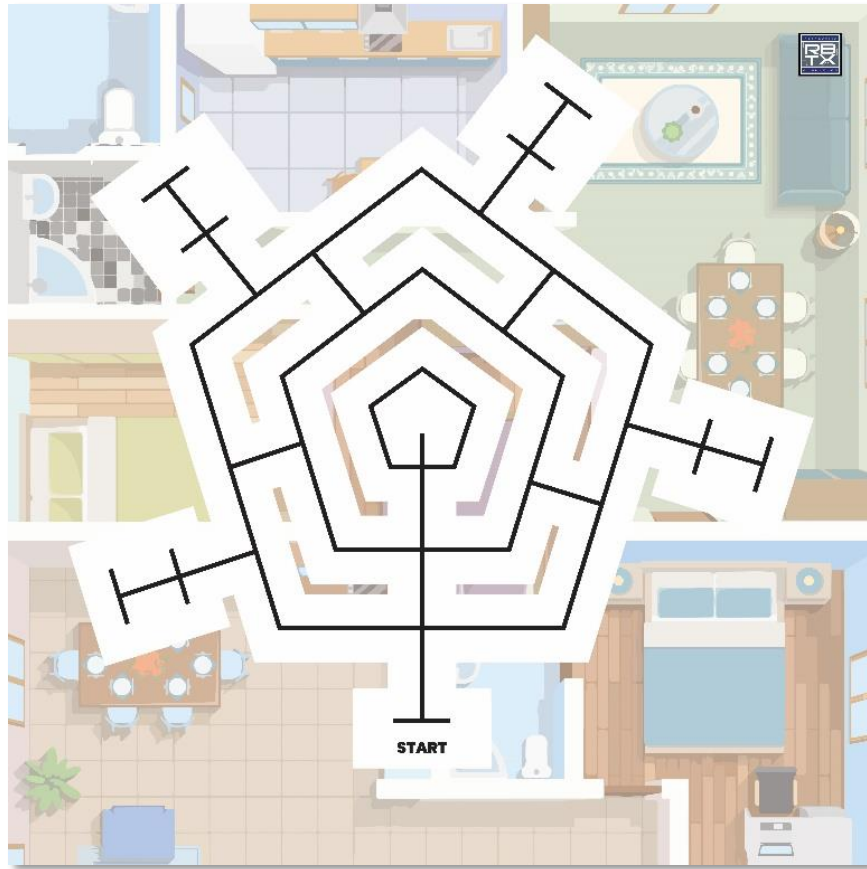
### 2.3. Competition Field and Mission Items

It is encouraged for participating teams to print their own competition field for the preparation & practice for the Zone Qualifying and Grand Finals stages. The competition field template will be issued by the organizer in PDF format.

#### 2.3.1. Field specifications

- i. The maximum dimensions of the Zone Qualifying and Grand Finals competition field are 3 meter x 3 meter.
- ii. The track for the game will consist of 3 pentagons with at least 200mm spacing in between. The grid will include black lines (on white tiles). There will also be a section of junction lines for the mission placements.
- iii. All the grid lines on the competition field are at least 16mm - 18mm in width and are black in colour.
- iv. Expect all measurements and dimensions to have a 10% tolerance.

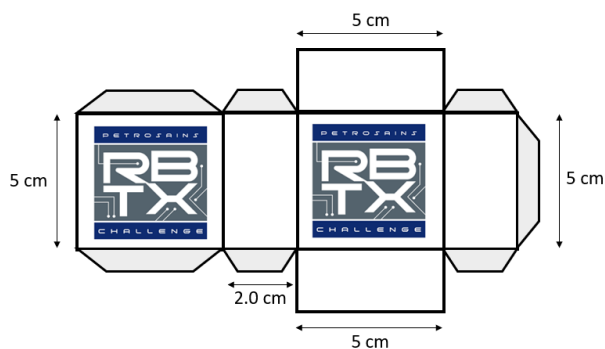
- v. There will be a Start Zone and THREE (3) Mission Item Placements.
- vi. The layout of the competition field is as below:



**Disclaimer: The track is fixed but the object placements will be revealed few days before event day (zone qualifying).**

### 2.3.2. Mission Item

The Mission Items are identified as a cuboid with the size of 50mm x 50mm x 20mm (Width x Length x Height) as follows:



\*Can be printed on A4 (350- 400gm) for training purposes. Zone qualifying and Grand Finals will be wooden block / 3D printed block.

- 2.3.3. The team's mission is to stack the cuboids one by one from the mission placements to the stacking area.
- 2.3.4. The weight of each cuboid is on average  $\pm 20$  grams (not more than 25 grams).
- 2.3.5. If the mission fails, the team can choose to restart the mission with their point tally reset to zero.

### 3. The Competition

#### 3.1. Moving the Mission Item

- 3.1.1. There are no restrictions on how the robots can move the mission items, as long as it does not cause damage to the competition field or the mission item.
- 3.1.2. The robots may push, carry, lift, or drag to move the mission item.
- 3.1.3. The robots may be equipped with claws, grippers, scoops, pushers and so forth to move the mission items.
- 3.1.4. The robots can only carry one mission item at a time from the object placement to the stacking area.

### 4. The Robot

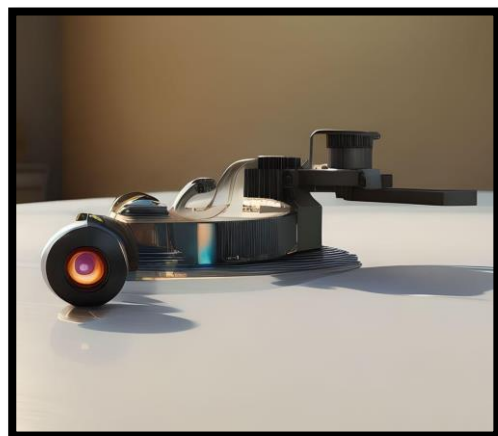
#### 4.1. Dimensions

Every robot must comply with the following robot size specifications (when all parts and accessories are fully extended):

- Width – 200 mm max
- Length – 200 mm max
- Height – no limit



Top View



Side View

## 4.2. Control and Programming

4.2.1. The robot must move autonomously with no human aid.

4.2.2. The controller unit should be embedded in the robot and cannot be placed on the robot's exterior.

4.2.3. The robot must be programmed by the team members (either text-based or GUI programming) and uploaded during the Construction and Programming phase.

## 4.3. Power Source

4.3.1. The robot must be powered by a power source such as a battery fixed onto the robot.

4.3.2. The robot cannot be powered by a stationary power source connected to the robot by a cord.

## 4.4. Sensors

4.4.1. A maximum of five-line sensors are allowed.

4.4.2. Ultrasonic/IR sensors are allowed as long as the robot body does not violate the robot's dimension (Refer to **4.1. Dimensions** ).

## 4.5. Construction

Any robot kit or building material may be used, as long as the robot fits the specifications. The team may risk disqualification if the robot or any of its parts cause damage or deface the competition field.

## 5. Game Play

### 5.1. Game Zone

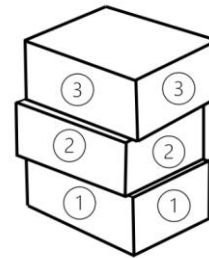
An area around the field will be designated as the **Game Zone**. No one is allowed inside the game zone except for the robot handlers (two team members).

#### 5.1.1. Scoring

Points are given when mission items are correctly placed in the stacking area.

##### **Cuboid stacking weightage:**

Third Cuboid	= 3 points
Second Cuboid	= 2 points
First Cuboid	= 1 point



- i. Additional one (1) point will be given if the robot reaches the finishing line.
- ii. The final score will be the total points accumulated based on the number of cuboids in the stacking area and robot reaches the finishing line. The maximum point would be 7 points.
- iii. The **Mission Time** is the time recorded for the robot to complete tracing the route from the Start Zone until it **completes the mission and returns to the Start Zone**.
- iv. The mission time starts once the robot starts to move.
- v. The final mission time is concluded as and when any part of the robot returns to the start zone.
- vi. The team with the **highest points will be ranked first**. If there are two teams or more with the same accumulated points, the team with the fastest mission time will be ranked higher.

#### 5.1.2. Restart

- i. The robots and the mission items will be placed at the start zone and any T-junction in the competition field.
- ii. The robot handlers may request a restart whenever it is deemed necessary within the three minutes time limit. During the restart process, the handlers are allowed to make minor adjustments to the robots but not in terms of programming or replacing parts.
- iii. When restarting, all robots and missions must be placed back inside the start zone accordingly.
- iv. The mission time will be reset to zero.



- v. There is no limit to the number of restarts within the three minutes time limit.
- vi. The robots **must restart** if:
  - The robot handler asks for a restart.
  - The robot handler touches any parts of the robot.
  - The robot moves off the field.
- vii. It is **advised** for the robots to **restart** if:
  - The mission items fall or are wrongly placed on the track.
  - The robot is unable to return to the start line.

### 5.1.3. Deciding the Winner

The winner will be decided based on the following criteria:

- i. Highest score
- ii. The team with the fastest mission time.
- iii. As per the judges' decision.

## 6. Code of Conduct

### 6.1. Fair Play

- 6.1.1. It is expected that all teams aim to play a fair and clean game.
- 6.1.2. The rules are enforced at the discretion of the referees, officials, and local law enforcement authorities.
- 6.1.3. Participating teams and robots that do not meet the regulations and specifications are not allowed to compete in the competition.
- 6.1.4. Participating teams that violate the code of conduct may be asked to leave the competition and risk disqualifying.

## 7. Judges

- 7.1. All decisions on scoring, game play and timing are made by the judges. Teams should completely respect their votes and decisions.
- 7.2. Judges may announce new rules or decisions about any issues that might not be mentioned in the existing rules and regulations, which must be abided by all participants.

## 8. Zone Qualifying Stage

### 8.1. Phases of Competition

The competition is divided into three (3) phases as per the following:

- i. **Track Testing**
- ii. **Robot Quarantine**
  - Upon the completion of Track Testing during the allocated time, all robots will be placed in the Quarantine area by the contestants. No addition, removal, or changes of hardware or software is allowed during this period.
- iii. **Competition Run**
  - In the Competition Run, contestants will take their robots from the Quarantine Area and place them on the track.

### 8.2. Competition Run and Tasks

8.2.1. Each team will have ONE (1) competition run.

8.2.2. The competition run will have its own Track Testing and Quarantine phase.

8.2.3. The competition run should not last more than three minutes (labelled as RUNTIME).

8.2.4. If a robot has yet to complete all the tasks once the RUNTIME is over, a BUZZER will sound, and the team will be asked to remove the robot from the COMPETITION FIELD.

8.2.5. The position of the objects will be revealed within 2 weeks before the day of the competition and may change between competition runs.

#### 8.2.1. Race clock

- i. When the robot moves from the START a timer will begin to count the **RACE TIME**.
- ii. The time that the robot takes to pass each target will be recorded. As it reaches the final line, the timer will **stop and the final recorded RACETIME value will be saved**.

### 8.3. Team Members & Mentors

8.3.1. All team members except for the team mentor must be between **13 to 17 years of age**. (Maximum of two team members)

8.3.2. Only one mentor in the team is allowed as a technical advisor.

8.3.3. The technical advisor is not allowed to touch or repair the robot during the phases of the competition (Refer to **2.1. Competition Phases**)

8.3.4. The technical advisor should not be involved in the programming of the robot during the phases of the competition (Refer to **2.1. Competition Phases**)

8.3.5. In case of any interference by the technical advisor with the robot or referee decisions during the competition, the team will risk disqualification.

#### 8.4. Competition Field

As stated in General Brief (Refer to **2.3 Competition Field and Mission Items**)

#### 8.5. The Robots

As stated in General Brief (Refer to **4. The Robot**)

#### 8.6. Game Play

##### 8.6.1. Game Zone

An area around the field will be designated as the GAME ZONE. No one is allowed inside the game zone except for the robot handlers, referees, and Petrosains' RBTX advisors.

#### 8.7. Start and Restarts

8.7.1. One team member is elected as the robot handler. Only that team member is permitted to handle the robot during the game.

8.7.2. The robot will be placed at the START line and checked by one of the referees.

8.7.3. A robot may restart the run as the handlers deem necessary within the RUNTIME. The restart can be requested only if the robot doesn't follow the line, has stopped halfway or has lost direction.

8.7.4. At any restart, the robot must be positioned back at the start line.

8.7.5. Adjusting the sensor position on the robot is allowed during the allocated RUNTIME.

8.7.6. The MISSION TIME will be reset to zero on every restart and all checkpoint marks will also be zero. The RUNTIME will keep running during all restarts.

8.7.7. There is no limit for the number of restarts within the RUNTIME of three minutes.

8.7.8. A robot **must restart** if:

- a. The robot handler asks for a restart.
- b. The robot is touched by a contestant.
- c. The robot moves off the field.

8.7.9. It is **advised** for the robots to **restart** if:

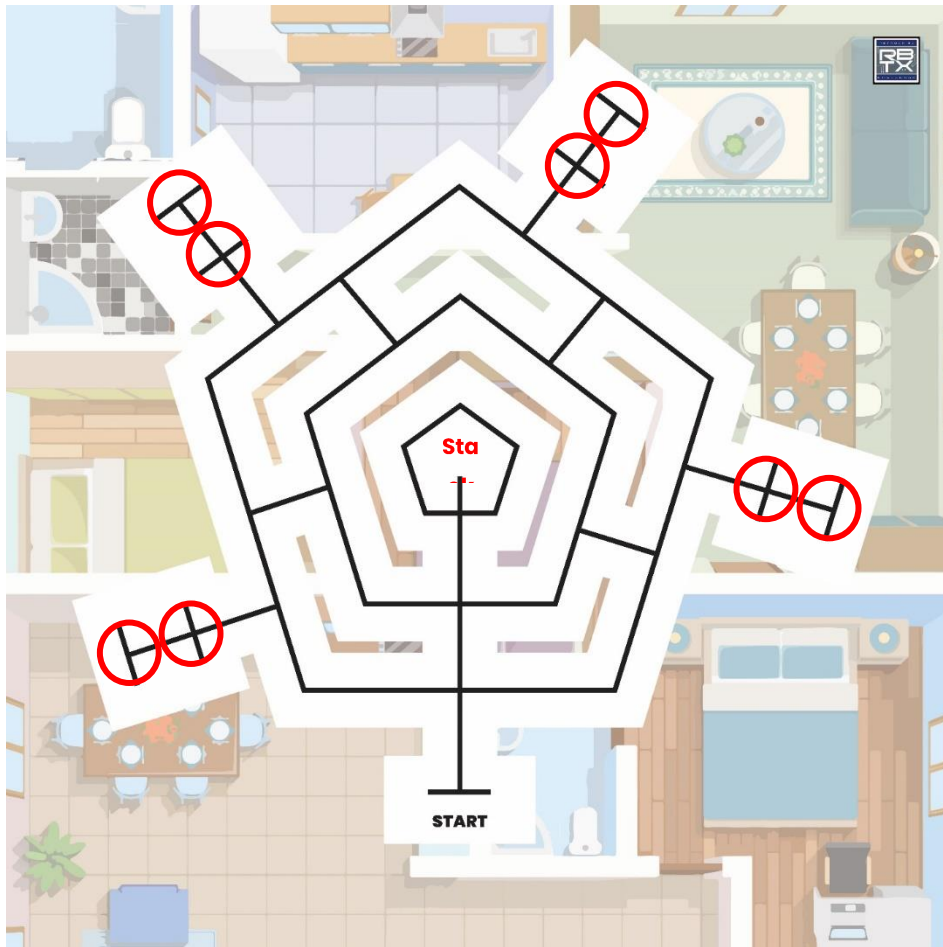
- a. The mission items fall or are wrongly placed on the track.
- b. The robot is unable to return to the start line.

## 8.8. Following the Line

8.8.1. To determine if the ROBOT has left the line or left the tile, the referee will use the CONVEX HULL of the robot. This measure is done by stretching an imaginary rubber band around the extremities of the robot and using the enclosed space as a silhouette.

8.8.2. A team's robot must remain on the field until it has completed its game.

## 8.9. Tasks position



**Remark: The object mission will be placed at any of the T-junctions in the track. There will be a possibility of 8 object mission placements in the track. Participants are encouraged to prepare with coding before the event day.**

- i. There will be at least THREE (3) object missions to be stacked.
- ii. The robot should be able to collect object mission and the items need to be stacked inside the stacking area while ensuring they do not come in contact with the edge of the stacking area (smallest pentagon).

## 8.10. Scoring

As stated in General Brief (Refer to **5.1.1 Scoring**)

## 8.11. Code of Conduct

As stated in General Brief (Refer to **6. Code of Conduct**)

## 8.12. Judges

As stated in General Brief (Refer **7. Judges**)

## 9. Grand Final Stage

### 9.1. Phases of Competition

The competition is divided into three phases as per the following:

**i. Construction and Programming**

The minimum Construction and Programming time is ONE hour. It can be extended depending on track complexity and subjected to committee discretion.

**ii. Quarantine**

Upon the completion of Construction and Programming during the allocated time, all robots will be placed in the Quarantine area by the contestants. No addition, removal, or changes of hardware or software is allowed during this period.

**iii. Competition Run**

In the Competition Run, contestants will take their robots from the Quarantine Area and place them on the track.

### 9.2. Competition Run

9.2.1. Each team will have two (2) competition runs.

9.2.2. The first competition run will have its own Construction and Programming and Quarantine phase. And second competition run will ONLY have a Quarantine phase.

9.2.3. The competition run should not last more than THREE (3) minutes (labelled as RUNTIME).

9.2.4. If a robot has yet to complete all the tasks once the RUNTIME is over, a BUZZER will sound, and the team will be asked to remove the robot from the COMPETITION FIELD.

9.2.5. The position of the objects and locations will be revealed on the day of the competition.

### 9.3. Race clock

9.3.1. There will be optical sensors that can detect the robot's movements.

9.3.2. When the robot moves from the START line and passes these optical sensors, a timer will automatically begin to count the MISSION TIME.

9.3.3. As the robot reaches the finish line, the timer will stop, and the final recorded MISSION TIME value will be saved.

#### 9.4. Team Members & Mentors

- 9.4.1. All team members except for the team mentor must be between **13 to 17 years of age**. (Maximum of two team members)
- 9.4.2. Only one mentor in the team is allowed as a technical advisor.
- 9.4.3. The technical advisor is not allowed to touch or repair the robot during the phases of the competition (Refer to **2.1. Competition Phases**).
- 9.4.4. The technical advisor should not be involved in the programming of the robot during the phases of the competition (Refer to **2.1. Competition Phases**)
- 9.4.5. In case of any interference by the technical advisor with the robot or referee decisions during the competition, the team will risk disqualification.

#### 9.5. Competition Field

As stated in General Brief (refer **2.3 Competition Field and Mission Items**)

#### 9.6. The Robots

The dimensions, power source, sensors, start button and construction is as stated in General Brief (Refer to **4. The Robot**) but for **control and programming** is as below:

- 9.6.1. The robot must be controlled autonomously with no human aid.
- 9.6.2. The controller unit should be embedded in the robot and cannot be placed on the robot's exterior.
- 9.6.3. The robot must be programmed by the team members (either text-based or graphical programming) and uploaded during the Construction and Programming phase. No pre-programming of the robot or switch-based coding is allowed.
- 9.6.4. Any type of communication device or medium of communication is prohibited during the Construction and Programming phase. These include but are not limited to handphones, internet connection, emails, WhatsApp, messengers, etc.
- 9.6.5. Contestants should prepare a laptop/computer for this purpose and must carry a fully charged battery in case of a power supply problem at the competition venue.

#### 9.7. Game Play

##### 9.7.1. Construction Zone

An area inside the competition venue will be designated as the CONSTRUCTION ZONE. No one is allowed inside the construction zone except for the robot handlers, referees, and Petrosains' RBTX advisors.

### 9.7.2. Game Zone

An area around the field will be designated as the GAME ZONE. No one is allowed inside the game zone except for the robot handlers, referees, and Petrosains' RBTX advisors.

### 9.7.3. Start and Restarts

- i. One team member is elected as the robot handler. Only that team member is permitted to handle the robot during the game.
- ii. The robot will be placed at the START line and checked by one of the referees.
- iii. A robot may restart the run as the handlers deem necessary within the RUNTIME. The restart can be requested only if the robot doesn't follow the line, has stopped halfway or has lost direction.
- iv. At any restart, the robot must be positioned back at the start line.
- v. Adjusting the sensor position on the robot is allowed during the allocated RUNTIME.
- vi. The MISSION TIME will be reset to zero on every restart and all checkpoint marks will also be zero. The RUNTIME will keep running during all restarts.
- vii. There is no limit for the number of restarts within the RUNTIME of three minutes.
- viii. A robot **must restart** if:
  - a. The robot handler asks for a restart.
  - b. The robot is touched by a contestant.
  - c. The robot moves off the field.
- ix. It is **advised** for the robots to **restart** if:
  - a. The mission items fall or are wrongly placed on the track.
  - b. The robot is unable to return to the start line.

### 9.7.4. Following the Line

- i. To determine if the ROBOT has left the line or left the tile, the referee will use the CONVEX HULL of the robot. This measure is done by stretching an imaginary rubber band around the extremities of the robot and using the enclosed space as a silhouette.
- ii. A team's robot must remain on the field until it has completed its game.

## 9.8. Scoring

As stated in General Brief (Refer **5.1.1 Scoring**)

## 9.9. Code of Conduct



As stated in General Brief (Refer to **6. Code of Conduct**)

9.10. Judges

As stated in General Brief (Refer **7. Judges**)

9.11. Behavior

9.11.1. Contestants who misbehave may be asked to leave the competition area and risk being disqualified from the contest.

9.11.2. The rules will be enforced at the discretion of the referees, officials, and local law enforcement authorities.

9.12. Juries

9.12.1. All decisions about scoring, game play and timing are made by the juries. Teams should completely respect their vote and decisions.

9.12.2. Juries may discuss and announce new rules or decisions about any issues that are not mentioned in the rules and regulations. Objections will not be entertained.