PETRONAS Powering Knowledge

#RBTX2024

Awarded by:

PETROSAINS RBTX CHALLENGE 2024

RULES AND REGULATIONS

TECH MARVELS

VERSION 8 OCTOBER 2024

It is recommended that you review the General Terms and Conditions prior to reading the rules for a specific category, as it applies to all categories throughout the entire competition.

Contents

1.0 INTRODUCTION **7**

2.0 GENERAL RULES **8**

2.1 COMPETITION PHASES 8
2.2 PARTICIPANTS 8

3.0 COMPETITION FIELD AND MISSION ITEMS **9**

3.1 FIELD SPECIFICATIONS 9
3.2 MISSION ITEM 10
3.3 THE MISSION 10

4.0 THE ROBOT **12**

4.1 DIMENSIONS 12
4.2 CONTROL AND PROGRAMMING 12
4.3 POWER SOURCE 12
4.4 SENSOR 13
4.5 START BUTTON 13
4.6 CONSTRUCTION 13
4.7 GRIPPER 13

5.0 CODE OF CONDUCT **13**

5.1 FAIR PLAY 13
5.2 JUDGES 13

6.0 COMPARISON OF EVERY STAGE **14**

APPENDIX **20**

The main changes in the general rules at **8 October 2024** are listed below:

6.0 COMPARISON OF EVERY STAGE

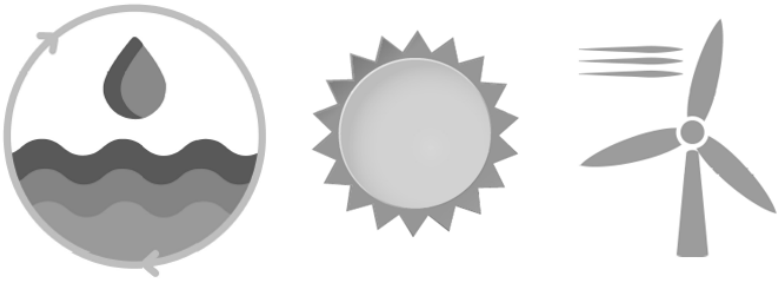
ITEMS	GRAND FINALS STAGE
Phases of Competition	Contestants should prepare a laptop/computer & WiFi, for this purpose and must carry a fully charged battery in case of a power supply problem at the competition venue.
Competition Run and Tasks	c) The position of the image cube and 2 drop point image and signboard measurement will be revealed within TWO (2) weeks before the day of the competition and may change between competition runs. d) The starting point, extra image cube, drop point image and its location will be revealed on the competition day. e) The image cube and drop point location may change between competition runs.
Start and Restarts	b) The robot will be placed at the START line and checked by one of the referees.   Top view Side view **k**) The referee will record the **most recent RACETIME using official timer or watch**.
Scoring	b) Race time is started once the robot starts moving, and the final Race time is concluded and ~~displayed on the robot~~ as and when any part of the robot touches the finish line. The referee will record the most recent RACETIME using their official timer or watch.

Point	Scan & detect AI image **ONE (1) point** will be given. The robot scan & detect all **3 AI images = THREE (3) points** will be awarded. There will be additional **AI image** and **image cube**. which will be revealed on the day of the Grand Final.

APPENDIX

C) AI IMAGES:

*** Size A4 Paper (Image diameter 12 - 15cm)*



The main changes in the general rules from **2 August to 7 August** are listed here.

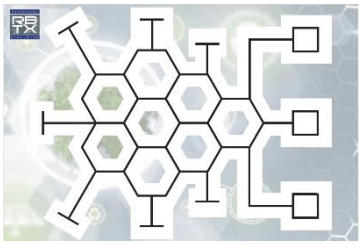
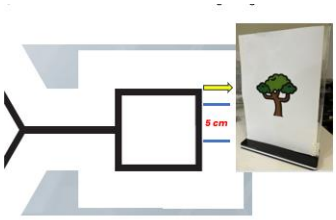
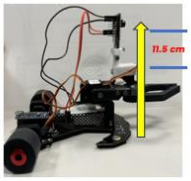
<table>
<tr>
<td>Rule 6.0</td>
<td>
Comparison of Every Stage

Point
<table>
<tr><td rowspan="5">Point</td><td>TWO (2) points will be awarded for each image cube that is successfully placed in the correct location.</td><td>TWO (2) points will be awarded for each image cube.
that is successfully placed in the correct location.</td></tr>
<tr><td>NO POINT (0) point if the image cube is placed in an incorrect location.</td><td>NO POINT (0) point if the image cube is placed in an incorrect location.</td></tr>
<tr><td>Scan & detect AI image ONE (1) point will be given.
The robot scan & detect all 3 AI images = THREE (3) points will be awarded.</td><td>Scan & detect AI image ONE (1) point will be given.
The robot scan & detect all 3 AI images = THREE (3) points will be awarded.</td></tr>
<tr><td>Extra ONE (1) point will be given if the robot returns back to start line after completed all mission</td><td>Extra ONE (1) point will be given if the robot returns back to start line after completed all mission.</td></tr>
<tr><td></td><td>Extra TWO (2) point will be given if the AI robot detect & function before, they run robot at track.</td></tr>
</table>
</td>
</tr>
</table>

The main changes in the general rules from **27 May to 2 August** are listed here:

<table>
<tr><td rowspan="2">2.0 General Rules</td><td>2.1 Competition Phases
a. Online Learning: Participants are required to complete the Learn Coding to be eligible for certification of participation.</td></tr>
<tr><td>2.3.1 Field specifications
a. Dimension: 3 meter x 2.3 meter .</td></tr>
<tr><td>File</td><td>Amendment track and updated cube file in Petrosains RBTX Challenge website</td></tr>
</table>

The main changes in the general rules from **1 May to 27 May** are listed here:

<table>
<tr><td>Rule 2.0</td><td>Competition Field & Mission Items: Updated Track
  </td></tr>
<tr><td rowspan="2">Rule 4.0</td><td>The Mission
e) The robots can only carry ONE (1) image cube from “T” junction to designated specific area at one time.</td></tr>
<tr><td>A.I (Artificial Intelligence) Recognition/Detection
a) Distance from box area to AI training image.
 
b) Camera position height from ground to the center of camera.
  </td></tr>
<tr><td>Appendix 1</td><td>Updated
A) Example Track for Zone Qualifying & Grand Finals
B) Images Cube Zone Qualifying.
C) AI Images</td></tr>
</table>

[Tech Marvels]

A forward-thinking and action-oriented teams challenge for participants **aged 13 - 17 years old**. The challenge is not only engaging participants in a meaningful in a meaningful manner while highlighting the importance of energy-efficient thinking, encouraging participants to consider how their choices can contribute to a more sustainable future. AI is also incorporated in this category as to scaffold further the knowledge and skills among the participants.

1.0 INTRODUCTION

Robot Tracer competitions and green technology intersect in various ways including:

Efficiency and Sustainability: Green technology often revolves around making processes more efficient and sustainable. Using AI is one of the ways to increase efficiency in processes.

Automation for Environmental Monitoring: Petrosains RBTX Challenge Competition Robot Tracer Category involve robots to navigate through controlled environment to perform tasks. These tasks could include environmental monitoring for pollution or wildlife conservation purposes, aligning with the goals of green technology by using automation to collect data that can inform sustainability efforts.

Innovation and Collaboration: Collaboration between industries and disciplines is essential for advancing both green technology and robotics. Participants in robot tracer competitions may collaborate with experts in green technology to develop innovative solutions that benefit both fields.

Education and Awareness: Both robot tracer competitions and green technology initiatives often involve education and raising awareness. These competitions provide opportunities to educate participants and spectators about the importance of sustainability and the role of technology in addressing environmental challenges.

By exploring the intersection between robot tracer competitions and green technology, we can promote the development of sustainable robotics solutions and inspire future **generations to pursue careers in science, technology, engineering, and mathematics (STEM) fields with a focus on environmental stewardship.**

2.0 GENERAL RULES

2.1 Competition Phases

a) **Registration:** Each team is required to register through the RBTX portal via RBTX microsite. Each participant can register for one team **ONLY**.
b) **Online Learning:** Participants are required to complete the Learn Coding to be eligible for certification of participation.
c) **Zone Qualifying Online Briefing:** Qualifiers are required to attend online briefings before zone qualifying to receive the updated game rules and regulations, competition schedules and flow. Participants are required to respond to the RSVP request prior to the Zone Qualifying stage.
d) **Zone Qualifying:** The zone qualifying stage will be held onsite. The zone level e-certificate will be awarded only to the qualifiers who attended and competed at the zone qualifying round. All costs incurred shall be borne solely by the participating teams.
e) **Grand Finals Online Briefing:** Finalist are required to attend online briefing before grand finals to receive the updated game rules and regulations, competition schedules and game flow. Participants are required to respond to the RSVP request prior to the Grand Final stage.
f) **Grand Finals:** Selected teams from the Zone Qualifying Stage will proceed to the Grand Finals which will be held onsite. All costs incurred shall be borne solely by the participating teams.

2.2 Participants

a) Everyone is allowed to sign up for one team in one category only. Participants are not allowed to sign up for more than one team, or in more than one category.
b) All team members except for the guardian must be between 13 to 17 years old of age. (Maximum of two team members).
c) No changes of participants are allowed once registration is complete.
d) The guardian can be a teacher, parent, mentor, or technical advisor, and must be 18 years and above.
e) The guardian is not allowed to touch or repair the robot during all phases of the competition.
f) Only participants are permitted to program the robot throughout all stages of the competition; the guardian is not allowed to be involved in the programming process.
g) If the guardian interferes with the robot at any point during the competition, the team may risk disqualification.
h) Participants should comply with the safety requirements throughout the competition.

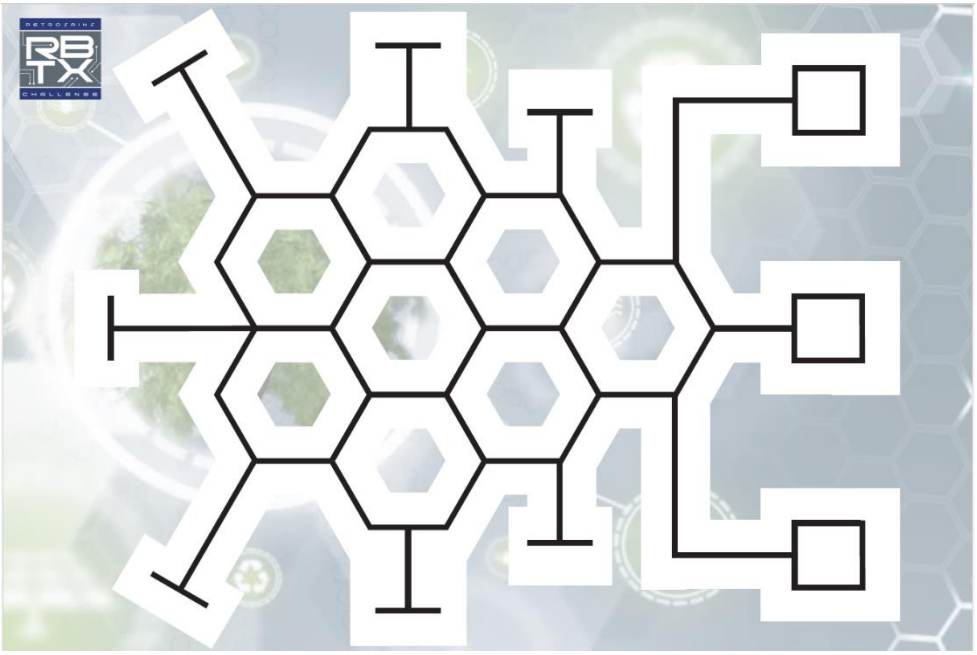
i) Participants must adhere to respectful behavior, sportsmanship, and ethical usage of technologies. Organizers may prohibit practices such as cheating, sabotage, or malicious interference during the competition.

3.0 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 in **exact measurement.**

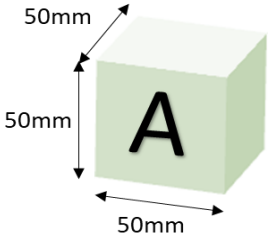
3.1 Field specifications

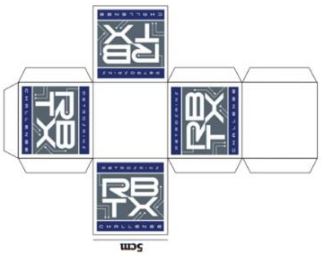
a) **Materials:** tarpaulin with matte surface**.**
b) **Dimension:** 3 meter x 2.3 meter.
c) **Grid lines:** 1.6cm to 2.0cm in width and are black in color.
d) Expect all measurements and dimensions to have a 10% tolerance. A printable rule scaler and robot size checker will also be made available to ensure accurate competition field measurements and robot specifications.
e) The layout of the competition field is as follows:



3.2 Mission Item

a) The image cube for pick up measurement is **5cm W x 5cm L x 5cm H**:



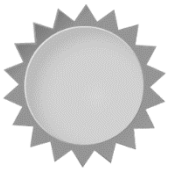


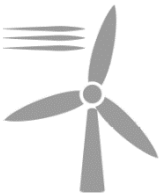
*Can be printed colour on A4 (300 - 350 gsm).

(For image, please refer Appendix 1)

b) Drop point is the location where the robot needs to scan an image signboard to drop the image cube. The measurement will be revealed during the briefing session.

Images for Qualifying round. Note that images for the Grand Finals will be revealed on the competition day.





3.3 The Mission

a) The robot shall begin from the starting point.

b) The robot should be able to pick up an image cube with a gripper, from “T” junction and transport it through the ‘Honeycomb’ path and drop the image cube at designated drop point.

c) The robots can only carry, lift, or push **ONE (1)** image cube from “T” junction to a specific drop point at one time.

d) To identify the correct drop point, robot **MUST use Artificial Intelligence (AI)** approach.

e) The robots can only carry **ONE (1)** image cube from "T" junction to designated specific area at one time.

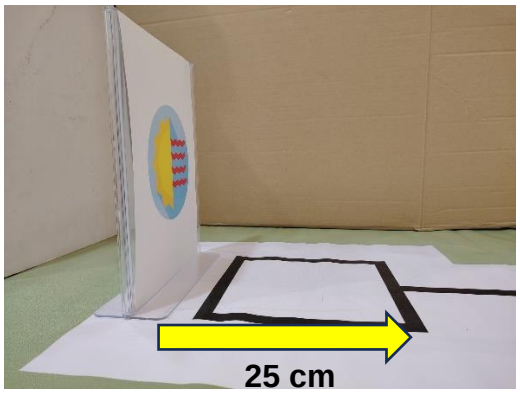
f) If the mission item **falls or is wrongly placed on the drop point,** the robot handlers may request a **RESTART** (Refer to 5 e. Error! Reference source n ot found.).

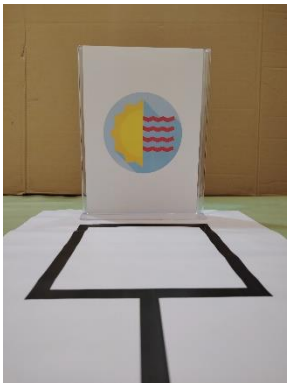
g) The starting point, the position of the image cube and the drop point image are at the sole discretion of the competition organizer and will be revealed to all teams as per the following:

1. **Zone Qualifying Phase** – Two (2) weeks before the Zone Qualifying stage competition date.
2. **Grand Finals Phase** – On the day of the Grand Finals competition date
3. The teams may face an additional challenge during the Grand Finals.

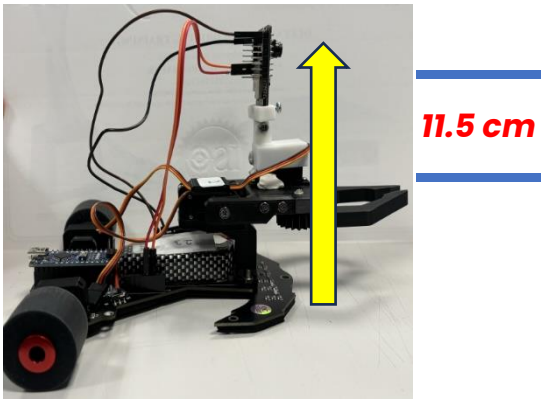
A.I (Artificial Intelligence) Recognition/Detection

A) Distance from camera to AI training image.





B) Camera position height from ground to the ***center*** of camera.



4.0 The Robot

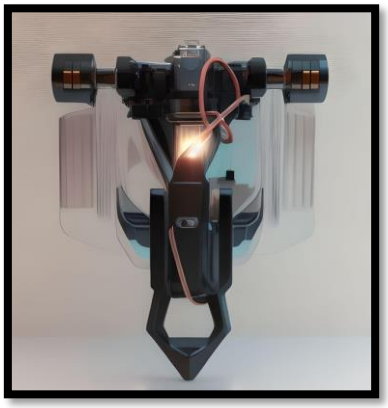
Each team must have its own robot and must not be shared with other participants of the Petrosains RBTX Challenge 2024.

Every robot must comply with the following specifications.

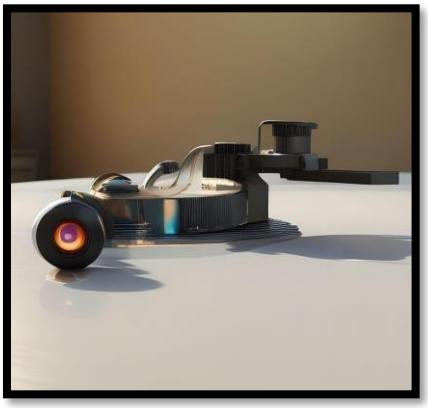
4.1 Dimensions

Ensure all parts and accessories are **fully extended**:

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



Top View



Side View

4.2 Control and Programming

a) The robot must operate autonomously, relying solely on sensors for line following and camera module with Artificial Intelligence (AI) for object recognition; it cannot be remotely controlled or receive any human aid.
b) The controller unit should be embedded in the robot and cannot be placed on the robot's exterior.
c) The robot must be programmed by the team members (either text-based or graphical programming).

4.3 Power Source

a) The robot must be powered by a power source such as a battery fixed onto the robot.
b) The robot cannot be powered by a stationary power source connected to the robot by a cord.

4.4 Sensor

a) Only a maximum of five-line tracking sensors are allowed.
b) Vision sensors (Camera) for image recognition.
c) No other form of sensors is allowed on the body.

4.5 Start Button

The robot **must be equipped with a push-button** to initiate the starting sequence.

4.6 Construction

Any robot kit or building material may be used, as long as the robot meets the above specifications.

4.7 Gripper

The robot must be equipped with **a (ONE) gripper** or **claws** only just to move the mission items. The gripper shall not damage the competition field, mission items, or harm nearby people.

5.0 CODE OF CONDUCT

5.1 Fair Play

a) It is expected that all teams aim to play a fair and clean game.
b) The rules are enforced at the discretion of the referees, officials, and local law enforcement authorities.
c) Participating teams and robot that does not meet the regulations and specifications will not be allowed to compete in the competition.
d) Participants must make sure their robot does not damage the track, or the team will be disqualified. Actions that can cause damage to the track are listed below:

    i. Tearing the track
    ii. Leaving any color marks to the track
    iii. Damaging additional item on the track (timer/hump)
    iv. Oil spillage.
    v. Glue/adhesive marks.
    vi. Any sabotaging action

5.2 Judges

a) The judges' decision in determining the winner shall be final and no appeals against the decision will be entertained.
b) Teams should completely respect their vote and decisions.

c) Petrosains reserves the right at any time without prior notice to add, alter, modify, change or vary the terms and conditions contained herein, wholly or in part at its absolute discretion and the Participants agree to be expressly bound by such additions, modifications, change or variations which must be abided by all participants.

6.0 COMPARISON OF EVERY STAGE

ITEMS	ZONE QUALIFYING STAGE	GRAND FINALS STAGE
Phases of Competition	**a) Track Testing** Tuning the robot during the allocated time.	**a) 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. ▪ The robot must be programmed and trained (AI) by the team members only and uploaded **during the Construction and Programming phase**. No pre-programming of the robot and/or switch-based coding is allowed. ▪ 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, emails, WhatsApp, messengers, etc. ▪ The usage of internet is limited to the training of AI model.

		• Contestants should prepare a laptop/computer & WiFi, for this purpose and must carry a fully charged battery in case of a power supply problem at the competition venue.
	b) Quarantine Upon completion of track testing during allocated time, all robots will be placed in the Quarantine area by the contestants. No addition, removal, or changes of hardware or coding is allowed during this period up until the end of your turn.	**b) 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 coding is allowed during this period up until the end of your turn.
	c) Competition Run In the Competition Run, contestant will bring their robot from the Quarantine Area to the competition field. Competition begins upon referee's que.	**c) Competition Run** In the Competition Run, contestant will bring their robot from the Quarantine Area to the competition field. Competition begins upon referee's que.
Competition Run and Tasks	a) Each team will have **one competition run.**	a) Each team will have **TWO (2) competition runs**.
	b) Every group will test and compete on the same field.	b) Every group will test and compete on the same field.
	c) The starting point, position of the image cube and drop point signboard measurement will be revealed within TWO (2) weeks before the day of the competition and may change between competition runs.	c) The position of the image cube and 2 drop point image and signboard measurement will be revealed within TWO (2) weeks before the day of the competition and may change between competition runs.
	d) The drop point location will be revealed on the day of the competition.	d)The starting point, extra image cube, drop point image and its location will be revealed on the competition day.

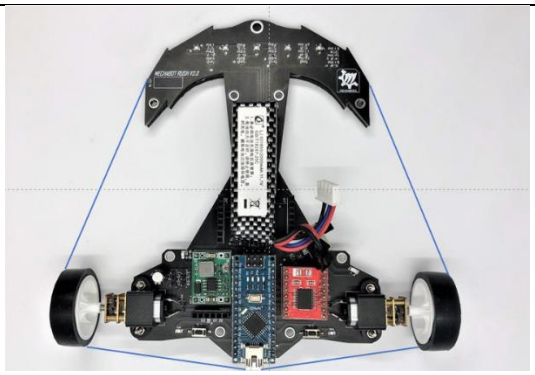
<table>
<tr><td></td><td></td><td>e) The image cube and drop point location may change between competition runs.</td></tr>
<tr><td></td><td colspan="2">d) The competition runs should not last more than five minutes. (labelled as RUNTIME).

e) Robot must complete the mission before the RUNTIME ends.

f) If a robot has yet to complete all the tasks once the RUNTIME is over, the team will be asked to remove the robot from the COMPETITION FIELD, and it will be recorded as did not finished.</td></tr>
<tr><td>Game Field</td><td>An area around the field will be designated as the Testing area. No one is allowed inside the game zone except for the robot handlers, referees, and Petrosains' RBTX advisors.</td><td>An area around the field will be designated as the CONSTRUCTION ZONE. No one is allowed inside the game zone except for the robot handlers, referees, and Petrosains' RBTX advisors.</td></tr>
<tr><td>Game Zone</td><td colspan="2">An area around the field will be designated as the GAME ZONE. No one is allowed inside the game zone except for the competing participants, referees, and Petrosains' RBTX advisors.</td></tr>
<tr><td>Start and Restarts</td><td colspan="2">a) One team member is elected as the robot handler while another member is mission assistant. Only the robot handler is permitted to handle the robot during the game.

b) The robot will be placed at the START line and checked by one of the referees.
 
Top view
 
Side view</td></tr>
</table>

	c) The team may restart as the handlers deem necessary within the RUNTIME. d) A robot **must restart** if: • The robot handler asks for a restart. • The robot is touched by a contestant. • The robot moves off the field. e) 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. f) At any restart, the robot and the image cube must be positioned back at its original starting line. g) During the restart process, the handlers are allowed to make minor adjustments to the robots but not in terms of programming or replacing parts. Adjusting the sensor position on the robot is allowed during the allocated RUNTIME. h) The RACETIME will be reset to zero on every restart and all checkpoint marks will also be zero. The RUNTIME will keep running during all restarts. i) There is no limit for the number of restarts within the RUNTIME of three minutes. j) The referee will record the most recent RACETIME using official timer or watch.
Following the Line	a) 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.

<table>
<tr><td></td><td colspan="2"> 
b) A team's robot must remain on the field until it has completed its game.</td></tr>
<tr><td>Scoring</td><td colspan="2">a) RACE TIME is the time recorded for tracing the route from START to FINISH.

b) Race time is started once the robot starts moving, and the final Race time is concluded and ~~displayed on the robot~~ as and when any part of the robot touches the finish line. The referee will record the most recent RACETIME using official timer or watch.

c) The final score will be the total points accumulated based on the number of mission complete and robot reaches the finishing line.

d) The final mission time is concluded once any part of the robot returns to the start line.

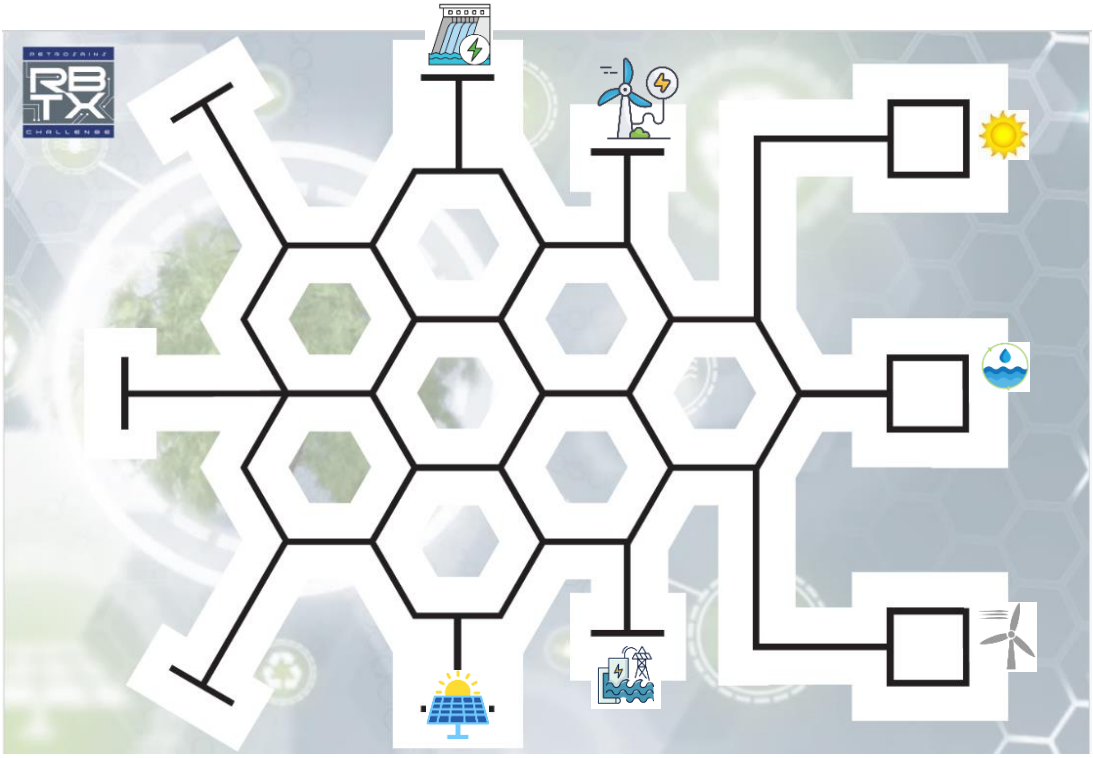
e) If two or more team that complete the challenge manage to accumulate the same points, the team that obtain faster race time will be ranked higher.</td></tr>
<tr><td rowspan="3">Point</td><td>TWO (2) points will be awarded for each image cube that is successfully placed in the correct location.</td><td>TWO (2) points will be awarded for each image cube.
that is successfully placed in the correct location.</td></tr>
<tr><td>NO POINT (0) point if the image cube is placed in an incorrect location.</td><td>NO POINT (0) point if the image cube is placed in an incorrect location.</td></tr>
<tr><td>Scan & detect AI image ONE (1) point will be given.
The robot scan & detect all 3 AI images = THREE (3) points will be awarded.</td><td>Scan & detect AI image ONE (1) point will be given.
The robot scan & detect all 3 AI images = THREE (3) points will be awarded.</td></tr>
</table>

		There will be additional **AI image** and **image cube**. which will be revealed on the day of the Grand Final.
	Extra ONE (1) point will be given if the robot returns back to start line after completed all mission	**Extra ONE (1)** point will be given if the robot returns back to start line after completed all mission.
Finalist / Winner selection	The winner will be decided based on the following criteria: a. Highest score (Complete Mission) b. The team with the fastest RACE TIME. c. As per the judges' decision.	The winner will be decided based on the following criteria: a. Highest score (Complete Mission) b. The team with the fastest RACE TIME. c. As per the judges' decision.

APPENDIX

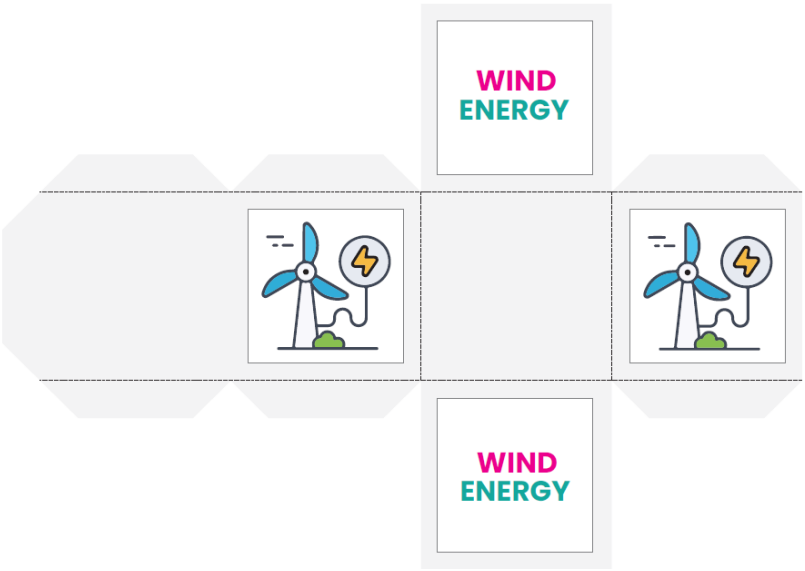
A) EXAMPLE TRACK FOR ZONE QUALIFYING & GRAND FINAL

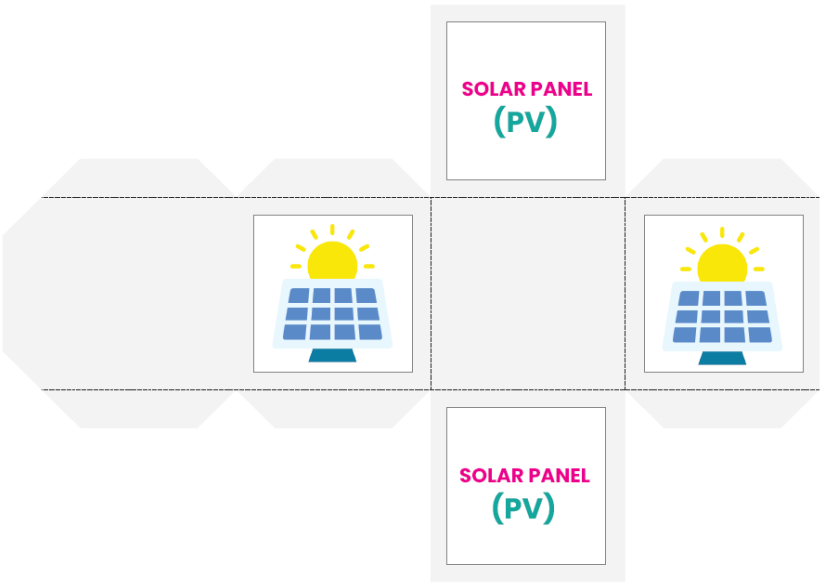
(For Grand Final level image cube and AI image will reveal on event day)



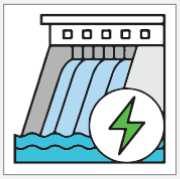
B) IMAGES CUBE ZONE QUALIFYING:

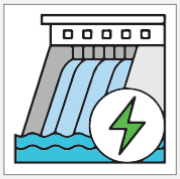
** *Image cube size 5cm x 5cm*





HYDRO POWER





HYDRO POWER

WAVE ENERGY

WAVE ENERGY

C) AI IMAGES:

*** Size A4 Paper (Image diameter 12 - 15cm)*