

CODEAVOUR 8.0

INTERNATIONAL

Track 2 - Clean Energy AI-Robo Challenge

Rules and Regulations



Energizing the Future Grid
through Innovation

VERSION 1
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1. Introduction

Engage in an exciting competition where your Artificial Intelligence (AI) powered robots navigate the arena to take on the **Clean Energy AI-Robo Challenge**. Harness the power of innovation to transform communities through clean energy solutions, promote efficient energy use, and build a more sustainable future. Showcase your expertise in AI, Robotics, Machine Learning, and Intelligent Systems as your robots tackle real-world energy challenges, demonstrating creativity, problem-solving, and engineering excellence while contributing towards a greener tomorrow.

In the Codeavour 8.0 International, Track 2, the **Clean Energy AI-Robo Challenge** is a physical robotics competition. The participants will design and build their own **Robot with Quarky series products** to complete various object-placing and other interactive challenges.

In Track 2, your robot will take on real-world clean energy challenges, using AI, robotics, and innovative solutions to build a cleaner and more sustainable future.

The robot must be Do-It-Yourself (DIY). Elementary teams may operate their robot in either Autonomous or Manual mode, whereas Junior and Senior teams must use a fully Autonomous robot.

Codeavour International helps students develop their 21st-century skills and creativity in the following areas:

- I. Coding
- II. Robotics and Automation
- III. Engineering Skills
- IV. Artificial Intelligence
- V. Strategy and Planning
- VI. Real-world problem-solving

1.1. Eligibility Criteria

You must adhere to these guidelines:

- 1.1.1. Each team can have a **maximum of three members** and must have one adult mentor/coach/guardian.
- 1.1.2. The age groups for track 2 are as follows:
 - I. **Elementary:** 7-10 Years
 - II. **Junior:** 11-14 Years
 - III. **Senior:** 15-18 Years

Note: All the participants must meet the age group and team size criteria.

1.2. How to Register

To register for this competition, participants must visit the Codeavour 8.0 International website and complete the registration process.

Registration Link: <https://codeavour.org/register-now/>

Complete your team registration to participate in the world's biggest Coding, AI and Robotics Festival for students!



1.3. General Rules and Regulations

In order to ensure a seamless and enjoyable experience for all, participants are recommended to strictly adhere to the established rules and regulations.

- 1.3.1. The robot should be programmed using **PictoBlox** only. Participants can use any coding environment inside PictoBlox.
- 1.3.2. The robot must use a **Quarky** series product as its primary processing unit. Participants are free to use sensors, cameras, motors, and other hardware components from any manufacturer, provided they are compatible with the Quarky.
- 1.3.3. For the Elementary Category, the robot may be operated in either Autonomous mode (programmed to follow a given line-following path or use sensors or a camera module to navigate) or Manual mode (directly controlled using a compatible device, similar to a remote-controlled robot).
- 1.3.4. For the Junior and Senior categories, the robot must operate fully autonomously throughout the match. It must navigate and complete the challenges independently using programming, sensors, and/or a camera module, without any manual control or intervention during the round.
- 1.3.5. Teams are not required to follow the designated line-following paths for navigation. Robots may move in any direction within the arena and may use advanced sensors, cameras, or other supported navigation techniques to navigate accurately. **No negative scoring or foul will be applied for deviating from or skipping the line-following path.**
- 1.3.6. Each team must have their own distinct robot adhering to the provided material and regulatory guidelines. Sharing robots across multiple teams is strictly forbidden and could lead to disqualification.

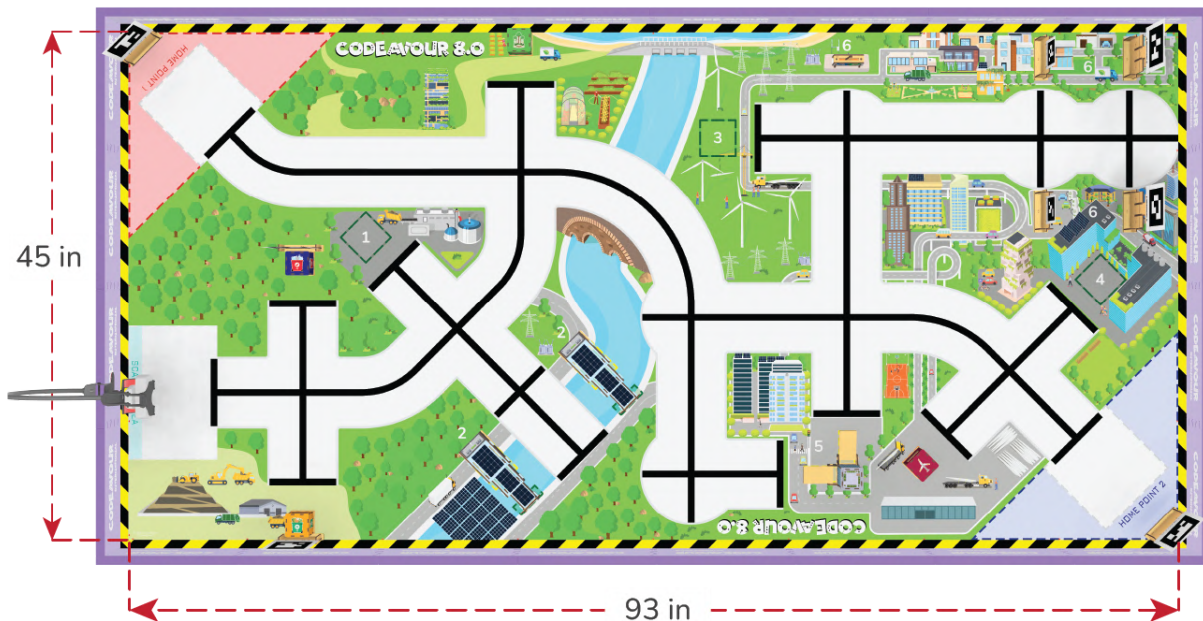
- 1.3.7. Participants must maintain discipline and follow the competition rules and regulations of the competition management authority. Any individual found violating the rules or causing disruptions may result in the disqualification of their team.
- 1.3.8. Mentors, coaches, teachers, parents, or guardians are not allowed in the competition area and must not be **directly involved** in controlling or manipulating the robot during the competition. Their role is limited to providing mentorship and guidance only. Any direct involvement in robot control will result in the team's disqualification.
- 1.3.9. Teams should abide by the participation and submission guidelines; non-adherence to them will result in disqualification.
- 1.3.10. The team must submit photos, videos, and detailed information about the robot on the Codeavour 8.0 submission portal.

1.4. Learning Resources

Participants can access [learning resources](#) on the Codeavour 8.0 official website, which offers e-learning resources for Coding, AI, Robotics, Machine Learning, and more.

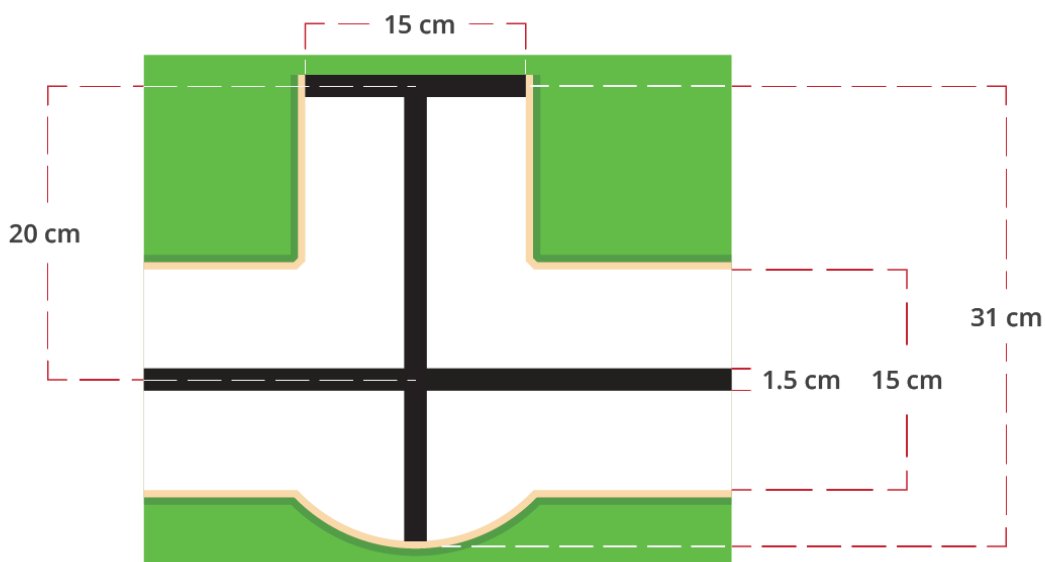


2. Game Arena and Specifications



Game Field Size: 45 in x 93 in

- I. Width of the white path: 15.0 cm
- II. Width of the black line: 1.5 cm



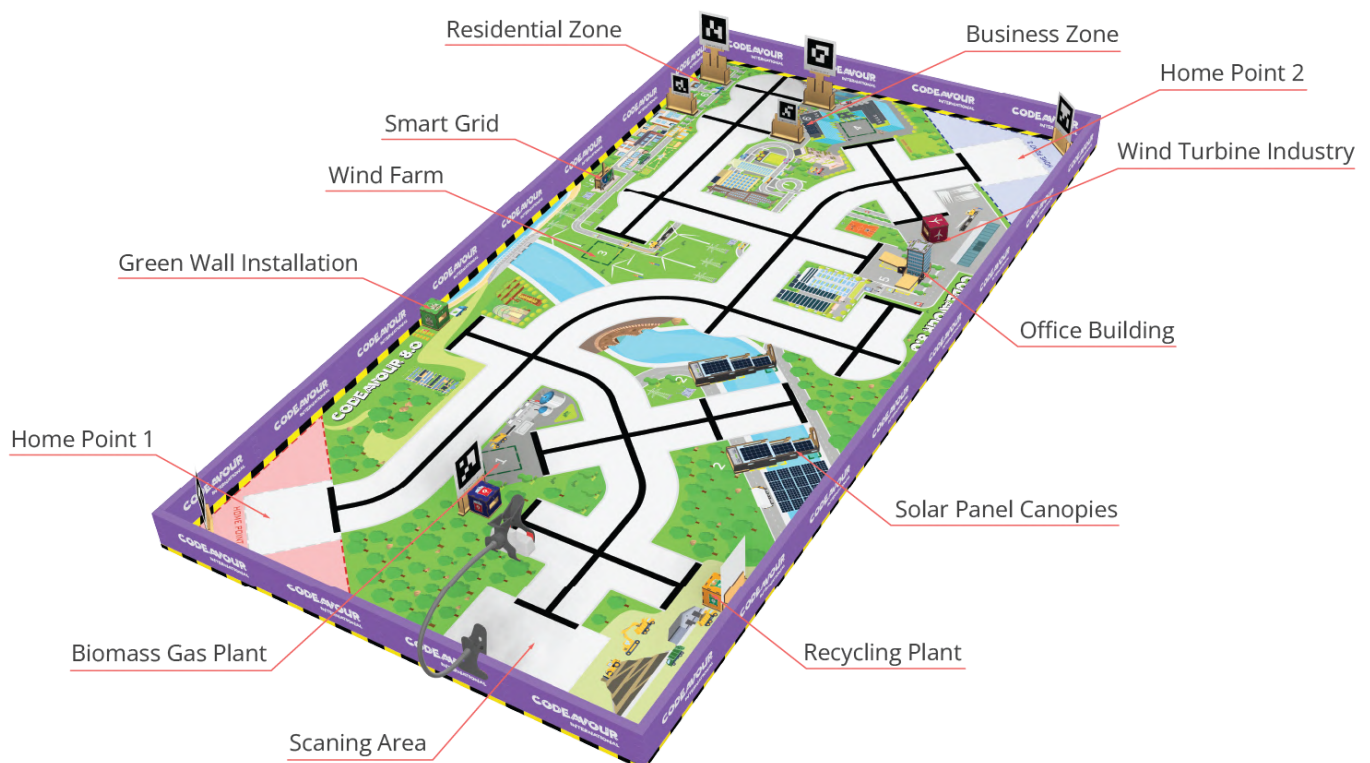
Pathway Dimensions

The arena, printed on high-quality **Grey Back Vinyl**, is clearly marked with red dashed lines for **Pick-up Points** and green dashed lines for **Drop Points**. Cubes are initially placed at the Pick-up Points and must be transported by the robot to the corresponding Drop Points as part of the challenge.



The size of Pick-up and Drop Points may vary depending on the activity and the objects used. Detailed information is provided in Section 4 (**Clean Energy AI-Robo Challenge**).

2.1. Arena for Clean Energy AI-Robo Challenge



2.2. Game Objects, Positioning, and Randomisation

A variety of objects are strategically placed within the arena for the challenges, with each element tailored to the specific task. These objects may include distinctive Quarky Cubes with unique appearances, while the arena will also feature mechanical elements that robots must interact with, as outlined below:

2.2.1. Game Objects

I. Quarky Cubes

Participants can use various methods such as Pick, Grab, Push, Pull, and more to move the cubes and complete the challenges.

Category-Specific Cubes for Elementary:



3. Number 1 Cube
(Inorganic Waste)



4. Number 2 Cube
(Organic Waste)

Category-Specific Cubes for Junior and Senior:



2. Inorganic Waste



1. Organic Waste

Common Cubes for All Age Groups:



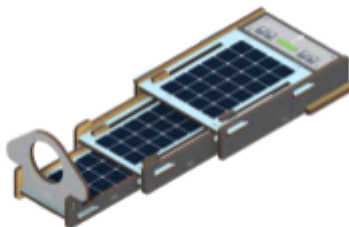
5. Wind Turbine



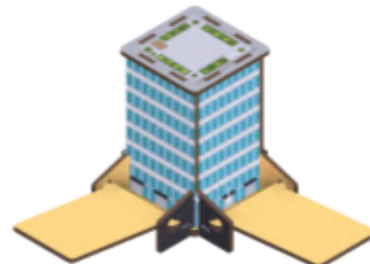
6. Green Installation

II. Unique Mechanisms and Objects

Activities with unique objects are special activities where the robot must interact with unique objects or adjust the orientation of its mechanisms. All unique mechanisms are common for all age groups and will be positioned in specific locations within the arena at the start of the match. Each unique mechanism, labelled from A to C, will be used by the robot during the game to complete the challenges.



(A) Solar Panel Canopies



(B) Office Building



(C) Smart Grid Load Balancer

III. AprilTags

AprilTags are visual fiducial markers placed in fixed locations across the arena to assist the robot with navigation, localization, and task identification. Each tag contains a distinct 2D barcode pattern corresponding to a specific game element or objective. Robots can scan these markers during the match to identify target zones, waste categories, and polling requirements.



01-T5
(Organic Waste)



01-T6
(Inorganic Waste)



06-T1
(Power Requirement Poll)



06-T2
(Power Requirement Poll)



06-T3
(Power Requirement Poll)



06-T4
(Power Requirement Poll)



07-T7
(Home Point 1)



07-T8
(Home Point 2)

Download the required printable resources for practice or get the complete Arena Objects Kit to access all original arena objects and components in one place.



2.3. Arena Setup

The Clean Energy AI-Robo Challenge arena has a common setup for both Elementary and Junior/Senior categories, with the variation appearing in AI Challenge 1 and Challenge 6.

For detailed instructions on assembling the arena and positioning the game objects, please refer to the [Arena setup guide](#).



2.3.1. Initial Configuration:

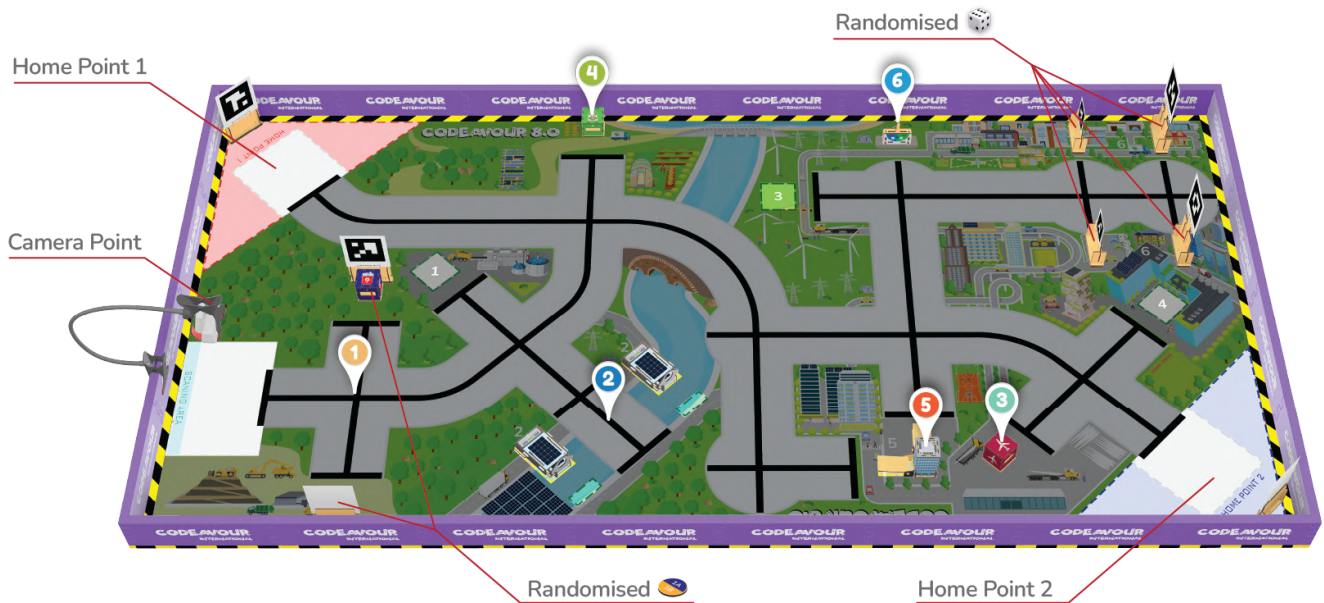
- I. All game objects will be arranged in the arena according to the setup diagrams provided below.
- II. The Quarky Cubes will be positioned at the Pick-up point from where the robot has to place them as per the challenge.

2.3.2. Randomisation Before the Match:

- III. **Challenge 1:** Before the match, the judge will toss the Decision Coin. Based on the result, the corresponding two cube types and their dedicated tags will be placed at the designated positions in the arena.
- IV. **Challenge 6:** Before the match, the judge will roll a die. Based on the number obtained, the corresponding arrangement shown in the Challenge 6 Randomisation Chart will be placed at the designated positions in the arena.

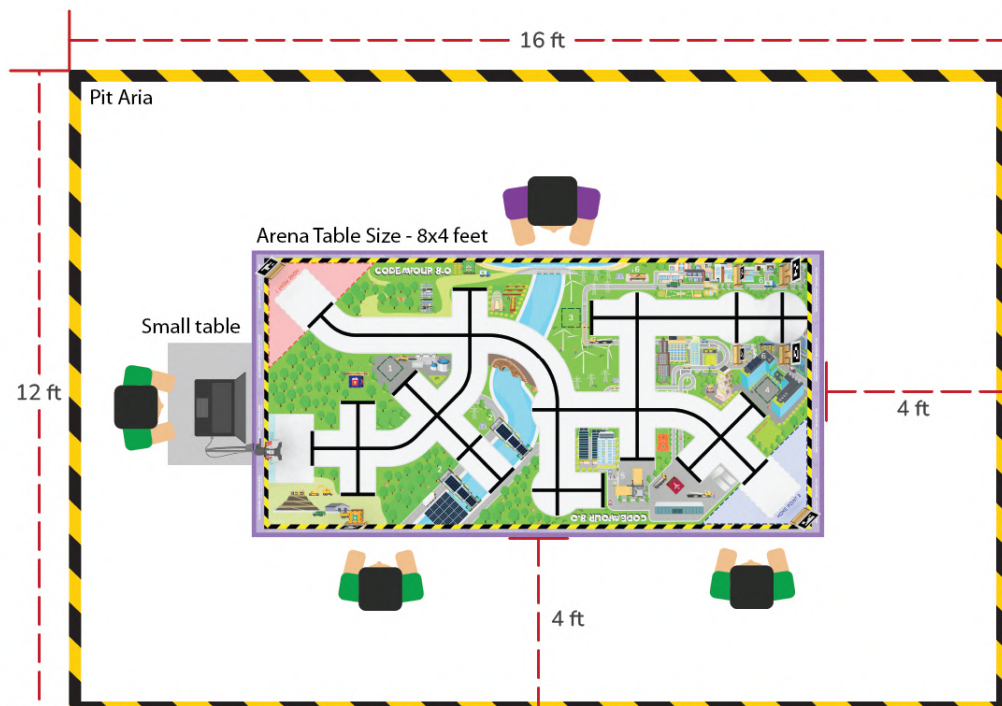


Initial positions of game objects (Elementary)



Initial positions of game objects (Junior/Senior)

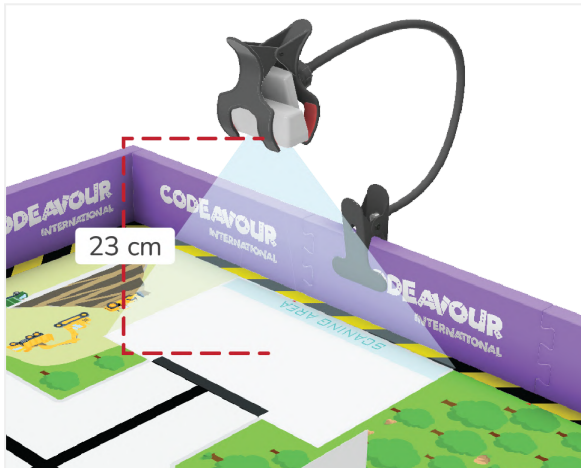
- 2.3.3. **Pit Area:** The pit area will be marked with yellow and black floor marking tape. Team members will have a designated area of **4 feet** around the arena inside the pit for their movement and observations.
- 2.3.4. **Device table:** The team will get a small table near the Camera Point to keep their device connected to a webcam.



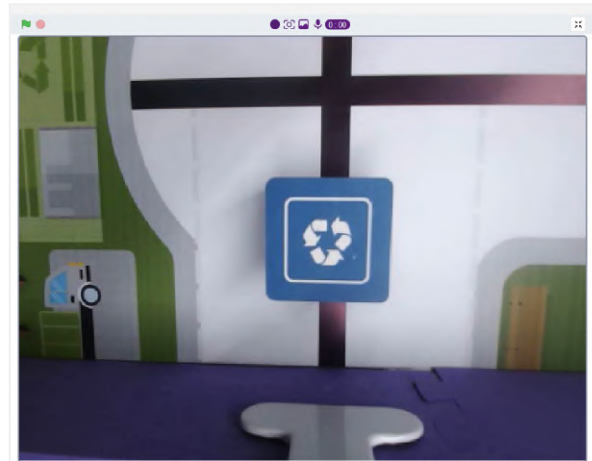
Arena Pit Area

2.3.5. Camera Setup

A web camera will be placed at the Recognition Point in the arena at a height of **23 cm** from the arena surface.



Camera Position



Camera Field of View

Note: Teams are responsible for checking and adjusting the camera position before the match begins to ensure proper alignment and functionality. They may adjust the camera themselves or seek assistance from a volunteer if required. However, teams must handle the camera and its mount with care and must not damage or modify the camera setup in any way. Once the match begins, no further adjustments to the camera are permitted.

2.3.6. Camera Specification

Connection Type: Wired, USB 2.0

Camera FOV: DFOV 95°

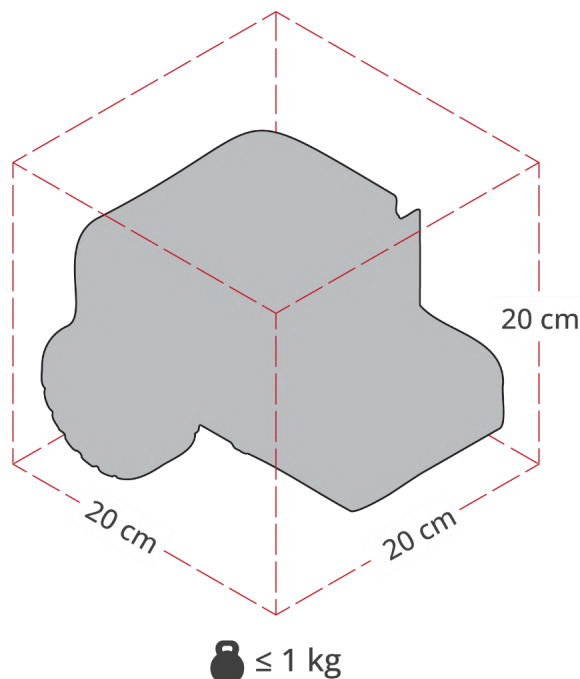
Capture Resolution: FHD (1920 x 1080)

(Recommended camera: Lenovo 300 FHD Webcam)

3. Robot Material and Regulations

A comprehensive list of all permissible hardware components brought by the team to the competition, including the robot, accessories, and any additional attachments, is provided below. The entire robot design must strictly adhere to the specified guidelines:

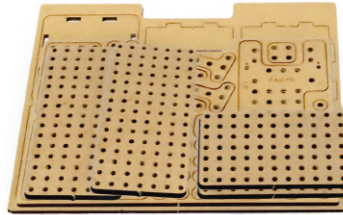
- I. **Primary processor:** Anything from the Quarky Series of Products can be used.
- II. **Programming Software:** PictoBlox (Participants can use different environments available in PictoBlox).
- III. **Power Supply:** A robot must be battery-operated at the time of competition, and the voltage must not exceed 5 volts between any two terminals of the Robot.
- IV. **Add-on boards:** Any board compatible with the Quarky Series of products can be used.
- V. **Robot size:** The robot must be at most 20x20x20cm (LxBxH) in size. However, the robot can expand itself while in the game.
- VI. **Maximum Weight:** Maximum 1kg.
- VII. **Communication:** The robot must be wirelessly connected to PictoBlox via Bluetooth.



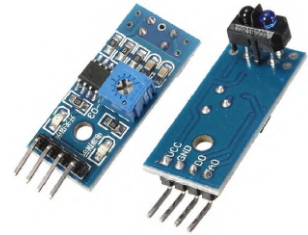
- VIII. Add-on Parts:** Participants are free to use sensors, cameras, motors, batteries, and other hardware components of their choice, provided they are compatible with the Quarky series. Construction materials may include 3D-printed parts, laser-cut parts, plastic construction components, MDF parts, acrylic parts, ice cream sticks, and other suitable materials, as required by the robot design.



Plastic construction parts



MDF parts



4 Pin IR sensor

Notes:

1. Teams must bring all the necessary components, spare parts, batteries, tools, power extension cords, soldering equipment, adhesives, fasteners, and any other items required for assembling, repairing, or operating their robot.
 2. The robot design must not damage the game field, arena elements, or any competition objects in any way.
- IX. No exposed sharp edges:** The entire design of a robot must not have sharp edges that may harm the game field or the people around it.
- X. No hazardous materials:** The Robot parts shall not be made with hazardous materials.

4. Clean Energy AI-Robo Challenge

The **Clean Energy AI-Robo Challenge** takes you to a diverse region where energy powers homes, transportation, industries, and daily life. However, years of unorganised and inefficient energy use have led to excessive consumption, pollution, and an overdependence on non-renewable resources. The region now faces the urgent need to transition towards clean, sustainable, and efficient energy solutions.

As innovators, your mission is to guide your robot through a series of real-world energy challenges that promote renewable energy adoption, energy conservation, and sustainable resource management. Each challenge represents a practical energy-related scenario, giving you the opportunity to solve it using Artificial Intelligence, robotics, and creative engineering.

In total, there are **6 Exciting Clean Energy AI-Robo Challenges**. Each one will test your technical skills, teamwork, strategic thinking, and problem-solving abilities while inspiring you to explore how intelligent technologies can contribute to a cleaner and more sustainable future.

Teams are free to plan their own strategies and decide the order in which to attempt the challenges. The path you choose is part of your unique journey to transform the region into a model of clean and sustainable energy use.

4.1. Challenge 1: Clean Energy from Waste

Every day, large amounts of waste are generated across the region. While some of it can be converted into clean energy, much of it ends up in landfills due to improper waste segregation. Organic waste, such as food scraps and plant matter, can be used to produce biogas at the Biomass Gas Plant, whereas inorganic waste cannot be processed in the same way.

Your task is to identify the Organic Waste cube using AI by scanning it directly or by taking it to the Scanning Area. The robot must ignore the Inorganic Waste cube, collect only the Organic Waste cube, and transport it to the Biomass Gas Plant to help generate clean and sustainable energy for the region.

Note: *There is no negative scoring for the 'Inorganic Waste' or 'Number 1' cube. The robot may leave it anywhere in the arena while completing the challenge. Scoring will be awarded only based on the correct identification and placement of the 'Organic Waste' or 'Number 2' cube.*

Conditions:

- 4.1.1. Before the match begins, the judge will toss the Decision Coin. Based on the outcome, the corresponding Organic Waste and Inorganic Waste cubes will be placed at their designated pickup positions.
- 4.1.2. The robot must identify the Organic Waste cube using AI, either by scanning it directly or by taking it to the Camera Point for recognition.
- 4.1.3. The Inorganic Waste cube must not be transported to the Biomass Gas Plant.
- 4.1.4. The challenge will be scored based on the successful identification and placement of the Organic Waste cube at the Biomass Gas Plant.



Decision Coin

4.1.5. Elementary:

- I. Robots must use either the AI-based Recognition Cards extension, the [AprilTag Extensions](#), or a [Recognition Cards extension](#) or a self-trained model in the ML Environment (Image Classifier or Object Detection in PictoBlox) to identify the Organic Waste cube (Number 2). The robot must ignore the Inorganic Waste cube (Number 1) and transport only the Organic Waste cube (Number 2) to the Biomass Gas Plant. Attempts that do not use any of these AI methods will receive no score for this challenge.



Recognition cubes for Elementary team:

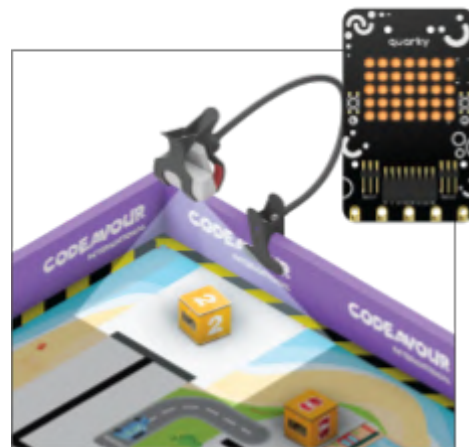
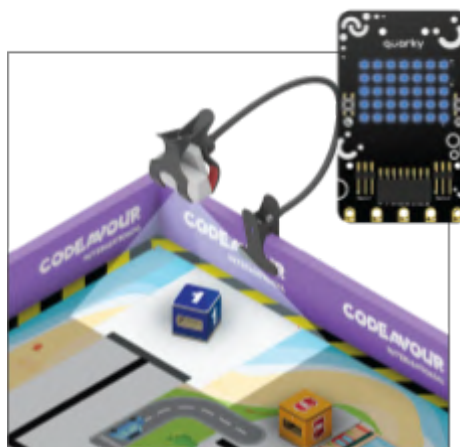


Number 1
(Inorganic Waste)



Number 2
(Organic Waste)

- II. The Quarky LED matrix display must show the color corresponding to the recognized cube from the moment of recognition and remain ON until the completion of Challenge 1 in both manual and autonomous modes, as illustrated below:

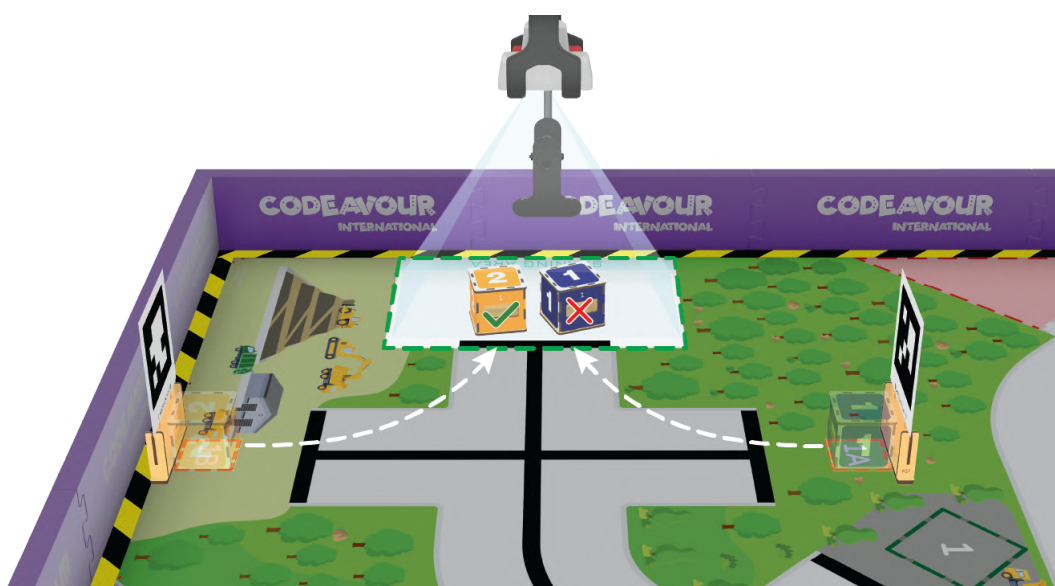




Challenge 1 (Elem.) : Initial Position - In case of '1A-Orange and 1B-Blue' as per the Decision Coin

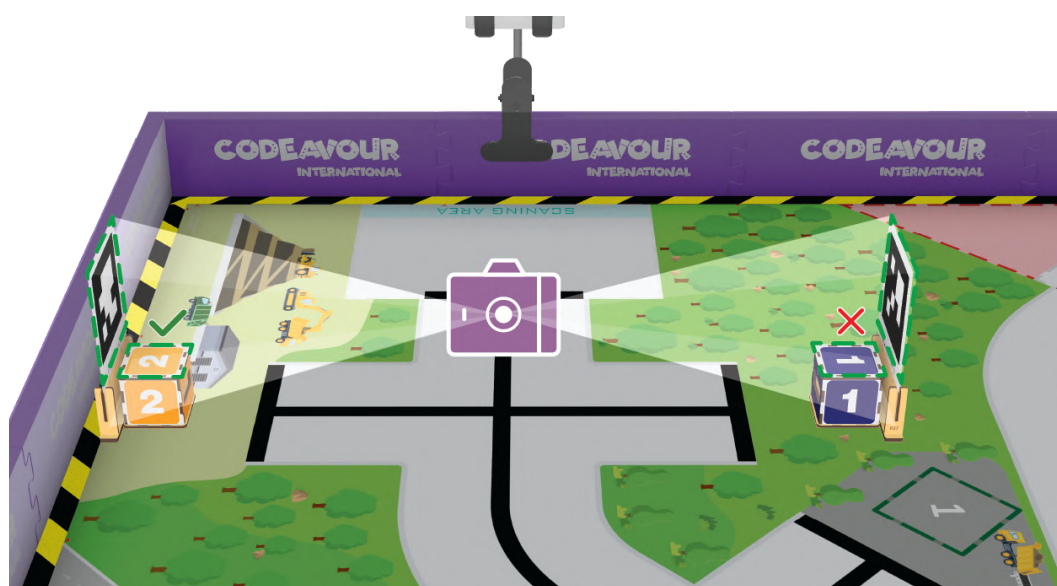


Challenge 1 (Elem.) : Initial Position - In case of '1A-Blue and 1B-Orange' as per the Decision Coin

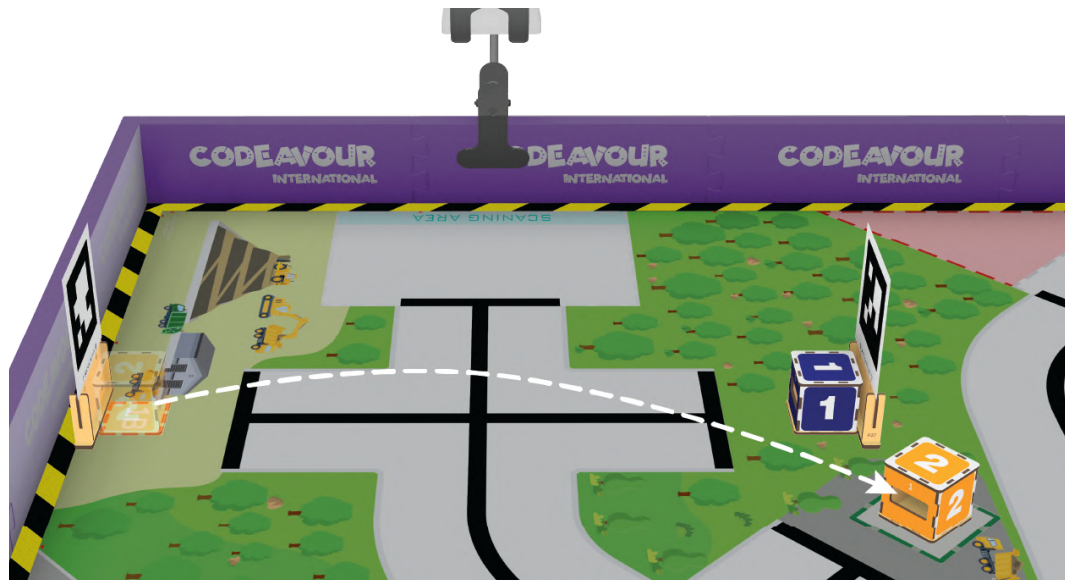
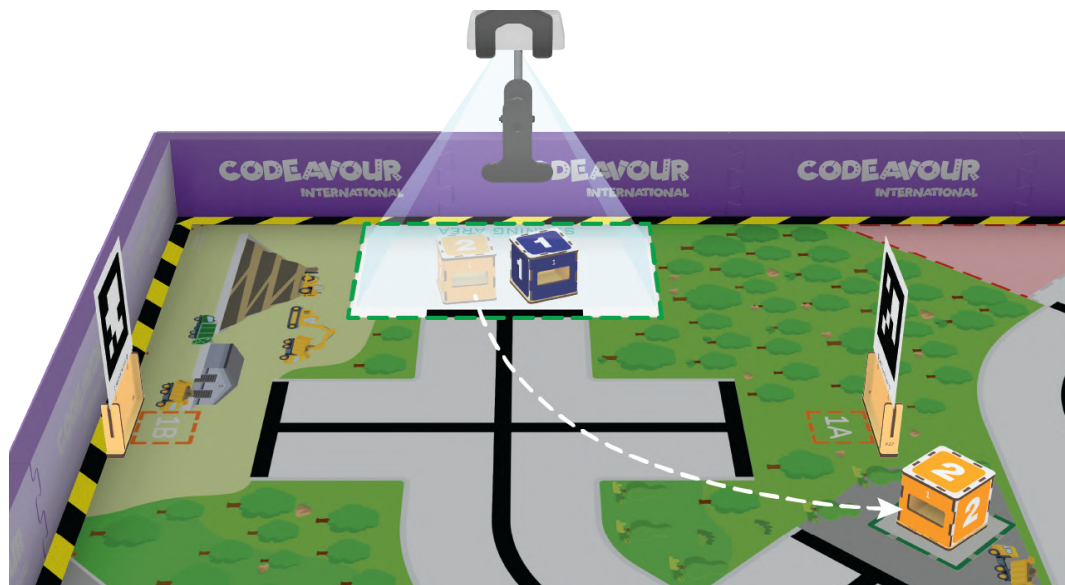


Challenge 1 (Elem.) : Searching 'Number 2' (Organic Waste) cube at Scanning Point

OR



Challenge 1 (Elem.) : Searching 'Number 2' (Organic Waste) cube or AprilTag with robot's camera



Challenge 1 (Elem.) : Delivering the correct 'Number 2' (Organic Waste) cube at Biomass Gas Plant

4.1.6. **Junior/Senior**

- III. Robots can use a self-trained model in the [ML Environment](#) (Image Classifier or Object Detection in PictoBlox) or the [AprilTag extensions](#) in PictoBlox to identify the Organic Waste cube (Number 2). The robot must ignore the Inorganic Waste cube (Number 1) and transport only the Organic Waste cube (Number 2) to the Biomass Gas Plant. Attempts that do not use either of these AI methods will receive no score for this challenge.



Recognition cubes for Senior and Junior team:

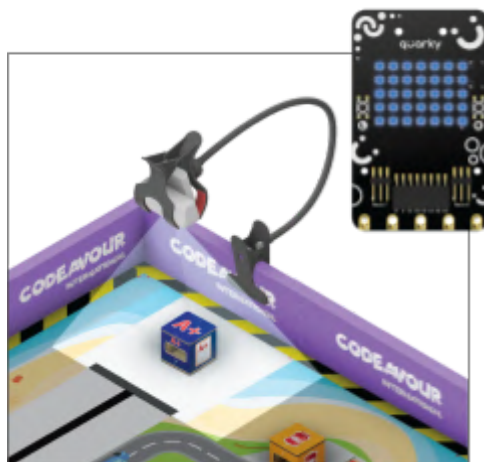


Inorganic Waste



Organic Waste

- IV. The Quarky LED matrix display must show the color corresponding to the recognized cube from the moment of recognition and remain ON until the completion of Challenge 1, as illustrated below:



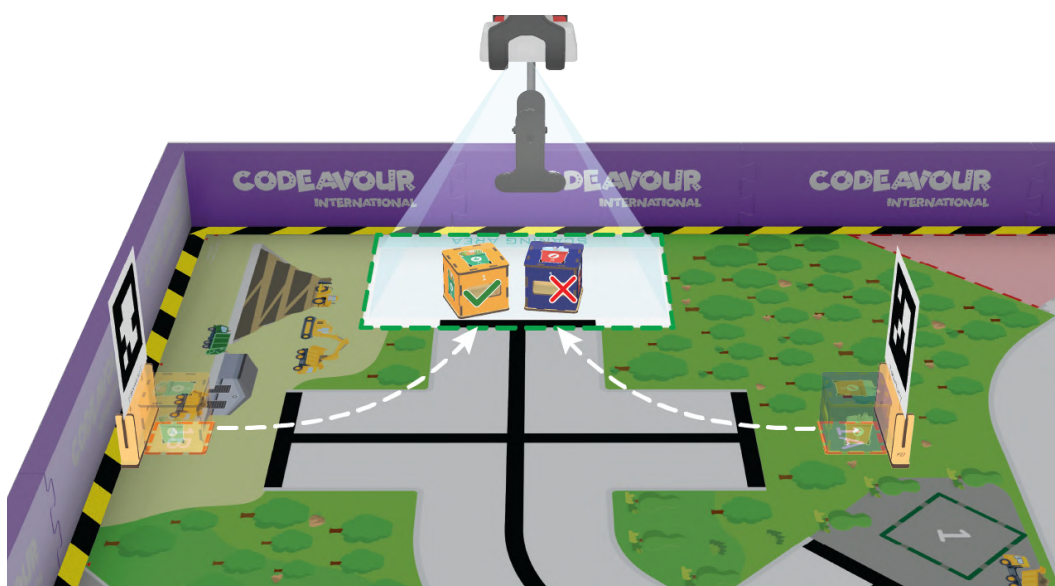
Note: Teams can take images of the organic and inorganic wastecubes for the image classifier model training by either preparing their own cubes from the print-ready files in [Arena Resources](#) or getting their own [Codeavour Arena Objects kit](#).



Challenge 1 (Jr. and Sr.) : Initial Position - In case of '1A-Orange and 1B-Blue' as per the Decision Coin

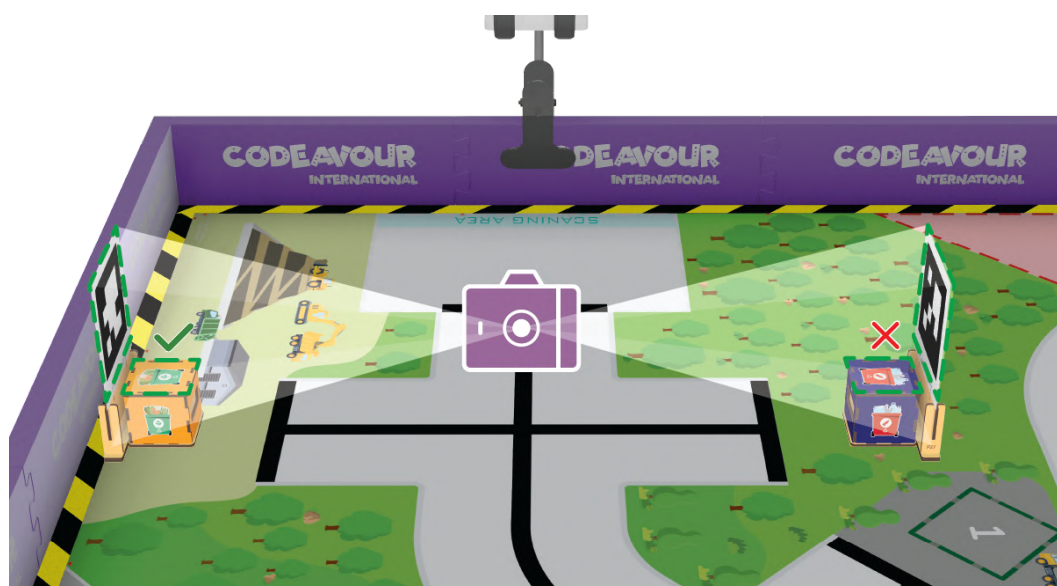


Challenge 1 (Jr. and Sr.) : Initial Position - In case of '1A-Blue and 1B-Orange' as per the Decision Coin

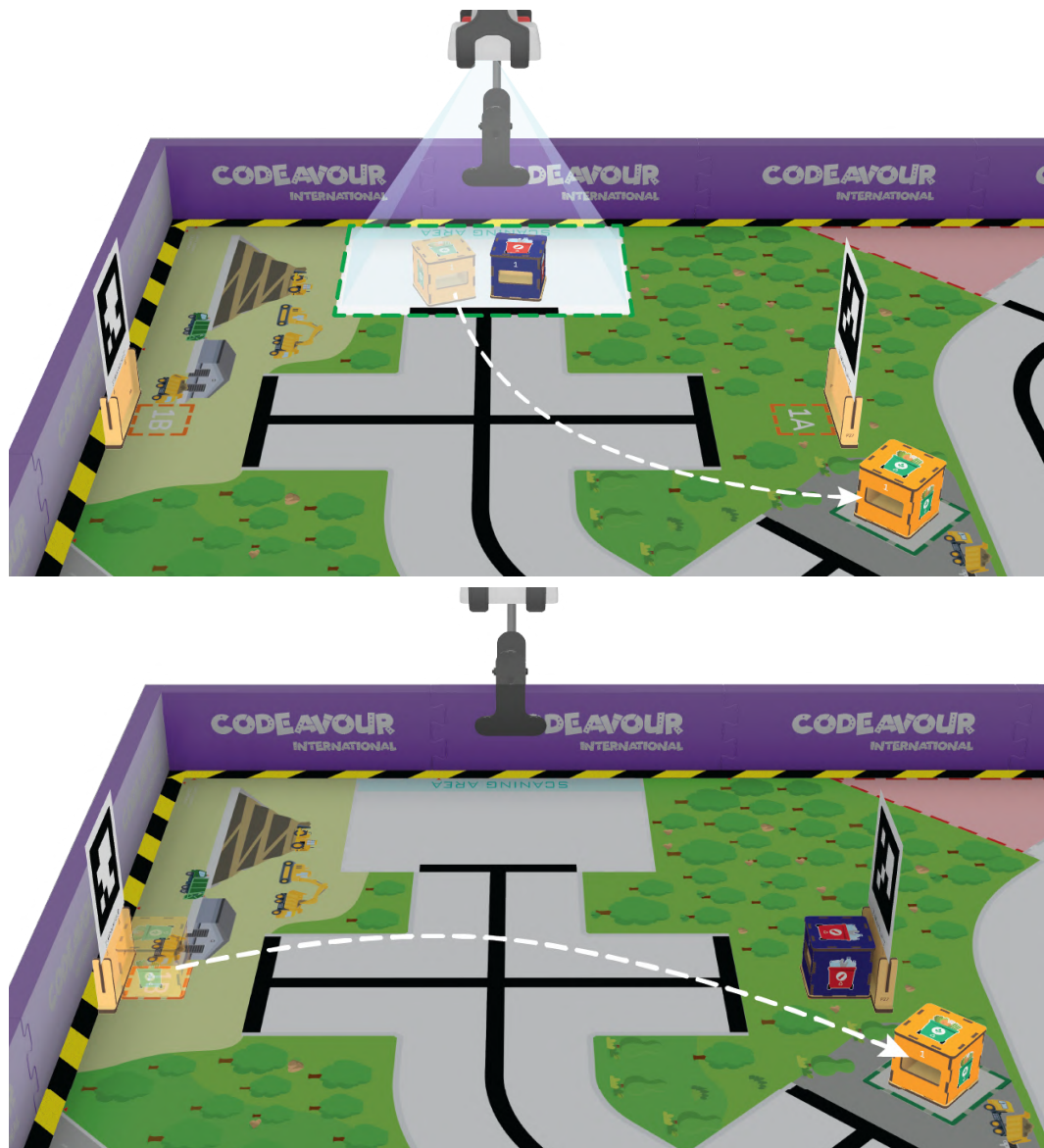


Challenge 1 (Jr. and Sr.) : Searching 'Number 2' (Organic Waste) cube at Scanning Point

OR



Challenge 1 (Jr. and Sr.) : Searching 'Number 2' (Organic Waste) cube or AprilTag with robot's camera

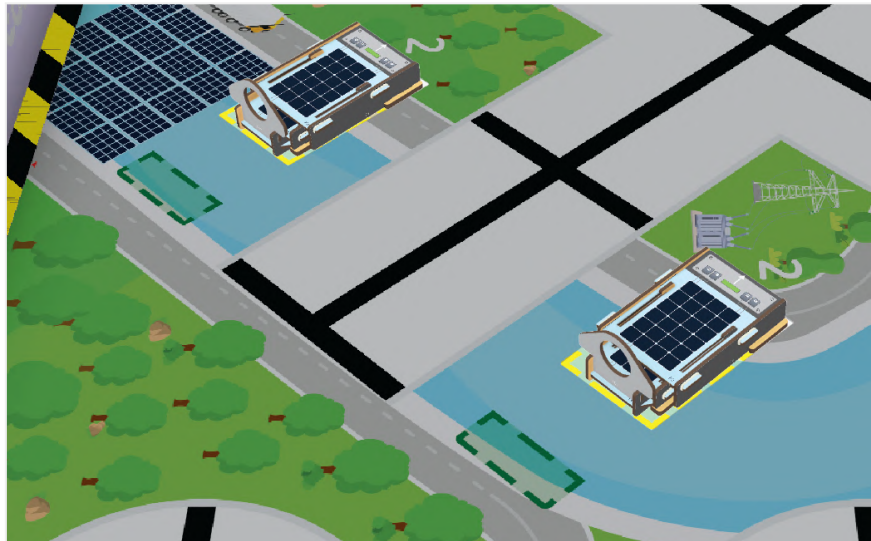


Challenge 1 (Jr. and Sr.) : Delivering the correct 'Number 2' (Organic Waste) cube at Biomass Gas Plant

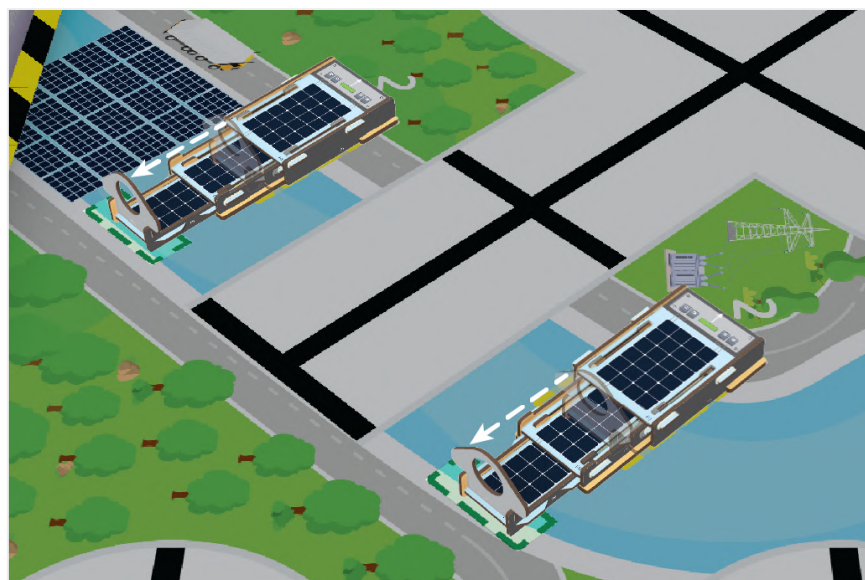
4.2. Challenge 2: Saving Water with Solar Energy

Many regions have canals that supply water for agriculture and communities. These open-water canals lose large amounts of water through evaporation while the available space above them remains unused. Installing canal-top solar panels provides a smart solution by generating clean electricity while shading the water, helping to reduce evaporation and make efficient use of existing infrastructure.

Your task is to carefully deploy the two Solar Panel Canopies across the canal by extending each canopy from one side of the canal to the other on the arena. Successfully deploying both canopies will earn the full score, while deploying only one canopy will earn half the score.



Challenge 2: Initial Position



Challenge 2: Final Position

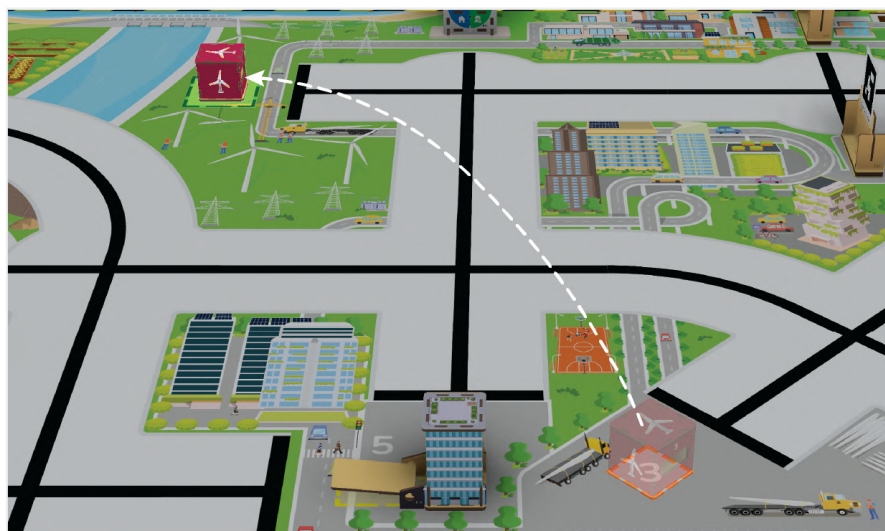
4.3. Challenge 3: Clean Energy from Wind

The region is expanding its use of renewable energy to reduce its dependence on fossil fuels. Coastal areas receive strong and consistent winds, making them ideal locations for generating clean electricity using wind turbines. Installing wind turbines in suitable locations helps provide sustainable energy while reducing environmental impact.

Your task is to collect a Wind Turbine from the Wind Turbine Industry and transport it to the designated Windy Seashore location in the arena. Carefully deploy the Wind Turbine at the installation site to help generate clean and renewable energy for the region.



Challenge 3: Initial Position

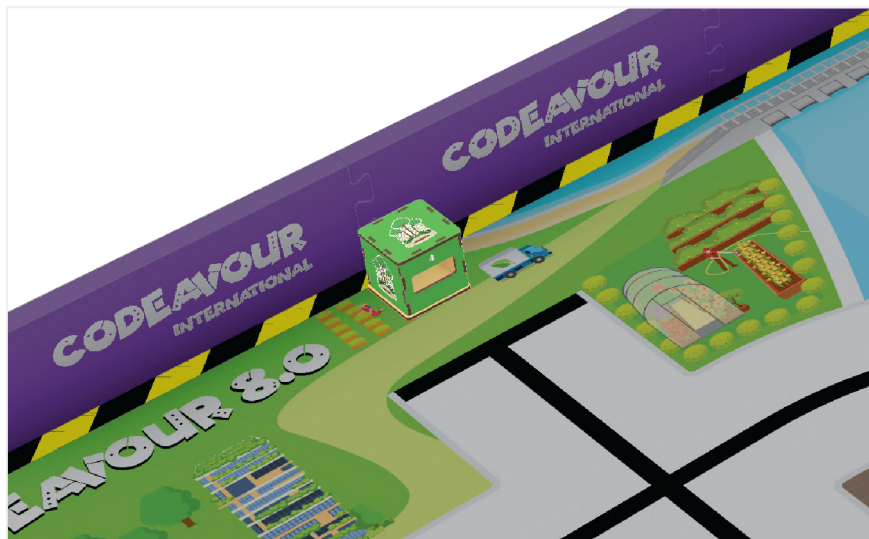


Challenge 3: Final Position

4.4. Challenge 4: Saving Energy with Natural Air Purifiers

As the region continues to grow, many green spaces are being replaced by buildings and roads. This reduces air quality, increases temperatures, and impacts the health and well-being of people living in urban areas. While devices like air purifiers can help clean the air, they consume energy and require resources to manufacture. Plants provide a natural and sustainable solution by improving air quality, absorbing carbon dioxide, producing oxygen, and cooling their surroundings. Developing green cities by integrating nature into urban spaces is essential for creating healthier and more sustainable communities.

Your task is to collect the Green Wall Installation and transport it to the Central Plaza. Carefully deploy the Green Wall at the designated location to help create a greener, cooler, and healthier urban environment.



Challenge 4: Initial Position



Challenge 4: Final Position

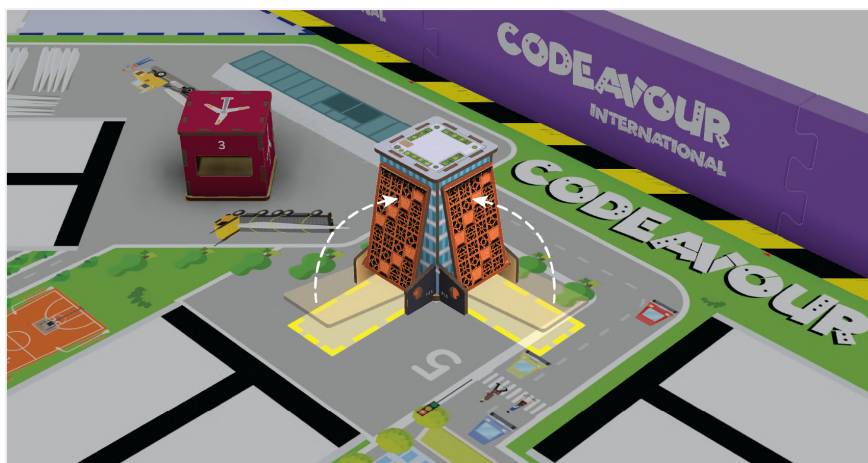
4.5. Challenge 5: Saving Energy and Environment with Natural Cooling

As the region becomes more urbanised, fewer trees and more concrete surfaces are causing cities to become significantly warmer than their surroundings. Rising temperatures have led to an increased use of air conditioners, which consume large amounts of electricity and contribute to higher carbon emissions. An effective and eco-friendly alternative is terracotta evaporative cooling, where specially designed clay structures naturally cool the surrounding air through water evaporation while using little or no energy. Adopting such passive cooling solutions can help create more comfortable and energy-efficient urban spaces.

Your task is to install the Terracotta Cooling Wall onto the outer wall of the Office Building. The Terracotta Cooling Wall is already positioned near the building and is connected using a hinge mechanism. Carefully lift it into its upright position to complete the installation and provide a natural, energy-efficient cooling solution.



Challenge 5: Initial Position



Challenge 5: Final Position

4.6. Challenge 6: Efficient Energy Management with Smart Grid

Generating clean energy is only part of the solution; using it efficiently is equally important. The demand for electricity constantly changes across different parts of the region depending on the time of day, seasons, weather conditions, and human activities. If electricity generation and distribution are not managed properly, energy may be wasted, or some areas may experience shortages. A Smart Grid Load Balancer helps monitor energy demand and intelligently distribute electricity where it is needed most, improving efficiency and reducing unnecessary power consumption.

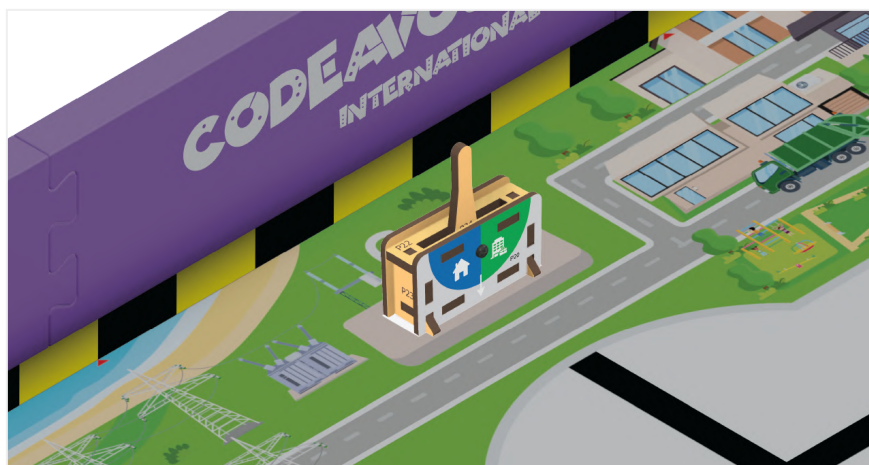
Your task is to identify the power requirement in the Residential Zone and the Business Zone by detecting the Power Requirement Polls in both regions. Based on the detected power requirements, the robot must switch the Smart Grid Load Balancer at the Power Grid to distribute electricity efficiently across the region.

Before the match begins, the Judge will roll a die to determine the arrangement for Challenge 6. The corresponding arrangement shown in the Challenge 6 Randomisation Chart will then be placed at the designated positions in the arena. Teams can download the [Challenge 6 Randomisation Chart](#) to prepare for the possible arrangements.



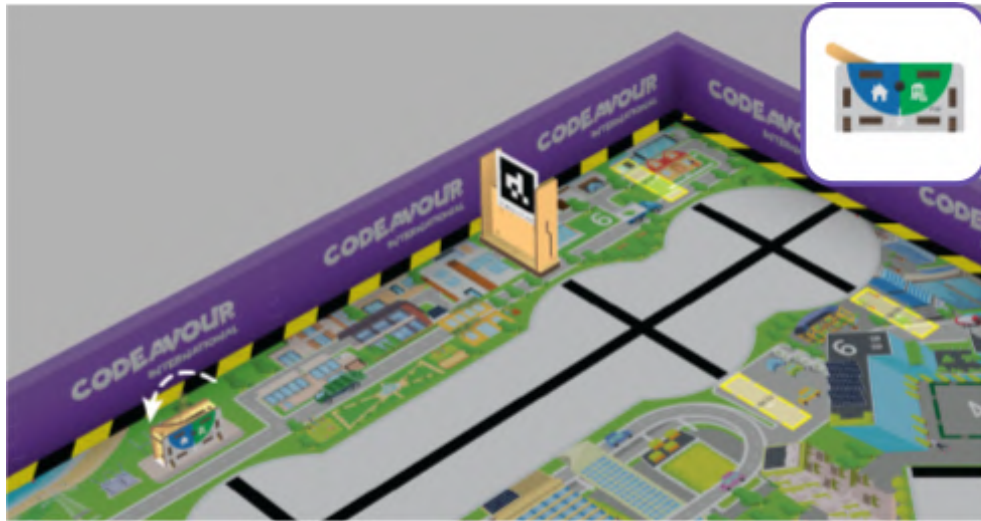
4.6.1. Elementary:

- I. There will be one 'Power Requirement Poll' placed at either '06-T1' or '06-T2' based on the given dice roll condition. The robot must detect the placement and switch the Smart Grid Load Balancer accordingly.



Challenge 6 (Elem.) : Initial Position of the Smart Grid Load Balancer

Challenge 6 (Elem.) : Final Positions of the Smart Grid Load Balancer based on the Power Requirement Poll conditions



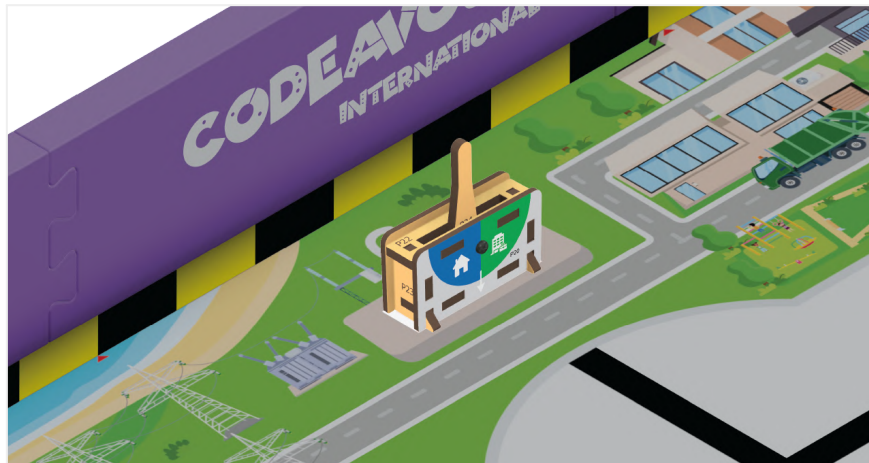
*Condition 1: 06-T1 Power Requirement Poll Placement
(Residential Zone has Higher Power Demand)*



*Condition 2: 06-T2 Power Requirement Poll Placement
(Business Zone has Higher Power Demand)*

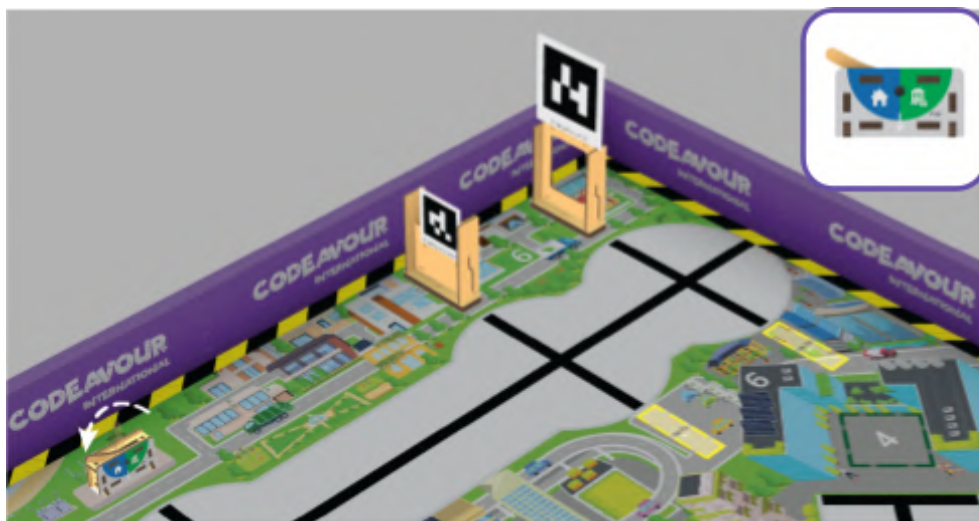
4.6.2. Junior and Senior:

- I. There are six different probability-based placement conditions for the Power Requirement Polls across 06-T1, 06-T2, 06-T3, and 06-T4. Based on the given dice roll condition, one of these placements will be selected and set on the arena. The robot must identify the placement and switch the Smart Grid Load Balancer accordingly.

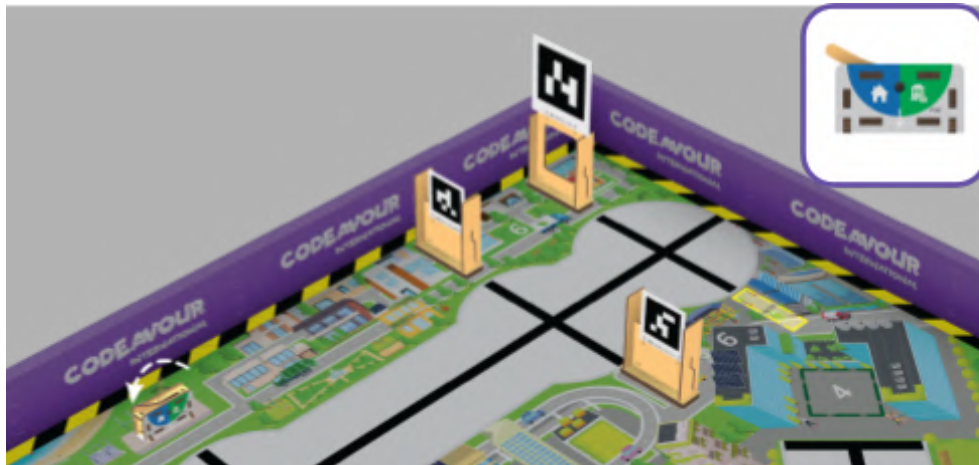


Challenge 6 (Elem.) : Initial Position of the Smart Grid Load Balancer

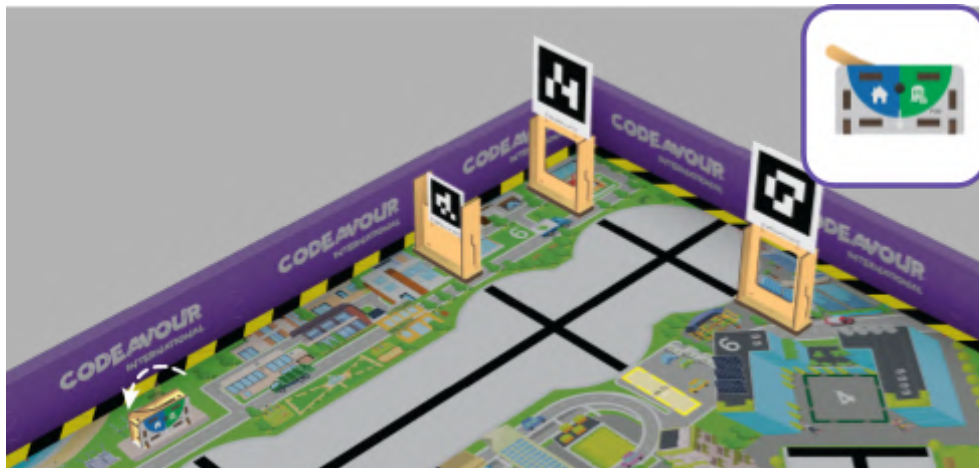
Challenge 6 (Elem.) : Final Positions of the Smart Grid Load Balancer based on the Power Requirement Poll conditions



**Condition 1: 06-T1 and 06-T3 Power Requirement Polls Placement
(Residential Zone has Higher Power Demand)**



*Condition 2: 06-T1, 06-T2 and 06-T3 Power Requirement Polls Placement
(Residential Zone has Higher Power Demand)*



*Condition 3: 06-T1, 06-T3 and 06-T4 Power Requirement Polls Placement
(Residential Zone has Higher Power Demand)*



*Condition 4: 06-T2 and 06-T4 Power Requirement Polls Placement
(Business Zone has Higher Power Demand)*



*Condition 5: 06-T1, 06-T2 and 06-T4 Power Requirement Polls Placement
(Business Zone has Higher Power Demand)*



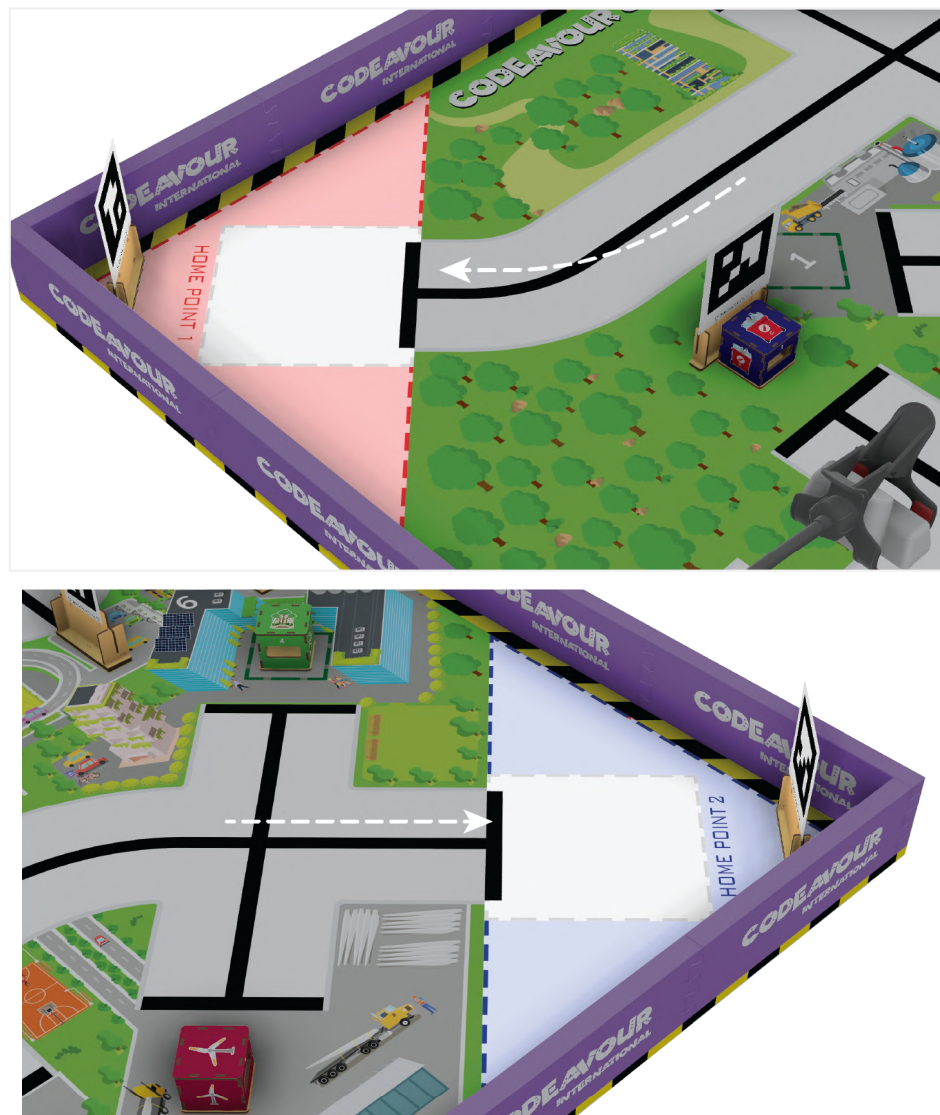
*Condition 6: 06-T2, 06-T3 and 06-T4 Power Requirement Poll Placement
(Business Zone has Higher Power Demand)*

4.7. Bonus Challenge: Return to the Energy Command Station

After completing its clean energy challenges, the robot may return to any one of the Energy Command Stations (Home Points) to report task completion and prepare for its next deployment.

Your task is to return the robot to any one of the designated Home Points on the arena before the end of the round.

Note: This is an optional bonus challenge. The robot is not required to complete all the challenges before returning to an Energy Command Station.



Bonus Challenge: Return the robot to either Home Point 1 or Home Point 2 before the end of the round.

5. Gameplay

5.1. Game Time

5.1.1. Each competition round will consist of the following:

- I. Practice Round: **5 minutes**
- II. Setup Time: **2 minutes**
- III. Main Round: The duration will depend on the team's age category:
 - a. Elementary: **4 minutes**
 - b. Junior & Senior: **3 minutes**

Notes:

- I. *The Practice Round and Main Round may not necessarily take place back-to-back. Teams will be informed of the schedule by the Judge/Volunteer.*
- II. *The number of rounds per team will be announced by the organisers on the event day. Teams should refer to the competition schedule for their assigned rounds and timings.*

5.1.2. The team must connect and place their robot, ready to begin, completely inside either Home Point before the Judge begins the randomisation process for the applicable challenges.

5.1.3. The match timer will start after the randomisation process for Challenges 1 and 6 has been completed through the designated coin toss and dice roll, and the Judge/Volunteer gives the signal to begin.

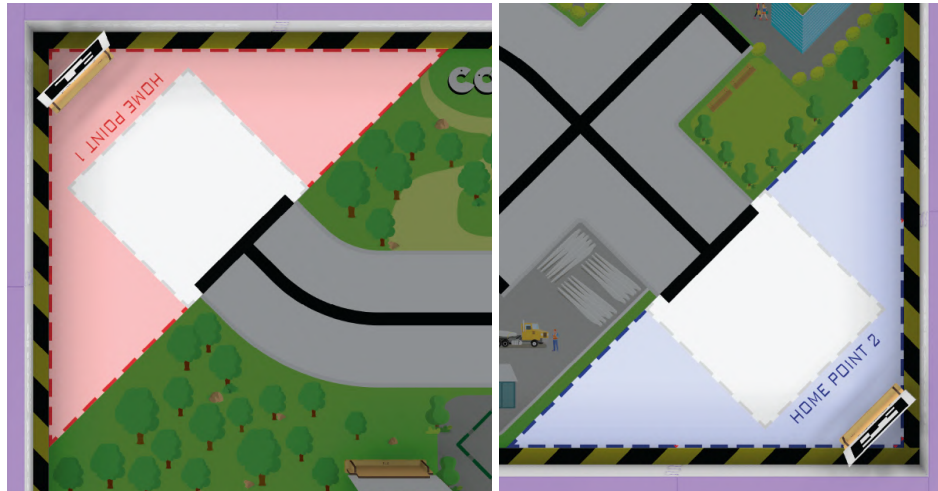
5.1.4. Once started, the timer will continue running throughout the match, including while the robot is at a Home Point, during mode switching for Elementary teams, or during permitted teleportation between Home Points.

5.1.5. If the team completes all desired challenges before the allotted time expires, or wishes to end the match early, the team must prompt the Judge/Volunteer to end the match and stop the timer. Once the timer is stopped, the team cannot resume the match.

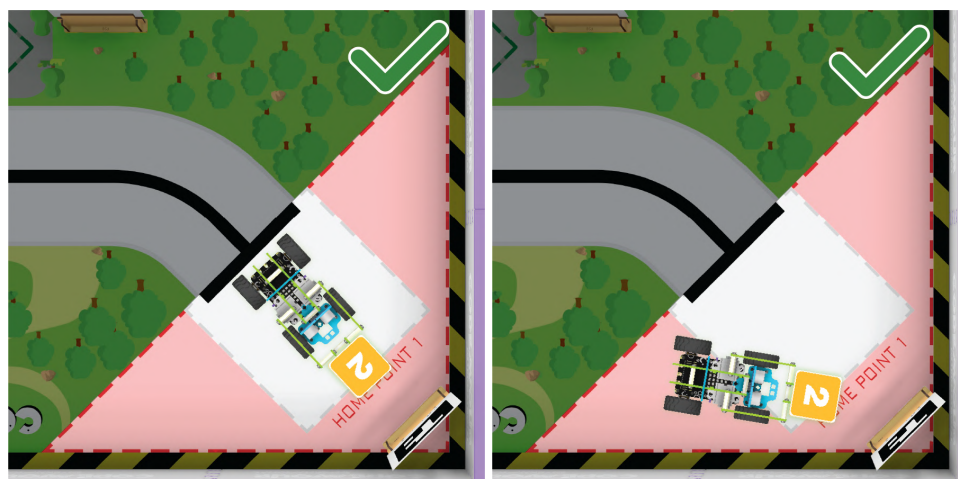
5.1.6. The match automatically ends when the allotted time expires. Teams must stop operating their robot immediately when the Judge/Volunteer announces the end of the match.

5.2. Home Point

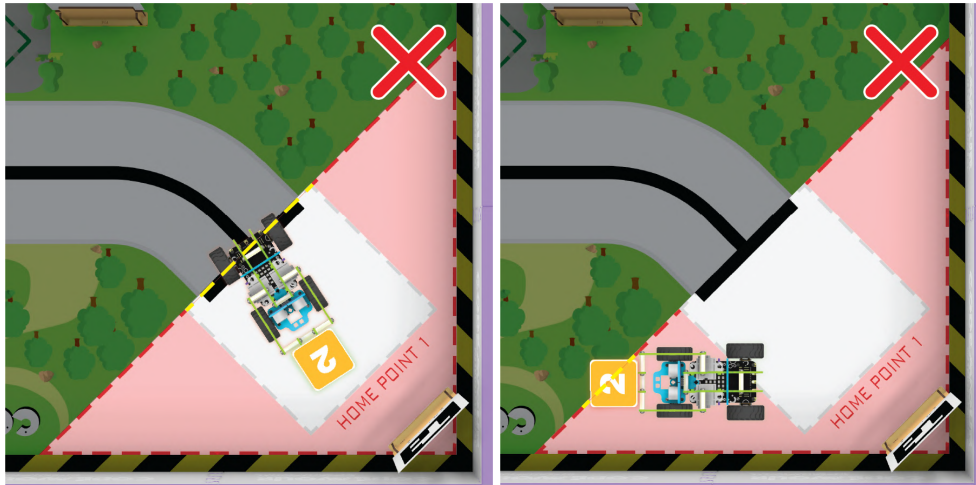
There will be two Home Points in the arena. These areas will act as safe zones where teams can interact with their robots according to the rules below.



- 5.2.1. Teams may start their match from either Home Point.
- 5.2.2. Teams may touch the robot and game objects only when the robot reaches a Home Point and is completely inside the designated Home Area.
- 5.2.3. Once the robot is completely inside the Home Area, teams may touch or adjust the robot. If the robot is holding an object, the object will also be considered part of the robot and must be completely inside the Home Area before touching is allowed.



The robot is completely inside the Home Area



The robot is not completely inside the Home Area

- 5.2.4. Teams may interact with connected devices (such as controllers, computers, or other permitted devices) only when the robot is completely inside a Home Point.
- 5.2.5. Teams are allowed to manually move/teleport the robot between the two Home Points. During this process, teams may correct the robot's position and load or unload objects.
- 5.2.6. Any game objects unloaded at a Home Point will be considered removed from the arena. These objects may be reloaded onto the robot from either Home Point if required.
- 5.2.7. The match timer will continue running after the match starts, including while the robot is inside a Home Point or while the team is teleporting the robot between Home Points.

5.3. Mode (Manual/Autonomous) Switch Rules:

The ability to switch between Manual and Autonomous modes allows teams to adapt their robot strategy during the competition. However, mode-switching rules vary based on the age group.

- 5.3.1. **Elementary Category:** Elementary teams are allowed to switch their robot between Manual Mode and Autonomous Mode during the match.

I. Mode Switching Conditions:

- a. Teams may switch the robot's mode only after completing a challenge and before starting the next challenge.

- b. Mode switching is allowed only when the robot is at a Home Point or a line-following path junction.
- c. Teams cannot switch modes while the robot is in contact with any game object related to a challenge.

II. Mode Switching Process:

- a. Teams must inform the Judge/Volunteer before switching the robot's mode.
- b. There is no limit on the number of mode switches allowed for Elementary teams during the match.
- c. The match timer will continue running while the team is switching the robot's mode.

Note: If any game object(s) come into contact with the robot during manual mode, the respective activity will be scored according to the manual mode criteria, even if the robot had performed the activity entirely or partially in autonomous mode.

- 5.3.2. **Junior and Senior Categories:** Junior and Senior teams must complete all challenges in fully Autonomous Mode. Mode switching to Manual Mode is not permitted for these categories.

5.4. Before the Competition Round

- 5.4.1. The robot must be fully assembled before the commencement of the competition round.
- 5.4.2. The Teams must validate their robot (made with Quarky) and PictoBlox code with the Codeavour robot verification team to ensure it meets the specified requirements physically at the venue. The Robot and the code must adhere to the specifications and inspection guidelines outlined in the rules.
- 5.4.3. The Verification Team may ask the team to disassemble the robot, partially or completely, if required for inspection.
- 5.4.4. Teams will be informed of their competition time slot and assigned game-field table before their round. Teams must report and be ready at the assigned location on time.
- 5.4.5. Teams must ensure that:
 - I. The robot is connected to the required device.
 - II. The robot and connected device are sufficiently charged.
 - III. All required code, programs, hardware, cables, and accessories are ready before the team's slot.

Teams that are not ready at their assigned time may lose their opportunity to compete in that round.

- 5.4.6. Just before each competition round, teams will be given **2 minutes of Setup Time** to test and set up their robots in the allotted practice arena.
- 5.4.7. Before the Judge/Volunteer begins the randomisation process, the team must have the robot connected and ready at either Home Point, as specified in the Game Time rules.

5.5. During the Competition Round

5.5.1. Do's

- I. Only registered team members are allowed in the designated competition/pit area during the match.
- II. When the match ends, the team is responsible for immediately retrieving their robot from the arena when instructed by the Judge/Volunteer.
- III. Teams have the flexibility to devise their own strategy and rearrange the order of challenges.
- IV. When attempting recognition-based Challenges 1 and 6, the robot must perform the required task only as per the permitted recognition methods.
- V. Teams may build and organise their code in separate parts or sequences to perform challenges from one junction or position, making it easier to reset and continue the robot's run.
- VI. Elementary teams may switch between Manual and Autonomous Modes according to the Mode Switch Rules. There is no limit on the number of mode switches. Junior and Senior teams must remain in Autonomous Mode throughout the competition.
- VII. Teams may touch or adjust the robot, game objects, or permitted connected devices only when the robot is completely inside a Home Area, as specified in the Home Point Rules.

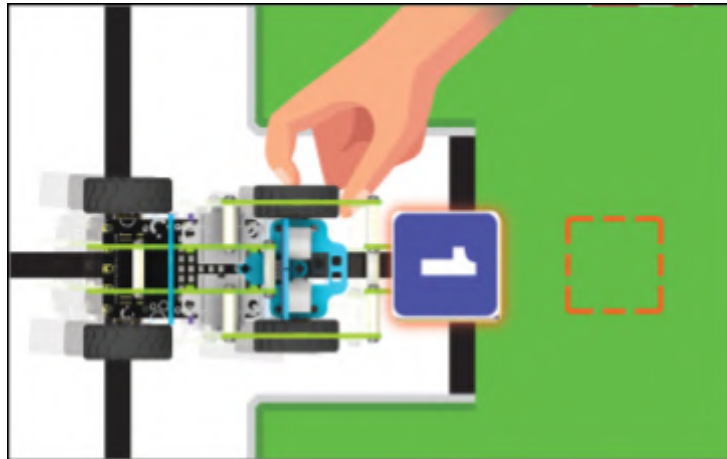
5.5.2. Don'ts

- I. Do not cause any damage to the competition field, arena, or any of the given equipment. Any such activity can result in instant disqualification.

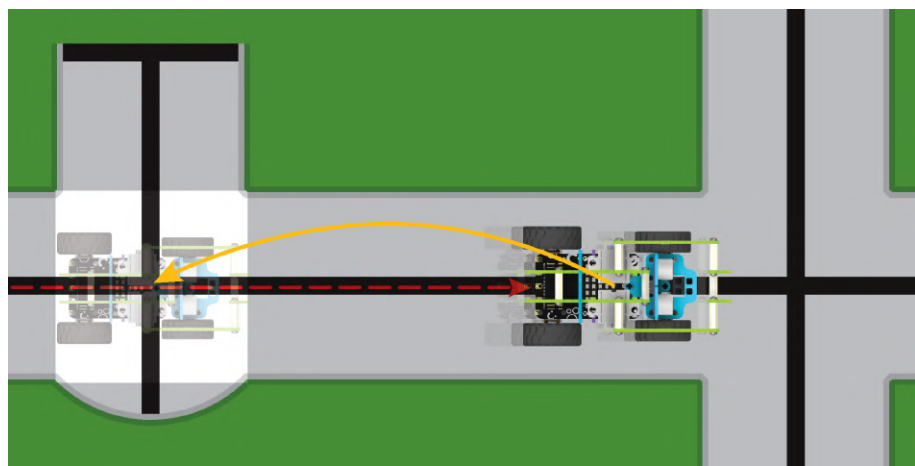
- II. Do not modify the arena setup or interfere with arena components once the match has started, except for actions specifically permitted under the Home Point Rules. Any other changes to the field may be made only by authorised Judges or Volunteers.
- III. Do not communicate, seek assistance, or engage with anyone outside the pit area (including mentors, coaches, teachers, parents, or guardians) during the match. Engaging with individuals outside the pit area can lead to disqualification.
- IV. Teams must not hardcode or otherwise bypass a required AI/recognition task. If a challenge requires object recognition, the robot must use one of the permitted recognition methods for the team's age group. Bypassing the required recognition step will result in a zero score for that challenge.
- V. Do not intentionally make physical contact with another team's robot, game objects, or equipment. Physical interference with another team's equipment may result in disqualification.
- VI. Junior and Senior teams must not operate their robot in Manual Mode at any point during the competition. Elementary teams may use Manual Mode only according to the Mode Switch Rules.

5.6. Fouls

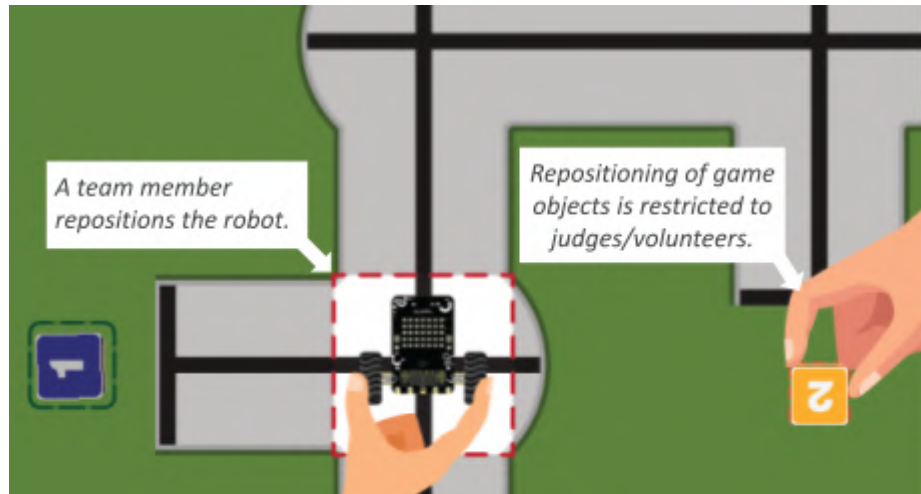
- 5.6.1. **Foul Penalty:** 10 points will be deducted from the team's total score for each foul.
- 5.6.2. **Timer:** The match timer will not be paused during a foul, reset, or corrective action.
- 5.6.3. **Touching the robot or device:** If a team touches the robot while it is outside a Home Point:



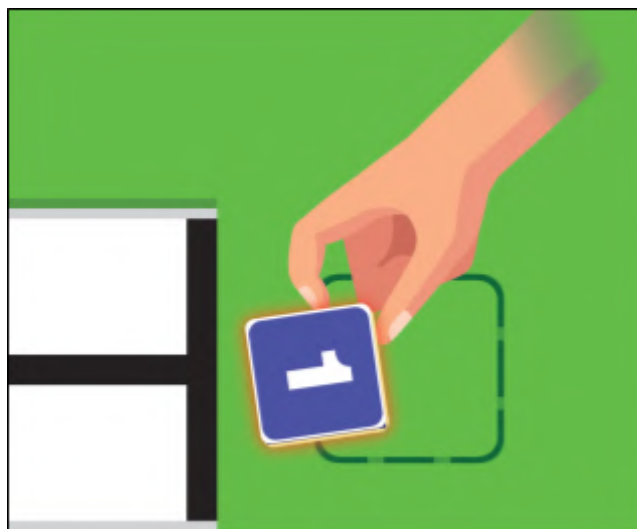
- I. **Autonomous Mode:** Touching the robot or its connected device while the robot is operating in Autonomous Mode is considered a foul and must follow the corrective actions mentioned below.
 - II. **Manual Mode:** Touching the connected device is allowed, but touching the robot while the robot is operating in Manual Mode is considered a foul and must follow the corrective actions mentioned below.
- 5.6.4. **Corrective actions:** If a team touches the robot, the robot must be repositioned at the last junction it successfully crossed or at either Home Point before the match can continue.



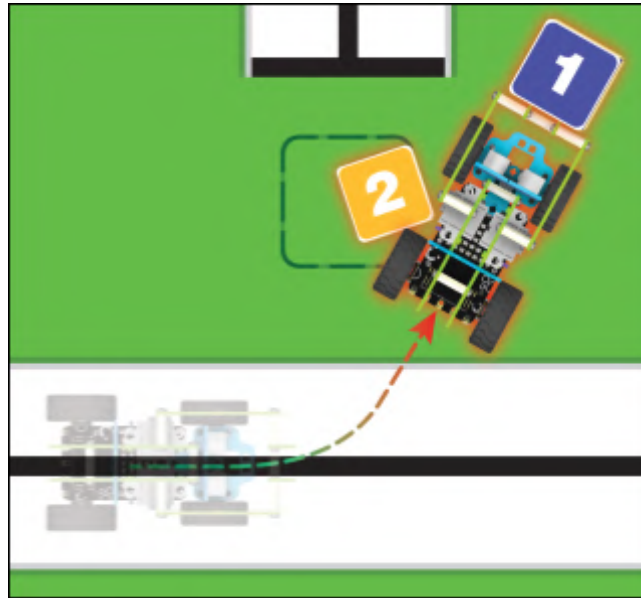
If any game object(s) are in contact with the robot during a hand touch will be reset to their original positions as per the arena setup, and any score previously gained from those object(s) will also be reset.



- 5.6.5. **Failure to Follow Corrective Action:** If a team does not follow the prescribed corrective action for a foul and continues the match, any points earned from challenges attempted after the violation will not be counted. The Judge may also end the match.
- 5.6.6. **Deliberate Game Object Touch:** Deliberately touching a game object when the robot is not in contact with it, except at a Home Point, will result in a foul. The score associated with that object will not be counted.



- 5.6.7. **Unexpected Collision:** If the robot unexpectedly collides with a game object or arena element:



- I. The team may call out the foul and request corrective action, or allow the match to continue without restoring any displaced object(s).
- II. If corrective action is requested, the robot must be repositioned at the last junction it successfully crossed, and any displaced game object(s) will be restored by the Judge/Volunteer to their positions immediately before the collision.
- III. The team may reset the code using the connected device to restart the autonomous programme after the robot has been repositioned.

6. Evaluation and Scoring

The team's score will be determined based on the successful completion of the challenges and the scoring criteria specified for each challenge. Participants are required to complete as many challenges as possible within the time limit. Unfinished tasks will not be awarded points once the time expires.

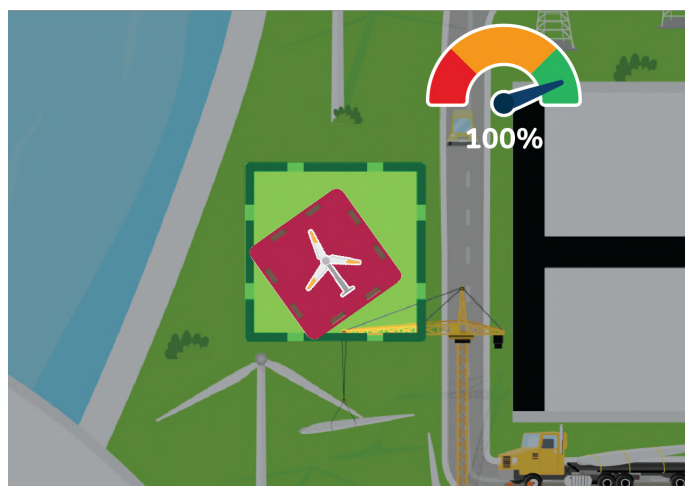
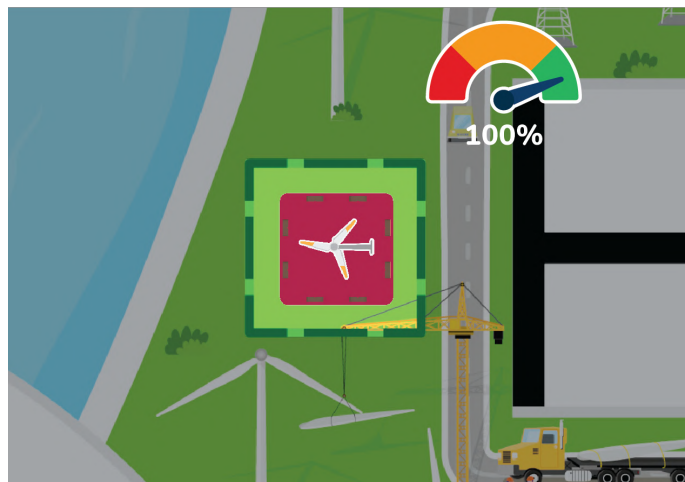
Download the [Score sheet](#) to review individual activity scores and use it for practice.



Note: The scoring for each challenge will be awarded according to the task completed, required conditions, and scoring rules defined in the respective challenge. Any applicable foul penalties will be deducted from the team's total score.

6.1. Scoring for Challenges 1, 3, and 4:

6.1.1. **Full Score:** If a Cube is placed inside or positioned on the green line.



- 6.1.2. **Half Score:** If a Cube is placed partially outside the drop point (green box) will only score half.



- 6.1.3. **No Score:** If a Cube is completely outside the drop point.



6.2. Scoring for Challenge 2:

Scoring will be awarded individually for each Solar Panel Canopy position.

- 6.2.1. **Full score:** If the Solar Panel Canopy is successfully extended up to the green-marked zone.



- 6.2.2. **No score:** If the Solar Panel Canopy is not extended up to the green-marked zone.



6.3. Scoring for Challenge 5:

- 6.3.1. **Full Score:** If both Terracotta Cooling Walls are successfully raised on the Office Building.

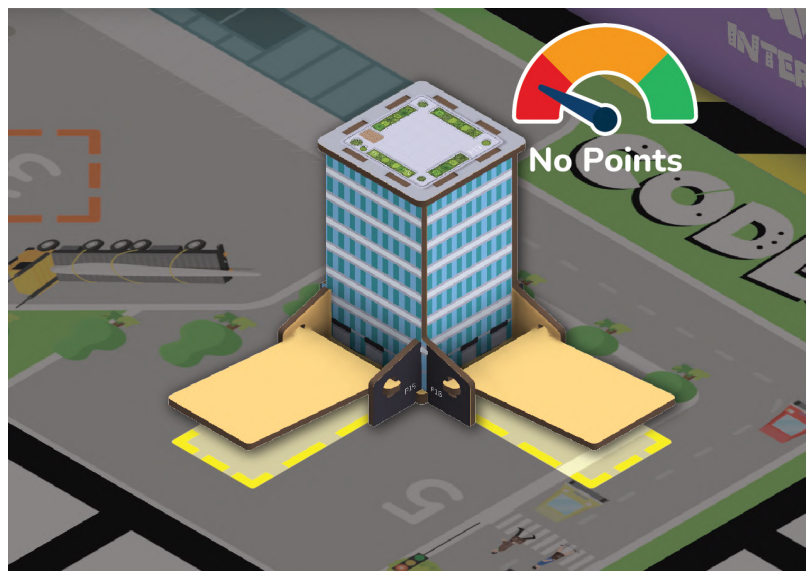


- 6.3.2. **Half Score:** If one of the two Terracotta Cooling Walls is successfully raised on the Office Building.





- 6.3.3. **No Score:** If neither Terracotta Cooling Wall is raised on the Office Building by the end of the game.



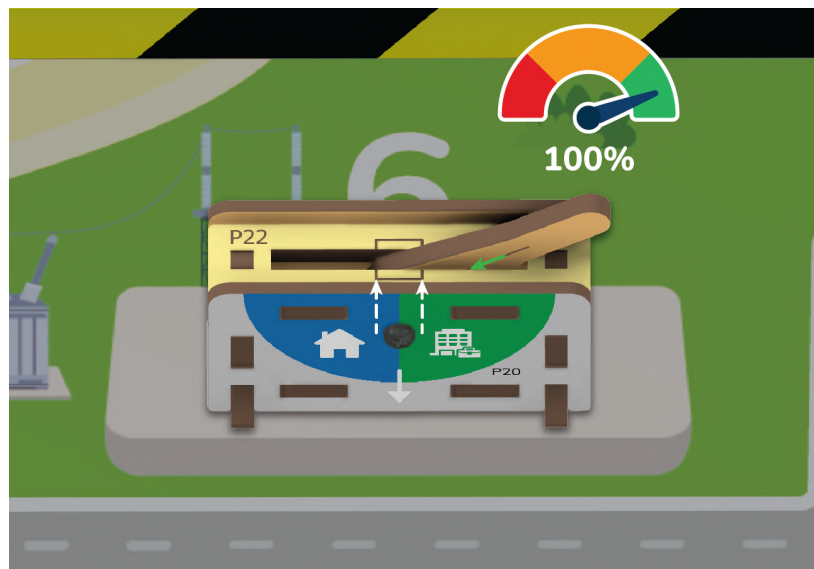
6.4. Scoring for Challenge 6:

6.4.1. **Full Score:** If the Smart Grid Load Balancer is switched to the correct side and the mark on the lever is outside the centre square marking.

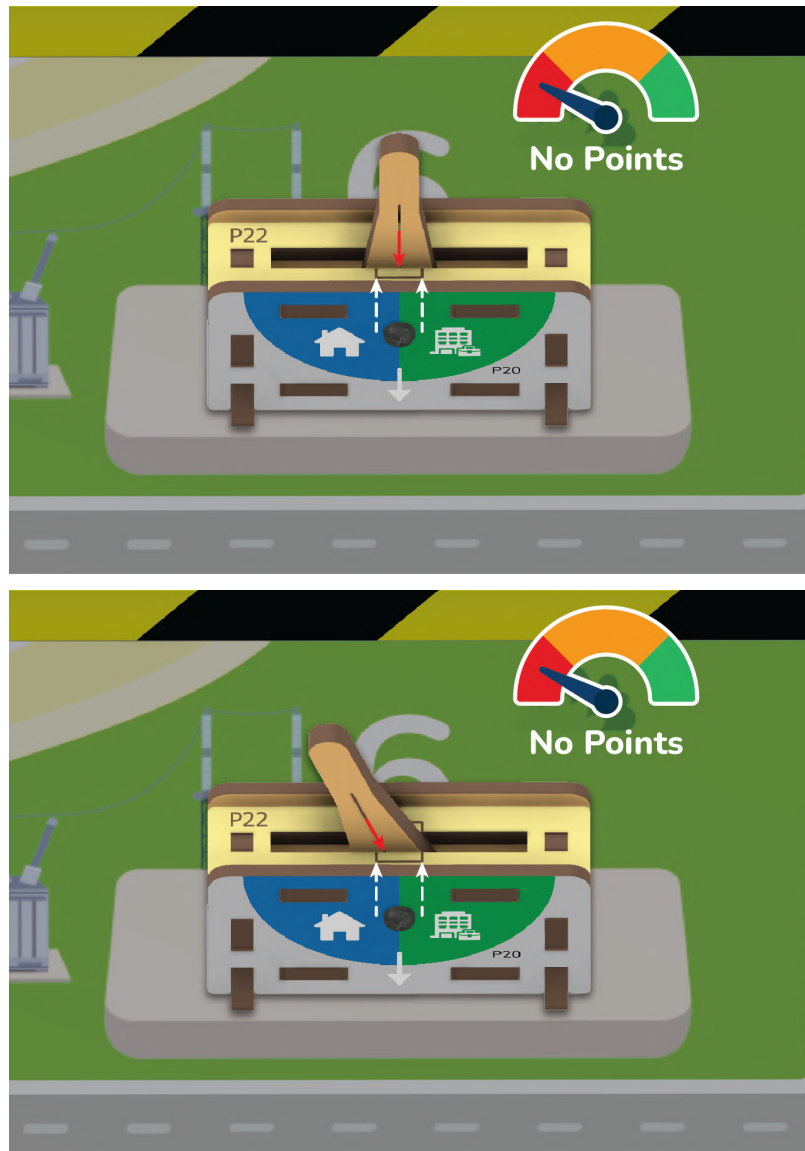
I. When Residential Zone has Higher Power Demand



II. When Business Zone has Higher Power Demand

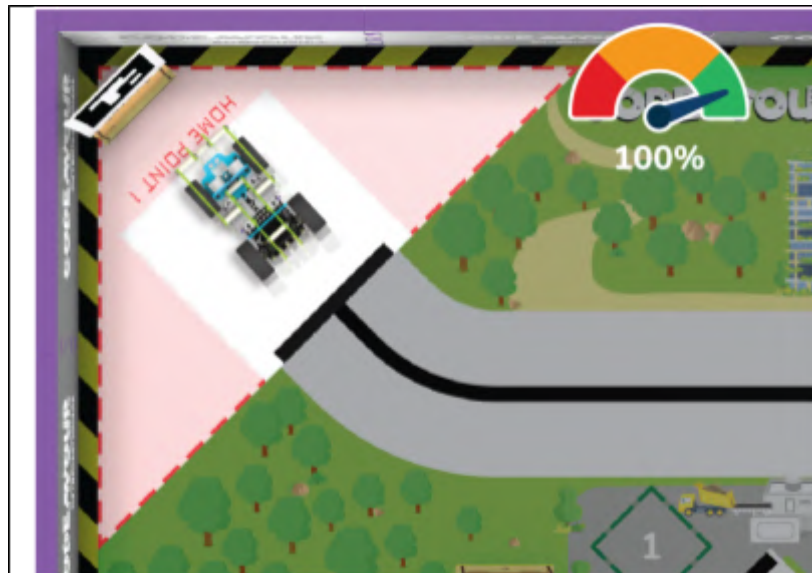


- 6.4.2. **No Score:** the Smart Grid Load Balancer is switched to the wrong side or the mark on the lever remains within the centre square marking.



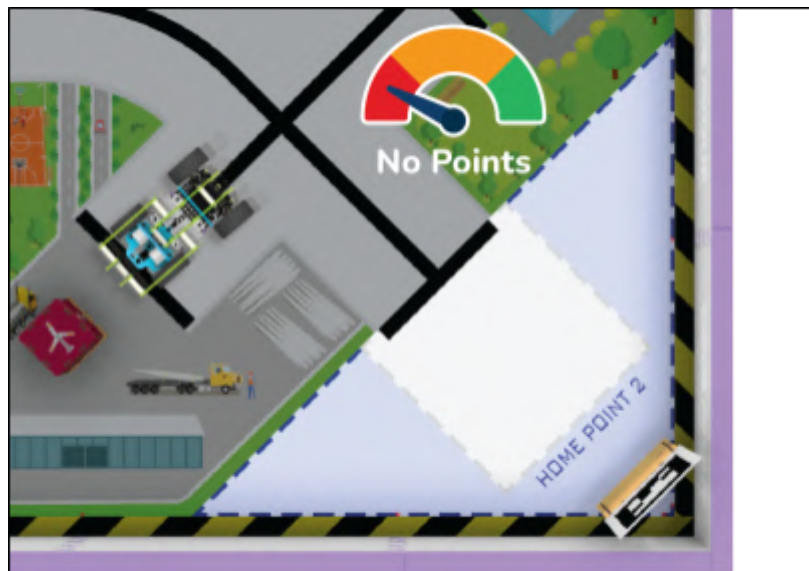
6.5. Scoring for Bonus Challenge:

- 6.5.1. **Bonus point:** If the robot returns to either Home Point and is completely inside the Home Area or positioned on the marked Home Point boundary line before the end of the round.



- 6.5.2. **No bonus point:** If the robot is not completely inside the marked Home Point area or is partially outside the marked Home Point boundary at the end of the round.

Note: If the robot is carrying any game object or has any loose or partially detached part due to a mishap, the game object or loose part must be completely inside the marked Home Point area for the team to receive the bonus point.



7. FAQ's

7.1. What is Track 2: Clean Energy AI-Robo Challenge?

Track 2 invites participants to design, build, and code AI-powered robots to tackle real-world clean energy and sustainability challenges across the arena. Participants will apply their robotics, AI, coding, and problem-solving skills to complete missions involving renewable energy, energy management, and sustainable solutions.

7.2. Who can participate in Track 2?

Track 2 is open to participants in three age groups:

- I. Elementary (7-10 years)
- II. Junior (11-14 years)
- III. Senior (15-18 years).

The maximum team size is three members and one mentor.

7.3. Can we use any robot or microcontroller for Track 2?

Participants must only use "Quarky" or "Quarky Intellio" to design and build their robots.

7.4. How many batteries can I use in my robot?

Any battery that is compliant with standard safety norms is acceptable, and a maximum voltage of 5 volts between any two Robot terminals is allowed.

7.5. What are the robot's size and weight limitations?

The robot's size must not exceed 20x20x20cm (LxBxH) and should weigh a maximum of 1kg. However, it can expand while in the game.

7.6. Should robots be fully autonomous, or can we control them manually?

The mode depends on the age category. Elementary teams can operate their robot in either Manual or Autonomous Mode and may switch between the two without any limit, subject to the Mode Switch Rules. Junior and Senior teams must operate their robot fully autonomously throughout the match without manual control or intervention.

7.7. What materials and components are required to build the robot?

Participants may build their robot using any materials and components that comply with standard safety requirements. The robot must use a Quarky Series controller as the main controller and must meet all the technical specifications, safety requirements, and inspection guidelines outlined in the competition rules.

7.8. Can we bring pre-assembled robots to the event?

Yes. Teams are encouraged to bring their custom-built robots pre-assembled to the event. The Codeavour Verification Team may ask teams to partially or completely disassemble the robot for inspection, if required. Teams are responsible for bringing all necessary components, including sensors, actuators, batteries, cables, and tools. No additional robot-building materials or components will be provided at the venue.

7.9. How many robots can we have as a team? Can we share our robot?

Each team must have one dedicated robot for the competition. Teams are not permitted to share their robot with another team. Sharing a robot between teams may result in disqualification.

7.10. How is scoring done for Track 2?

The scoring criteria for Track 2 are based on several factors:

- I. Number of challenges completed
- II. Status of completion of each Challenge
- III. Mode of control for each challenge – manual/autonomous
- IV. Total Fouls committed
- V. Status of completion of Bonus challenge

7.11. Are there time limits for completing challenges?

The total game time depends on the team's age category:

- I. Elementary: 4 minutes
- II. Junior & Senior: 3 minutes

The timer starts after the randomisation process for Challenges 1 and 6 is completed and the Judge/Volunteer gives the start signal. The timer continues running throughout the match and will not be paused. Teams must complete as many challenges as possible within the allotted time; unfinished challenges will not receive points once the timer expires.

Note: *The stopwatch timer is not paused once the round has started under any circumstances.*

7.12. What is the role of referees and volunteers in the event?

Referees and volunteers will oversee the competition, ensuring rules are followed, scoring is accurate, and assistance is provided where needed.

7.13. Are the objects in the arena secured in their designated positions?

Game objects will be placed in their designated positions according to the arena setup before the match. However, some objects may be moved or repositioned as part of a challenge or due to robot interaction. Teams must not deliberately modify the position of game objects unless permitted by the

challenge rules or Home Point rules.

In case of an unexpected collision, the Judge/Volunteer may restore any displaced game object to its position immediately before the collision, as specified in the Foul and Corrective Action rules.

7.14. What should we do if the time and scores are equal?

There will be another tiebreaker round for those who have a tie in both best score and time.

7.15. Are the Unique Mechanisms and AprilTags fixed to the table? Is knocking over or moving these objects considered a foul?

The Unique Mechanisms and AprilTags will be placed at their designated positions as per the arena setup. Teams must not intentionally move, remove, or modify them unless the relevant challenge specifically requires the robot to interact with them.

Accidentally knocking over or moving an object due to an unexpected collision is not automatically considered a foul. The team may call out the incident and follow the applicable Unexpected Collision and Corrective Action rules. Any displaced object may be restored by the Judge/Volunteer to its position immediately before the collision.

Intentional interference with arena components or game objects outside the permitted challenge actions may result in a foul or termination of the round.

7.16. If the Bluetooth connection is lost, does the timer pause or continue running?

The timer will not be paused for any reason once the round commences. Teams are responsible for resolving any encountered issues within the round duration.

7.17. When can code changes be made during the competition? Can code updates be made during trial periods or in the main round?

Teams may modify or update their code during the competition, including during the Practice Round and Main Round, subject to the competition rules. For challenges that require AI-based recognition, the required recognition process must be properly implemented and executed. Teams must not hardcode the result or bypass the required recognition step. Bypassing the required recognition process will result in zero score for that specific challenge.

Teams may also prepare and execute their code in separate parts or sequences to perform challenges from a line-following junction, as permitted by the competition rules

7.18. Can the robot be controlled via Dabble or directly via PictoBlox (computer)?

Yes. Elementary teams may control their robot manually using Dabble or PictoBlox on a computer, provided the control method is compatible with the robot and competition setup.

However, Junior and Senior teams must operate their robots fully autonomously throughout the competition and cannot use manual control through Dabble, PictoBlox, or any other control method.

7.19. Can the robot mechanically expand during the game, and what size must it be when returning to a Home Point?

The robot's initial dimensions must not exceed 20cm x 20cm x 20cm (Length x Breadth x Height). Expansion is permissible once the robot departs from the starting position. The robot may maintain any expanded size or position when returning to a home point or utilizing a teleportation mechanism between home points.

7.20. Can we use a wired connection between the robot and the connected device?

No. Only a wireless connection is allowed between the robot and the connected device during the competition. However, for the recognition-based Challenge 1, teams will be provided with a wired webcam that may be connected to their device for recognition.

7.21. Can we use any camera module with Quarky?

Yes. Teams may use Intellio or another compatible camera module with the Quarky for recognition. However, Quarky must remain the main controller board of the robot.

7.22. Can we use Intellio as the main controller for our robot?

Yes. Teams may use Intellio as the main controller of their robot. They may use Intellio along with compatible expansion boards, provided that Intellio remains the main controller throughout the competition.

8. Glossary

Glossary	
AI (Artificial Intelligence)	The ability of machines, especially computer systems, to perform tasks that typically require human intelligence, such as visual perception, recognition, decision-making, and problem-solving.
AprilTag	A visual marker that can be detected by a camera and used by a robot for identification, positioning, or navigation.
Autonomous Robot	A mode in which the robot operates independently using its programmed instructions, sensors, camera, and/or other permitted technologies without manual control.
Bonus Point	Additional points awarded when the robot meets the specified end-of-round Home Point condition.
Calibration	The process of adjusting and fine-tuning the robot's sensors, camera, or movements to improve accuracy and performance.
Challenge	A specific task that participants must complete using their robot according to the defined rules and scoring criteria.
Codeavour	An international AI and robotics competition that challenges participants to design, build, and programme robots to solve real-world problems.
Corrective Actions	The actions required after a foul, such as repositioning the robot or resetting affected game objects, before the team can continue the match.
Decision Coin	A physical coin used for the designated randomisation process before the match, including determining the required Challenge 1 setup.
DIY (Do-It-Yourself)	The practice of building, modifying, or repairing something without the direct aid of experts or professionals.
FOV (Field of View)	A camera or other optical device can see the extent of the observable world at any given moment.
Foul	A violation of a competition rule that results in a penalty and may require specific corrective actions.
Game Arena	The complete designated competition area containing the game field, Home Points, game objects, and other arena elements.
Game Field	The area within the competition arena where the robots perform the challenges and tasks.
Game Objects	Physical items are placed inside the arena that robots interact with during the challenges.
Grab	A method of robot manipulation in which a mechanism grips and holds an object.
Home Point	One of the two designated safe areas in the arena where a team may start the match and interact with the robot, game objects, and permitted connected devices according to the rules.
Home Point Teleportation	The permitted manual movement of the robot, along with game objects it is carrying, from one Home Point to the other.

Junction	The intersection of two black lines on the arena that serves as a reference point for robot repositioning and, where permitted, mode switching or code execution.
Machine Learning	A method that enables computers to learn patterns from data and use those patterns to make predictions, classifications, or decisions without being explicitly programmed for every situation.
Machine Learning Environment	The PictoBlox environment used to collect data, train Machine Learning models, and use or export the trained models for supported coding environments.
Manual Mode	A mode in which the robot is controlled by a participant in real time using a permitted control method.
Pick and Place	A robot manipulation method in which an object is picked up from one location and placed at another designated location.
Pick up Point	The designated area from which a game object is to be picked up before or during a challenge, as specified in the challenge rules.
PictoBlox	The programming software specified for programming and controlling the robots used in the competition.
Push Pull	A robot manipulation method in which force is applied to an object to push or pull it to a desired location.
Quarky Expansion Board	An additional board that can be connected to Quarky to extend its functionality and provide additional interfaces or capabilities.
Quarky	The specified programmable controller used as the main controller for building robots in the competition.
Robot Verification Team	The designated team responsible for checking whether robots, hardware, and PictoBlox code comply with the competition requirements and inspection guidelines.
Robotics	An interdisciplinary field combining mechanical engineering, electronics, computer science, and AI to design, build, programme, and operate robots.
Scoring Sheet	A record used to document the points earned by a team for individual challenges, bonuses, and other applicable scoring criteria.
Sensors	Devices that detect information from the physical environment, such as distance, light, colour, motion, or other conditions, and provide input to the robot.
Table Number	A unique identifier is assigned to each competition table or area where teams perform their challenges.
Teleportation Strategy	A permitted strategy in which the team manually moves the robot and permitted carried objects between the two Home Points to continue the match from a different Home Point.
Track	A specific competition category within Codeavour. Track 2 is the Clean Energy AI-Robo Challenge.
Unexpected Collision	An unplanned collision between the robot and a game object or arena element that may require the corrective actions specified in the rules.
Unique Mechanism	A designated mechanism or arena element that the robot must interact with as part of a specific challenge.
Violation	To act against (a rule, law, principle, promise, agreement, instruction, etc.); break,

	transgress, or fail to honor.
Wired Connection	A physical connection using wires or cables to transfer data or power between devices.
Wireless Connection	A connection that allows data or power transfer between devices without the need for physical wires or cables.

Important: Please note that minor updates to this competition's rules and guidelines may be made before/during the competition to ensure accuracy and fairness. Before the competition, you will receive your time slot and table number.

The Challenge Awaits!

Get your robot ready, plan your strategy, and put your AI, robotics, and problem-solving skills to the test in the Clean Energy AI-Robo Challenge.

The arena is ready. Are you?

Register Now!

Join thousands of young innovators worldwide
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