

# SEAKEEPERS ROBOTICS COMPETITION 2023

## ROBOTICS PLAYFIELD COMPETITION MANUAL

JOINTLY ORGANISED BY:



## 1. Introduction

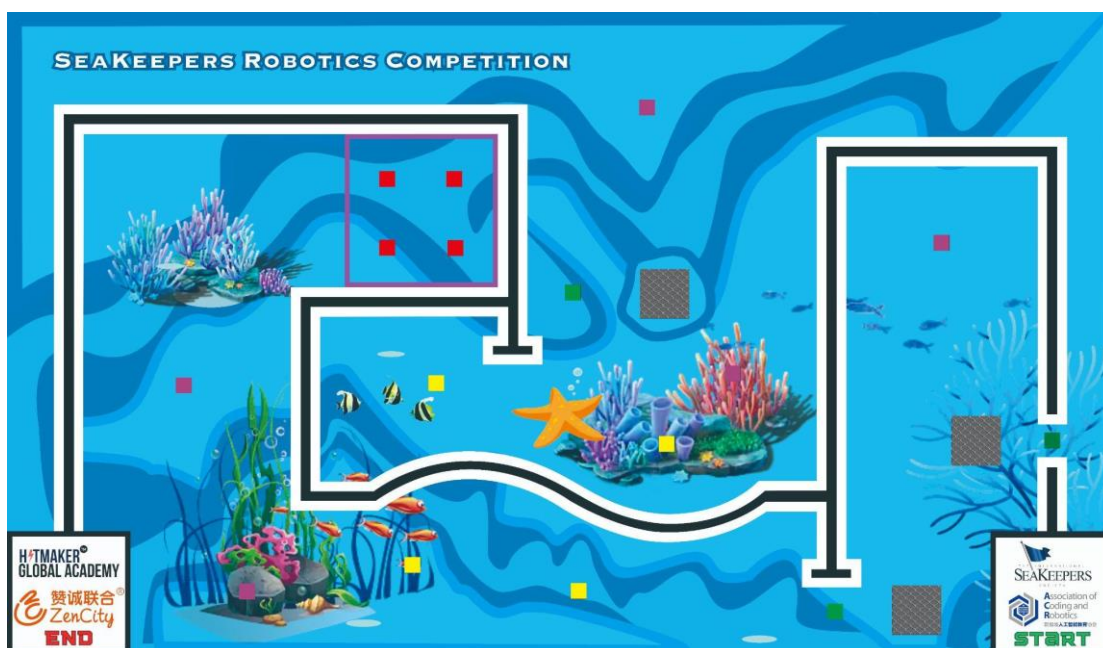
Coral reefs, often referred to as the "rainforests of the sea," are vibrant and diverse underwater ecosystems formed by the accumulation of calcium carbonate skeletons secreted by tiny coral polyps. They play a critical role in maintaining coastal ecosystems, protecting shorelines from erosion, and supporting local economies through tourism and fisheries. However, these precious ecosystems are facing unprecedented threats, including climate change, overfishing, pollution, and habitat destruction.

Conservation efforts for coral reefs are crucial to safeguarding their future and the health of our oceans. One innovative approach to bolster these efforts is the use of automated robots. These robots have the potential to revolutionise coral reef conservation by performing a range of tasks, such as monitoring water quality, identifying coral health, mapping reef structures, and even assisting in reef restoration.

In this competition, the team's robot is tasked to collect plastic trash, remove harmful invasive species, and plant new corals in an identified coral garden, all the while avoiding causing damage to the fragile ecosystem.

## 2. Playfield

The following graphic shows the playfield for this competition:



### **3. Game Rules**

#### **3.1. Pre-Run**

- Robot will be inspected by the referee according to the requirements prior to quarantine. The maximum robot dimensions before the robot run starts are 250 mm x 250 mm x 250 mm, including cables.
- Once quarantined, teams are not allowed to make changes to the design of the robot or the programme.
- No wireless communication (Wifi, Bluetooth, etc.) is allowed.

#### **3.2. Start of Robot Run**

- Robot must be placed on the play field so the projection of the robot is completely within the starting area.
- Teams are allowed to make physical adjustments to the robot in the starting area.
- Referees are to inspect the placement of the robot.
- Each robot run attempt is 2 minutes (120 seconds). The time starts when the referee gives the signal to start.

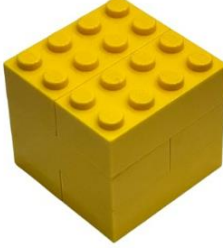

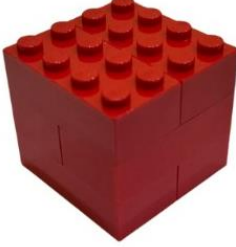

#### **3.3. During Robot Run**

- The robot must be fully automatic. Teams are not allowed to touch the robot throughout the entire robot run.
- Teams are not allowed to reprogram and enter data into the robot during the robot run.

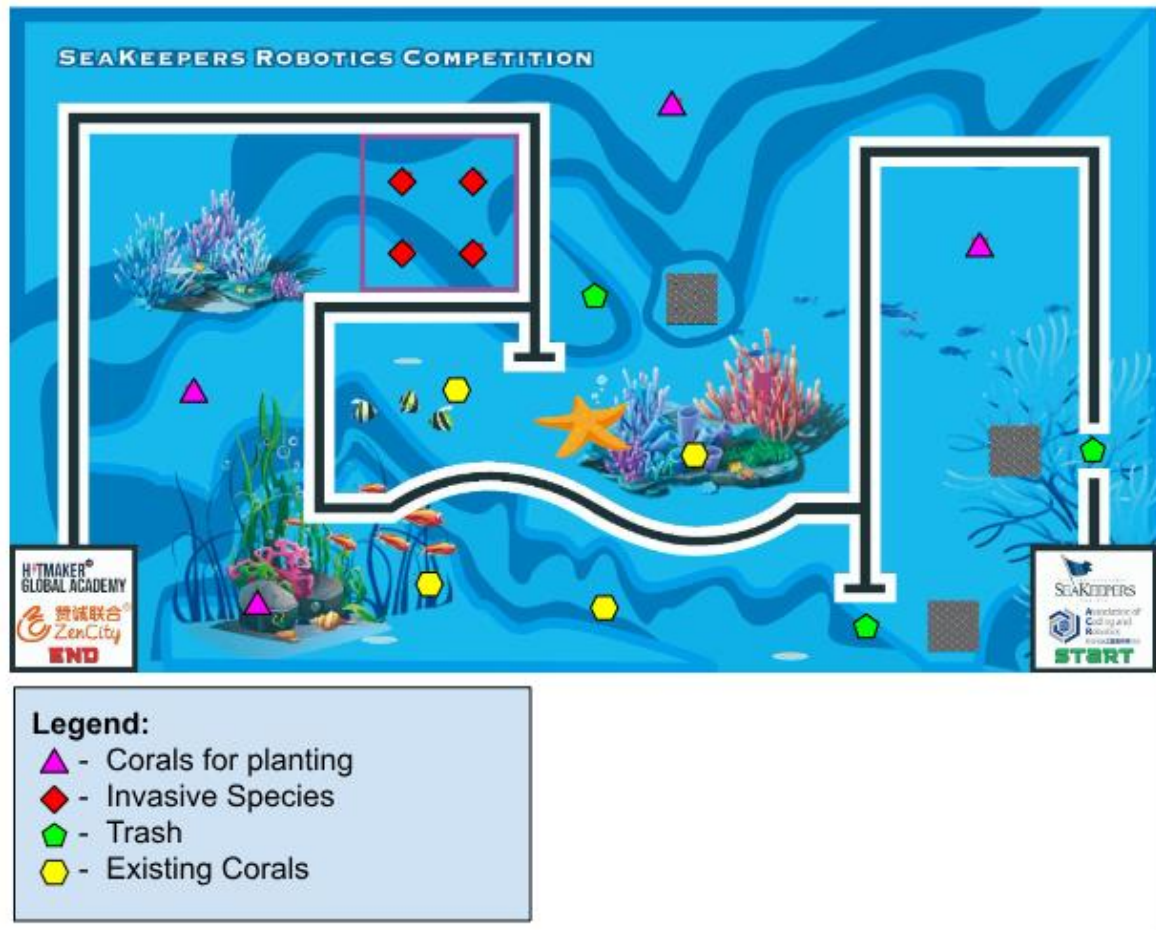
#### **3.4. End of Robot Run**

- A robot run will end if:
  - The two minute mark is up.
  - The robot has completely left the game table.
  - The robot or team has violated the rules or regulations.
  - A team member shouts "STOP" and the robot comes to a complete stop. If the robot is still moving, the team is then allowed to stop the robot by hand, and the robot run only ends when the robot either stops by itself or is stopped by the team.
- After the robot run, the referee will score the attempt. Teams are required to sign off the scores on the score sheet. Once the score is signed off no further changes are allowed.
- If a team does not sign off the scores after a certain period of time, the referee may decide to disqualify the team's robot run attempt.

### 3. Game Objects

<p><b>4 Existing Corals</b></p> <p>There are 4 existing corals placed on the yellow squares on the playfield.</p>	
<p><b>3 Pieces of Plastic Trash</b></p> <p>There are three pieces of plastic trash placed on the green squares on the playfield.</p>	
<p><b>4 Invasive Species</b></p> <p>There are four invasive species placed on the red squares on the playfield inside the purple square (coral garden).</p>	
<p><b>4 Corals for Planting/Relocation</b></p> <p>There are four corals placed on the purple squares on the playfield.</p>	

The following graphic shows the starting positions of the Game Objects on the playfield for this competition:



## **4. Robot Missions**

### **4.1. Coral Reef Traversal**

Coral reefs are fragile ecosystems. One of the key requirements of the robot is to carry out its tasks without accidentally damaging the reefs. In this mission, the robot will be judged on whether it can avoid causing destruction to existing corals.

There are four pieces of yellow corals placed on the four yellow colour squares on the playfield. To complete this mission, the robot must end its run by stopping completely inside the end area without displacing any of the yellow corals from their original positions.

Full points are awarded only when the robot also manages to earn some points from the other two missions. For example, this mission is not considered completed if the robot travels from the start area to the end area without engaging anything else on the playfield.

### **4.2. Plastic Trash Collection**

Coral reefs are often subjected to the risks of pollution, and plastic debris is especially damaging as it often suffocates corals and increases the likelihood of disease spreading. In this mission, the robot's task is to remove plastic wastes from the environment.

There are three pieces of green plastic trash placed on the three green colour squares on the playfield. To complete this mission, the robot must move the plastic trash pieces into the collection nets.

Full points are awarded if all plastic trash pieces are completely inside the collection nets.

### **4.3. Coral Garden Management**

One way to preserve coral reefs is to manage coral gardens, i.e. dense aggregation of colonies or individuals of coral species. In this mission, the robot's task is to plant new corals in the garden for restoration and remove the potentially harmful invasive species in the same region.

The coral garden can be identified on the playfield by the purple square. There are four individuals of invasive species (red) placed in the coral garden and five pieces of purple coral placed on the purple squares on the playfield.

Full points are awarded if all invasive species are completely outside the coral garden and all purple corals are completely inside the coral garden.

## 5. Scoring

Tasks	Each	Total
<b>1. Coral Reef Traversal</b>		
Yellow coral NOT completely removed from original position.	10	40
Robot coming to a stop completely inside the end area after earning points from one of the other two missions.		20
<b>2. Plastic Trash Collection</b>		
Green plastic trash completely placed inside collection net.	20	60
<b>3. Coral Garden Management</b>		
Invasive species completely removed from the coral garden area.	20	80
Purple coral completely placed inside the coral garden area.	20	100
<b>Maximum Score</b>		300

For each team, the best attempt of two robot runs is used as their final score. If multiple competing teams have the same points, the ranking is decided by their completion time. If a team finishes a robot run attempt without having solved any task that yields positive scores, the time of that particular robot run will be set to two minutes (120 seconds).