NATIONAL ROBOTICS COMPETITION

Welcome to National Robotics Competition 2023

Organiser:

Sponsored by:

Supported by:

NRC Moving Forward

- Remains the only robotic competition in Singapore supported by the Ministry of Education (MOE)

- Celebrating the process of learning through interactive and meaningful experiences

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NATIONAL ROBOTICS COMPETITION

NRC Regular Category

Lower Primary: 7-9 years old | Upper Primary: 10-12 years old
Secondary: 13-16 years old | Tertiary: 16-19 years old

NRC Open Category

Primary: 8-12 years old | Secondary: 13-16 years old | Tertiary: 16-19 years old

NRC AI Maker Series

Primary: 8-12 years old | Secondary: 13-16 years old

NRC Pre-School (Kubo and ARTec Challenge)

5-6 years old

NRC CoderZ Coding Challenge (Online)

Primary: 8-12 years old | Secondary: 13-16 years old

NRC RoboCup Singapore CoSpace Coding Challenge *NEW*

Primary: 8-12 years old | Secondary: 13-16 years old | Tertiary: 16-19 years old

Organiser:

Science Centre Singapore

DUCK LEARNING opportunities in education

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Ministry of Education SINGAPORE

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GLOBAL ROBOTICS GAMES

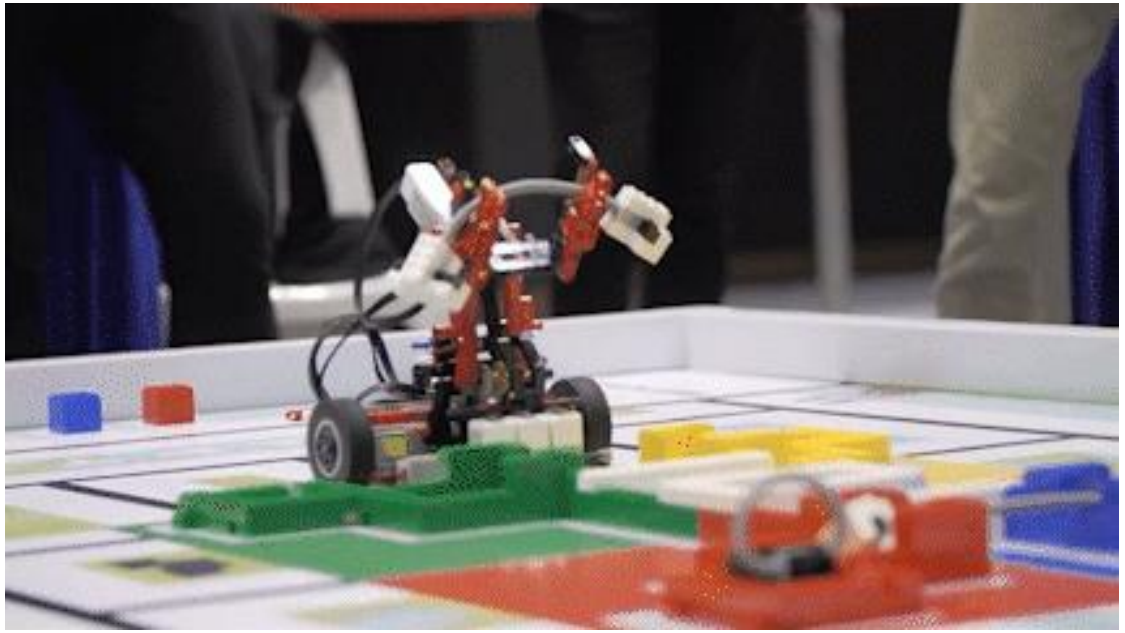
SP Singapore Polytechnic

RoboCup SINGAPORE

WOW Learning

NATIONAL ROBOTICS COMPETITION

Held live on-site at Science Centre Singapore from 21 August to 9 September 2023



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NRC Regular Category 2023

Lower Primary

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Agenda for the Webinar

- Introduction to the NRC Regular Category
- Introduction to the Lower Primary theme
- Introduction to Gameplay
- Scoring
- Qualifiers and Finals
- Important Dates

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NRC Regular Category 2023

Presentation and Robot Runs

- Presentation based on themes of individual categories
- Robot Runs based on scores from solving missions

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Introduction to NRC Regular Category 2023

General rules

- Teams
  - 2 to 3 team members per team
- Age groups
  - Lower Primary: 7 to 9 years old (born in 2014 to 2016)
  - Upper Primary: 10 to 12 years old (born in 2011 to 2013)
  - Secondary: 13 to 16 years old (born in 2007 to 2010)
  - Tertiary: 16 to 19 years old (born in 2004 to 2007)

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Introduction to Lower Primary Theme

- This year theme is “Green School”
- Sustainability efforts must be applied at the best place outside our homes, at school. Food security, proper water management, renewable energy sources and recycling are just some of the green practices that can be done in our schools.
- The robot takes on the task of planting edible seeds, collecting rainwater, activating solar panels, locating the recycling bin and even displaying the schools sustainability mascot! Remember the robot is operating in a school so it must be intelligent enough to avoid bumping into obstacles.

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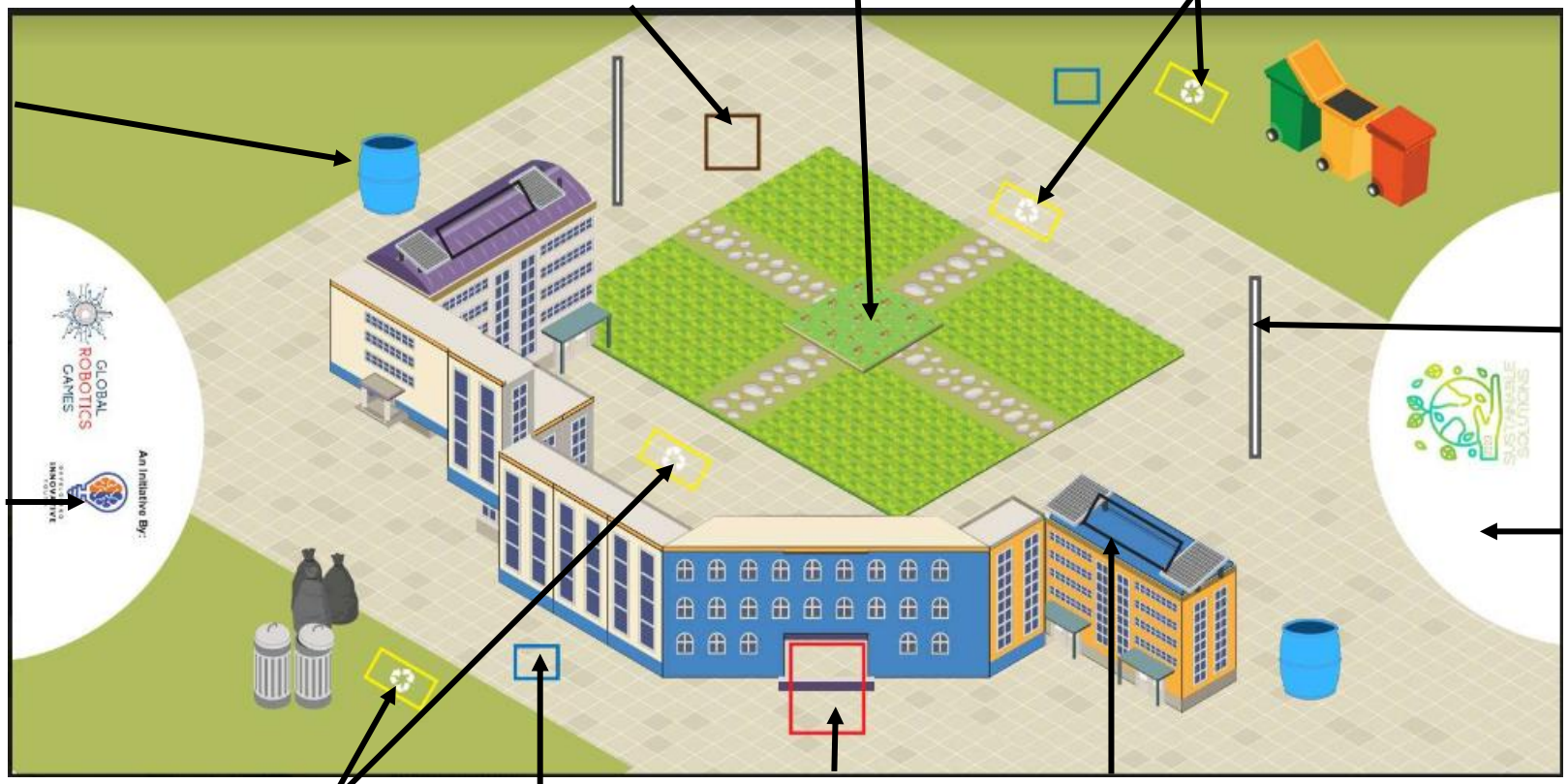
Game Mat (I)



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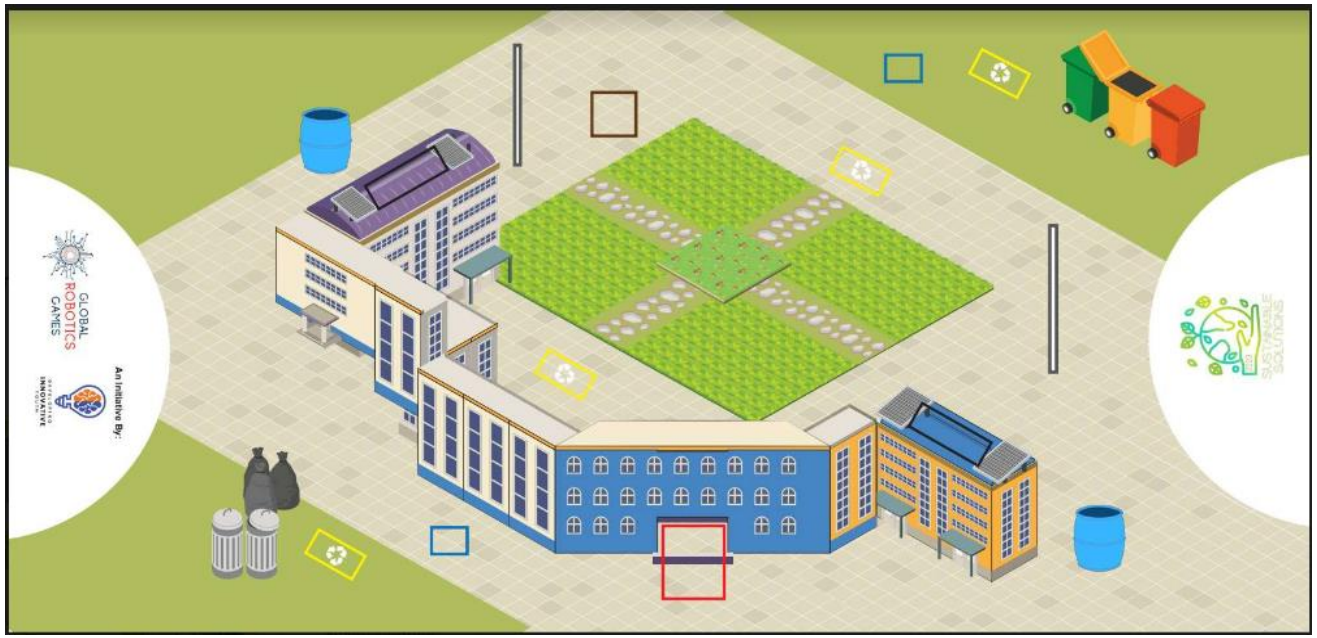
Game Mat (II)

- The playfield design has to be printed on a mat that is pasted onto the game table.
- The game mat must be printed with a matt finish/overlay on a PVC tarp.
- The dimension of the mat is 2362 mm x 1143 mm.
- Game tables should have the same size or max +/- 5mm in each dimension.
- The official height of the borders of a game table is 50mm.

Sub-Category Game Rules (I)

Pre Run

a) Robot and Construction Equipment will be inspected by referees according to the requirements prior to quarantine.
b) The Robot must be placed in the starting area so that the entire robot on the game mat is completely within the start area.
c) Teams are allowed to make physical adjustments to the robot in the starting area before the start of the run.
d) Teams are not allowed to enter data to a program by changing positions or orientation of the robot parts or to make any sensor calibrations of the robot.



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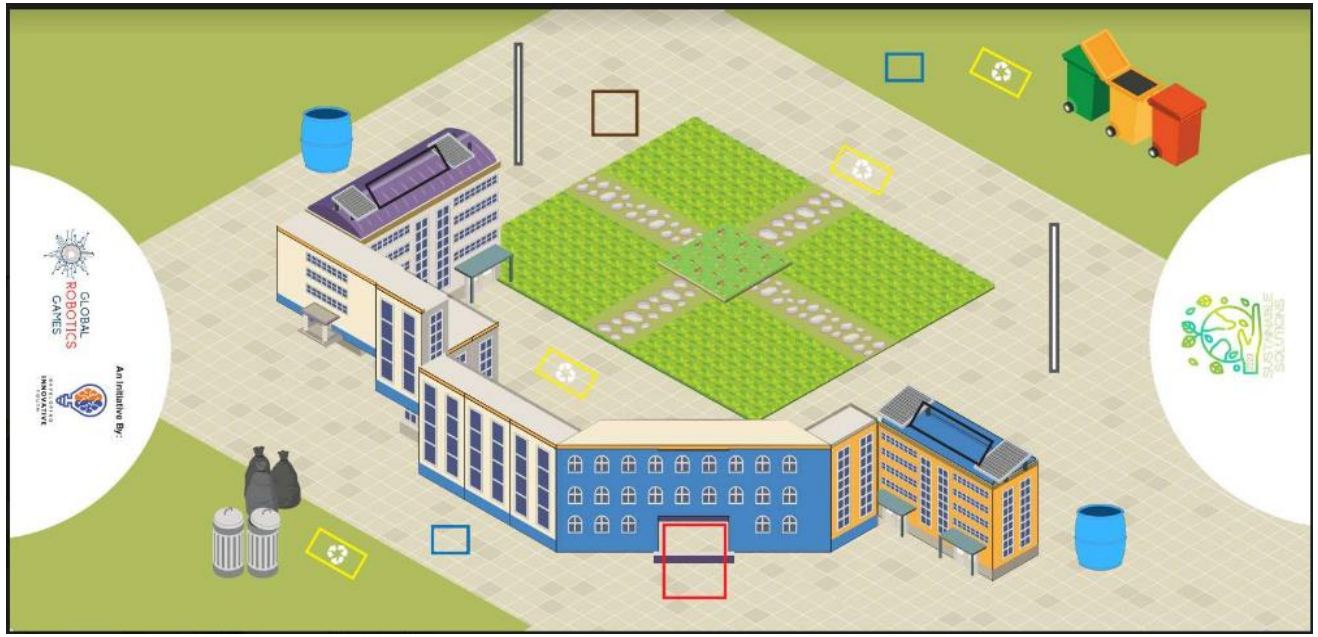
Sub-Category Game Rules (II)

Start of Robot Run

a) Time begins when the judge gives the signal to start.

b) Each robot attempt is 2 minutes run (120 seconds)



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Sub-Category Game Rules (III)

During Robot Run

Robot must always start/re-start from any start area.

- Teams are allowed the following only when their robot is **completely within any start area**:

a) To swap between autonomous and non-autonomous mode.

b) To change the location of the starting point of the robot to any start area.

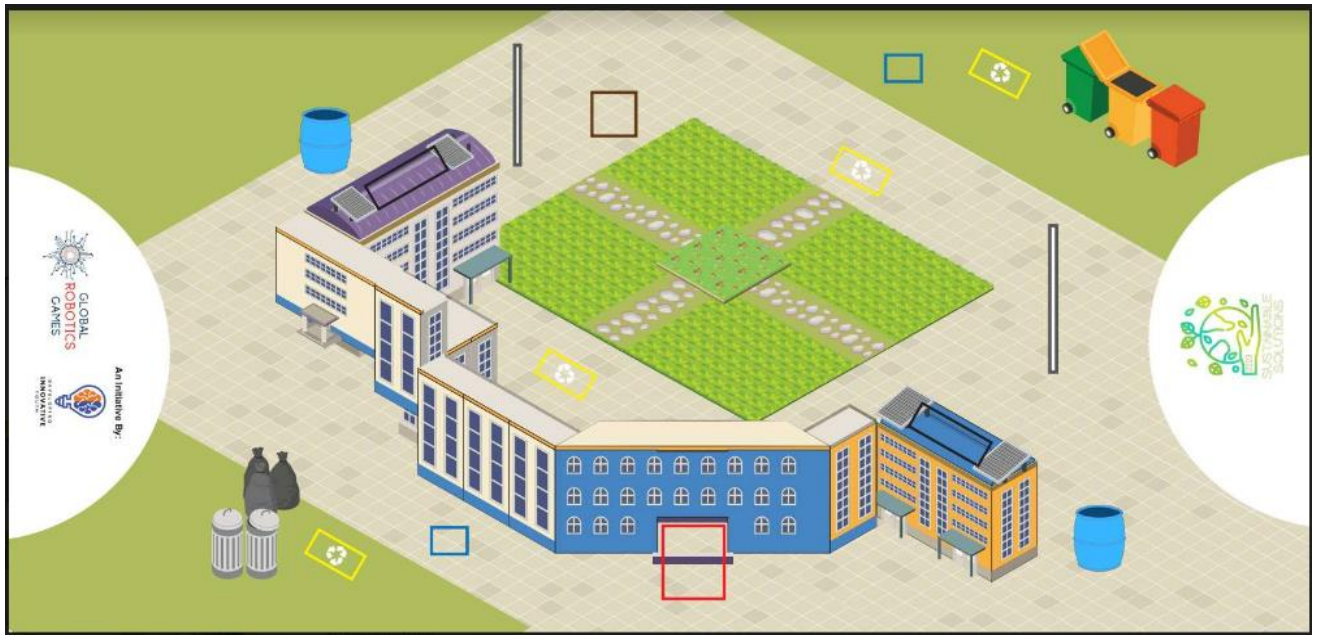
c) To change and select the program file that they would like to execute to complete the particular mission.

- Teams are not allowed:

a) To touch the robot when the robot is moving.

b) To reprogram and enter data into the robot during robot run.

c) When in autonomous mode, to control the robot using any form of remote or wireless control.



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Sub-Category Game Rules (IV)

Ending of Robot Run

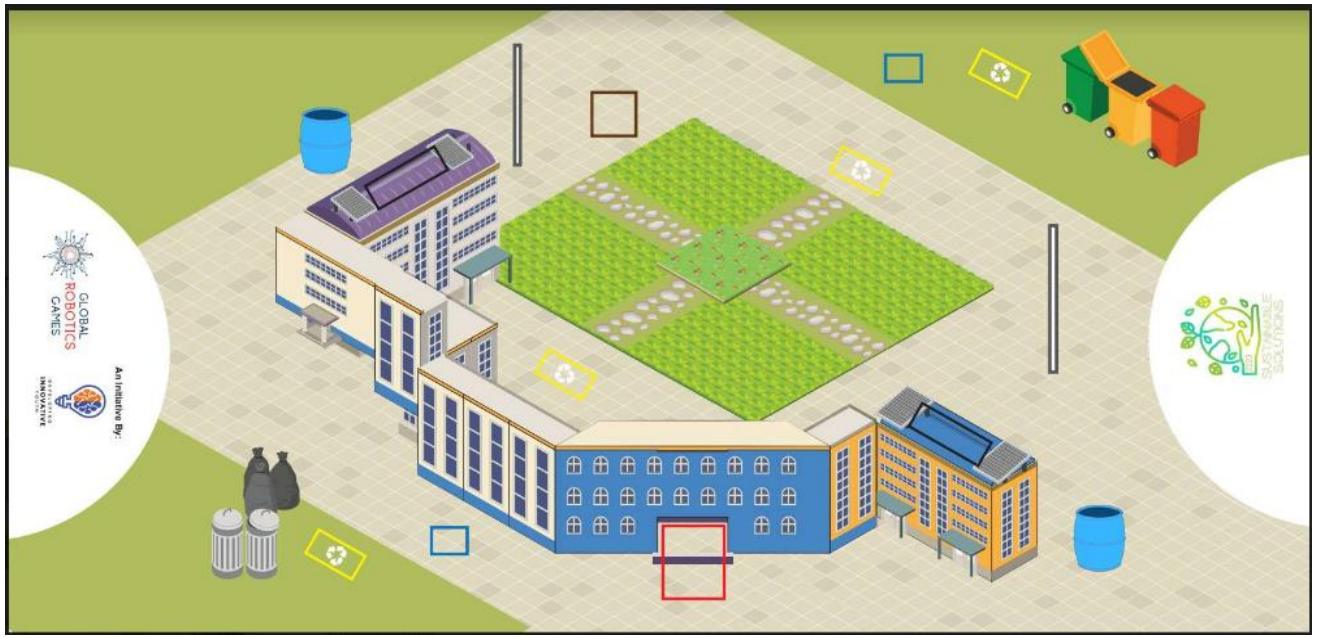
A robot attempt will end if…

a) The 2 minutes mark is up (120 seconds).

b) The robot has completely left the game table.

c) The robot or team has violated the rules or regulations.

d) A team member shouts “STOP”, and the robot does not move anymore. If the robot is still moving, the robot attempt will only end once the robot stops by itself or is stopped by the team or judge.



NATIONAL ROBOTICS COMPETITION

Introduction to Gameplay

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Lower Primary: Green School

Robot Missions:

- Plant edible seeds in the school garden
- Collect rainwater using water buckets
- Activate solar panel
- Display your sustainability mascot
- Share the location of the new recycling bin
- Avoid the obstacles
- Park the Robot

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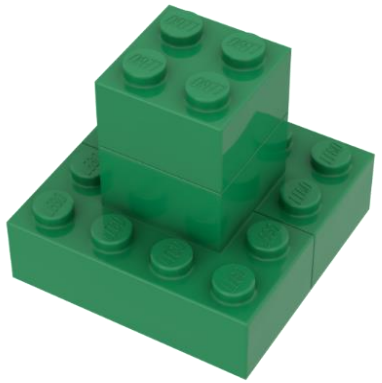
Mission (I) – Plant edible seeds in the school garden

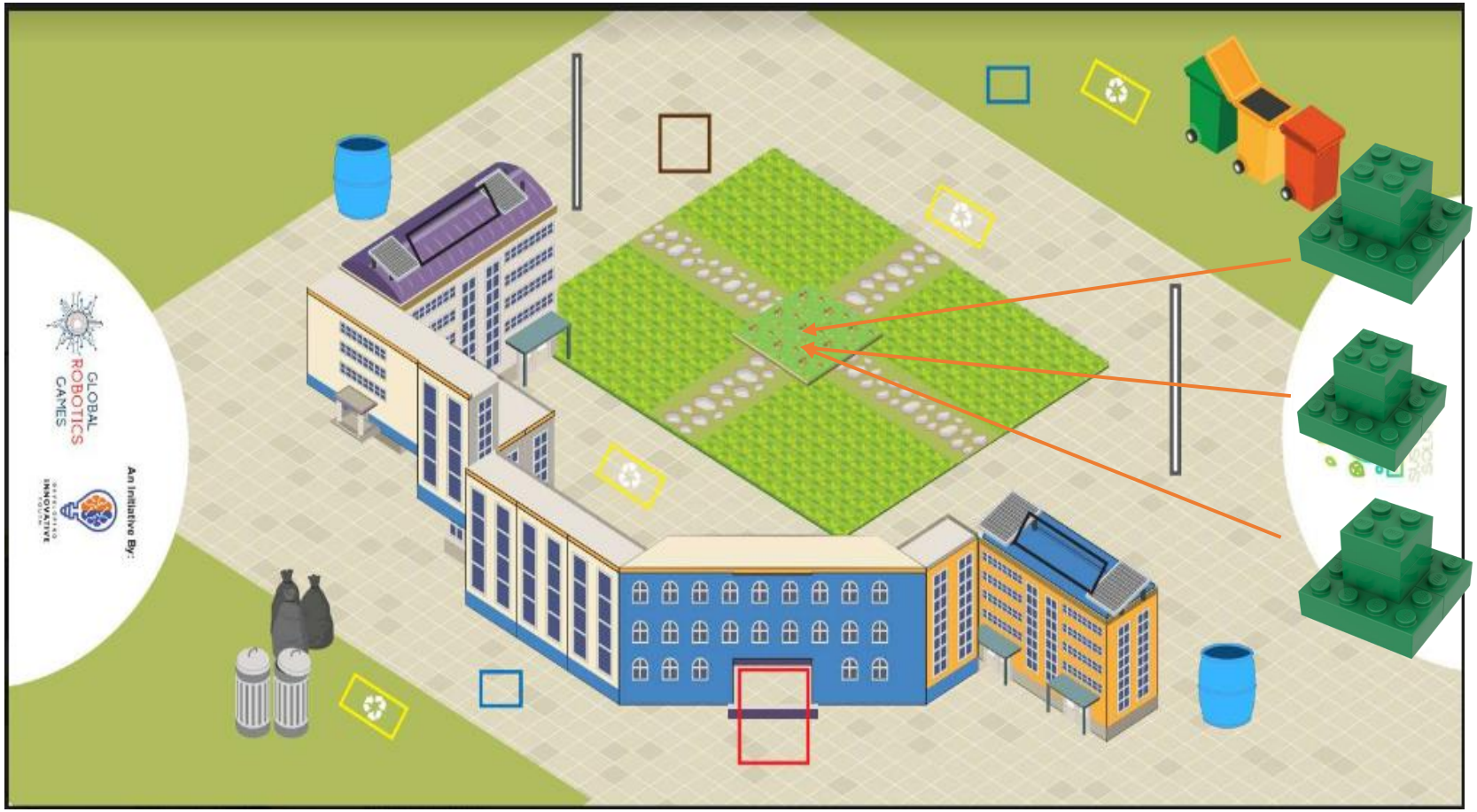
Task

- The edible seeds will begin with your robot in the starting area.
- Transport and plant the edible seeds in the school garden. Your mission will be considered successful if your edible seeds are completely in the gardening area (defined as the green square in the center of the 4 pavement).

Final State	Points (Each)
Edible seed is completely in the gardening area	10
Edible seed is partly the gardening area	5



Mission (I) - Plant edible seeds in the school garden



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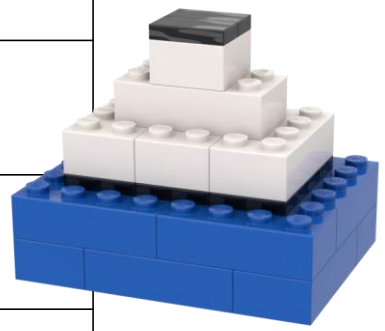
Mission (II) - **Collect rainwater using water buckets**

We can reuse the rainwater collected for other cleaning purposes. Your task is to collect the rainwater by transporting the water bucket into the rainwater collection area. Your mission will be considered successful if you have transported the water bucket to the collection area, then removed the bucket cover. The collection area is defined as the blue water bucket image on the playfield.

In State	Points (Each)
Water bucket is upright and completely in the rainwater collection area and the bucket cover is completely removed by the robot after placing within the collection area	15
Water bucket is completely in the rainwater collection area in any other position ; or with the bucket cover touching the water bucket	10
Water bucket is completely in the rainwater collection area but the bucket cover fell off during the transportation process	5



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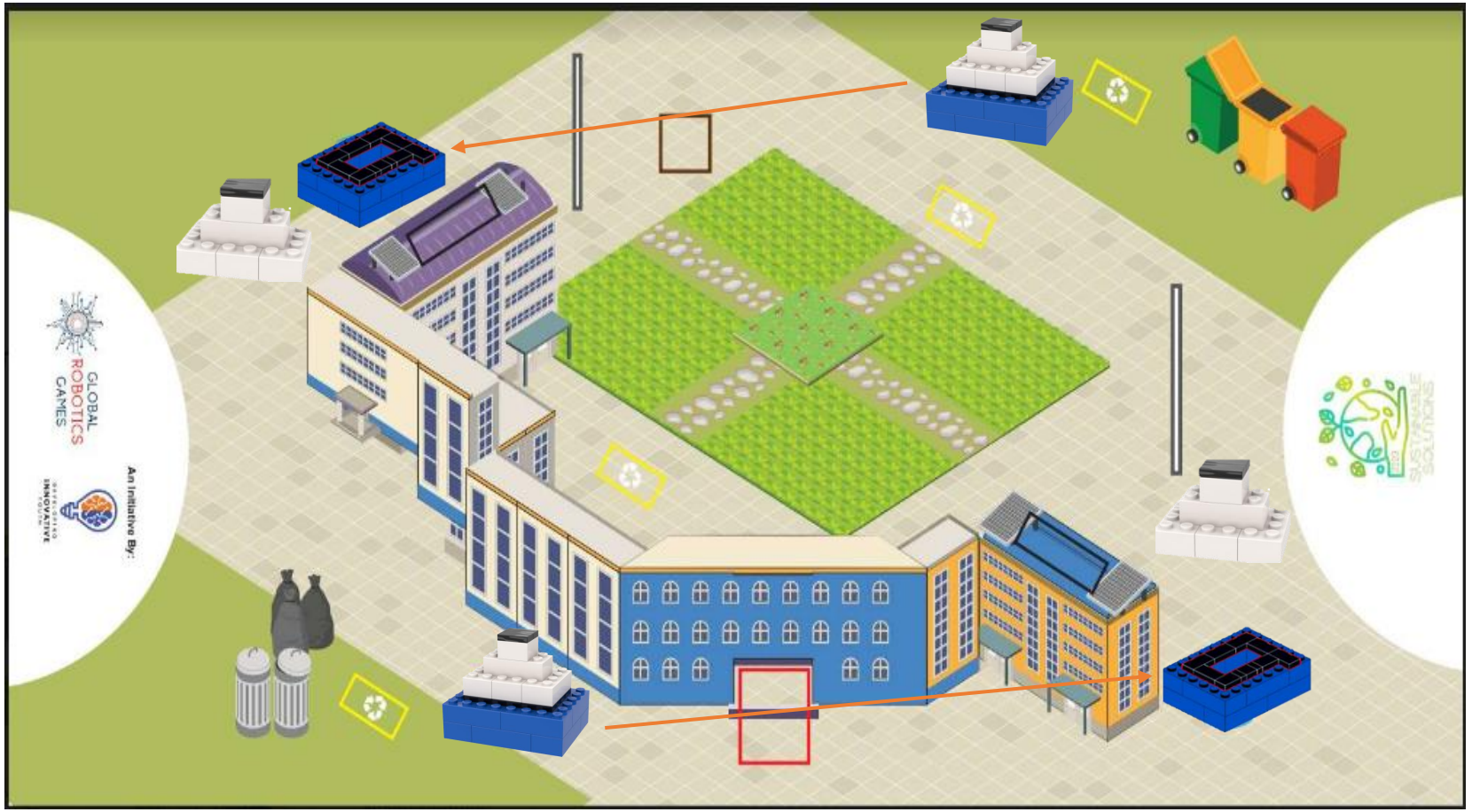
Mission (II) - Collect rainwater using water buckets



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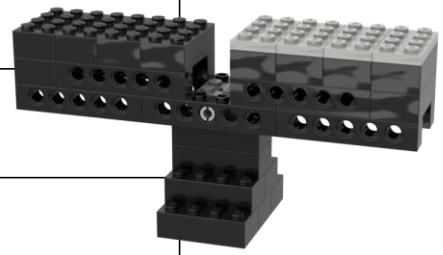
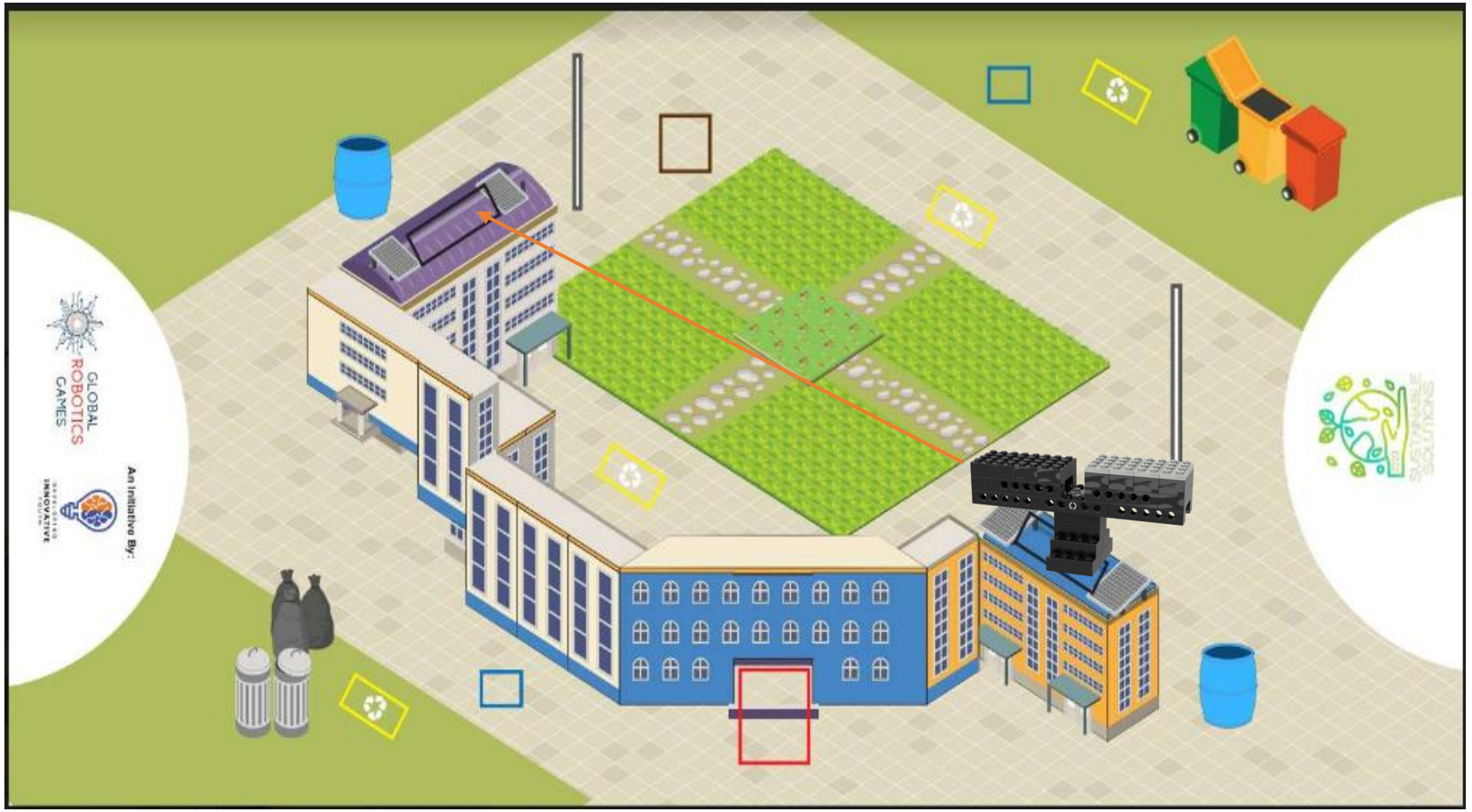
Mission (III) - Activate the solar panel

Activate the solar panel in the designated area. Your task is to transport the solar panel from one of the black rectangles to the other rectangle and activate the lever of the solar panel. The initial position of the solar panel will be randomized. Your mission will be considered successful if the grey panel is facing upwards and the solar panel is completely in the designated area.

Final State	Points (Each)
Solar panel is completely in the designated area and the grey panel is facing upwards	30
Solar panel is partially in the designated area and the grey panel is facing upwards	20
Solar panel is completely in the designated area	10



Mission (III) - Activate solar panel



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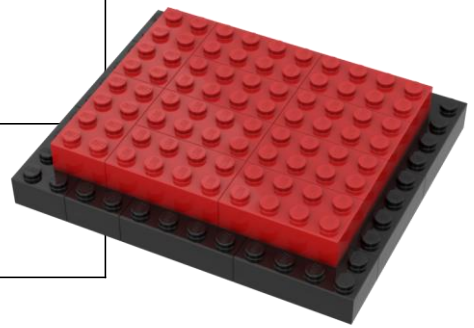
Mission (IV) - Display Sustainability mascot

Create a Sustainable Mascot using LEGO® bricks with a maximum size of 8cm x 8cm x 8cm. Your task is to display your mascot at the school's foyer. Your mission will be considered successful if your mascot is placed directly on the display platform and the platform is completely in the red box.

Final State	Points
Mascot is placed directly on top of the display platform and the platform is completely in the red box	30
Mascot is placed directly on the display platform and the platform is partially in the red box	10



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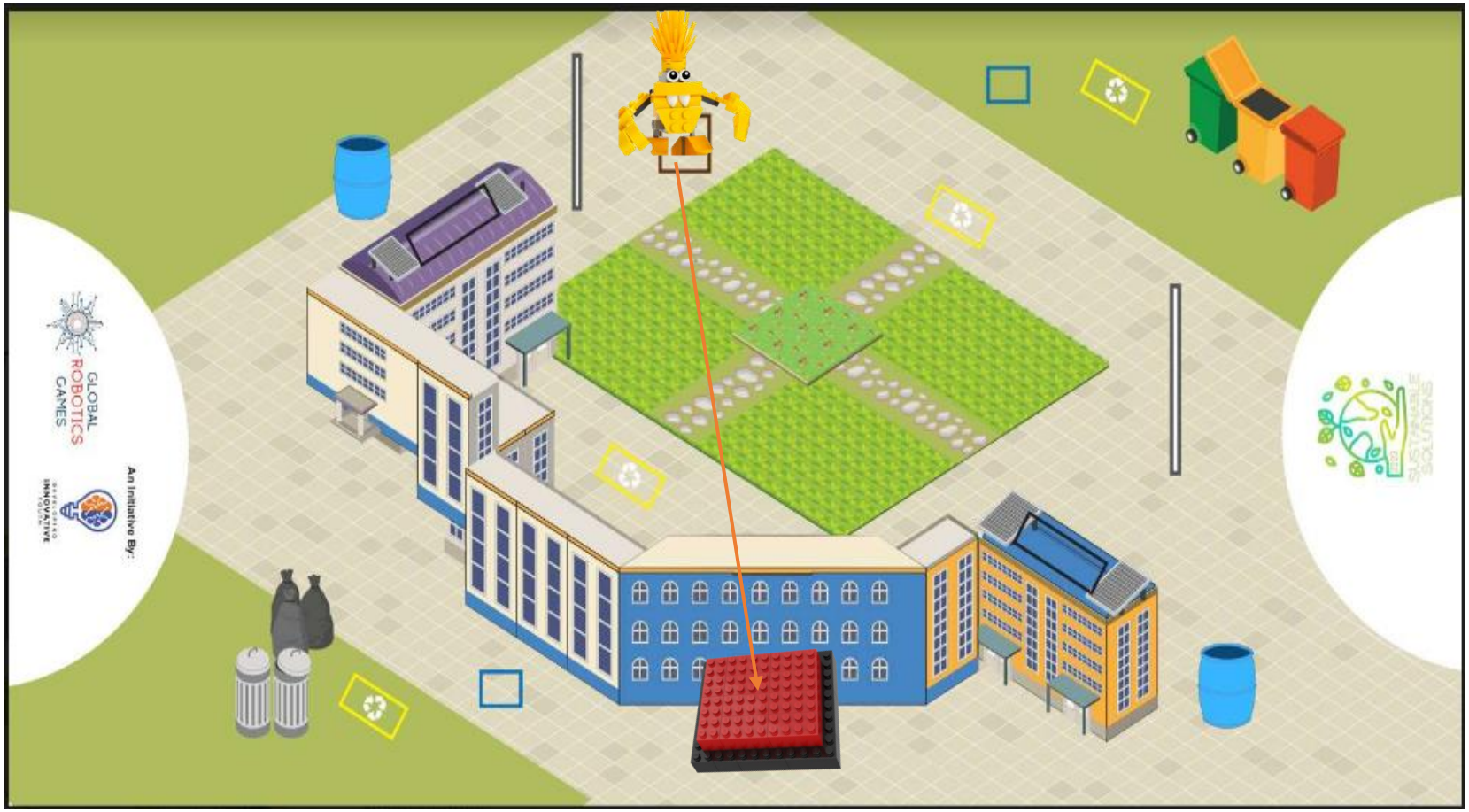
Mission (IV) - Display Sustainability mascot



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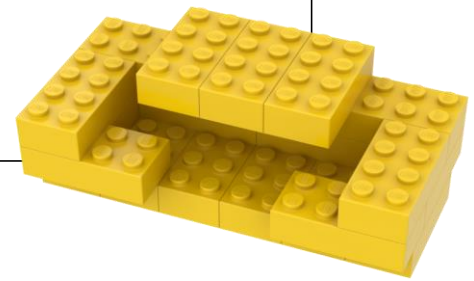
Mission (V) - Share location of new recycling bin

There is a new recycling bin placed somewhere in the school. Your task is to locate the new recycling bin by using an autonomous robot. Your robot will need to detect the recycling bin using either a colour sensor or motion sensor and to share its location by displaying an output using movement - do a 360º turn on the spot.

In State	Points
Autonomous robot detected the recycling bin using a sensor (colour sensor or motion sensor) and share its location by displaying an output using movement.	40



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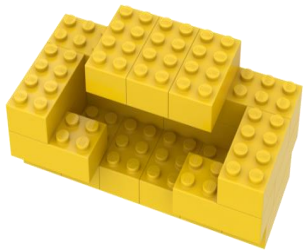
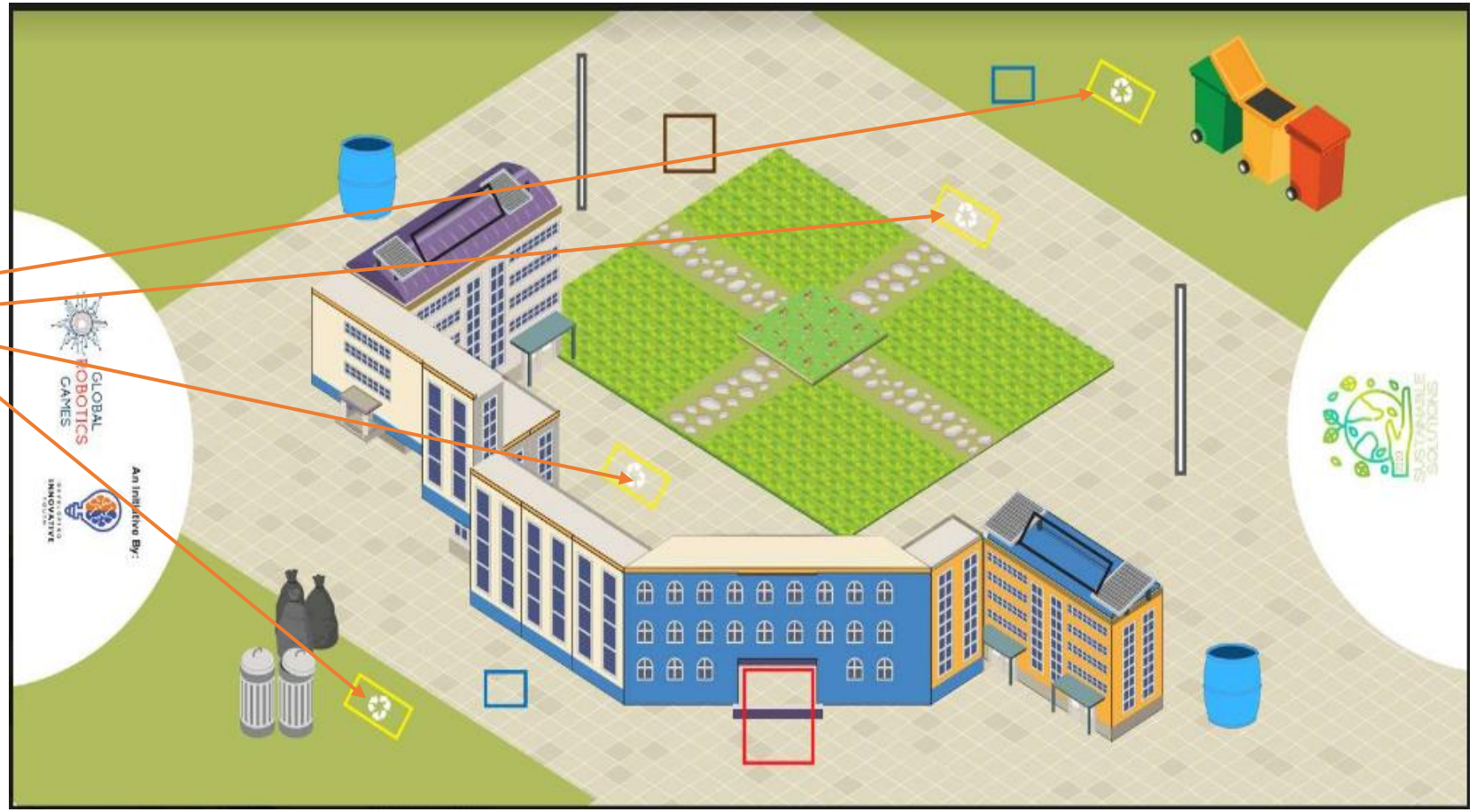
Mission (V) - Share location of new recycling bin





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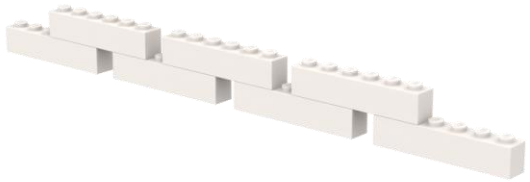
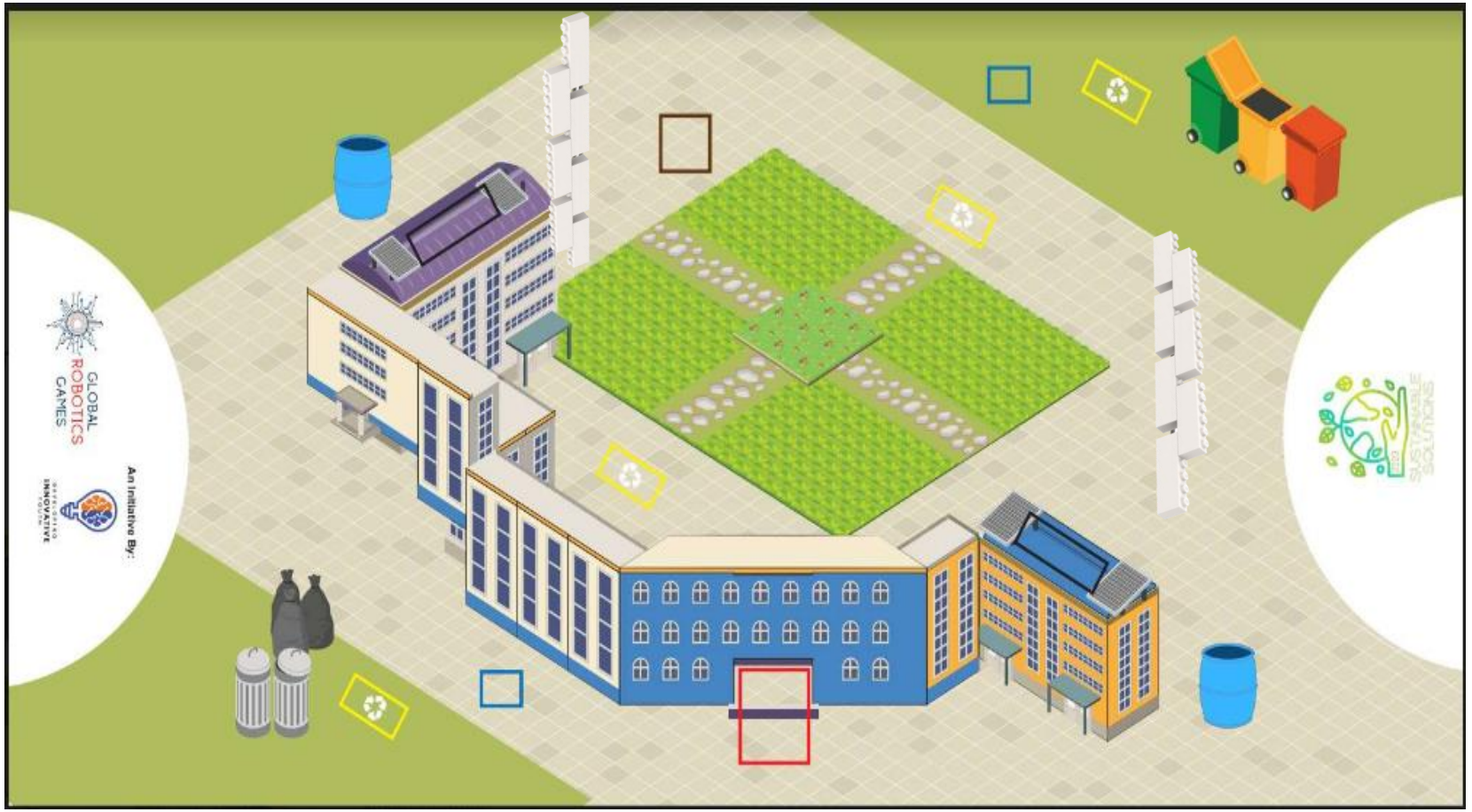
Mission (VI) - Avoid the obstacles

Avoid hitting the obstacles within the playfield. More points will be awarded if the obstacles are left untouched. If obstacles are out of the boxes, no points will be awarded. Teams can only score these if the robot has scored points in the previous challenges stated.

Final State	Points (each)
Obstacle is completely in the white box	15
Obstacles is completely in the black box (even if it is partly touching the line)	5



Mission (VI) - Avoid obstacles



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Mission (VII) - Park the robot

Return your robot to its charging station before the timer runs out. Your task is to park it within the designated charging station. Teams can only score this if the robot has scored points in the previous challenges stated.

Final State	Points
Robot is completely in the charging station	10

Allowed robot systems

Controller	LEGO® Education SPIKE™ ESSENTIAL; LEGO® Education WeDo 2.0
Motors	Only motors from the platforms/sets mentioned at “Controller”
Sensors	From the platforms/sets mentioned at “Controller”.
Batteries	Only official LEGO rechargeable batteries (no. 45612 for SPIKE™ Essential).
Building Materials	For the construction of the robot only LEGO® branded elements are allowed.

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Scoring

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Judging for Presentations

- Page 12 of General Rules
- 10 mins to present
- 5 mins for Q&A

- Best Presentation Award
- Best Research Award
- Best Programming Award
- Best Engineering Award
- Best Robot Performance Award

Category	Criteria	Points
Programming (Total Points: 50)	**Automation Level** The project uses appropriate inputs from sensors to run specific routines and clearly demonstrates automation in the completing of the tasks.	15
	Good Logic The programming options used make sense, work reliably, are relevant in terms of their use, complexity and design.	15
	Strategy Use of sub-routines and sub-functions, how the team complete mission objectives, coming up with different strategies to see what works.	20
Engineering Design (Total Points: 50)	**Engineering Concepts** The project shows evidence and good use of engineering concepts and team members are able to explain the concepts and need for use. Designer / Builder applications.	15
	Mechanical Efficiency and Structural Stability Parts and energy have been used efficiently – evidence of proper use of mechanical concepts / principles (gears/pulleys/levers/wheels & axles). The project (robots and structures) is strong, sturdy and the demonstration can be run repeatedly – parts don't detach – little need for repairs.	20
	Overall design & aesthetic The Robot design is functional yet unique and aesthetically appealing.	15
Presentation (Total Points: 50)	**Successful Demonstration** Using unique, interesting and aesthetic method to convey the project and Theme.	20
	Communication & Reasoning Skills The team is able to present their project idea in clear, concise and engaging way.	20
	Quick Thinking The team is able to easily answer questions about their project. They are also able to deal with any problems that arose during the presentation.	10
Research (Total Points: 50)	**Research contents quality and relevancy** There is evidence that team members explain their research and content relevant to the theme.	15
	Research methodology The team is to share how they conduct their research & the method on how they obtained their information. E.g. Internet, survey.	15
	Learning outcome & teamwork The team is able to explain the research journey and give an insight to what they have learnt.	20
Total Points		**200**

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Scoring for Robot Runs

- Page 11 of Lower Primary Challenge booklet

5. Scoring

Game field score is up to a maximum of 200 points scored as described in the table below.

Game Field Score

Tasks	Each	Total / Max
Plant the Edible Seeds in the School Garden		
Edible seed is completely in the gardening area	**10**	**30**
Edible seed is to partly in the gardening area	5	
Collect Rainwater using Water Bucket		
Water bucket is completely in the rainwater collection area and the bucket cover is completely removed	**15**	**30**
Water bucket is completely in the rainwater collection area with the bucket cover touching the water bucket	10	

National Robotic Competition 2023

Example for Lower Primary Category

NATIONAL ROBOTICS COMPETITION

Qualifiers and Finals

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Qualifiers

- Everybody takes part
- Presentation
- Robot Run
- Requirements listed in General Rules Document
- Top teams selected for Finals

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Finals

- Presentation Finals
- Robot Challenge Finals
  - Surprise rule may be added

- Best Robot Performance Award
- Championship Awards
  - 60% Robot Performance (based on Robot Run Finals)
  - 40% Presentation Score (based on Presentation Week)

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GLOBAL ROBOTICS GAMES

Introduction

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WOW Learning

About Developing Innovative Youth Ltd. (DIY)

DIY is a non-profit organisation based in Singapore which aims to:

- encourage and develop innovation amongst youth to become builders of a better future.
- Develop ecosystems for educators to build capacity to develop 21st century competencies in youth.
- Promote STEAM education amongst youth as a platform to innovate and solve mankind's problems.

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What are the Global Robotics Games (GRG)?

Global Robotics Games (GRG) is an international robotics competition, comprising of various tournaments, organised by DIY.

We aim for the competition to be organised in each country by one or more operational partners culminating in an international competition that will be held in Singapore every year.

The competition will be based on a socially relevant theme each year upon which the tournaments will be designed.

GRG aims to:

- Equip youth with relevant skills in order to be future-ready
- Develop creative thinking, problem solving and independent learning skills amongst youth
- Encourage youth to take an active interest in STEAM to use it as a platform to build the future

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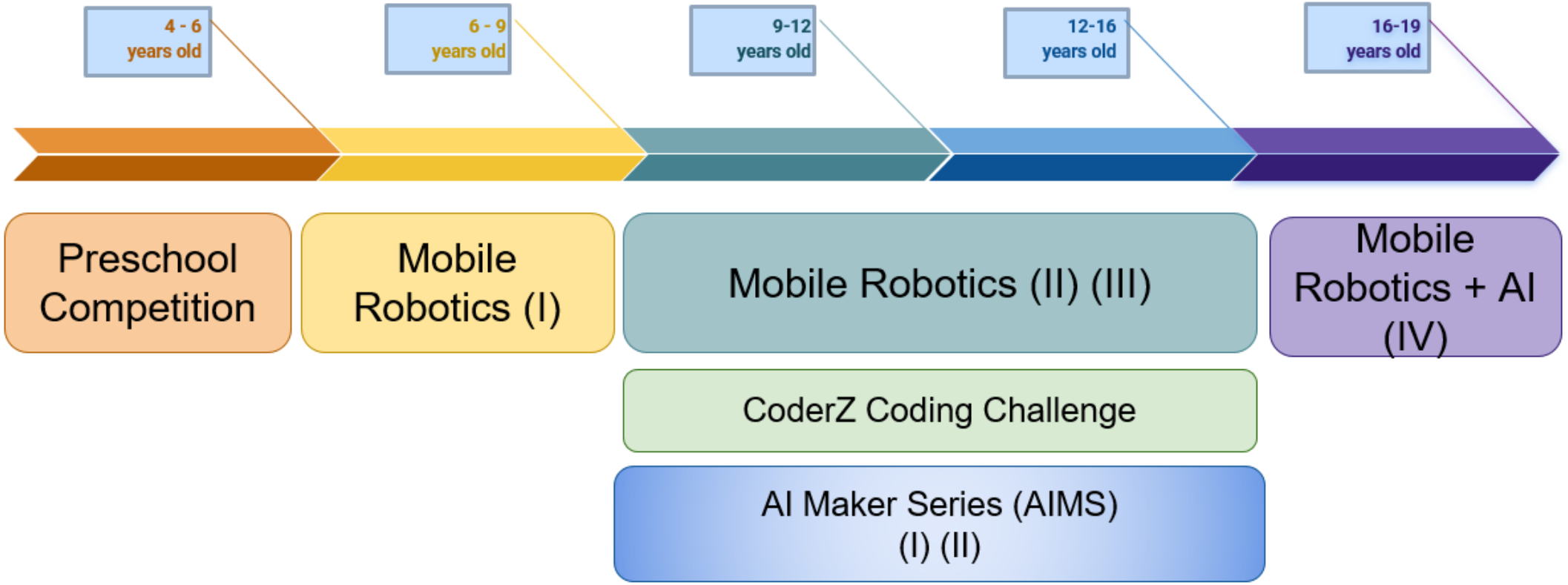
GRG Tournaments



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Important Dates

	Dates	Time	Remarks
Trial playfield	June onwards		Look out for NRC EDM
Onsite Presentation	21St August 2023	9am – 5pm	Subjected to changes
Onsite Competition	4th September 2023	9am – 5pm	
Finals & Award Ceremony	9th September 2023	9am – 5pm	

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NATIONAL ROBOTICS COMPETITION

Contact us/Updates/FAQ

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FAQ – Regular Category

1. Can the participants bring robots pre-assembled? Will there be dismantling of robots?

Ans: We do not require robots to be assembled on the spot during competition. You may bring pre-assembled robots

2. Apart from showcasing their physical robot for robot game, is the team expected to present on their robot game strategy, robot design, build and coding process?

Ans: Yes. The processes are important for judges to gauge participants' learning journey. It also helps to demonstrate originality of work i.e. not just a solution given by mentor.

3. How will the presentations be conducted? Judges go from table to table for each team?

Ans: Presentations are conducted in rooms, with judges and students in the room. Screens and VGA/ HDMI cables will be provided for presentation projections.

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FAQ - Registration

1. Can I register for more than one category?

Is there a maximum no. of teams each school can register for?

Ans: Yes, if the dates are not overlapped. There is no maximum no. of teams a school can register.

2. If we are registering as a private team, what do we put under school name?
Ans: You can indicate as “independent” or “private”.

3. Can we pay the registration fee by e-invoice? Is there any other method of payment?
Ans: We only accept credit card payment through our registration platform.

4. Can a coach/mentor be repeated for multiple teams?
Ans: Yes.

5. When is the latest cut off for registration?
Ans: Registration opens from 24 Feb to 1st July 2023

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FAQ -Others

1. Can I get tickets as a bystander to view the competition?

Ans: There is no need of bystander tickets to view the competition, walk-in is allowed. There will be a designated zone for the audience to sit and view the competition.

2. Is there any preparation class from Science Centre?

Ans: There is no preparatory classes from SCS.

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Contact us/ Updates/ FAQ

Website

Social Media

Sign-up Link

For any queries

Email

NRC@science.edu.sg

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