NRC PRESCHOOL CATEGORY
(KUBO Challenge)

CHALLENGE BOOKLET

Version: 09 March 2023

Organiser:

Sponsored by:

Supported by:

NRC 2023 PRESCHOOL (KUBO Challenge)

CHALLENGE BOOKLET CHANGE LOG

Version	Release Date	Description
1.0	10 March 2023	Official Challenge Booklet release

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1. General Information

1.1 National Robotics Competition (NRC) 2023

National Robotics Competition (NRC) has been an ongoing competition organised annually by Science Centre Singapore for the past 24 years with support from the Ministry of Education, various partners and sponsors. This competition has attracted more than 62,500 participants and 250,000 supporters to date.

NRC spurs students' interest and innovation in Science, Technology, Engineering and Mathematics (STEM). Students will be able to put their knowledge to practice and engage in hands-on STEM learning. With NRC as a stage for students to develop kinaesthetic learning and collaboration, it encourages students to develop problem solving skills, entrepreneurial skills, creative thinking skills and team spirit among the participants.

This year, NRC marks its 25th Anniversary and it promises to be filled with exciting challenges that will ensure a fun and meaningful learning experience for the participants. NRC is also an excellent opportunity for students to interact with their peers, teachers and judges from the various industries during the course of the competition.

NRC 2023 tournaments comprise of:

- NRC Regular Category
- NRC Open Category
- NRC AI Maker Series
- **NRC Preschool Category**
  - **KUBO Challenge**
  - ARTec Challenge **NEW*
- NRC CoderZ Coding Challenge
- NRC RoboCup Singapore CoSpace Coding Challenges **NEW*
  - Autonomous Driving Category
  - Rescue Category

Registration for these category challenges will be via https://www.gevme.com/NRC2023. Competition registration opens from **24 February to 1 July 2023.**

Note: Registration will be on a first come, first serve basis. If the category is full, your registration will be rejected and refunded.

1.2 Theme for NRC 2023

Every year, NRC revolves around a specific theme and this year, the theme for NRC is "**Sustainable Solutions**". Climate change is a global challenge, and Singapore is taking firm actions to do our part to build a sustainable future. This year, the challenges will revolve around Singapore's national agenda on sustainable development.

2. Team and Age Group Definition

2.1 Team Definition

Each team will have a minimum of 2 members and up to 5 members, accompanied by 1 to 2 coaches.

The age group in NRC Preschool (KUBO Challenge) is:

- 5 - 6 years old (as of 31 Dec 2023)

2.2 Expectations on Teams

Teams should behave fairly and be respectful towards other teams, coaches, judges and competition organisers. Teams are to adhere to the competition rules to ensure fair competition.

The construction and coding of the robot may be done only by the team. The task of the coach is to accompany them, help them with organisational and logistical matters and support the team in the case of questions or problems. The coach cannot be involved in the construction and programming of the robot.

On the competition day, during mission runs, coaches may offer students advice and guidance. However, all work related to the preparation and submission, and the actual competition must be performed by the student members of the team.

If any of the rules mentioned in this document are broken or violated, the judges or chief referees can decide on one or more of the following consequences. Before a decision is reached, a team or individual team members may be interviewed to find out more about the possible violation of the rules. The interview can include questions about the robot or the program.

- A team may get up to a 50% reduced score for one or more judging rounds.
- A team may be disqualified completely from the competition immediately.

2.3 Rules Hierarchy

On the competition day, the following rule hierarchy applies:

- General Rules for NRC Preschool Category provides the basis for rules in this category.
- Questions & Answers (Q&As) can override rules in the general rule document.
- **The Chief Referees have the final say in any decision.**

During a season, NRC may publish additional Question & Answers (Q&As) that can clarify, extend, or re-define rules in game and general rule documents. Teams should read these Q&As before the competition.

3. Tournament Format and Procedure

In this category, there are 2 rounds:

- An online presentation round (including a Q&A session with each team) on **21st or 22nd August 2023**.
- An onsite competition round on **28th or 29th August 2023**.

3.1 Competition Format

Presentations and Q&A sessions will be conducted on the same day for the participants. These will be held online via Zoom on **21st or 22nd August 2023**.

The Competition Round will be conducted on **28th or 29th August 2023** for all participants. This will be held at Annexe Hall 2 & 3, Science Centre Singapore.

Scores from the Presentation (30%) and Competition Round (70%) will be combined for the Overall Championship.

3.2 Competition Schedule

Dates	**Components**	**Mode**
21st - 22nd August (Monday - Tuesday)	NRC Preschool Category (KUBO Challenge) Presentation	Online (Zoom)
28th - 29th August (Monday - Tuesday)	NRC Preschool Category (KUBO Challenge) Competition	Onsite Science Centre Singapore (Annexe Hall 2 & 3)

*Teams will be notified of their scheduled presentation date and time.
**The Organiser reserves the right to amend the competition schedule and mode of the competition. Participants will be notified of any changes via email.

3.3 Presentation Format

Presentations and Q&A sessions will be conducted on the same day for the participants. These will be held online via Zoom on **21st or 22nd August 2023.**

The introductory story to *KUBO: My Green Home* will be provided to all participating teams in soft copy.

- Each presentation shall not exceed a duration of 5 minutes (excluding Q&A).
- Each Q&A session will take approximately 3 minutes.
- Presentation format shall not exceed 10 PowerPoint Slides.
- Slides may include photos and/or videos to showcase the students' learning process.
- Students are to present their prototype based on the introductory story during the presentation.
- Students are encouraged to take an active role during the presentation.

Criteria	**Score**
Reflection	10
Design and fabrication of KUBO's solar panel	10
Presentation	10

More details on the scoring can be found at Section 7.

3.4 Robot Run

The competition will be held onsite on **28th or 29th August 2023**.

- Teams will get 1 practice run (20 minutes) before the actual attempt.
- Teams will only get 1 attempt (50 minutes) to complete all KUBO Missions on the day of the Competition Round.
- There will be 5 missions to complete, each mission is 10 minutes.
- All teams will begin the same mission simultaneously.

Missions	**Score**
Mission 1: Sorting Recyclables	15
Mission 2: Collecting Organic Waste	15
Mission 3: Following Road Safety	15
Mission 4: Planting Seeds	15
Collaborative Mission: Harnessing Solar Energy	10

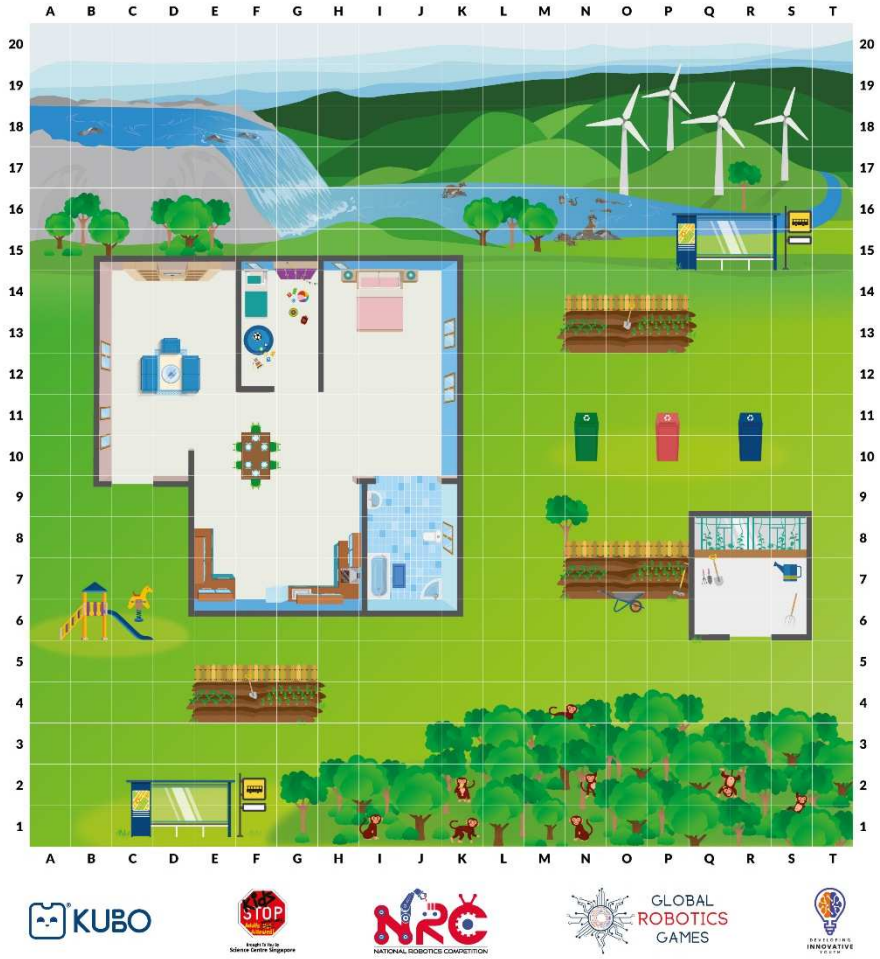
Points to note about the Competition:

- Game Field 1 (Missions 1 to 4) will be loaned to each participating team, together with a set of KUBO Coding Starter Set and KUBO Coding+ Set prior to the competition.
- Participating teams must bring along the Game Field 1, game objects, KUBO Coding Starter Set and KUBO Coding+ Set on the day of the Competition Round on 28th or 29th August 2023.
- Participating teams that fail to return the Game Field 1, game objects, KUBO Coding Starter Set and KUBO Coding+ Set in full working condition will be liable to make full payment of the items listed above to Science Centre Singapore.
- In the event that overall scores are tied, the team with the shortest overall time (during the competition) wins the Competition Round.
- Scoring for the Competition Round can be found in Section 7.

4. Game Table and Equipment

4.1 Game Field 1

Game Field 1 (Missions 1 to 4) will be provided to each participating team, together with a set of game objects.



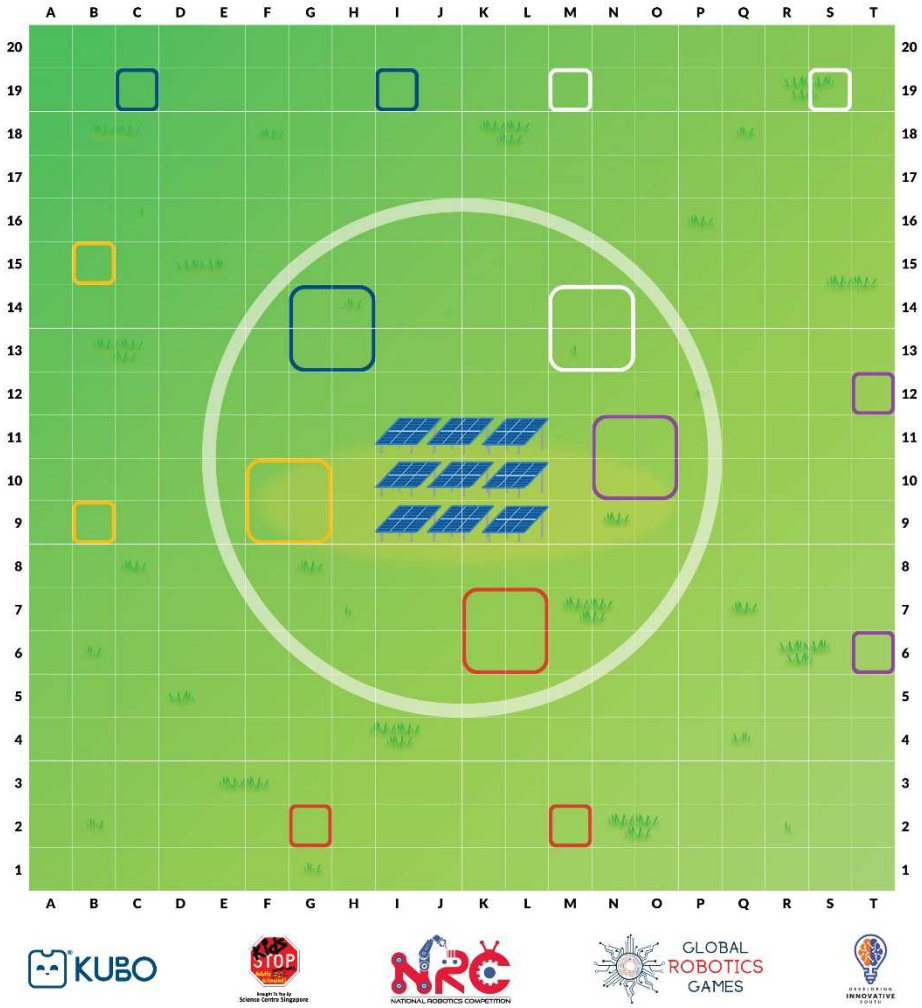
Participating teams are required to bring along Game Field 1, game objects, KUBO Coding Starter Set and KUBO Coding+ Set on the day of the Competition Round on 28th or 29th August 2023.

The dimensions of the game field mat are as follows:

- 1 m (Length) x 1 m (Breadth)
- The game field will be divided into grids of 4cm x 4cm each. There will be a total of 400 playable grids.

4.2 Game Field 2

The Game Field 2 (Collaborative Mission) **will only be provided on the day of the competition** held onsite on 28th or 29th August 2023.

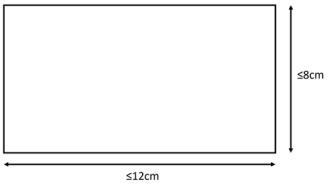


The dimensions of Game Field 2 (Collaborative Mission) are as follows:

- 1 m (Length) x 1 m (Breadth)
- The game field will be divided into grids of 4cm x 4cm each. There will be a total of 400 playable grids.

4.3 Game Objects, Positioning, Randomisation

The KUBO robot must start from the playable area of Game Field 1 (Grid A1).

1 Plastic container There will be 1 Plastic container placed upright on the game field mat. Plastic container will be in Grid G13. Plastic container may be placed upright in any orientation within the grid.	
1 Brown crate with 3 bananas There are 3 bananas placed inside 1 brown crate on the game field mat. Brown crate with bananas will be in Grid F10. Brown crate with bananas inside may be placed upright in any orientation within the grid.	
1 Packet of seeds There is 1 packet of seeds that KUBO needs to carry while on the game field mat. The packet of seeds is made of 2 LEGO 6143 pieces stacked together as shown in the image. A hidden task will be revealed on the day of challenge. Fulfilment of the hidden task is compulsory to complete the mission.	
1 Solar panel There is 1 solar panel that KUBO needs to carry while on the game field mat during the collaborative mission. Teams will have to fabricate and decorate their own solar panels using recyclable or reusable materials. The solar panel should be at least 8cm (width) x 8cm (length) and not exceed 8cm (width) x 12cm (length).	

A hidden task will be revealed on the day of challenge. Completion of the collaborative mission is compulsory.	

5. KUBO Missions

The missions will be explained in multiple sections.

The order of the missions are fixed and every team will start simultaneously.

Each mission will be given a maximum duration for completion as follows:

Mission	Duration (min)
Sorting Recyclables	**10**
Collecting Organic Waste	**10**
Following Road Safety	**10**
Planting Seeds	**10**
Harnessing Solar Energy	**10**

For scoring rubrics please refer to Section 7.

5.1 Sorting Recyclables

KUBO robot wants to recycle the empty plastic container by bringing it to the recycling bin.

From Grid A1, KUBO robot is tasked to go to the children's playroom (Grid G13) to collect the empty plastic container and bring it to the recycling bin for plastics (Grid P10 - P11).

Teams can fabricate their own method of transport to be attached to the KUBO robot to aid in transporting the plastic container to the recycling bin.

Participants can only use their hands to transfer the plastic container into or onto their transportation device when KUBO reaches a 1 grid radius around the dining table and the code has stopped running.

Additional points will be awarded if teams are able to transport the plastic container to the recycling bin (Grid P10 - P11) hands-free (i.e. no physical contact with the game objects throughout the run).

5.2 Collecting Organic Waste

KUBO robot decides to make compost from organic waste.

From the plastic recycling bin (Grid P10-P11), KUBO robot is tasked to go to the dining table (Grid F10) to collect the banana peels and bring them to the garden shed (Grid Q6 - S8).

Teams can fabricate their own method of transport to be attached to the KUBO robot to aid in transporting the banana peel to the garden shed.

Participants can only use their hands to transfer the crate of banana peels into or onto their transportation device when KUBO reaches a 1 grid radius around the crate of banana peels and the code has stopped running.

Additional points will be awarded if teams are able to transport crate of banana peels to the garden shed (Grid Q6 - S8) hands-free (i.e. no physical contact with the game objects throughout the run).

5.3 Following Road Safety

KUBO robot plans to create more green spaces by having a community garden. To complete its plan, KUBO robot needs to take the bus to get some seeds for the garden.

From the garden shed (Grid Q6 - S8), KUBO robot is tasked to go to the bus stop (Grid C1 - F2), pause for at least 3 seconds and look left and right on the spot to look out for oncoming buses.

5.4 Planting Seeds

KUBO robot has returned with its packet of seeds and wants to plant them in its garden.

Teams can fabricate their own method of transport to be attached to the KUBO robot to aid in transporting the packet of seeds to the garden.

Additional points will be awarded if teams are able to transport the packet of seeds to the garden hands-free (i.e. no physical contact with the game objects throughout the run).

However, there is a catch to planting the seeds. Find out more on the day of the Competition.

***The hidden task will only be made known to participating teams on the day of the Competition, after the first 3 missions have been completed.**

5.5 Harnessing Solar Energy

KUBO robot is looking for ways to be more sustainable. One such way is to collect solar energy from the solar panel field.

Teams will have to fabricate and decorate their own solar panel to be attached to the KUBO robot to aid in the harnessing of solar energy at the field.

Teams will have to maximise the amount of solar energy that can be harvested.

However, there is a catch to harnessing solar energy. Find out more on the day of the Competition.

***The hidden task will only be made known to participating teams on the day of the Competition, after the first 4 missions have been completed.**

6. Specific Game Rules

For this competition, there are some specific rules as mentioned below:

6.1 Specific Rules about Materials

- The KUBO robot must be assembled using the complete KUBO Coding Starter Set and KUBO Coding+ Set loaned to each participating team by Science Centre Singapore.
- Any number and combination of KUBO TagTile® pieces are allowed in programming the KUBO robot.
- Only KUBO branded TagTile® pieces can be used in the programming of the KUBO robot.
- Each set of KUBO robot is tagged to its own set of TagTile® pieces. Please ensure that only the TagTile® pieces that come with the KUBO robot are used in the coding of the robot.
- Teams are highly encouraged to use recyclable materials in the fabrication of carriers or equipment to assist their KUBO robot in completing the various missions.

6.2 Specific Rules about the Missions

Prior to each mission attempt, the team may touch the KUBO robot to dress or equip it for the selected mission. The design or KUBO, including any carriers, should also be unique to each mission. It should also not be reutilised for any other missions.

The team is only allowed to move the KUBO robot, not the game objects. **Game objects not attached to the KUBO robot cannot be moved to another Mission Area.**

During the mission attempt, the KUBO robot may only be operated under KUBO's TagTile® programme control.

During a mission attempt, while the KUBO robot is running its program, members of the team are:

- *Not allowed to touch any game object.* If a participant touches a game object, the judge will give a verbal warning to the team and reset the game object to its original position and orientation. A total of 2 verbal warnings will be given. After which, the Organiser reserves the right to not score for that mission.

- *Not allowed to touch the game field mat while the KUBO robot is completing its mission.* If a participant touches the game field mat while the KUBO robot is running its programme, the judge will give a verbal warning to the team. A total of 2 verbal warnings will be given. After which, the Organiser reserves the right to not score for that mission.

6.3 Specific Rules about the Competition

Each mission ends when either:

The KUBO robot completes its coded programme successfully for the mission and the team communicates to the judge that the robot has completed the mission.

OR

The time limit has expired for the mission.

Missions will be considered successful if either KUBO robot or its transported game objects fall within the designated grids.

7. Scoring

The overall scoring of the teams is based on the sum of two scores:

Presentation Score: up to 30 points scored as described in the table below.

Competition Score: up to 70 points scored as described in the table below.

7.1 Presentation Score

Criteria	**Score**
Reflection ● What have they learnt during the coding process? ● What was their favourite part of the process?	10
Design and fabrication of KUBO's solar panel ● What materials did they use to build the solar panel? ● How did they come up with the design of the solar panel? ● Why is solar energy a good source of renewable energy?	10
Presentation ● Clarity of presentation ● Creativity of presentation ● Q&A	10

7.2 Competition Score

Missions	Score	Total/Max
1. Sorting Recyclables		
Travel from Grid A1 to children's playroom (Grid G13)	2	
Transport empty plastic container from children's playroom (Grid G13) to recycling bin for plastics (Grid P10 - P11) - Any part of plastic container within the grids of the recycling bin	2	
Transport empty plastic container (hands-free)* throughout mission	2	
Time left: <2 minutes: 1 pts 2 - 4 minutes: 2 pts >4 - 6 minutes: 3 pts >6 - 8 minutes: 4 pts >8 - 10 minutes: 5 pts	5	
Use at least 1 set of KUBO function tile (at least 3 TagTile® pieces, excluding function tiles)	2	
No interference from coaches#	2	**15**
2. Collecting Organic Waste		
Travel from recycling bin (Grid P10 - P11) to dining table (Grid F10) where brown crate with banana peels is	2	
Transport brown crate with banana peels from dining table (Grid F10) to garden shed (Grid Q6 - S8)	2	
Transport brown crate with banana peels (hands-free)* throughout mission	2	
Time left: <2 minutes: 1 pts 2 - 4 minutes: 2 pts >4 - 6 minutes: 3 pts >6 - 8 minutes: 4 pts >8 - 10 minutes: 5 pts	5	
Use at least 1 set of KUBO function tile (at least 3 TagTile® pieces, excluding function tiles)	2	
No interference from coaches#	2	**15**
3. Following Road Safety		
Travel from garden shed (Grid Q6 - S8) to bus stop (Grid C1 - F2)	2	
Pause for at least 3 seconds while at the bus stop (Grid C1 - F2)	2	
Pivot left and right on the spot while at the bus stop (Grid C1 - F2)	2	
Time left: <2 minutes: 1 pts 2 - 4 minutes: 2 pts >4 - 6 minutes: 3 pts >6 - 8 minutes: 4 pts >8 - 10 minutes: 5 pts	5	**15**

Use at least 1 set of KUBO function tile (at least 3 TagTile® pieces, excluding function tiles)	2	
No interference from coaches#	2	
4. Planting Seeds		
Transport packet of seeds from bus stop^ to garden^	3	
Transport packet of seeds (hands-free)* throughout mission	2	
Time left: <2 minutes: 1 pts 2 - 4 minutes: 2 pts >4 - 6 minutes: 3 pts >6 - 8 minutes: 4 pts >8 - 10 minutes: 5 pts	5	
Use at least 1 set of KUBO function tile (at least 3 TagTile® pieces, excluding function tiles)	3	
No interference from coaches#	2	**15**
5. Harnessing Solar Energy		
From starting position^, transport solar panel to solar panel field^	-	
Rotate 3 full rounds on the spot	2	
Use at least 1 set of KUBO function tile	2	
Use at least 1 set of KUBO function tile (at least 3 TagTile® pieces, excluding function tiles)	2	
All teams on game field complete the mission together **(compulsory task)**	4	**10**
Maximum Score		**70**

**No physical contact with any game objects throughout the code run.*

 # Coaches may offer students advice and guidance during the competition. However, all work during the competition must be performed by the student members of the team.

^Bonus missions will be announced on the day of the Onsite Competition. Participants are required to complete the bonus mission to qualify for task completion.

7.3 Best KUBO Robot Design (Additional Prize)

Scoring for the Best KUBO Robot Design will be based on the following:

Criteria	**Score**
Creativity ● Imagination used to develop and create the robot design	5
Innovation ● Original solution and application to add significant value to the robot	5

* Note that the Best KUBO Robot Design score is an additional prize category and the scores will not be counted towards the overall championship score.

7.4 Best Teamwork Score (Additional Prize)

Scoring for the Best Teamwork will be based on the following:

Criteria	**Score**
Team Play ● Student members show initiative in assisting other teams during the Collaborative Mission	5
Attitude ● Demonstrate participation and show enthusiasm throughout the competition	5

* Note that the Best Teamwork score is an additional prize category, and the scores will not be counted towards the overall championship score.

8. Awards

Overall Championship

Teams are considered for the Overall Championship Award based on the total scores of their Presentation and Competition Rounds.

Score tables can be found in Section 7.

The top team will receive the following:

$400, trophy, banner, and one medal for each participant.

Best Robot Performance

1st Place: Trophy, medals (per participant)
2nd Place: Medals (per participant)
3rd Place: Medals (per participant)

Best Presentation

Awards will be based on scores given during the Presentation Round.

The top 3 teams will receive one medal for each participant.

Best KUBO Robot Design

Award will be based on scores given during the Competition Round.

The best team will receive one medal for each participant.

Best Teamwork

Award will be based on scores given during the Competition Round.

The best team will receive one medal for each participant.

Certificate of Participation

All participants will also be presented with a Certificate of Participation for taking part in the competition.

The Organiser reserves the right to amend the prizes without prior notice.