



NATIONAL ROBOTICS COMPETITION

NRC Open Category 2023

Primary, Secondary, Tertiary

CHALLENGE BOOKLET

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Organiser:



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NRC 2023 OPEN CATEGORY CHALLENGE BOOKLET CHANGE LOG

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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:

- NRC Regular Category
- **NRC Open Category**
- NRC AI Maker Series
- NRC Preschool
- NRC Artec (Preschool) *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. Teams and Rules Hierarchy

2.1. Team Definition

Each team will have a minimum of 2 members and up to 3 members.

This category is open to the following age groups:

- Primary: students 8-12 years old (in season 2023: born years 2011-2015)
- Secondary: students 13-16 years old (in season 2023: born years 2007-2010)
- Tertiary: students 17-19 years old (in season 2023: born years 2004-2006)

Students need not be from the same school. However, all the members of a team must be in the same category age group to qualify.

2.2. Expectations on Teams

Teams should behave fairly and be respectful towards other teams, coaches, judges and competition organizers. 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 organizational 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 presentation judging, coaches/mentors are not allowed to communicate with or guide their teams or interfere with the judging process.

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 Open 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. NRC Open Category

3.1. Introduction

One of the UN Sustainable Development Goals is zero hunger. The number of people going hungry and suffering from food security had been gradually rising since 2014. In 2020, between 720 million and 811 million people worldwide were suffering from hunger. The COVID 19 crisis has pushed those rising rates even higher and has also exacerbated all forms of malnutrition, particularly in children.

3.2. Robotic Solution

Teams are required to develop a robotic solution to address one of the UN Sustainable Development Goal, Zero Hunger.

- Increase food production and food yield

Plants and vegetations can become stressed or die when environmental conditions fluctuate drastically. Some examples of the environmental conditions are pH of soil and amount of water and nutrients the plant or vegetation receive. A robot can help to monitor and maintain these environmental conditions at the optimal conditions for the plants and vegetations to thrive in.

Teams can develop robotic solutions that can work together with humans safely to increase food production and food yield.

- Reduce food loss and waste

Food is lost or wasted along the food supply chain. For example, food could be damaged or turn bad when it is being transported from the farms to the stores. A robot that can improve the efficiency of the transport system or storage of the food can reduce the amount of food that is being lost or wasted along the food supply chain.

Teams can develop robotic solutions that can improve processes in the food supply chain.

Teams are to choose one of above topics to work on for their robotic solution.

Note: Robotic solutions that are clearly not within the theme will receive a score of 0.

3.3. Project Booth

Teams will present their robotic solution in a project booth (or other defined area). The booth size is 2m x 2m x 2m. Each team will be provided with 3 vertical display surfaces within the booth.

Teams should make use of the booth to present information about their research and the development of the robotic solution. All booth decorations and set up (including your robotic solution) should fit inside the booth. Any teams with props, decoration or robots outside of the boundary will be subjected to penalties.

Teams will be provided with a 120cm by 60cm table. If a team uses the table, the table must be placed inside the project booth. Teams are allowed up to 3 chairs in the booth area.

The use of fire or mist is prohibited for safety reasons. If you need to use liquids for your project, please check with the competition organizer before the event. The use of liquids may be restricted to water only and may be restricted to a specific amount or may be forbidden completely pending on the regulations associated with the event. If fire, mist, or liquids are important for your solution, think of other ways to showcase it in your video and in your project booth.

3.4. Project Video Submission

The project video has the following requirements:

Objective	A creative promotional video on their robot to present and demonstrate your robotic solution to the public.
Maximum length of the video	90 seconds (1.5 minutes).
File type	Instagram post link, TikTok post link Please note that the video settings must be open to public. Please ensure that likes and views count are enabled.
Content	In the video the team shows their robotic solution while it is running. The team may do this in the real-world environment. Teams should briefly introduce themselves and the project idea, but the main part of the video should show how the robotic solution works.
Language	The video must be done in English. (English subtitles may be used to help with understanding, but these are optional.)
Expectation	The video should be done by the team, not by the coach or others. A coach or others may only help with any technical issues that teams have while preparing the video (especially for younger students). Judges will consider whether the video is delivered at a level appropriate to the age of the team when scoring. Judges do not expect a professional video production. It is completely acceptable if teams just use a mobile device (e.g. smartphone, tablet) to capture the video in one go.

All video submissions are to be received by the Organizers by **18 August 2023 1700 hrs.** Please email your submission links to NRC@science.edu.sg by the deadline. The submission will contribute to your final scores under 7. Scoring Rubric.

4. Presentation & Judging

Teams in this category need to go through the following process on the competition day:

- Setting up their project booth and testing of the robotic solution
- Presentation of the robotic solution in one or multiple judging sessions

Each judging session takes 15 minutes. Judges will form groups of 2-3 judges and visit teams at their booth. Each team has 10 minutes to present the project idea and demonstrate the robotic solution live at the project booth. Judges will then have a 5-minute Q&A session with the team.

A team should inform themselves of the schedule of the competition day and should be present at their booth in time for a judging session. The team must make sure that the booth is ready, and the robotic solution is on stand-by for a live presentation in English before the judges arrive.

If a robotic solution does not function during a judging session, the judges will see if they can come back later and/or the team can demonstrate the solution in the next judging session.

Do note that there is a minimum number of teams for the judging to proceed for each level. If the registration number falls below 10 for any level, it will be combined with the next closest level for judging.

4.1. Expectations For Each Age Group

Primary (8 – 12 years old)

If you are in this age group, you will need to explain how your robotic solution will help your community.

Secondary (13 – 16 years old)

If you are in this age group, you will need to explain the impact of your solution on current issues facing society. Explore questions such as: What impact will your robot model have on society? Who will benefit from your solution?

Tertiary (16 – 19 years old)

If you are in this age group, you will have to investigate how your idea can become reality. Describe the possible challenges and demonstrate which problems must be solved to get your robot model ready for action. Present your thoughts in an appealing way.

5. Awards and Prizes

For each category – Primary, Secondary and Tertiary respectively:

Category	Rank	Prize
Open Category*	1 st	Cash prize of \$600, Trophy [1 per team], Medal & Certificate for each team member
	2 nd	Medal & Certificate for each team member
	3 rd	

Across all categories:

Awards	Remarks	Prize
Best Booth Design Award*	For the team(s) that designs and puts up the most creative and outstanding booth	Medal and Certificate for each team member
Most Popular Video Award*	For the team(s) that gain the most number of likes and/or views on their video	
Judges Awards*	Apart from all the awards listed, judges may present up to 5 other awards to teams and/or individuals that have displayed outstanding attributes (during the competition) that set them apart in a unique way.	

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

*The specific number of awards listed that will be presented to teams will be subjected to the judges and chief referees' decision, independent of the overall scoring of the teams.

Kindly note that the minimum number of teams for each age group is 10 for judging to proceed, otherwise the age group will be combined with the next closest age group for judging.

E.g. A total of 20 Secondary Teams and 3 Tertiary Teams have registered, the Tertiary level teams will be judged together with the Secondary level teams.

6. Glossary

Coach	A person assisting a team in the process to learn different robotics aspects, teamwork, problem solving, time management, etc. The role of the coach is not to win the competition for the team, but to teach them and guide them through the problem identification and in discovering ways to solve the competition challenge.
Judging Group	In general, 2 or 3 people form a judging group. These group will visit the teams in a judging session and ask questions. The same people will have seen the project report and video before the judging session as well.
Judging Session	Teams are judged in judging sessions. Every session has 15 minutes, 10 minutes for a presentation from the team, 5 minutes to answer questions from the judges.
Project Booth	The project booth is the place where teams present their solution. The project booth's dimensions are 2m x 2m x 2m.
Robotic Solution	<p>The robotic solution is the core result of the team's work. A team presents their solution to judges. A robotic solution cannot be larger than the project booth.</p> <p>The solution can use one or multiple robot devices. Every robot should work autonomously and not be operated by a remote control. Any remote controlled or additional devices are only allowed if this is connected to the solution for the real world (e.g. interacting with humans).</p> <p>There is no restriction on the use of controllers, motors, sensors, or any other building equipment the team needs to create their robotic solution and project booth.</p> <p>Teams can use any software / programming language to code the robotic solution.</p>
NRC	In this document, NRC stands for National Robotics Competition.

7. Scoring rubric

Category	Criteria	Points
1. Project (Total Points: 50)	1. Creativity – The project is original, innovative and demonstrates creative thinking.	10
	2. Quality of Solution – The project is well-thought out and is a good and is an effective solution to the problem. Prototype development and next step of the project is elaborated clearly.	15
	3. Limitations – able to identify limitations in their design and possible solutions to overcome these limitations	10
	4. Research and Entrepreneurship – Research shows elements of entrepreneurship such as, target customer group, cost structure, revenue stream, key resources, and partners.	15
2. Programming (Total Points: 30)	1. Automation – The project uses appropriate inputs from sensors to run specific routines and clearly demonstrates automation in the completing of the tasks.	10
	2. Good Logic – The programming options used are relevant, work reliably and efficiently.	10
	3. Readable and understandable – Codes are easy to follow e.g variables are well named, good use of comments	10
3. Engineering Design (Total Points: 40)	1. Technical Understanding – Team members are able to produce clear, precise, and convincing explanations about each step of the mechanical and programming process.	10
	2. 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.	10
	3. 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) are strong, sturdy and the demonstration can be run repeatedly - parts don't detach - little need for repairs.	15
	4. Aesthetics – The mechanical elements have aesthetic appeal, there is evidence that the team went out of their way to make the project look as professional as possible.	5
4. Presentation (Total Points 25)	1. Successful Demonstration – A demo of the capabilities was completed, there is a sense that it could reliably be repeated, and that preparation and practice have taken place.	10
	2. Communication & Reasoning Skills – The team were able to present their project idea in an interesting way - how it works - why they chose it - why it has relevance. The team are able to easily answer questions about their project. They were also able to deal with any problems that arose during the presentation	10
	3. Entertainment Value – The project has a certain “WOW” factor - looks fun, captures the attention of passer by - makes you want to see it again or learn more about it.	5
5. Teamwork (Total Points: 15)	1. Unified Learning Outcome – There is evidence that team members have internalized knowledge and understanding of the subject matter pertaining to their project.	5
	2. Inclusiveness – The team are able to demonstrate that all members played an important role in the development, construction and presentation of their project.	5
	3. Team Spirit – The team display positive energy, good cohesiveness, value one another and are enthusiastic and excited about sharing their project with others.	5
6. Social Media Video (Total Points: 40)	1. Originality – Creative way of promoting their robot based on overall theme	40
Maximum Points		200

