

# National Robotics Competition 2020

## RoboMaster Youth Challenge Manual

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Ministry of Education  
SINGAPORE

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## Introduction

The RoboMaster Youth Challenge is a brand-new category within the NRC which derives its format from the RoboMaster Robotics Competition and is targeted at young participants. Launched by DJI and in collaboration with Science Center Singapore (SCS), the Challenge requires young participants to form teams and engage in battles by operating their self-developed or modified robots.

It focuses on building the theoretical engineering knowledge and AI application skills among youths and helping them progress from mastering robotic basics and programming to AI and robot control theory. Its competitive format is a test of the participants' quick adaptability, problem detection and problem-solving skills. Meanwhile, the Challenge will also put the participants' teamwork and sense of responsibility to the test.

RoboMaster is starting a revolution in fostering innovative talents. Besides driving the development of robotics, it is channeling the enthusiasm and passion of top scientists and engineers for technology to the younger generation. The RoboMaster Youth Challenge hopes to nurture scientific thinking and the potential for innovation among youths and help them derive a sense of joy and achievement through technical battle, so that they gain the confidence to face the challenges of the future and move towards the goal of changing the world.

## Competition Rules Overview

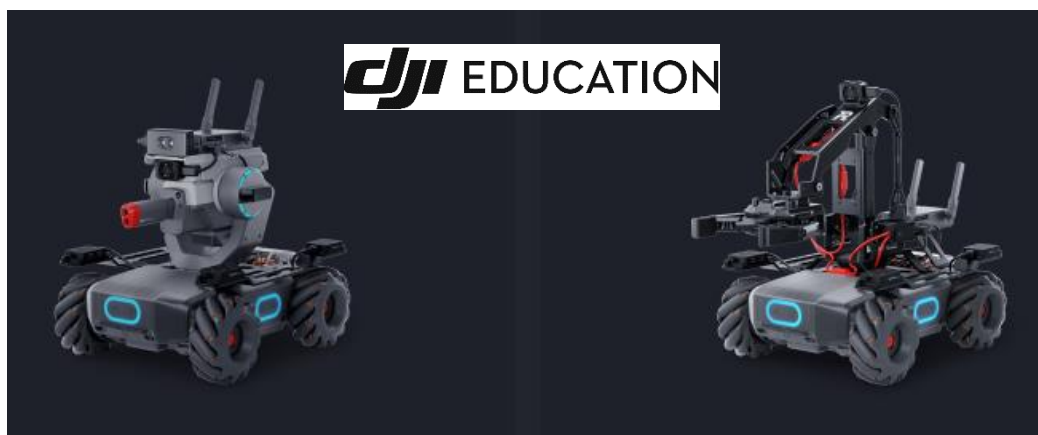
The types of robots used for the 2020 season will be the RoboMaster EP and S1 robots. With their robots, opposing teams will engage in 3v3 tactical shooting battles as well as perform various tasks. Teams will be scored accordingly for the following:

### Expected technical skills for the challenge:

- Program RoboMaster robot to follow a line
- Program RoboMaster robot to recognise and stop at visual markers
- Program RoboMaster robot to aim and shoot at visual marker
- Manually control RoboMaster robot to move the gripper arm, pick and place objects
- Manually control the RoboMaster robot for race mode
- Manually control the RoboMaster robot for battle

### Optional technical skills that will impress the judges:

- Program RoboMaster with gripper arm to autonomously follow lines and pick and place objects.



## Competition Dates & Venue

**Preliminaries (Round-Robin):** 11 November 2020

**Finals (Knock-Out):** 12 November 2020

**Venue:** Science Centre Singapore

**Duration:** 1 day or 2 days (for top 8 teams making to the finals)

*\* Detailed schedule will be sent out at a later date to registered participants. \**

## Team Definition

Each team should consist of 3 students. Given current safety measures, teams will need to keep to this cap of 3 members per team. On the day of the competition, only 3 students per team will be allowed within the competition arena at any one time.

## Equipment & Software Definitions

Teams may opt to use the 1 x RoboMaster robot with gripper arm and 2 x RoboMaster robots with turrets as well as the laptops provided for the competition. However, teams may bring their own robots and/or laptops if they wish to do so. However, the teams will need to be technically proficient on their own to setup their robots and laptops for the competition if they chose this option.

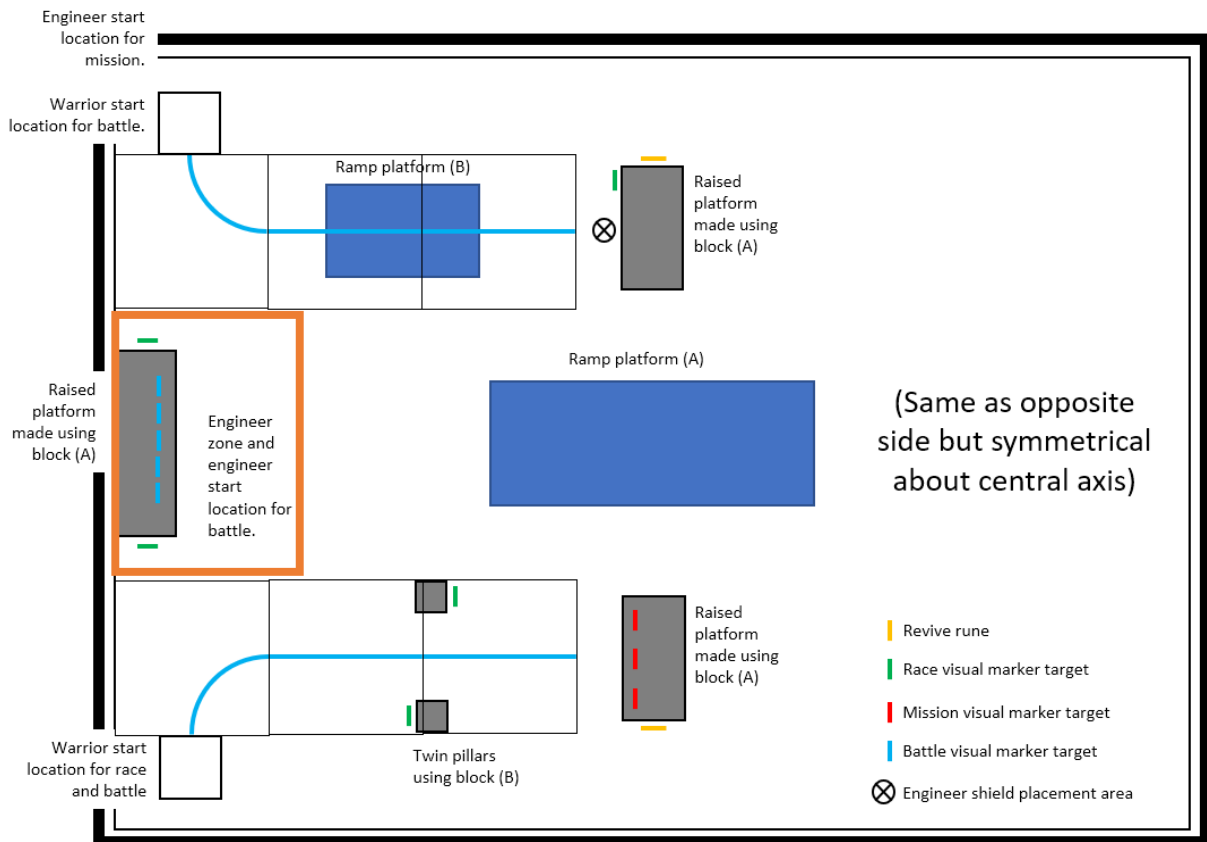
Teams may opt to use any block-based or script-based languages if they choose to perform the tasks autonomously. Teams are to prepare their code, saved as dsp file, and bring their codes for the competition. Teams using SCS laptops are to bring their codes in USB flash drive.

Teams need to construct and bring their own “Engineer Shield” based on the following specifications:

- Dimensions (Max): 500mm (H), 400 mm (W), 70mm (T)
- Weight (Max): 130 g
- Material: Any safe and durable material

## Map of Arena

The following diagram shows the competition arena to be used for the competition. The actual dimensions and layout may differ at the discretion of the organising committee.



## Gameplay Details

### Robot Lineup:

S/N	Robot Types	Quantity
1	RoboMaster robot with turret (as warrior)	2
2	RoboMaster robot with gripper (as engineer)	1

Each robot will start at their designated location in the arena.

### Competition Round:

Each round occurs between two competing teams and is comprised of the following phases:

1. Race
2. Mission
3. Battle

Phase	Activity	Duration
Race	<p>Each team will send one warrior to complete the race mode built into the RoboMaster app.</p> <ul style="list-style-type: none"><li>• Each warrior robot will only race on their side of the arena.</li><li>• Placement of the markers as indicated in the arena map.</li><li>• Complete two full laps.</li><li>• <b>Robots are not allowed to leave the arena. Forfeit may be implemented for non-compliance.</b></li></ul> <p>Phase ends when time is up or both teams have completed the tasks, whichever comes first.</p>	2 min
Mission	<p>Each team will have to prepare codes prior to the competition day to perform the following tasks and run their prepared codes during this phase:</p> <ul style="list-style-type: none"><li>• Program one warrior robot to follow the line and shoot at the visual marker targets at the end of the line.</li><li>• Teams may prepare multiple codes and run them consecutively or <b>one single code to complete the required tasks.</b></li></ul> <p>Concurrently, each team will also control their engineer robot to retrieve the engineer shield:</p> <ul style="list-style-type: none"><li>• Teams can decide whether to code autonomously or control manually, or a combination of both.</li><li>• Failure to retrieve the shield will result in the engineer not having the shield during the battle phase.</li><li>• Any shield toppled by its team's robot will not be reset or repositioned. Teams are advised to build their shields to stand properly while the engineer robot is reaching to grip it.</li><li>• <b>Engineer robot should return to the starting box (i.e. its chassis should at least touch the boundary line of the starting box)</b></li></ul> <p>Phase ends when time is up or both teams have completed the tasks, whichever comes first.</p>	1 min
Battle	<p>Teams will battle using the battle mode built into the RoboMaster app.</p> <ul style="list-style-type: none"><li>• Warriors can shoot other warriors and visual marker targets.</li><li>• Engineers (with or without the shield) will attempt to block the enemy warriors from shooting their targets.</li><li>• Warriors can revive using the revive runes (locations as indicated on the arena map).</li><li>• <b>Robots are not allowed to leave the arena. Forfeit may be</b></li></ul>	4 min

	<b>implemented for non-compliance.</b>	
	The phase ends when time is up.	

### Scoring

Points will be awarded for the following:

Phase	Items	Competition Points
Race	First team to complete the race within the given time limit of 2 minutes.	50
	Time taken to complete race mode.	1 point for every second under 60 seconds
Mission	Warrior robot successfully programmed to <b>follow the line</b> and move between the obstacles.	<b>100 (previously 50)</b>
	Warrior robot successfully programmed to shoot a target down.	50 for every target shot down
	Bonus: Engineer robot successfully programmed to autonomously follow the line.	<b>100 (previously 50)</b>
	Bonus: Engineer robot successfully programmed to autonomously pick up the shield. <b>This score supercedes the bonus for programming the engineer to follow the line (i.e. if the engineer is programmed to successfully follow the line and pick up the shield, it still gets 200 points, not 100+200 points. If the engineer is programmed to autonomously pick the shield without following the line, it also gets the 200 points).</b>	<b>200 (previously 100)</b>
	<b>After successfully collecting the shield, engineer robot returns to the starting box (i.e. its chassis should at least touch the boundary line)</b>	50
Battle	Every enemy visual marker target knocked down	50
	Every time an enemy warrior is destroyed	120

### Groupings:

Day 1:

Round robin, top 2 per group will advance to day 2.

Day 2:

Double knockout.

## Competition Rules and Regulations

### Pre-competition:

1. Teams to prepare their codes for mission phase:
  - a. Warrior is to autonomously follow the line and shoot the targets at the end of the line
  - b. (optional) Engineer codes to autonomously find the shield and pick it up
2. **Teams to construct and bring along their engineer shield** according to the following specifications:
  - a. Dimensions cannot exceed height: 50 cm, width: 40 cm, thickness: 7 cm, weight: 130 g

### Pre-match:

1. Teams take up positions at their respective locations
2. Teams load their codes into the competition laptops
3. Visual markers are reset by referees to their respective locations
4. Referees to ensure all robots are connected to their respective laptops
5. Warrior robots placed at starting locations.

### Race phase:

1. Referee will call out the countdown to start the phase. Players will then start their games based on the countdown.
2. Teams begin their race at the same time, but winner will be judged by the timing recorded in the RoboMaster app.

### Pre-mission phase:

1. Referees set up the arena accordingly.
2. Robots are placed by referees at their respective starting locations.
3. Engineer shields are placed at the designated locations.
4. Referees to ensure all robots are connected to their respective laptops

### Mission phase:

1. Referee will call out the countdown to start the phase. Players will then start their games based on the countdown.
2. Teams begin the phase at the same time.
3. Both teams run their warrior codes and control their engineer robots concurrently.

### Pre-battle phase

1. Referees to ensure all robots are connected to their respective laptops
2. Referees to create the battle and add the robots to the match. Each robot will need to set:
  - a. 1200 HP
  - b. Fast mode
  - c. Gel bead shooting
  - d. 4 min battle
3. Arena equipment (e.g. visual marker targets) is reset if knocked down or otherwise displaced.



Battle phase:

1. Referee will call out the countdown to start the phase. Players will then start their games based on the countdown.
2. Teams battle.

End of each round:

1. Teams leave the competition area.
2. Referees delete previous teams' codes from laptops.

**Timeouts:**

Referees can call timeout at any point in time when deemed necessary e.g. technical faults, reset fallen objects, accidents, etc.

Teams can call timeouts for the following:

- Equipment failure or disconnection

When timeout is called, the referee will stop and reset the game for affected teams. Countdown timer will also reset for affected teams that reset their game.

**Referee powers:**

- Referees can stop and reset any round and prohibit activities if they deem that any action by any player or team threatens the safety of everyone present or is destructive to the robots and other equipment in use.
- Referees will be the final arbiters of whether any player has made any violations.

**Robot interactions:**

Race phase:

- Robots are not allowed to enter the opponent's area.
- Robots are not allowed to do any shooting.

Mission phase:

- Robots are not allowed to enter the opponent's area.
- Robots are not allowed to shoot at anything other than their designated visual marker targets.

Battle phase:

- Robots are not allowed to shoot at anything other than their designated visual marker targets and enemy robots.
- Engineer robots are free to obstruct the enemy warrior robots' line of sight within the engineer zone without intentionally making physical contact.
- Warrior robots are not allowed to enter the engineer zone and engineers are not allowed to exit the engineer zone.
- No robot is allowed to intentionally physically contact any robot. No ramming, trying to push away robots, gripping their turrets, gripper arms, or other parts of the robot, etc.
- Accidental collisions should be minimised. Please be careful with the robots.

**Serious violations:**

- Verbal abuse
- Violent behavior
- Public nuisance behavior

- Failure to obey competition staff
- Failure to obey competition rules
- Tampering with any of the provided equipment
- Deliberately firing projectiles at any person, or object other than designated competition targets
- Other serious actions that violate the spirit of fair competition

**Safety:**

COVID-19 safety management measures:

- All persons are required to do temperature check before entering the competition areas
- Anyone with temperature above 37.5 °C will not be allowed into the competition areas
- All persons are required to sanitise hands before touching the competition laptops
- All competition laptops and safety goggles provided by SCS will be sanitised before and after use. Teams may choose to bring their own laptops and safety goggles
- All persons are to observe safe distancing at all times

Game play safety:

- As the robots will be shooting gel pellets, all persons in the competition area are to wear safety goggles at all times.

**Prizes and Judging Criteria**

Scoring is based on the competition scoring rubric. All decisions and scores given made by the officials during the competition will be final. The organizing committee reserves the right to review the competition scoring rubric as well as the prize payouts prior to the actual competition.

Ranking	Cash Prize	DJI Prizes	Certificate
Champion	\$250	\$500 Voucher* + 1 set of Tello Talent Drone	Certificate of Distinction
1 <sup>st</sup> Runner-Up	\$200	\$400 Voucher* + 1 set of Tello Talent Drone	Certificate of Distinction
2 <sup>nd</sup> Runner-Up	\$150	\$300 Voucher*	Certificate of Distinction
3 <sup>rd</sup> Runner-Up	\$100	\$200 Voucher*	Certificate of Merit
4 <sup>th</sup> & 5 <sup>th</sup> Runner-Up	\$100	10% Discount Vouchers*	Certificate of Merit
All Remaining Teams	NIL	5% Discount Vouchers*	Certificate of Participation



\* Vouchers can be used for purchase of DJI products and courses on [www.65drones.com](http://www.65drones.com) or at 65Drones Pte Ltd. Terms & Conditions may apply. \*

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