RoboMaster Youth Technical Challenge – Drone Tournament 2022 Rule Manual (Preview Edition)

Prepared by DJI RoboMaster Organizing Committee
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(Preview Edition)

1 Introduction

RoboMaster Youth Technical Challenge – Drone Tournament (RMYT Drone Tournament) is an exciting and challenging drone competition that requires students to use their drone knowledge and coding skills to solve two competition missions, namely Obstacles Mission and Maze Mission. No manual piloting is allowed.

2 Category

There are three categories in RMYT Drone Tournament, namely Primary, Secondary and Senior category. The age requirements for the three categories are:

- Primary category: 8 to 12 years old.
- Secondary group (Junior): 13 to 16+ years old.
- Senior group: 16 to 20 years old.

There are two rule sets, namely beginner and advanced rules. The beginner is for Primary category only while advanced applies to Secondary and Senior category only. Both Beginner and Advanced are to solve the Obstacles and Maze missions.

3 Team

Each team shall comprise up to 2 members and a Teacher or Trainer. One of the members is the team leader.

4 Competition Equipment

Beginner and Advanced challenges require each team to solve the challenge with a drone. The drone must meet the following specifications:

Drone type: Quadcopter with 4 coreless motors
Diagonal dimension: up to 100mm
Flight Time: no less than 7 minutes
Takeoff weight: less than 105g (including protective guard and battery)
Propeller blade protector: All-round enclosed propeller blade protective guard
Battery type: Removable li-ion of 1.1Ah/3.8V
Programming language: Block or Python
LED display: programmable full-color RGB LED
Programmable dot-matrix LED indicator: 8x8 red-blue matrix indicator
Positioning Capabilities: Vision-based capabilities
WIFI capabilities: 2.4Ghz and 5.8Ghz WIFI
Sensors capabilities: Infra-red height determination, barometer, downwards vision sensor, HD720P image transmission, and Infra-red distance ToF sensor.

Each team is to prepare the following:

- up to 2 sets of drones (including lipo battery and charger) of the above specifications where one of the drones is a spare drone.
- Computing devices (such as laptops, ipads, tablets and phones) and necessary software for coding and operating the drone during the competition.
- WIFI equipment such as WIFI adaptor or router (if required)

The organizer reserves the right to disqualify team if the team do not use drones of the above specifications. The organizer will provide the competition arena for use during the competition.

5 Competition Arena

The challenge arena is made up of 60 cm grid. The beginner challenge is based on a 3 x 4 grids arena for the maze mission and a 3 x 3 grids arena for the obstacles mission with 4 obstacles in the 3 x 3 grids arena. The advanced challenge is based on 5 x 5 grids for the maze mission and a 3 x 3 grids arena for the obstacles mission with 6 obstacles in the 3 x 3 grids arena. Height of all grids arena wall is 120cm. The placement of obstacles and design of maze in the following diagrams are for illustration purpose and the judge reserve the rights to change the placements and design of the maze.

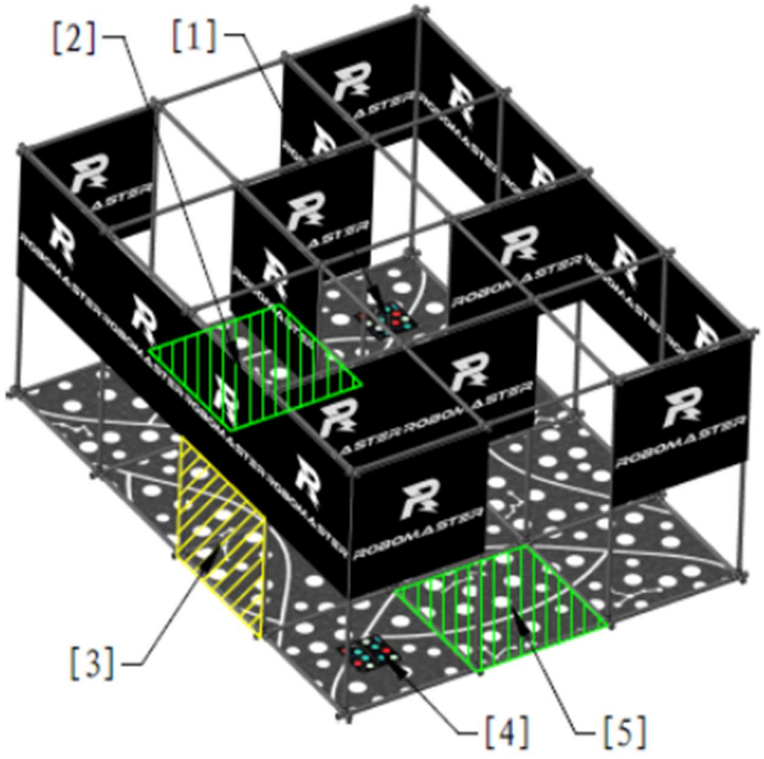


Diagram 1 – Beginner 3 x 4 grid maze arena

Legend:

1- Hidden Point 2- Maze Start point 3 – Off-limit perimeter barrier

4- Hidden Point 4 – Maze End point

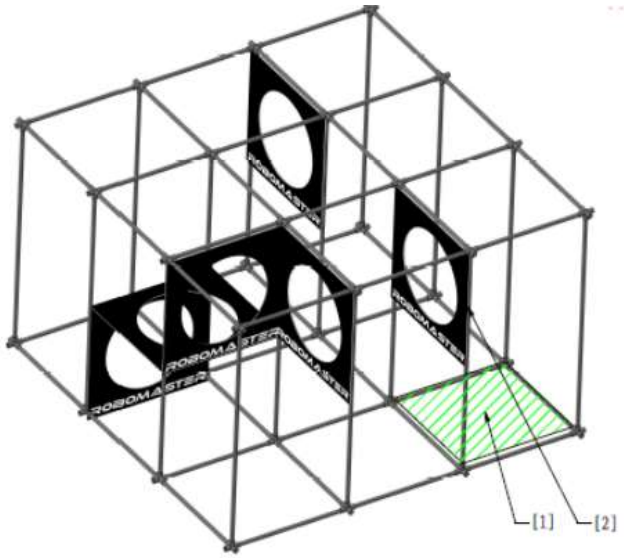


Diagram 2 – Beginner 3 x 3 grid obstacles arena

Legend:

1 - Obstacle Start point 2- Obstacle

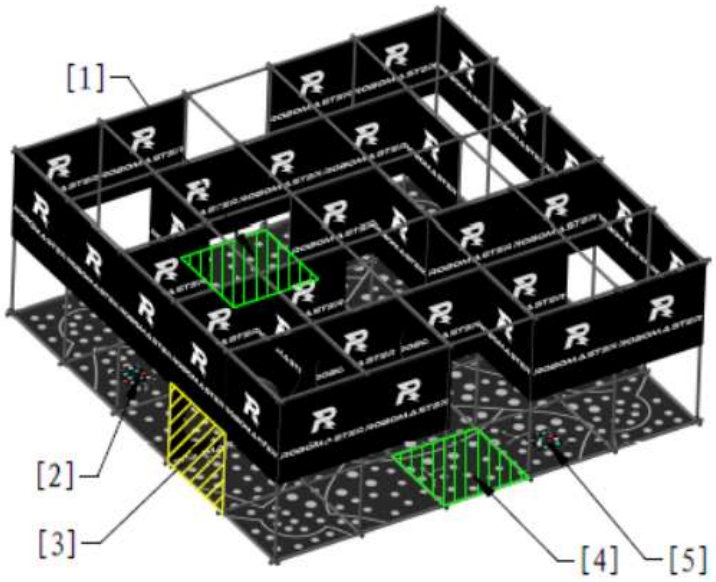


Diagram 3 – Advanced 5 x 5 grid maze arena

Legend:

1- Hidden Point 2- Maze Start point 3 – Off-limit perimeter barrier

4- Hidden Point 4 – Maze End point

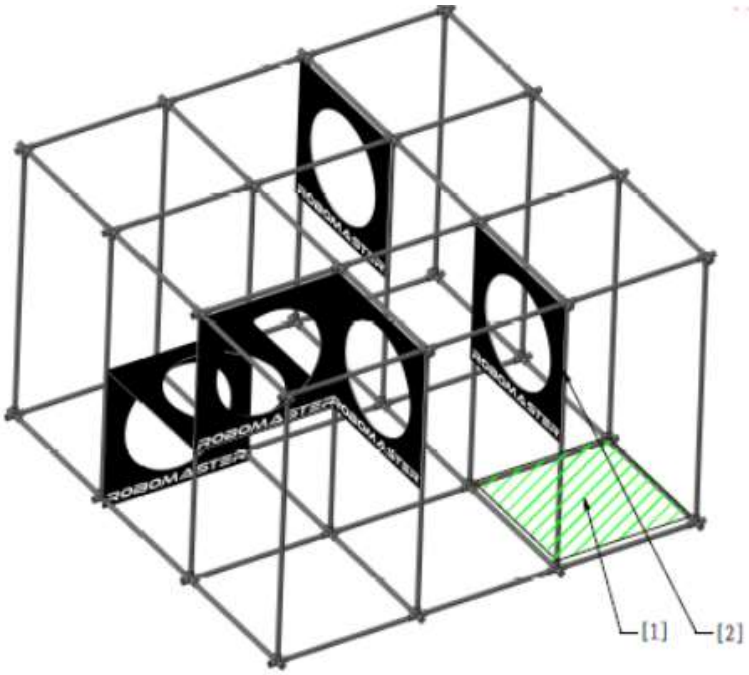


Diagram 4 – Advanced 3 x 3 grid obstacles arena

Legend:

1 - Obstacle Start point 2- Obstacle

The challenge arena is made up of 60 cm grid

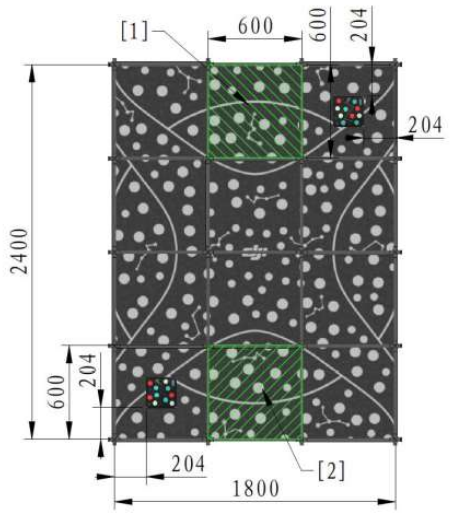


Diagram 5 – Beginner maze arena vision positioning layout

Legend:

1 - Maze Start point 2 – Maze End point

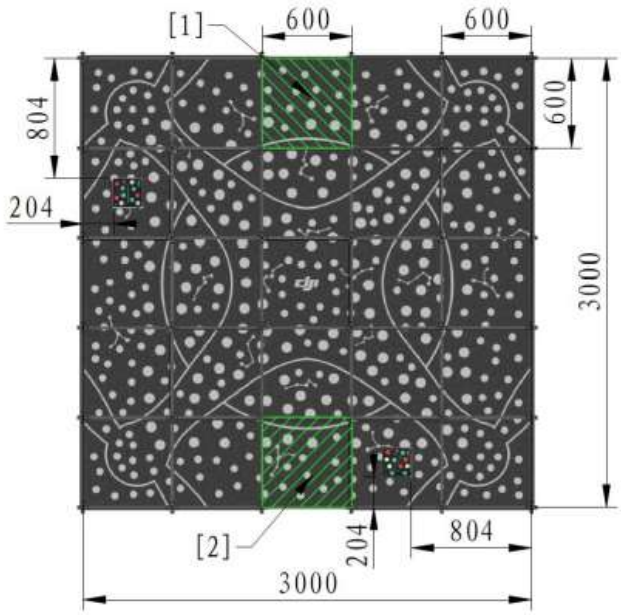


Diagram 6 – Advanced maze arena vision positioning layout

Legend:

1 - Maze Start point 2 – Maze End point

6 Competition Rules

6.1 Competition Missions

There are two missions namely Obstacles Mission and Maze Mission. All team are to start with Obstacles Mission and then follow with Maze Mission. The team are to complete all missions within 7 minutes.

At the Obstacles Mission, the team are to code their drone to take off from the Obstacle start point in the Obstacles arena, and fly through the obstacles in Obstacles Arena while navigating towards the starting point in Maze Arena. When the drone flies through an obstacle, the LED on the drone must change color to indicate successfully fly through an obstacle. After navigated out of Obstacles Arena and reaches the starting point of Maze Arena, Maze Mission begins.

The Maze Mission comprises of Search and Traverse missions. The team is to start with Search mission of the Maze Mission. During the Search mission, the drone starts the Search mission from the starting point of the Maze Arena. The Search mission is to uncover hidden points within the Maze Arena and to find the shortest path from the starting point in the Maze Arena to ending point in the

Maze Arena. When the drone reaches the ending point in the Maze Arena, the LED on the drone must flash red color 3 times to indicate completion of Search mission.

After the team has completed the Search mission, the team can start the Traverse mission of Maze Mission. During the Traverse mission, the drone is to navigate from ending point in Maze arena to starting point in the Maze arena using the shortest time. When the drone reaches the starting point in the Maze arena, the LED on the drone must change to blue color to indicate completion of Traverse mission and the competition ends.

The LED on the drone shall show green color at all times, except for during phases of the missions where the drone is required to show other colors indicated by the rules.

When the drone is at a hidden point, the drone is to hover at the hidden point. While at the hidden point, the drone is to detect the ID of the mission card placed at that hidden point and display the identified ID number (the ID can be from 1 to 4) on the dot-matrix display on the drone for 1 seconds to indicate a hidden point is discovered. Score is only awarded once for a hidden point in a round.

In the event of code malfunction, the team can request to restart the mission that are being carried out. The team cannot request to restart the entire round. While the team is in the midst of Obstacle mission, or during Traverse or Search mission of Maze mission, team can request to restart that phase of mission and points that were collected at that phase of mission will be reset. Time taken will not be reset. The team will start at starting point of that mission phase. If the team requests to restart Obstacle mission, their drone will start at the starting point of Obstacle arena. If the team requests to restart Search of Maze mission, their drone will start at the starting point of Maze arena. If the team requests to restart Traverse of Maze Mission, their drone will start at the end point of Maze Arena.

In the event of code or drone malfunction, the team can request to end the round. When the team ends the round, points earned will be considered as the team's score for the round.

The team can place 2 additional mission cards in the Arena for positioning estimation. The mission card shall not have the same ID number as the hidden points in the Arena. The team is not allowed to use adhesive to tape the mission cards onto the Arena.

6.2 Scoring

6.2.1 Time Details

Every team is given 7 minutes to complete all missions for a round. Once a round starts, the judge will keep track of the time taken. The judge will keep track of the time taken for Obstacle Mission and Maze Mission. The judge will also keep track of the time taken for Search and Traverse mission of the Maze Mission. A round ends when:

- The drone has successfully completed all the missions.
- 7 minutes have been used up and the drone has not completed all the missions.

- The team declared to end the round.

The team is considered to have completed the Obstacle mission when the drone reaches the starting point of the Maze Arena.

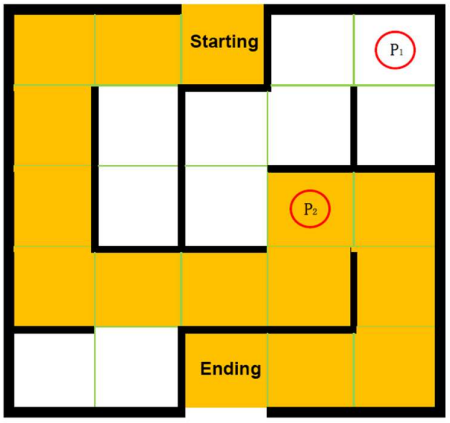
The team is considered to have completed the search mission of the Maze Mission when the drone reaches the end point of the Maze Arena and the LED flashes red times at the frequency of 1Hz. The judge will take note of the time taken for that search mission. The time taken for the LED flashing will be considered as time taken by the team to complete mission. If the round ended and the team could not complete the search mission, the judge will consider the team has taken 7 minutes for that round.

The team is considered to have completed the Traverse mission of the Maze mission when the drone reaches the starting point of the Maze Arena after traversing from the end point of the Maze Arena and the LED on the drone lighted with blue color. The judge will stop counting the time taken and record the time taken for the team.

6.2.2 Scoring Details

Condition	Score
Discovered a hidden point	20 points per hidden point
Complete Obstacles Mission	40 points
Complete Search Mission of Maze Mission	40 points
Complete Traverse Mission of Maze Mission	40 points
Obstacles Flew Through	(40 points * n) / N where: - n is the number of the obstacles flew through - N is the 6 for Advanced (Secondary) and 4 for Beginner (Primary)

When the team could not complete the Search or Traverse mission of Maze Mission and the round has ended, the scores for the Search or traverse mission will be awarded based on the closest point on the shortest path from the starting point to end point of the Maze Arena to the location at which the drone is at or landed when the round has ended.



For example: The drone lands at P1 when the round has ended and closest point on the shortest path from the starting point to the ending point of the Maze Arena is P2.

Condition	Score
Incomplete Search Mission and round has eneded	Number of grids from the starting point to P2 / L * 40 Where: L is number of grids based on the shortest path between the starting point and ending point of the Maze Arena. Using the above example: 0 + (9 / 14 * 40 = 25.7) as the team has not complete traverse mission.
Incomplete Traverse Mission and round has ended	Number of grids to P2 from the ending point / L * 40 Where: L is number of grids based on the shortest path between the starting point and ending point of the Maze Arena. Using the above example: 40 + (5 / 14 * 40 = 14.3) as the team has completed the Search mission.

6.2.3 Time Bonus Score

When team has completed all missions in less than 7 minutes, additional score will be awarded based on the time taken for completing the Traverse mission of the Maze mission:

(t – time taken for completing the Traverse mission of the Maze mission) * 5

Where t is 120 for Advanced (Secondary) or 90 for Beginner (Primary)

6.2.4 Penalty

Condition	Penalty
Fly out of the Arena for more than 5 seconds	Score reset and restart at starting point. Time will not be reset.
Fly higher than the Arena for more than 5 seconds	Score reset and restart at starting point. Time will not be reset.
Fly below the wall in the Maze Arena	Score reset and restart at starting point. Time will not be reset.
Drone does not show LED color as stated in the rules when complete Obstacles mission	Deduce 5 points

Drone does not show flashing LED color as stated in the rules when completed Search mission	Deduce 5 points
Drone does not show LED color as stated in the rules when completed Traverse mission	Deduce 5 points
Drones does not show LED color as stated in the rules resulting in judge not able to correctly record time	Team has accept responsibility based on the score awarded

6.2.5 Competition Format

The team will be ranked based on the following:

- Total scores
- In the event where the teams have the same score, the teams will be ranked according to the time taken to complete Traverse mission of the Maze mission. The team that takes the lesser time will be ranked higher.
- In the event where the teams have the same score and taken the same amount of time for Traverse mission, the teams will be ranked according to the time taken to complete the Search mission. The team that takes the lesser time of Search mission will be ranked higher.
- In the event where the teams have the same score and taken the same amount of time for Traverse mission and Search mission, the teams will be ranked according to the time taken to complete the Obstacles mission. The team that takes the lesser time of Obstacles mission will be ranked higher.
- In the event where the teams have the same score and taken the same amount of time for Traverse mission and Search mission and Obstacles mission, and the teams are within the top 5 ranking, the teams will complete one more round in another arena setting.
- In the event where the teams have the same score and taken the same amount of time for Traverse mission and Search mission and Obstacles mission, and the teams are not within the top 5 ranking, the teams will be ranked to the ranking.

7 Competition Flow

7.1 Registration

After the team has registered, the team will ballot for the order to compete.

7.2 Testing

Each team will be given time to test with the Arena. The judge will allocate time according to the number of teams taking part in the competitions. Each team will be given at least 5 minutes to test. The judge will schedule the team and inform the team of their time to test.

7.3 Coding Obstacles Mission

After the judge has announced the obstacles placement in the Obstacles arena, the team will be given 15 minutes to code their drone to fly through the obstacles in the arena.

7.4 Inspection

Before the team enters the holding area, the judging team will inspect the drones if the drones are within the rules specifications. After the inspection, the team leader has to acknowledge the inspection results and handed over the drones and computing equipments to the competition staff team for safekeeping. Thereafter, the team can enter the holding area of the competition arena.

7.5 Holding Area

10 minutes before the schedule for the team to compete, the team are to enter the holding area. At the holding area, the competition staff will verify identity of the team members and trainer/teacher. After identity verification, the competition staff will return the drones and computing equipments to the team. The team are not allowed to make changes to the drones and codes.

7.6 1 minute Preparation Phase

After the team has entered the Competition Arena, the team is given 1 minutes to enter the arena to clean up the arena, place the mission card on the arena. Within the 1 minute, the team is to prepare the computing equipments. The team is not allowed to make changes to the codes and drones. In the last 10 seconds, the team is to power the drones and place the drone at the starting point of the Obstacles Arena, and leave the arena.

7.7 7 minutes of Competition

Upon instruction of the judge to start up the drone, one of the team is to startup the drone. After the startup the drone, the team is to await for further instructions before starting the code. Upon instruction of the judge to start the code, the team can execute their code and compete.

7.8 Results Verification

Within 5 minutes after a round ends, the team leader is to sign and acknowledge the results or to raise dispute if any. After 5 minutes and there is no acknowledgment, all results will be considered as acknowledged by the team.