



# DRONE ODYSSEY CHALLENGE 2019

## COMPETITION MANUAL

Main Organiser:

Co-Organiser:



## Drone Odyssey Challenge 2019 Manual - Change Log

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## Contents

<b>DRONE ODYSSEY CHALLENGE 2019</b> .....	<b>4</b>
1. INTRODUCTION.....	4
2. CATEGORIES.....	4
3. GENERAL RULES .....	5
4. FORMAT OF COMPETITION .....	6
5. PRELIMINARIES.....	8
5.1 CATEGORY A, CATEGORY B.....	8
6. FINALS.....	9
6.1 CATERGORY A, CATEGORY B .....	9
6.2 OPEN CATEGORY.....	10
7. AWARDS.....	11
7.1 CHALLENGE AWARDS .....	11
7.2 MERIT AWARDS .....	12
8. CATEGORY A MISSION TASKS (PRELIMINARY) .....	13
9. CATEGORY B MISSION TASKS (PRELIMINARY) .....	17
10. OPEN CATEGORY MISSION TASKS .....	20

# DRONE ODYSSEY CHALLENGE 2019

## 1. INTRODUCTION

Drone Odyssey Challenge is an exciting game-based competition that promises plenty of fun while inculcating technical skillsets, critical thinking and an appreciation of new and disruptive technologies relevant to the modern world. Open to students from the Primary and Secondary levels, this competition will see participants working together in teams to code their programmable drones so as to transform them into Unmanned Aerial Vehicles (UAVs) capable of performing tasks under given scenarios. A series of workshops and live demonstrations have been specially developed for both students and mentors to complement their learning journeys leading up to the competition proper. Drone Odyssey Challenge is organized by Science Centre Singapore with support from the Ministry of Education (MOE) and various partners.

## 2. CATEGORIES

There are a total of three main categories for Drone Odyssey Challenge 2019:

Main Category	Sub-category	Allowed Drone	Education Level
<b>Category A – Coding with Drones</b>	Category A1	Parrot Mambo	Primary Schools
	Category A2	DJI Tello Edu	Primary Schools
<b>Category B – Coding with Drones</b>	Category B1	Parrot Mambo	Secondary Schools
	Category B2	DJI Tello Edu	Secondary Schools
<b>Open Category – Drone Swarming</b>	-	DJI Tello Edu	Secondary Schools

### ***Category A – Coding with Drones (Primary Schools)***

Code a programmable drone and turn it into an unmanned aerial vehicle (UAV) that can navigate itself through a course, passing by waypoints along the way.

Each team should consist of **TWO (2) to THREE (3)** Members.

### **Category B – Coding with Drones (Secondary Schools)**

Code a programmable drone and turn it into an unmanned aerial vehicle (UAV) that can navigate itself through a course, passing by waypoints along the way.

Each team should consist of **TWO (2) to THREE (3)** Members.

### **Open Category –Drone Swarming (Secondary Schools)**

Choreograph a drone performance and code programmable drones that autonomously synchronize with the music of your choice.

Each team should consist of **TWO (2) to THREE (3)** Members.

## **3. GENERAL RULES**

- The deadline for registration is **31 May 2019**. Teams can register online at the following URL: <https://www.stemacademy.sg/events/drone-odyssey-challenge-2019/>. A \$25 registration fee applies for all MOE schools.
- International school teams are subjected to different fees. Interested International school team can email your interest to [Timothy\\_THAM@science.edu.sg](mailto:Timothy_THAM@science.edu.sg)
- Participants must be full time registered students of a school of the correct level for the category they are registering for. They are not allowed to take part in categories higher or lower than their educational standard, i.e. Primary school students are not allowed to take part in Category B and Open Category. Secondary school students are not allowed to take part in Category A.
- Participants will be notified upon successful registration within one week of the registration deadline. The decision made by the Drone Odyssey Challenge organizing committee is FINAL, and is subject to the competition schedule and logistics support availability.
- Each member can only participate in one team within their eligible category.
- Members and family members of the organizing committee are not allowed to participate in Drone Odyssey Challenge.
- The organizers reserve the right to amend the rules and regulations. In the event of any change, all teams will be informed at least **TWO (2)** weeks prior to the start of the competition.
- Prizes will be awarded to the designated recipient(s), as stated in the registration form.
- The organizers of Drone Odyssey Challenge 2019 will not be held responsible for any damage to, or the loss of, any drone(s) and associated equipment throughout the entire competition.

- All participants will be held responsible for the safe flying of their drone(s) throughout the entire competition. The organizers reserve the right to ground the flying machine(s) of any team.
- Information pertaining to the competition may be found at the event website: [www.science.edu.sg/events/Pages/dronechallenge.aspx](http://www.science.edu.sg/events/Pages/dronechallenge.aspx). For any specific queries regarding the competition, please send an email with the title addressed to the relevant category (e.g. <CAT A1> Clarification about General Rules & Regulations) to the following email address: [drone\\_odyssey@science.edu.sg](mailto:drone_odyssey@science.edu.sg)

#### **4. FORMAT OF COMPETITION**

Interested participants and mentors are invited for the formal announcement of the competition to be held at Science Centre Singapore on 22 April 2019 at 2:30pm. Participants and mentors will be briefed on the rules and regulations as well as the mission tasks for the three competition main categories. They are also welcomed to clarify any queries they may have about the competition during the Questions & Answers session.

##### ***Category A & B – Coding with Drones (Primary & Secondary Schools)***

Registered teams will then work on their respective mission tasks based on the game-play announced by the Drone Odyssey Challenge organizing committee in preparation for the preliminary rounds to be held at Science Centre Singapore on 9-11 July 2019 for Category A.

Top 10 teams of each subcategory, i.e. Category A1 and Category A2, from the preliminary rounds will be invited back for the finals to be held on 12 July 2019 at the Science Centre Singapore. These finalist teams will be required to prepare for and perform additional mission tasks that will be announced only after the completion of the preliminary rounds. These finalist teams will also have to prepare and present before a panel of judges on their learning journey for the competition thus far.

##### ***Open Category – Drone Swarming (Secondary Schools)***

Registered teams will then work on choreographing a drone swarming performance by coding programmable drones that synchronize with the music of your choice based on the game-play announced by the Drone Odyssey Challenge organizing committee in preparation for Open Category will be held on 11 July 2019.

Drone Odyssey Challenge 2019 schedule is as follows:

Date	Event	Venue
<b>12 April 2019</b>	Registration Opens	-
<b>22 April 2019</b>	Challenge Announcement	Science Centre Singapore
<b>14 May 2019</b>	Learning Journey <sup>1</sup>	Science Centre Singapore
<b>15 May 2019</b>	Learning Journey <sup>1</sup>	Science Centre Singapore
<b>16 May 2019</b>	Learning Journey <sup>1</sup>	Science Centre Singapore
<b>21 May 2019</b>	Learning Journey <sup>1</sup>	Science Centre Singapore
<b>22 May 2019</b>	Learning Journey <sup>1</sup>	Science Centre Singapore
<b>28 May 2019</b>	Learning Journey <sup>1</sup>	Science Centre Singapore
<b>31 May 2019</b>	Registration closes	-
<b>9-11 July 2019</b>	Category A Preliminaries Category B Preliminaries Open Category	Science Centre Singapore
<b>12 July 2019</b>	Category A Finals Category B Finals Awards Presentation Ceremony	Science Centre Singapore

Any changes to the above schedule for the various categories will be informed latest by 21 June 2019.

<sup>1</sup> Fee applies for International school teams. Interested International school team can email your interest to [Timothy\\_THAM@science.edu.sg](mailto:Timothy_THAM@science.edu.sg)

## 5. PRELIMINARIES

### 5.1 CATEGORY A, CATEGORY B

The preliminary rounds will take place on 9-11 July 2019 at Science Centre Singapore. All participating teams should expect the following during the course of the preliminaries of the day.

- The competition hall will open at 8:30 am. Only registered team members of the participating teams can enter the competition zone from 8:30 am to 5:30 pm.
- Teams will be assigned to either AM (morning) or PM (afternoon) session and is thus expected to report at the stipulated timings 08:00am and 12:00pm respectively.
- Teams are advised to arrive early to prevent potential delays or bottleneck. Teams reporting for registration later than this stipulated timing without extenuating reasons may be barred from competition at the discretion of the Drone Odyssey Challenge 2019 organizing committee.
- Following registration, teams will be ushered to the Competition Hall/ Holding Rooms. All teams must stay within these competition areas and follow instructions from the officials. No team are allowed to venture beyond these areas without informing the officials.
- As for spectators, they are not permitted within the competition zone (playing field and student work areas).
- Flying will only be done within the designated flying space. Teams violating this may be barred from competition at the discretion of the Drone Odyssey Challenge 2019 organizing committee.
- Teams are advised to bring chargers and sufficient spare batteries for the competition. Teams are allowed to charge their batteries within the competition hall. Only official battery packs are allowed and charged according to the manufacturer's recommendations. Teams are required to bring sufficient batteries for all the missions.
- Likewise, teams need to ensure that there is sufficient charge for their smart devices to last through the competition. Else, they are advised to bring a suitable charger for the smart device.
- Teams are to bring their own drones and accessories. However, there will be limited spare drones and iPads provided to teams in event of technical difficulties.
- Teams will be brief on the proceedings on the day and issued specific instructions pertaining to the challenge during the Mission Briefing. Following which, teams will be given time to practice for their mission runs during trial session.
- All participating teams will be expected to complete **TWO (2)** mission runs lasting throughout the day. Teams will be allowed time in between each mission runs to practice as well as prepare. The total score out for the **TWO (2)** mission runs will be used to determine the final rankings for the preliminaries. In the



case of a tie in scores, the total time for the **TWO (2)** mission runs will be used as a tie-breaker.

- All participating teams will be expected to make a **FIVE (5)** minute presentation and **FIVE (5)** minute questions and answers session before a panel of judges using suitable presentation aids such as but not restricted to; PowerPoint slides, A2 posters, journals, demonstrations, printed A4 handouts, various AV media and etc. The team's performance, as assessed by the judging panel, will be used as consideration of the various Merit Awards to be presented. Teams may strategically scope their presentations to vie for specific Merit Awards.
- The top **TEN (10)** performing teams from each category will be invited for the finals. Details for the final missions will then be made known to all finalist teams so that they may start preparations in anticipation of the finals to be held later.

## 6. FINALS

### 6.1 CATERGORY A, CATEGORY B

The finals will take place on 12 July 2019 at Science Centre Singapore. All finalist teams should expect the following during the course of the finals on that day:

- The competition hall will open at 8:30 am. Only registered team members of the finalist teams can enter the competition zone from 8:30 am to 5:30 pm.
- All finalist teams will report to the venue by 8:00 am for registration.
- Teams are advised to arrive early to prevent potential delays or bottleneck. Teams reporting for registration later than this stipulated timing without extenuating reasons may be barred from competition at the discretion of the Drone Odyssey Challenge 2019 organizing committee.
- Following registration, teams will be ushered to the Competition Hall/ Holding Rooms. All teams must stay within these competition areas and follow instructions from the officials. No team are allowed to venture beyond these areas without informing the officials.
- As for spectators, they are not permitted within the competition zone (playing field and student work areas).
- Flying will only be done within the designated flying space. Teams violating this may be barred from competition at the discretion of the Drone Odyssey Challenge 2019 organizing committee.
- Teams are advised to bring chargers and sufficient spare batteries for the competition. Teams are allowed to charge their batteries within the competition hall. Only official battery packs are allowed and charged according to the manufacturer's recommendations. Teams are required to bring sufficient batteries for all the missions.
- Likewise, teams need to ensure that there is sufficient charge for their smart devices to last through the competition. Else, they are advised to bring a suitable charger for the smart device.

- Teams are to bring their own drones and accessories. However, there will be limited spare drones and iPads provided to teams in event of technical difficulties.
- Teams will be brief on the proceedings on the day and issued specific instructions pertaining to the final challenge during the Mission Briefing. Following which, teams will be given time to practice for their mission runs during trial session.
- The Trial/Practice session available. The session will be conducted as a free practice session with teams allowed access to the playfields on a first come first serve basis. However, teams will not be able to spend more than 5 minutes at a playfield at any one time. Officials will ensure that no team is allowed to hog any playfield.
- Presentation to a panel of judges for teams vying for the Merit Awards will run in tandem with the trial/practice session. Teams will be rostered to present at specific timings and thus teams are advised to plan their trial/practice around this schedule.
- Teams will commence with the Final Mission after their lunch break. Each team will be allowed reasonable preparation time before their **ONE (1)** Final Mission run. The scores obtained for that **ONE (1)** Final Mission Run will be used to determine the final rankings for the finals. In the case of a tie in scores, the faster timing for that **ONE (1)** Final Mission Run will be used as a tie-breaker.
- The winners for the Challenge and Merit Awards will be notified by the end of the competition.

## 6.2 OPEN CATEGORY

Open Category will take place on 12 July 2019 at Science Centre Singapore. All finalist teams should expect the following during the course of the finals on that day:

- The competition hall will open at 8:30 am. Only registered team members of the finalist teams can enter the competition zone from 8:30 am to 5:30 pm.
- All finalist teams will report to the venue by 8:00 am for registration. Teams reporting for registration later than this stipulated timing without extenuating reasons may be barred from competition at the discretion of the Drone Odyssey Challenge 2019 organizing committee.
- As for spectators, they are not permitted within the competition zone (playing field and student work areas).
- Flying will only be done within the designated flying space. Teams violating this may be barred from competition at the discretion of the Drone Odyssey Challenge 2019 organizing committee.
- Teams are advised to all necessary equipment, ie routers, laptops, drones and accessories. Teams are allowed to charge their batteries within the competition hall. Only official battery packs are allowed and charged according to the manufacturer's recommendations. Teams are required to bring sufficient

batteries for all the missions. In event of technical difficulties, teams are expected to be able to troubleshoot their own equipment.

- Teams will commence with the challenge. Each team will be allowed reasonable preparation time before **ONE (1)** challenge run. The scores obtained for that **ONE (1)** challenge run will be used to determine the final rankings.
- The winners for the Challenge Awards will be notified by the end of the competition.

## 7. AWARDS

Drone Odyssey Challenge judges and officials make all scoring decisions and their decision is FINAL. For arbitrary cases, the Drone Odyssey Challenge organizing committee will have the FINAL say.

There is no limit to the number of awards that a team can win, but there may not be a winner for every award. Awards may not be given out if the team do not meet the minimum standard determined by the Drone Odyssey Challenge organizing committee.

### 7.1 CHALLENGE AWARDS

Challenge Awards are presented to the best performing teams in their respective categories based on their mission runs. Prizes associated with these awards are summarized below:

#### **CATEGORY A AND CATEGORY B**

Awards	Prizes
<b>Champion</b>	\$500 Cash and Championship Trophy, Winner Medals/ Sponsored Products
<b>1<sup>ST</sup> Runner-up</b>	\$400 Cash and Winner Medals/ Sponsored Products
<b>2<sup>nd</sup> Runner-up</b>	\$300 Cash and Winner Medals/ Sponsored Products
<b>3<sup>rd</sup> Runner-up</b>	\$200 Cash and Winner Medals/ Sponsored Products
<b>4<sup>th</sup> Runner-up</b>	\$100 Cash and Winner Medals/ Sponsored Products

<b>FIVE (5) Consolation Awards</b>	Winner Medals/ Sponsored Products
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## **OPEN CATEGORY**

Awards	Prizes
<b>Champion</b>	\$500 Cash and Championship Trophy, Winner Medals/ Sponsored Products
<b>1<sup>st</sup> Runner-up</b>	\$400 Cash and Winner Medals/ Sponsored Products
<b>2<sup>nd</sup> Runner-up</b>	\$300 Cash and Winner Medals/ Sponsored Products

## **7.2 MERIT AWARDS**

Merit Awards are presented to finalist teams in each category by a panel of judges in recognition of outstanding attributes displayed. Teams may strategies and scope their presentations to specifically vie for a particular Merit Award. Merit Awards may include the following awards and/or more: They may include the following awards and more:

### **CATEGORY A AND CATEGORY B**

Awards	Awarded to	How to win
<b>Best Presentation</b>	Team that best exhibits creativity, fluency, confidence and flair in its presentation, and that demonstrates that “WOW” factor to the panel of judges during the interview session.	Present your topic of choice and impress the judges with your flair in delivery or come up with the most unique and captivating presentation.
<b>Best Knowledge</b>	Team that best exhibits in-depth knowledge on subjects relevant to the theme, programming, mechanical design and unmanned aerial systems in general.	Pick a relevant topic of choice and impress our judges with your in-depth knowledge and understanding
<b>Best Strategy</b>	Team that takes the initiative to achieve its	Do you have a unique strategy that you will be

	mission objectives through intelligent and well calculated risk management skills and strategies, as well as a willingness to plan and execute risky maneuvers.	employing for the final mission run? Or an original risk management strategy? Share with the judges and impress them.
<b>Best Learning Journey</b>	Team that best demonstrate the highest levels of learning, application, analysis, synthesis, critical evaluation, self-awareness and the ability to maintain a reflective log of their learning journey.	Share with the judges the learning journey you had as along the Drone Odyssey Challenge journey. Beyond just the hard skills, also tell us the value and moral learnings you have gleaned from the experience.
<b>Judge's Commendation</b>	Team that demonstrate exceptional skills or qualities as recognized by the Judges	Showcase exceptional skills or qualities.

All teams presented with a Merit Award shall receive the following prizes:

<b>Merit Award Prizes</b>
<b>\$300 Cash and Merit Award Medals/ Sponsored Products</b>

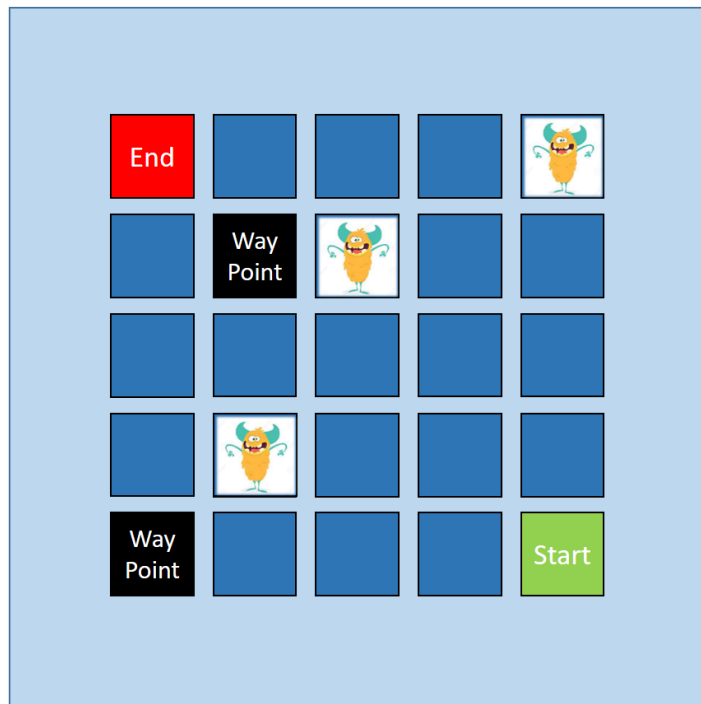
Any of the above awards may not be given out if no team is deemed to have meet the minimum standard as determined by the Drone Odyssey Challenge organising committee's panel of judges. Merit awards beyond what has been specified above may also be awarded to teams at the discretion of the Drone Odyssey Challenge organising committee's panel of judges.

## **8. CATEGORY A MISSION TASKS (PRELIMINARY)**

### ***Gameplay***

There are monsters within the forest. Your drone is to fly continuously over waypoints in the forest and determine if there are monsters hiding at each waypoint. The more waypoints correctly visited and number of monsters identified will allow the team to score more points.

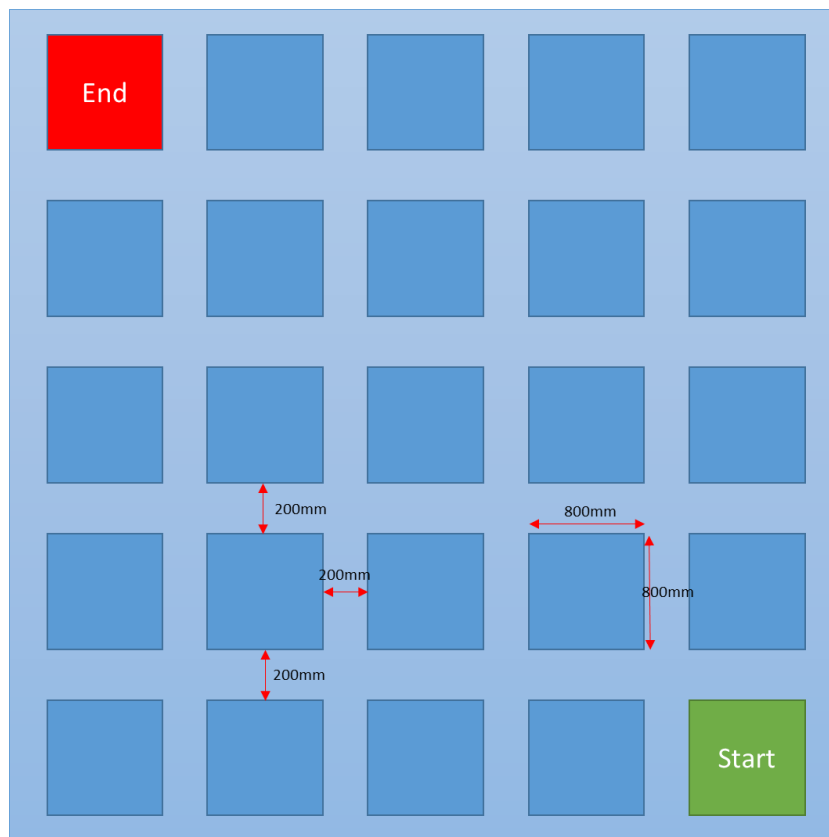
- There are 5 waypoints to visit. These waypoints will only be made known before each run and will be consistent for all teams doing that run.
- Up to 3 monsters may each occupy any of the waypoints. The location of the monsters will only be made known before each run and will be consistent for all teams doing that run.
- Teams are supposed to start at the “Start” tile and end at the “End” tile. The location of these two tiles will also be determined only at the start of each run. Teams may visit the waypoints in any sequence in between.



*For illustrative purposes only*

### ***Playfield specifications***

The playfield sits within an approximate 6m by 6m space. The playfield consists of 25 tiles, each of dimensions 800mm by 800mm with a spacing of 200mm between edges. See illustration below.



*Illustration is not to scale,  
for illustrative purposes only.*

### **Parrot Mambo (Category A1)**

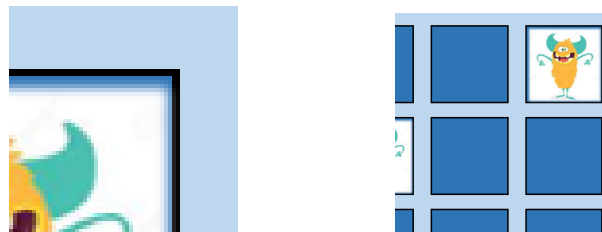
Teams are to take a picture of at each of the waypoint visited as proof of having visited the waypoints. Teams are also to then report to the referee the number of monsters visually identified and their respective locations on the grid.

- Teams will be given 10 minutes to code and autonomously navigate their drones to each of the waypoints in any sequence the team may prefer. Timing will start when the team is given instruction by the Referee to start coding. Autonomous flight can start any time after during the 10 minutes given.
- At each co-ordinate visited, the team need to hover and stabilise the drone sufficiently to take a picture of the way point using the drone's vertical camera. The picture taken is considered valid as long as it is sufficiently clear to identify the way point visually and covers over 50% of the frame of the picture. For example:



**Acceptable**

*Covers >50% of Picture*



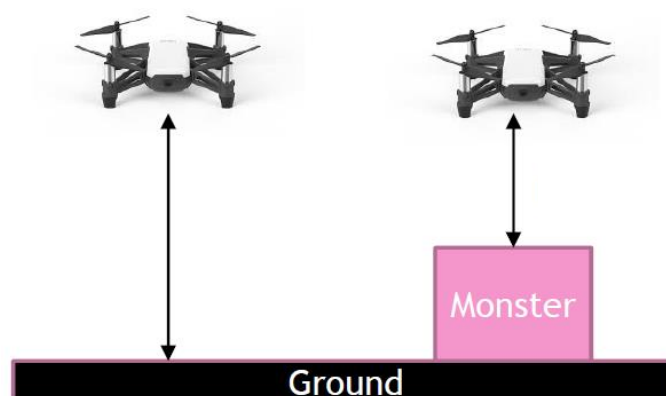
**Not Acceptable**

*Covers <50% of Picture. Drone is off target or flying too high above the tiles.*

**DJI Tello Edu (Category A2)**

Teams are to visit each waypoint. Teams are also to then report to the referee the number of monsters visually identified and their respective locations on the grid.

- Teams will be given 10 minutes to code and autonomously navigate their drones to each of the waypoints in any sequence the team may prefer. Timing will start when the team is given instruction by the Referee to start coding. Autonomous flight can start any time after during the 10 minutes given.
- There will be mission pads located at each waypoint. A waypoint is considered to have been visited if the mission pads were detected.
- Teams are then to use the DJI Tello's TOF data to ascertain if a certain waypoint has a monster. Monsters are represented as a platform that is higher than its surrounding. Teams are then to report to the referee the number of monsters detected and their locations.



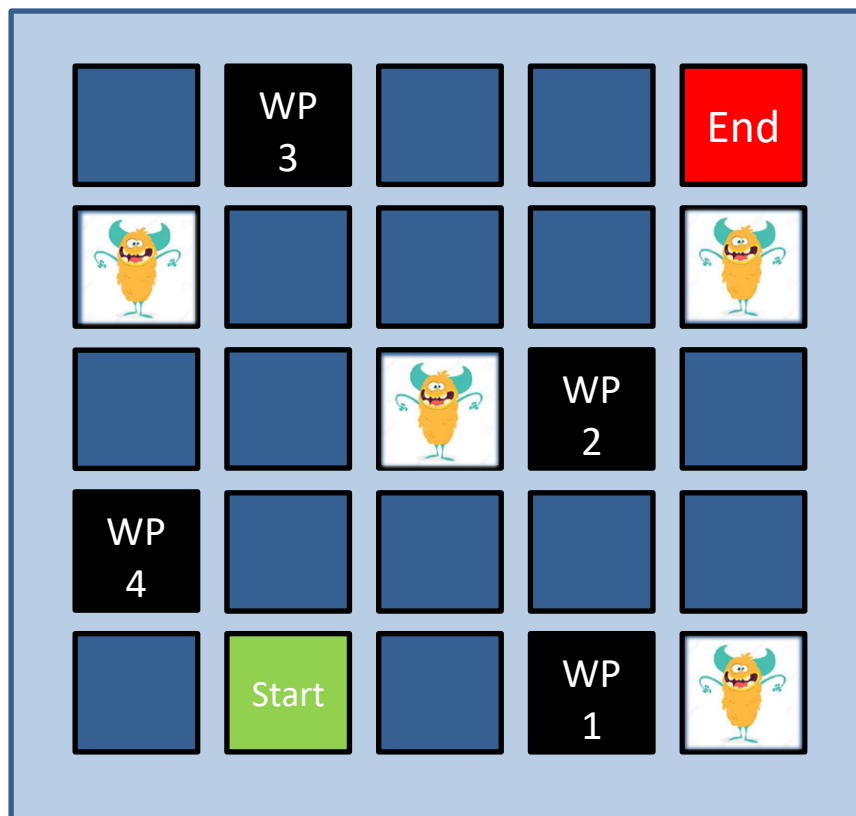


## 9. CATEGORY B MISSION TASKS (PRELIMINARY)

### Gameplay

There are monsters within the forest. Your drone is to fly continuously and autonomously over waypoints in the forest while avoiding monsters in its vicinity. Teams should do a reconnaissance flight first to determine the locations of the waypoints and monsters before planning the fastest and safest route through all waypoints.

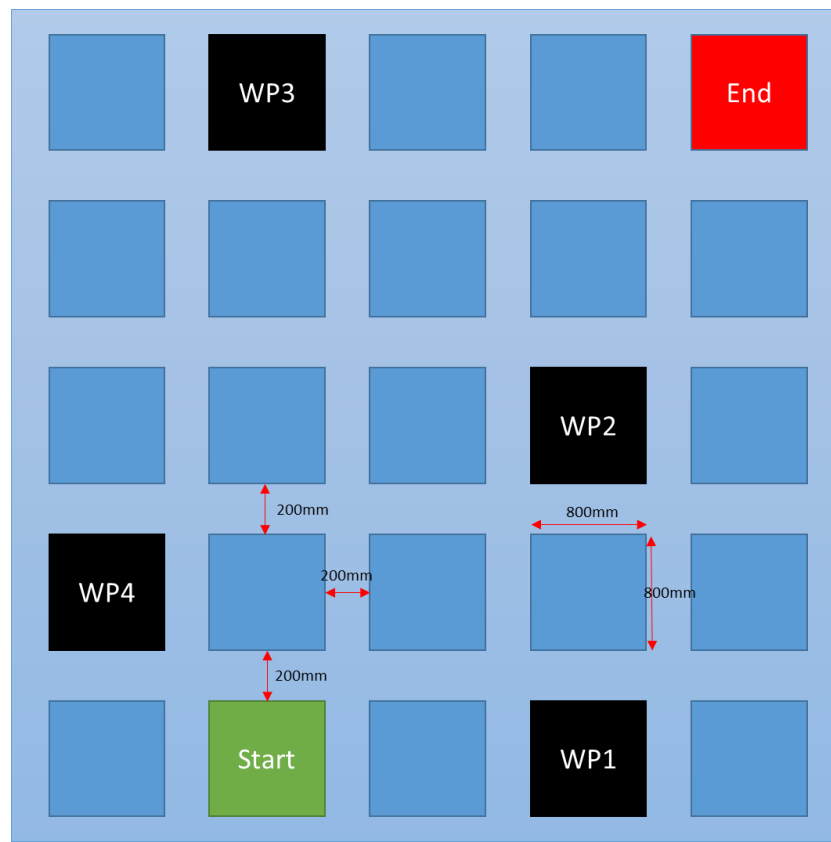
- There are 4 waypoints to visit. These waypoints will only be made known before each run and will be consistent throughout each run for all teams.
- Any number of monsters may occupy the vicinity of the waypoints. Teams are to code for their drones to avoid running into them as penalties will result.
- The team who visits the most waypoints in the shortest time with least penalties wins.
- Teams are supposed to start at the “Start” tile and end at the “End” tile. The location of these two tiles will also be determined only at the start of each run. Teams have to visit the waypoints in the sequence dictated by the numbering of the waypoints.



*For illustrative purposes only*

## ***Playfield specifications***

The playfield sits within an approximate 6m by 6m space. The playfield consists of 25 tiles, each of dimensions 800mm by 800mm with a spacing of 200mm between edges. See illustration below.



*Illustration is not to scale,  
for illustrative purposes only.*

## ***Parrot Mambo (Category B1)***

Teams are to first do a reconnaissance flight and take pictures of the whole forest to determine the locations of the waypoints and monsters. Using that information, teams are to then plan a route to visit each waypoint in sequence. Teams are to take a picture at each of the waypoint visited as proof of having visited the waypoints.

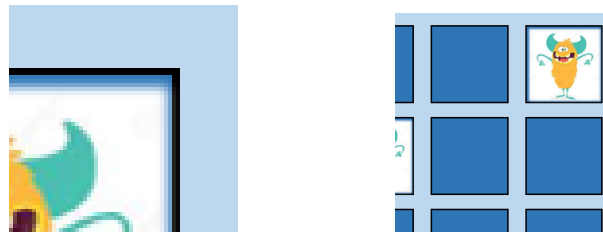
- Teams will be given 10 minutes to code and autonomously navigate their drones to do a reconnaissance flight and subsequently to each of the waypoints in the specified sequence. Timing will start when the team is given instruction by the Referee to start coding. Autonomous flight can start any time after during the 10 minutes given.
- At each co-coordinate visited, the team need to hover and stabilise the drone sufficiently to take a picture of the way point using the drone's vertical camera. The picture taken is considered valid as long as it is sufficiently clear to identify

the waypoint visually and covers over 50% of the frame of the picture. For example:



**Acceptable**

*Covers >50% of Picture*



**Not Acceptable**

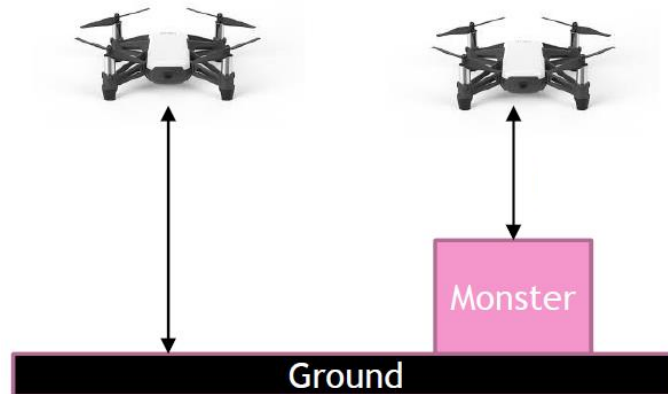
*Covers <50% of Picture. Drone is off target or flying too high above the tiles.*

### ***DJI Tello Edu (Category B2)***

Teams are to first code for their drones to do a reconnaissance flight to determine the locations of the waypoints and monsters. Using that information, teams are to then plan a route to visit each waypoint in sequence.

- Teams will be given 10 minutes to code and autonomously navigate their drones to do a reconnaissance flight and subsequently to each of the waypoints in the specified sequence. Timing will start when the team is given instruction by the Referee to start coding. Autonomous flight can start any time after during the 10 minutes given.

- There will be mission pads located at each waypoint. A waypoint is considered to have been visited if the mission pads were detected. Teams are to use the DJI tello's TOF data to ascertain if any part of the grid, ie forest, has a monster. Monsters are represented as a platform that is higher than its surrounding. Teams are to note the locations of these monsters for their route planning.



## 10. OPEN CATEGORY MISSION TASKS

### *Gameplay*

New for this year, the Open Category introduces the concepts of autonomous drone swarming to students. As we celebrate the 200th year founding of Singapore, students are to choreograph a drone swarm showcase. Teams are to program, setup and perform the showcase, with minimum of **THREE (3)** DJI Tello Edu drones, in front of a panel of judges who will be judging the performance based on the following aspects:

Technical Merits	<ul style="list-style-type: none"> <li>• Execution – How well the moves are executed.</li> <li>• Synchronisation – How well the moves of each drone is synchronised with the other drones.</li> <li>• Difficulty – How challenging the are the moves attempted</li> <li>• Technical – Understand and knowledge of programming and hardware.</li> </ul>
Artistic Impressions	<ul style="list-style-type: none"> <li>• Choreography — How varied, smooth and creative a routine is, covering the whole staging area.</li> <li>• Music interpretation — How the mood and dynamics of the music complement the performance.</li> <li>• Manner of Presentation — How well the overall performance is put across</li> </ul>

### ***Playfield specifications***

The playfield sits within an approximate 6m by 6m space.

### ***Preparations***

Teams are to submit a proposed flight routine, submit their song(s) of choice for the routine and a high quality video of their full test flight to the organisers at least 1 week before the competition. The judging panel may use the high quality video as basis for judging should teams run in to technical difficulties on the actual competition day. Teams may also prepare and use additional props or add attachments/payload to their drones to enhance the performance. However, teams need to ensure that the attachments/payload do not affect the performance or integrity of the drones.

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