

## 2021 IEEE Region 5 Annual Conference

### Rules for a Remote Student Robotics Competition

The competition is open to teams of 1 or more undergraduate students who are enrolled in a College or University with a student chapter within IEEE Region 5. Only one team member is required to be a current IEEE Student Member.

#### **Competition Motivation**

This year's competition has been redesigned to accommodate social distancing restrictions on group sizes and the availability of on-campus facilities. Each team will be provided a time slot, not to exceed 15-minutes in duration, to complete the course during a Zoom (or similar) video call with the judges.

The objective of the competition is to demonstrate autonomous operation of a designated educational drone primarily operated indoors.

#### **Introduction and Setup**

The course will require teams to have access to a 3-meter by 3-meter floor space with at least 2-meters of headroom. The space should be indoors if possible. A grid consisting of 1-meter by 1-meter squares should be marked and numbered using non-conductive materials such as rope, caution tape, 2x2 construction lumber, or similar and of sufficient size and contrast to be easily observed by the judges via Zoom (or similar). See Figure 1 for the grid dimensions and numbering. Additional items to aid the drones (for example, Mission Pads) are NOT allowed within or touching the grid. The grid must be aligned with the team-provided camera assigned to the judges as shown in Figure 2.

The team will have on-hand four (4), movable helium-filled balloons. Each balloon will have a weight on a string to keep the balloon suspended between 1-2 meters above the floor. The required colors are RED, GREEN, BLUE and YELLOW. The Judges will display via screen sharing the location of each balloon within the grid. The judges will then display via screen sharing the order in which the balloons are to be popped by the drone. When a Judge signals the team to begin, a team member will hand launch their drone and allow it to AUTONOMOUSLY pop the balloons in the required popping order within 3-minutes of launching. The launch must occur within view of the judges and cannot begin inside the Gameplay Grid

The team-provided camera assigned to the judges (Judge's Camera in Figures 2 – 3) must be stationary and enable viewing of the entire grid. It must also allow the judges to reliably discern the colors of the balloons and the grid markings. Please test this in advance.

Points will be awarded for incremental progress popping balloons in the required order. Bonus points will be awarded for landing with any portion of the drone landing skids clearly touching any deflated balloon.

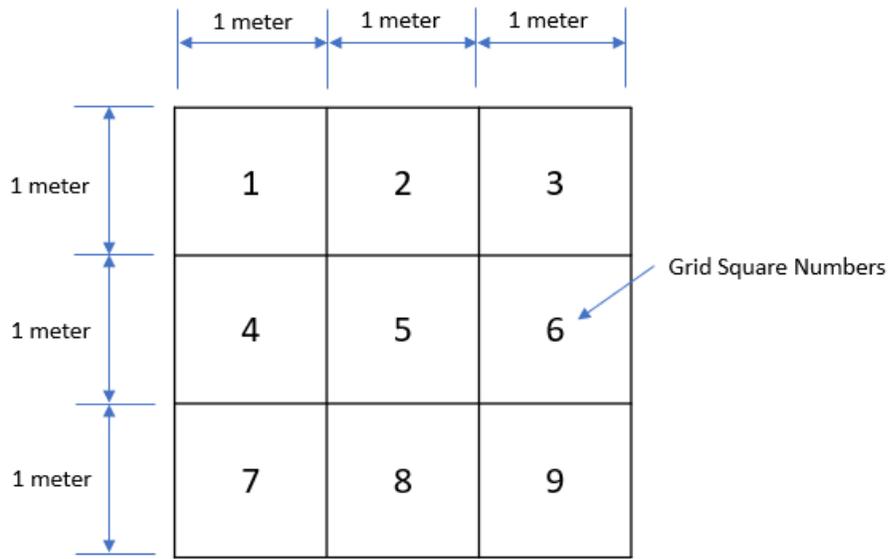


Figure 1 - Gameplay Grid

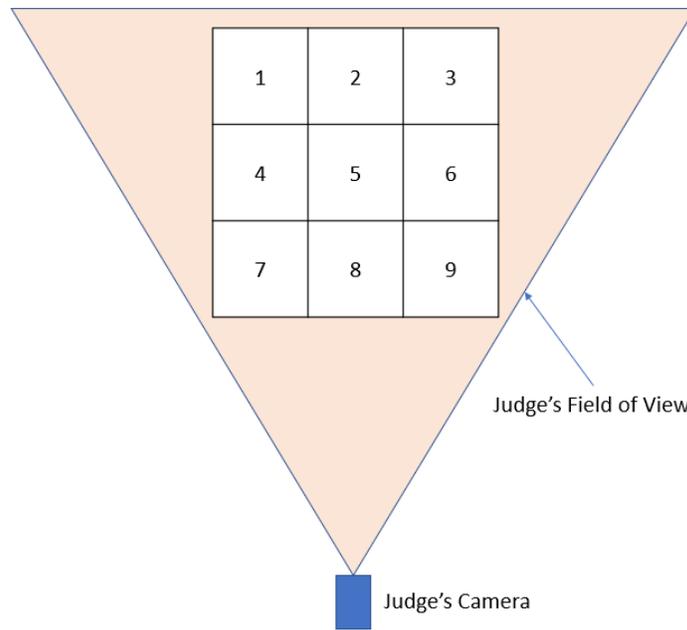
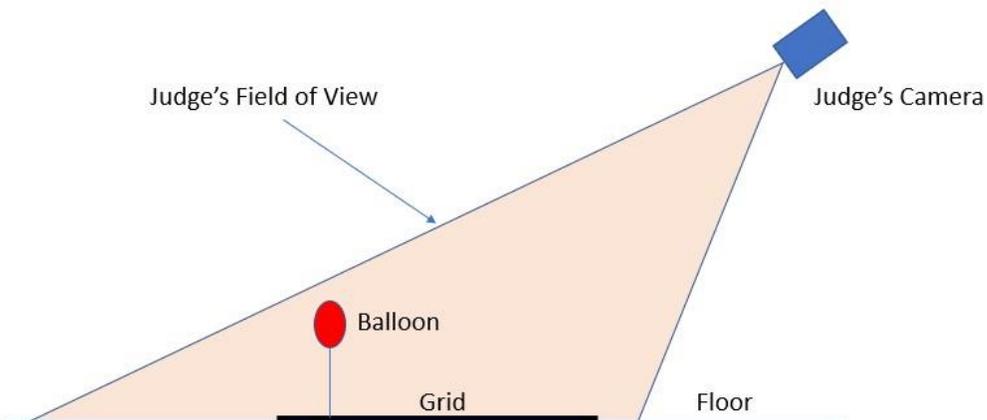


Figure 2 – Overhead (Plan) View of Judges Camera with Respect to Grid



*Figure 3 - Elevation (Side) View of Judges Camera with Respect to Grid*

### **Competition Divisions**

After a team initiates their video call with the judges, they must immediately display their team number and the Division they intend to compete in. The Divisions are described below.

**Division A** – The drone operates autonomously with no communications or assistance with any other device. No human interaction allowed during a competition round after hand launch.

**Division B** – The drone operates autonomously and only communicates with an Unmanned Standalone Computer (USC) for off-board processing positioned within view of the judges. The Unmanned Standalone Computer (USC) can be a computer, phone or device. The USC is intended to off-load data processing from the drone, however it is not excluded from performing other functions, as long as it remains standalone. The USC must never communicate with any other device or human. No human interaction allowed during a competition round after hand launch.

**Drone** – Only one drone will be allowed to compete on the Gameplay Grid. It must be a (RYZE) DJI Tello or DJI Tello EDU. The factory propellers, motors, motor drive system and batteries cannot be modified.

## Gameplay / Order of Operations

Task and Responsible Party		Total of 15 Minutes Allocated to Each Team																		
		1 minute	1 minute	1 minute	1 minute	1 minute	1 minute	1 minute	1 minute	1 minute	1 minute	1 minute	1 minute	1 minute	1 minute	1 minute				
Video Call Initiation	Judges																			
Screen Share Name and Division to Judges	Team																			
Verbal Confirmation of Name and Division	Judges																			
Screen Share Balloon Popping Order	Judges																			
Verbal Confirmation of Balloon Popping Order	Team																			
Screen Share Grid Location of Balloons	Judges																			
Placement of Balloons	Team																			
Video Confirmation of Balloon Locations	Judges																			
Verbal Announcement that Launch May Begin	Judges																			
Drone is Hand Launched and Elapsed Time Begins	Team																			
Three (3) Minute <b>Maximum</b> Gameplay Duration	Judges																			
Time Slot Slip	Judges																			

Only two of the time durations shown above are fixed;

- Maximum elapsed time after hand launch is 3 minutes
- Maximum overall gameplay window is 15 minutes

All of the remaining time durations shown above are estimates.

### End of Gameplay Conditions

1. A team member touches the drone after hand launch
2. Three (3) minutes have elapsed after hand launch
3. Drone pops a balloon in the wrong order
4. Drone lands or impacts anywhere before all of the balloons are popped
5. After all of the balloons are popped, in any order, the drone lands on a balloon for bonus points
6. Drone leaves the field of view of the judges

### Scoring

- 1 point for every balloon popped in the correct order
- 1 bonus point when any portion of the drone clearly lands on any popped and deflated balloon lying on the grid after all of the balloons are popped

### Award Determination

- Total points obtained during the elapsed time
- If the head judge determines a team has communicated with their drone during gameplay, they risk forfeiting awards

### Awards

- Monetary awards will be given to the top three (3) finishers in each Division. A monetary award for team participation will be given to any team that pops at least one balloon. The amounts and disbursement process will be displayed on the Region 5 Student Competition website

### Placing and Tie Conditions

1. Teams scoring 5 points will be placed in awards by shortest elapsed time
2. For ties at 1 to 4 points, Teams will be placed by shortest elapsed time to pop their last correct balloon
3. For ties at 0 points, the award will be shared equally
4. If no Teams place in one or more lower award levels, the lower awards will be summed with the next higher level(s) for distribution
5. In the event zero (0) points are scored by all competitors in a Division, the total sum of all awards in the Division will be shared equally by the Teams

**Honor and Cheating** – extraordinary efforts have been made to allow interested undergraduate students to compete in a friendly, remote competition without exposure to Covid-19 risks. The remote gameplay and judging will make cheating very easy. Region 5 expects all participants to honor and respect the hard work invested by all of the teams and avoid cheating at all costs.

**Team Registration** – will be provided on the Region 5 Student Competition website

**Video Call-in Details** – will be provided on the Region 5 Student Competition website

#### **Preview of Possible Q & A**

1. The balloons can be made of any common balloon material.
2. Consider your safety when choosing a method to pop the balloons.
3. Wear Personal Protective Equipment (PPE) as appropriate. Eye protection, hand protection, etc.
4. Any shade of RED, BLUE, GREEN and YELLOW are acceptable as long as the judges can discern them. This allows teams to learn and/or train on their own equipment.
5. One of many advantages of the remote approach is local control over lighting and backgrounds
6. Every team is responsible for making their own safety assessment, safety procedures and supplying their identified PPE

#### **Glossary of Key Terms and Abbreviations**

**Head Judge** – A Denver Section Robot Committee Member who makes all final rule decisions and award determinations

**Scoring Judge** – Records and reports all points and penalties

**Timing Judge** – Controls and reports elapsed time

**Elapsed Time** – The time interval between the drone clearly leaving the hand launcher and the moment when any End of Round Condition occurs.

**Field Clock** – The timing device controlled by the Timing Judge

**Grid** - Consists of (9) 1-meter x 1-meter squares arranged in a 3-meter by 3-meter square