Istanbul Technical University Robot Olimpics 2022

Drone Category Rules

Definition of the Task:

- In this category, participant flying robots try to fly drawing 8 in a determined direction around 2 poles on the racing area.

Success Criteria:

- The success criterion in this category is that the flying robot draws the figure of 8 for at least 3 turns around two poles without intervening.

Robot Specifications:

1) Only rotary-wing(helicopter and multicopter) autonomous aircrafts can participate in the race.

2) Robot's weight cannot exceed a maximum weight of 2.5 kilograms.

3) Robot's width, length and height cannot exceed 0.5 x 0.5 x 0.5 meter.

4) Mass production multicopters cannot participate in the competition. Multicopters must be prepared by the competitors, but off-the-shelf products can be used in the design, production and sub-systems of robots (body, wing, motor, flight controller, etc.).

5) Competitors can perform the image processing task on the robot by communicating with cards such as Nvidia Jetson, Raspberry Pi, or an external computer. The computers of the competitors who want to use an external computer will be checked by the referees before and during the competition.

6) Participants should have a wireless remote controller. The participant should be able to control the robot manually and the remote controller should have the ability to switch the robot's mode between manual and autonomous if needed.

7) If referees suspect that robot doesn't use image processing to move, they may request a technical control after the race is over. They can ask questions to the owner of the robot about their robot and the participant should give satisfactory answers to these questions. Referees may demand to investigate robot's software, and in such a case, the participant should show them the robot's software. After the technical control, if it is proven that the robot does not satisfy the rules, the robot will be disqualified.

8) The competition will be held inside of Istanbul Technical University Süleyman Demirel Cultural Center. Therefore, robots will not be able to use GPS for navigation.

Race Area Specification:

9) Race area's has a minimum length of 8 meters and a minimum weight of 4 meters. The poles have a minimum height of 3 meters.

10) There is a black line in the figure of 8 number and 5 cm wide around two poles on the runway floor.

11) The race area is surrounded by a security net.

12) There is a barrier on either left or the right side of the race area, from 1 meter to 2.5 meters above the ground.

13) The top view of the race area is given in the figure below.

Competition:

14) Robots compete one by one, in a determined order.

15) Before the competition, each competitor is given a 5 minutes period of time for setup and calibration. The length of this period may change depending on the number of competitors.

16) Competitors put their robot to the starting point shown by the referee.

17) Each robot has 8 minutes of time for competition. The competitor can finish earlier if they wish.

18) Robots can take off autonomously or manually. Each robot have 2 minutes for departure, and after the robot has departed, the 8 minutes of race time begins.

19) The competitor can make 3 interventions in the 8 minutes period. During the intervention periods, the timer will not stop and these periods will count in the racing time.

20) Each time the competitor interferes with the robot and interrupts the robot's autonomous flight by hand or remote controller is called an intervention. Similarly, if the robot crashes anything, gets caught on the net or fall down and gets out of the race area this is also counted as intervention.

21) Robots that take off manually should switch to the autonomous mode after take off.

22) After the departure, robots should fly autonomously in the race area throughout a line with the shape of an 8 shape without going out of the border lines. If the robot completes a round following an another way, it is counted as a fault.

23) Dashed lines and the black line is drawn as a reference to the robots. Robots do not have to follow the lines accurately.

24) Robots must fly at least 1.20 meters and at most 3 meters above the ground.

25) Robots should pass under the barrier when they reach the barrier. If the robot hits the barrier or fails to pass under it, it is counted a fault.

26) Robots can land manually when their race time is over.

Scoring:

27) Score = (number of rounds) * 100 – (number of mistakes) * 50.

28) The robot will get 100 points for each round they completed. In case of a draw, the interventions used for the robots will be compared. The competitor that has made less interventions, will have higher ranking. If it is still a draw, the distance that robots travelled from the round that they were in when the 8 minutes race time is over is calculated and rated over 100, as 100 taken as a full round.

29) If the competitor wants to continue racing after an intervention during the 8 minutes race time, the number of rounds and mistakes are recorded and the rounds that it completes after that and mistakes it does are calculated separately. At the end of the competition, the higher score will be taken into account when calculating the robot's ultimate score.

Security:

30) Robots' propellers are not allowed to be installed anywhere outside the area that is surrounded by safety net. Before the competition, the propellers must be installed and they should be removed from the robot before leaving the safe area after the competition.

31) In case the robot has a valid propeller protection, the competitor may be exempted from rule 30. Competitors who demand exemption should state that on the robot registration table and the robot is examined by the referees. If it is approved by the referees, rule 30 does not apply on that robot.
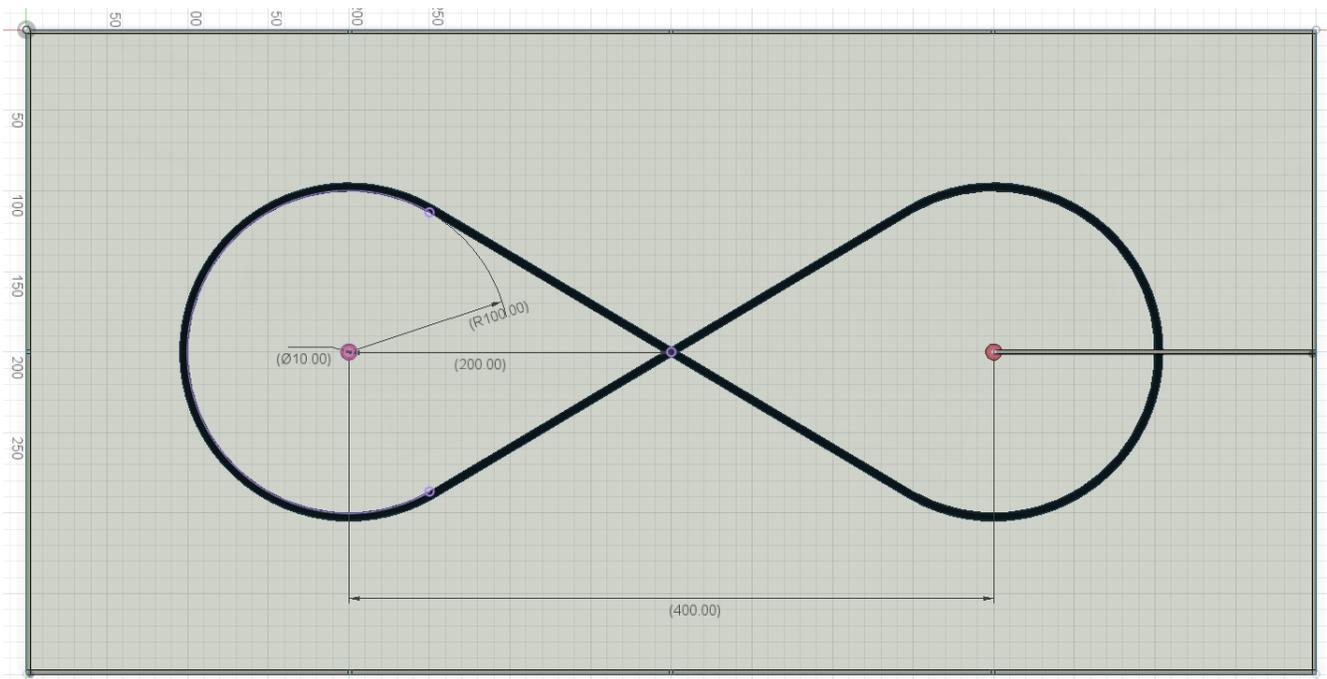
Figure 1 - Top view of the competition track