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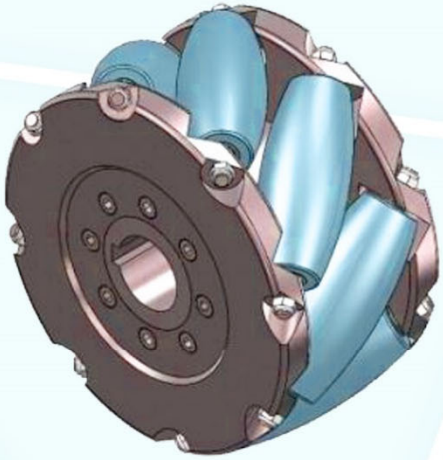
SAF 2023

STEAM AZERBAIJAN FESTIVAL



Wings & Wheels

Technical Task

BAKU 2023

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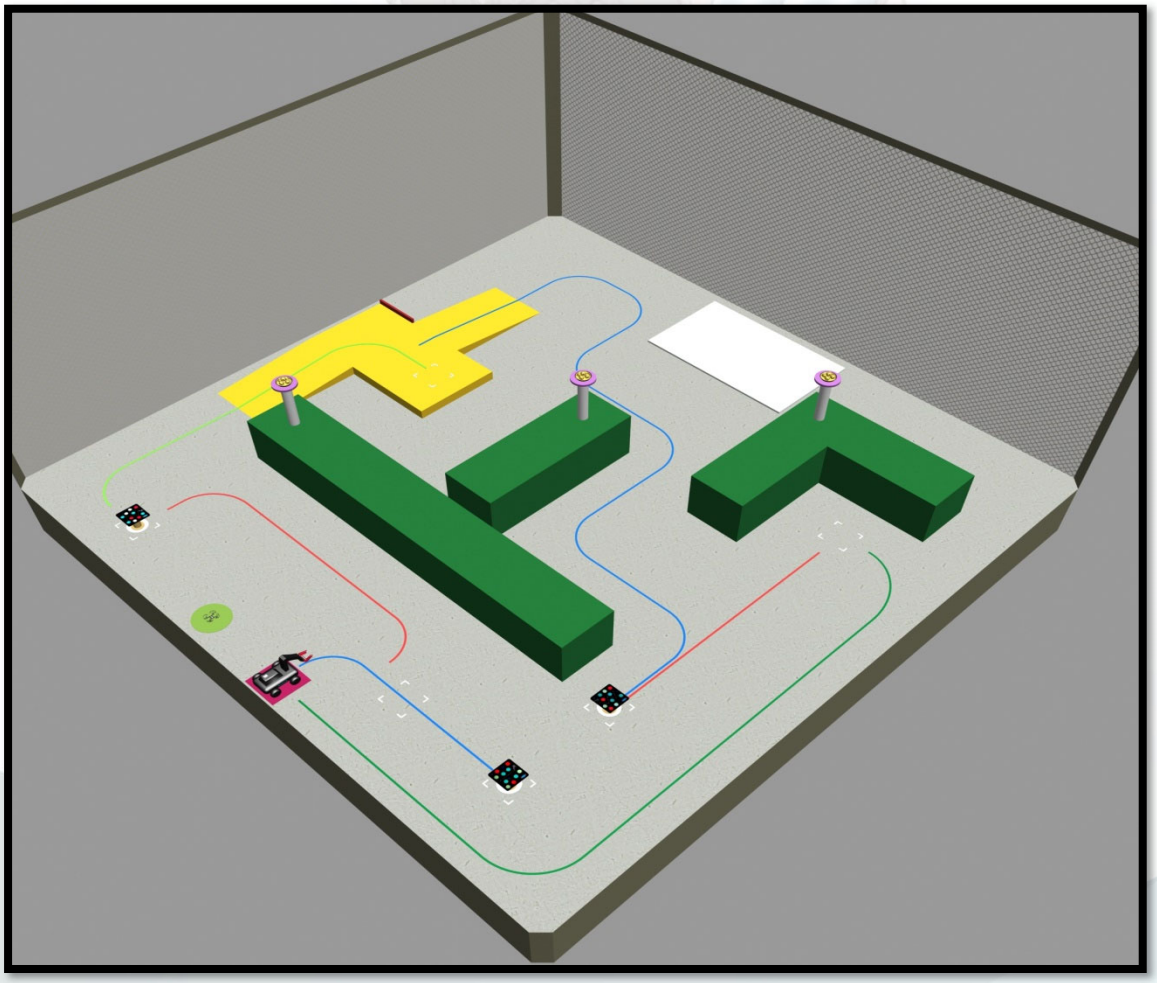
1. Introduction

"Wings and wheels" category within SAF 2023 is a collaboration of educational robots and drones built to bring out the potential of each student . Through distinct, advanced game modes and smart features, participants can gain an in-depth understanding of science, math, physics and more, with programming as the core. Robot and drone programming youth learn to solve complex problems piecemeal by breaking them down into smaller, easier parts, while also understanding the fundamentals of STEAM and applying their skills in competition while developing learning, self-confidence, and teamwork skills along the way.In addition, the participants' enjoyment during the competition is the most important priority.

2. Description of the competition

The main principle in the competition is to establish the correct connection between the robot and the drone, each of them using a separate code to place the 3 mission pads of the drone in the appropriate places, after the mission pad are placed, the drone reads them and executes the commands and ensures that the balls at the designated points come out of their containers.



3. Purpose of the competition

" **Wings & Wheels** " competition encourages young people and technology enthusiasts to learn and use **STEAM knowledge, explore the working principles of future technology, and achieve results by developing engineering practices and independent thinking.** Thus, the participants will strengthen their cooperation abilities by thinking of the method of doing the given task in a faster and shorter way within the team. The goal is to gather knowledge, learn to cooperate, compete and have fun at the same time . Advanced scientific and educational concepts help train future engineers. Students get the experience of the theoretical knowledge acquired in the lessons through these competitions, which ensures that the knowledge is more durable. While preparing for the competition, the students develop their engineering and programming skills. Global robotics competitions drive the development of the robotics industry through the strictest competition rules. Stimulates students' interest in robotics through state-of-the-art technologies and innovations.

4. Team composition

4.1. The composition of the team consists of 3 participants, including 2 students aged 13-15 (not turning 15 by November 1, 2023) and 1 team leader.
4.2. Only teams that have passed the selection stage can participate in the competition.
4.3. Teams should consist of 3 people (1 team leader, 2 students).
4.4. The team leader must be over 18 years old, and the students must be between 13-15 years old.
4.5. Participants in the team must be students of the same school.
4.6. Each team leader and student can participate in only one team.
4.7. After the registration is over, a selection round will be held among the teams and the finalists will be determined. The conditions and time of the selection round will be announced after the end of registration.
4.8. **(!) The team leader does not enter the competition area and the grandstand.**
4.9. **(!) After the competition, the final points will be calculated based on the evaluation table, the team with the highest score will win the first place. If at the end 2 teams got the same score, the team that finishes the process in the shortest time will be the winner of the competition.**

5. The structure and rules of the competition

The competition was organized by the joint action of the **RoboMaster EP** educational robot and the **TELLO EDU** drone. The robot and the drone must perform the assigned tasks completely autonomously.

The robot delivers the mission pad to the task station in a consistent and designated route. At the same time, the drone must perform its tasks. participants must program their drones and fly them autonomously. Participants must perform mathematical calculations, evaluate physical processes, apply programming and other knowledge to program the drone's autonomous flight. After reading the first mission pad, the drone must scatter the balls in the ball container. There are 3 ball containers on the competition field, each containing 5 tennis balls. At the last stage, the drone must perform a landing on the landing platform.

5.1. In this category, teams have to create the right route between the RoboMaster EP robot and the Tello drone and complete the tasks using only code. That is, the robot and drone will perform the given tasks autonomously.

5.2. From the start of the race,so during the 180 seconds (3 minutes) of the race, it is strictly forbidden to change the codes or touch the robot!

5.3. If the robot has any technical problems and if the robot does not execute the written code correctly, as well as if the battery runs out, the robot cannot be touched in the competition area. The referee must have permission to touch the robot. To get permission from the referee, one of the team members must raise his hand and call the referee in an audible tone "RoboMaster".

5.4. Each team is given 3 chances and the result of each race (score and time) is recorded. The result of the round with the highest score of the participants is considered as the main result of the competition.

5.5. During the task, the robomaster moves along the designated route lines of the competition area, picks up the first of the mission pads and carries it to the designated point.Then he repeats the same process for the second and third mission pad.

5.6. At the same time,Tello Edu drone flies and reads the first mission pad with its sensors,destroys the balls from the corresponding ball container and go to the 2nd point. Then, after reading task number 2, he must destroys the balls from the plate. After this operation is finished, the drone **destroys the balls after reading the mission pad number 3 or comes directly to the landing zone and lands** . The size of the task area is 600x600 cm. The height of the side obstacles is 50 cm, the height of the slope obstacle is 10 cm, and the slope is 6 degrees.

5.7. 180 seconds (3 minutes) are given for the execution of the task.

5.8. One of the most important requirements for teams to participate in the competition is to have a Robomaster Ep robot.

6. Preparation

6.1. Before the competition, all teams must register their drones and number them with the given numbers.
6.2. Each team will have at least three opportunities to familiarize themselves with the competition areas and test their drones.
6.3. Each team must come to the competition area with their own numbered robot and drone.
6.4. Each team must compete with its own Robot.
6.5. Each team must have a drone and robot driver and must program them individually.

7. Competition stage

7.1. The teams that will compete together will start the competition with the start whistle and finish the competition by landing on the landing zone after completing the tasks on the competition field within 3 minutes.
7.2. Teams will be timed at the start whistle and stopped when the drone has made a full landing. Teams will still be timed if they land their drone outside the landing zone.
7.3. Teams can use phones, tablets, laptops, etc. to program and control drones and robots. Participants can program their drones in any language they want.
7.4. If the drones fall to the ground due to hitting an obstacle or for any other reason during the competition, the participant can restart the drone from the START zone.
7.5. Also, if the Robot stops by hitting any obstacle, the participant can bring the robot to the starting place without stopping the time, **here the instruction of the judge must be taken into account.**
7.6. Points for a drone's landing zone will be determined based on whether the drone is fully or partially in the landing zone.

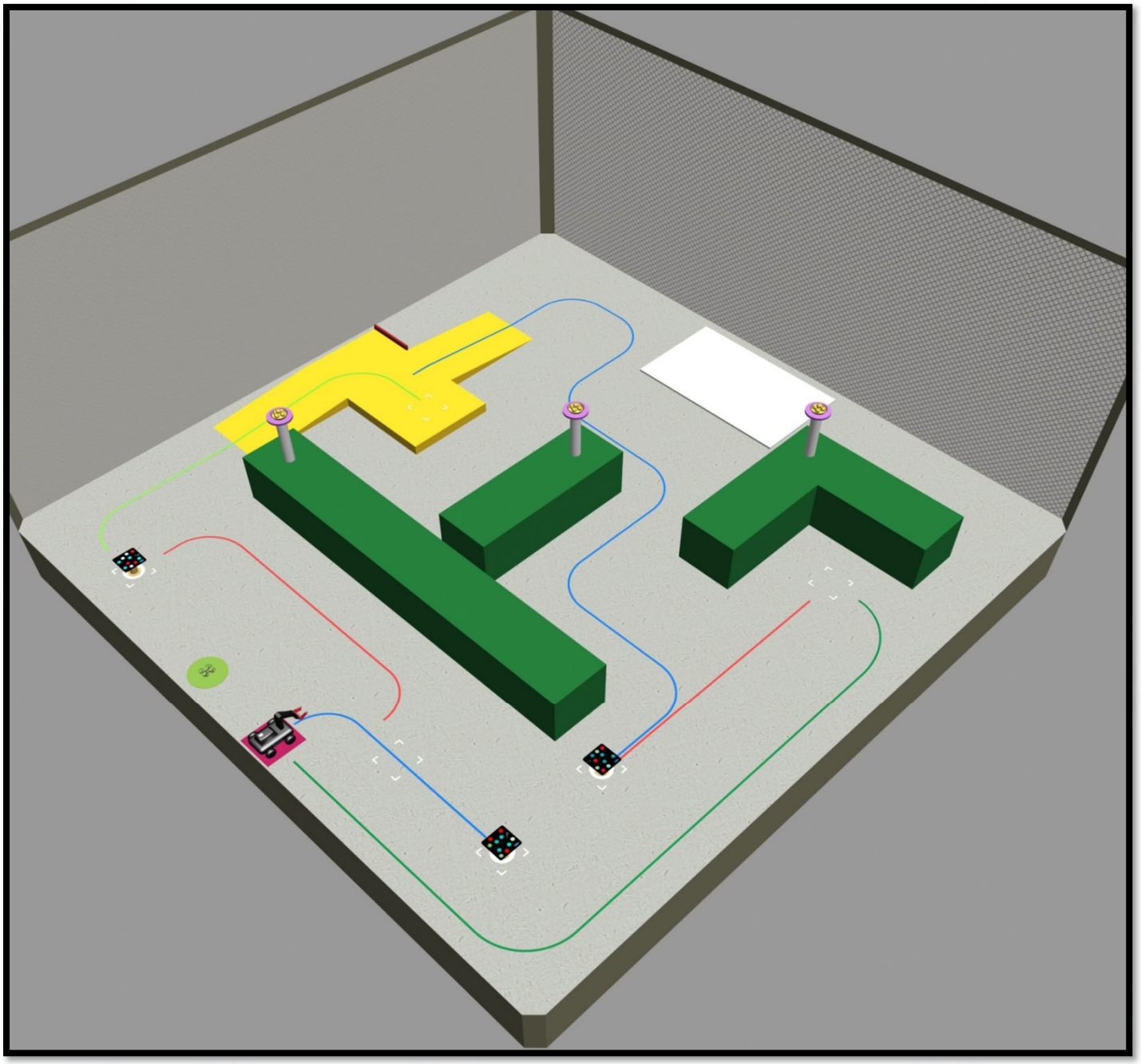
8. Calculation of the total result

8.1. The overall result of the teams is the best result of the team at the end of 3 attempts.
8.2. In the overall result, ranking is done according to the points. If the points of two teams are the same, then the ranking is done according to the duration of the competition.
8.3. The final decision on the calculation of points and unforeseen circumstances that may arise during the competition is made by the head of the category and the judges in accordance with the rules of the competition.

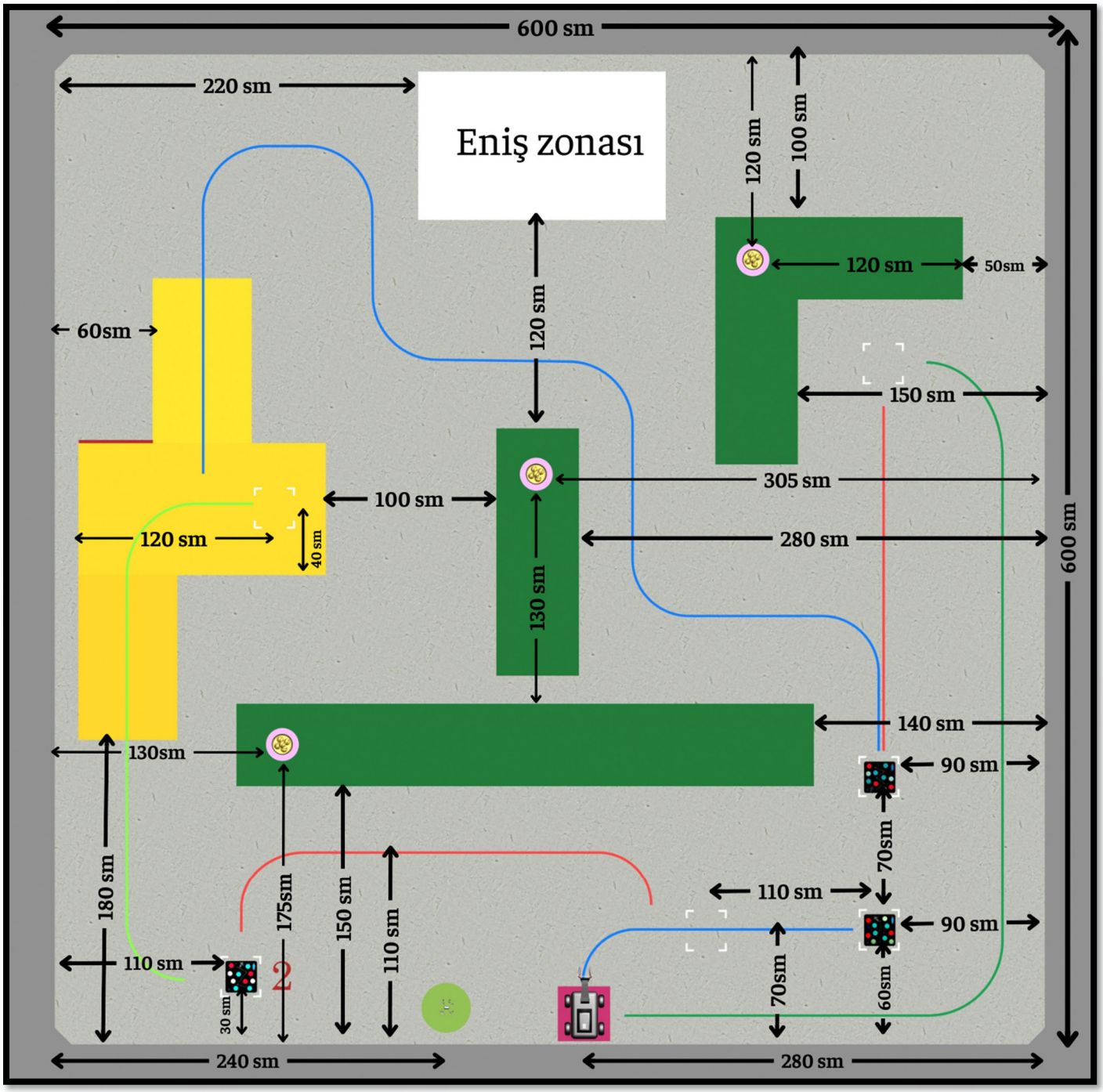
9. Evaluations during the competition

9.1. **In all cases, the judge's decision is the main one.**
9.2. The team that starts the competition must place its drone and robot at the designated point and in the prescribed manner.
9.3. Each participant entering the competition area must check the configuration, wireless communication and power source of their drone and robot. If there is any problem during the competition, the competition will not be stopped and the problem must be solved during the competition period.
9.4. **It is not necessary** that the drone and the robot start at the same time during the start whistle .
9.5. During the competition, all tasks must be performed in an expected sequence.
9.6. The robot must be programmed to fetch mission pad number 1 by the shortest route.
9.7. When the robot picks up the mission pad number 2, it must climb the inclined obstacle and bring it to its designated point.
9.8. In order to pick up mission pad 3, the robot must cross the inclined barrier to arrive at the station of mission pad 3 and move it to its designated point.
9.9. If task No. 2 is not fully or partially executed, it is forbidden to take the board of task No. 3. Otherwise, task No. 3 will not be registered.
9.10. After reading the mission pad, the mission will not be registered if the drone does not go to the corresponding to dispersal point or goes to another ball dispersal point.
9.11. If the drone overshoots or makes the mission pad unreadable while reading the mission pad, the race is not stopped and the competitor continues the race.
9.12. If the robot oversteps or makes the mission pad unreadable, the race is not stopped and the participant continues the race.
9.13. It is not mandatory to use the auxiliary line (colored lines) during the race. Directions and commands can be carried in standard encoding.
9.14. If the drone destroys the ball by contacting the dispersal point, the score is counted, then the drone continues to perform the tasks and solves the next task. Otherwise, destruction by contact will be considered accidental and disregarded.
9.15. The timing of the race is stopped when the drone lands. Here, the return of the robot to the "home" zone is expected for 30 seconds, as it is considered an additional advantage. otherwise, the return home is not counted.
9.16. When the drone lands outside the "home" zone, the participant can enter a code to bring the drone to the takeoff zone or start from where it is.

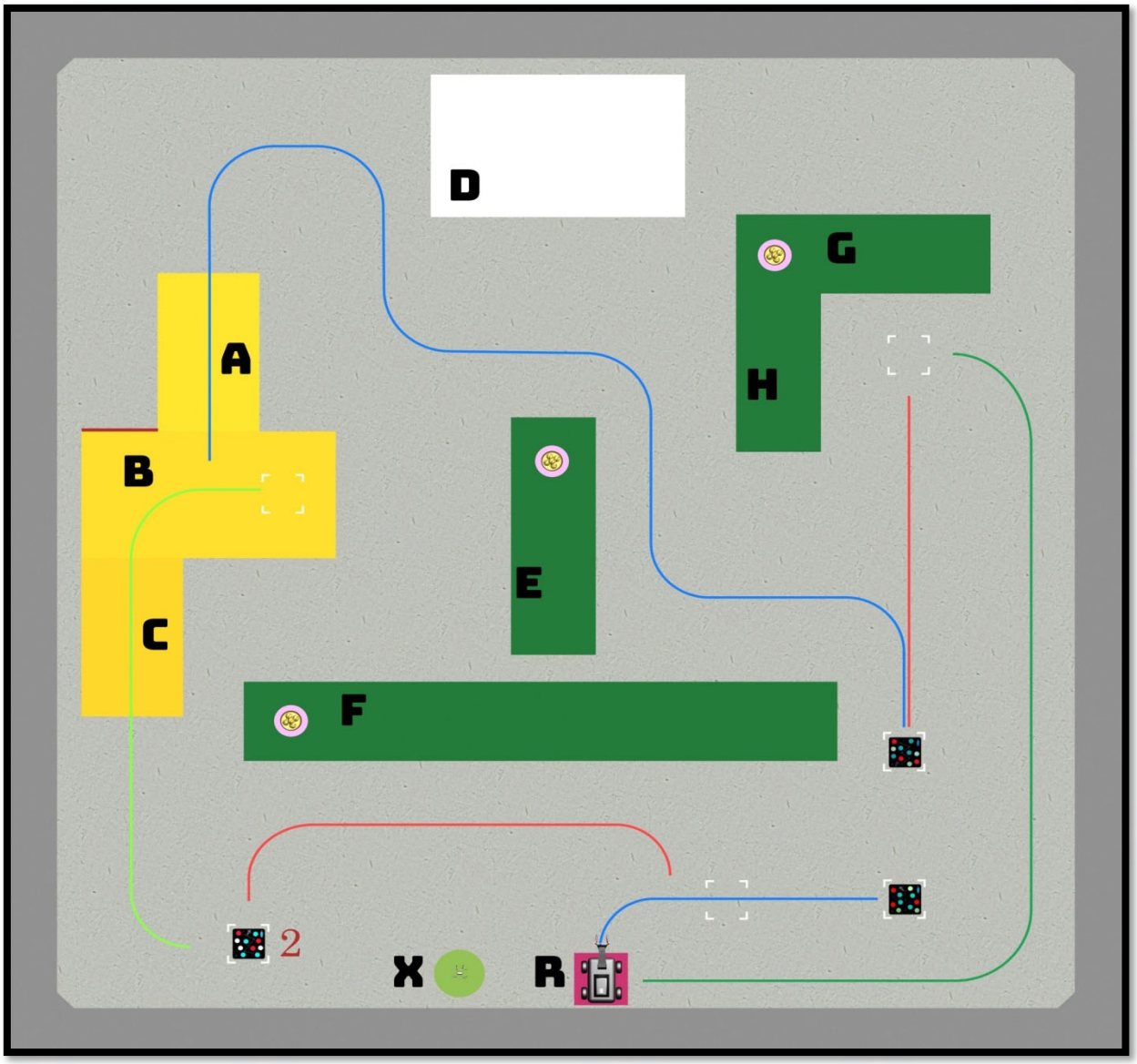
10. Description of the race



11. Dimensions of the competition area



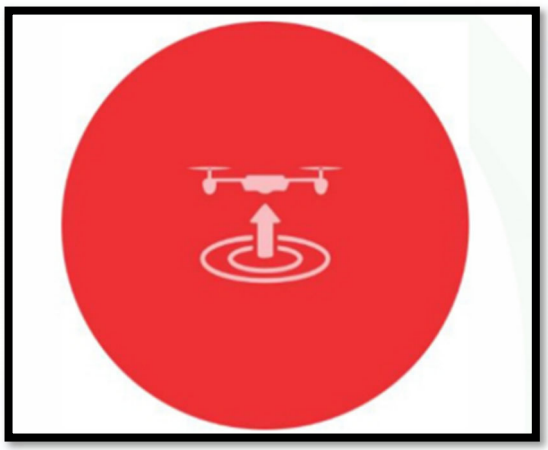
12. The dimensions of the obstacles in the competition area



12.1. Task of the field size 600x600x250cm **, Grid wall (cell L=10cm)**
12.2. A: height 10 cm, length 100 cm, width 60 cm, slope **6 degrees** (A, B and C combined or can be combined later)
12.3. B: height 10 cm, length 150 cm, width 80 cm. Front combined width 5cm, length 50cm, height 15cm (A, B and C combined)
12.4. C: height 10 cm, length 100 cm, width 60 cm, slope **6 degrees** (A, B and C combined or can be combined later)
12.5. D: height 2 cm, width 90 cm, length 150 cm
12.6. E: height 50 cm, length 150 cm, width 50 cm
12.7. F: height 50 cm, length 350 cm, width 50 cm
12.8. G: height 50 cm, length 100 cm, width 50 cm
12.9. H: height 50 cm, length 150 cm, width 50 cm
12.10. X: Soft and non-hard material with a diameter of 30 cm and a thickness of 1 cm. Green in color
12.11. The floor is black non-slip tatami, with blue, red and green tape to mark the way.
12.12. A,B,C,F,E,G,H wooden or solid plastic dark green color (can carry 5kg)
12.13. Mushrooms (3 pieces) - 50 cm high, 10 cm diameter, 20 cm diameter, 2 cm thick plastic ceiling.

Ball containers - A hollow container with a seat diameter of 8 cm, a mouth diameter of 14 cm and a depth of 3 cm, which can hold 5 tennis balls.

Balls - Standard table tennis balls. Diameter 40 mm. Weight 2.5-3 grams.



Rise platform - The diameter of the platform is 30 cm.

13. Competition evaluation table

№	The name of the task	Point
1	Robot picked up mission pad #1	5
2	Robot mission pad #1 to the designated location brought (**incomplete/full)**	5/10
3	Robot picked up mission pad #2	5
4	Robot brought mission pad number 2 to the designated location (**incomplete/full)**	5/10
5	Robot picked up mission pad #3	5
6	Robot brought mission pad number 3 to the designated location (**incomplete/full)**	5/10
7	The drone took off	5
8	Dron read mission pad #1	10
9	Dron read mission pad #2	15
10	Dron read mission pad #3	20
11	The drone removed the balls from their containers (for each ball)	5
12	The drone made an incomplete landing	5
13	The drone made a full landing	10
14	The robot returned to its home area (**incomplete/full)**	5/10
Duration of the task: 180 seconds		

Table 1

14. Advice and recommendations

14.1. To control the technical condition of the robot. For example: The batteries are full, there are no obstacles affecting the operation of the sensors (dust, mud and other details of the robot).

14.2. It is recommended that you bring as many extra batteries as possible, as batteries run out quickly .

14.3. All team members must prepare for the competition. However, **it is not recommended that processes such as programming be done directly by the mentor** . This will lead to unfair competition and will not affect the development of students. This will definitely have an impact on the competition. Judges control whether students write the code or not . **The mentor should provide moral support, motivation and necessary information to the team** .

15. Equipment and programs used during the competition.

- " Robomaster Ep" robot car
- "DJI Tello Edu" drone

- Mission pad for DJI Tello Edu drone.

- "Robomaster" program
- Python programming language
- DJI Tello block coding program