DIRECTORATE GENERAL OF VOCATIONAL AND TECHNICAL EDUCATION

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INTERNATIONAL MEB ROBOT COMPETITION

17. INTERNATIONAL MEB ROBOT CONTEST

LINE FOLLOWER BASIC CATEGORY RULES

2025

Education, Technology, Production from Roots to the Future

CONTENTS

LINE FOLLOWER BASIC CATEGORY RULES

1. INTRODUCTION

Line following robots are designed to autonomously follow a black line on a white background or a white line on a black background. In the industrial field, these autonomous line following robots are used to transport materials or products from one place to another. What needs to be done is to draw the road line that the robots will follow on the ground. The successful completion of the line-following robots depends on appropriate programming, the right hardware and effective speed control.

The aim of autonomous line-following robots in this category is to follow the white lines on the black track or the black lines on the white track and complete the path before the opponent in the shortest time and without error.

2. ROBOT SPECIFICATIONS

2.1 Robot Dimensions

The robots that will compete in the Basic Line Following Robot category must not exceed 220 mm in length, 180 mm in width and 65 mm in height. (including wheels)

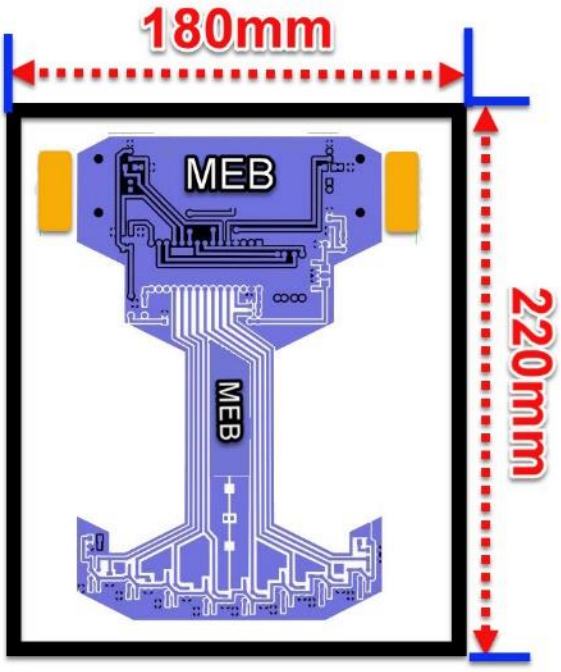


Figure 1. *Robot dimensions*

2.2 Equipments

- ***Control board:*** Any microcontroller or ready-made microcontroller boards (except those with Wifi and Bluetooth) can be used.
- ***Motor driver:*** Commercial Motor Shields (Motor Driver Modules) or motor drivers that you prepare with any electronic component can be used.
- ***DC motor:*** DC Motor with L reducer, 6-12V plastic gears is mandatory.
- ***Wheels:*** Wheels with a diameter not exceeding 65 mm and a thickness not exceeding 30 mm shall be used. Competitors may manufacture the wheels to be used with these specifications or may use ready-made wheels with these specifications.
- ***Sensor array board:*** Analog or digital one with max. 8 sensors can be used.
- Battery box and ball caster can be used if you wish.
- It is obligatory that robots must have 2 motors and 2 wheels.
- Using vacum or fan motor is forbitted.
- The operating voltage of the robots during the competition cannot exceed 16 volt.
- The maximum weight must be no more than 500g including the battery, but a tolerance of 5% in weight is acceptable.
- Batteries must be sealed, fixed, electrolyte type (gel cell, lithium, Lipo, NiCad or dry cells).. Robots can’t use liquid fuel.
- Robots must be wireless and autonomous. Wifi, Bluetooth and RF modules cannot be present on the robot.

3. COMPETITION AREA

- Lines are formed by white color with black ground or vice versa.
- Tracks is made of 5 mm thick black opaque PVC foam material. Joints between parts that made up the track are covered with black opaque foil.
- Lines on the black ground are made by using white opaque foil with 20±2 mm width
- Lines on the white ground are made by using black opaque foil with 20±2 mm width
- There are two bridges which has 1300 slope , 1000mm lenght and 360mm width
- The road on the bridge is covered with white foil and has a black road line 20±2 mm thick

- In the starting section of the road, 300 mm between the beginning of the decota and the starting line.
- There is an automatic door ahead of the starting line. Door opening section shall be white. Door dimensions are given in Figure 8.
- For both robots, there is a tunnel made of transparent mica material on the runway, illuminated with a blue LED strip. Tunnel dimensions are shown at figure 9.
- 10 mm high sensors are used at the edges of the finish line.
- There are two same tracks in the competition area. These tracks will be called 'Track 1' and 'Track 2' (depending on the number of participants, the number of tracks can be reduced to one).

3.1 Runway

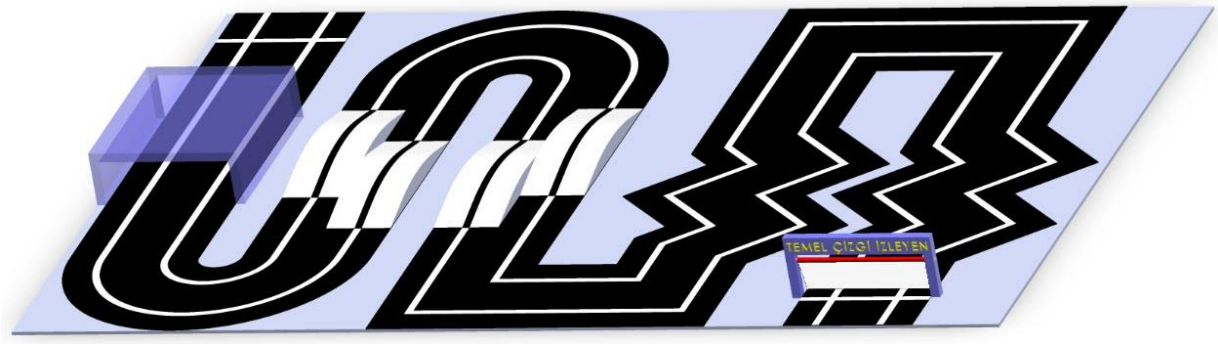


Figure 2. *3D View of Runway*

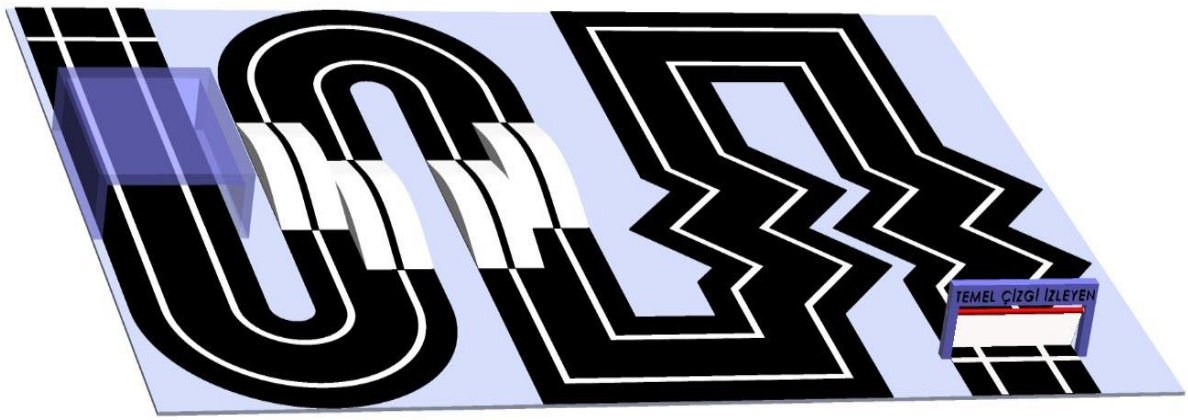


Figure 3. *3D View of Runway*

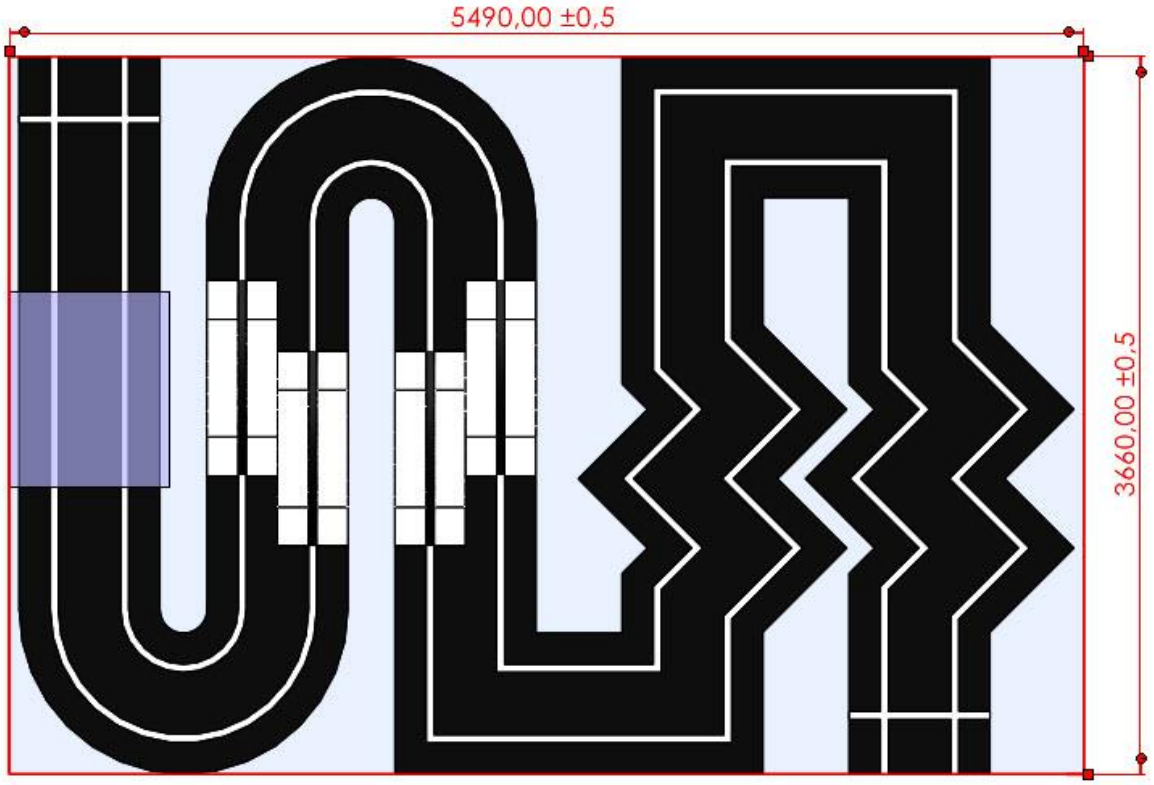


Figure 4. *Runway dimensions*

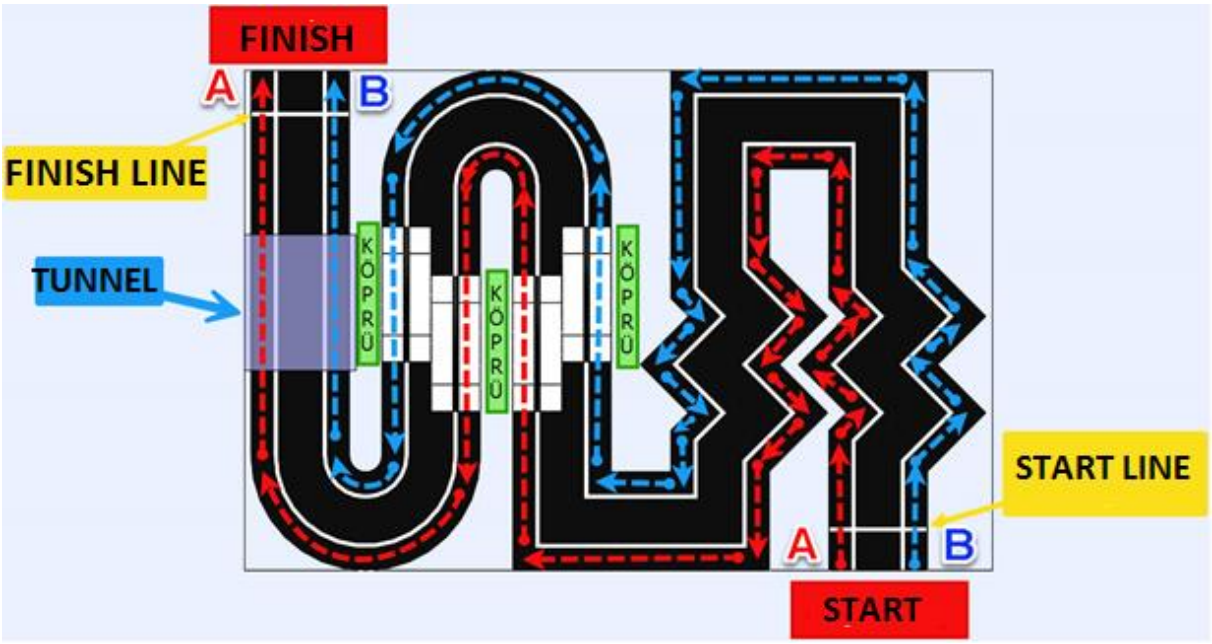
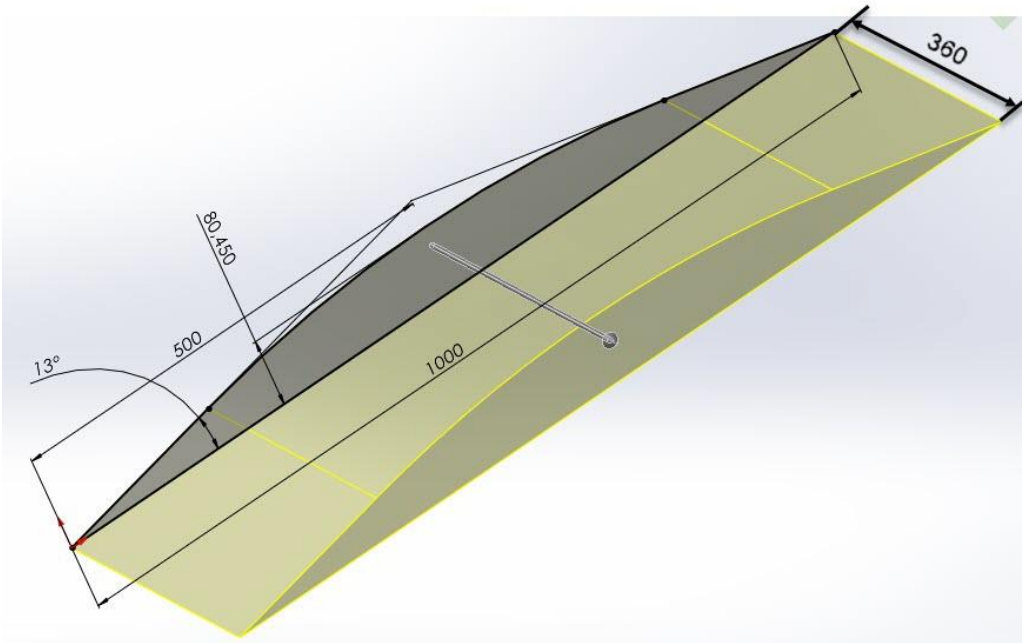


Figure 5. *Robot movement directions*



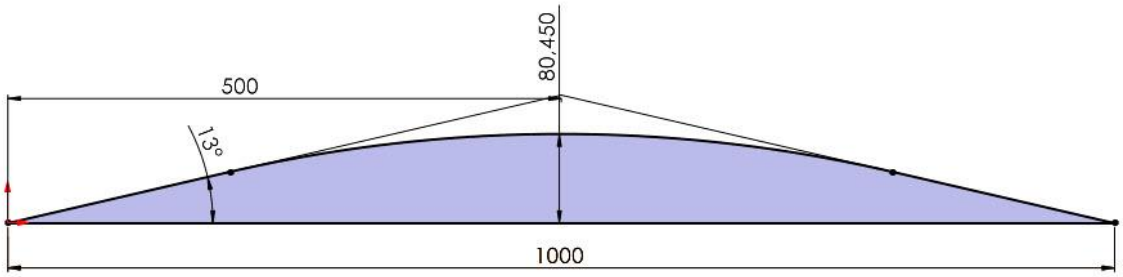


Figure 6. *Bridge*

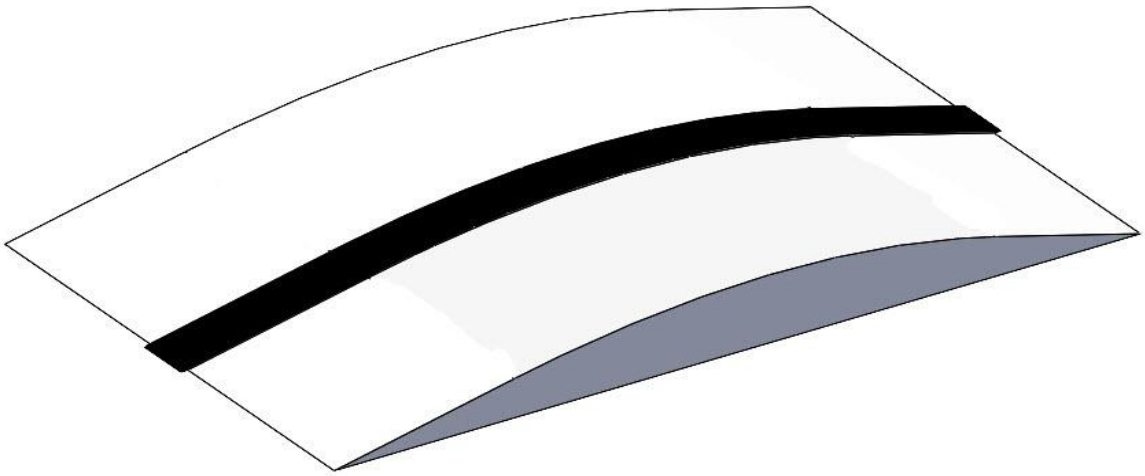


Figure 7. *Bridge 3D view*

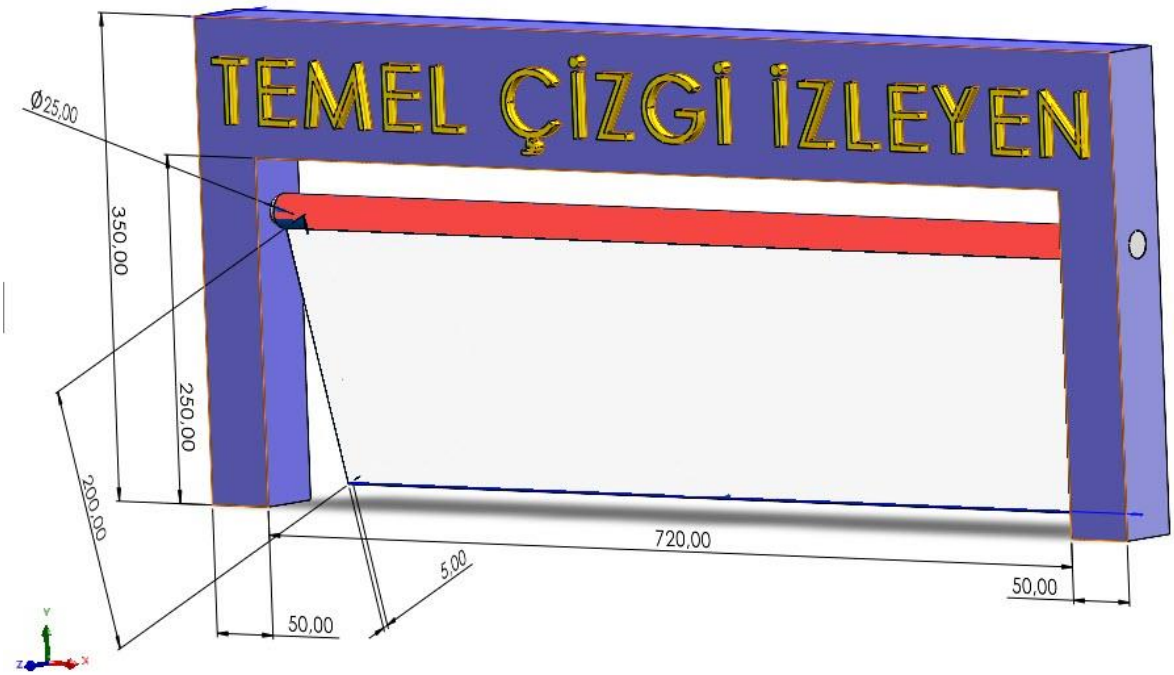


Figure 8. *Automatic gate 3D viw*

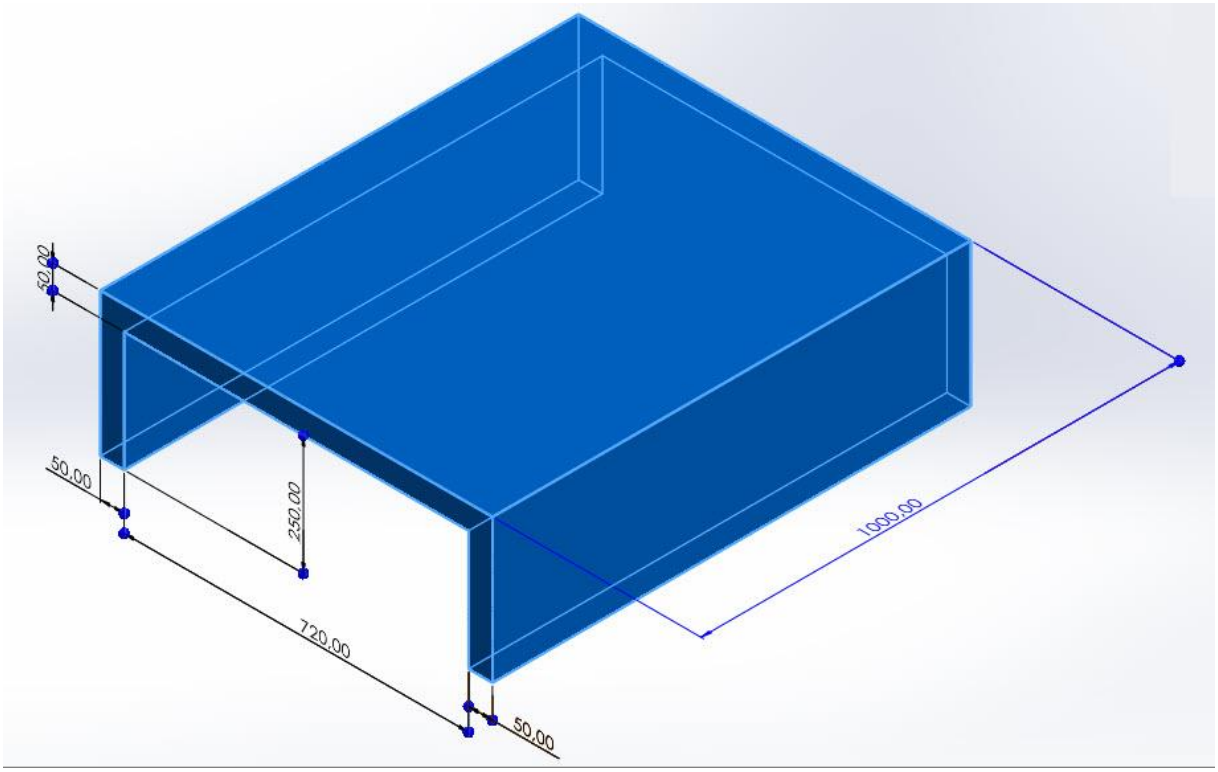


Figure 9. *Transparent Tunnel dimensions and 3D view*

4. GAME FORMAT

The robots that have passed the application stage and whose applications are accepted are competed in ranking rounds by computer draw. After the ranking rounds, the final competitions are continued with the first 64 robots and the top three robots are determined.

4.1 How to apply to the competitions:

- For the Line-Following Robot (Basic Level) Category, a production report will be required for robots applying to the competition via https://robot.meb.gov.tr/.

Report content:

  - Materials used in the construction of the robot,
  - Explaining the construction process of the robot,
  - The language used in programming the robot,
  - Total cost of the robot,
  - It should include photographs showing the production and preparation stages of the robot, including the robot name and the logo of the organisation.

- The applications of the competitors who do not send the detailed report until the date specified in the application guide will not be accepted.
- The list of Basic Line Tracing Robots whose applications are accepted will be announced in the announcements section of https://robot.meb.gov.tr/

4.2 Qualifying races

1. In ranking competitions, each robot competes in pairs. Which track the robots will compete on is determined by computer draw (1st track A road-B road or 2nd track A road-B road).
2. Before the robots start the competition, their dimensions are tested in the test box. (The dimensions of the test box are 220 x 180 x 65 mm)
3. The weight of the robots passing the test box is measured. It is recorded by the judges. Weight measurement includes battery. If otherwise, the robot is disqualified

4. Robots take 1 lap on the track at the same time. The times of the robots that complete the track by following the line are recorded.
5. The time of the robots to finish the competition will be kept by the stopwatch on the track.
6. As soon as the door at the starting line is opened, the stopwatch will start counting. When the robots complete the track and pass the sensor on the finish line, the stopwatches will stop counting and end the competition.
7. A 10 second penalty point is given to the robot that cannot start after the door is opened. Competitors are entitled to 2 non-starts

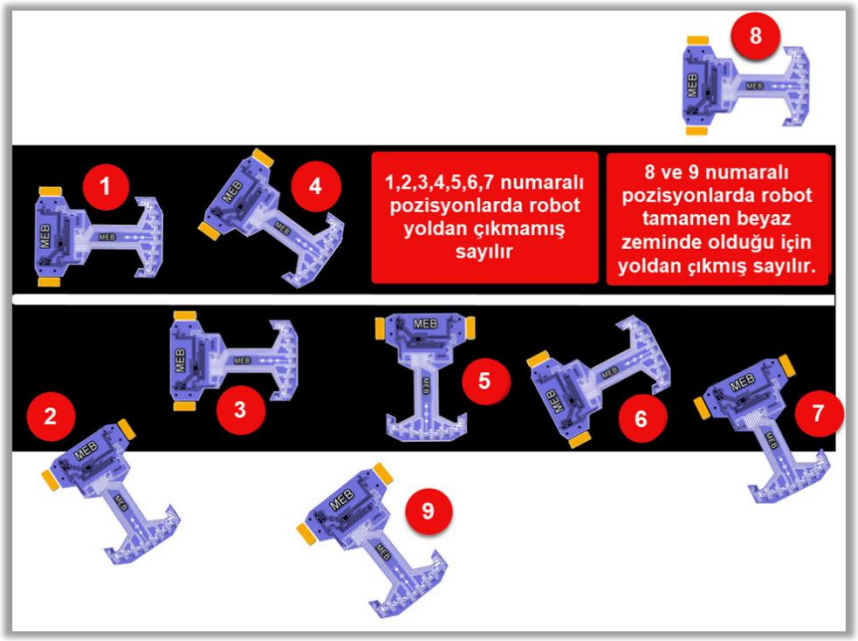


Figure 10: *Robot positions on the line*

8. It is compulsory for the robots to move on the track in the direction of movement indicated in Figure 5.
9. It is essential that the robots follow the line. The robot leaving the track means that the robot body leaves the black road and goes completely on the white ground. During the movement of the robot, if any part of the robot is on the black road, the robot continues the competition.
10. In case the robot goes off the road (the body of the robot is completely on the white ground from the black road), the robot is placed behind the starting line and the competition continues. 10 seconds off the road penalty is given. This situation is

applied to a competitor once. In case of going off the road for the second time, the robot is deemed not to have completed the track and is disqualified.

11. Competitor robots must pass the zigzag sections on the track by following the line. If the robot passes these sections directly without following the line, a penalty of 10 seconds is added to the competition time.
12. If the robot goes off the track for the second time (with the decision of the referee), the competition ends. The other robot is expected to complete the track and the finishing time is recorded.
13. During the competition, 30 seconds waiting time is given for robots that pause on the white or black line in any part of the track. Robots that continue to remain stationary are disqualified. It is forbidden for the competitor to intervene in cases where the robot remains immobilised.
14. The ranking times of the robots are obtained by adding the penalty times to the finishing times of the competition
15. Total time = [(Stopwatch time + sum of penalty times)].
16. At the end of the first competitions, a ranking is made by taking into account the total times obtained by the robots completing the track. The competitors among the first 64 robots in this ranking are eligible to participate in the final competitions.
17. Robots that leave their own track area during the competitions and enter the opponent's track area are disqualified.
18. During the competitions, the robot that leaves its own track area and enters the opponent's track area and hits the other robot is disqualified. It is restarted again to determine the time of the other robot.
19. In case of equality of the total time of the robots; the weight of the robots is checked, the lighter robot is considered the winner.
20. If the equality is not broken in the above cases, the total age of the competing students is taken into consideration. The robot of the team with the younger age total takes priority in the ranking.
21. The robots in the final compete in two heats.
22. In the final competitions, the rules of derailment in the qualifying round apply.

4.3 Final races

1. ***Start:*** Starting with 64 robots, the robots are paired two by two in each round. The pairing is made as 1st robot and 64th robot, 2nd robot and 63rd robot.
2. ***First Elimination:*** 64 robots compete in pairs and 32 robots advance to the next round.
3. ***Second Elimination:*** 32 robots compete again by pairing randomly in pairs and 16 robots advance to the next round. (If 32 robots cannot reach the second elimination round in the first elimination, the number is completed to 32 robots with the robots with the best time from the eliminated robots).
4. ***Third Elimination:*** 16 robots compete again by being randomly paired in pairs and 8 robots advance to the next round. (if 16 robots cannot reach the third elimination round in the second elimination, the number is completed to 16 robots with the robots with the best time from the eliminated robots).
5. ***Fourth Elimination:*** 8 robots compete again by randomly pairing in pairs and 4 robots advance to the next round. (if 8 robots cannot reach the fourth elimination round in the third elimination, the number is completed to 8 robots with the robots with the best time from the eliminated robots).
6. ***Fifth Elimination:*** 4 robots compete again by randomly pairing in pairs and 2 robots advance to the final competition. (If 4 robots cannot reach the fifth elimination round in the fourth elimination, the number is completed to 4 robots with the robots with the best time from the eliminated robots).
7. ***Third place:*** In the fifth elimination round, the third place competition is held between the robots that cannot advance to the upper round (cannot qualify for the final).
8. ***Final:*** The 2 finalists meet in the grand final. First and second are determined.

4.4 Other Rules

1. No break, maintenance or repair time is allowed.
2. No permanent mark or marking may be left on the track or damaged. Robots that damage the track are disqualified.
3. Robots can use an energy source such as a battery or battery group. They cannot use liquid, flammable energy sources.

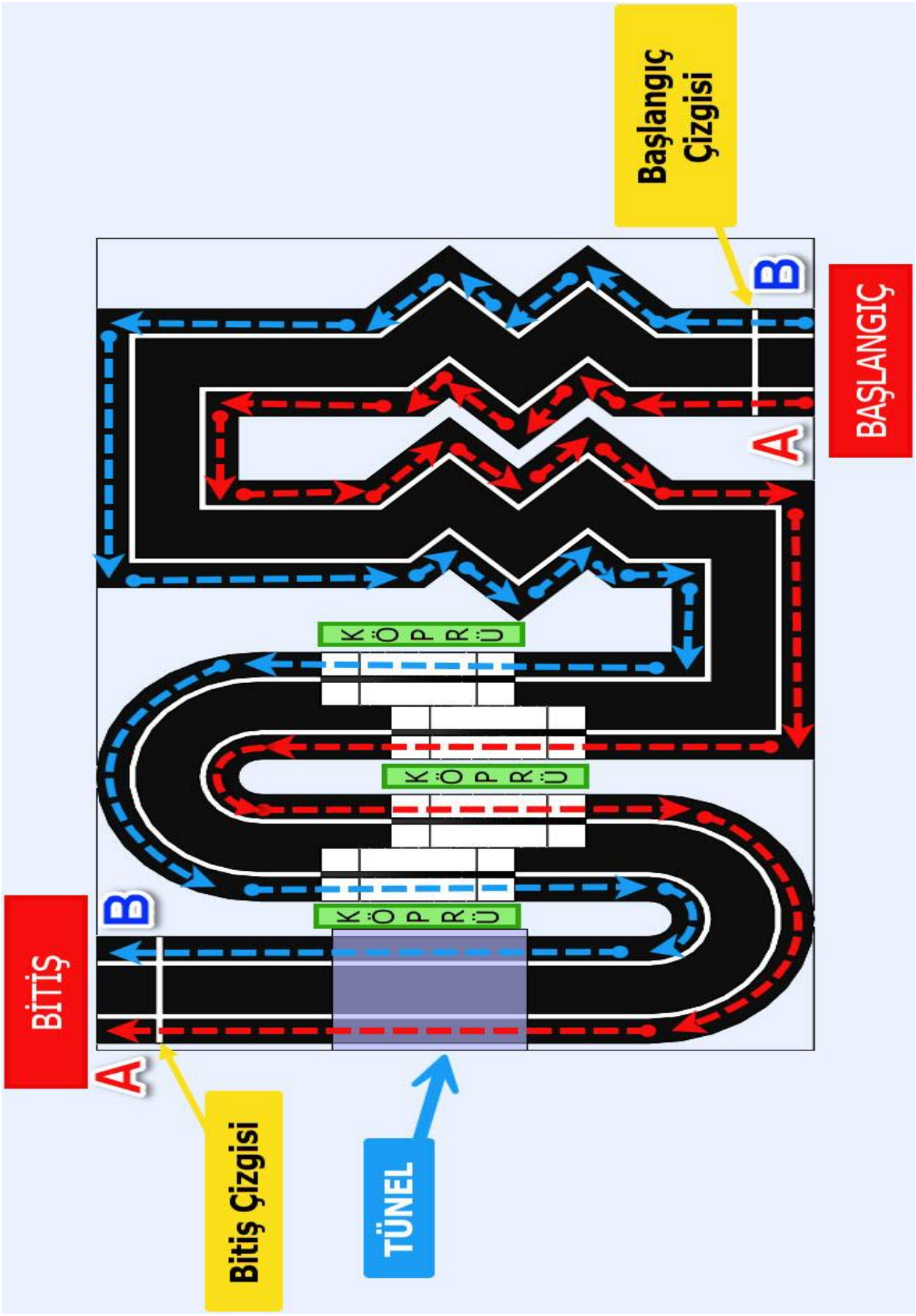
4. During the competitions, they cannot make any changes on the robots other than changing the tyre wheels and batteries. In all physical changes such as changing the robot body, the robot is disqualified.
5. During the competitions, the robot will be disqualified if the square code affixed on the registration desk is removed, replaced and the square code is damaged.
6. Robots that do not match the competitor robot photos registered in the system at the referee table are disqualified.
7. When electronic elements need to be replaced, the same type of elements can be replaced in the same place. The QR code must not be damaged during the replacement of the elements. Otherwise, the robot is disqualified.
8. The QR code must be affixed to the robot body. It should not be pasted on removable materials. In such cases, the referee disqualifies the robot in case of a problem with the robot.
9. There may be changes in the dimensions of the tracks during the construction phase without disturbing the general structure.
10. During the competitions, objections made due to illuminated signs, cameras and lighting around the track will be deemed invalid.
11. The Competition Organising Committee has the right to change the rules when it deems necessary so as not to disrupt the integrity of the competition

5. WARNINGS

- Only lower secondary school students can apply to this category.
- The general rules regarding the competition applications and the Line Tracing (Basic Level) category are included in the 'Application Guide'. The Application Guide must be read before making an application.

6. CONTACT

Competitors are required to ask their questions by selecting their categories from the information menu after logging into the 'robot.meb.gov.tr' system. Questions other than category messages will not be answered. The responsibility in this regard belongs to the competitor.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INTERNATIONAL MEB ROBOT COMPETITION

17th INTERNATIONAL MEB ROBOT COMPETITION

DESIGN-BUILD

(JUNIOR) CATEGORY RULES

2025

Education, Technology, Production from Roots to the Future

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DESIGN&BUILD (JUNIOR) RULES

1. INTRODUCTION

1.1. Objective

This competition is based on competing professional skills, knowledges and programming experiences of students. Teams will provide all the products, materials, hand tools and laptops which are announced by the organization in the specifications necessary for robot construction in their province where their schools are located before the competition and will keep them ready with them. No materials will be given to the teams before the competition, only an envelope containing the information of the track where the robot will compete and the rules of the competition will be given and they will be asked to race them in competition area.

2. Competition Format and Evaluation

2.1. Application Process

Competition applications are made according to the process and principles specified in the Application Guide. Competitors who meet the conditions specified in the Application Guide will be able to participate in the competitions.

2.2. Competition Stages and Evaluation

2.2.1.Competition stages:

The competition will last for three days and teams will consist of two competitors. On the first day, all teams will participate in the qualification exam at the same time. The teams that pass the qualification exam will settle at their tables determined by lot on the second day in the morning and make preparations for designing and programming their robots. In the afternoon of the same day, the teams will program their robots with the computers provided by the organisation and make them ready for the competition by testing them on the test track. At the end of the period, the robots will be delivered to the referees and the final ranking will be determined by the final races to be held in front of the audience on the third day.

2.2.2.Evaluation

The evaluation criteria will be announced to the teams just before the competition starts.

2.3. Tasks definitions and Success Criteria

The game principles will be announced to the teams just before the start of the competition.

Competition rules, how the competition will be carried out and scored will be announced to the teams just before the competition starts. The prepared robots will compete on the competition track in the order of draw.

2.3.1.Competency Exam

Competency exam will be held at first day of competition. All team members will sit the exam at the same time. Participation in the exam with a single team member will not be possible.

Exam will consists of multiple choice questions which are related with the following topics.

- Basic Electric & Electronics ,
- Basic Digital Electronics,
- Arduino
- Basic Arduino Programming.

*** You can see sample questions at Appendix-1.

Teams will be sorted according to their scores at the end of exam.

If teams have same scores , the team which gives its exam sheet earlier will be listed upper than other.

If teams are still equal, the one has lower average age will be listed upper than other. Only 40 teams from top of list will get right to join "**design**" session of the competition.

2.3.2.Designing

Teams that successfully pass the qualification exam will be placed on the tables where they will work according to the order of lots. Competitor teams will design their robots and make them ready for programming within the specified time after they move to the work areas reserved for them. Teams will be present at the tables with all the materials they bring with them. The characteristics of the track/platform where the competition will be held and the

tasks of the robot will be given to the competitor teams in a sealed envelope just before the competition starts.

2.3.3. Programming

The teams will make their robots ready for the competition by programming them with the computer given to them by the organisation within the specified period and trying them on the test track. At the end of the period, the referee committee will receive the robots from the competitors and will deliver them again on the third day at the time of the final competition. The ranking list will be announced by the referees at the end of the competition.

2.3.4. Racing

The final races will be held in the indoor hall according to the order of draw in front of the audience.

3. Robot Specifications

Robots move autonomously.

While designing robot, using any kind of module except modules announced by organization is not allowed.

Using any kind of communication modules such as wireless, bluetooth, etc is strictly forbidden.

Power unit; Using any kind of power supply on robot except LI-PO battery which announced by organization will not be allowed.

4. Other Rules

- The Tournament Committee reserves the right to change the rules when necessary without giving a reason.
- The computers to be used in the competition will be formatted by the school assigned by Kayseri Provincial Directorate of National Education and will be brought to the competition area in a re-installed and working condition.
- Contestants; computers, mobile phones, tablets, USB sticks, external discs, smart watches, etc. electronic devices will not be allowed to be brought with them.

- The computers that will be given to the participants by the competition organisation in the competition area will have the operating system, office application program, pdf reader program and the Arduino IDE program downloaded from https://www.arduino.cc/en/Main/Software and the necessary libraries installed. Programming will only be done using this programme. There will be no different applications and programmes other than these software. Computers will be examined by the referee committee before the competition.
- Before the start of the competition, the following products and materials to be used in robot construction will be available at the work tables and the robot will be built using the product groups specified in the list.

5. Equipments

Some of the materials will be provided by the organisation. Other materials will be brought by the competitors. Teams will be able to have twice as many materials ready with them as the specified quantities of other materials other than Tool Box and Hand Tools. (For example, RGB Colour Sensor is specified as 1 piece and if desired, maximum 2 pieces can be brought).

5.1. Materials to be provided by the Organisation.

- **Motors;**

*DC Gear Motor 6V 2 pieces ***(will be given by organization)***

- **Others**

*DC Motor Bracket 2 pieces ***(will be given by organization)***
*Wheel 2 pieces ***(will be given by organization)***
*Robot Body 1 pieces ***(will be given by organization)***
*Ball Caster 1 pieces ***(will be given by organization)***

5.2. Materials that Competitor Teams should bring with them

- **Mainboards:**

Open source microcontroller board
DC motor driver shield (double motor driver board)

- **Sensors:**

Line Sensor array (8 sensor)	1 piece,	Analog signal
4-Line sensor array	1 piece	
Object detection Sensor	3 pieces	2-450cm Ultrasonic distance sensor

- **Batteries;**

LI-PO Battery	1 piece	7.4V
LI-PO Charger	1 piece	

- **Others;**

Sensor holder	3 pieces

- **Tool Box and Tools:**

Inside tool box, there will be the following tools;

Tool Box	1 piece	15”
Bread Board	1 piece	
Jumper Cables	2 pieces	male- male, female- male 40pin 100mm
Mini Plier	1 piece	
Screwdriver set	1 piece	
Screw-Nut Set	1 piece	M2 YHB Screw, Nut and Washer in sufficient quantity
USB cable (1 meter)	1 piece	compatible with board
Double sided Tape	1 piece	

6. CONTACT

The general rules regarding the competition applications and the Labyrinth Master Category are included in the ‘Application Guide’. The Application Guide must be read before making an application.

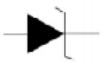
Competitors should make their questions by selecting their categories from the information menu after logging into the robot.meb.gov.tr system. Questions other than category messages will not be answered and no responsibility will be accepted.

Appendix-1 SAMPLE QUESTIONS;

S-1) What is the value of resistance which has following color code: Red – Green – Yellow – Silver?

a)2 KΩ b) 200 KΩ c) 250 KΩ d) 2 MΩ

S-2) Which one is the symbol of diode?

a)  b)  c)  d) 

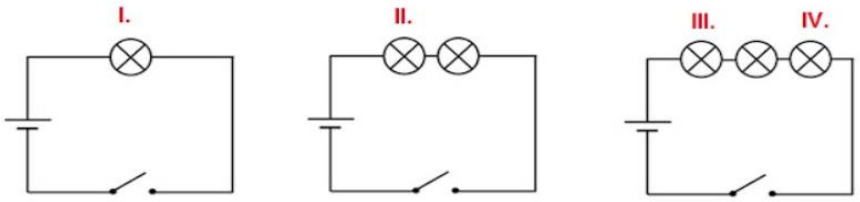
S-3) Which one is not present in a simple electric circuit?

a)Battery b) Cable c) Bulb d) Fuse

S-4) Task of which of following circuit component is incorrect?

a) Battery generates electric engery
b) The connection cable prevents the passage of electrical energy.
c) The light bulb converts electrical energy into light energy.
d) The switch controls the passage of electrical energy.

S-5) Below are simple electrical circuits with identical batteries and lamps.



When switch is turned on, which of lamp gives the brightest light?

a) I b) II c) III d) IV

S-6) Which one is correct statement to activate output pin 3 of Arduino?

a) digitalWrite(3,LOW);

b) digitalWrite(3,SET);

c) digitalWrite(3,HIGH);

d) digitalWrite(3,high);

S-7) Which script can be used to define all pins of Arduino from 3 to 9 as output?

a) for(int i=0;i<10;i++)
pinMode(i,output);

b) for(int i=0;i<10;i++)
pinMode(i,OUTPUT);

c) for(int i=3;i<10;i++)
pinMode(i,output);

d) for(int i=3;i<10;i++)
pinMode(i,OUTPUT);

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UNMANNED SURFACE VEHICLE (USV) JUNIOR CATEGORY GUIDE

2025

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UNMANNED SURFACE VEHICLE (USV) CATEGORY GUIDE

1. PURPOSE

As stated in the MoNE 2024-2028 strategic plan, the MoNE USV Robot Competition aims to provide our young people with an environment where they can gain the knowledge, skills and competencies needed by the age, participate in the process of producing technology, construct the future through history awareness and science, and develop empathy and courtesy. For this purpose, our young people at the secondary school level (5th, 6th, 7th and 8th grades) are expected to increase their interest in technology, design robots that can fulfil the tasks given on water by developing innovative thinking skills, plan research and development processes by engaging in technological studies, access and use information, analyse possible problems, produce solutions and access new information.

2. COMPETITION THEME

The importance of our seas, which are the heart of our planet, is obvious to all of us. Half of the oxygen in our world is thanks to the living creatures in the seas. From climate regulation to temperature distribution; from tourism to energy production, we benefit from our seas in a very wide range. Considering this and all other world ecosystems, protecting the seas, water resources and natural life in this environment should be one of the primary responsibilities of us humans. However, with the increasing need for resources and our changing consumption habits, the natural life in our seas and water resources is endangered day by day. Considering that our country is surrounded by seas on three sides, it is obvious that we should not remain indifferent to this threat. In order to eliminate this threat, the dissemination of intelligent robots to be used in manned and unmanned missions has increased its importance. For the "Surface Robots" category, which is planned for the first time this year, we aim to use the prefix name TCG (Ships of the Republic of Turkey), which is given to our ships that have served in every field since the establishment of the Turkish Naval Forces (1081), to develop your surface robots that will come out of the hands of our esteemed students with the slogan "TCG-1081" and turn them into a product so that you can perform the tasks assigned to your teams. In this context, you will be able to move the

robots you will develop in the desired direction on the water and solve real world problems with them, even if it is a simulation.

In addition, in this competition category, in cooperation with social and economic sectors, it is aimed to raise a competent labour force that has national and international professional competence, ethical culture, professional ethics and professional values; innovative, entrepreneurial, productive, adding value to the economy. In addition to this, the MEB Competition, which aims to understand the real-life equivalents of what we see at school, to understand the relationship between the production process by seeing the processes of turning the studies into products and to encourage international cooperation and experience sharing, focuses on the use of unmanned robots in order to bring together the knowledge and equipment of our developing technological infrastructure with you, our esteemed students, to meet the needs of sustainable, nature-friendly, people and natural water resources, to prevent the lives of living things from being put at risk by cleaning the nature, to contribute to the reduction of costs in overwater studies and energy efficiency studies.

This category of the 17th International MEB Robot Competition will be a competition that will pioneer the development of original robots that will spread to a wider base throughout the country in the production and development of surface robots and will bring you, our esteemed students, the opportunity to produce a robot that can move controlled on water.

3. COMPETITION SPECIALITIES

In the MEB USV Competition, the competing teams are expected to design an USV robot that has the ability to move on the track to be prepared on the water and can fulfil the tasks of guiding and carrying various objects. Before applying to the competition, it is absolutely necessary to read the 'Application Guide', which includes the general rules regarding the application conditions and categories.

3.1. Scoring, Evaluation, Competition Tracks and Task Objects

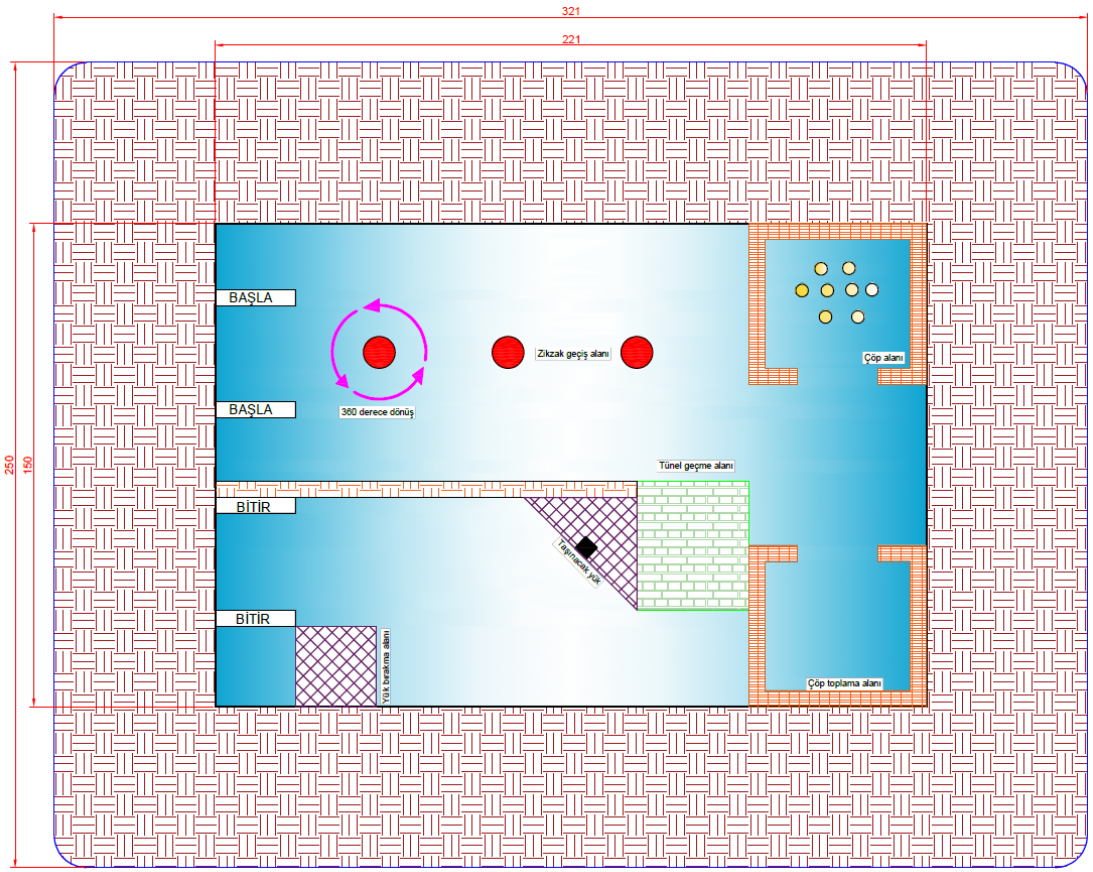


Figure 3.1: *USV Competition Pool and Mission View*

The USV robot in the competition pool; The 360-degree rotation task and zigzag passage task refers to the tours made for cleaning work, the object collection task refers to carrying the wastes that need to be cleaned from where they are located to the garbage collection area where they will be disposed of. The movement to the area where the waste materials are processed afterwards refers to the tunnel passage task and the container transport task of the containers in which the waste materials whose dimensions are shared with you are placed.

The competition will be held in a pool with a depth of 43cm, a width of 150cm and a length of 221cm. Platforms will be placed in the pool to determine the start and finish areas. The competition track area where the tasks will be performed will be placed by the referees before the competition. After each team is positioned at the starting point, they will start the competition by passing through the starting point when the referee starts the competition.

Competitor teams are expected to perform five different tasks with their surface robots. These tasks have no order of priority and each task is subject to a scoring within itself. One of these tasks is to rotate 360 degrees around a buoy on the pool. Another task is to pass between two buoys with a diameter of 10cm and a distance of 40cm from each other, regardless of direction. The direction here is directly related to the previous stage and the zigzag movement of the surface vehicle between the 3 buoys to be considered together with the buoy on the turning track after the 360 degree rotation task. The next task is to pick up 8 ping pong balls from the garbage area and take them to the garbage collection area. The next task is to pass through a 35cm wide, 40cm long and 35cm high tunnel to the second stage of the course. In the second stage of the competition, at the exit of the tunnel, the task of disposing of the recyclable material loaded into containers on the isosceles triangular harbour with a side length of 35cm on the right side and leaving it to the load drop-off area approximately 70cm away. Figure 3.2 shows a picture of the competition course.

The robots will be left in the starting area in the competition area and the stopwatch will automatically start counting the time as soon as they leave the area. Again, after all the tracks are completed, the time will be stopped with their full entry / approach to the finishing area. Starting and finishing will be done automatically via sensors. The starting and finishing areas will be considered as surrounded by pontoons and will not have a negative effect on the scoring in case of collision.

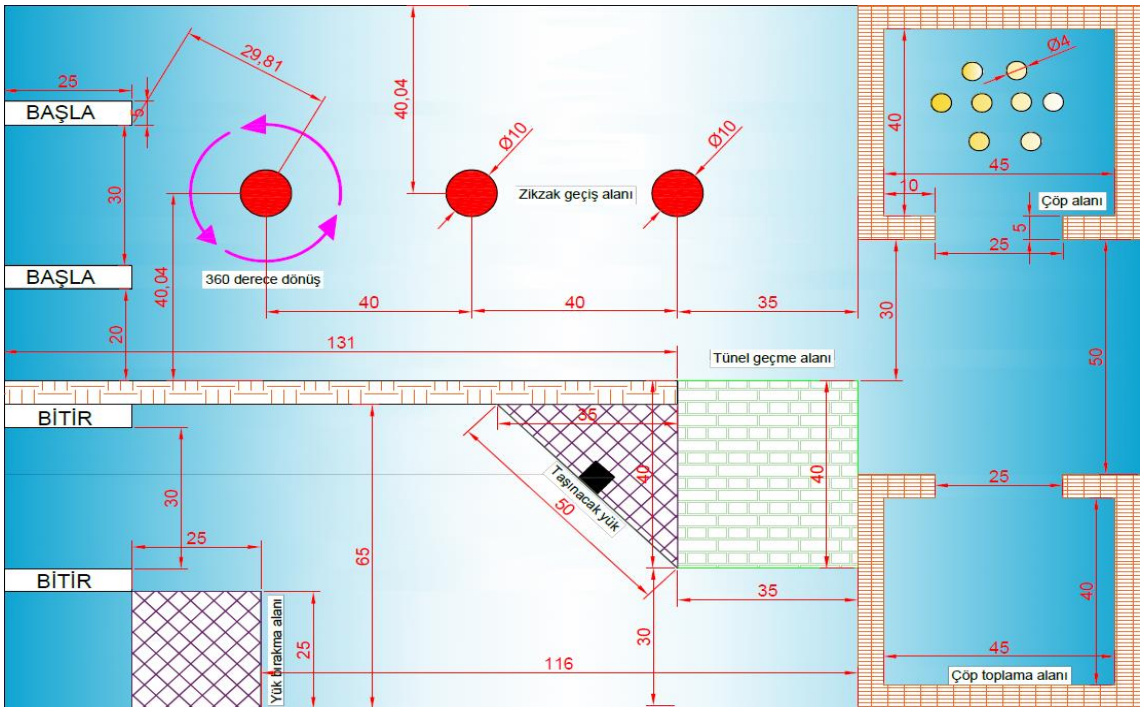


Figure 3.2: *USV Robot Competition Track*

3.1.1. 360 Degree Rotation Mission

In this task, the competitors are expected to complete the course by taking a full lap around a buoy fixed to the pool floor with a diameter of 10cm. The starting point of the task is the part directly opposite to the competition starting buoy platform, and the rotation of the vehicle around this platform will add 10 points to the team score, while the team that passes around the platform without making a full lap around the platform will not receive points, and 5 points will be deleted from the team score of the robots that overturn the platform with the USV Robot or displace it as a result of impact. Failure of the robots to pass through the 360 degree rotation platform will only cause them to be deprived of that platform score and will not prevent them from reaching the finish platform at the end of the track.

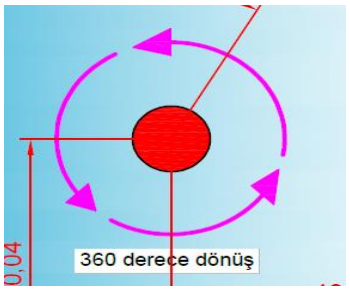


Figure 3.3: *360 Degree Rotation Platform*

This platform will be formed by the buoy shown in Figure 3.3 which is fixed to the pool floor and visible over the water. This platform will be referred to as "360 Degree Platform". The height of the buoy on the 360 degree buoy platform in Figure 3.3 from the pool floor will be 10cm and the diameter width of the buoy will be 10cm.

After the teams' preparation time, the robot will be deemed to have entered the competition course by passing through the 'Starting Buoy Platform' with the start of the competition. Within the preparation time given to the teams, the vehicle must be kept in front of the starting buoy ready to start the competition. After the referee starts the competition, the competing robots are expected to pass the 'Finish Buoy Platform' after completing the tasks within the competition time. Figure 3.4 shows the start buoy platform and Figure 3.5 shows the finish buoy platform.

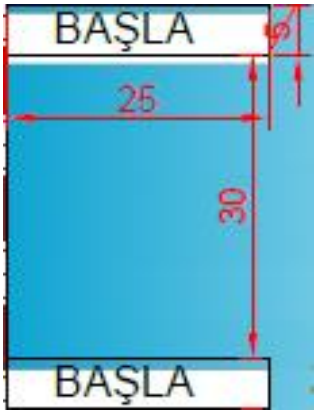


Figure 3.4: *Starting Buoy Platform*

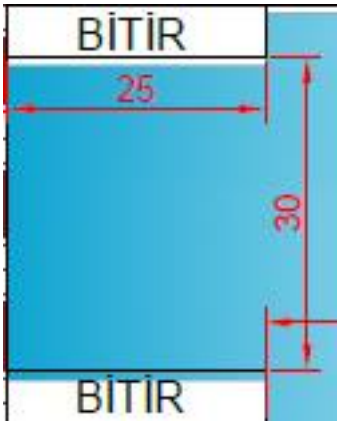


Figure 3.5: *End Buoy Platform*

The height of the buoys on the buoy platforms in Figure 3.4 and Figure 3.5 will be 10cm from the pool floor and the distance between the two buoy centres will be 30cm.

While no points will be added to the robots passing through the start and finish buoy platform, the finishing time of the robots passing through the finish buoy platform will be accepted by the referees as the time written on the stopwatch screen at that moment.

3.1.2. Zigzag Passing Task

In this task, the competitors have to drive the Surface Car through the floating buoys on the pool surface, which are 10cm in diameter and 40cm apart from each other. This task will add 10 points to the team. The visual of the task is shown in Figure 3.6.

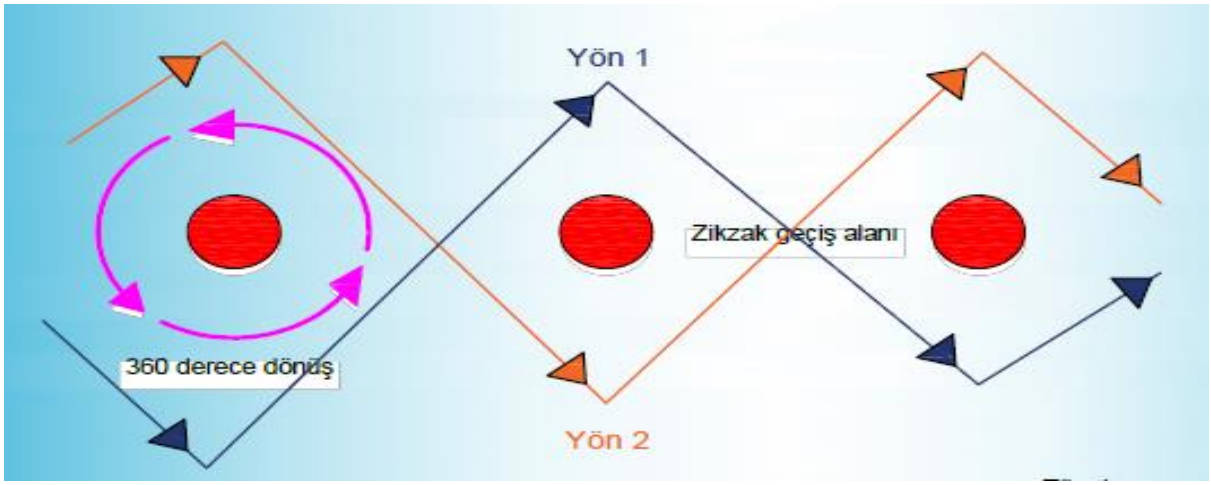


Figure 3.6: *Zigzag Transition Task*

In this task, 10 points will be added to the team score if the vehicle passes through the pontoons. If the Surface Car displaces or overturns the pontoons placed on the ground as a result of impact, 4 points will be deducted from the team score. Although the start of this task is not directly related to the previous task, in order to complete the task, the zigzag passage between a total of 3 buoys located 40cm apart must be shown completely. For this reason, it is recommended to plan the exit of the previous stage and the start of the next stage together. The task consists of travelling in the direction of 'Direction 1' indicated by the blue line or in the direction of 'Direction 2' indicated by the orange line. A one-way movement from top to bottom or bottom to top (left to right or right to left) between the first two or the last two pontoons will bring only 5 points to the team. Each task will be scored separately and one task will not affect the score of another task.

3.1.3. Task Object Collection Task

In this task, the competitors' Surface Watercraft will fill 8 ping pong balls in the garbage area, which refers to the waste materials found in the seas, by dragging/carrying them to the garbage collection area designated by the pool side. A visual of the task is shown in Figure 3.7. The balls will be left randomly in the garbage area determined by the referees

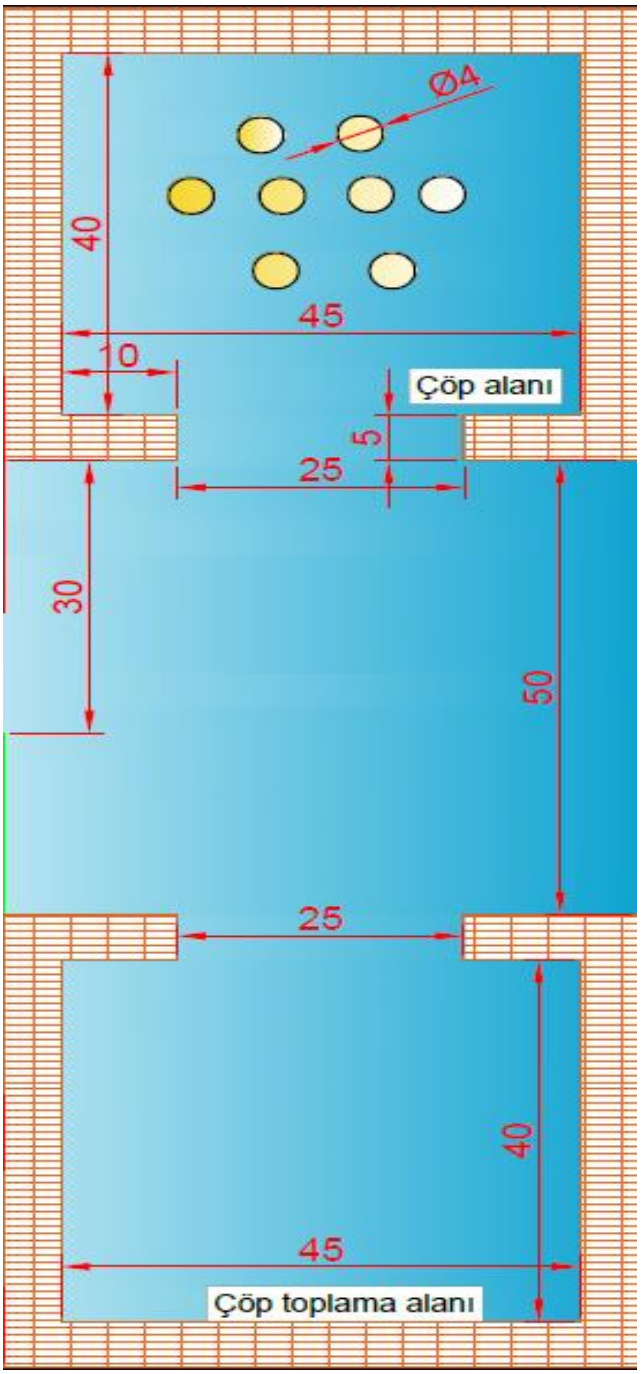


Figure 3.7: *Task Object Collection Task*

Task objects are ping pong balls with a diameter of 4cm and there are 8 of them. The garbage area is a rectangular area with interior wall dimensions of 40cm deep and 45cm wide and has a door opening of 25cm. The task is to take the ping pong balls, which are called garbage, from the garbage area and take them to the garbage collection area, which is 50cm away and has the same dimensions. In case of contact with the walls while in the designated area (garbage area) during the removal of the balls, no point penalty will be applied and this is only valid within this area. Although there is no requirement for robots to enter the garbage collection area, robots entering the area shown in Figure 3.8 will be penalised 5 points for hitting the platform. The top view technical dimensions of the platform are shown in Figure 3.8.

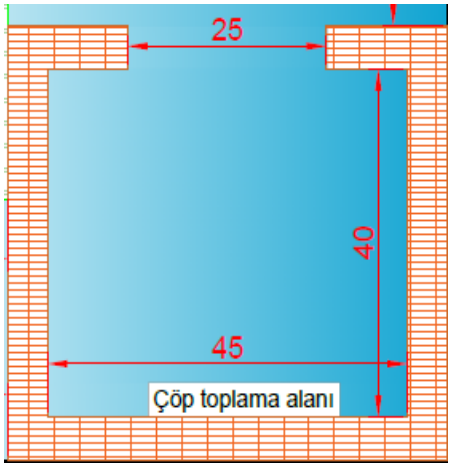


Figure 3.8: *Technical Dimensions of the Platform Top View (centimetre)*

In this task, passing each object through the appropriate gap in the collection area will add 5 points to the team score. If all objects are collected, 8 x 5 = 40 full points will be scored. Competitors will act in a way to pay attention to the total time and, if deemed necessary, may proceed to the next task without completing the object collection task. In this task, each object (ping pong ball) will be scored individually. There is no number limit for carrying the balls. In this case, the number of ping pong balls entering the garbage collection area will be taken into account. After the start of the next task (tunnel crossing), the number of ping pong balls that may come out of the garbage collection area will not change the team score. In case the USV robot overturns the platform, 5 points will be deducted from the team score. If the vehicle hits the area during the dropping of the mission objects to the area, 5 points will be deducted from the team score.

3.1.4. Tunnel Crossing Mission

In this task, the contestants must pass to the second stage of the competition by passing through the semicircular tunnel with an inner width of 35cm, height of 35cm and length of 40cm placed on the pool floor. Figure 3.9 shows the visual of the task.

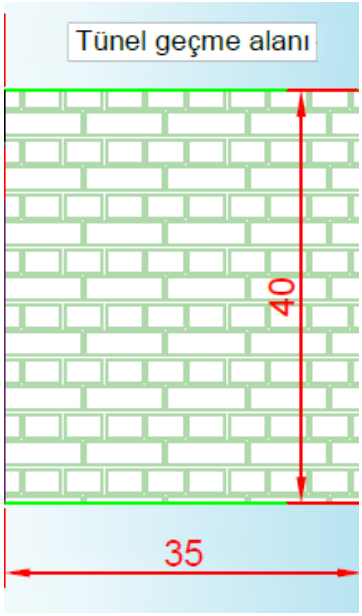


***Figure 3.9**: Tunnel Passing Task*

In this task, 10 points will be added if the vehicle passes through the pipe. In the event that the USV robot hits/dislodges the pipe platform supported by wedges, 6 points will be deducted from the team score. Competitors will be able to receive the points specified for their tasks separately. Completion of the entire task will not be required. However, since the tunnel crossing task provides the transition to the second stage of the competition, this task must be completed for the tracks in the second stage and in order to reach the finish line.

3.1.5. Container Handling Task

In this task, the competitors are required to load the cube-shaped container with a side length of 5cm from the area where the containers are located on the pool surface in the isosceles area with a side length of 35cm located on the right side of the tunnel immediately after the tunnel crossing task to their robots and drop them by docking at the cargo drop-off port approximately 70cm away. The visual of the task is shown in Figure 3.10.

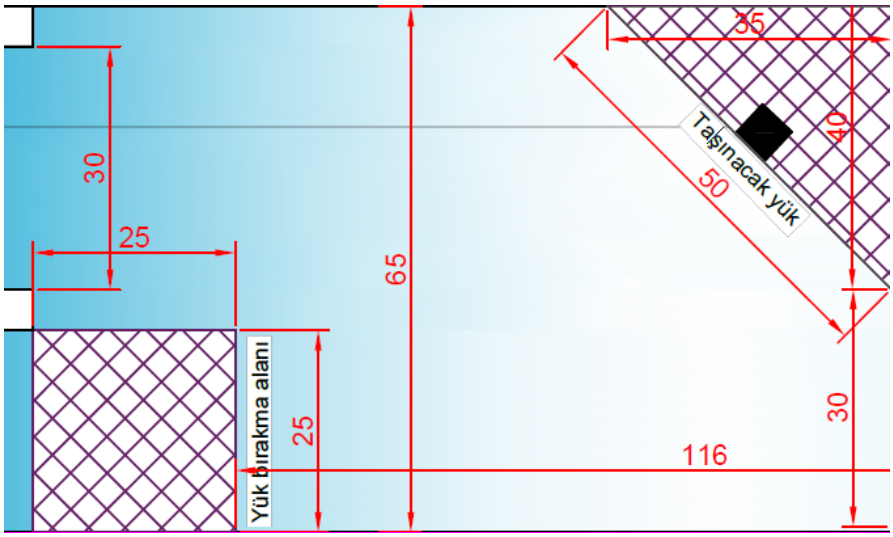


Figure 3.10: *Container Handling Task*

In this task, 15 points will be added to the team score separately for the pick-up and drop-off tasks. In order to complete the container pick-up, the load must be loaded onto the vehicle. Otherwise, no task points will be awarded. During the pick-up or drop-off of the container from the ports placed on the floor of the pool surface, 4 points will be deducted from the team score in case of overturning one of the three containers placed on top of each other and similar in size to the cargo to be transported. During berthing in port areas, the berthing areas will be considered to be surrounded by pontoons and berthing contacts will not be considered as collisions. However, points will be deducted from the teams that overturn containers other than the cargo to be transported in the area as a result of severe impacts.

3.2. Rules

- International MEB Robot Competition 60 teams will be invited as competitors in the category of Surface Robot (TCG-1081). In the determination of the competitors, technical information such as "Materials used in robot construction", "Robot construction process", "Language used in robot programming", "Budget used for robot construction" as well as videos showing the mobility of surface robots and photographs taken from different angles showing the construction stages of the robot will be decisive. 17. "Robot Production Reports" will be uploaded to the Production Report addition page and evaluated as specified in the General Application Guide of the International MEB Robot Competition. The video showing

the mobility of the robots should be at least one minute, maximum three minutes. When adding videos and pictures, the criteria in the production report guide should be taken into consideration. The mobility tasks expected to be performed in the video content requested as URL and the evaluation criteria of these tasks will be done as described in the article "5. Technical Specifications, Safety and Restrictions of the Surface Vehicle" of this guide. Team score will be determined according to the Robot Production Report. Teams with the first 60 rankings will be eligible to compete in the 17th International MEB Robot Competition Surface Robot (TCG-1081) category.

- The competitors will start the competition by sorting by lot.
- The competition time is 8 minutes in total. At the end of this time, teams **must** remove their robots from the pool.
- Each team is given 5 minutes for preparation. After 5 minutes, the competition time is started. The competition is started with the start command given by the referee for the **team robot driver who** is ready before the preparation time and **declares** to the referee that he is ready.
- Teams may withdraw from the competition at any time. The decision to withdraw must be notified to the poolside referee by the driver. Tasks performed after the decision to withdraw are not added to the team score and tasks accomplished before the decision are added to the team score.
- **No** points **will be** added to teams that reach the finish line before the expected task completion time (8 min.)**.**
- The competing teams will be **ranked from high to low** according to the team score they earned at the end of the competition. The places of the teams with the same score in the ranking will be determined by the teams' **time to cross the finish line**. The team with the least time to finish the competition will be placed higher in the ranking. In addition, if one of the two teams with the same team score decides to withdraw, the team that decided to withdraw will be placed in the lower place in the ranking. In the ranking between the teams with the same finishing time, the team with less penalty points will be evaluated to be in the top rank. If the

rankings are the same in the evaluation, the ranking of the teams will be determined according to the robot weights. The lighter robot will be placed at the top of the ranking.

- A maximum of two people can be present at the poolside with the team captain and team member.

3.3. Scoring Table

Tasks	Competition Score
360 Degree Rotation Around Obstacle	10 Points
Garbage Collection Task	8 x 5 Points
Tunnel Task	10 Points
Container Handling Task	2 x 15 Points
Zigzag Passing Task	10 Points
Maximum Mission Points	100 Points

3.4.1. Penalty points

- **5 points will be deducted** from the team score of the robots that overturn the 360 Degree Rotation buoy platforms or displace them as a result of impact**.**
- In case of hitting the pontoons in the Zigzag Passing Mission, **4 points will be deducted** from the team score k
- If the Surface Car hits the outer edges of the pool area during the task object collection stage, **5 points will be deducted** from the team score**.** In case of hitting the inner edges of the pool, no penalty points will be applied. (This situation is limited only to the area where the ping pong balls will be picked up. This is not valid in the area to be left).
- If the Surface Car hits the pool area in any way during the rubbish drop-off stage, **5 points will be deducted** from the team score**.**
- In the Tunnelling Task**, 5 points will be deducted** from the team score for hitting platforms, the tunnel or the sides of the pool area.

- Except for the containers to be transported and left in the container transport and drop-off areas, **4 points will be deducted** from the team score that overturns the stacked containers**.**

Note: *Penalty points will be applied only once for each task and penalty points will not be applied for repeated behaviours that require punishment in the same task.*

Total team points = *Mission Points - Penalty Points*

4. DETAILS OF THE COMPETITION AREA AND WORKING AREAS

The competition area will be formed according to the dimensions of the pool and task areas shown in Figure 3.1 and the 50cm wide platform on the edge of the pool will not be climbed. The competition will be managed from outside this area and only the referees will be allowed to go to this area if necessary. 220 VAC energy will be supplied in the competition area. In addition, there will be a control table at the edge of the competition pool where the team whose turn it is to compete will control the surface vehicle. ***220 VAC voltage will be provided to the teams here. The highest DC voltage level that can be used in the designed USV robot will be 50V*** (There is no current and capacity limit). In case of necessity, the pool dimensions or other areas in the competition area may be changed later so as not to affect the general course of the competition.

5. TECHNICAL SPECIFICATIONS, SAFETY AND LIMITATIONS OF THE SURFACE ROBOT

- Competitors are required to make questions about the competition by selecting their categories from the information menu after logging into the robot.meb.gov.tr system. The questions received outside the category messages will remain unanswered and the responsibility for the victimisation that may arise in this case will be entirely on the competition team.
- The largest separation of the surface vehicle will not exceed **25cm**. The control of this situation will be checked by the referees with a box **20cm** wide, **25cm** long and **20cm** high when entering the competition area, and robots that do not fit in the box limited by these dimensions will not be allowed into the competition area.

- The surface vehicle can be controlled **with or without a camera**. During the competition, drivers have the opportunity to see the status of the vehicle in the pool.
- USV robots must be water resistant so that they do not absorb water.
- Before the competition, the safety suitability of the surface robots will be checked by the referees. If deemed appropriate, the team will be able to participate in the competition.
- 220 VAC **will not be allowed** to be transmitted to the vehicle and/or pool for safety reasons**.**
- Robots will be checked by the referees before they are taken to the track, and robots that do not comply with the rules will not be allowed to enter the pool.
- If the robots are branded robots (ready-to-sell products), they will not be allowed to enter the pool by the referees.
- Robot bodies can be made of all materials such as wood, metal, foam, 3D printout, etc. within the school facilities. Please note that if ready-made chassis are used, they will not be taken into the competition area by the referees.
- Ready-made products can only be used in the assembly of the vehicle by considering modular structure (motor driver, control circuit, propeller protector, rudder, etc.).
- RF, Wifi, Bluetooth, IR etc. communication method can be used as control.
- Before the competition, the robots will be subjected to a water tightness test by the referees with the power off. Teams that are found to have taken water during the competition or within the preparation period given to the teams **will be excluded from the competition.**
- Robots that fall over during the competition **will be out of the competition**. However, the points they have received until that moment will determine the competition points**.**

- After the necessary controls are made, the robots can be energised.
- Battery robots **must** have an easy-to-access emergency stop button. This button must cut all power of the vehicle and stop the motors. There is no restriction on the creation of magnetic rotary, push button, etc. stop devices.
- The operating voltage of battery robots should be maximum 50V DC and **should not exceed** this limit.
- Any battery can be used. There is no current and capacity limit.
- Batteries should be transported in a fireproof protection bag. If the battery cannot be removed embedded in the robot, the vehicle must be powered off and transported.
- **It will** never **be** allowed to supply 220 VAC to the vehicle and/or pool**.**
- There must not be any sharp parts and spikes on the body engine propeller parts of the vehicle; unsuitable parts must be blunted or rounded off.
- Motor propellers **must not be** exposed. The propellers must be **insulated** with a protective outer shell**.**
- Due to changes in the pool dimensions, it may cause changes in the track or in the dimensions of the task objects in a way that does not disturb the general structure.
- **Objections** made during the competition due to problems caused by light and sound **will be deemed invalid**. The Competition Organising Committee **has the right to change the rules** when it deems necessary**.**
- **It is forbidden** to use any oil in the hydraulic systems and robot reservoir as it will adversely affect the continuation of the competition in case of leakage.
- Chemicals **should not be** allowed to mix into the pool in any way. Robots **should be designed** with this situation in mind.
- The motors to be used in robots should only be selected from electric motors. Gasoline, diesel or any fossil fuel engine should not be used.

6. CODE OF ETHICS

"It is one of us who comes to us by asking for patience with the truth. It is one of us who labours with intellect and morality and overtakes us."

Ahi EVRAN

- Rude and unkind words and behaviour should be avoided.
- Insults, threats and bad words should be avoided.
- Direct targeting and insulting with social media robots such as e-mail, facebook, skype, messenger, whatsapp, twitter etc. should be avoided.
- In your petitions and objections, attention should be paid to spelling rules and style.
- In the competition area, behaviours such as situations, actions, words, etc. that will affect the functioning and motivation of other teams should not be exhibited.

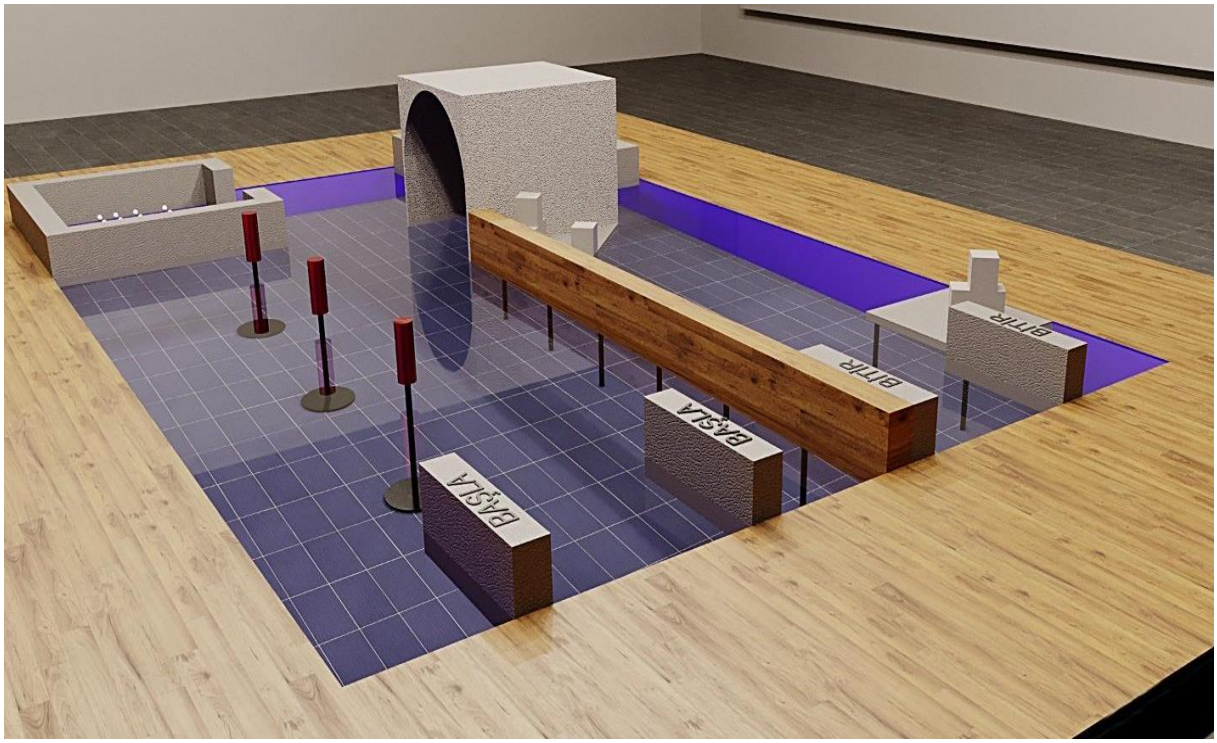
7. WARNINGS FOR COMPETITORS

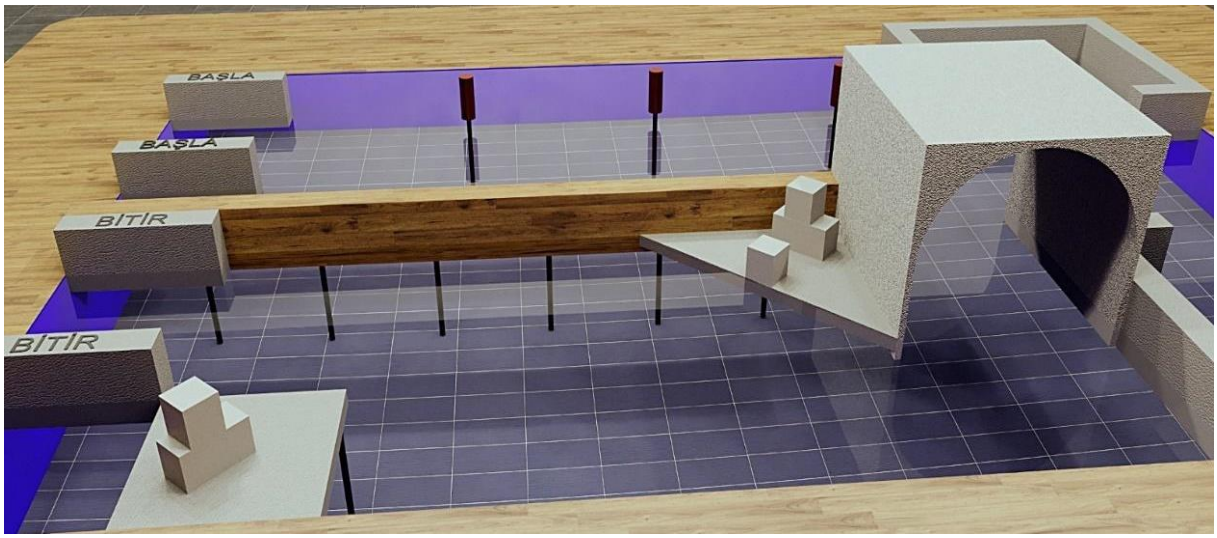
- Only Secondary School students can apply for this category.
- The general rules regarding the competition applications and the USV Robot category are included in the "Application Guide". The Application Guide must be read before making an application.

8. CONTACT US

You can ask your questions about the category via the contact form under the information menu after logging in at robot.meb.gov.tr. Your questions outside the category will remain unanswered.

APPENDIX-1. 3D VISUALS OF THE USV ROBOT TRACK TAKEN FROM DIFFERENT ANGLES

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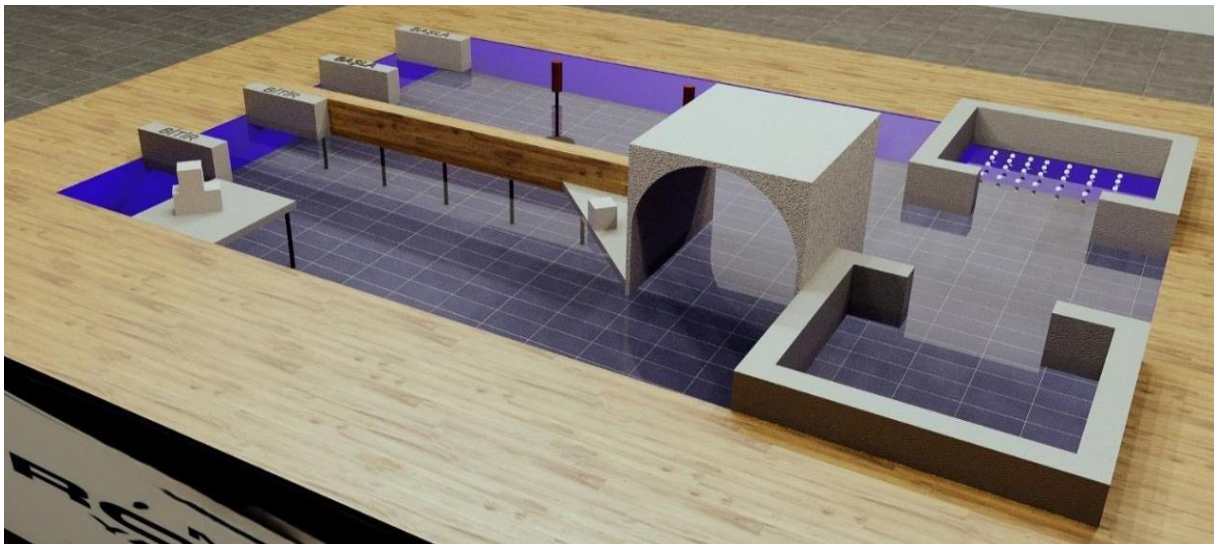

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INTERNATIONAL MEB ROBOT COMPETITION

17th INTERNATIONAL MEB ROBOT COMPETITION

ARCHER (TOZKOPARAN) ROBOT CATEGORY RULES

2025

Education, Technology, Production from Roots to the Future

CONTENTS

ARCHER ROBOT CATEGORY COMPETITION RULES

1. GENERAL INFORMATION ABOUT THE COMPETITION

1.1. Theme

During the Ottoman Empire, there were kemankeş (keman: bow, keş: drawer; kemankeş: bow drawer, i.e. archer) who drew the bow so strongly that sometimes the dust parts of the bow would break off, and for this reason the kemankeş was nicknamed tozkoparan. The bowstring of the bow was made of animal intestines, and the parts where the bowstring was attached to the bow were called "dust". The theme of this competition was inspired by the very good bowmen who were nicknamed tozkoparan.

This competition is carried out with robots created using mechanical, software and sensor technology. The competition will be in the form of following a certain track and shooting from a point on the track to a target and finishing the track as fast as possible. Scoring will be made according to the stages that the robots have passed on the track and the place they hit on the target board.

1.2. Objective

Autonomous dust scooter robots in this category follow the white lines on the black track, detect the coloured area and shoot arrows at the target with a scoring on it, and try to complete the track in the shortest time without any errors by reaching the finish point.

Archer (Tozkoparan) Robot Competition will be held over 4 rounds according to point ranking. At the end of the 1st round and the 2nd round, there will be no elimination. At the end of the 3rd round, elimination will be made according to the 3 round total score ranking formed by adding the points received by the robots in all rounds and the robots that will pass to the next round (Final round) will be determined. Depending on the number of robots participating in the competition, the number of rounds can be changed by the referees. At the end of each round, the total score ranking will be published. In order to advance to the 4th round, it is essential to enter the top 16 in the ranking. At the end of the 4th round, according to the point ranking to be made at the end of the 4th round, the first three ranked robots will win the competition as 1st, 2nd and 3rd respectively. Depending on the number of robots

participating in the competition, the number of robots in the 2nd and 3rd rounds can be changed by technical advisors and referees.

2. ROBOT FEATURES

2.1. Size and Weight Restrictions

There is no restriction on the weight of the robot. However, the largest dimensions of the robots (including the arrow throwing mechanism) must be such that they pass through the starting and ending gates. Regardless of the robot length, the maximum width required for the robot to pass through the door should be within 600 mm and the maximum height should be within 250 mm.

2.2. Autonomous Operation Requirements

The robots will move autonomously and shoot arrows.

2.3. Information About Arrow Shooting Mechanism

The dimensions of the arrow to be given to the competitor by the referee committee at the start of the competition are given in Figure-1 below. An arrow throwing mechanism that can throw an arrow of these dimensions to the scored target board at a certain distance and height will be made by the competitors. This arrow throwing mechanism, which they make as they wish, will be mounted on the robot and will be in a size that can pass through the starting and finishing gates.

3. COMPETITION FORMAT AND EVALUATION CRITERIA

3.1. Application Process

Competition applications are made according to the process and principles specified in the Application Guide. Robots that meet the conditions specified in the Application Guide will be able to participate in the competitions.

3.2. Pre-Screening

There will be no pre-selection in this category

3.3. Competition Stages and Evaluation

Competition Stages:

Stage 1 - Start gate

After the start gate is opened, the robot that takes action and crosses the start line is considered to have started. If the robot does not start within 10 seconds or does not start and does not cross the start line, it is deemed to have used the 1st hand intervention right and receives (-5p). If the robot does not cross the start line in the 60th second, the competition is terminated by the referee and the robot is given "100 points" as base point and "180 seconds" as time. If the robot does not work at the start gate and uses the total of 5 intervention rights there, it is disqualified from that round of the competition in the 6th intervention. In case of manual intervention, if the robot crosses the start line, it is given 1 time (-5p) for that error only at that stage, regardless of the number of interventions (provided that it does not exceed the 5th intervention as stated above). The robot that crosses the first turquoise line completes this stage and gets "20p".

Stage 2 - Erciyes Hill Region

When the robot reaches the Erciyes Hill region, the road line will turn black and there will be a 20mm white area around it. On the return, the road lines will be white again. In case the robot leaves the line in the specified direction of movement and cannot find the road again, the robot will be put back on the track with its front part to the Turquoise line in front of the point where it left; in the meantime, the time continues to run. In case of manual intervention to the robot due to leaving the white road line during the movement on the track, 1 time (-5p) is given for that error only at that stage, regardless of the number of interventions (provided that it does not exceed 5 interventions as stated above). The robot that crosses the second turquoise line receives "20p" by completing this stage.

Phase 3 - Red zone (Shooting zone)

When the robot reaches the red zone, it detects the red zone, lights the red LED and shoots. If the robot shoots before reaching the red zone as an error, even if the arrow finds the target, this shot is considered invalid and a new arrow is given and the competition is continued from the turquoise line number 2. In the meantime, the time is not stopped and the stopwatch continues to count. After the robot shoots, it turns right and leaves the red zone and the red

LED turns off. Failure to switch off the LED is considered as an error and (-5 p) is given. In case of manual intervention to the robot, 1 time (-5p) is given for that error only at that stage, regardless of the number of interventions (provided that it does not exceed 5 interventions as stated above).

Robots that leave the red zone and go out of the line before reaching the 3rd turquoise line, whether they have shot or not, are continued to compete from the turquoise line numbered 3 in front of the previous one, exclusively for this zone. The robot that completes this stage by crossing the third turquoise line gets "20p"

Stage 4 - 90° turns zone

Elimination Round: The robot will only make a 90° turn in this area. If it goes off the line, it will be intervened manually. In case of manual intervention, only 1 time (-5p) is given in total for each intervention (provided that it does not exceed 5 interventions as stated above). The robot that completes this stage by crossing the fourth turquoise line receives "20p".

Final Lap In the final round, there are 5 90° turns in this zone. In case of manual intervention, only 1 time (-5p) is given in total for each intervention provided that it does not exceed 5 interventions as mentioned above). The robot that completes this stage by crossing the fourth turquoise line receives "20p".

Phase 5-Green zone (Bridge zone)

When the robot reaches the green zone, it will climb the bridge with a height of approximately 80 ± 5mm. The green LED will light up when it enters the green zone and will go out when it leaves the zone. In case of manual intervention to the robot, no matter how many times it intervenes manually as an error score, 1 time (-5p) is given only at that stage due to that error (provided that it does not exceed 5 interventions as stated above). The robot is given "20p" if it detects the green zone and the green LED lights up continuously until it leaves the zone and passes the green zone and then follows the white line to the finish gate. The competition is completed and the stopwatch will automatically stop the time.

Evaluation and Scoring System

An arrow will be shot autonomously by each robot. The shot is scored according to the position of the arrow tip on the target face. If the tip of the arrow touches two colours or any

dividing line in two separate scoring zones, the arrow is scored as the higher of the two contacted zones. In addition, a score of "0" is awarded if the arrow travels off the target or hits an empty Velcro area on the target board. The point value of the colours on the target surface is as follows:

Point Values of Colours:

Point Value	Colour
100	Yellow
80	Red
60	Blue
40	Black
20	White

- In the event that the arrow falls out of the mechanism in any way after the start of the competition or the arrow is shot outside the shooting area, this will be considered as an error (-5 Points) and the arrow can be put back into the mechanism by allowing manual intervention.
- If the LED is not illuminated in the zones or if the LED is illuminated in a different colour, it will be considered as an error (-5p). For example: If the Red LED is not illuminated in the Red zone and the Green LED is illuminated, the situations caused by the Red LED not illuminating or the Green LED illuminating (-5p) will be evaluated as an error.
- The time will be kept with the stopwatch on the track. The stopwatch will start counting when the referee presses the start button to start the competition and the start gate opens automatically, when the robot reaches the finish gate, the stopwatch will finish counting with the detection of the sensor and the competition will end.
- Each robot must finish the competition within 180 seconds. If the robot fails to finish the competition within this period, the stopwatch automatically stops counting and the competition is terminated. The competitor is included in the ranking according to the points he / she has received from the stages he / she has passed until that moment.
- Robots must move on the track in the specified direction of movement. From the start of the competition by the referee, 100 points are given to the robots as base points. The

5 stages that the robot has passed within the time until it moves and reaches the finish gate will be evaluated with a total of 100 points (5X20 P). The score obtained as a result of arrow shooting will be added to this score. Since the highest score on the target board is 100 points, the highest total score will be 300 points. Robots that do not come to the competition area and are disqualified will be given "0 points" and 180 seconds as time.

- In case the robot makes a mistake on the track in any way, the competitor is given the right to intervene manually by the referee a total of 5 times until the end of the competition. After the 5th manual intervention, when the robot makes the 6th manual intervention or for any other reason, the competition is terminated. The robots in this situation participate in the ranking according to the score they have received and the maximum finishing time of 180 seconds is accepted as the time they have finished. For each stage; regardless of the number of manual interventions to be made, error points are given only once (-5p) for that error at that stage.
- In case the robot makes a mistake in any way on the competition track, in case of manual intervention and other non-hand intervention (such as LED not lighting, lighting in a different colour, shooting an arrow in the wrong place, not shooting an arrow in the red zone), (-5p) is given as an error point. Only 1 time (-5p) is awarded for the same error in a stage.
- In cases such as the robot not performing any of the 5 stages in the specified direction of movement in any way, reaching the finish point in a short way, the robot not working in the start area, the arrow falling out of the mechanism and the arrow being shot outside the shooting area, the referee is allowed to intervene manually by the referee and the competition is continued from the turquoise line before the stage where the error is made.
- At the end of the first three rounds, the total time and total score of the 3 rounds will be taken into account. The robot that does not participate in any round will be given "0 points" (although the starting score is 100) and "180 sec. time" for that round.
- Entering the track with shoes will be considered as manual intervention and (-5p) penalty points will be applied.

- In case of equality of points, the robot that finishes the track in a shorter time, and if there is equality again, the robot with less error points has priority over the other. In cases where the equality is not broken, the light robot has priority.
- At the end of the 1st and 2nd rounds, there will be no elimination. At the end of the 3rd round, according to the 3 round total score ranking formed by adding the points received by the robots in all rounds, elimination will be made and the robots that will pass to the next round will be determined. Depending on the number of robots participating in the competition, the number of rounds can be changed by the referees.
- At the end of each round, the point standings for that round will be published.
- In order to get to the final round, it is essential to enter the top 16 in the ranking. According to the point ranking to be made at the end of the final round, the first three ranked robots will win the competition as 1st, 2nd and 3rd respectively. Depending on the number of robots participating in the competition, the number of robots that will go to the final round can be changed by the referees.

3.4. Description of Tasks

- According to the ranking determined as a result of the draw, each robot coming to the competition area is weighed and its weight is recorded and this weight is taken into account in case of equality in the results.
- Measurements are taken in the box with a maximum width of 600 mm and a maximum height of 250 mm required for the robot to pass through the door, without taking into account the robot length.
- Which track the Archer robot will compete on is determined by lot at the referee table. As a result of the draw, it is determined which robot will compete on which track (Track 1 or Track 2).
- The robot arriving at the referee's desk is sent to the competition area after the necessary controls (weight and size measurement, etc.) by giving an arrow for shooting.
- The competitor places the arrow on the mechanism on the robot and puts it in the starting area. The competition is started by the referee by giving the start.

- The stopwatch will start counting when the referee presses the start button to start the competition and the start gate opens automatically, and will stop counting when the finish sensor detects the robot when the robot reaches the finish area.
- After entering the track from the starting point, the robot will reach the shooting zone by passing the "Erciyes Hill" without lighting any LEDs.
- When the robot enters the red zone, the Red LED will light and the robot will shoot at the target. When the robot leaves the red zone, the Red LED will turn off.
- 2 identical tracks (A-rink) will be used for the 1st round, 2nd round and 3rd round qualifying competitions.
- In the final round, the identical tracks used in the first three rounds will be converted into B-tracks.
- As a result of the draw, it is determined which robot will compete on which track (Track 1 or Track 2).
- In all rounds, robots will compete individually and ranking will be made according to the score they receive.
- In the elimination round, the robot will reach the exit gate by fulfilling the tasks of "Erciyes Hill", Red area and arrow shooting, 90-degree turn, bridge (green area) climbing, respectively after the exit (Figure 1a).
- In the final round, the robot will reach the exit gate by completing 5 90° turns after the shot (Figure 1b).

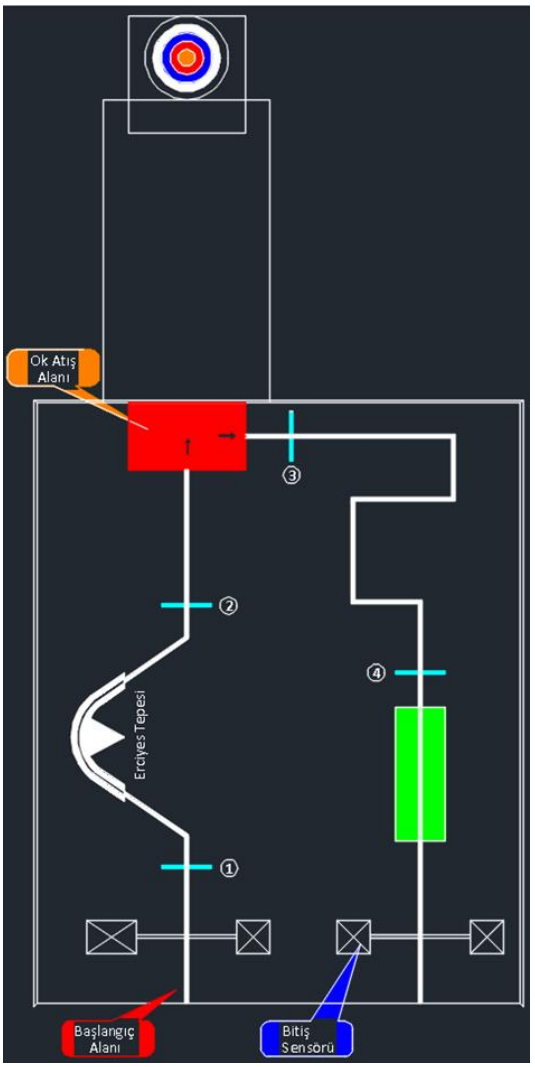


***Figure 1a** - Qualifying Track (Track-A)*

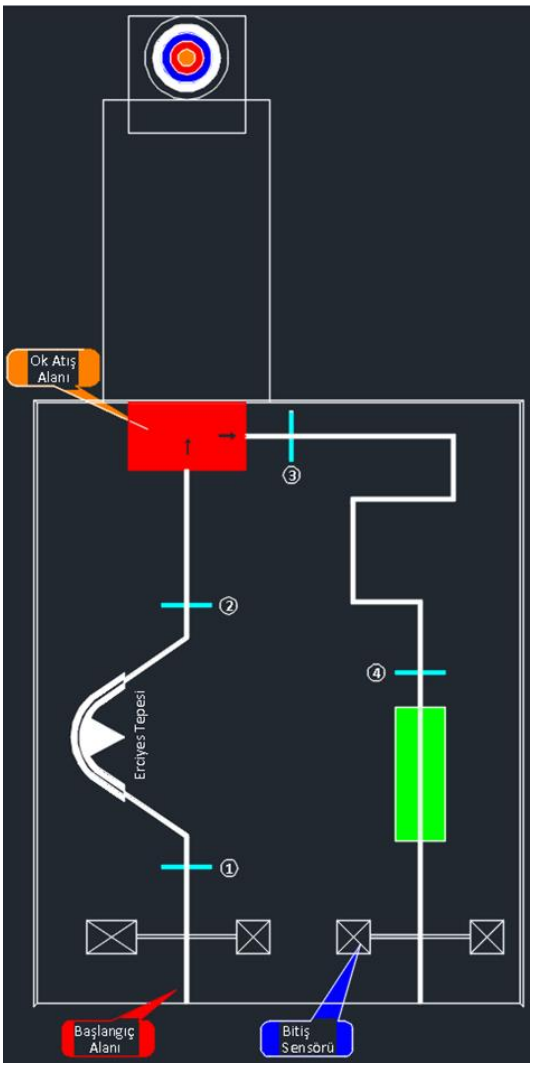


***Figure 1b** - Final Track (Track-B)*

- Only 1 person from each team will be able to intervene in the robot on the competition track.
- Competitors will not enter the track with shoes. The competitor's shoes are removed and the competition is continued from the turquoise line before the stage where the robot made a mistake.
- It is essential to finish the rounds on the same day. While the rounds are in progress, competitors whose turn has not arrived should not leave the competition area. If the rounds are postponed to the next day under compelling circumstances, the referees will announce this via text message, mobile app notification, website announcement or announcement. It is sufficient that the announcement is made by at least one method.

- After the end of the round is announced by the referees; if the competitor requests to compete for a round that he/she could not participate, this will not be taken into account and the robot will receive "0 points" and "180 seconds" from that competition.
- Referees send sms to call the robots. In order to avoid any victimisation regarding this issue, the phone numbers of the two competitors and the mentor teacher must be recorded at the time of registration.
- When the parents' phones are recorded, the message will go to the parents, the competitor will not be informed about this message.
- Robots compete in order. The order in which the robots will compete is determined by lot and announced. Regardless of the order of the competitor, if the round is not over, it is taken into the competition with the decision of the referee. The order in which the robots will compete in groups of 10 is announced by in-field announcement. Until this announcement is made, the competitors must not leave the hall regardless of their ranking. Robots that do not come to the track despite the calls will not be allowed to compete if the round is over. It is the responsibility of the competitor and the mentor teacher to follow the announcements made in the competition area.
- If the competitor is competing in a second category at the same time, he/she is waited until the end of the round at most, and if the round is over, he/she is deemed not to have participated in the round and given "0 points" and "180 seconds".
- No break, maintenance or repair time is given for the robot called to the competition at the time of the competition.
- If there are too many applications for the competition, if it is requested to finish early or if the competitions cannot be completed within the specified time for any reason (health, epidemic, heat, etc.), one more track can be added to the existing two tracks or the number of laps can be reduced.
- No permanent mark or marking may be left or damaged on the road on the competition track.
- Vehicles can use any energy source that will not harm the track and spectators.

- Matte red foil and matte green foil will be used for the coloured areas on the competition track.
- There may be changes in the dimensions of the tracks during the construction phase without disturbing the general structure.
- During the competitions, the objections made due to the illuminated marquee, camera and lighting around the track will be deemed invalid.
- Robots that have attachments other than the start button on the robot that may cause adjustment or that are judged to be adjusted by the referees are disqualified at any stage. Referees are the sole authority on whether or not adjustments have been made.
- The Competition Organising Executive Committee has the right to change the rules when it deems necessary.

3.5. Disqualifications

- The robot cannot leave permanent marks on the track or damage the track. If the judges decide that the robot has damaged the track, the robot will be removed from the track and the competitor will be disqualified. The referee committee is authorised to decide on the cleanliness, layout or suitability of the maze for the competition.
- Robots that are too big to pass through the start and finish gates are disqualified.
- In case of remote access to robots, robots are disqualified.
- Robots that do not come to the track despite the calls will not compete. It is the competitor's responsibility to follow the announcements and announcements.

3.6. Safety Precautions

- There will be no competitors in the arrow shooting area.
- When the floor has just been cleaned, the competitor must wait for the floor to dry before entering the track.
- Technical advisor and referee warnings must be taken into consideration.

4. COMPETITION AREA AND EQUIPMENT USED

4.1. Information About Arrow

The arrow consists of 4 parts. Figure-2 These parts consisted of a wooden body, a PLA tip printed on a 3D printer, polyethylene foam and female Velcro tape. The arrow body is made of wood in the form of a round slat with a diameter of 9 mm and a length of 180 mm. The tip is 28 mm in diameter, 14.75 mm long, conical shaped, printed from PLA material on a 3D printer. Polyethylene foam with a diameter of 28-20.5 mm and a thickness of 12 mm was glued to the tip of the arrow to provide flexibility. A 36 mm diameter female Velcro tape (the target board will be the male part) was glued on the polythene foam. For better adhesion of the arrow tip to the target surface, the ends of the Velcro tape were attached to the holes drilled on the conical shaped PLA material with string. The weight of the arrow is 8 ± 0.5 gr and the arrow will be given to the competitor by the referee committee before the competition starts and placed in the arrow shooting mechanism of the robot. One arrow will be shot autonomously by each robot. When the arrow sticks to the target, the highest score it touches will be scored. If the arrow does not stick to the target, the shooting score will be determined by the camera.

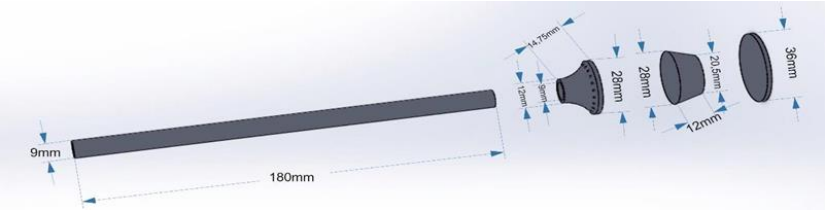


Figure-2 *Arrow Dimensions*

4.2. Information About Target Board

The target board will be made of 700x700 mm chipboard and 12 mm thick polyethylene foam will be adhered on the chipboard to provide flexibility on the surface. The foam surface will be covered with Velcro tape (male part). The target board will be at a height of 400 mm from the ground for better arrow shooting and for the spectators to watch. For this purpose, a stand will be made on the target board. The target surface to be scored on the target board is a surface with a diameter of 600 mm and 5 different coloured circles drawn inside each other. These colours are yellow, red, blue, black and white from the centre outwards.

The size of the target face is measured using the diameter of 5 circles, each enclosing a scoring zone. The tolerance of each diameter measurement should not exceed ±3 mm for the zones (Figure-3).

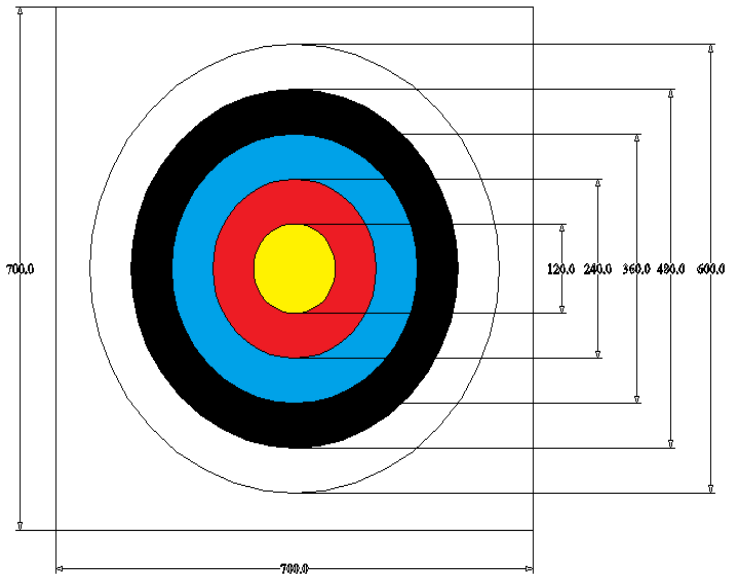


Figure-3- *Target Board and Target Face Dimensions*

4.3. Qualifying Track (Track-A)

Information about the runway:

- The dimensions of the qualifying runway, Runway-A, and the roads are given in Annex-1 (Figure-4).
- The roads on the platform are white lines on a matt black dota background. Only the road line on Erciyes Hill is black.
- The platform consists of two parts: 2900 mm x 3600 mm, 18 mm thick chipboard, 2900x3100 mm in size, made of 5 mm thick black matt dacota material and 1800 x 1000 mm, on which the 700 x 700 target board is located. For the race start area where the start gate is located and the race finish area where the sensors to end the competition are located, 2 pieces of 600 x 500 mm dacota material were also used. The joints of the parts forming the road were covered with black matt foil. The chipboard used in the first part of the platform was bordered with a thickness of 18 mm and a height of 68 mm (the height on the competition floor will be 50 mm) on three sides except for the start

and end sides. Together with the borders, the size of the first part is 2936x3618 mm. The total area covered by the platform is 5418x2936 mm.

- The road lines on the platform are made of 20±2 mm thick white matt foil.
- The entry and exit angles to Erciyes Hill on Dakota ground are 125°. After the robot enters the track from the starting area, it will move by following white lines on a black background. ***When reaching the top point, the road line will turn black and there will be a 20 mm white area around it.*** On the way back, the path lines will be white again.
- There are 4 turquoise coloured lines on the competition tracks. These lines; When the robot goes out of the line, if the competitor needs manual intervention, the robot is placed with its front side to the turquoise line it last passed. When the competitor intervenes the robot manually, the robot is placed in the competition area with its front side to the turquoise line it last left, wherever it is.
- Dimensions of the coloured zones: The dimensions of the red zone are 700 mm x 400 mm, as shown in Figure-3. The dimensions of the green coloured zone (Bridge) are: length 800 mm, width 300 mm and maximum height 80 mm.
- Two of the competition runways will be built and the runways will be prepared to be identical. In the qualifying phase; two pieces of the A runway will be prepared. These tracks will be named as Track 1 and Track 2. When the qualifying phase is finalised and the 'Final' phase is started, both of these runways will be converted into runway B. The total area of the two circuits is 7418x7872 mm, including the utilisation areas (1000 mm). There is one white coloured start gate for each track. When the start button is pressed by the referee to start the competition, the start gate will open automatically and the stopwatch will start at the same time. When the start gate is opened, the height of the upper part of the door mechanism is 250 mm from the ground, the height of the gap from the ground to the bottom of the door before opening is 15 mm, and the width of the door is 600±3 mm.
- The end sensor is located in the centre of the towers at the end door, in the form of a mutual transceiver and 15 mm above the ground.

- The target board is directly opposite the red zone where the robot will shoot an arrow. The distance of the target board to the outer edge of the track is 1600±5 mm. When the border (18 mm thick chipboard) surrounding three sides of the track is taken into account, the target board is 1618 ± 5 mm from the end of the red zone.
- The bottom point of the target board is 400 ± 3 mm above the ground.

4.4. Final Circuit (Runway-B)

- The dimensions of the final track, Runway-B, and the roads are given in Annex-2 (Figure-5).
- In the final round; unlike the qualifying round, after the robot shoots in the red zone and turns right, it has to pass through 5 90° turn paths before the bridge.

5. CONTACT US

The general rules regarding the competition applications and the Labyrinth Master Category are included in the "Application Guide". The Application Guide must be read before making an application.

Competitors should ask their questions by selecting their categories from the information menu after logging into the robot.meb.gov.tr system. Questions other than category messages will not be answered and no responsibility will be accepted.

ANNEX-1 QUALIFYING TRACK (TRACK -A)

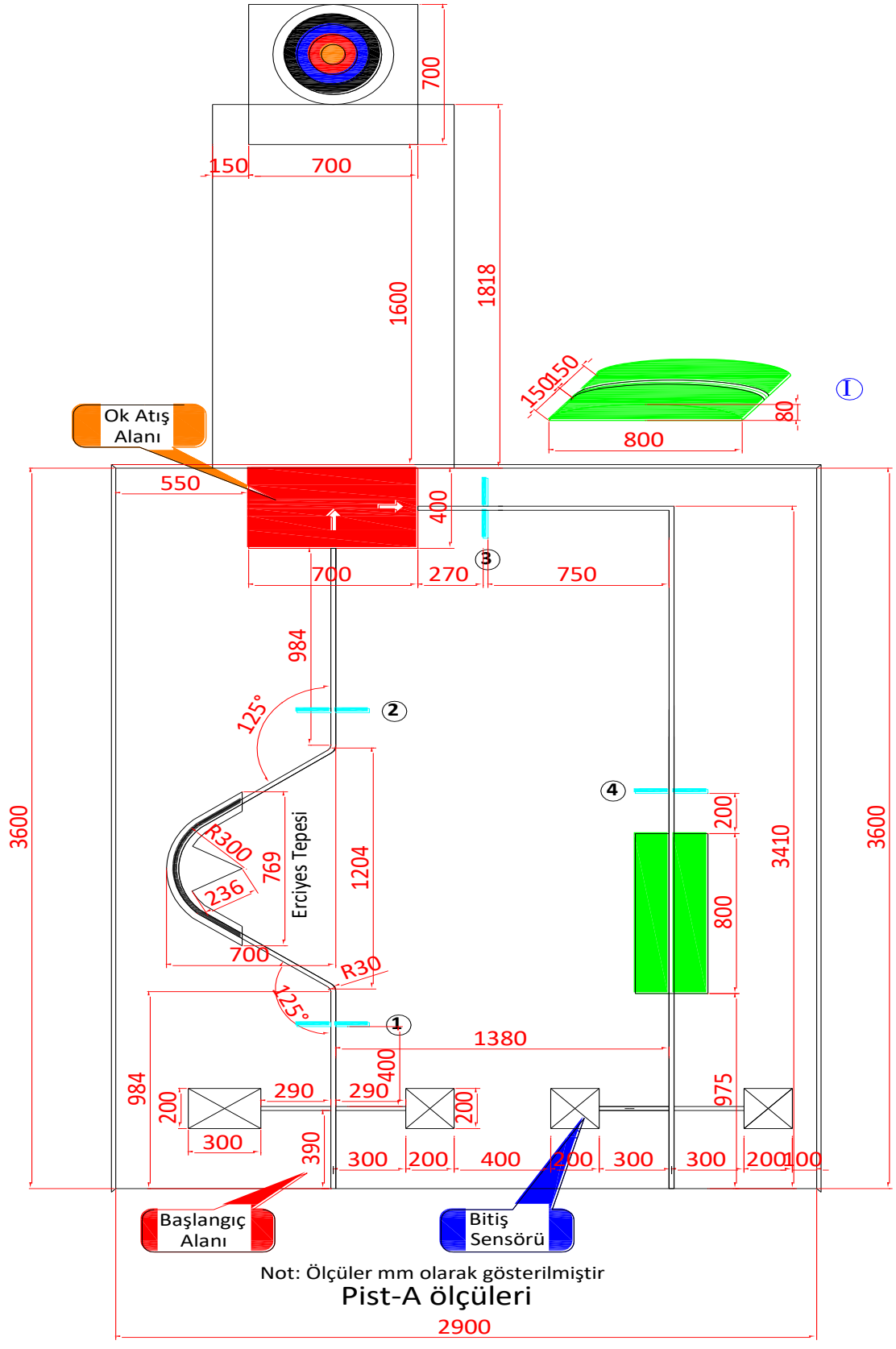
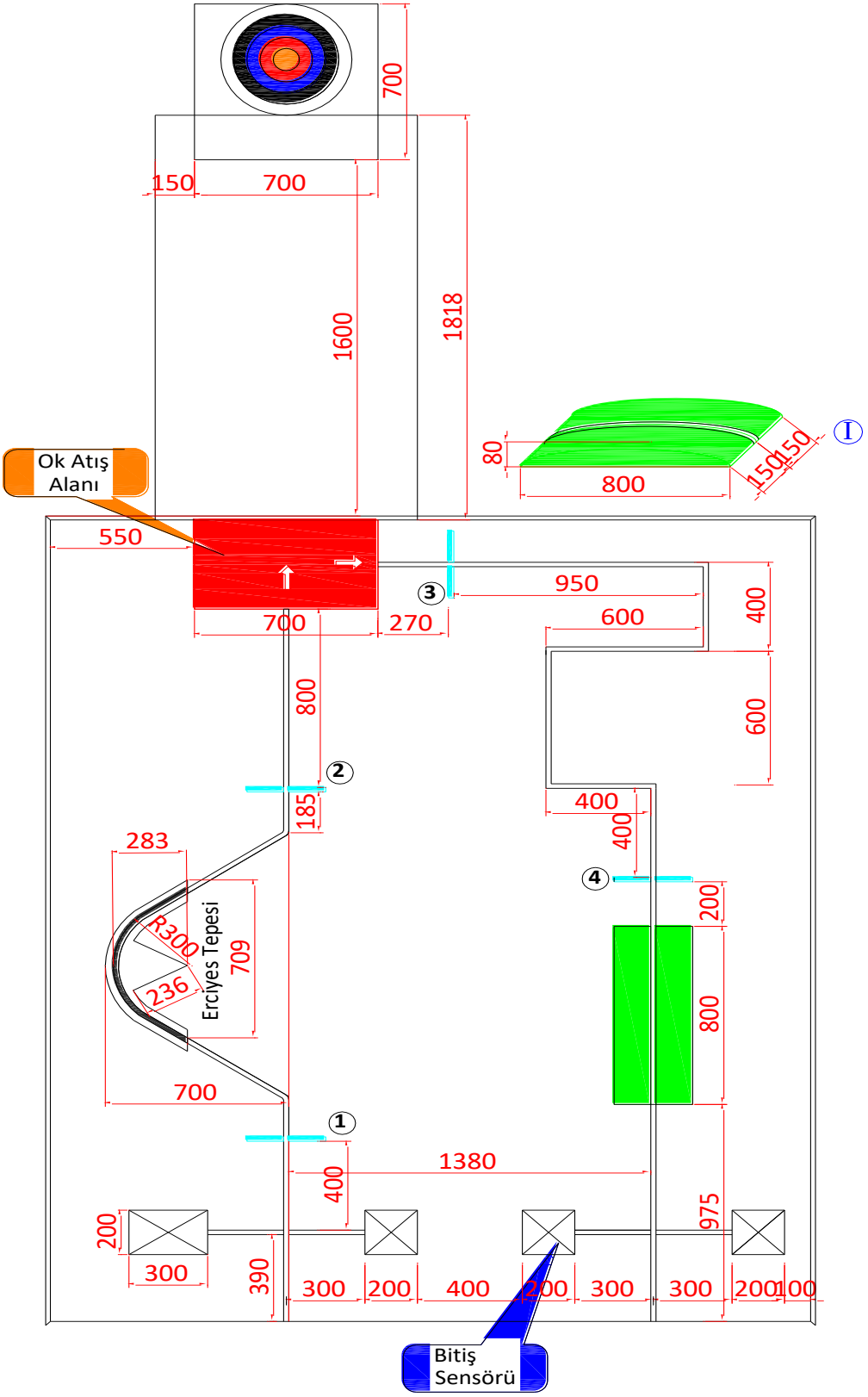


Figure 4- *Qualifying Track (Track -A)*

ANNEX-2 FINAL TRACK (TRACK -A)



Not: Ölçüler mm olarak gösterilmiştir

Pist-B ölçüleri

***Figure 5** - Final Runway (Runway -B)*

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INTERNATIONAL MEB ROBOT COMPETITION

17th INTERNATIONAL MEB ROBOT COMPETITION

INDUSTRIAL ROBOTIC ARM CATEGORY RULES

2025

Education, Technology, Production from Roots to the Future

CONTENT

INDUSTRIAL ROBOTIC ARM

1. INTRODUCTION

1.1. Objective:

Robotic arms are automatic systems that perform the works determined according to their purposes at the desired times and with minimum error. Today, robotic arms are used to save manpower, minimise human errors and prevent loss of time. This competition category is designed to develop programming skills, to follow the developing technology, to provide the vision of using the gains obtained in other fields and to make the process fun.

In the robotic arm competition category, the aim is to autonomously place objects of different colours in a fixed place according to their colours into boxes in a fixed place by means of a robotic arm. The data received with the help of sensors should be processed by microcontrollers and the robotic arm should be directed to the correct target. The objects to be transported are coloured flex cubes with a size of 40 mm and a weight of approximately 27 g (±10%).

High school and university students can apply for this category.

2. ROBOT SPECIFICATION

In order for robots to compete in this category;

1. Robots should be placed comfortably in the frame on the 250 mm x 250 mm robot platform floor.
2. There is no height or weight limit for robots. Design should be made taking into account the dimensions of the work area. Robots that cannot be placed in the work area will be disqualified.
3. There is no limitation on the number of cameras to be used.
4. There is no limitation on the controller or control card to be used. The robots' control card includes infrared, bluetooth, radio signals, wifi, etc. There is no harm in having electronic devices that provide remote control. Remote access will never be allowed during the competition. If its use is detected, the contestant will be disqualified.

5. Likewise, there is no limitation for the number of engines and the engine features to be used.

6. The robotic arm to be brought by the competitor must be in the articulated robot arm category with at least 4 degrees of freedom. Optionally, the degrees of freedom can be increased. Different types of robot arms (Cartesian, Cylindrical, Spherical, Sled, Scara and Parallel etc.) will not be accepted. Figure 8 shows an example image of an articulated type robotic arm.

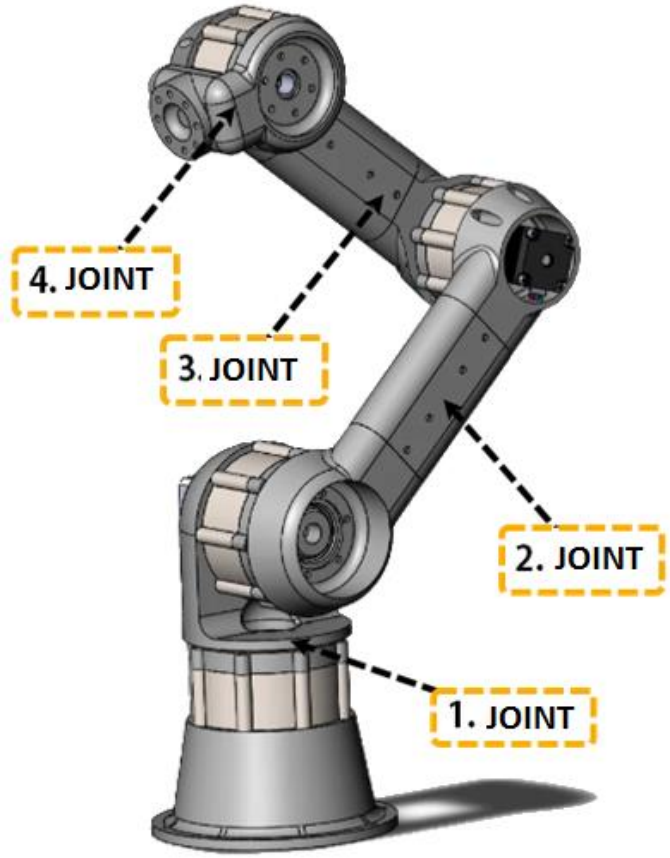


Figure 1: *Robotic arm sample*

7. Hydraulic, pneumatic or electrical actuators can be used on the robotic arm.

8. The axes of the robotic arm must have the ability to move independently of each other. Opening and closing the gripper (Gripper) in the robotic arm is not a degree of freedom. This issue will be taken into account in the robot's degrees of freedom. Axis movements of the robotic arm will be checked by the referee board before the

competition. (All axes must be in working order; participants who cannot prove this condition will not be accepted into the competition.)

9. In order for the robotic arm to perform tasks, control operations will not be manual (wired) or remote (wireless), but will be autonomous. After the competition is started by the referee, only the starting start will be given by computer or remote control, and these devices will not be interfered with during the competition.

3. COMPETITION FORMAT AND EVOLUATION

3.1. Robot Production Report:

It is the report documenting that the robot to be participated in the competition by the applying student and the counsellor is designed by them and the production process. The report will be uploaded to the system by selecting the relevant robot name from the production reports section under the management menu after entering the username and password information to robot.meb.gov.tr.

Report as content:

- Materials used in the construction of the robot,
- Explaining the construction process of the robot,
- The language used in programming the robot,
- The total cost of the robot,
- It should include photos of the robot's production stage, its final form, the name of the robot and the logo of the school.

3.2. Qualifing competition

1. The rankings of the robots during the pre-competition test and during the competition are determined by computer draw.
2. The contestant will place the robot wherever he/she wishes, provided that it is within the robot placement area specified in the guide, and will not be able to change the location of the robot or contact the robot in any way after the competition starts.

3. The competition ends with the referee saying "The competition has started." After the statement, the game will start by pressing the stopwatch (simultaneously with the referee, the contestant gives the robot the start command).
4. After the competition starts, the robots must complete the tasks (Put all the objects in the specified places) within 5 minutes. If the competition is optionally terminated before the tasks are completed, no time points can be received. If the tasks are completed before the maximum competition time of 5 minutes, the competition ends when the referee stops the stopwatch. If the competition duration exceeds 5 minutes, the referee notifies the contestant that the time is over and the points obtained up to that point are recorded for the robot.
5. If the robot does not move within 1 minute after the competition starts, it will fail and will not receive any points.
6. The robots' completion time in the competition will be recorded by the referees.
7. The objects will be placed in different combinations by the referees in a 3x3 matrix-shaped layout before each competitor. 1 object place in 9 fields will remain empty.
8. Objects cannot be picked up more than once by the robotic arm at the same time. Each object must be picked up separately and left in its place.
9. It is essential for robots to drop objects at the correct targets. 20 reward points will be awarded for each object taken from the starting area and 30 reward points if placed in the box of the same color. If the object is placed in a box of a different color, 15 reward points will be given. The arrangement of the objects is given as a representation, and the placement of colored cubes will be done randomly before each contestant during the competition. The robot arm is placed as a representation. Figure 2 and Figure 3 show the robotic arm platform.

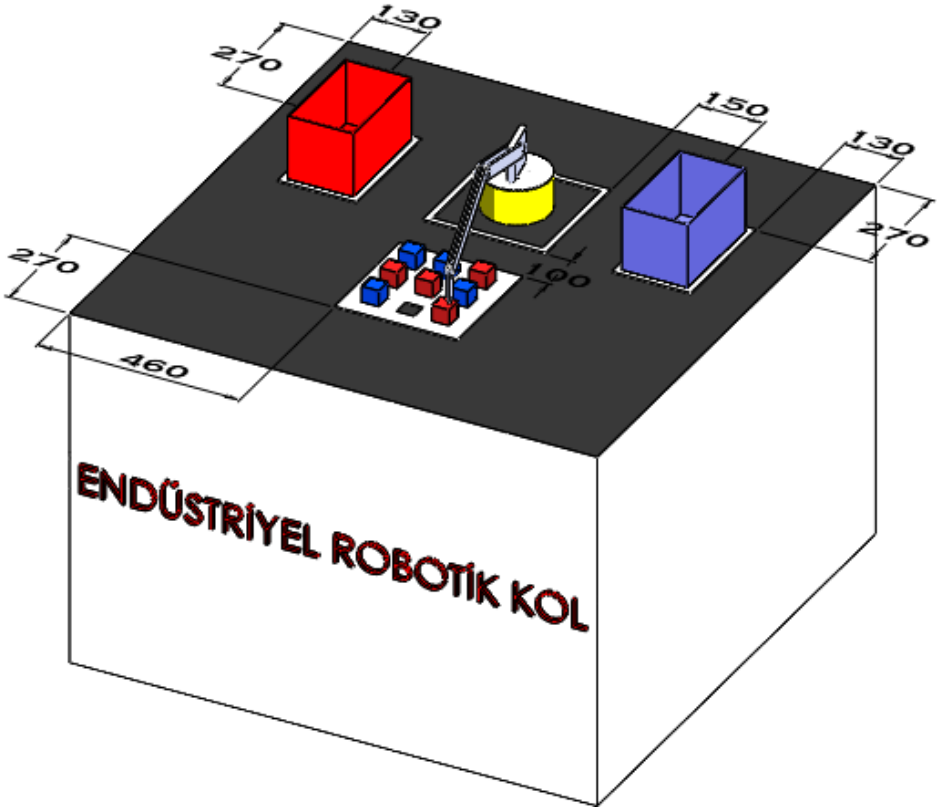


Figure 2: *Platform- isometric view*

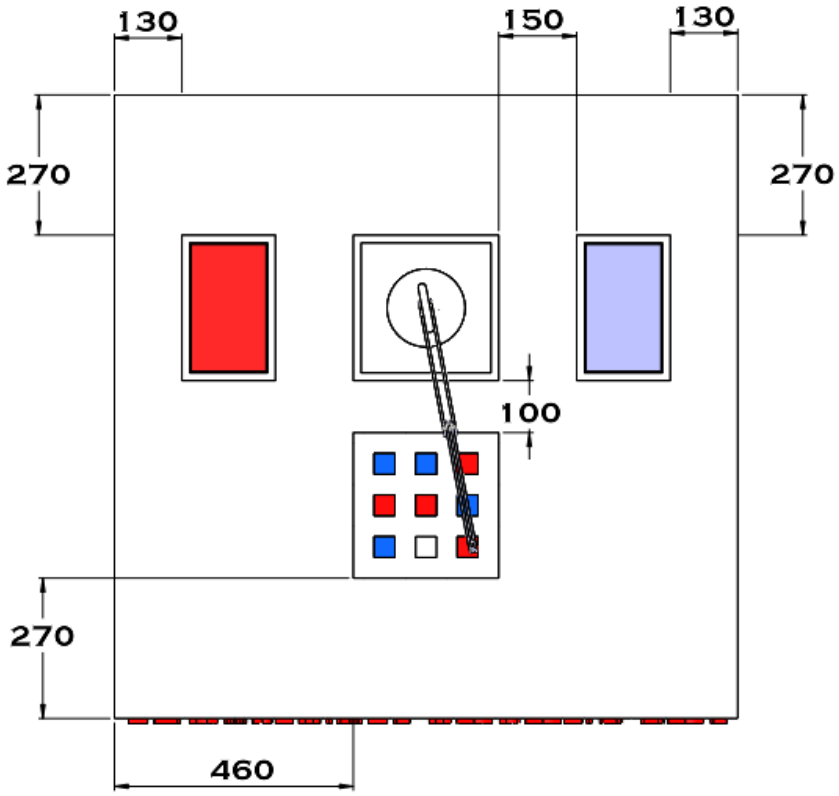


Figure 3: *Platform Top view*

10. If the robot drops or releases the object at any stage of the competition, the competition will continue and there will be no outside intervention. If the robot is programmed to make its own decision, it can pick up the object again and drop it at the target. In this case, there will be no loss of points.
11. The time the competition is completed will be calculated according to the formula (300- completion time (sec)) /2 and will be added as reward points.
12. At the end of the ranking competitions, the robots will be ranked according to their total points after completing the competition, and the team and robot with the highest score will be declared the winner.
13. At the end of the competition, if the contestants' scores are equal, the team with the lowest robot weight will be placed at the top.

4. COMPETITION AREA

The general view of the competition platform designed for the industrial robotic arm category is given in Figure 4.

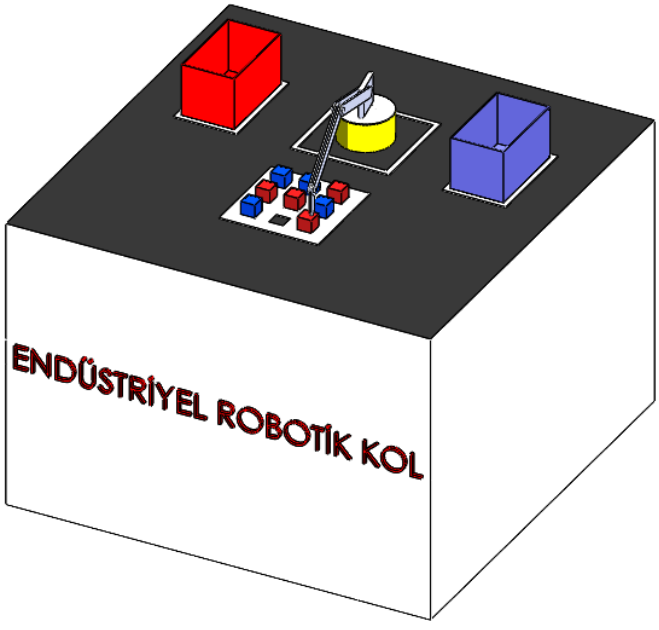


Figure 4: *Platform- isometric view*

The floor on which the robotic arm and objects will be placed is made of black matte chipboard with dimensions of 1200 mm x 1200 mm and a thickness of 18 mm. Figure 5 shows the competition platform floor dimensions.

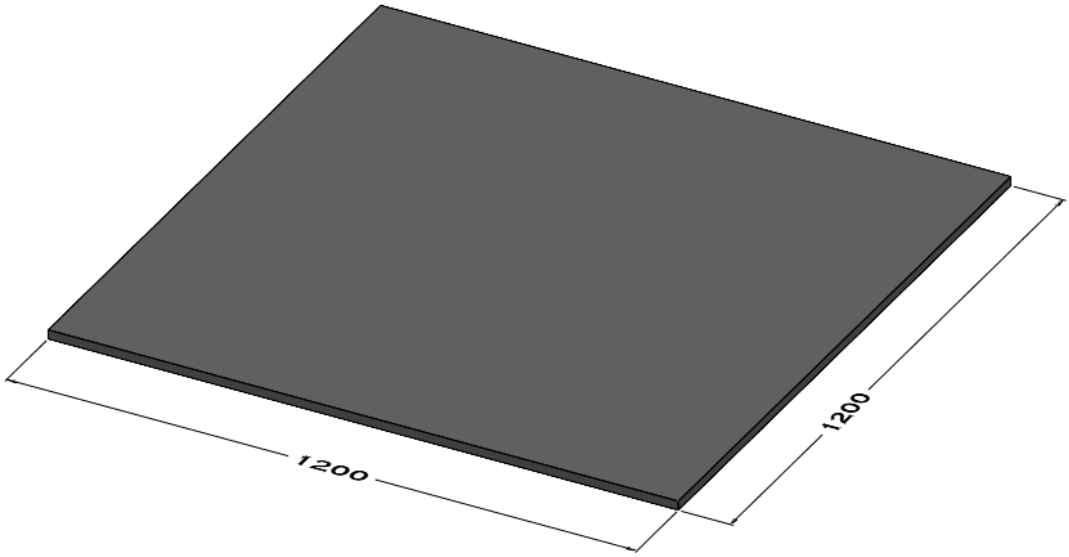
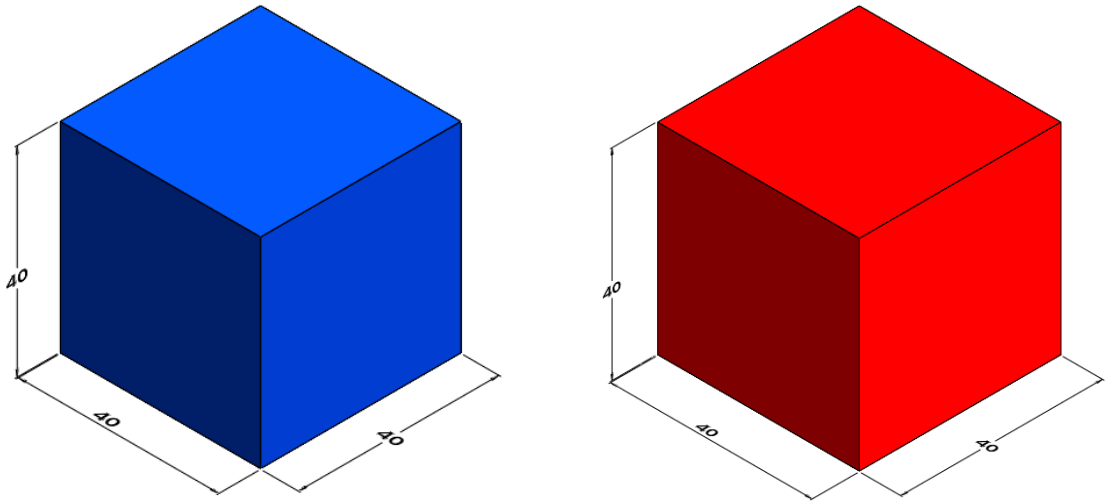


Figure 5: *Platform ground dimensions*

The cube blocks that the robotic arm will carry are made of 40 mm sized plexi sheets, which are durable and sturdy as well as lightweight, in blue and red colors. Figure 6 shows the images of the objects.



(a) **(b)**

Figure 6: Object dimensions (a-Blue cube, b-Red cube)

2.8 mm thick white plexiglass sheet will be used for the area where the cube blocks will be located on the competition floor. Figure 7 shows the visual containing the flexible sheet dimensions.

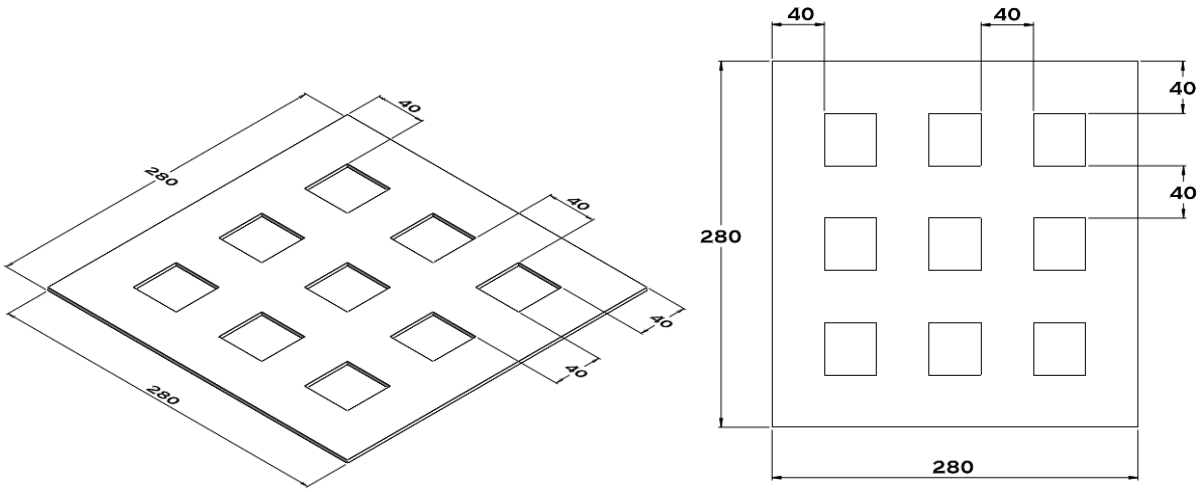


Figure 7: *Plate dimensions (a-isometric b-Top view)*

The boxes into which the robotic arm will place the objects it carries are made of the same colored plexi material as the objects to be carried. The boxes will be placed on the competition platform in the area limited by the white plexi sheets shown in Figure 8.

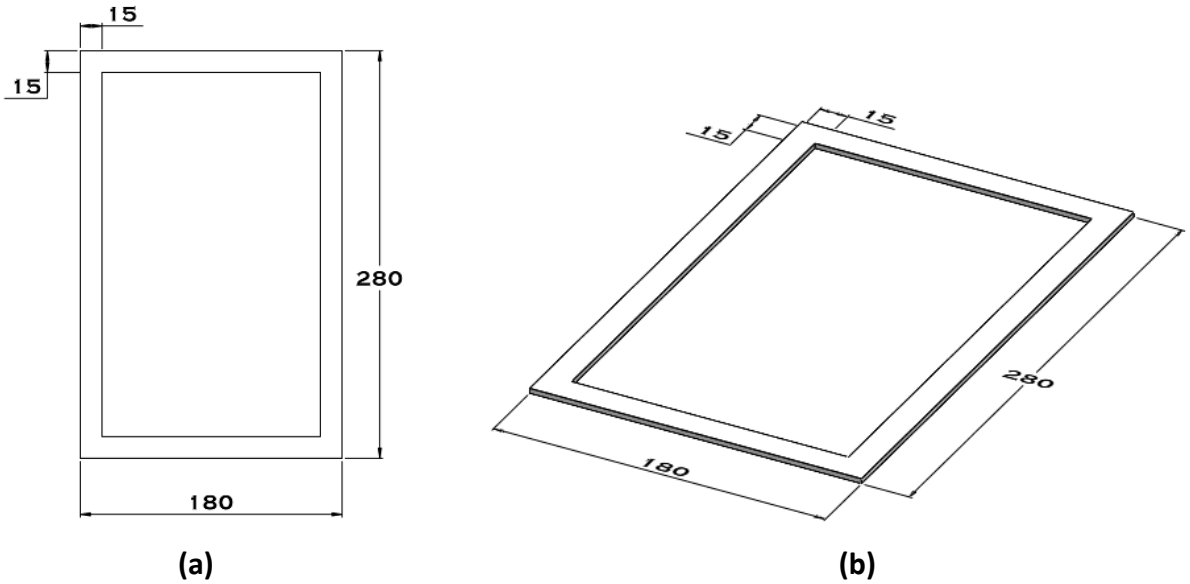


Figure 8: *Dimensions of flexible sheet for boxes (a-isometric b-top view)*

Boxes are manufactured in dimensions of 250x150x150 mm. Figure 9 shows the visual containing the dimensions of the flex boxes.

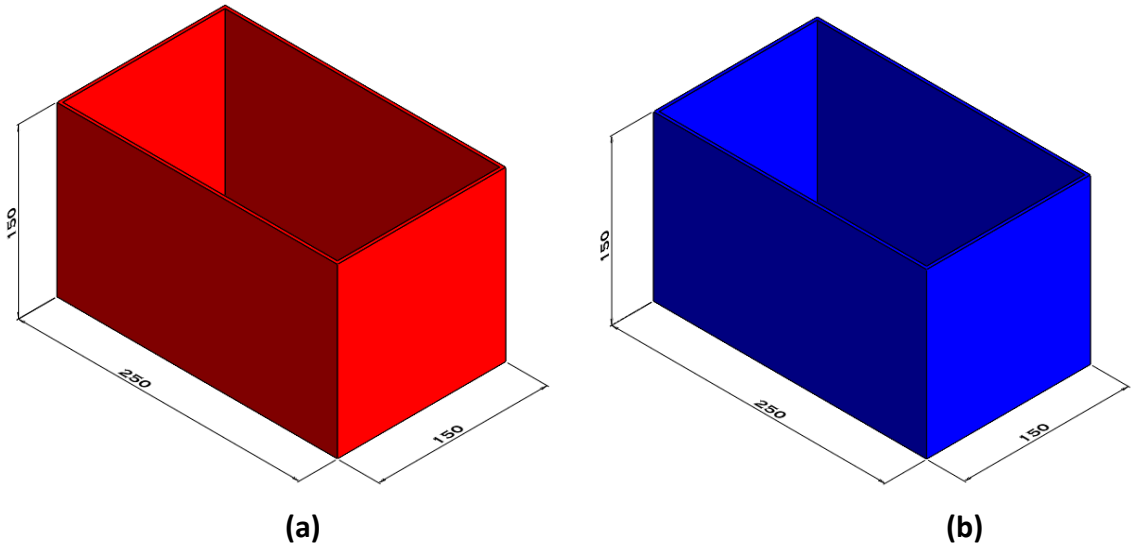


Figure 9: *Box dimensions (a-Red box b-Blue box)*

The area where the robotic arm will be placed during the competition is limited with 2.8 mm thick white plexi material. The robotic arm must be designed in such a way that it does not protrude beyond this area. Figure 10 shows the dimensions of the robot placement area.

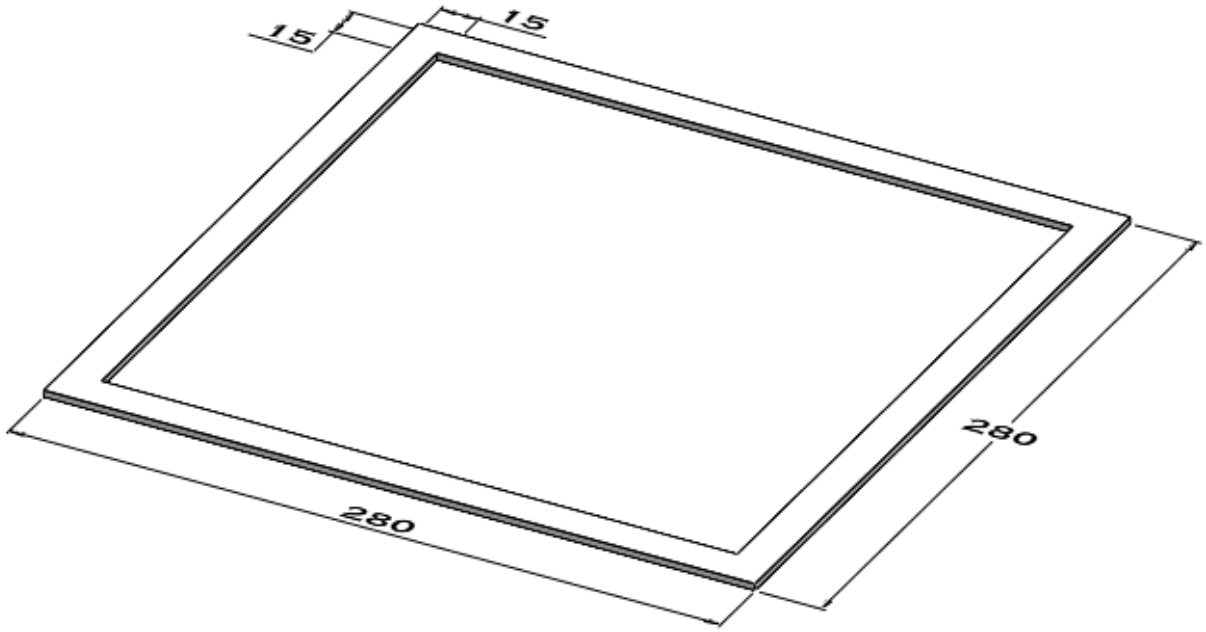


Figure 10: *Robot yerleşim yeri ölçüleri*

The competition area will be supplied with main voltage (220V 50Hz). Competitors who need lower energy requirements can bring the necessary equipment with them.

5. OTHER RULES AND WARNINGS

1. Competitors called to the work area will not be given additional time to charge their batteries.
2. No permanent trace or mark may be left or damaged in the work area. Robots that damage the track are disqualified.
3. Robots can use an energy source such as a battery or battery group. Liquid or flammable energy sources cannot be used.
4. Competitors cannot make physical changes on robots if there are competitions with more than one round, software changes are possible. In all physical appearance changes such as changing the robot body, the robot will be disqualified.
5. The robot will be disqualified if the square code affixed on the registration desk during the competitions is removed, replaced and the square code is damaged.
6. Robots that do not match the competitor robot photos at the referee table are disqualified.
7. When the electronic circuit elements need to be replaced, the same type of elements can be replaced in the same place. The QR code must not be damaged during the replacement of the elements. Otherwise, the robot is disqualified.
8. The QR code must be affixed to the robot body. It should not be pasted on removable materials. In such cases, the referee disqualifies the robot in case of a problem with the robot.
9. During the competitions, objections made due to illuminated marquees, cameras, cameras and lighting around the track will be deemed invalid.
10. Changes can be made to the dimensions of the robot working area during the construction phase without disturbing the general structure.
11. The Competition Organising Committee has the right to make changes in the guide when it deems necessary.

12. Competitors are required to send their questions by selecting the relevant categories from the information menu after logging into the robot.meb.gov.tr system. Questions received outside the category messages will remain unanswered and those responsible for the category will not be responsible for these questions.

5.1. Test Stage

1. According to the number of competitors whose applications are accepted, Industrial Robotic Arms will be allowed to test in the competition area on the first day.
2. Each team will be given equal time during the test phase. The time may vary according to the number of participating robots. This time will be given at least 10 minutes.
3. Robots that damage the track during the test phase or during the competition will be disqualified.

5.2. Sample Scenario:

The robotic arm named **Robot1** has completed all tasks in 140 seconds without error. The total score will be 480.

Another robotic arm named **Robot2** picked up 7 objects and failed to pick up 1 of them (in this case 7x20=**140** reward points). It left 3 of the objects in the right places (In this case, it will get 3x30=**90** reward points). Left 3 of the objects in the wrong place (in this case 3x15=**45** reward points). He/she dropped 1 of the objects on the way (In this case, he/she will not get points). He performed all these operations in a total time of 120 seconds (In this case, he will receive (300-120) / 2=**90** reward points). The total score will be 365.

Table 1: *Sample score table*

Robot Name	Pick the object 20 P.								N.A. Point	Drop the object 30 p.								N.B. Point	Time	TOTAL SCORE
	20	20	20	20	20	20	20	20	160	30	30	30	30	30	30	30	30	240	TIME	
										15	15	15	15	15	15	15	15		SCORE	
Robot1	✓	✓	✓	✓	✓	✓	✓	✓	160	✓	✓	✓	✓	✓	✓	✓	✓	240	140	480
																		---	80	
Robot2	✓	✓	✓	✓	✓	✓	✓	--	140	✓		✓		✓		X	--	90	120	365
											✓		✓		✓	X	--	45	90	

6. CONTACT

Competition applications and general rules regarding the Industrial Robotic Arm category are included in the "Application Guide". The Application Guide must be read before applying.

You can ask your questions about the category via the contact form under the information menu after logging in at robot.meb.gov.tr. Your questions outside the category will remain unanswered.

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17th INTERNATIONAL MEB ROBOT COMPETITION

LINE FOLLOWER-DRAG ROBOT CATEGORIES RULES

2025

Education, Technology, Production from Roots to the Future

CONTENTS

CATEGORY RULES

1. INTRODUCTION

1.1. Objective

The Line-Following Drag Robot Category offers a dynamic platform designed to develop robot technologies and engineering skills. In this category, robots autonomously follow a white line on a black background and try to complete the track in the shortest time and with the least error. The aim of the competition is to develop participants' knowledge and skills in sensor technology, motor control, path-finding algorithms and autonomous system design. In this process, participants have the opportunity to test their technical competences by combining speed, accuracy and stability.

The Line Follower Drag Category offers a rich learning environment, especially in terms of sensor integration and control algorithms. Infrared or optical sensors are used for robots to accurately detect the line, and the data received from these sensors are processed by motor drive circuits to precisely control the movement of the robot. Advanced mechanisms such as PID control algorithms used in this process provide competitors with the experience of providing precise and stable motion control. In addition, since robots need to perform in a balanced performance between speed and accuracy, competitors learn to optimise algorithm design.

The technological importance of this category is that it contributes to a wide range of applications from autonomous vehicles to industrial robots. The path-finding algorithms underlying fast line-following robots are frequently used in automated transport systems used in the logistics industry and autonomous production lines in factories. In addition, these robots have an important role in the development of intelligent transport systems. Thanks to this competition, participants learn the basic principles of such systems in practice, reinforcing their theoretical knowledge and producing solutions to engineering problems they may encounter in real life.

The Line Follower Drag Category not only offers competitors a competition experience, but also provides an educational environment that prepares them for the technologies of the

future. The knowledge and skills gained in this category make significant contributions not only to the competition process, but also to the advances in the field of robotics, artificial intelligence and autonomous systems. Thus, the participants are able to direct their engineering careers by contributing to their personal development and shed light on the future of technology.

2. ROBOT SPECIFICATION

2.1. Dimensions and Weight Limitations

2.1.1.Maximum weight and dimensions of robot:

In order for robots to compete in this category;

- Robots must fit comfortably in a 150 x 250 mm box.
- The height of the robots cannot exceed 50 mm.
- There is no weight limit for robots.

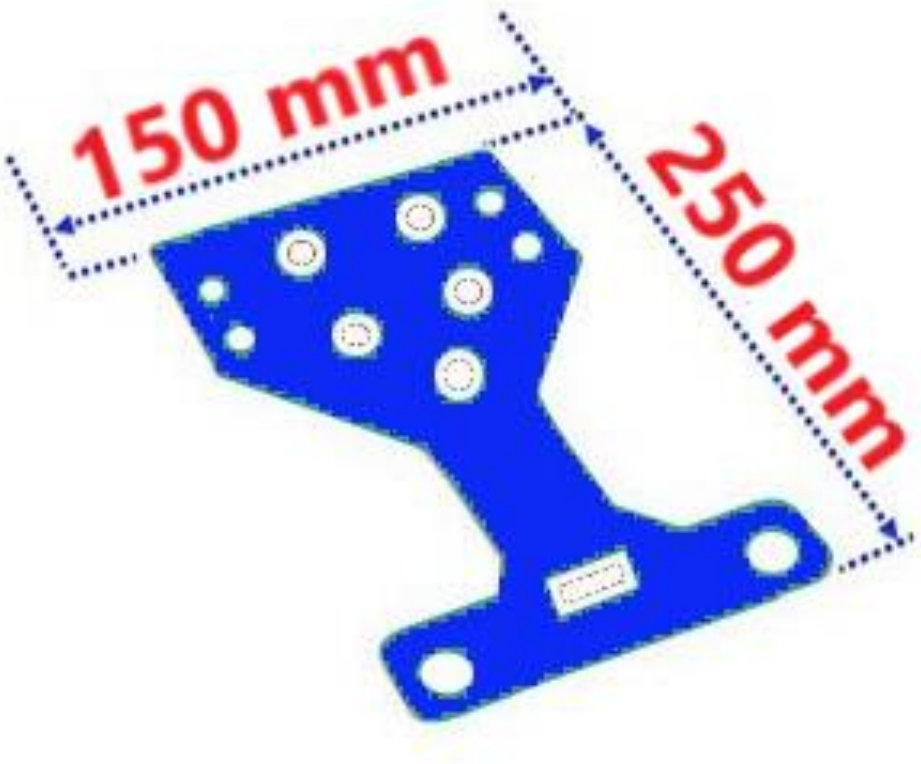

Figure 1 *Robot dimensions*

3. GAME FORMAT AND EVOLUATION

3.1. Application

Competition applications are made according to the process and principles specified in the Application Guide. Robots that meet the conditions specified in the Application Guide will be able to participate in the competitions.

3.1.1.Robot production report

It is the report documenting that the robot to be participated in the competition by the applying student and the counsellor is designed by them and the production process. The report will be uploaded to the system by selecting the relevant robot name from the production reports section under the management menu after entering the username and password information to robot.meb.gov.tr

Report content:

- Materials used in the construction of the robot,
- Explaining the construction process of the robot,
- The language used in programming the robot,
- The total cost of the robot,
- It should include photos of the robot's production stage, its final form, the robot name and the school's logo.

3.2. Racing stages and Evaluation

3.2.1.Racing Stages:

Qualifying Races

- Robots compete in groups of 4.
- Groups and track information are determined by computer draw.
- As a result of the draw, it is determined which robot will compete on which track (1st track, 2nd track, 3rd track, 4th track).
- The competition starts with the opening of the automatic door and ends with the robots crossing the finish line.

- As a result of the ranking competitions, all robots are ranked according to the times they took in the competition and the 64 robots with the best time qualify for the qualifying competitions.

Elimination races

- The 64 robots from the ranking competitions are divided into 4 bags according to the time ranking. Competition groups of 4 are formed with one robot from each bag. Groups and track information are determined by computer.
- Groups compete among themselves. The 1st robot from each group passes to the next round. Time is not taken into consideration.
- After all competitions, 4 more competitions are held among 16 robots who deserve to go to the next round. The first 4 robots in these competitions compete in the final competition.
- As a result of the final competition, the ranking robots are determined.

3.2.2. Evaluation and Scoring

- It is essential to complete the track in competitions.
- In the ranking competition, the times of the robots are recorded. In qualifying competitions, it is essential to finish 1st, time is not taken into consideration.

3.3. Description of Tasks and Success Criteria

- For the start of the competition, the competitors in the group will place their robots on their own track in front of the starting line in working order.
- After the referee's signal, the competitors must place their robot in front of the automatic door within 30 seconds.
- Robots are expected to start and complete the competition on their own track when the automatic door opens after the referee's signal and the competition starts.
- After the referee's signal, the automatic door is opened and the robot starting the race is expected to complete the track within 60 seconds. Over 60 seconds, even if the track is completed, the criterion for moving to the next round is not met.

- During the qualifying competitions, if a robot leaves its own lane and collides with the other robot or robots and throws them off the track, the robot or robots travelling on their own track will compete again. In case of a collision in the qualifying competitions, the decision of the referees will prevail. If the collided robot or robots do not leave the track, they continue to compete.
- There is no break, maintenance or repair time.
- No permanent trace or marking can be left on the road and no damage can be done.
- Robots can use an energy source such as a battery or battery group. Liquid or flammable energy sources cannot be used.
- Competitors can change tyre wheels or batteries on the robots after the first competition. They cannot make any other changes on the robot.
- When electronic circuit elements need to be replaced, the same type of elements can be replaced in the same place.
- During the competitions, objections made due to illuminated marquees, cameras, cameras and lighting around the track will be deemed invalid.

3.4. Disqualifying

- Robots that do not comply with the Fast Line Following Robot size standards are disqualified.
- The robot that leaves the lane and goes out is disqualified. No right to continue.
- The robot of the team that cannot place the robot in front of the automatic door within 30 seconds after the referee's signal is disqualified.
- After the referee signal, the automatic door is opened and the robots that cannot start or pass to the wrong track when the competition starts are disqualified.
- The robot that starts the race by opening the automatic door after the referee signal is disqualified if it cannot complete the track within 60 seconds.
- The robot or robots that complete the competition on the wrong track are disqualified.
- Robots that damage the track and automatic door are disqualified.

- The robot is disqualified in all physical appearance changes such as changing the robot body.
- The robot will be disqualified if the QR code pasted on the registration desk during the competitions is removed, replaced, pasted on removable materials and the QR code is damaged.
- Robots that do not match the competitor robot photos at the referee table are disqualified.
- The QR code must not be damaged during the replacement of the permitted elements. Otherwise, the robot will be disqualified.
- Robots must be wireless and autonomous. Wifi, Bluetooth and RF modules cannot be present on the robot
- The Competition Organising Committee has the right to change the rules when it deems necessary.

3.5. Safety measurements

- The QR code given at the registration desk during the competitions must be affixed to the robot body. It should not be pasted on removable materials.
- The energy sources of the robots must have passed safety tests against short circuit and overheating.
- Sockets and extension cables provided in the competition area should be used carefully, and any danger should be prevented by paying attention to the cable arrangement.

4. COMPETITION AREA

- The roads are in the form of white lines on a black background.
- The competition track consists of an area of 7320 x 10980 mm formed by arranging 12 of 1830x3660 mm chipboards in the form of 3 x 4.
- The competition floor used is made of 1560 mm wide and 5 mm thick black matt decota material. The joints of the parts forming the road were covered with black matt foil. There is no empty space between the decota and chipboard in the starting section.

Except for this section, there is a 200 mm free space between decota and chipboard on the whole track.

- White lines will be made of 20±2 mm thick white matt foil. The distance to be covered for a robot is approximately 34.7 metres.
- There are four lanes with a width of 390 mm that each line following robot can use.
- There are Start and Finish lines on the competition track.
- The start line is 400 mm from the beginning of the track. At the end of this line, there is a 200 mm high white coloured automatic gate.
- The opening mechanism of the automatic door is 10 mm above the ground.
- The finish line will be made of reflective tape directly below the sensor group that will detect the robots.
- The sensor group, which will measure the times of the line following robots, is mounted 200 mm above the competition track for each robot on each track.
- After the reflector under the sensor group, there is a 1780 mm long stopping area made of 5mm thick white decota.
- On the road lines, 300 mm before the start of the bends with a radius of 300 mm; there are marking lines perpendicular to the road line on the left side according to the direction of movement of the robot, 60 mm long and 20±2 mm thick from the centre of the road line.
- Changes can be made in the track dimensions during the construction phase in a way not to disturb the general structure.

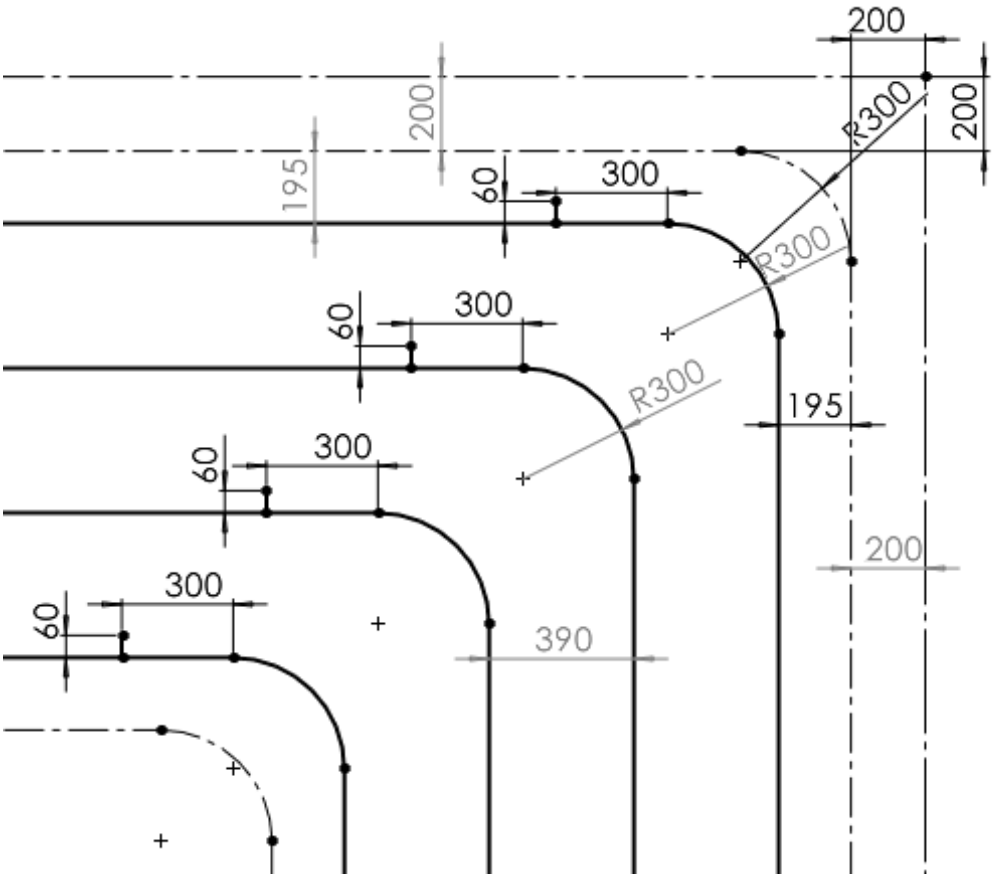

Figure 2 *Distance between lanes and radius dimensions of curves*

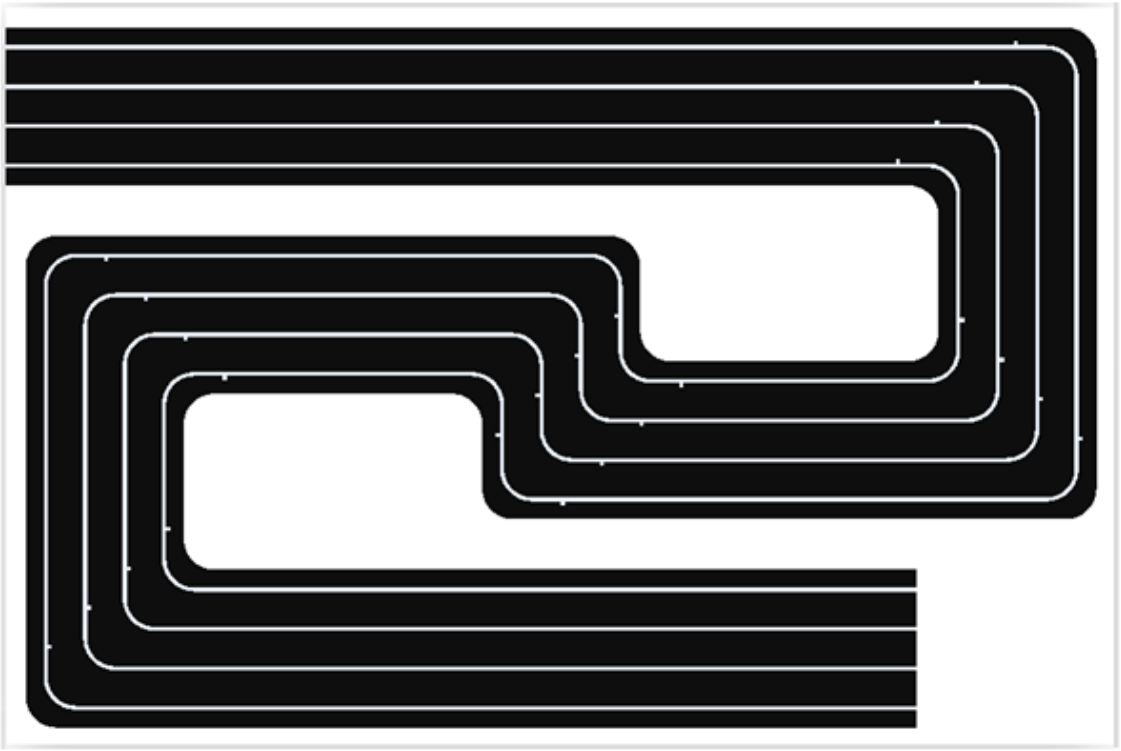

Figure 3 *Top view of runway*

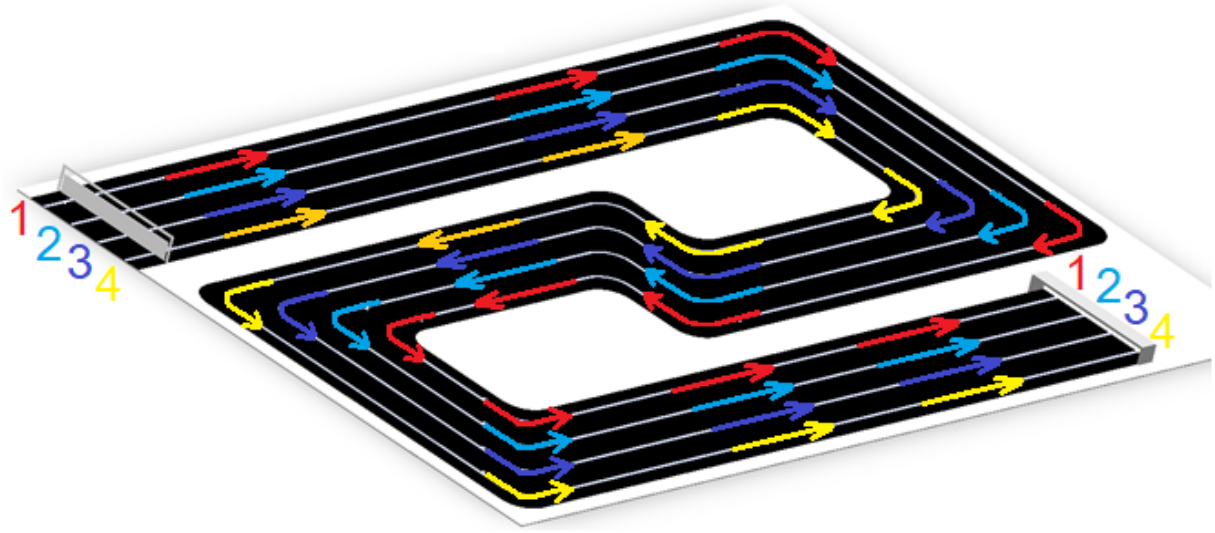

Figure 4 *3D view of runway*

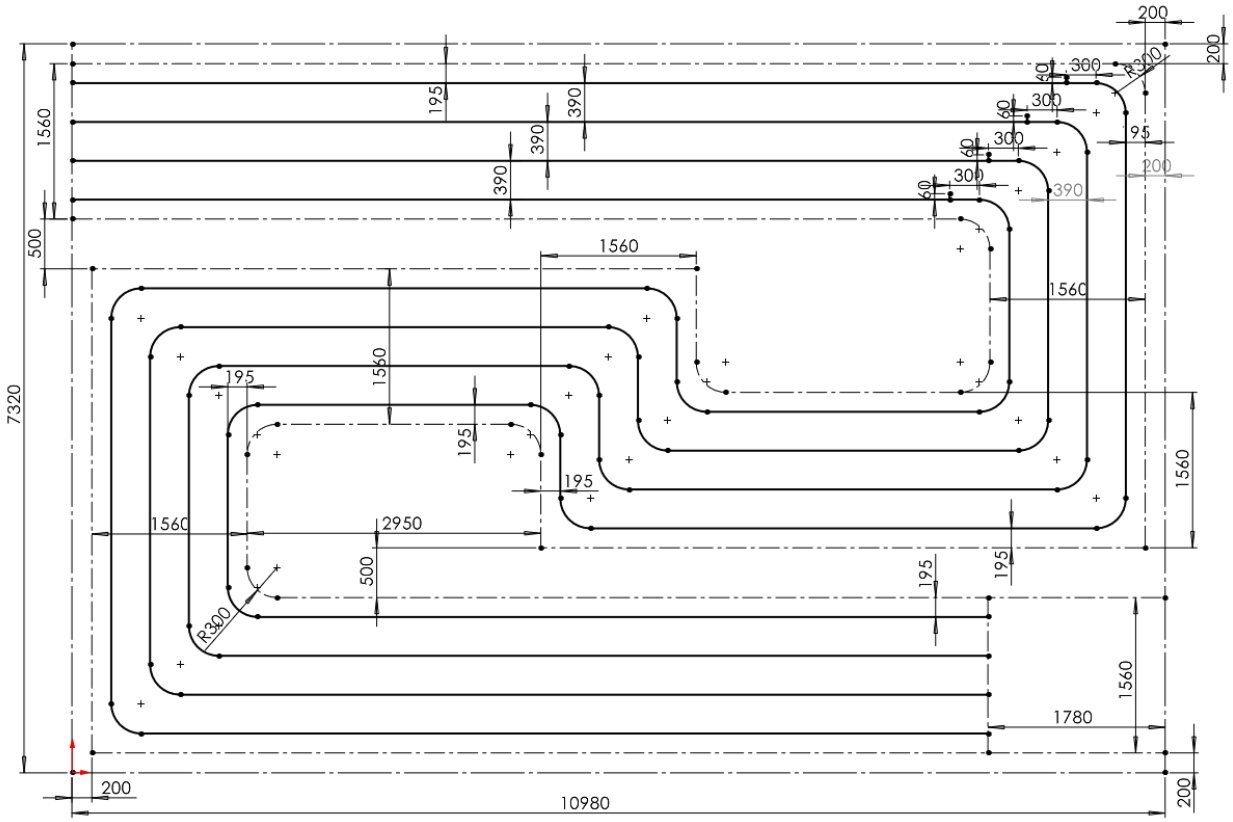

Figure 5 *Runway dimensions*

5. CONTACT

The general rules regarding the competition applications and Line Follower Drag Category are included in the 'Application Guide'. The Application Guide must be read before making an application.

Competitors should ask their questions by selecting their categories from the information menu after logging into the robot.meb.gov.tr system. Questions other than category messages will not be answered and no responsibility will be accepted.

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MINI DRONE (UAV) CATEGORY GUIDE

2025

Education, Technology, Production from Roots to the Future

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MINI UAV CATEGORY GUIDE

1. PURPOSE

Unmanned Aerial Vehicles (UAVs) are used in various fields today. Although aerial imaging and mapping are among the most common applications, UAVs are also utilized in small-scale cargo transportation, firefighting, defense industry, first aid, and life-saving operations.

Technological breakthroughs are events that act as a "booster" to enhance a nation's level of development and the well-being of its citizens. Historical technological breakthroughs include the steam engine, automobile and aircraft production, atomic energy, computers, space technology, and industrial robots. The technological breakthrough of today is UAV technology. Successful military applications have demonstrated how UAVs can contribute to national defense. As a result, many countries are conducting R&D activities in this field and bringing their UAV products to market.

The purpose of this competition, which is open to high school and university students, is to foster a culture of UAV manufacturing and operation in our country. While doing so, it aims to encourage young people to combine technology with entertainment and enhance their knowledge and skills. In this way, the competition will also contribute to developing the human resources necessary for both UAV operation (piloting) and UAV production in the near future.

2. SCOPE

As a fundamental structure, UAVs can be classified into three groups: fixed-wing, rotary-wing, and hybrid. UAVs with stationary and fixed wings that keep the vehicle airborne are generally referred to as fixed-wing UAVs. Airplanes fall into this category. The ability of fixed-wing UAVs to remain in the air depends on the continuous movement of their fuselage. The propulsion force required for this movement is generated by liquid-fueled internal combustion engines or propellers driven by electric motors. In some models, high-speed liquid-fueled turbines (jet) or electric fans (fanjet) are used. The propulsion force is applied perpendicular to the direction of gravity. In electric motor-powered models, the propeller

position can typically be at the front (a), on the wings (b), on top of the fuselage (c), or at the very rear of the fuselage (d), as shown in Figure 1.

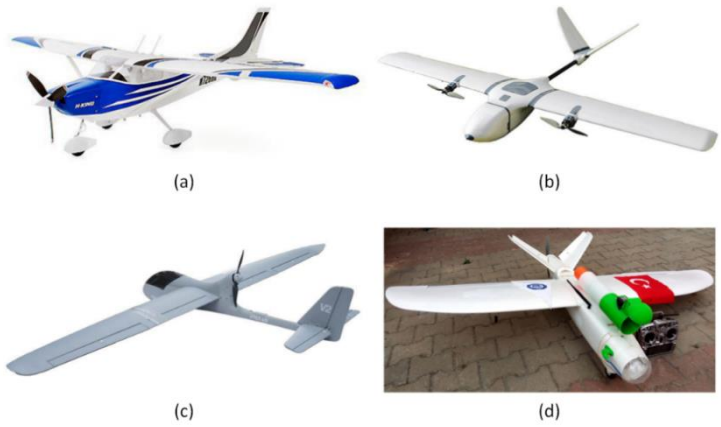

***Figure 1**. Fixed-wing UAV configurations: front-mounted motor (a), wing-mounted motors (b), top-mounted motor (c), and rear-thrust propulsion (d).*

Each fixed-wing design has its own advantages and disadvantages compared to others. The design and production of fixed-wing UAVs are largely mechanical in nature. These vehicles, which are generally single-engine, have lower production costs compared to other UAV models. Although they require large areas for takeoff and landing, their flight range is significantly high.

UAVs that stay airborne by continuously rotating propeller blades in the direction opposite to gravity are called rotary-wing UAVs. Based on the number of propellers, these vehicles are named helicopter, tricopter, quadcopter (quadrotor), hexacopter, and octocopter, respectively, following their Latin-rooted terminology. In rotary-wing UAVs, the fuselage remains stationary while the propellers rotate, eliminating the necessity for constant movement like in fixed-wing UAVs. This allows rotary-wing UAVs to have more controlled aerial movement, enabling them to hover in place and take off and land in very small areas.

The design and production of rotary-wing UAVs mainly involve electronic craftsmanship and planning, including weight distribution and battery balance. Due to the increasing number of motors and electronic components like motor drivers as the number of propellers grows, production costs are significantly higher. Additionally, their flight range is much shorter. Figure 2 illustrates various rotary-wing UAVs with different numbers of propellers.

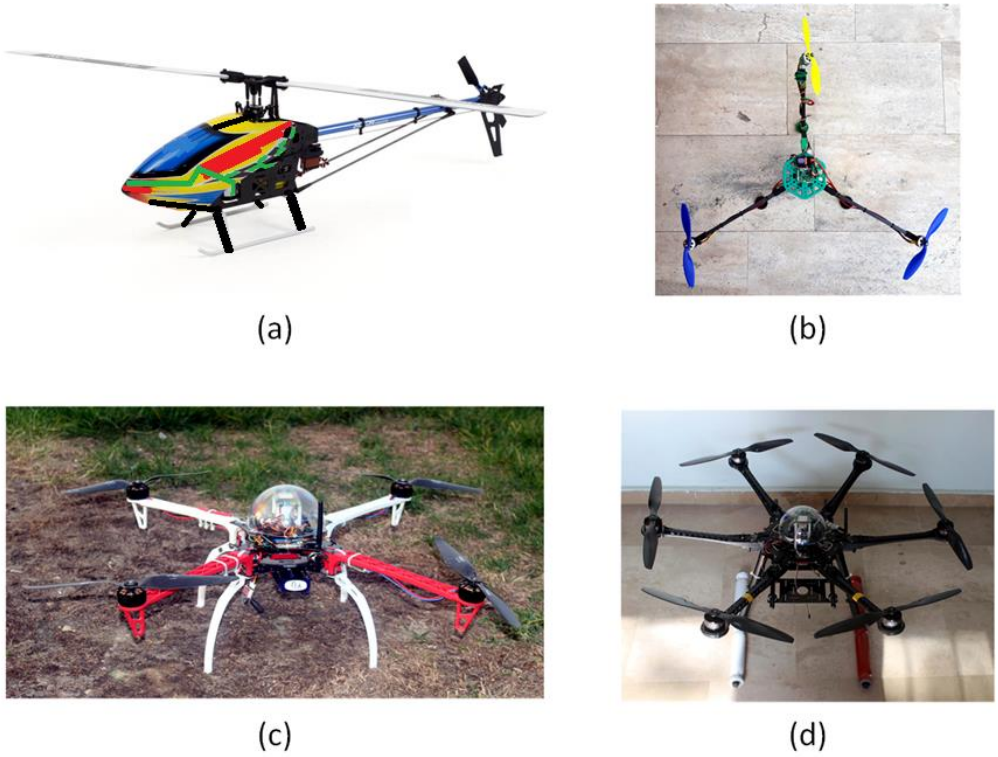

Figure 2. *Rotary-Wing UAV Configurations: Single-rotor helicopter (a), three-rotor tricopter (b), four-rotor quadcopter (c), and six-rotor hexacopter (d).*

Another design type that is becoming increasingly popular and widespread is hybrid UAVs. In hybrid UAV design, the long-range capability of fixed-wing UAVs is combined with the vertical takeoff and landing (VTOL) capability of rotary-wing UAVs. This hybrid UAV type, also known as VTOL (Vertical Take-Off and Landing), is expected to shape the future of both manned and unmanned aerial vehicle designs.

In principle, hybrid UAVs are equipped with both rotary propellers that enable vertical takeoff and landing and fixed wings attached to the fuselage that allow gliding in the air. Various design approaches exist for this UAV model, and research and development efforts on different configurations are still ongoing.

In some designs, the vehicle has propellers only on the vertical axis, and after vertical takeoff, it transitions to horizontal flight. In other designs, the UAV features both vertical-axis propellers (similar to rotary-wing UAVs) and horizontal-axis propellers (like fixed-wing UAVs). In certain models, the vertical-axis propellers change direction after takeoff and

transition into horizontal flight mode. Figure 3 illustrates various hybrid UAV designs developed by different companies.

***Figure 3**. Hybrid UAV Designs Developed by Different Companies.*

In the mini UAV category, it has been deemed appropriate to include rotary-wing "Mini UAVs" (racer drones) due to their high maneuverability and ability to take off and land in small areas. As shown in Figure 4, these Mini UAVs are preferred because of their small physical dimensions, lower production and procurement costs, and reduced risk of damage or causing damage in case of a crash.

***Figure 4**. Example Mini UAV Image*

The Mini UAV category competition will be held in an open area in accordance with the rules detailed below. When establishing the rules, both international and national Mini UAV racing leagues (e.g., TDL – Tech Drone League, FPV Drone Racers Sports Club, etc.) were taken into

consideration. This ensures that a team competing as an amateur in the Mini UAV category can later obtain a license and participate professionally in national and international competitions.

3. BASIC INFORMATION ABOUT MINI UAVs

The example components that make up the Mini UAVs participating in the competition and the required technical specifications are as follows:

3.1. Flight Simulator Software

Enthusiasts eager to fly UAVs might assume they can operate their aircraft immediately upon purchase. In fact, beginners often opt for a cheaper UAV, expecting minimal losses in case of a crash. However, regardless of the purchase price, if there is no prior flight experience, it is highly likely that the UAV will crash (suffer structural damage) and become unusable on the first flight. Beyond financial loss, such an experience can discourage enthusiasm for UAV piloting.

A critical aspect that new UAV pilots often overlook is the necessity of controlling the UAV from a fixed position. This concept can be illustrated with an example: a car driver sits in the front seat and directly perceives directional inputs from the steering wheel. When the wheel is turned right, the car moves right, and the driver's perspective aligns naturally with the motion. However, in remote-controlled vehicles, the pilot remains stationary. When a model vehicle is moving away from the operator, a right turn command will make the vehicle turn right. Conversely, when the same vehicle is facing the pilot and moving toward them, a right turn command will cause the vehicle to turn left from the pilot’s perspective. This continuous change in directional perception depending on orientation is one of the biggest challenges in model UAV operation, requiring dedicated orientation training. The most effective and cost-efficient way to acquire this training is through simulator software.

A common feature among professional flight simulator software used for UAV piloting is that they are controlled via remote transmitters, just like real UAVs. Unlike video games, they do not use keyboards, mice, or joysticks. This allows pilots to familiarize themselves with the remote control they will use for actual flights and see their responses in the simulator environment. The simulator also enhances hand-eye coordination and controller handling

skills. For these reasons, it is mandatory for UAV pilots competing in this event to undergo training in a simulator environment.

Figure 5. *Example of a Flight Simulator Software and its Accessories*

Older generation remote controllers often feature a dedicated trainer port designed for flight training. These ports are usually 3.5mm mono headphone jacks. The connection between the controller and the computer is established using a USB dongle, which is typically provided with simulator software. It is advisable to select a simulator package that includes both a USB adapter and connection cables. (Tip: Relevant search keywords in online search engines: “rc flight simulator”, “6 in 1 flight simulator”, “FPV Drone simulator”, “Uncrashed FPV”, “VelociDrone”, “PhoenixRC”.)

New-generation remote controllers now feature a USB port for direct connection to a computer. This eliminates the need for additional adapters, allowing seamless connectivity with a simple mini-USB cable.

With advancements in internet software technology, simulators specifically designed for racing drones have become available via online platforms. These web-based simulators also support remote controllers connected to the computer. Examples of such online simulators include:

- https://www.velocidrone.com
- https://store.steampowered.com/app/1682970/Uncrashed__FPV_Drone_Simulator/

3.2. Frame

The frame of a Mini UAV must support four motors (Quadrotor) and can be made of carbon fiber or fiberglass. Ready-made frames from 220mm and 250mm series (or similar) are

allowed. Alternatively, custom-designed frames made using 3D printing, FR4 (printed circuit board material), or wood are also permitted.

(Tip: Relevant search keywords in online search engines: “quad frame 250”, “racer frame”, “5 inch FPV Drone Frame”.)

Figure 6. *Example Quadrotor Frames*

3.3. Motor

Brushless DC motors with a diameter of 18-24mm and an operating voltage range of 2-6S (8.4-25.2V) can be used. (Tip: Relevant search keywords in online search engines: “brushless DC 22”, “brushless DC racer”, “FPV Drone Motor”, “brushless 2205”, “brushless 2207”.)

Figure 7. *Example UAV Motors*

3.4. Electronic Speed Controller (ESC)

The electronic speed controllers (ESCs) used in the UAV must be capable of handling current loads between 10-80A and must utilize optocouplers to isolate the control signals from power noise, ensuring stable motor operation. ESCs should be OPTO models, meaning they do not include a built-in Battery Eliminator Circuit (BEC) to reduce electrical interference.

ESCs with an operating voltage of 2-6S (7.4-22.2V) are recommended. For flight controllers that come as preassembled stacks, 4-in-1 ESCs can be used. (Tip: Relevant search keywords in online search engines: “30A ESC OPTO”, “BLHeli ESC”, “4-in-1 ESC”, “micro ESC”.)

Figure 8. *Example UAV ESC Modules*

3.5. Flight Controller

Flight controllers should be based on 32-bit processors and support various MEMS sensors, such as: 3-axis gyroscope, 3-axis accelerometer, 3-axis magnetometer

Prebuilt flight controllers such as Pixracer, HGLR Zeus F722, Naze32, Mamba F405 Mk2, X-Racer, SP3 and similar models are allowed. Custom flight controllers using MEMS sensors are also permitted. (Tip: Relevant search keywords in online search engines: “Pixracer”, “Mamba F4 Mk2”, “Rush Blade F722+60A Stack”, “HGLR Zeus F7”, “SP F4”.)

Figure 9. *Example Flight Controllers*

3.6. Power Distributor and Power Supply

The power distribution board (PDB) is used to distribute current from the battery to the motor controllers. The battery eliminator circuit (BEC), on the other hand, steps down the battery voltage (typically between 10-14V) to supply power to the flight controller and other onboard electronics. Some models feature dual BECs, providing 5V for the flight controller and peripherals and 12V for the FPV camera system. Additionally, certain models include current sensors (low-ohm resistors) to measure the current drawn from the battery. There are also 2-in-1 models that integrate both PDB and BEC in a single unit. In some models, a 3-

in-1 version includes an On-Screen Display (OSD) module, which is further explained in section 3.9. For UAVs using 4-in-1 ESCs, an external PDB/BEC is not required, as the flight controller already has built-in voltage regulators. (Tip: Relevant search keywords for online searches: “PDB”, “BEC”, “PDB BEC”, “PDB BEC 2-in-1”, “PDB BEC OSD”, “PDB BEC OSD 3-in-1”, “current sensor”). “current sensor”)

Figure 10. *Example Power Distribution Boards*

3.7. Remote Control

To prevent signal interference with other UAVs, a remote control system with at least 6 channels and operating on the 2.4GHz frequency band with frequency-hopping technology must be used. For compatibility with flight simulators, it is recommended to select a professional-grade transmitter that features a trainer port on the back. A high-quality remote control is an essential investment, as a single professional transmitter can be used to control multiple UAVs by simply changing the receiver. Advanced models also allow storing configurations for at least 16 different aircraft. (Tip: Relevant search keywords in online search engines: “Boxer Radio Controller”, “Taranis RC Control”, “Pocket ELRS”, “T-Pro RC Controller”.)

Figure 11. *Example Remote Controllers from Various Brands*

3.8. Pilot Camera, Display, and Goggles (FPV)

The First Person View (FPV) system allows the pilot to perceive the flight experience as if they were on board the UAV. This system significantly enhances navigation and control of the aircraft. The FPV setup typically consists of a camera, transmitter (VTX), receiver (VRX), antenna set, and a display device (LCD screen or goggles). Each component of the FPV system can be purchased separately and combined, but modern integrated models are also available, where the camera and transmitter or the receiver and display are built into a single unit. When choosing receiver-equipped screens or goggles, models with dual receivers (diversity) should be preferred to ensure a clear and uninterrupted video signal. These models feature an automatic switching circuit, which selects the best quality video feed from the available receivers. For camera selection, it is recommended to choose models with a high-quality image sensor, high resolution, low minimum illumination (lux) value, and built-in transmitter with DVR capability for simultaneous recording on an SD card.

Most FPV systems use analog video transmission, which, despite having lower image quality and susceptibility to interference, provides near-zero latency. This ensures that pilots can react to the UAV's movements without delay, making analog FPV systems still widely popular. Analog transmissions typically operate on the 5.8 GHz frequency band. To prevent signal interference during drone races, specific race frequency channels (Band R: 5658, 5695, 5732, 5769, 5806, 5843, 5880, 5917) have been designated. When purchasing an FPV system, it is recommended to choose a model that supports 5.8 GHz frequency and 40-50 channels for better compatibility. Recently, digital FPV systems with ultra-low latency (as low as 10 ms) have been developed. These systems provide superior image clarity, and some models can transmit both video and control signals simultaneously. Additionally, certain digital FPV goggles allow users to connect an analog module to receive analog VTX signals. (Tip: Relevant search keywords for online searches: "FPV LCD", "FPV goggles", "diversity LCD", "diversity goggles", "FPV camera").

The HDZero Event VRX is a high-resolution digital video receiver designed for FPV drone racing. It receives video signals from HDZero video transmitters, delivering clear and detailed footage through FPV goggles or screens. The HDZero system ensures low-latency transmission, digital noise reduction, and stable signal quality, making it ideal for

competitive racing. Thanks to these features, the HDZero Event VRX provides a smooth and uninterrupted viewing experience for both pilots and spectators. It also supports live streaming and DVR recording, making it a valuable tool for event organizers. Due to its high-definition video capabilities, HDZero technology is becoming increasingly popular in modern FPV racing.

Figure 12. *Example FPV Cameras*

Figure 13. *Example FPV Screens and Goggles*

3.9. On-Screen Display (OSD) Module

The On-Screen Display (OSD) module overlays flight data—such as battery voltage, current draw, aircraft tilt, and other sensor readings—onto the FPV camera feed. It functions similarly to how TVs display volume levels when adjusted at home. This allows FPV pilots to monitor critical flight information in real-time without needing additional external screens or telemetry setups. Most VTX units used in conjunction with flight controllers come with built-in OSD functionality. For these setups, purchasing an external OSD module is unnecessary. However, for systems without integrated OSD, an external module can be added for enhanced monitoring. OSD is not a mandatory component, but it greatly improves

situational awareness during flight. (Tip: Relevant search keywords for online searches: “mini OSD”, “Minim OSD”).

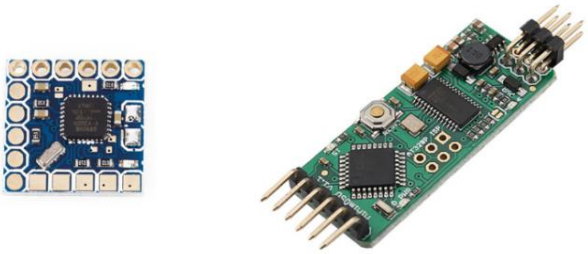

Figure 14. *Example OSD Modules*

3.10. Propellers

The propellers used in UAVs must be appropriately sized to ensure compatibility with the motor’s power and to prevent collisions between blades. The specifications of a motor will indicate the optimal propeller dimensions for efficient operation.

Based on these specifications, suitable propellers should have:

- A diameter of 4-7 inches
- A pitch of 4-5 inches (e.g., a propeller labeled 6045 is 6 inches in diameter and advances 4.5 inches per full rotation)
- Two-blade or three-blade configurations

Propellers must be purchased in clockwise (CW) and counterclockwise (CCW) pairs to ensure balanced thrust distribution. Propellers are one of the most frequently replaced components in a UAV. Therefore, having spare sets is highly recommended. Even with brand-new propellers, balancing is necessary to prevent vibrations, similar to how car wheels require balancing. Properly balanced propellers contribute to:

- Reduced battery consumption
- Increased motor bearing lifespan

(Tip: Relevant search keywords in online search engines: “5x4.5 prop”, “6045 prop”, “5147-3 prop”, “5045 3 blade”.)

Figure 15. *Example Propellers*

3.11. Battery

Lithium Polymer (LiPo) batteries are commonly used in UAVs due to their high instantaneous discharge capability, a result of their chemically unstable structure. LiPo batteries consist of multiple series-connected cells, and the required number of cells depends on the desired voltage. Each LiPo cell operates within a safe voltage range of 3.5V (empty) to 4.2V (fully charged). If a cell's voltage falls outside this range, it may become permanently damaged. For long-term storage, LiPo cells should be maintained at 3.85V per cell to prevent degradation. Many chargers include a storage mode for this purpose. This is crucial since batteries are often stored between competition seasons.

Series (S) Rating: The number of series-connected cells determines the battery's voltage. A 3S battery consists of three cells, meaning: 10.5V is empty, 12.6V is fully charged.

Capacity (mAh): Indicates how much energy the battery can store. A 2200mAh battery can supply 2200mA for one hour or 44A for approximately three minutes.

Charge Rate (C Rating): Defines the maximum safe charging current. A 1C charge rate means a battery should be charged at a current equal to its capacity (e.g., a 3000mAh battery should not exceed 3A during charging).

Discharge Rate (C Rating): Indicates the maximum instantaneous discharge current. A 1500mAh 120C battery can discharge 180A (1.5Ah × 120).

Since racing UAVs prioritize low weight, their batteries have lower capacity but higher voltage (S) and discharge (C) ratings. Typical racing UAV batteries have: 1000-2000mAh capacity, 3-6S voltage range, 60-120C discharge rates

LiPo batteries require balancing to ensure all cells are charged evenly. Chargers achieve this by: Measuring the voltage of each cell, Discharging overcharged cells to match the others.

This is why LiPo batteries include both main power leads (+ and -) and a balance lead with (S + 1) wires (e.g., a 3S battery has a 4-wire balance connector).

Finally, when purchasing a LiPo battery, consider its connector type. Racing UAVs commonly use T-plug or XT60 connectors.

(Tip: Relevant search keywords in online search engines: “120C drone battery”, “1500 mAh 90C LiPo”, “1300 mAh 4S 120C LiPo”.)

Figure 16. *Example LiPo Batteries*

3.12. Battery Alarm (LiPo Alarm) and UAV Finder

A LiPo alarm is a small electronic module that connects to the battery's balance lead and displays the individual cell voltages. It emits an audible warning when the voltage of any cell drops below a set threshold during flight. The threshold voltage is adjustable and is typically set above 3.5V (e.g., 3.7V) to ensure a safe landing before the battery is fully drained.

Additionally, a UAV finder is a self-powered electronic module that activates when it detects a signal loss from the remote controller for a certain duration. Once triggered, it emits a loud alarm, helping locate a crashed UAV in the field.

(Tip: Relevant search keywords in online search engines: “LiPo alarm”, “Finder buzzer”, “Battery alarm”.)

Figure 17. *Example Battery Alarm and Finder*

3.13. Battery Safety Transport Case (LiPo Safe Bag)

LiPo batteries pose a fire risk, and to prevent accidents, they should be stored and charged inside a fireproof bag. These specially designed LiPo-safe bags protect against explosions and fires, ensuring safe transport and charging of the batteries. (Tip: Relevant search keywords in online search engines: *"Fireproof LiPo bag"*, *"LiPo safe bag"*, *"LiPo guard"*.)

Figure 18. *Example LiPo Safety Bags*

3.14. Mechanical Assembly

To prevent screws and bolts from loosening during flight, thread-locking compounds (e.g., Loctite) must be used. During pre-race technical inspections, officials will check whether these compounds have been applied.

3.15. Electrical and Electronic Assembly

Shrink tubing will be used for cable and connector connections, and no exposed electrical wires will be visible. Cables will be secured to the UAV body with cable ties. Exposed and unsecured (dangling) cables pose a fire hazard if they come into contact with each other when the UAV crashes or hits an obstacle. In Figure 19, a fire extinguisher is being used to intervene in a UAV that caught fire during a fall in the competition area. Therefore, during the pre-competition technical inspection, it will be checked whether cable ties have been used to secure cables with shrink tubing, ensuring no exposed wires remain. Any team failing to comply with even one of these rules will not be allowed to participate in the competition.

Figure 19. *Intervention of Judges on a Mini UAV that Caught Fire in the Competition Area Due to a Previous Fall.*

3.16. Electrical-Electronic Liquid Protection

UAVs must be resistant to adverse weather conditions. To operate in weather conditions with a risk of rain, snow, etc., it is important to coat the electronics of the devices. Coating is not mandatory, and flights can still be performed without it, but this poses a risk. The electronics should be coated with waterproof solutions to protect them from water. These solutions are applied to the exposed electronic surfaces using a brush or stick to form a layer, which is then dried either by waiting, depending on the type of solution, or using UV light. Care should be taken not to apply the solution to the barometer or buttons, and the inner parts of the connectors should also be avoided. Teams using open PCBs for flight control boards and ESCs should pay special attention to this. Detailed application instructions and videos can be found on many platforms. (Tip: Use keywords such as “FPV Waterproof Silicone Coating,” “OscarLiang-Waterproofing FPV Drone Electronics,” “Silicone Conformal Coating” in search engines.)

Figure 20. *Example of Electronic Liquid Protection.*

4. COMPETITION AREA

1. Sample images of the competition venue are as shown in Figures 21, 22, 23, and 24:

   Google Earth link

Figure 21. *Images from the Competition Area #1.*

Figure 22. *Images from the Competition Area #2.*

Figure 23. *Images from the Competition Area #3.*

Figure 24. *Images from the Competition Area #4.*

2. The competition environment and layout are as follows

The detailed layout plan will be published on our website as an announcement after the site inspection. Please follow the announcements.

Figure 25. *General Layout Plan of the Competition Area.*

3. In the competitor tents (or area) shown in the general layout plan in Figure 25, competitors will be able to make final adjustments, additions, checks, and modifications to their mini UAVs. Additionally, 220VAC power outlets will be available for charging batteries in the same area. Competitors may also use the practice area, as seen in the layout plan, for flight tests, provided they follow the order. Technical inspections will be carried out in the judge tents (or area). For safety, the areas for spectators, competitors, and judges will be enclosed with netting.

4. The competition obstacles will be inflatable types and/or made of neon LED lights, and the arrangement of the obstacles and course layout will be announced before the races. Figure 26 shows the dimensions of the inflatable obstacles, Figures 27-30 show images of the inflatable obstacles, Figure 31 shows a representative image of the tunnel used in the Erzurum competition, and Figure 32 shows the technical drawing of the tunnel. Additionally, there may be sail flag-shaped obstacles in the competition area, as represented in Figure 33.

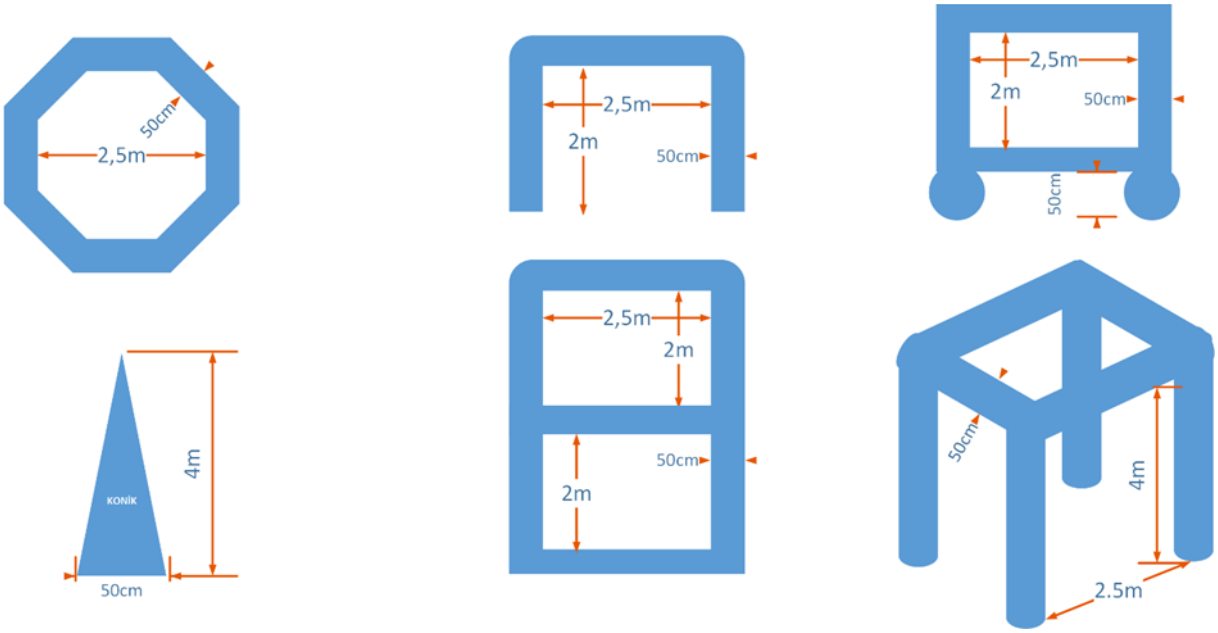

Figure 26. *Dimensions of the Inflatable Obstacles.*

Figure 27. *Inflatable Obstacle Image #1.*

Figure 28. *Inflatable Obstacle Image #2.*

Figure 29. *Inflatable Obstacle Image #3.*

Figure 30. *Inflatable Obstacle Image #4.*

Figure 31. *Representative Tunnel Image.*

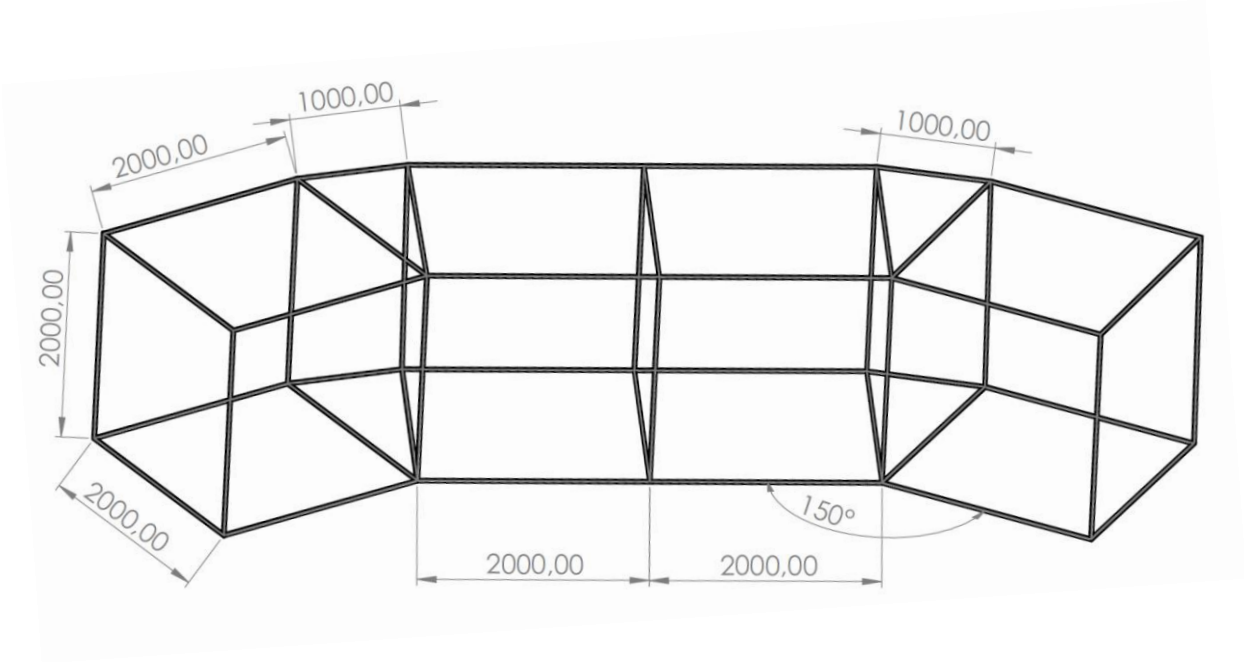

Figure 32. *Technical Drawings and Dimensions of the Tunnel.*

Figure 33. *Representative Image of a Sail Flag-Shaped Obstacle.*

5. For sample images of the Mini UAV competition held outdoors in 2022 in Şanlıurfa province as part of the 14th International MEB Robotics Competition, click here
6. The competition area image, including indoor obstacles from the 2023 competition in Bursa province as part of the 15th International MEB Robotics Competition, is shown in Figure 34.

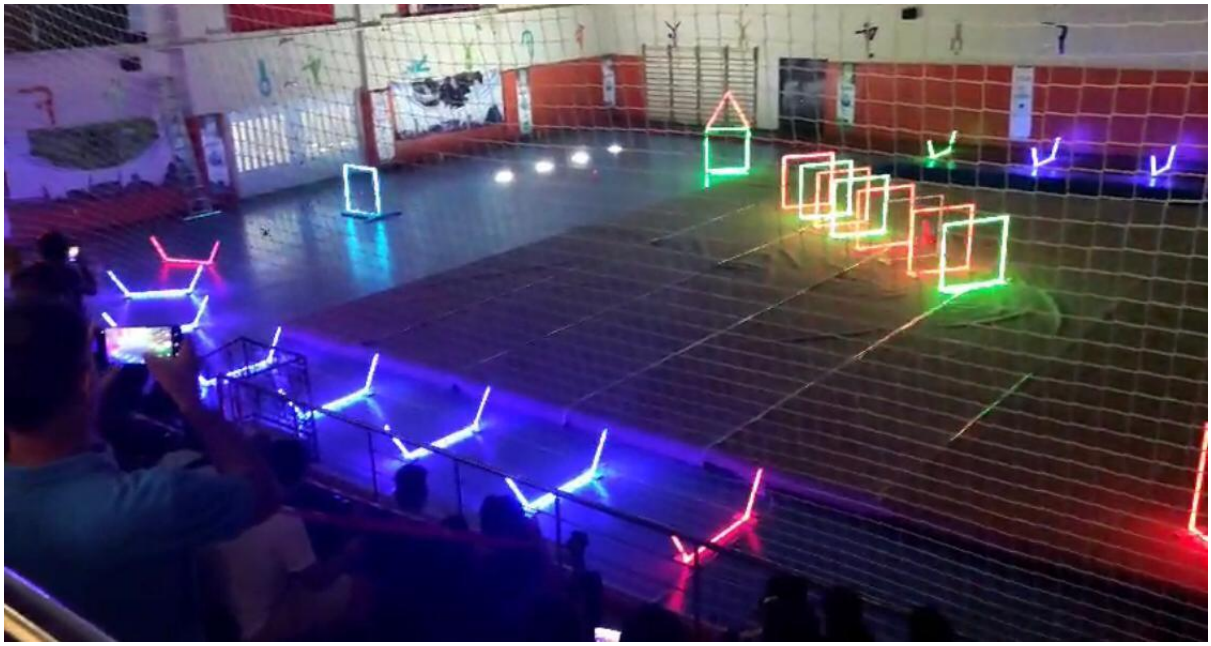

Figure 34. *Competition Area Image from the 2023 Bursa Competition, Including Indoor Obstacles.*

7. For sample images of the Mini UAV competition held in an indoor sports hall in Bursa in 2023 as part of the 15th International MEB Robotics Competition, click here.
8. Before the competition, the race course, created in the UNCRASHED FPV Drone Simulator environment, will be shared with the competitors. Competitors can either obtain the drone simulator software themselves or, if possible, use the simulator set up at the competition venue to prepare for the course.

5. COMPETITION RULES

For competition applications and general rules, please follow the application guide and updates published on the website https://robot.meb.gov.tr/. The competition committee may modify the competition rules according to technical and application requirements when necessary. The most up-to-date rules will be published on the competition website. (Please check the version number on the cover page.)

1. Each team must strictly adhere to the rules set by the competition committee and the referee warnings. Teams found violating the rules will be disqualified.
2. The competition committee may, at its discretion, order a re-run of the competition.
3. Teams can make all objections based on the general "Application Guide" rules.
4. Each team may have at least two members: one pilot and one observer (co-pilot).
5. Each team can bring up to 4 Mini UAVs for the competition. All Mini UAVs must be registered separately and receive a QR code label.
6. A pilot can only compete for one team. If a pilot competes for more than one team, all teams for which the pilot competes will be disqualified.
7. During the competition, the pilot must control their Mini UAV using their FPV goggles or LCD screen. Mini UAVs without FPV video transmission systems will not be allowed to compete. The competition committee will not provide cameras/goggles/screens.
8. The observer will assist the pilot by following the Mini UAV and performing tasks such as placing it at the starting point, removing it from the competition area, and providing voice commands as needed (co-pilot).
9. The competition will be organized in three stages, with a total of 5 rounds, as shown in Figure 35. In the first stage, qualifying rounds will be held. In the second stage, elimination rounds, quarter-finals, semi-finals, and in the third stage, the final stage will take place.

STAGE 1.

ROUND 1: Qualifying

- Each team participating in the competition first takes part in the qualification rounds.
- The competition order for Round 1 is determined by a draw.
- Each team completes laps on the track either alone or alongside multiple teams.
- The fastest lap time completed within 4 minutes is recorded as the "Round 1 Lap Time."
- During Round 1, each team has a maximum of two attempts (chances) in the qualification rounds.

STAGE 2.

ROUND 2: Elimination

- The 32 teams with the best lap times in the qualification rounds (shortest "Round 1 Lap Time") can advance to the elimination rounds.
- Teams compete on the track in groups of four, completing three laps each.
- The total time of these three laps is recorded as the "Round 2 Lap Time."
- A total of 32/4 = 8 groups are formed.
- The teams in each group are determined through a seeded draw.
- The starting positions of the teams within each group are assigned based on their qualification round rankings.

ROUND 3: Quarter Final

- In the elimination rounds, the top 2 teams from each group (shortest "Round 2 Lap Time") can advance to the quarter-finals, making a total of 2 × 8 = 16 teams.
- Teams compete on the track in groups of four, completing three laps each.
- The total time of these three laps is recorded as the "Round 3 Lap Time."
- A total of 16/4 = 4 groups are formed.
- The teams in each group are determined through a seeded draw.
- The starting positions of the teams within each group are assigned based on their Round 2 lap times.

ROUND 4: Semi Final

- In the quarter-final rounds, the top 2 teams from each group (shortest "Round 3 Lap Time") can advance to the semi-finals, making a total of 2 × 4 = 8 teams.
- Teams compete on the track in groups of four, completing three laps each.
- The total time of these three laps is recorded as the "Round 4 Lap Time."
- A total of 8/4 = 2 groups are formed.
- The teams in each group are determined through a seeded draw.
- The starting positions of the teams within each group are assigned based on their Round 3 lap times.

STAGE 3.

ROUND 5: Final

- In the semi-final rounds, the top 2 teams from each group (shortest "Round 4 Lap Time") can advance to the finals, making a total of 2 × 2 = 4 teams.
- Teams compete on the track in a single group of four, completing three laps each.
- The total time of these three laps is recorded.
- The final races continue until one team wins twice (maximum of 5 races).
- The team that wins twice is crowned the competition champion.
- The second, third, and fourth-place teams are determined based on their cumulative total time across all final races.
- In case of a time tie, a tie-breaker race is conducted. The starting positions of the teams in the final races are determined based on their Round 4 lap times.

Figure 35. *Competition Plan.*

10. Each team has a maximum of two attempts to participate in the qualifying rounds. (The number of qualifying round attempts may be adjusted by the competition committee depending on the number of participants.)
11. The best time (based on completing the course in the shortest time) obtained by a team in the qualifying rounds will be accepted as the team's qualifying round result.
12. Teams that do not complete all their attempts before the announcement of the end of the qualifying rounds will lose their remaining attempts.
13. The order in which teams participate in the qualifying rounds will be determined by a draw before the competition. Teams will be notified of their video broadcast channel and competition times. Teams that fail to report to the technical inspection tent when called by announcement will lose their first attempt in the qualifying rounds.
14. In the second stage elimination rounds, the two teams with the best results in their groups will qualify for the quarter-finals.
15. In the quarter-finals, the two teams with the best results in their groups will qualify for the semi-finals.
16. In the semi-finals, the two teams with the best results in their groups will qualify for the finals.
17. In the final race, the four teams with the best results in the semi-finals will compete.
18. At the start of every race, the referees will check if the competitors' video transmission systems are operating on the correct channel and power. Then, the Mini UAV's first start (ARM) will be checked to ensure the remote controls are functioning. Teams that experience issues with the video transmission system or ARM control will be given time to fix the issue before the race begins. After this period, teams with unresolved technical issues will be considered as having used their first attempt. In all races in the second stage, teams that cannot resolve their issues during the technical break will be eliminated, and the remaining teams will compete.

19. The starting time for each team will be determined by a special electronic lap timer when the team passes the first obstacle (1st obstacle). The lap time for each team will be calculated electronically by the timer as they pass subsequent checkpoints.

The lap timer starts by detecting signals from the video transmitters (VTX) on the Mini UAVs. In some cases, the lap timer may fail to detect the first pass of a Mini UAV. In such cases, the timer will not start, and the race must be restarted. The referees will check whether all UAVs' first passes are detected by the lap timer. If the pass of any team is not detected, the race will be restarted.

20. Each team will have a referee assigned to them. The referee will monitor the team through a screen. The image that the pilot sees through their goggles/screen will be displayed on the referee's screen. These images will also be recorded with a DVR device, allowing the referee to check whether the team is following the correct order of obstacles and abiding by the rules. A time penalty may be given if the team fails to comply.

21. Each team will compete with their own video transmitter (VTX) and goggles. The VTX modules used by the teams must support the standard 48-channel analog racing band. The transmission power must be set to a maximum of 25 mW. Only one analog VTX transmission will be allowed from each Mini UAV. Teams detected using more than one VTX transmission will have their second VTX module turned off within a short time by the referees. Teams violating this rule may be disqualified. If a team causes interference (signal jamming) with other teams' transmissions, they will be disqualified unless they fix the issue.

22. Each competitor will be assigned a transmission channel by the referees before the competition. Competitors will bring their VTX modules and FPV goggles to the channel designated by the referees. In the final check before the competition, a special measurement device will be used to check if a team is broadcasting on more than one VTX, if the VTX power is within limits, and if the channel is correct. Teams who fail to comply with the rules will need to adjust their Mini UAVs accordingly. If not, they may be disqualified at the referee's discretion.

23. The VTXs used on the Mini UAVs must support the R band channels: R1: 5658 MHz, R2: 5695 MHz, R7: 5880 MHz, R8: 5917 MHz. Teams that arrive without adjusting to their assigned channel and band will not be allowed to compete.
24. The HDzero system will be used, which is compatible with both analog and HD video transmission systems used in previous years.
25. In the final checks before the race, if any team's transmission interferes with the images or control signals of other teams, the team causing the interference will lose their flight rights.
26. Mini UAVs that crash into obstacles, collide with other UAVs, or fall due to individual errors during the race, and suffer damage to their video transmission systems, will be allowed to continue the race if they can take off again. The time spent on the ground will be included in the race time, and the competition time will not stop for the team. Any Mini UAV that cannot take off for any reason will be considered out of the race.
27. Any unsafe practice or behavior identified by the referees, such as flying dangerously near spectators, flying outside the designated area, or unsportsmanlike conduct that negatively impacts another user, will result in disqualification.
28. Unauthorized entry into the competition area is prohibited. In case of any incident (such as UAV crashing, malfunction, battery depletion, etc.), entry into the competition area will only be allowed with referee permission. Any violation will result in disqualification.
29. If any unsportsmanlike conduct or inappropriate cheering occurs, the individual(s) responsible, if identified from their school, will result in a 20-second time penalty for all teams from that school in this category.
30. Teams that skip or pass obstacles in the wrong order will be given a 10-second penalty for each error, as determined by the referees. A maximum of 5 obstacles can be skipped or missed (with penalties) in any stage. Skipping more than 5 obstacles will result in disqualification. (Penalties for some obstacles may differ depending on the referee's decision.)

6. TECHNICAL SPECIFICATIONS OF MINI UAVs

The technical specifications of the UAVs competing in the Mini UAV category within the scope of the International MEB Robot Competition are as follows:

NOTE: To prevent arming issues during takeoff, teams are advised to set the minimum arm angle parameter in their flight control software (e.g., Betaflight) to 60 degrees or higher.

1. The motor-to-motor diagonal distance of the Mini UAV must be between 180-270 mm. The UAV must completely fit within a 240 mm × 240 mm square (excluding propellers). During pre-race technical inspections, UAVs will be checked for compliance with this requirement. Figure 36 shows an example Mini UAV fitting inside the required frame.

Figure 36. Example Mini UAV fitting inside the required square frame (12/05/2018, SİVAS).

2. The total weight of the Mini UAV, including the battery and all components, must be between 400 and 1000 grams. Technical inspections before the race will include weighing the UAV.
3. Teams failing to meet technical inspection requirements will lose their race rights if they do not resolve their issues before the competition starts.
4. The propeller diameter must be between 4 inches and 6 inches.

5. The Mini UAV must have a single VTX module capable of broadcasting on the analog race band with a maximum power output of 25 mW. Teams are responsible for providing their own VTX modules, FPV goggles, or LCD screens.
6. To enhance visibility for other FPV pilots and spectators, Mini UAVs must be equipped with visible LED lighting. Teams can choose the number, color, and pattern of LEDs as they wish. However, the lighting must be sufficient to ensure the UAV is visible in low-light conditions. An example of a Mini UAV with visible LEDs is shown in Figure 37.

Figure 37. Example Mini UAV with visible LED lighting.

7. The airframe type must be a Quadrotor (Quadcopter - 4 motors).
8. UAV frames can be custom-designed or commercially available prebuilt frames. However, fully preassembled UAVs or kits (RTF, ARF) are not allowed. Teams found using such UAVs will be disqualified.
9. Teams must assemble their UAVs themselves, including mechanical, electrical, and electronic components. Additionally, flight controller software must be installed and configured by the team.
10. Teams must store and transport their LiPo batteries in fireproof battery bags (LiPo safe bags). Teams without fireproof battery bags will not be allowed to participate.
11. Autonomous flight is not allowed.

12. The competition will be held in open areas, and weather conditions (rain, snow, etc.) will not lead to race cancellations. Teams must use equipment suitable for such conditions.

7. VIDEO UPLOAD AND PRODUCTION REPORT RULES

Each team must download the technical report template from the competition website, complete it, and upload it to the designated section of the website by the specified deadline. Printed reports or USB submissions will not be accepted. All teams must record a video of their Mini UAV and upload it to an online video platform.

The video should showcase:

- The Mini UAV's design and technical specifications
- The manufacturing process
- The pilot's flight capabilities

The video link must also be included in the production report. Teams that fail to submit their reports and videos on time or fail to meet content requirements will not be allowed to compete.

7.1. Video Upload Platform

- The video must be uploaded to an online video platform such as YouTube or Vimeo.
- The platform choice is free, but the video must not be password-protected.
- The video does not need to be publicly available, but the link must be accessible.

7.2. Video Content:

- **Introduction:** The first 5 seconds of the video must clearly display the Mini UAV's name and the name or logo of the participating school.
    - This information must be clearly visible at the beginning of the video.
    - A brief introduction and photo of team members may be included in the video.
- **Technical Specifications:** The Mini UAV's specifications (motor type, battery capacity, weight, dimensions, etc.) must be presented both verbally and visually.

- **Manufacturing Process:** The video must include photos or video footage of the Mini UAV's design and production stages, showing a step-by-step process.
- **Pilot's Flight Capabilities:** The video must include test flight footage demonstrating the pilot's ability to fly with FPV goggles and without FPV goggles. Both types of flights must be shown separately, with clear start and end points.

7.3. Technical Requirements

- **Video Quality:** The video must be at least 720p resolution. Low-quality videos will not be accepted.
- **Playback Speed:** The video must be recorded at normal speed, without fast-forwarding or slow motion.
- **Video Duration:** There is no specific time limit, but the video should be informative and engaging.

7.4. Video Link and Production Report

- The video link must be included in the production report.
- Teams must ensure that the embedded video link is correct and functional.

7.5. Example Video:

- A sample video link will be provided in future announcements. Teams must follow the competition website and updates. Ensure that all content is prepared completely and accurately.

7.6. Video Content and Report Consistency:

- The video content must match the technical specifications and flight tests mentioned in the production report.
- Both the video and the report must provide consistent and accurate information about the UAV.

8. SAFETY MEASURES

The following safety measures apply to both teams and UAVs. Failure to comply will result in disqualification.

1. A switch or button on the transmitter must be configured to arm/disarm the Mini UAV. This feature will be inspected before the competition. UAVs without a functional arm/disarm system will not pass technical inspections.
2. If the Mini UAV loses signal with the transmitter, it must immediately cut motor power and descend (drop feature). This feature will be checked before the competition. UAVs without this failsafe will not pass inspection.
3. If a Mini UAV leaves the competition area or pilot's line of sight, the pilot must immediately disarm the UAV upon referee instruction.
4. LiPo batteries are chemically unstable and can explode under improper handling. Teams must have a sufficient number of fireproof battery bags (LiPo safe bags).
    - If a team leaves batteries exposed or charges them unsafely, they will be penalized with a 20-second penalty per violation.
5. Battery connectors (plugs) must be easily removable by referees in case of an emergency. This must be considered during UAV design and assembly. Referees will inspect this during technical checks.
6. A designated test area will be provided for UAV testing. Teams found flying outside this area (hallways, gardens, etc.) will receive a 30-second penalty per violation. If necessary, referees may disqualify the team.

9. CONTACT

Participants must submit their inquiries through the https://robot.meb.gov.tr/ system by selecting the appropriate category under the information menu. Questions submitted outside the designated category will not be answered. Teams are responsible for reading the competition guide thoroughly, as it already addresses most inquiries. Reading the guide carefully can prevent unnecessary questions.

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17th INTERNATIONAL MEB ROBOT COMPETITION

LABYRINTH MASTER CATEGORY RULES

2025

Education, Technology, Production from Roots to the Future

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LABYRINTH MASTER CATEGORY RULES

1. INTRODUCTION

1.1. Purpose

Maze-solving robots offer an ideal platform for the development and testing of a wide range of skills in robotics. These robots enable technical advances, especially in areas such as sensor technology, motor control, path-finding algorithms, mapping and autonomous decision-making. Devices such as ultrasonic sensors, infrared sensors and LIDAR are used for environmental sensing, enabling the robot to detect obstacles and paths in its environment. Motor drive circuits and various motors, together with PID control algorithms, regulate the robot's movements in a precise and stable manner.

In the path finding process, various algorithms enable the robot to determine the shortest or most suitable route. More advanced models can map the maze with SLAM (Simultaneous Localisation and Mapping) technology and determine its position in real time. In addition, these robots can make autonomous decisions by quickly processing the data they collect from the environment thanks to microcontrollers or embedded systems.

Maze robots contribute to a wide range of applications from autonomous vehicles to industrial robots by increasing knowledge in areas such as sensor integration, artificial intelligence and autonomous systems. Therefore, it is a critical tool for both education and research.

In the Labyrinth Master category of the International MEB Robot Competition, the aim is for the autonomous labyrinth solving robot of appropriate dimensions, which is started from the determined starting point, to reach the end point in the shortest time and complete the labyrinth with the least time penalty.

2. ROBOT SPECIFICATIONS

2.1. Dimension and Weight limitations

Maximum Dimensions and Weight of the Robot: There is no partial restriction on the width, length and height of the robot. Each competitor must make the robot design in accordance with the characteristics of the competition track**.**

2.2. Equipments

Electronic and Mechanical Components: Maze solving robots can use devices such as ultrasonic sensors, infrared sensors and LIDAR for environmental sensing. In addition, motor drive circuits and various motors can be used. There are no restrictions on the sensors that robots can use to detect the floor and walls.

Prohibited Materials and Technologies: The robot will operate autonomously. Wireless remote access or wired control will not be provided to the robot. Systems that provide software or hardware remote access (Bluetooth, Wi-Fi, etc.) are prohibited. Internal or external hardware that will provide remote access to the robot by any means (including hardware that will enable wireless program loading to the robot) cannot be found on the robot, even if it is software and/or hardware cancelled. If a robot that does not comply with the rule in this article is detected at any time of the competition or after the winners are determined, it will be disqualified from the competition even if it has ranked, and the situation will be reported to the Organisation Executive Committee for the evaluation of other sanctions.

The robots cannot have any other button, switch, dipswitch, dipswitch except the start button, and a state-changing attachment that may cause adjustment, even if its nature is not specified here..

2.3. Requirements for Autonomous Operation

Technical and Software Requirements: Robots must operate completely autonomously. In this context, they should process the data they collect using microcontrollers or embedded systems and make autonomous decisions.

Sensor and Algorithm Usage: There is no restriction on the sensors that robots will use to detect the floor and walls. Various sensors (ultrasonic, infrared, LIDAR) can be used in robots for environmental sensing. PID control algorithms can be used in the path finding process and SLAM (Simultaneous Localisation and Mapping) technology can be used in more advanced models.

3. FORMAT AND EVOLUATION

3.1. Application process

Competition applications are made according to the process and principles specified in the Application Guide. Robots that meet the conditions specified in the Application Guide will be able to participate in the competitions.

3.1.1. Robot Production Report

It is the report documenting that the robot to be participated in the competition by the applying student and the counsellor was designed by them and the production process. The report will be uploaded to the system by selecting the robot name from the relevant menu after entering the username and password information to robot.meb.gov.tr.

Report as content:

- Materials used in the construction of the robot,
- Explaining the construction process of the robot,
- The language used in programming the robot,
- The total cost of the robot,
- It should include photos of the robot's production stage, its final form, the robot name and the school's logo.

3.2. Stages and Evaulations

3.2.1. Competition Stages

The competition consists of two rounds. The order of competition in each round is determined by lot. In the 1st round, the registered robots compete. After the 1st round competitions are completed, the track is organised and the final round is started. In the 1st round, the first 60 robots whose time to complete the track and penalty times are calculated pass to the final round. In the final round, the results are announced by ranking the robots with the best times among the robots whose completion time and penalty times are calculated. If the number of robots that will go to the final round is below the specified number, the number of robots that

will go to the final round is completed by looking at the time of the robots that can start but cannot complete the track.

There will be one or more identical maze tracks in the competition area according to the number of participants in the 1st round and the competitors will not be allowed to try before the competition. In the final round, there will be one maze track and the competitors will not be allowed to test before the competition.

Robots compete in order. The order in which the robots will compete is determined by lot and announced. Regardless of the order of the competitor, the number of robots to be competed on which day is notified to the competitors by announcements made by means of tools such as SMS, mobile application, website, kiosk, information screens. Until this announcement is made, the competitors must not leave the hall regardless of the order of the draw. Robots that do not come to the track despite the calls will not compete. It is the competitor's responsibility to follow the announcements and announcements.

3.2.2. Evaluation and Scoring

The score calculation principles are as follows.

- The total time of the robots completing the track is found by totalling the time of the penalties and the stopwatch time at the end of the competition. The robot with the smallest time is ranked higher. In case of time equality of the robots completing the track, the lightest robot will be ranked higher than the heavier robot.
- In robots that can start but cannot complete the track, the row number of the cell at the end of the competition is checked. Total time is found by the formula '200+(16-row number)x10+time penalty'. The robot with the lower time is ranked higher in the ranking. In case of time equality of robots that cannot complete the track, the lightest robot will be ranked higher than the heavier robot.
- Robots that cannot start take place in the ranking with 400 seconds. It cannot move to the next round.
- Robots that register and do not participate in the competition take place in the ranking with 500 seconds. Cannot move to the next round.

- Robots that disrupt the functioning of the competition and damage the security measures are ranked with 1000 seconds.
- Robots will detect the white area at the end point and stop. The competition ends when the sensor in the finish area detects the robot. The robot must not leave the finish cell for 5 seconds. The robot will not be removed from the track before this time expires. The robot that takes the robot without the referee's approval or leaves the finish cell within 5 seconds will be penalised 10 seconds.
- In the 1st round and the final round, the calculation principles of the competition time are the same.
- The competition is held according to the above rules, the ranking is determined and announced.

3.3. Task definitions and success criteria

- The robots in the Labyrinth Master Category will complete the track consisting of black floor and white walls in the shortest time starting from the starting point.
- Competitors are not given break, maintenance or repair time during the competition.
- There may be changes in the dimensions of the tracks that will not disturb the general structure during the construction phase.
- During the competitions, the objections made due to the illuminated marquee, camera, lighting, shading caused by the movements in the field and sound/sound will be deemed invalid.
- The 1st round competition track will be the same as the track in Figure 3.
- After the 1st round is completed, the track will be organised and/or modified and made ready for the final round.
- The competition will be against the time and the time will be kept with a hand stopwatch and/or a stopwatch connected to the sensors on the track, the time will never be stopped after the competition starts.

- The total duration of the competition cannot exceed 150 seconds in the 1st round and 120 seconds in the final round. These times can be changed before the competition according to the number of robots applying to the competition.
- In the 1st round, the robot is weighed with the battery installed in order to determine the ranking if necessary, and the weight of the robot is noted.
- The competitor arriving for the final round gives the packed and secured box containing the robot to the referee for examination. Robots that are not packed and safety precautions are not taken are not competed. When it is understood that the security measures are not damaged, the box is opened and the battery is installed after opening the box. The robot is weighed to determine the ranking if necessary, the weight of the robot is noted
- Stopwatch start sensor is located in the cell after the start. The stopwatch end sensor is located near the entrance of the end cell. Sensors can be located on the left or right wall. The sensor may protrude on the side walls, causing thickness. The sensor assembly may include reflective tape placed on the walls. The sensor may emit light.
- The robot is placed where the competitor wants in the starting cell shown. The front side of the robot will be placed straight towards the direction of movement. If the robot does not move after it is placed on the track, it is taken from the track by the competitor with the request of the competitor and the approval of the referee and / or the referee's request, and it is checked and put back to the starting point, the robot is given a 10 second time penalty. The intervention is completed within a maximum of 20 seconds, no objection is accepted. Competitors can intervene a maximum of 3 times to robots that cannot start (10 seconds time penalty is taken for each intervention). The robot that cannot start the competition despite the interventions is eliminated. When the robot passes to the 2nd cell and the time starts, the competitor cannot interfere with the robot. If the robot passes to the 2nd cell and the time does not start due to a problem that may occur in the stopwatch, the time is kept with a hand stopwatch, it is the authority of the referee to decide whether the robot has passed to the 2nd cell and to determine the duration of the competition. .

- If the robot passes to the 2nd cell and stops after the start of the time, remains motionless, gets stuck in dead-end streets, remains unmanoeuvred on a wall and the robot cannot provide the appropriate movement, the robot cannot be intervened. In the 1st round and the final round, the specified time is expected to expire, at the end of the competition time, the row number in the cell where the robot is located is determined and noted.
- While creating the final track, according to the generally used algorithm of following the right / left wall, the number of steps and turns will be equal to each other and a fair track will be made.
- The Organization Executive Board has the right to change the rules as deemed necessary.
- The starting and finishing points on the maze are in different areas. All competitors will start the maze from the same starting point and complete the competition at the same finishing point

3.4. Disqualifying

- The robot cannot leave permanent marks on the track or damage the track. If it is decided that the robot has damaged the track, the robot will be removed from the track and the competitor will be disqualified. The referee committee is authorised to decide on the cleanliness, order or suitability of the maze for the competition.
- Competitors cannot adjust, test or load programmes to their robots during the competition. The competitor who insists on making any adjustment, test or programme on the robot during the competition despite the warnings will be disqualified.
- It is checked whether the robot coming to the competition area for the 1st round complies with the rules specified under the heading '2. Robot Features'. Robots that do not have these features are disqualified by not competing.
- A sensor cannot be switched off manually before pressing the start button. All movements will be monitored during the competition. Robots that make adjustments or are judged to make adjustments other than the start button are disqualified regardless of the stage.

- Robots that disrupt the functioning of the competition and damage the security measures are disqualified. They cannot pass to the next round and the situation is reported to the Organisation Executive Committee.
- Robots that come with unboxed packaging will not be processed and these robots will not compete.
- The robots of the competitors who damage, tear, open, cut, etc. the security measures taken in the transparent clamshell box will be disqualified.
- Competitors who do not have their robots packed in the final round will definitely not compete, all responsibility belongs to the competitors.
- Robots that do not come to the track despite the calls will not compete. It is the competitor's responsibility to follow the announcements and announcements.

3.5. Safety Measurements

- In the 1st round, no packaging and security measures will be applied as in the final round, the details of which are described below.
- After the 1st round rankings are announced, the 60 robots in the final round will be called for safety precautions and will be packaged and secured. The first 60 robots that are eligible to participate in the final races will be brought to the robot packaging and security table, whose location will be announced with an announcement to be made, without batteries. After the robot is checked, it will be placed in a transparent box with a lid and no holes brought by the competitor without the battery installed. The box with a transparent lid will be closed to be opened only at the time of the competition by the methods determined by the technical advisors of the competition and will be delivered to the competitor. The competitor can take any precaution he/she wants to prevent the robot from moving in the transparent clamshell box. The box with a transparent lid must be sized to fit in a bag measuring 35cmx45cm. It is the competitor's responsibility to bring a box in accordance with the conditions specified in the manual.
- It is the competitor's responsibility to follow the calls for packaging and security measures to be applied in the final round.

4. COMPETITION AREA

- The height of the walls of the labyrinth will be 8 cm, thickness 18 mm white coloured wood.
- The floor is made of black matt wood and the walls are made of white glossy wood.
- The labyrinth matrix consists of 8x16 squares and the size of each square is 20 cm x 20 cm.
- The start and end points are 20 cm x 20 cm and are inside the track matrix. The start and end points of the 1st round are shown in Figure 3. In the final round, the start point can be found in row 1 of the matrix, the end point can be found in row 16 of the matrix and in any cell. The end point has a white area of 20 cm x 20 cm.
- The margin of error for the specified dimensions is 5%.
- The maze may contain dead ends, closed cells that robots cannot enter.
- Arrangements and/or changes will be made on the track walls during the final stage of the competition.
- There may be unevenness on the runway floor and walls caused by paint, tape, etc. and such factors.
- Since the inner and outer corners and joints of the track walls will not be closed, there may be marks or lines.

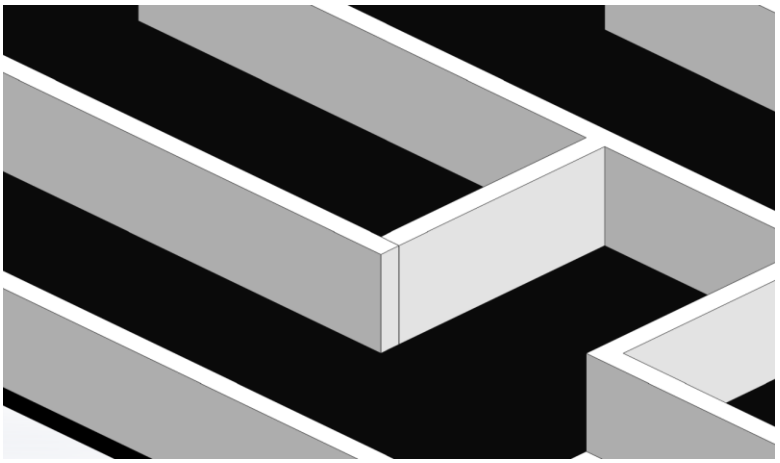

Figure 1. *Example track. It does not represent the track in the competition. The joints will be as shown in the figure.*

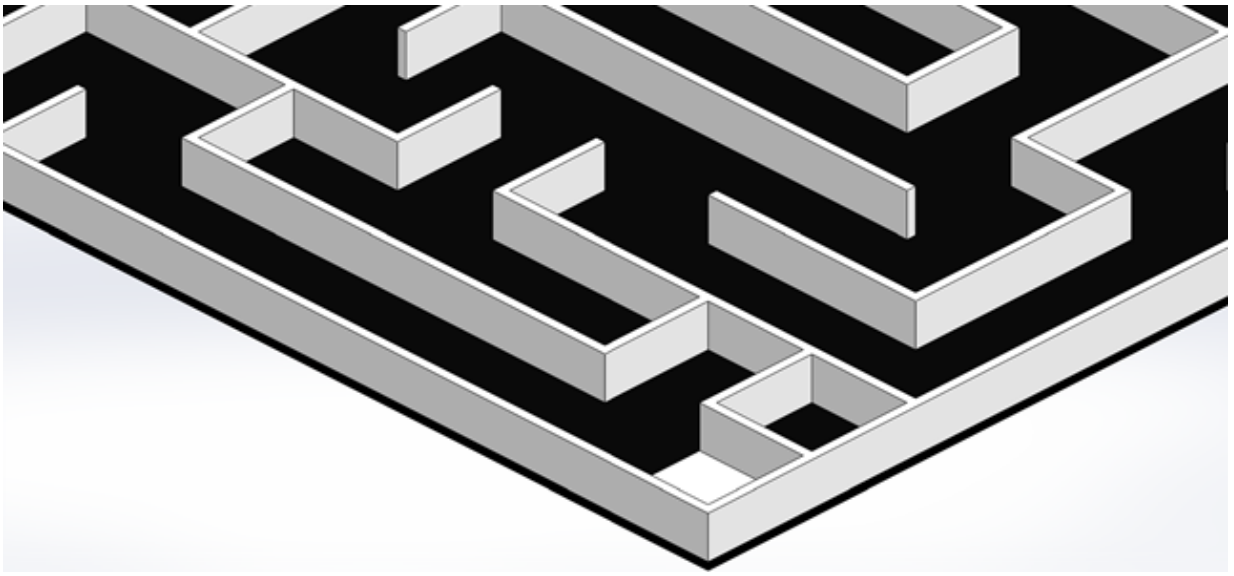

Figure 2. *Example track. Does not represent the track in the competition.*

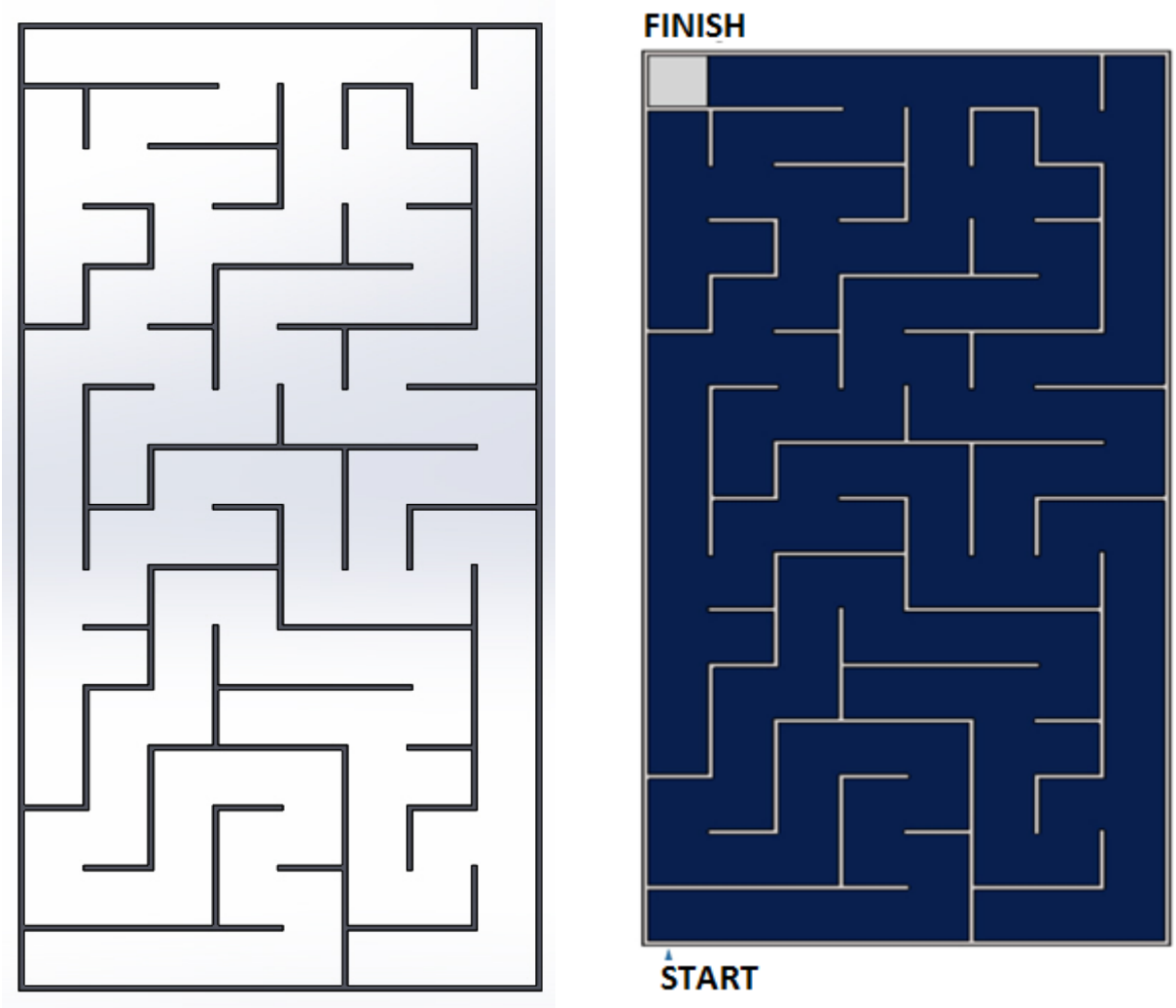

Figure 3. *Competition Track for Round One*

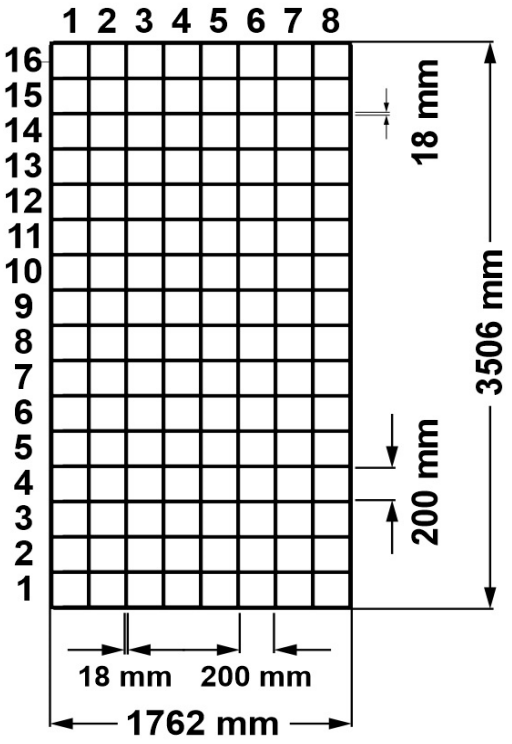

Figure 4. *Dimensions*

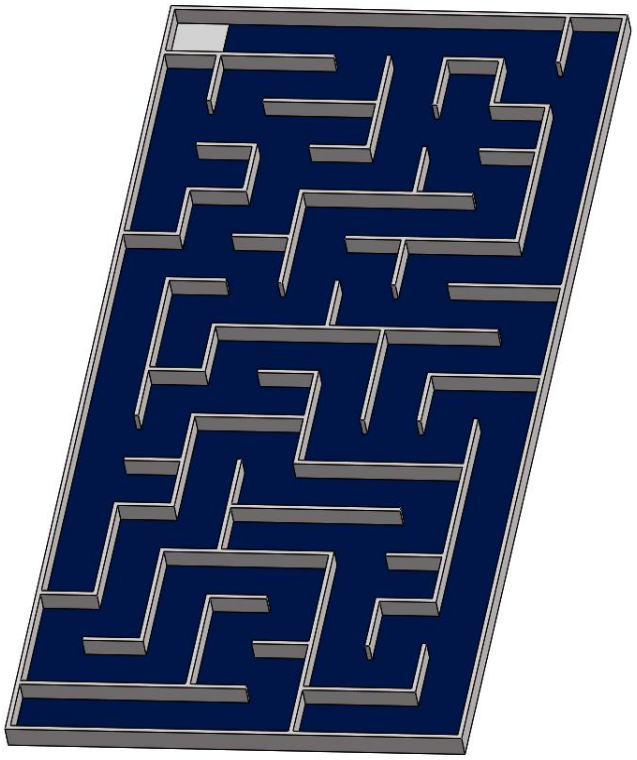

Figure 5. *3D view of the First Round Circuit*

5. CONTACT

5.1. Access to us

The general rules regarding the competition applications and the Labyrinth Master category are included in the Application Guide. The Application Guide must be read before making an application.

Competitors should ask their questions by selecting their categories from the information menu after logging into the robot.meb.gov.tr system. Questions other than category messages will not be answered and no responsibility will be accepted.

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MINI SUMO CATEGORY RULES

2025

Education, Technology, Production from Roots to the Future

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MINI SUMO

1. INTRODUCTION

Sumo robots emerged when those interested in robotics as a hobby were inspired by Japanese sumo wrestling and wanted robots to do the same wrestling.

Sumo robots are robots that are capable of autonomous movement, contain electronic circuits, are designed to compete with each other, and are programmed for the intended movements. They are produced in different standards and categories.

Sumo robots meet each other on a round ring with certain standards and features called Dohyo. During the match, sumo robots try to push each other out of the line around the ring. The robots detect the white line around the dohyo with the help of contrast sensors, and try not to go out of the ring and stay in the ring. Various sensors (IR, ultrasonic, laser, etc.) are added to the robots to detect the environment and the opponent robot in a short time and improved tactical algorithms are also installed. Sumo robots win the match because of their mechanical and electronic design and the program algorithms they are loaded with.

2. ROBOT SPECIFICATION

2.1. Detailed Description of Robot

a) Mini Sumo Robot should be 10cm width and 10cm depth and able to be stored **in a cubic box** for inspection purpose

b) No restriction on the height

c) The weight of mini sumo robot will be maximum 500gr.

2.2. Controlling Robot

a) Robots will be autonomous type. It is not allowed remote control except “remote start-stop function”

b) Starting the movement;

- Mini sumo robots are started by the judge using remote controller at the same time.
- Mini sumo robots have to move in 10 sec.

c) Terminating the movement;

- Judge announced the end of round.
- It is not compulsory to stop the robots by judge's remote controller at the end of round.

2.3. The rules for using blades

1. Paper test will be applied to the robots by the judges. Robots that have very sharp blades won't be accepted.
2. Using the blades should not cause any damages to Dohyo and injury to spectators. Robots which have materials such as craft knifes, razor blade etc. won't be accepted.
3. Judges will decide whether disqualify the robot which damaging to Dohyo or not.

2.4. Movements of Robots

The movements of the robot should be designed to detect the movements of the opponent and respond/attack accordingly. If the movement is suspicious, operation check maybe made by indication of the judges. The check is carried out as the condition that a match terminates without program modification.

2.5. Prohıbıted Items In Desıgn And Manufacturıng Of The Robots

1. Any components that may affect the operating frequency or operation of opponents (such as flasher, laser sensors etc.) are prohibited. Infrared signals emitted from the standard optical sensors on the robots will not be evaluated in this context.
2. Using any components that may scratch or cause any damages on the surface of dohyo are prohibited.
3. Liquid, powder or gas which is used as a weapon or attack mechanism against the opponent are prohibited

4. Inflammable components should not be installed in the robots.
5. It is not allowed that placing batteries caused to damage Dohyo , other robot or itself.
6. The robot must not include any kind of launching device.
7. The robot must not include any parts that stick the robot to dohyo surface and prevents its movement (such as suckers, glue and so on)

3. GAME FORMAT AND EVALUATION

3.1. Game Principles

1. In principle, the competition time based on three matches in 3 minutes of each. Team who get two effective points within the competition time will be the winner.
2. If only one single effective point has been got by the end of the competition time, the team that has get this point will be the winner of the competition.
3. In case of equality such as 1-1 or 0-0, the competition will be extended one more round. In extension time, the team who get 1 effective point will be the winner of the competition.
4. Within the match time, if no team has win any round, 1 effective point is given to lighter robot than other according to robot weight and then the winner is determined.
5. Before the match is over, all maintenance is prohibited.(however, under supervising of judge, competitors can interfere only in 30 seconds without leaving match area and getting any technical support from outside. They also cannot change anything on robot in this moment)

3.2. Effective Point

The winner of round is determined based on the following situations

1. If the opponent robot is forced out of dohyo and the robot touches outside of dohyo.
2. If the opponent robot falls out of Dohyo by itself and touches outside of Dohyo

3. If the robot stays inactive more than 10 seconds (inactive robot loses the round even if the other robot touches out of Dohyo)
4. If some parts described in Article 15 are falling down
5. If “warning ” was given two times to the opponent,

Placement Direction Of Robot On Dohyo

a. Robotların Judges decide how to place the robots on Dohyo. Head to head placement does not allowed. (In extention rounds, judges will decide the placements of robots on Dohyo symetrically)

b. Before the match, Sumo robots should be placed manually at the same time accorring to rules shown below. It is not allowed to change the position of robots once they were placed on Dohyo.

c. Robots will be placed back to back on any place in quadrants as shown in Figure

3.3. Robot Markings

Photos of robots will be taken and the stickers will be pasted on each of them at the first day of competition.

3.4. Startıng Game

Competitors must have safety equipments such as glases,shoes etc.

1. Judges will start the match after checking the dohyo and competitors as well. If there are any scratches/dirt in the dohyo, the judges will decide whether the match can continue on the same dohyo or not.
2. The match will begin when placing robots on Dohyo by the instruction of judges.
3. Placement of robots will be determined by judges as side by side or back to back
4. Robots are not allowed to be moved after they have been placed.
5. The game will start when judge presses the remote control and robots move.

3.5. The Ending Of The Game

1. Game will officially end upon the announcement of judge.
2. Contestants will take their robots from the outside of dohyo by moving only inside restricted competitor area.

3.6. Restart of a Match

In the following situations, the match will be suspended and resumed.

1. In case of both robots are stuck facing each other and further movements are not possible. It will be waited in 10 second, then after round restarted by judges.
2. In case of that both robots fall out into the outside of Dohyo simultaneously (or cannot distinguish which one dropped first).
3. If winner cannot be determined after 3 rounds, the judge places the robots in a specific position symetrically and restart 4th round which is last round.

3.7. Warnings and Penalties

3.7.1. Warning

A contestant who takes any of the following actions will receive a warning. If a contestant receives two warning, one effective point will be granted to his/her opponent.

1. Any violation of Article 7.
2. If the robot is repositioned once it has been placed in Dohyo.
3. All actions that may be deemed unfair / tricky by judges.

3.7.2. Violations

If the following situation happens, the opponent will be granted one effective point.

1. If the components (over than 10gr.) were dropped from the robots
2. If the robot doesn't move within 10sec. after starting signal.
3. If there is a request from contestants to terminate the match

3.7.3. Losing the Game Becaue of Violations

A contestant who takes any of the following actions will lose the game because of violation.

1. A contestant doesn't come to the appointed dohyo in 5 minutes.
2. A contestant sabotages the game. For example, by intentionally breaking,damaging or defacing dohyo.
3. A contestant violates Article 5.
4. If robot cannot move as described in Article 6 "the requirements of autonomous robots"
5. If the robot fires and then then it causes the robot broken.

3.7.4. Disqualification

A contestant who take any of the following actions will be disqualified and forced to leave the game and will not be on the ranking list.

1. A contestant's robot does not meet the requirements which is stated in Article 7 "specification of the robots" .
2. A contestant doesn't respect the fairplay rules. (For example, using offensive language or assaulting opponents or judges).
3. A contestant injures the opponent or judges deliberately.

3.8. Robot Production Report:

There will be a pre-selection for participation in the competition. The points to be considered for pre-qualification are explained below.

1. Competitors must log in to robot.meb.gov.tr with their username and password and complete the Robot Production Report steps.
2. Robot production report steps are explained in detail in the "Robot Production Report Guide".
3. The uploaded reports will be reviewed by technical advisors and corrections may be requested for one time only if necessary.
4. Reports that are not corrected within the correction period will be evaluated as they are.

5. Robots whose robot production report is approved are eligible to participate in the competition.

4. GAME AREA

Dohyo Definition

1. Dohyo consist of the match ring and the outer layer area of the ring. The rest of the space will be assumed as area which is outside of Dohyo and objections for this area won't be accepted.
2. The specification of Dohyo
   - Dohyo of Mini Sumo Robot is a circular MDF board which has 5cm height and 77 cm diameter
   - The dividing line; It is the 2,5cm white area outside of Dohyo of Mini Sumo Robot and it is included to dohyo area.

Dohyo Images

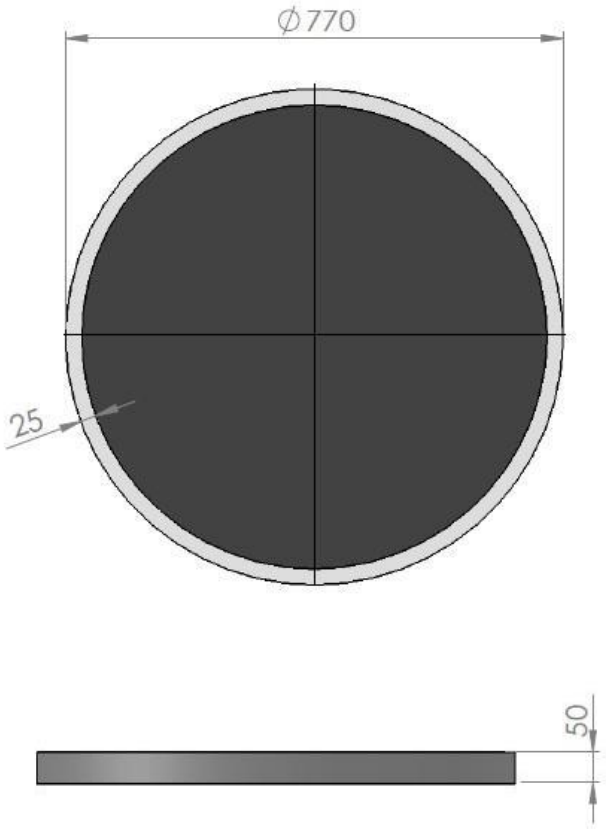

Figure 1: *Mini Sumo Robot Dohyo Dimensions(mm)*

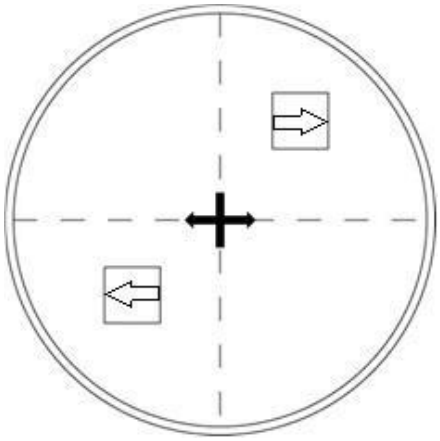

Figure 2: *Robot placement on Dohyo*

5. SAFETY MEASUREMENTS

1. For the safety of the competitors, safety goggles, gloves and sneakers must be worn throughout the competition. This safety equipment (goggles and gloves) is the responsibility of the competitor and competitors with missing safety equipment will not compete
2. Fire prevention measures
   a. A fuse or protection circuit must be used to prevent excessive current draw from the battery. Otherwise, the referees will intervene in damaged or dangerous robots.
   b. The game is stopped at the discretion of the referee in case of fire hazard or flashes during the competition. The referees decide whether to continue the competition or not. If the referees decide to end the competition; the stopped round and the following rounds are given as effective points on behalf of the opponent.

5.1. Accıdents and Injurıes

Request for suspension/postpone

1. When a contestant is injured and the game cannot be continued, a suspension can be requested by the contestant.
2. In the event above, the judges will make necessary arrangements for the game to be resumed immediately.

3. If the arrangements made do not enable match to be resumed, the opponent will be declared as a winner without match.

6. OTHER RULES AND WARNINGS FOR COMPETITORS

For each robot, a single operator and an assistant can be registered. However, only one competitor will operate the robot in match area. Both contestants have to know the competition rules and obey these rules. Robots must be autonomous robots. The winner will be determined by the judges after the match.

Teams will provide Start/stop circuit of mini sumo robots by themselves. No any start/stop module will be given to teams. Competitors must use the IR Launch modules on their robots so that they will not be affected by the Infrared Sourced Optical Sensors on the competing robots, and the IR device must be positioned with the IR receive lens facing upwards. Once positioned on Dohyo, objections made due to the Start Module will not be considered.

Advice: Some robots that are not enclosed around the launch module may cause the module not to work as desired, naturally due to interference signals from the front, rear and sides. Therefore, it may cause the robot not to start. In order to minimise this kind of problem, the perimeter of the module is raised to get only IR signals come from above. Example is given in Figure 3.

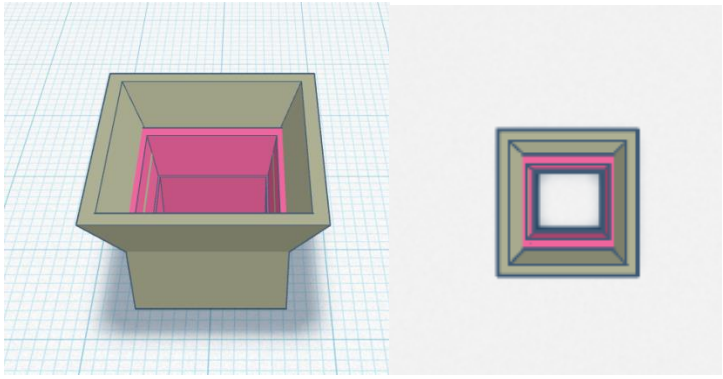

Figure 3

7. START MODULE

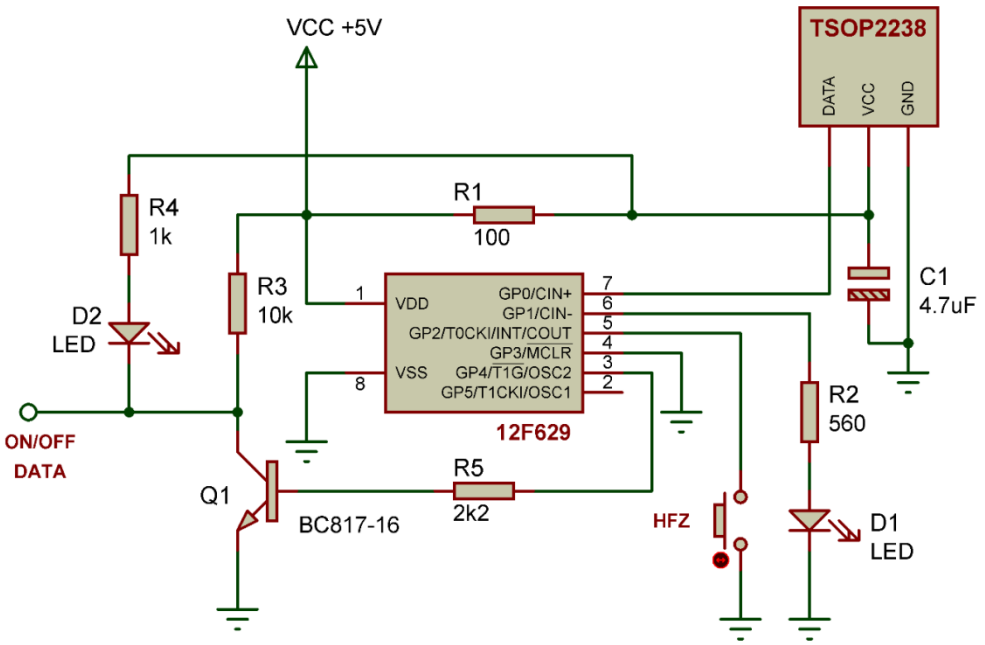

Figure 4: *Start modüle circuit*

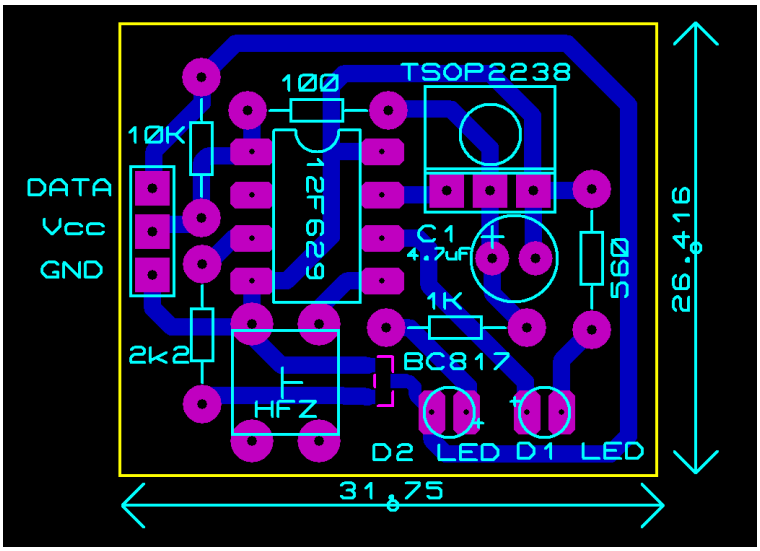

Figure 5: *Start module PCB*

7.1. START MODULE: HOW TO USE

First of all, which button on transmitter will be used for on/off function on receiver side should be determined. You should push memory button on the receiver and then D1 led turns on permanently. At this time, you should press a button which you want to save in

memory on transmitter two times successively then wait. D1 led will turn off. Now module is ready to use.

To set the output ON, push the button (memorized button on transmitter) one times. D1 led will flash but D2 will turn on permanently. The output voltage drops 0V.

To set the output OFF, push the button (memorized button on transmitter) one times. D1 led will flash but D2 will turn off permanently. The output voltage rises to +5V.

You can use any kind remote controller using “RC5” protocol as a transmitter for this circuit. A special area called “test point” will be reserved for competitors to test their remote modules.

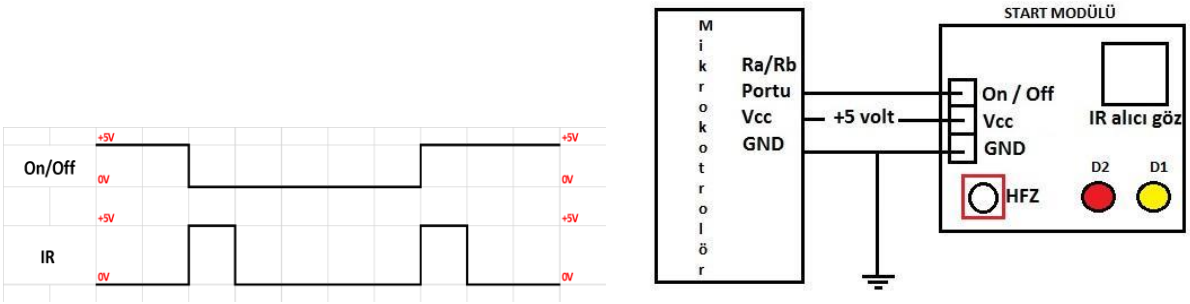

Figure 6 *Wiring diagram between MCU and start module*

8. CONTACT

Any changes in the rules are authorized by the Organization Executive Committee.

The general rules regarding the competition applications and Mini Sumo category are included in the “Application Guide”. The Application Guide must be read before making an application.

You can ask your questions about the category via the contact form under the information menu after logging in at robot.meb.gov.tr. Your questions irrelevant with the category will remain unanswered.

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AUTONOMOUS VEHICLE(AV) CATEGORY GUIDE

2025

Education, Technology, Production from Roots to the Future

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AUTONOMOUS VEHICLE (AV)

1. INTRODUCTION

The autonomous vehicle category is an image processing competition based on camera. This competition is designed to improve programming skills, to use image processing technology effectively and to provide the vision to use the gains obtained in other fields and to make the process fun. Autonomous AVs in this category stay on the competition track and work to perform the desired tasks and complete the track as soon as possible. In this competition, which makes the process both educational and entertaining, autonomous vehicles stay on the track using only cameras, detect visual elements such as traffic lights, pedestrian crossings and parking areas and perform the desired tasks. Autonomous vehicles demonstrate autonomous decision-making skills by completing tasks in the shortest time thanks to advanced image processing and artificial intelligence algorithms.

2. AUTONOMOUS VEHICLE (AV) SPECIFICATION

In order for AVs to compete in this category:

- AVs must fit comfortably in a 20x30 cm box.
- The height of the AVs cannot exceed 25 cm. There is no weight limit for AVs.
- AVs that do not fit in a 20x30 cm box or exceed 25 cm in height are disqualified.
- The wheel diameter to be used must not exceed 10 cm.
- Since the competition is based on image processing, no other sensor or sensor-like electronic or mechanical device other than a camera may be used.
- There is no limit to the number of cameras to be used.
- If the control card used on autonomous vehicles has modules that provide remote control such as infrared, Bluetooth, radio signals, Wi-Fi, etc., these features will not be used during the competition.. If detected, the competitor will be disqualified.
- There is no limitation on the controller or control card to be used.

- Likewise, there is no limitation for the number of motor and the RPM value of the motor to be used.
- The control systems and algorithms of the vehicles must be run with original software developed entirely by the team. Professional software solutions or standard software of commercial autonomous vehicle kits (e.g. LEGO Spike software, etc.) cannot be used.

3. COMPETITION FIELD

3.1 COMPETITION TRACK SHAPE AND DIMENSIONS

- The track is made of 100 cm wide, 18 mm thick, black mdf plate. There will be dashed and straight road lines on the black background.
- The road edges of the track will be drawn with a white line.
- There will be traffic lights on the roadside at the start. The start of the competition will be by means of these lights.
- At the start, there will be a sensor placed at a height of 5 cm to start the stopwatch that will measure the competition time.
- There will be 20 cm high signs at the roadside for pedestrian crossing, level crossing and overtaking.
- The level crossing and pedestrian crossing will be on a separate decota and will be placed in different places for each competition. The maximum thickness of the decota will be 6 mm.
- For the vehicle overtaking task, 1 vehicle will be used on the track and the position of the vehicle will be re-determined for each competitor. The vehicle will be placed in any of the areas where overtaking is not prohibited. Sample locations of the vehicle to be overtaken are shown in Figure 1. The characteristics of the vehicle are as follows: orange in colour, 20x30x25 cm in size and designed in the form of a taxi.

- In areas where overtaking is prohibited, yellow coloured vehicles with dimensions of 20x45x25 cm will be placed at a random location as shown in Figure 1. These vehicles are designed as taxis or lorries.
- There are 5 zones on the track, as shown in blue in Figure 1. The zones will be determined by signs to be placed on the ground on the roadside.
- At the end of the track, there will be parking areas measuring 28x40 cm with 3 different ground colours. The autonomous vehicle will have to park in the red coloured area among these areas. The ground colours of the parking areas will be on a separate decota and the referee will be able to change the location of these areas in each competition.
- There will be a sensor 5 cm above the ground in the parking area to stop the stopwatch to measure the competition time.

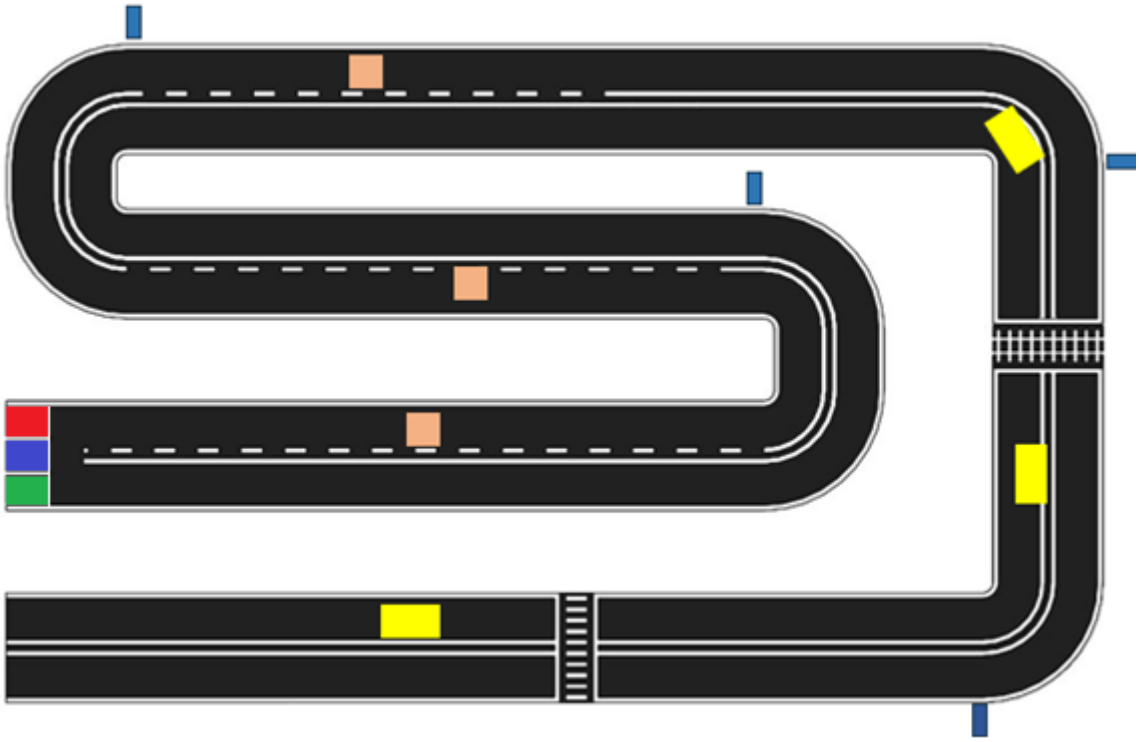

Figure 1: *Competition Track*

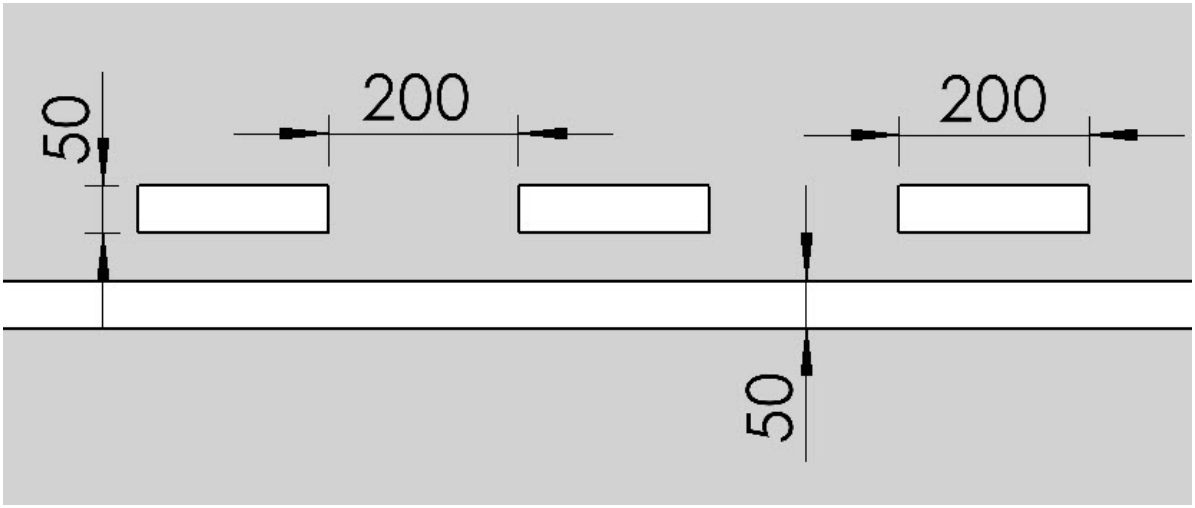

Figure 2: *Road Line dimensions*

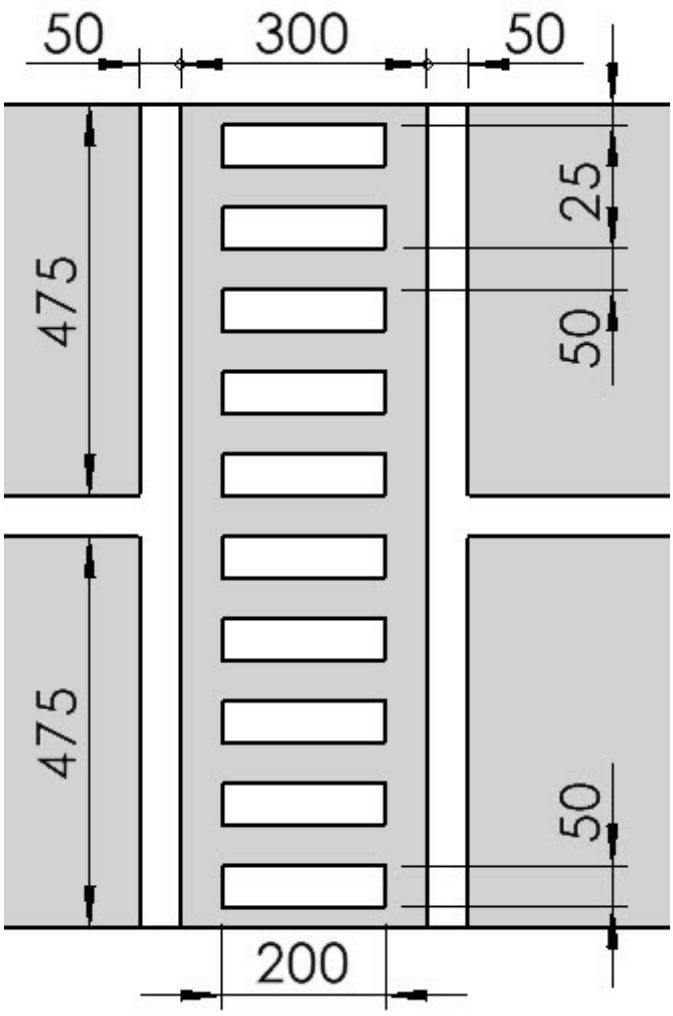

Figure 3: *Pedestarian crossing dimensions*

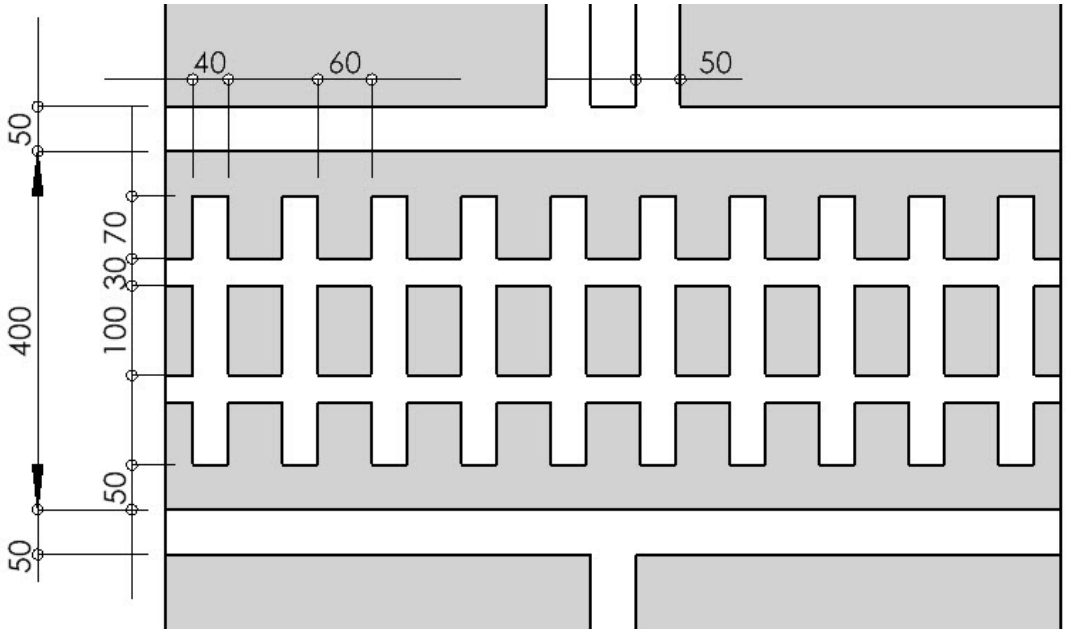

Figure 4: *Level crossing dimensions*

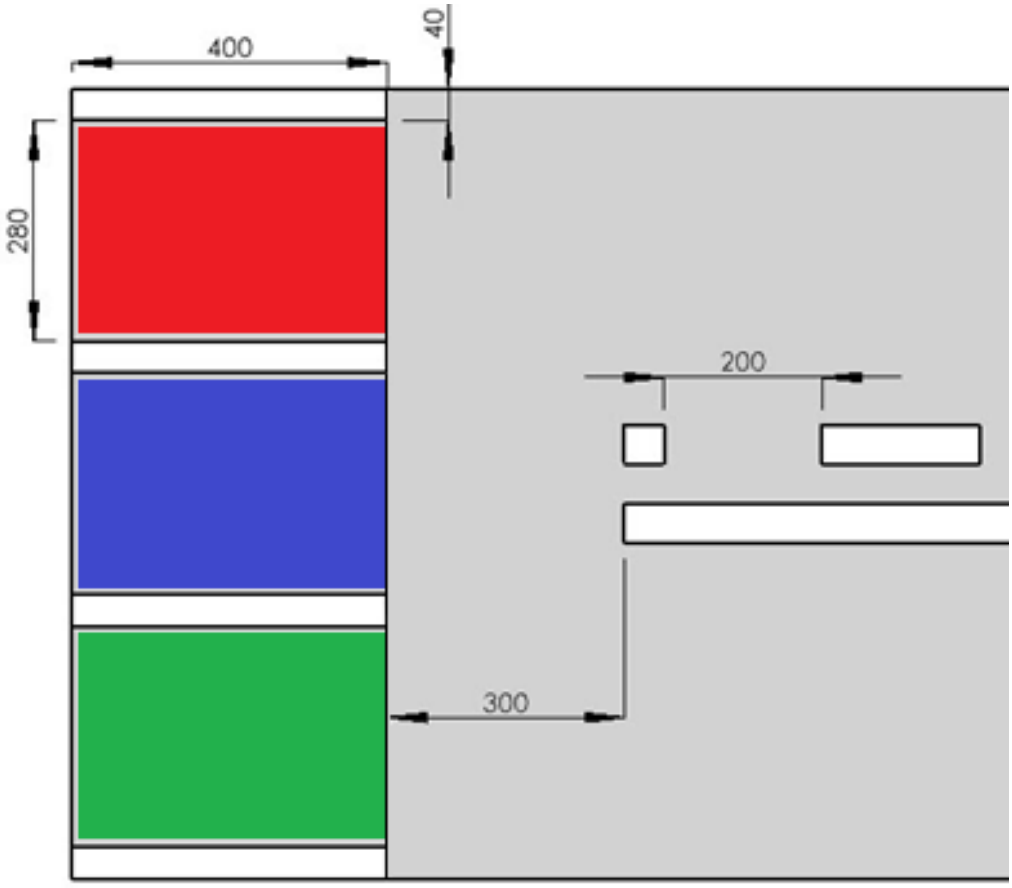

Figure 5: *Parking area dimensions*

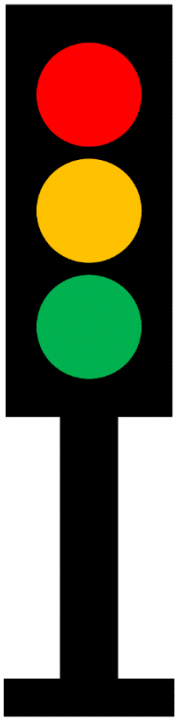

Figure 6: *Traffic lights*

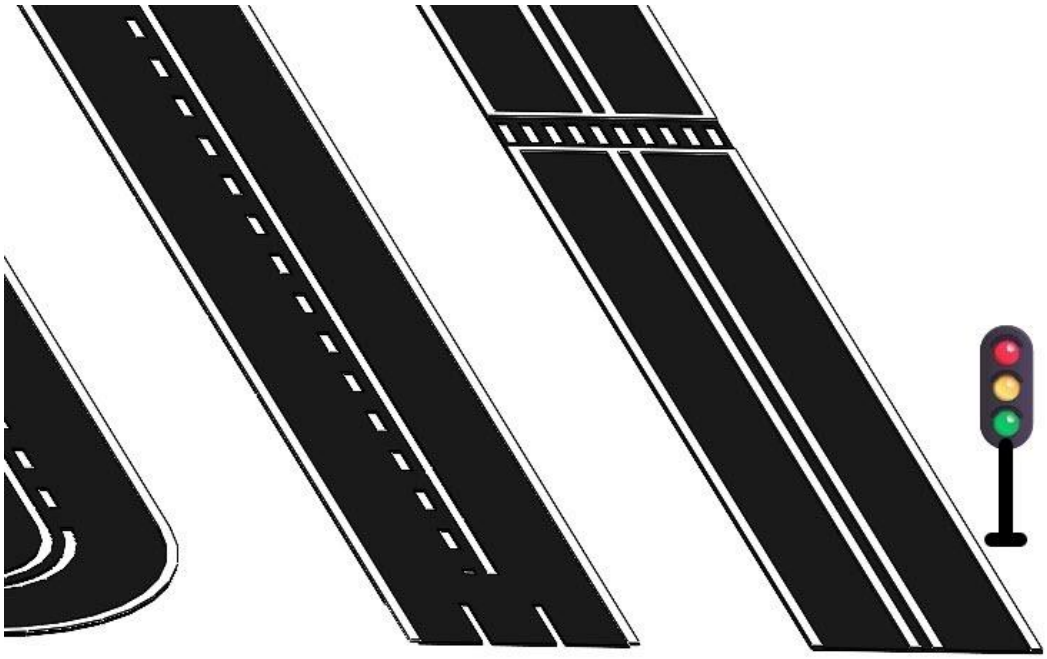

Figure 7: *Starting*

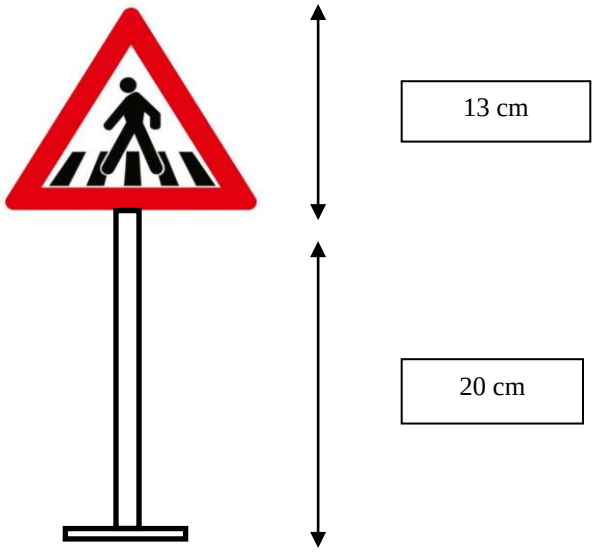

Figure 8: *Pedestrian crossing sign dimensions*

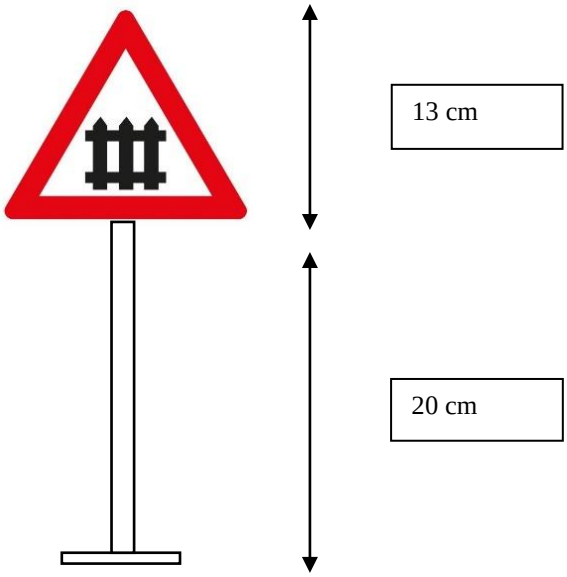

Figure 9: *Level crossing sign dimensions*

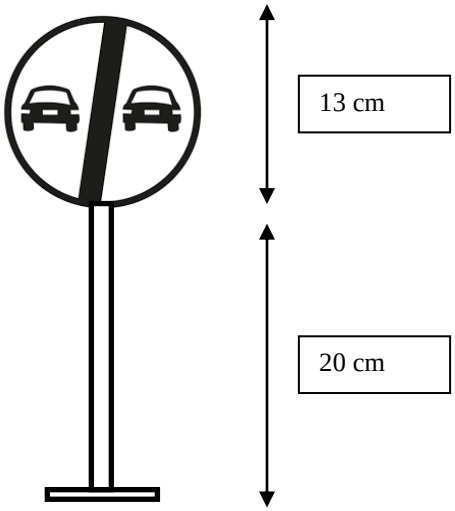

Figure 10: *Overtaking sign dimensions*

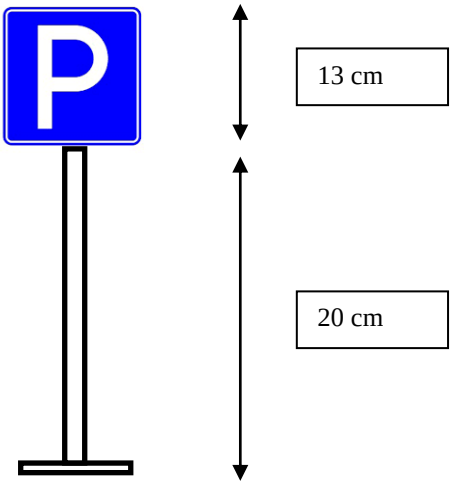

Figure 11: Parking place sign dimensions

4. COMPETITION FORMAT

4.1 PRE-QUALIFICATION

- There will be no pre-selection in this category.

4.2 TEST STAGE

- Autonomous vehicles will be allowed to test on the track on the first day according to the number of competitors whose applications are accepted.
- Each team will be given equal time during the test phase.
- AV that damage the track during the test phase or during the competition will be disqualified.

4.3 RANKING COMPETITION

- Before the competition starts, team members are asked for information about the software and the autonomous vehicle. The competitor must explain which image processing technique he/she is using. Competitors who do not have information about the autonomous vehicle and software may be disqualified by the decision of technical advisors and referees.
- The competition starts when the AV cross the starting sensor and ends when they pass the sensor in the parking area.
- The AV accepted to the competition area are placed behind the traffic lights and be ready for run by the competitor.
- The traffic light at the start will be red, yellow and green, and autonomous vehicles will start the race within 3 sec. after the light turns green. The times between the lights will be randomised.
- AV that cannot start will be given extra time (duration will be determined competition day) for technical intervention. During this time, they stay in the field, and then they will be asked to start again.
- 50 reward points will be awarded to the AVs that start correctly at the first time. AVs that start correctly the second time will be awarded 25 points. Those who start the autonomous vehicle automatically with the button will be awarded 50 additional points.
- Reward points will not be given to the AV that cannot start properly.
- Autonomous vehicles that fail to start within 15 sec. after the start signal for the second time will be disqualified from the related round.
- AVs will stop at the pedestrian crossing. The distance between where the AV stops and the pedestrian crossing should be maximum 30 cm. It must wait here for at least 5 seconds. AVs that fulfil this task will receive 50 reward points.

- AV will stop at the level crossing. The distance between where the AV stops and the level crossing must be maximum 30 cm. It must wait here for at least 5 seconds. AVs that fulfil this task will receive 50 reward points.
- AV must move to the right lane in the overtaking ban zone and fulfil the overtaking task when the ban ends. AV that fulfil this task will receive 100 reward points.
- There will be 3 parking zone at the end of the track. These parking areas will be red, green and blue. AV will park in the red coloured zone. AV that fulfil this task will receive 100 reward points.
- 50 reward points will be awarded to AV that completes the zones without out of track. In case of leaving from track, 5 reward points will be deducted from 50 points for each leaving. The minimum score will be 0.
- If AV goes out of track, competitor will place it at back on the track parallel to the point from which it left.
- If the AV turns upside down on the track, the rules for leaving track will be applied.
- If the AV remains stationary in a zone for 30 seconds, the rules for running off the track will apply. If the inactivity becomes permanent, the vehicle will be disqualified from that lap by the decision of the referee. Also, millimetre movements of the autonomous vehicle will not be considered as movement.
- If the run-off becomes permanent, the AV will be disqualified from that lap by the decision of the referee.
- In no overtaking zones, if the AV collides with the yellow vehicle in the opposite direction, 25 points will be deducted from the relevant zone completion score. However, the total reward points will not fall below 0
- The maximum completion time of the competition is 5 minutes.
- When AV enters the parking area at the end of the track, the stopwatch will stop and the AV's competition time will be determined.

- When the competition is over (Finishing time coefficient = (5*60-finishing time (sec)) is calculated and added as award points.
- At the end of the ranking competitions, AVs are ranked with their total points at the end of the competition.
- Total score = calculated with award points.
- In case of equality, AVs are ranked according to the time to finish the competition.
- The AVwith the lowest time in the ranking is declared the first.
- After the number of autonomous vehicles is determined, it will be determined how many laps the AV will compete. In case autonomous vehicles compete two or more times, the total score will be calculated by adding the lap scores.

5. WARNINGS TO THE COMPETITORS

- The general rules regarding the competition applications and the Autonomous Vehicle category are included in the “Application Guide”. The Application Guide must be read before making an application.
- Competitors called to game area are not given additional time to charge their batteries.
- No permanent trace or marking can be left on the track and it cannot be damaged. AVs that damage the track are disqualified.
- AV can use an energy source such as a battery or battery group. Liquid or flammable energy sources cannot be used.
- Competitors, after the first competition; they can change the tyre wheel or battery on the AVs. They cannot make any other changes on the AV. In all physical appearance changes such as changing the AV body, the AV is disqualified.
- The AV will be disqualified if the QR code pasted on the registration desk during the competitions is removed, replaced and the QR code is damaged.
- AVs that do not match the competitor AV photos on the referee desk are disqualified.

- When the electronic circuit components need to be replaced, the same type of components can be replaced in the same place. The QR code must not be damaged during the replacement of the components. Otherwise, the AV is disqualified.
- The QR code must be affixed to the AV body. It should not be pasted on removable materials. In such cases, the referee disqualifies the AV in case of a problem with the AV.
- Objections made during the competitions due to illuminated marquees, cameras, cameras and lighting around the track will be deemed invalid.
- Changes can be made to the track dimensions during the construction phase without disturbing the general structure.
- The Competition Organising Committee has the right to make changes in the manual when it deems necessarY.

6. CONTACT

Competitors are required to ask their questions by selecting their categories from the information menu after logging into the “robot.meb.gov.tr” system. Questions other than category messages will not be answered. The responsibility in this regard belongs to the contestant.

No	Robot	starting	pedest cross	level cross	over taking	parkin	finish the zones					timing coefficiant	total score	time
		50/25+50	50	50	100	100	(50)-(	hit x5)				(5*60-time)		
1														
2														
3														
4														
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Tablo 1: *Scoring table*

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RC FIXED WING AIRPLANE CATEGORY GUIDE

2025

Education, Technology, Production from Roots to the Future

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RC FIXED WING AIRCRAFT CATEGORY COMPETITION RULES

1. PURPOSE

Unmanned aerial vehicles (UAVs) are used in many fields today. Although aerial imaging and mapping are among the most common applications, there are also various applications in areas such as small-scale cargo transport, fire fighting, defence industry, first aid and life saving.

Technological leap points are events that increase the level of development of countries and the welfare of their people with a "doping" effect. Technological leap points in the past are considered to be the steam engine, car and aircraft production, atomic energy, computer and space technology, and industrial robots. The current technological leap point is UAV technology. Successful applications in the military field show how UAVs can contribute to the defence of the country. For this reason, many countries carry out R&D studies in the field of UAVs and offer their products to the market.

The aim of this competition, which high school and university students can participate in, is to develop the culture of producing and using unmanned aerial vehicles in our country. In doing so, it is aimed for young people to combine technology with entertainment and to increase their knowledge and skills. Thus, the competition will also contribute to the development of the human resources that our country will need in the near future, both in terms of UAV use (pilot) and UAV production.

2. SCOPE

As a basic structure, UAVs can be divided into three groups as fixed wing, rotary wing and hybrid.

UAVs with immobile and fixed wings that keep the vehicle in the air are generally called fixed-wing UAVs. Aircraft belong to this group. The ability of fixed-wing UAVs to stay in the air depends on the continuous movement of their bodies. The propulsion force that provides movement is provided by propellers connected to a liquid fuelled, internal combustion engine or electric motor. Some models use a liquid fuelled turbine (jet) or electric fan (fanjet) that

can reach high speeds. The propulsion force is applied perpendicular to the direction of gravity. In electric motorised models, the position of the propeller can be at the front (a), on the wings (b), on top of the fuselage (c) or at the rear of the fuselage (d), as shown in Figure 1.

Figure 1: *Fixed Wing UAV Images: Front Motorised (a), Wing Motorised (b), Top Motorised (c) and Rear Propulsion (d)*

It should also be noted that each fixed wing design has advantages and disadvantages compared to the other. A large part of the design and production of fixed-wing UAVs consists of mechanical works. The production costs of these vehicles, which are generally single-engined, are low compared to other UAV models. Although large areas are needed for them to be flown and to take off and land, their flight range is quite high.

UAVs whose propeller blades that keep the vehicle in the air rotate continuously in the direction opposite to the direction of gravity are called rotary-winged UAVs. These vehicles, which have one, three, four, six and eight propellers according to the number of propellers they have, are called helicopter, tricopter, quadcopter (quadrotor), hexacopter and octocopter, respectively, from Latin origin. Since the body is fixed and the propeller blades rotate in rotary blades, the body does not have to move continuously as in fixed blades in order to keep the vehicle in the air. In this way, the movements of rotary wings in the air are more controlled, they can hover at a single point in the air and can take off and land in very small areas. A large part of the design and production of rotary wings consists of electronic labour and planning (weight, load, battery balance). Production costs are much higher due to the exponential increase in the number of expensive electronic materials such as motors and drives according to the number of rotating wings. Flight ranges are short. Figure 2 shows rotary wing UAVs with various numbers of propellers.

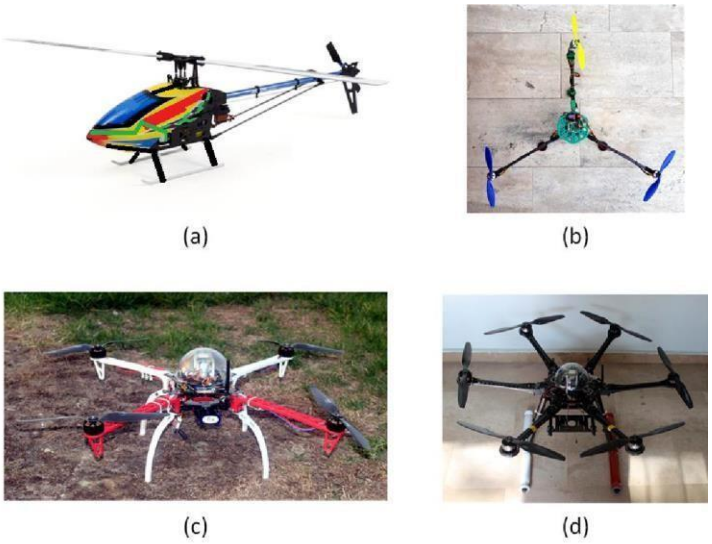

Figure 2: *Rotary Wing UAV Images: a. Single Propeller Helicopter, b. Three Propeller Tricopter, c. Quadcopter with Four Propellers, d. Hexacopter with Six Propellers*

Another design type that has recently become popular and widespread is hybrid UAVs. The hybrid UAV design combines the superiority of fixed-wing UAVs in terms of long range with the superiority of rotary-wing UAVs in terms of vertical take-off and landing capability. This hybrid UAV type, also called VTOL (Vertical Take Off Landing) in English, will be the manned and unmanned aerial vehicle design of the future. In principle, hybrid UAVs have both rotary propeller blades that allow the vehicle to take off and land vertically, and fixed wings attached to the fuselage that allow the vehicle to glide in the air. There are various designs in this UAV model and development studies of different models are still ongoing. In some designs, there is only a propeller on the vertical axis and the vehicle returns to the horizontal axis after the vehicle takes off vertically. Some designs have a propeller both on the vertical axis, as in rotary wing UAVs, and on the horizontal axis, as in fixed wing UAVs. In some designs, the propellers on the vertical axis change direction after take-off and return to the horizontal axis. Figure 3 shows various hybrid UAV designs produced by different companies.

Figure 3: *Hybrid UAV Designs Produced by Different Companies.*

In the Unmanned Aerial Vehicle RC Fixed Wing category, fixed wing UAVs with low production cost, open to development and offering design flexibility were preferred. These UAVs provide a suitable platform where the competitors can add their own designs and interpretations and produce them in an original way. The fixed-wing UAVs shown in Figure 4 were preferred because they are suitable for innovative designs and domestic production, have low production and material procurement costs, and are open to continuous development.

Figure 4: *Sample UAV RC Fixed Wing Images*

In the RC Fixed Wing category, a race will be organised in an open area within the scope of the rules detailed below. While determining the rules, the rules of international and national UAV racing leagues (e.g. TEKNOFEST, SESA, etc.) were taken into consideration. In this way, the ground has been prepared for a team competing as an amateur in the Unmanned Aerial Vehicle category to be able to participate professionally in national and international races by obtaining a licence in the future.

3. BASIC INFORMATION ABOUT DRONES

The sample components that make up the UAV that will participate in the competition and the technical specifications to be complied with are as follows:

3.1. Flight Simulator Software

When the UAV is on the ground, the flight plan is set via the ground station. The content of this flight plan includes information such as which direction the aircraft will go, which direction it will turn, and how high it will go. The prepared flight plan is loaded into the flight card and the UAV is made ready for flight and taken into the air. While the UAV is in the air, the autonomous flight card calculates the position of the UAV, which direction it is travelling, how fast it is travelling and at what altitude it is, and compares it with the information entered in the flight plan, and flies the UAV according to the information entered in the flight plan. Various applications can be used as ground stations, such as Q ground control or Mission planner. Various calibrations and settings of the UAV are made via ground stations. Flight plan

preparation and loading of the flight plan to the card is done via the ground station. Telemetry modules provide communication between the UAV and the ground station. We can see the position of the UAV in the air , the direction and speed of the UAV through the ground station thanks to the gps module to be installed externally on the card. There are various autonomous flight modes, such as FBWA and Auto modes. FBWA mode allows the UAV to fly in an assisted manner, the flight card restricts the turns that the aircraft can make. Auto mode flies the UAV according to the information entered in the flight plan. The UAV flies completely autonomously, turns and accelerates autonomously.

3.2. Body

The body of the Unmanned Aerial Vehicle (UAV) is usually made of various materials. These materials include FOAM (styrofoam foam), BALSA, COMPOSITE (fibreglass), CARBON or PLA (with 3D printers). Which material is preferred should be determined depending on the specific characteristics and intended use of the designed UAV.

Figure 5: *UAVs made of different materials*

- ***FOAM (Styrofoam Foam):*** It is a light, cheap and easy to process material. It enables the UAV to be produced quickly and economically. However, its durability is lower than other materials, so it is more suitable for use only in light and low-speed flights.
- ***BALSA****:* It is a light, flexible and durable material. It can be well processed and easily shaped. However, BALSA material mostly requires manual labour and production costs may be higher than other materials.
- ***COMPOSITE (Fibreglass):*** It is a high strength and lightweight material. It is frequently used in UAV bodies due to its durability and aerodynamic properties. However, composite material is more difficult to process and its production cost is higher than others.
- ***CARBON****:* It is an extremely light and high strength material. Therefore, it is preferred for fast and high performance UAVs. However, carbon material is quite expensive and

difficult to process.

- ***PLA (with 3D Printers)****:* Can be easily produced with 3D printers and provides design flexibility. PLA material is lightweight and durable, but it is not recommended for use in high-speed and high-altitude flights.

Which material is preferred may vary depending on the design requirements, performance expectations, cost factors and usage scenarios of the UAV. For example, FOAM or PLA may be preferred if lightness and economy are at the forefront, while CARBON or COMPOSITE materials may be more suitable if durability and high performance are sought.

3.3. Engine

The number of brushless motors or fan motors to be used in the UAV is limited to 2, and there are no size, KV rotation speed and operating voltage limitations on the motors to be used. Teams can choose any motor that will meet their needs. This flexibility gives UAV designers the freedom to choose the most suitable motor from a variety of motor options. In this way, the engine that best suits the design requirements and performance targets can be selected and the efficiency, reliability and performance of the UAV can be increased. Factors that need to be taken into account when selecting an engine include flight expectations, payloads to be carried, speed requirements and energy efficiency.

Figure 6: *Example UAV Engines*

3.4. Motor Driver (ESC)

Motor drives (electronic speed controller) that can drive 10-80A current with the power to support the current of the motor to be used in the UAV can be preferred. These drives receive the RC control signal through an optical isolator (optocoupler), so that interference caused by the supply voltage does not prevent the operation of the drive and maintains the motor rotation speed more stably.

Figure 7: *Example UAV Motor Drivers*

3.5. Flight Controller

Off-the-shelf controllers with 8-bit or 32-bit based processors (compatible with PIXHAWK, APM, CUAV, etc.) can be used, as well as personal design flight controllers using MEMs sensors (3-axis gyro, 3-axis accelerometer, 3-axis magnetic compass).

Figure 8: *Example UAV Autonomous Flight Controllers*

3.6. Power Module And Power Supply

The UAV provides the power it needs from Li-PO batteries that provide high discharge current. In UAVs without a flight controller, equipment other than the engine is provided from the signal output of the ESC. In UAVs with a flight controller, the PIXHAWK POWER MODULE or a similar power reduction module must be used. This module takes the power required for the engine from the battery and transfers it directly to the engine without reducing it at all, while reducing the voltage and amperage to other equipment.

Figure 9: *LiPo battery and power distribution module*

3.7. Remote Control

To avoid interference with other UAVs, 2.4GHz frequency hopping transceiver modules with at least 6 channels should be used. In order for the remote control to work in harmony with the training simulator, it is recommended to choose among the professional models with a trainer connection socket on the back. Thanks to a single professional remote control to be purchased, different vehicles can be controlled with a single remote control by purchasing an additional RC receiver in the future, professional remote controls can store the settings of at least 16 different vehicles separately, for these reasons, the remote control is a basic device (fixture) and it is recommended to prefer good brand models.

Figure 10: *RC Control Types*

3.8. Pilotage Camera, Display and Goggles Kit (FPV)

The first person view (FPV) is an image and transmission system that allows the pilot to perceive the aircraft as if he is flying the aircraft while flying it. It is an equipment that facilitates the steering of the aircraft. The kit basically consists of a camera transmitter, 7/21 receiver, antenna assembly and a display device (LCD screen or goggle). Each device can be purchased and combined separately, but today there are also models that combine camera and transmitter, receiver and screen or goggles. Especially when choosing a screen or glasses with a receiver, models with two separate receivers (diversity) should be preferred in order to get a clear image. When selecting a camera, it is recommended to choose a model with a high quality image sensor, low image resolution and minimum illumination value, and if possible, a transmitter and the ability to record simultaneously to the SD card. It is not mandatory to use a pilotage camera set. If it is used, in order to avoid conflicts with other UAVs, the transmitter broadcast frequency should be preferred models that use only the 5.8GHz band and can broadcast 40-50 channels supporting the racing band (Band R: 5658, 5695, 5732, 5769, 5806, 5843, 5880, 5917).

Figure 11: *FPV Goggles system*

3.9. OSD (On Screen Display) Module

It is a module used to place information such as battery voltage, current, inclination of the aircraft, etc. read and calculated by the flight controller from the sensors on the camera image. For example, when you want to switch on the TV volume at home, you can see the volume level on the screen. Thus, the users of the pilotage camera set will be able to see the information about the vehicle live on the screen image. It is forbidden to use in the competition.

Figure 12: *OSD Modules*

3.10. Propeller

The power of the engine to be used in the UAV should be large enough so that the wings will not collide. When selecting the engine, its specifications (datasheet) contain information on which sizes of propellers it can work efficiently with.

Figure 13: *Example Propellers*

3.11. Battery Alarm (Li-Po Alarm)

It is a small electronic module that can be attached to the feedback terminal of the battery, will display the battery cell voltage and will give an audible warning when the cell voltage drops below 3.7V during flight.

Figure 14: *Sample Battery Alarm*

3.12. Safe Battery Carrying Case (Li-Po Safe Bag)

A fireproof bag with protective features should be used against explosions of LiPo batteries, all batteries should be charged and stored in the bag.

Figure 15: *Sample LiPo Battery Safe Transport Case*

3.13. Mechanical Assembly

Special liquid solutions (locktite etc.) or fibre nuts will be used to prevent loosening of nuts, bolts and screws during flight. In the technical control to be carried out before the competition, it will be examined whether these solutions are used or not.

3.14. Electric-Electronic Assembly

Shrinking macron shall be used in cable and connector connections, and no exposed electrical wires shall be seen. Cables shall be fixed to the UAV body with cable ties. Exposed and unfixed (dangling) cables pose a fire hazard by contacting each other when the UAV falls to the ground or hits something. For this reason, in the technical control to be carried out before the competition, it will be checked whether cable ties are used to fix the cables with shrinkable tubing so that there are no exposed cables. The team that does not comply with even one of these rules will not compete.

4. MISSION:

The task of all teams is to drop 2 tennis balls from their UAVs to the specified target within a maximum flight time of 6 minutes. The size and weight of the tennis balls are standardised. The balls to be used for the mission will be given to the teams before the flight.

4.1. Implementation of the Task:

The teams have to perform the mission and land within 6 minutes after take-off to perform the mission. The mission mechanism of the UAVs must be unique, but the ball to be dropped by all teams is the same. If the dropped balls hit the target (**2 square metre canvas**) at the moment of the first fall, it is written in the team's score as full points. The balls cannot be dropped at the same time. After the first ball, at least one round flight must be made for the second ball to be dropped.

Take-off, flight, mission and landing time cannot exceed 6 minutes. For every 30 seconds exceeding this time, 1 penalty point is awarded to the flying team. If the take-off, flight, mission and landing time is less than 3 minutes, 1 penalty point is awarded for every 30 seconds.

5. OBJECTIVES FOR TEAMS:

***Business science**:* The engineering skill, quality-oriented approach, functionality, effort and seriousness demonstrated by the team during the design process are indicators of business science. BI includes the technical capabilities and expertise related to the design, production and performance of the UAV.

***Experience**:* The experience gained in the organised competition contributes to the team to be more successful in future projects.

***Opportunity**:* Participation in competitions provides teams with the opportunity to establish collaborations with each other and with the private sector. Teams can access technology transfer and co-operation opportunities by establishing industrial partnerships through competitions.

Motivation Participation in the competition and the awards received provide motivation to the teams and create a desire to participate in various competitions.

***Team Awareness**:* It includes interdisciplinary work, sustainability, social responsibility and ethics. These achievements include elements such as the ability to succeed together, ensuring sustainability, process discipline, honesty, openness and transparency, and benevolence.

5.1. Expected Features of the Developed UAV

Localisation: The developed UAV is expected to be produced with domestic capabilities. (For example; the use of indigenous hardware, software or both).

- Domestic design of the UAV.
- Production of the UAV using domestic facilities.

Innovation: An innovative UAV is one that includes new hardware, software, auxiliary equipment or design. For example;

- Using a different engine or adapting the engine type used in another field to the UAV.
- Feeding the UAV through another power source.
- Use or design a different flight control board.
- Designing an original fuselage or mission mechanism.

Affordability: It is an indicator of economy for the developed UAV to perform its mission with less cost, but the efficiency and capabilities of the aircraft should not be restricted while ensuring economy.

Ease of Production: Ease of production is an indicator of the efficiency and sustainability of the developed UAV in the production process.

- The design and manufacture of the UAV should be as simple and easy to use as possible.
- The assembly time should be simple and efficient.
- Parts must be easily accessible and easy to replace.

Stability: The developed UAV is expected to perform a stable flight during take-off, during the mission and during landing.

Capability: The capability criterion is assessed according to the following aspects;

- The UAV must effectively fulfil the tasks set.
- The UAV's successful completion of missions with a specified degree of difficulty is an indication of its capability.
- The UAV's speed, manoeuvrability, payload, precision, accuracy and other performance characteristics determine its overall capability.
- UAV's the specified tasks in a fast, reliable and The ability to fulfil it effectively indicates high level of ability.

Autonomy: Autonomous flight capability scores higher than manual flights with remote control of the UAV, and this criterion is often a decisive factor in the successful completion of the mission.

The reliability and accuracy of autonomous flight systems are critical for the UAV to successfully fulfil its missions. The ability of the UAV to follow the specified targets and routes, to change the route when necessary during the mission and to make effective decisions is an indicator of autonomy capability.

Mission Success: Even if the UAV has a high capability, it is expected to successfully complete the prescribed mission. The UAV's completion of the specified missions in accordance with the targeted success criteria is an indicator of mission success.

Team Skill: The UAV must be built by the competing team. Detection of the contrary will cause the team to be eliminated from the competition. This process will affect the evaluation during the technical control phase.

****The developed UAV is expected to include all the above-mentioned aspects, scoring will be made according to these principles. Otherwise, teams will receive missing points in scoring.*

6. GENERAL RULES

The rules of the competition are as follows:

1. Each team must strictly follow the rules set by the race committee and the referee's warnings. Teams found to have violated the rules will be excluded from the competition.
2. The race committee may re-run the race it deems appropriate.
3. Teams can make all appeals according to the general "Application Guide" rules.
4. Each team can have a maximum of two students, one pilot and one observer (co-pilot).
5. UAVs cannot be controlled by watching through FPV goggles or LCD screen.
6. The observer will carry out the tasks of placing the UAV at the starting point with the instructions of the referee, taking coordinates from the competition area, visually following the UAV by standing next to the pilot during the competition and providing all kinds of support by giving voice commands (co-pilot) when necessary.
7. The selection of the teams that will come to the city where the competition will be held will be based on the videos requested from the teams. The selection of the videos will be made by the competition committee according to the criteria specified in section 5.1 of the specification.
8. Video length should be at least 4 minutes. The UAV produced in the videos should be described according to title 5.1.
9. Production videos are uploaded to YouTube by teams with the team name and the name of the competition category. The links of the uploaded videos are added to a specific area on the registration system.
10. The first 30 teams with the highest score from the video submission are invited to the competition.
11. On the first day of the competition, all teams are scored by the technical committee

according to section 5.1 of the specifications. This scoring constitutes 50% of the points the team will receive in the semi-final and final. The team that gets full points from the technical committee gets 50 points. The points received at this stage will also be used in the final stage.

12. After the completion of the technical controls, the flights start on the first day. Flight order is determined randomly. For this reason, all teams are expected to be ready for the flight on the first day.
13. Teams do not have the right to skip a flight. Teams that do not take the flight even though it is their turn to fly will forfeit 1 flight right.
14. The score to be obtained from the flight and flight task is added to the score obtained from the technical committee and the 6 teams that will remain in the final stage are determined. A team can get 50 points from technical control, 20 points from flight, 10 points from autonomous flight and 20 points from mission.
15. Each of the 30 teams has the right to fly 2 times in the mission area. The highest score from the 2 flights is used in the ranking of the final stage.
16. Each team that qualifies for the final stage gets 2 more flight rights. With the sum of the highest score obtained from the flights and the score given by the Technical Committee, the award-winning teams of the final stage are announced.
17. The flight order in the competitions will be determined by lot.
18. Before each flight, the UAV of the teams is taken into technical control and it is determined whether it is suitable for flight. Since each team has 2 flight rights, teams that are found unfit for flight 2 times are disqualified.
19. Teams invited to the competition area according to the draw order must take their places in the technical control section within 15 minutes. Teams that do not show up will forfeit their right to fly.
20. Teams that pass the technical control are given 15 minutes to start the flight. Teams that do not start their flight at the end of the time will be penalised 1 point for every 2 minutes of delay. The flight right of the teams whose delay time exceeds 30 minutes will be cancelled. (It should be noted that each team has 2 flight rights).

21. The autonomous or semi-autonomous flight will bring 10 additional points for the teams.
22. In the 100-point competition; the flight has 20 points and the mission has 20 points.
23. In order for the flight to be considered complete, the UAV must make an undamaged landing after a stable flight without leaving the designated area.
24. UAVs that go out of the area during the flight are detected by the signallers waiting at the borders of the flight area. For each violation after the first violation, 1 point will be deducted. Teams with 6 warnings are asked to land their UAVs and their flight rights are terminated.
25. In order for the mission to be deemed to be fully completed, the balls released from the mission mechanism are expected to hit the targets that are predetermined and marked in the competition area before the flight. The first point of contact of the balls on the ground is considered as hitting the target. The officials near the target determine the realisation of the hit with the flags in their hands and notify the scoring committee. A ball falling within 2 square metres of the target is considered to have hit the target. Each hit of the target is worth 10 points. For each metre away from the target, 1 point is deducted as a duty point. For example, the ball that makes first contact 8 metres away from the target earns 2 points for the team.

7. TECHNICAL CHARACTERISTICS OF UNMANNED AERIAL VEHICLES

1. The wingspan of the Unmanned Aerial Vehicle that can participate in the competition must have a maximum wingspan of 2000 mm and a length of 2000 mm from beginning to end. In the technical control to be carried out before the competition, it is checked whether the UAV complies with the specified dimensions.
2. The weight of the UAV must be maximum 6 kg including the battery and all other equipment. The UAV will be weighed during the technical controls before the competition.
3. The propeller diameter that can be used in UAVs can be selected according to the needs of the UAV, there are no restrictions.
4. UAV bodies must be personal custom design. The UAV and its team will be excluded

from the competition.

5. Teams must keep their LiPo batteries in a fireproof battery bag (LiPo safe bag). Teams without a fireproof battery bag will not be registered.

8. SECURITY MEASURES

1. A switch or button on the controller will be set to make the UAV active/passive (arm/disarm). This feature will be checked before the competition and the UAV and its team will be excluded from the competition.
2. When the control connection with the UAV is lost, the vehicle will land automatically (radio failsafe). The presence of this feature will be checked by the judges before the competition. UAVs without this feature will be excluded from the competition.
3. When the UAV goes beyond the boundaries of the competition area or the field of view, the UAV will be disarmed by the pilot when the referee gives instructions.
4. UAVs use LiPo or derivative batteries with high current capability. These batteries are chemically unstable and can easily explode. Each team must have a sufficient number and size of fireproof battery bags (LiPo safe bag) to carry their batteries.
5. The plugs on the UAV where LiPo or derivative batteries are installed shall be placed in such a way that they can be removed by the referee when necessary. Thus, it will be ensured that the battery can be easily removed from the UAV in case of emergency. This issue should be taken into consideration in the design and assembly of the UAV.
6. Teams will be allocated a special test area within the competition area to test their UAVs. Referees in this test area will organise the test flights. Teams found flying outside the test area (corridor, garden, etc.) will be warned and 2 penalty points will be given to the team for each warning. If necessary, at the discretion of the referees, the UAV and its team will be excluded from the competition.

9. GENERAL RULES OF THE COMPETITION

- The flight order of the teams is determined by lot. It is announced before the competition. Teams cannot object to the grouping and flight order.
- It is the responsibility of the team to provide all kinds of materials and equipment to be used for the task to be performed.

- Robot teams consist of 3 students and 1 counsellor teacher.
- All registered teams are obliged to take technical control before the flight.
- Since it is planned to complete the scoring to be made on the first day of the competitions in areas such as Technical Control, Design Ergonomics, Innovation, Localisation, etc., teams should have completed all preparations in advance.
- In technical control, the UAV is checked by experts in the field for weight components, structural strength, mechanical mobility and safety of electronic equipment.
- Teams that are successful in the technical control are prohibited from disassembling or changing parts of the UAV before the flight in terms of flight safety.
- It is the teams' responsibility to follow the flight order. Excuses of 'not being ready' or 'not passing the technical control' are not accepted.
- Teams taken to the Queue Waiting Tents wait in a ready state by attaching their propellers after making the last checks of their vehicles. It is at the discretion of the relevant referee to consider the readiness status of the teams in the queue waiting tent instead of the ranking when calling them to the track. No objection is accepted.
- When there is a possibility that the flights may not be completed due to weather conditions or other reasons that may occur during the competitions, another team may prepare in a part of the area by taking the necessary security measures. Those of the teams in the queue who are in a position to disturb the other team for reasons such as signal interference or visual pollution shall notify the coordinator of this situation on the first day of the competitions. Otherwise, no excuse will be accepted.
- In order to prevent loss of time, teams whose turn is approaching during non-flight hours should make preparations such as taking coordinates from the area and placing/forming the auxiliary platforms needed. Announcements can be made to announce the times when preparatory work can be done. It is the responsibility of the teams to follow the announcements.
- It is essential that the teams perform their flights within the specified area. It is forbidden to go outside the specified area for security reasons.

- If the UAV crosses the buffer zone, the referee may request the flight to be stopped if he/she feels a safety hazard. In this case, the vehicle is switched to FAIL-SAFE mode and asked to land safely.
- The maximum flight height in competitions is 120 metres. However, for the sake of safety and accurate observation, it is recommended that flights do not exceed this height.
- Teams cannot fly with harmful biological, chemical, etc. substances that may endanger human health and safety in the competition areas.

10. CONTACT US

Contestants are required to ask their questions by selecting their categories from the information menu after logging into the https://robot.meb.gov.tr/ system. All questions other than category messages will remain unanswered and only the contestant team is responsible for this situation. For all your questions, please read the competition guide first. The guide has been prepared to answer almost all questions that may arise. It will be useful to read the guide again and carefully when necessary.

DIRECTORATE GENERAL OF VOCATIONAL AND TECHNICAL EDUCATION

100 CENTURY OF EDUCATION

TÜBİTAK

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INTERNATIONAL MEB ROBOT COMPETITION

17th INTERNATIONAL MEB ROBOT COMPETITION

OPEN PROJECT CATEGORY RULES

2025

Education, Technology, Production from Roots to the Future

CONTENTS

OPEN PROJECT CATEGORY RULES

1. GENERAL INFORMATION ABOUT THE COMPETITION

1.1. Objective

Robot Project Competition is organised in the Free Category within the International Robot Competitions in order to create an environment where vocational and technical education students at secondary and higher education level can present their knowledge and skills, dreams and dreams by transforming them into reality with entrepreneurial scientific thinking

The category "Open Project" addresses the following skills:

- ***Innovation***: It enables students to produce original ideas by using their imagination and innovative thinking capacities.
- ***Scientific Thinking and Problem Solving****:* It supports the ability to analyse problems with scientific methods, design and implement solutions.
- ***Technical and Engineering Skills:*** Provides the opportunity to develop technical knowledge and application skills in the fields of robotics and electronics.
- ***Entrepreneurship:*** It encourages students to transform their original ideas into projects and present them with an entrepreneurial approach.
- ***Teamwork and Collaboration:*** Since projects are usually realised through teamwork, students develop communication, role sharing and cooperation skills within the team.
- ***Project Management and Organisation:*** It covers the skills of planning project processes, time management and goal achievement.
- ***Presentation and Communication Skills:*** Allows students to effectively present their projects and express their ideas.
- ***Research and Development (R&D):*** Gains the ability to develop technological and scientific solutions by researching a specific subject in depth.
- ***Interdisciplinary Working:*** Supports the creation of integrated projects by bringing together knowledge and skills from different fields (e.g. software, mechanical, electrical, design).

- ***Self-confidence and Motivation:*** The process of realising and presenting their own ideas increases students' self-confidence and motivates them for bigger projects.

This category contributes greatly to the development of students' individual talents as well as their teamwork and co-production skills.

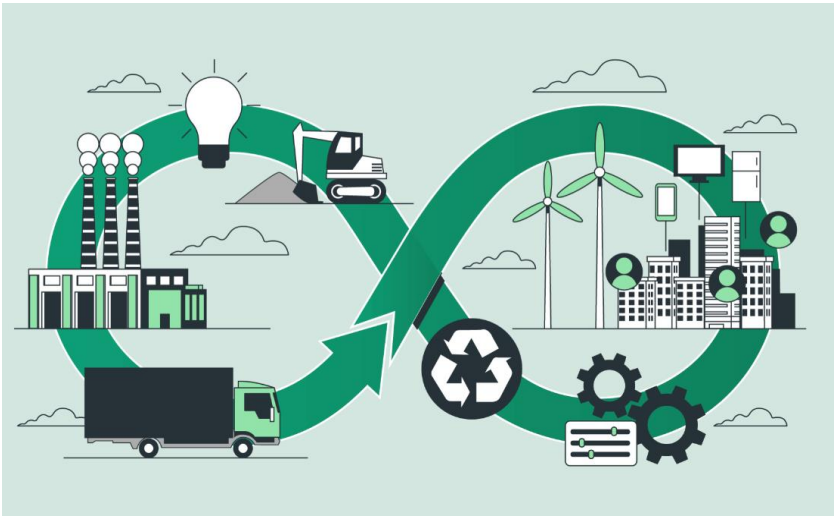
2. PROJECT SUBJECTS

17th International MEB Robot Competition Free Project Category will be organised in 4 groups. These are

- Twin Transformation (Digital and Green Transformation)
- Artificial Intelligence Supported Robots and Autonomous Systems
- Environment and Energy Technologies
- Social Responsibility and Charity Technologies

2.1. Twin Transformation (Digital and Green Transformation)

Projects that integrate digital transformation and green transformation processes aim to improve efficiency and competitiveness through technological innovations while increasing environmental sustainability.



We expect applications to clearly demonstrate how digital technologies are used to minimise environmental impacts, optimise energy and resource consumption, reduce carbon footprint and take concrete steps to support the transition to a green economy. It is critical that project proposals provide innovative, feasible and scalable solutions in both environmental and technological aspects.

2.2. Artificial Intelligence Supported Robots and Autonomous Systems

These projects aim to develop robots and systems capable of autonomous decision-making, analysis and task execution by integrating artificial intelligence technologies.

Applications should describe in detail how artificial intelligence and robotic systems are combined and how these systems contribute to the improvement of industrial processes, safety enhancement or the solution of challenges in everyday life. Projects are expected to include innovative algorithms, data analytics and autonomous operation capabilities, but also to make a difference in aspects such as human-robot interaction or system security.

2.3. Environment and Energy Technologies

These are projects that focus on the protection of natural resources, reduction of environmental impacts and development of sustainable energy solutions.

Applications should describe in detail how renewable energy generation, energy storage, energy efficiency or environmental protection technologies are innovatively addressed and applied. Projects are expected to deliver tangible environmental benefits, such as reducing carbon emissions, optimising resource use, waste management or supporting the circular economy. In addition, the contribution of these technologies to social and economic sustainability is an important evaluation criterion.

2.4. Social Responsibility and Charity Technologies

These are projects in which technology is used effectively to produce solutions to social problems, support disadvantaged groups and increase social benefit.

The applications should explain in detail how the technologies developed have an impact in areas such as eliminating social inequalities, accessibility, education, health, disaster relief or humanitarian aid and how they support social responsibility goals. The projects are expected to offer innovative and sustainable solutions, create measurable social impacts and provide a lasting benefit by raising awareness in the society.

3. Competition Format and Evaluation Criteria.

3.1. Application Process

Competition applications are made according to the process and principles specified in the Application Guide. Projects that meet the conditions specified in the Application Guide will be able to participate in the competitions.

3.2. Competition Stages and Evaluation

3.2.1. Competition Stages:

The competition process proceeds as the preparation and presentation of the projects and the determination of the ranking by the jury evaluation. Firstly, the competitors prepare their project reports and upload them to the robot.meb.gov.tr system until the date specified in the Application Guide. As a result of the preliminary evaluation by the jury, the finalist projects are determined and announced.

The finalists prepare their projects by supporting them with posters, brochures and, if necessary, 3D design models. The projects exhibited in the exhibition hall are evaluated by presentations made in front of the jury. The jury creates a ranking according to the points given to the projects by the jury.

3.2.2. Evaluation and Scoring System

- The projects determined to be prepared in accordance with the plan will first be pre-evaluated by the relevant technical team consultants through the "Free Project Report". Additional time may be given by the technical team for projects that are found deficient in this evaluation.
- The projects are expected to originate from the original ideas of the students, to be shaped by them, to be completed in consultation but with their own knowledge and skills. In the projects that are determined not to be so, the project owner students and counsellors will be eliminated from the competition.
- Free project category jury members will consist of academic staff to be selected by TÜBİTAK from our universities.
- The projects invited to the final will exhibit their projects to the participants at the tables / sections allocated to them in the exhibition area. The projects will be audited by two independent auditors without prior notice and without stating that they are auditing.

Supervisors projects;

- Presentation of the project and presentation performance of the competitors for the visitors to their stands (10 P)
- Posters and brochures explaining the project (10 P)

will make a score on the subjects.

- Free project category robots/projects will be evaluated over a total of eighty (80) points by the jury members of each field, taking into account the following criteria;
  - Innovation (15 P)
  - Design (Performance, Cost, Simplicity) (15 P)
  - Applicability (15 P)
  - Relevance of the Project (15 P)
  - Presentation Performance (20 P)

Evaluation Criteria	***Stand Evaluation***	***Jury Evaluation***
Promotional performance of the project, made for visitors	10	
Posters and brochures explaining the project	10	
Innovation		15
Applicability		15
Design (Performance, Cost, Simplicity)		15
Relevance of the Project		15
Presentation Performance		20
Interim Total	***20***	***80***
General Total	***100***	

- Considering the scoring table above, the scores given by the independent auditors and the scores given by the jury committee will be totalled and announced as the evaluation score. The first, second and third winners of the competition will be determined.
- In case of equality of points as a result of the evaluation, the jury may call the contestants again to make a presentation.

3.3. Description of Tasks

- Secondary education, associate degree and undergraduate students will be able to participate in the free project category.
- Teams to participate in the competition are determined within the framework of general rules.
- All competitors are obliged to follow the announcements to be made at http://robot.meb.gov.tr.

- It is the responsibility of the competitors to fill in and upload all documents in the required time and format.
- All competitors will upload their project reports for preliminary evaluation to the system at robot.meb.gov.tr until the date specified in the Application Guide.
- According to the preliminary evaluation results, the finalist projects will be determined on the date specified in the Application Guide and will be announced on http://robot.meb.gov.tr.
- As a result of the preliminary evaluation, the competitors invited to the final competition must create poster, brochure, presentation explanatory text and, if necessary, 3D design models of their projects.
- The projects will be exhibited in the exhibition hall. It is the responsibility of the competitors to transport the project to the presentation hall.
- Each competitor has to make a maximum 10 minute project presentation and video/slide show to the jury members in the order of the draw.
- The equipment required during the presentation such as computer and projection device etc. will be provided by the organisation. Technical equipment foreseen to be used other than these will be provided by the competitors.
- By applying;
    - That he/she used his/her own ideas, knowledge and skills in the selection of the subject of the project, in his/her approach to the problem, in his/her thinking and implementation,
    - Receiving limited help from the counsellor teacher and related people for the problems encountered,
    - That the project was entirely their own,
    - That you have not participated in another project competition with the same project before the deadline of this competition,
    - They are deemed to have accepted that they have prepared it in accordance with the rules specified in the application guide.

3.4. Disqualifications

- Projects that have participated or applied to any other project competition with the same or other names and/or with the same or similar content (subject) before the deadline of this competition cannot participate in this competition. Projects that are determined to have participated or applied to another competition with the same project before the deadline will be eliminated from the competition, regardless of the stage. If any, their vested rights will be revoked.
- Students participating in the TUBITAK Secondary Education Students Research Projects Competition with the same project are not considered valid.
- The Competition Organising Committee has the right to change the rules when it deems necessary.

3.5. Safety Precautions

The security of the projects to be exhibited in the Free Project Category is of great importance for both the participants and the organisation. For this reason, the following security measures will be taken:

3.5.1. Prototype and Device Security

- All necessary precautions will be taken by the competitors to ensure that the prototypes or devices exhibited are not damaged and operate safely.
- The equipment used in prototypes should be safe, with particular attention to sharp or pointed parts, and should be supported with protective coatings where necessary.
- In electrically operated projects, regular operation of circuit elements should be ensured and safety checks should be made to prevent short circuit and overheating.

3.5.2. Electricity and Energy Security

- Each stand will be equipped with an electrical socket and competitors will plan their energy needs accordingly.
- If the use of extension cords and adapters is necessary, this equipment must comply with the standards and must not pose any safety risk.
- The energy sources used in the projects will be pre-tested to prevent problems such as electrical leakage or circuit failure.

- In case of electrical faults, the authorities must be informed and the competitors must not intervene.

3.5.3. Competitor Safety

- Competitors must be careful when transporting or installing their projects and must follow safety rules when handling heavy or delicate parts.
- Protective equipment must be worn when working with electrical or mechanical components.
- Any interventions to the project during the competition must be approved in advance and must be within the knowledge of the organisation.

3.5.4. Visitor Security

- The working area of all prototypes will be clearly marked to ensure the safety of visitors during the presentation of the projects.
- Safety barriers or warning signs shall be used in projects with moving parts.
- During the project exhibition, small children or unauthorised persons must be prevented from interfering with the devices

4. Exhibition and Presentation Area

4.1. Exhibition Area

- There will be a table of sufficient width for each project.
- The project can be exhibited on the table.
- Each table will have 2 chairs.
- Each stand will have one electrical socket.
- The team name and project name will be clearly visible on the table or stand.

5.2. Presentation Area

- Projection Device or LED Screen
- Sound System
- Computer
- Presentation Platform
- Electrical Sockets and Extension Cables in case of need

5. CONTACT

5.1. Contact Us:

The general rules regarding the competition applications and the Free Project Category are given in the "Application Guide". It is absolutely necessary to read the Application Guide before making an application.

Competitors should ask their questions by selecting their categories from the information menu after logging into the robot.meb.gov.tr system. Questions other than category messages will not be answered and no responsibility will be accepted.

5.2. Frequently Asked Questions

- **What are the requirements for application?**

  Applications must be made according to the conditions specified in the Application Guide. Participants are required to upload their projects to robot.meb.gov.tr until the specified application date.

- **How can I participate in the competition?**

  For participation, you need to upload the project report and other necessary documents to the competition system (robot.meb.gov.tr). The detailed application process is explained in the Application Guide.

- **Can I get information about the content of the project report?**

  The project report should contain all the details of the project you have developed. This includes information such as technologies used, project objectives, innovative elements and environmental/social benefits. The report should be in a specific format and of a certain length.

- **How will the finalist projects be selected?**

  The preliminary evaluation will be made by analysing the project reports. Finalist projects will be announced on robot.meb.gov.tr. Finalist projects should be presented with poster, brochure and 3D design models if necessary.

- **How will the projects be presented?**

  The finalised projects will be presented to the jury members in the exhibition hall. Participants should present their projects by supporting them with posters,

brochures and necessary 3D models. During the presentation, a detailed explanation about the projects will be made and evaluated by the jury.

- **Who can participate in the competition?**

  All participants who fulfil the conditions specified in the Application Guide can apply to the competition.

- **How does the jury evaluate?**

  The jury evaluates the projects according to various criteria. The Jury score is determined by averaging the scores of the Jury members who score independently of each other.

  These criteria are Innovation (15 P)
  Design (Performance, Cost, Simplicity) (15 P)
  Applicability (15 P)
  Relevance of the Project (15 P)
  Presentation Performance (20 P)

- **Is there a budget limitation for the project?**

  There may be no limit on the budget of the projects, but projects are expected to be realistic and feasible.

- **I have presented my project in another competition before, will this be a problem?**

  It is among the conditions that the projects should not have participated in another competition before. It should be ensured that the projects are original and offer an original solution. It is important to check the application requirements carefully.

- **What should I do if I miss the application deadline?**

  If you miss the application deadline, unfortunately your application will not be valid. It is important that applications are submitted on time. We recommend that you pay attention to the dates specified in the application guide.

ANNEX-1 Matters to be Considered While Uploading the Free Project Category Report to the System

17th International MEB Robot Competition Free Project Category project reports will be scored in detail by the jury in the pre-selection stage. Therefore, it is of great importance to prepare the report in accordance with the specified format and content. The report should clearly express the scope, innovative aspects, methods and expected results of the project and should include the following sections. It should be made more understandable by supporting it with visual elements (diagrams, graphics, photographs, etc.) when necessary.

Summary

This section should be an introduction summarising the general framework and main purpose of the project. The summary should explain the methods and procedures followed for the realisation of the Free Project idea, the validation processes used, such as modelling, simulation, testing, prototyping. In addition, the results obtained or expected to be obtained should be expressed together with the contributions provided by the project. The abstract should present a short, clear and effective narrative and the word count should not exceed 250.

Objective

In this section, the main objectives of the project should be elaborated. In particular, the following questions should be answered:

- What is the main reason for starting the Free Project category?
- What benefits will be realised upon successful completion of the project?
- Where and for what purpose will the results of the project be used?
- Economic evaluations of the project (e.g. cost analysis, competitiveness, savings rate and benefit/cost ratio) should be explained with concrete data.
- The contribution of the project output to the sector, national level organisations or the country should be expressed in detail.

This section should demonstrate not only the technical but also the economic and social value of the project.

The element of novelty contained in the Free Project

The innovative aspects of the project should be clearly emphasised. The following points should be addressed in this section:

- In which of the categories of international, national or firm-level innovation does the project idea fall?
- In which ways does the product, method or process that is the output of the project differ or excel compared to existing solutions?
- Do the intermediate or final outputs of the project have the potential to be evaluated in terms of intellectual property rights such as patents and industrial designs?
- What are the differences or advantages of the project with the previous registrations?

This section should provide concrete examples of how innovative approaches contribute to the value of the project.

Methods and Methods Used in Free Project Preparation Phase

The methods, procedures and tools used in the realisation of the project should be described in detail in this section. The following points should be emphasised:

- What are the methods and techniques used for the solution?
- How were verification processes such as modelling, simulation, testing and prototyping carried out?
- What are the activities carried out to test the accuracy or validity of the outputs of the project?

This section should describe the technical background and process management of the project and present the scientific basis for the approaches used.

Business, Process and Planning

The plan and process management followed during the implementation phases of the project should be described in this section. The following elements should be addressed:

- What are the activities carried out within the scope of the project and in which time period were these activities realised?
- How is the distribution of tasks and responsibilities determined?
- The project schedule and plans for the management of the process should be expressed in visual material (e.g. Gantt chart).

This section should clearly show the organisational structure of the project and the strategic planning followed throughout the process.

Conclusion

In this section, the results achieved or expected to be achieved at the end of the project should be evaluated and interpreted. In particular, the following questions should be answered:

- How do the project results relate to the intended objectives?
- What are the applicability and sectoral contributions of the project?
- If the project outputs have been implemented in industry, the data and results obtained to date should be presented in this section.

These assessments should demonstrate the real-life impact and implementation potential of the project.

Sources Utilised

This section lists all references used in the preparation of the project. Books, articles, technical reports, online resources and other references used should be given in bibliography format in accordance with international standards.

DIRECTORATE GENERAL OF VOCATIONAL AND TECHNICAL EDUCATION

100 CENTURY OF EDUCATION

TÜBİTAK

TİKA

INTERNATIONAL MEB ROBOT COMPETITION

17th INTERNATIONAL MEB ROBOTICS COMPETITION

UNDERWATER ROBOTS (SAR) CATEGORY COMPETITION RULES

2025

Education, Technology, Production from Roots to the Future

CONTENTS

UNDERWATER ROBOTS (SAR) CATEGORY RULES

1. GENERAL INFORMATİON ABOUT THE COMPETİTİON

1.1. Theme

In this competition, you will have the opportunity to showcase your engineering skills by designing robots capable of maneuvering in underwater depths, while also experiencing the use of technology for the benefit of humanity and nature. The tasks in this competition focus on real-world problems and will test your robots' precision control abilities, their potential to contribute to the ecosystem by creating artificial reefs, and their ability to detect and eliminate pollution. This process supports the development of robots that contribute to the preservation of underwater ecosystems and scientific research through underwater technologies.

1.2. Objective

The **Underwater Robots (SAR) Competition** aims to enable students to design unmanned vehicles capable of performing underwater tasks using modern technologies. In addition to supporting the development of unmanned vehicles, which are considered the technology of the future, the competition also seeks to promote technological advancements and R&D processes related to underwater tasks at both secondary and university levels. During this process, students are expected to access information, utilize it effectively, analyze and solve encountered problems, and explore new technologies.

2. COMPETITION FEATURESI

In the **MEB Underwater Robots Competition**, participating teams are expected to design an unmanned underwater vehicle capable of maneuvering through an underwater course and performing tasks such as dragging and carrying objects.

Competitors applying for the **17th International MEB Underwater Robot (SAR) Category** must read the **Application Guide**, which includes the competition application process and general category rules, available at https://robot.meb.gov.tr under the "Organization" menu.

Please do not forget to regularly check the **MEB Robot Competitions** website for announcements and updates related to the **Underwater Robots (SAR) Category**!

2.1. Scoring, Evaluation, Competition Courses, and Task Objects

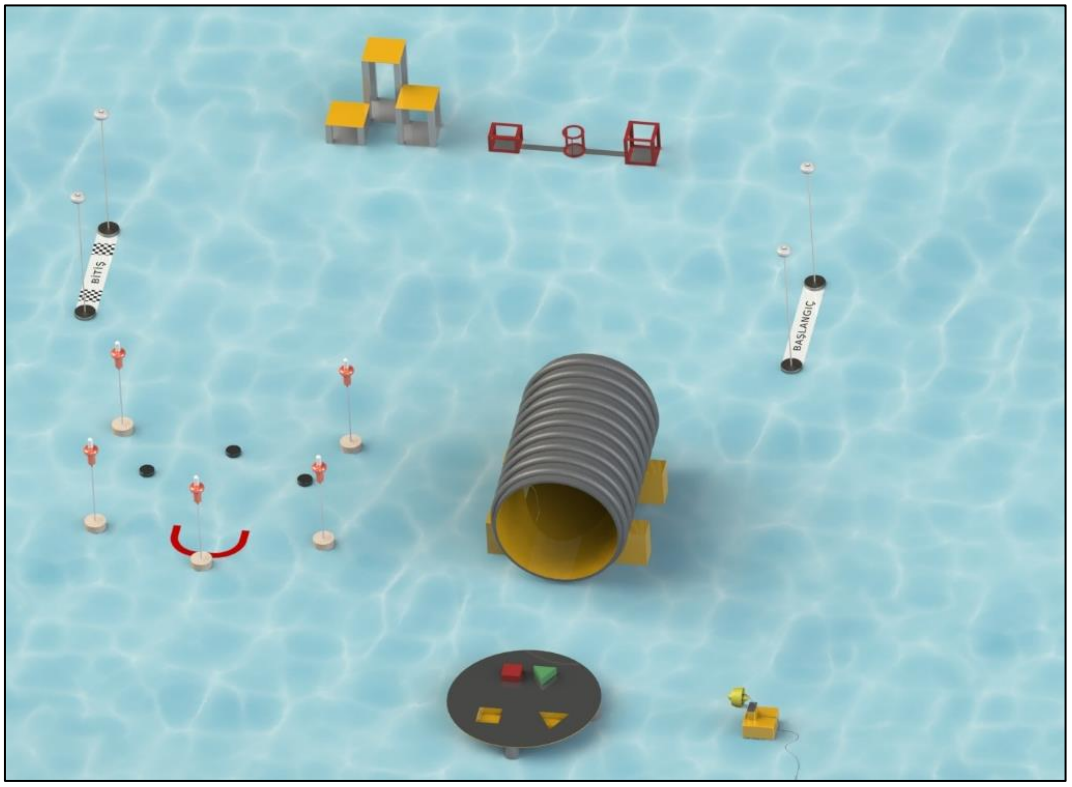


***Figure 3.1**: Underwater Robots Competition Pool and Task Overview*

The competition will take place in a pool with a depth of 140 cm, a width of 1250 cm, and a length of 2500 cm. Platforms will be placed inside the pool to mark the start and finish areas. The competition course, where the tasks will be performed, will be set up by referees before the competition. Each team will position their underwater vehicle at the starting point, and once the referee signals the start of the competition, they must pass through the starting area to begin.

Competing teams are expected to complete four different tasks using their underwater vehicles. There is no required order of priority for these tasks; each task is scored independently. One of these tasks is passing through a pipe placed on the pool floor. Another task involves placing designated task objects into the correct slots on a table-like platform fixed to the pool floor, despite artificial water currents. Another task requires the underwater robot to collect three cylindrical balls and place them in a U-shaped area, regardless of the order. The final task involves transporting three task objects of different sizes and shapes from their original locations to table-like platforms of varying heights. Figure 3.2 illustrates the competition course.

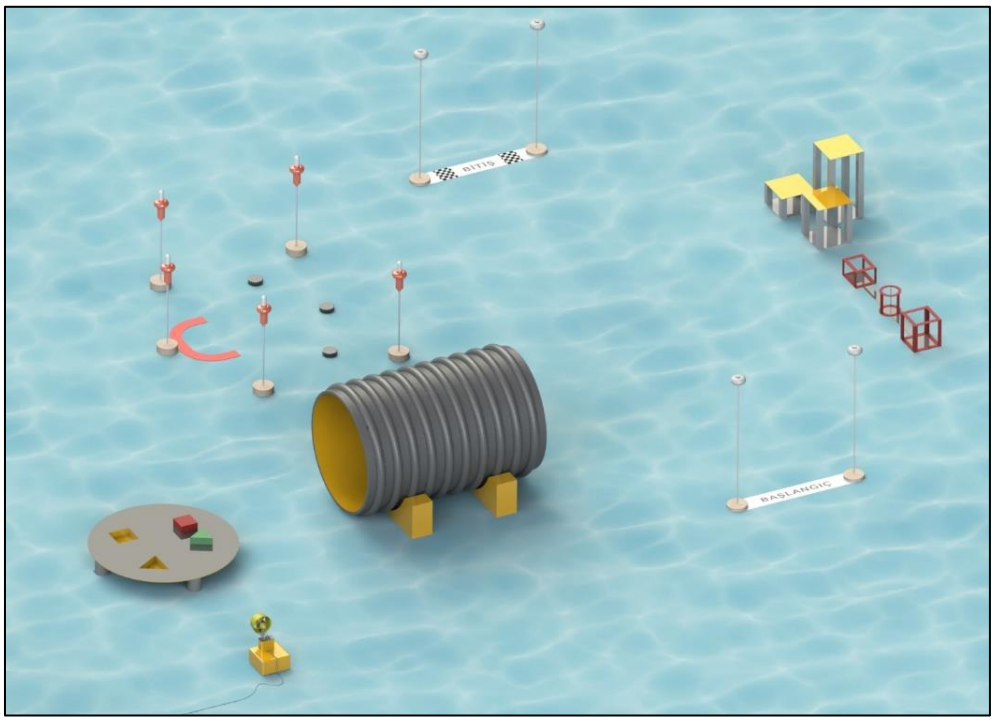


Figure 3.2: *Underwater Robot Competition Course*

2.1.1. Buoy-Based Start and Finish Platforms

After the preparation period, the underwater robot will be considered to have entered the competition course once it passes through the **Start Buoy Platform**, and the competition time will begin. During the allocated preparation time, teams are expected to position their vehicle in front of the start buoy, ready to begin the competition.Once the referee signals the start of the competition, teams are required to complete their tasks within the competition time and then pass through the **Finish Buoy Platform**. **Figure 3.3** shows the start buoy platform, while **Figure 3.4** illustrates the finish buoy platform.

Figure 3.3*: Start Buoy Platform*

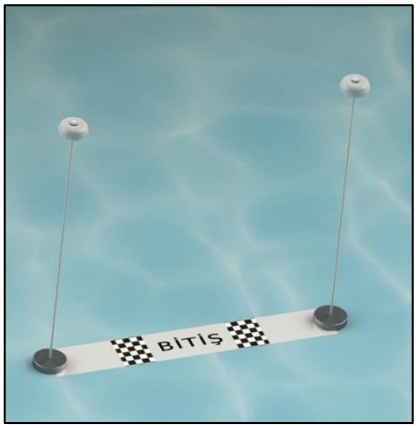


Figure 3.4: *Finish Buoy Platform*

The buoys on the buoy platforms in **Figures 3.3** and **3.4** will be positioned at a height of **1000 mm** above the pool floor, with a distance of **860 mm** between the centers of the two buoys. Vehicles passing through the start and finish buoy platforms will not receive additional points. However, the time at which a vehicle passes through the finish buoy platform will be considered the **finish time** by the referees, as displayed on the stopwatch screen at that moment. The time will be determined when any part of the underwater robot passes through the finish buoy platform.

2.1.2. Passing Through the Pipe Task

In this task, the competing teams' underwater robots are expected to enter one end of a hollow cylindrical pipe, which has an inner diameter of 800 mm and a length of 1300 mm, and exit from the other end. The team that successfully passes their robot through the pipe and out of the other end will receive 10 points. If the robot moves the pipe platform, which is supported by wedges, from its position, the team will lose 5 points. Not passing through the pipe does not prevent teams from reaching the finish line and completing the competition.

The visual for this task is shown in Figure 3.5.

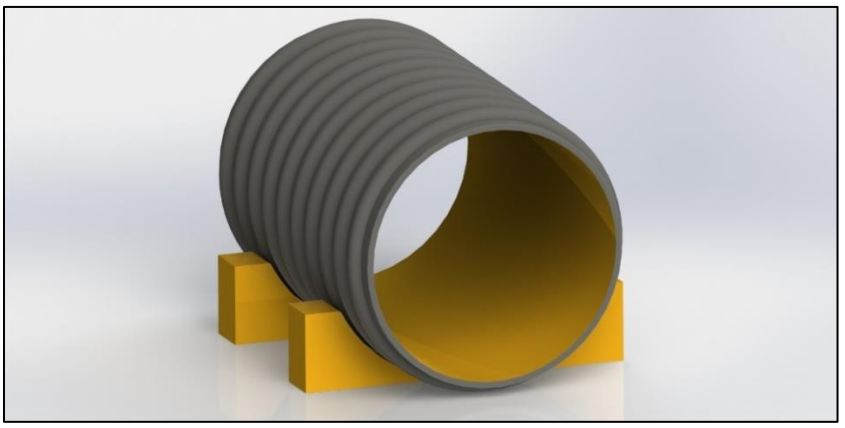


Figure 3.5: *Passing Through the Pipe Task*

2.1.3. Object Placement in Underwater Current Task

this task, an artificial current will be created with the help of an underwater motor. Despite the created current, the competing teams' underwater robots are expected to place equilateral triangle and rectangular prism shaped objects into the corresponding openings of an equilateral triangle and square on a table-like platform fixed to the pool floor.

The visual for this task is shown in Figure 3.6.

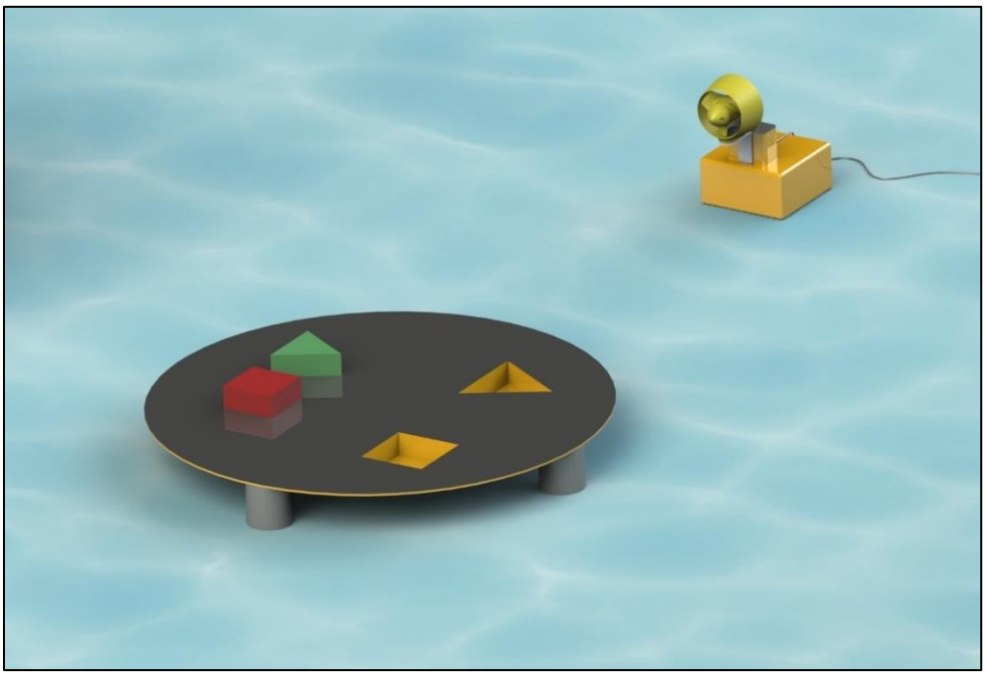


Figure 3. 6: *Object Placement in Underwater Current Task*

The table-like platform, on which the task objects are placed, has a height of **105 mm** above the pool floor, a **diameter of 1000 mm**, and a platform thickness of **5 mm**. The technical details of the platform are shown in **Figure 3.7**.

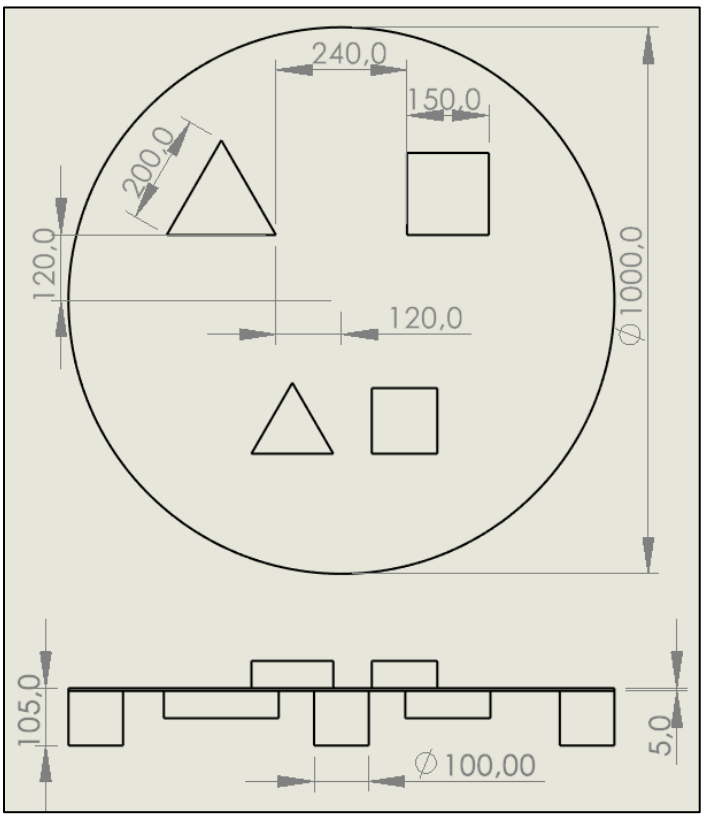


Figure 3.7: *Platform technical drawing (in millimeters)*

The heights of the equilateral triangle and rectangular prisms, which are expected to be passed through the gaps on the platform, are 50 mm. The dimensions of the task objects are provided in Table 3.1 below.

Table 3.1: *Dimensions of the equilateral triangle and rectangular prism objects*

Object	Top Surface Edge Length	Height (mm)
Equilateral Triangle Prism	Equilateral triangle side length 150 mm	50
Square Prism	Square side length 120 mm	50

A brushless direct current (BLDC) motor will be used to create artificial current. The height of the motor propeller center from the pool floor will be 250 mm (±30 mm) and is shown in Figure 3.9. The motor propeller will be positioned to face the center of the object placement platform, and its distance from the table diameter will be 800 mm (±50 mm), as shown in Figure 3.10. An image of the setup for creating artificial current is shared in Figure 3.8.

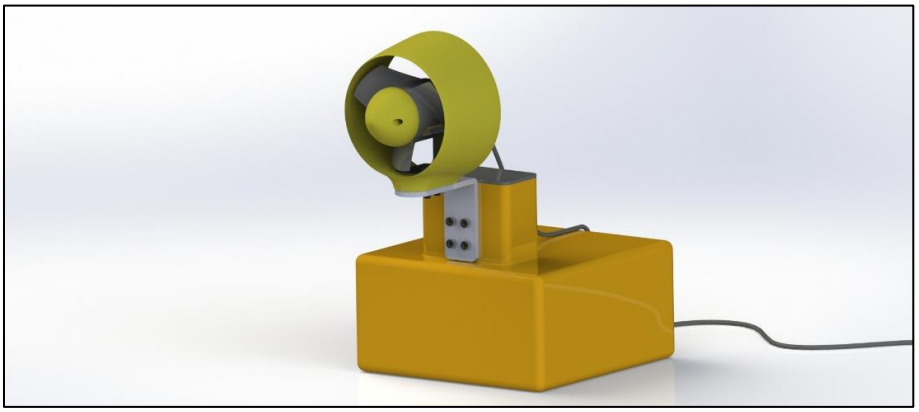


Figure 3.8: *Artificial Current Motor Platform*

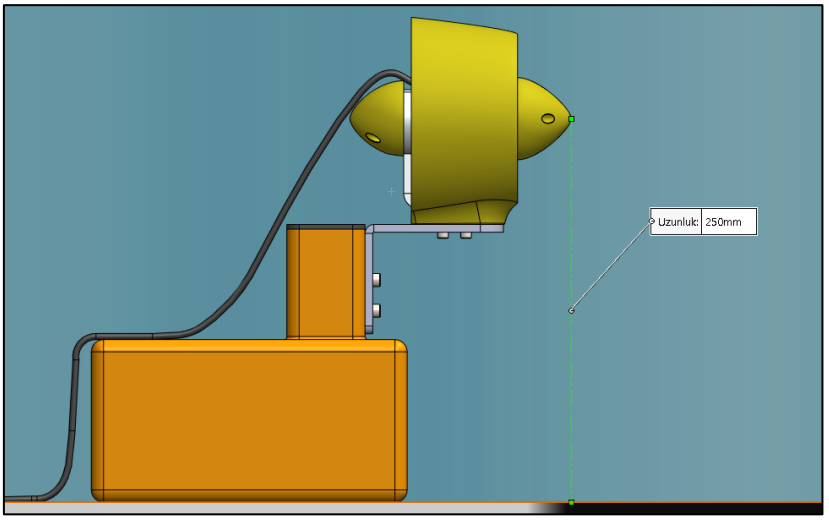


Figure 3. 9: *Height of the motor propeller center from the pool floor*

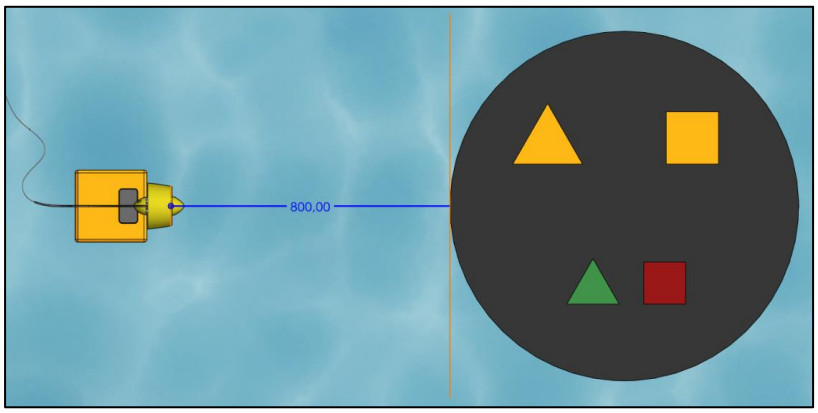


Figure 3. 10: Distance of the motor propeller from the object placement platform

In this task, the competing team's robot is expected to place the triangular prism object into the triangular gap and the square prism object into the square gap, despite the artificial underwater current. Successfully placing each object into the correct gap, despite the artificial underwater current, will add 15 points to the team's score. However, if the artificial underwater current motor platform is displaced by the team's underwater robot, even if the objects are placed in the correct gaps, no points will be added. If the underwater robot tips over the platform or moves the artificial current motor from its place, 5 points will be deducted from the team's score. Not completing this task does not prevent teams from reaching the finish line and completing the competition.

2.1.4. Task of Collecting Unwanted Objects Underwater

In this task, the competitors' underwater robots will perform the task of collecting objects that are considered to negatively affect underwater life, within an area symbolically surrounded by illuminated buoys. The visual for the task is shown in Figure 3.11. The height of the illuminated buoys from the ground, as seen in Figure 3.11, will be 600 mm.

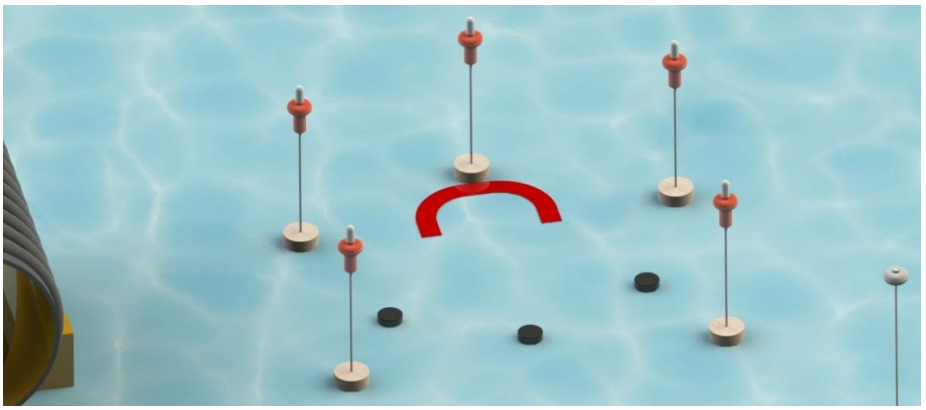


Figure 3.11: *Ring Transport Task*

The unwanted objects underwater will be identical black cylinders with a diameter of 100 mm and a height of 30 mm. The technical drawing of one of these cylinders is shown in Figure 3.12.

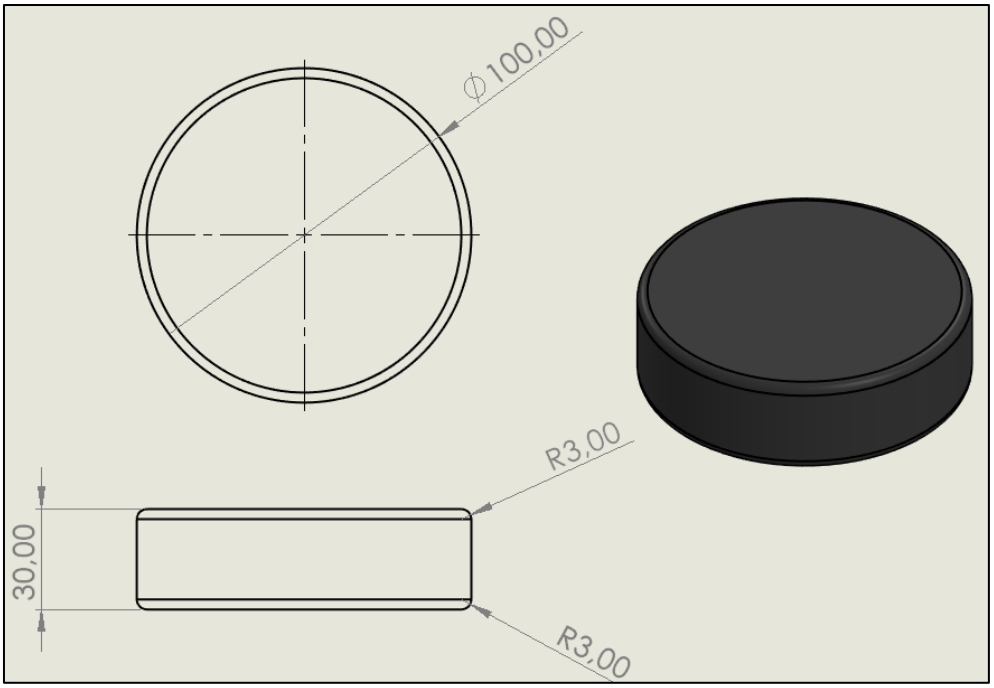


Figure 3. 12: *Technical drawing of the cylinder object to be collected (in millimeters)*

The black cylinders will be collected from their location by dragging or carrying methods into a red-colored area resembling the letter "U," as shown in the technical drawing in Figure 3.13.

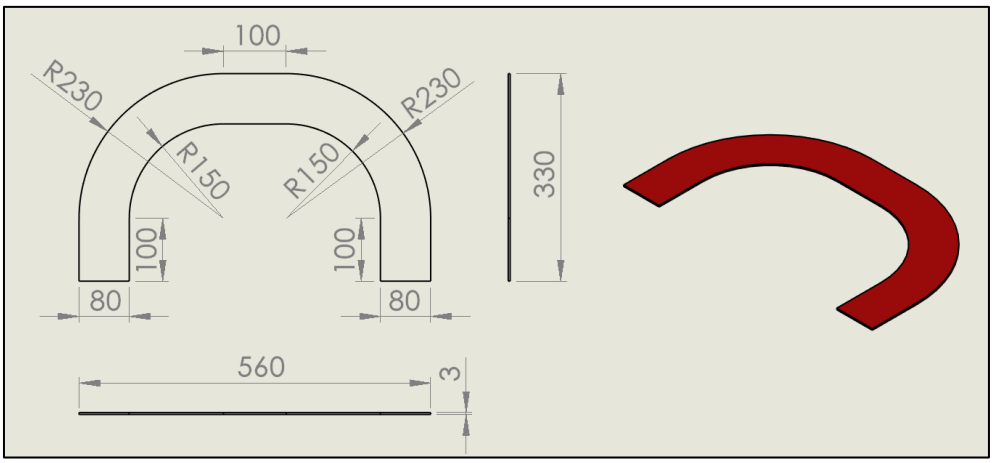


Figure 3. 13: *Technical drawing of the 'U' shaped black cylinder collection area (in millimeters)*

The black cylinders will be randomly placed on the pool floor by the referees. The corners of this placement area will be surrounded by illuminated buoys. The distance between the centers of the illuminated buoys, when viewed from above, will be 1000 mm (±50 mm) in the vertical

direction and 1500 mm (±50 mm) in the horizontal direction, and will be placed by the referees. The technical drawing of the placement plan is shown in Figure 3.14.

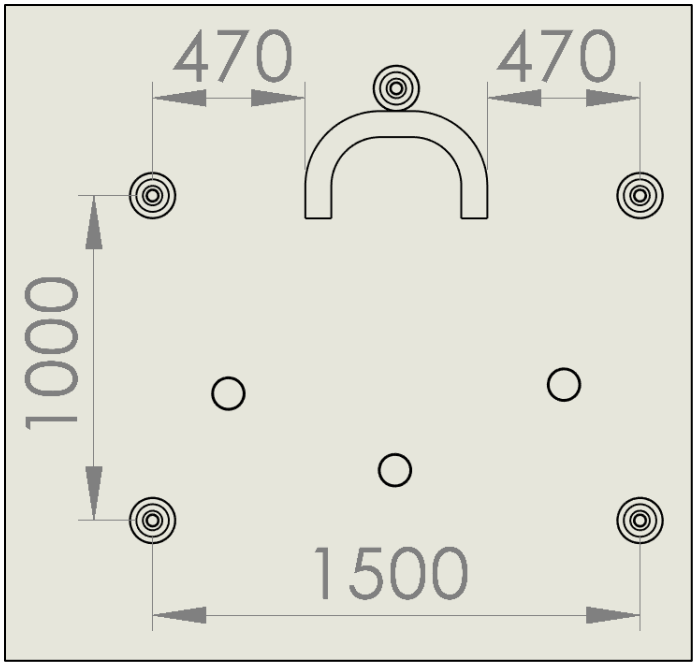


Figure 3. 14: *Technical drawing of the black cylinder collection task placement plan (in millimeters)*

In this task, if the robot places each black cylinder into the red-colored area resembling the letter 'U,' 10 points will be added to the team's score. If the underwater robot displaces the 'U' shaped collection area platform placed on the floor, 5 points will be deducted from the team's score. It is the teams' responsibility to avoid maneuvers that cause the robots to get caught on the illuminated buoys. In this case, the competition time will not be stopped. Team members are expected to move in coordination to prevent this situation from occurring.

2.1.5. Artificial Reef Creation Task

Artificial reefs are constructed using man-made hard materials to preserve underwater biodiversity, develop and rehabilitate marine life in areas that have lost their biological characteristics. In this task, the competitors are expected to successfully build an artificial reef. The visual for the artificial reef creation task is shown in Figure 3.15.

In the artificial reef creation task shown in Figure 3.15, competing teams are expected to place three different-sized and shaped task objects onto three platforms of different heights, resembling tables. There are no requirements for the order or size of the placement. During the

competition, the vehicle operator will be able to place the desired object onto the platform of their chosen height in any order they prefer.

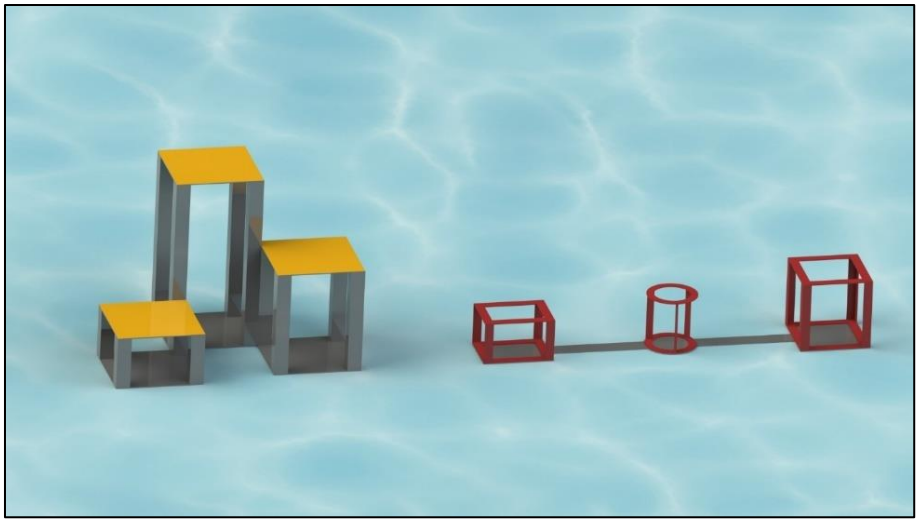


Figure 3. 15: *Artificial reef creation task objects*

The technical drawings of the objects to be carried and placed on the platforms to create the artificial reef are shared in Figures 3.16, 3.17, and 3.18.

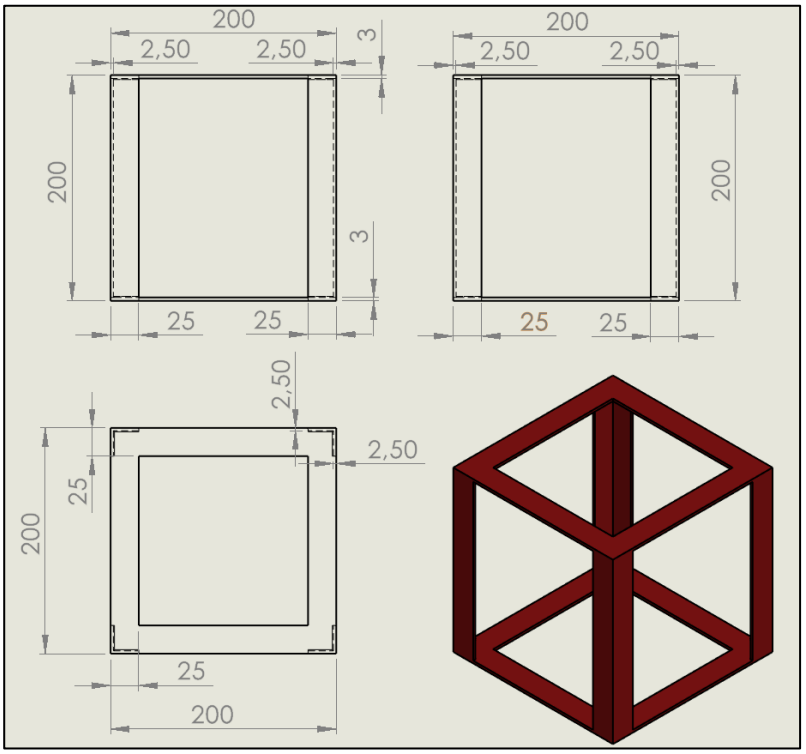


Figure 3. 16: Technical drawing of the hollow cube artificial reef object (in millimeters)

In Figure 3.16, the hollow cube object created has a base and top thickness of 3 mm, and the column structures are drawn as angle brackets with a width of 25 mm x 25 mm and a thickness

of 2.50 mm. In Figure 3.17, the hollow cylinder created has a base and top thickness of 3 mm, and the column structures are drawn with a width of 20 mm and a thickness of 2.50 mm.

In Figure 3.18, the hollow rectangular prism created has a base and top thickness of 3 mm, and the column structures are drawn with a width of 20 mm and a thickness of 2.50 mm.

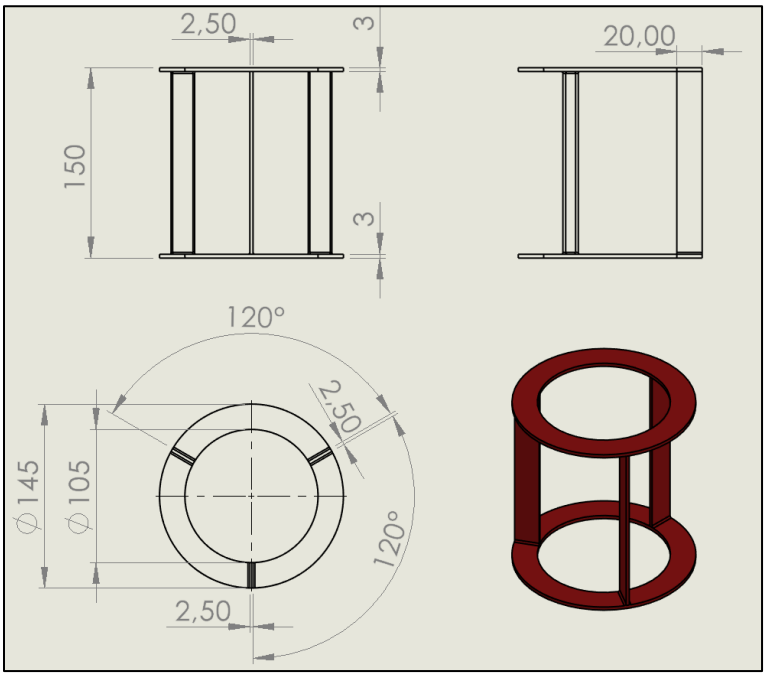


Figure 3. 17: *Technical drawing of the hollow cylinder artificial reef object (in millimeters)*

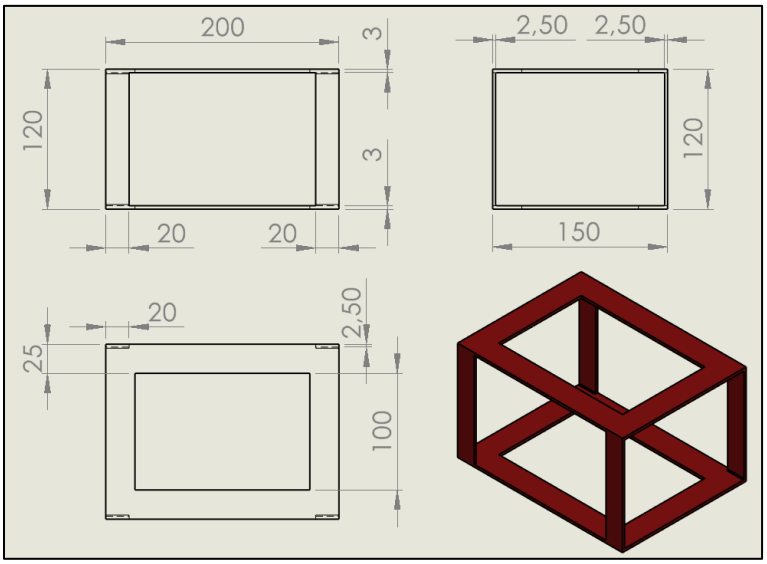


Figure 3. 18: *Technical drawing of the hollow rectangular prism artificial reef object (in millimeters)*

In the artificial reef creation task, the platforms on which the underwater robots will carry and place the objects shown in Figures 3.16, 3.17, and 3.18 are shown in Figure 3.19.

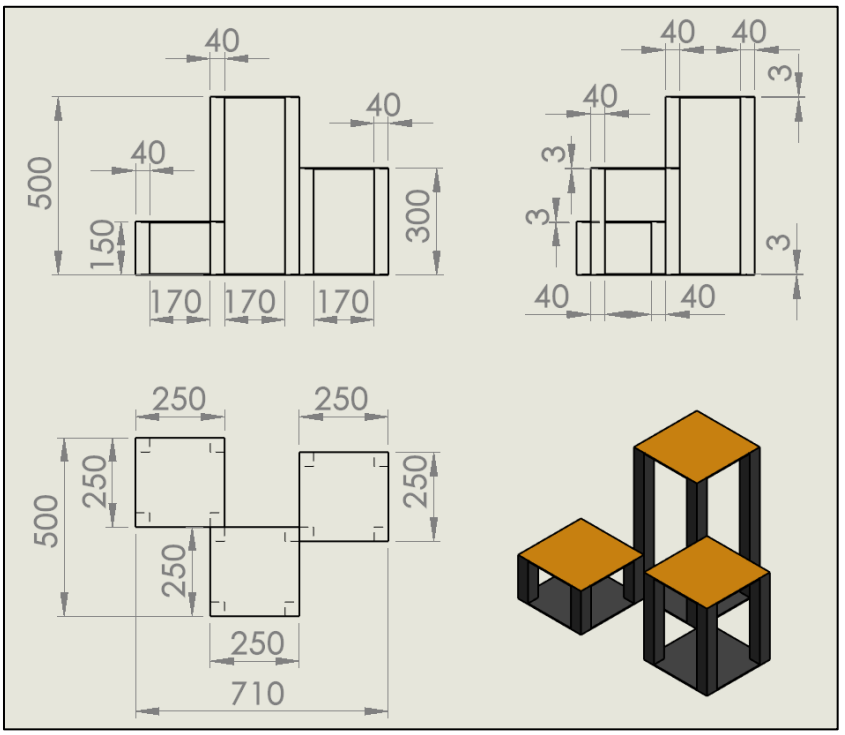


Figure 3. 19: *Technical drawing of the platform where the artificial reef creation objects will be placed (in millimeters)*

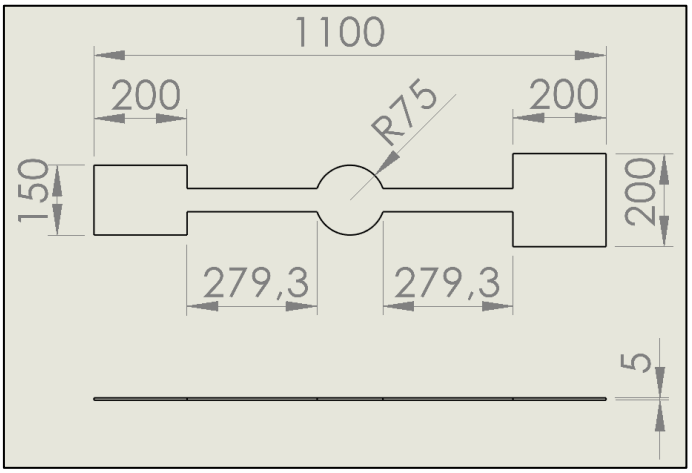


Figure 3. 20: *Technical drawing of the ground platform for positioning the reef creation objects (cube, cylinder, and rectangular prism) (in millimeters)*

In the view shown in Figure 3.19, the artificial reef objects shown in Figures 3.16, 3.17, and 3.18 will be carried and placed on platforms with three different heights, resembling tables, on 250mm x 250mm surfaces. For each object placed, regardless of the order, 10 points will be added to the team's score. If any or all of the platforms, resembling tables with three different heights shown in Figure 3.19, are displaced or tipped over by the underwater robot, 5 points will be deducted from the team's score.

In the artificial reef creation task, the artificial reef objects shown in Figures 3.16, 3.17, and 3.18 will be placed on the platform shown in Figure 3.20, according to their dimensions, on the surface. The purpose of placing this platform on the floor is to position artificial reef objects at the same distances for each competitor. If the platform shown in Figure 3.20, which holds the objects, is moved by the underwater robot trying to carry and transport the objects, 5 points will be deducted from the robot's team score.

2.1.6. Competition Course Layout Plan

The objects for the tasks in the competition course will be placed by the referees according to the technical drawings. The layout plan may be modified by the referees to ensure the overall integrity of the competition is maintained, based on the dimensions of the pool. The planned task object layout plan is shown in Figure 3.21. The dimensions in this layout plan will be placed with a margin of error of ±100 mm, considering the difficulty of placing objects underwater. The referees will ensure that all competitors race under the same conditions according to the prepared competition course layout plan. If any competing teams change the positions of the objects, the referees will place them back within the allowed margin of error. The table referee will monitor this situation through cameras.

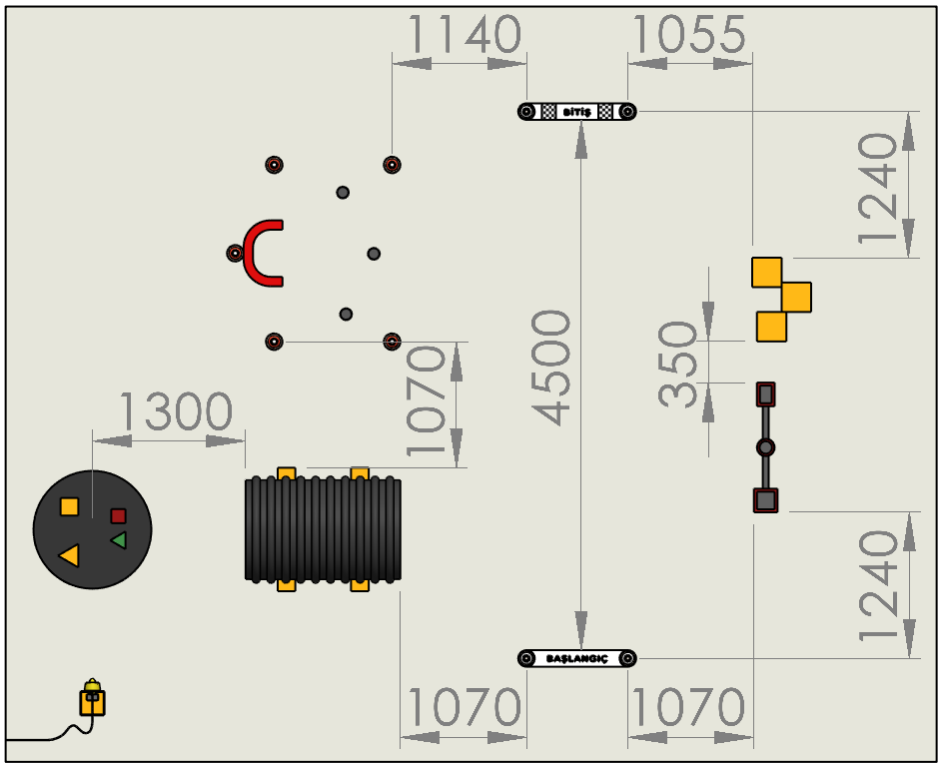


Figure 3. 21: *Competition course layout plan (in millimeters)*

2.2. Preliminary Selection Process

2.2.1. Robot Production Report

In the International MEB Robotics Competition Underwater Robots (SAR) category, 50 teams will be invited to compete. In selecting the competitors, technical information such as "Materials used in robot production," "Robot production process," "Programming language used for the robot," and "Budget used for the robot production" under the subheading of "Robot Production Report," along with a video demonstrating the underwater robot's mobility and photos taken from different angles showing the robot's construction stages, will be decisive. The "Robot Production Reports" will be uploaded to the Production Report attachment page and evaluated as specified in the general Application Guide of the 17th International MEB Robotics Competition.

2.2.2. Underwater Robot Movement Video

In determining the competitors, the applying teams should consider the criteria in the Production Report Guide when adding videos and images. The video demonstrating the robot's mobility, provided as a URL, must be at least two minutes and no more than three minutes long. The beginning of the video must show the robot's waterproof status. After the video starts, the underwater robot must be submerged and held steady within the camera's view for 30 seconds.

After the 30 seconds of the waterproof test, the robot must dive down at least half of its height and move at least one meter forward. Then, at the driver's request, the robot should make a 90-degree turn to the right or left and move forward at least 50 cm. From this point, it should stop, turn 180 degrees, and be able to return to the water surface following the same path back to the point where it first dived..

2.3. Rules

- Teams must submit all objections according to the general rules outlined in the "**Application Guide**".
- For questions related to the competition, participants must log into the International MEB Robotics Competition system at robot.meb.gov.tr, and select the "Underwater

Robots (SAR)" category from the information menu. Questions outside the category messages will not be answered. Objections regarding this will not be accepted.

- In the International MEB Robotics Competition Underwater Robots (SAR) category, 50 teams will be invited to participate. The selection of participants will be based on technical information such as "Materials used in robot production," "Robot production process," "Programming language used for the robot," and "Budget used for robot production," along with a video demonstrating the underwater robot's mobility and photos showing different angles of the robot's construction stages. The "Robot Production Reports" will be uploaded to the Production Report attachment page and evaluated as specified in the general Application Guide of the 17th International MEB Robotics Competition. The video demonstrating the robot's mobility must be at least two minutes and no more than three minutes long. Teams must adhere to the criteria outlined in the Production Report Guide when adding videos and images. The tasks expected to be performed and the evaluation criteria for these tasks are explained in the "3.2. Preliminary Selection Process" section of this guide. The team score will be determined based on the Robot Production Report. The top 50 teams will qualify to compete in the 17th International MEB Robotics Competition Underwater Robots (SAR) category..
- Teams can consist of a maximum of two members: one robot control member (driver) and one assistant member. The assistant team member may assist with verbal guidance and controlling the robot's cable. If any of the two members fail to attend the competition area, no additional member will be allowed. In this case, the team will continue with only one member. During the competition, role switching between the assistant member and the driver is allowed.
- The competition ranking for teams will be determined by a draw according to the conditions outlined in the Application Guide and will be announced before the competition. Teams cannot object to the competition order. The team whose turn it is must be present in the competition area.

- In case a team has competition assignments in another category at the same time, the responsibility lies with the team. No precaution will be taken for this situation. Teams must begin their competition at the time determined by the draw.
- The provision of any materials and equipment needed for the tasks will be the team's responsibility.
- If cables or equipment of the underwater robots become tangled or attached to a task object, resulting in the failure to complete the task under the specified conditions, no points will be awarded for the task. Teams are responsible for taking preventive measures to avoid such situations. Objections due to this situation will not be accepted.
- If the cables or equipment of the underwater robots become tangled or attached to a task object, the robot driver is expected to resolve the situation through the robot's mobility. If the driver is unable to resolve this, they may choose to withdraw.
- The desk referee will watch live footage from the underwater cameras. They will share any unseen situations with the poolside referees and ensure that the competition is conducted according to the specified rules. The live footage viewed by the desk referee will be shared on a television screen. Objections to the viewing of this footage by spectators or competitors will not be accepted.
- Not completing any task does not prevent teams from completing other tasks. The order of tasks is based on the strategy developed by the teams for the competition.
- Each team will be given 5 minutes for preparation. After 5 minutes, the competition time will start. If the team is ready before the preparation time is over and informs the referee that they are ready, the competition will start with the referee’s command.

- The total competition time is **10 minutes**. At the end of this time, teams must remove their robot from the pool, regardless of whether the robot has passed the finish platform or not. The task points earned by the teams at the end of the competition will be added to their total score.

- Competing teams will be ranked based on their total points in descending order. If two teams have the same points, their ranking will be determined by the time recorded on the chronometer at the finish platform. The team with the shorter completion time will be ranked higher. If two teams with equal points have also withdrawn, the team that withdrew will be ranked lower. If both teams with equal points have withdrawn, their ranking will be determined by the weight of their robots, with the lighter robot ranked higher.
- Completing the tasks and passing the finish platform before the total competition time will determine the completion time. The total team points and competition completion time will affect the competition ranking.
- Competing teams can withdraw from the competition at any time. The withdrawal decision must be communicated to the referee at the poolside by the driver. Tasks performed after the withdrawal decision will not be added to the team's score, and the tasks completed before the decision will be included in the total score. The withdrawal time for these teams will be recorded as the total competition time of 10 minutes.
- Teams that pass the finish platform before the total competition time (10 minutes) will not receive points for any tasks.
- When a team is called to the competition and enters the competition area, the entry of team advisors into the area is prohibited. If an advisor persists in entering, their team will be disqualified.
- Object displacement or overturn penalties will be given once for each task. After a penalty is applied, no further penalties will be given for additional contacts with the same task. If the robot's contact with the task object renders the task unachievable, objections to obtaining points for that task will not be accepted.
- If the cables of robots controlled from outside the pool are manipulated by any team member to guide the robot, the competition time will be stopped, and the robot will be removed from the pool. **50 points will be deducted from the team's score**. Tasks completed before this incident will be added to the team's total score. If cable

manipulation is later detected from the camera footage, points for subsequent tasks will be deducted, and 50 points will be deducted from the team's score.

2.4. Team Score Calculation

2.4.1. Scoring Table:

Tasks	Competition Points
Passing through the Pipe Task	1 x 10 Points
Placing Object Underwater Task	2 x 15 Points
Collecting Unwanted Objects Underwater Task	3 x 10 Points
Artificial Reef Creation Task	3 x 10 Points
Maximum Possible Task Points	100 Points

2.4.2. Penalty Points:

- If the underwater robot moves the pipe platform supported by wedges (Figure 3.5), **5 points will be deducted from the team score.**
- In the underwater current object placement task, if the underwater robot knocks over the platform resembling a table that carries objects (Figure 3.6) or moves the artificial current motor**, 5 points will be deducted from the team score**.
- If the underwater robot moves the artificial current-generating motor platform (Figure 3.9) and prevents the task from being performed under the required conditions, **5 points will be deducted from the team score.**
- If the underwater robot moves the "U" shaped collection area platform (Figure 3.13) placed on the ground, **5 points will be deducted from the team score**.
- In the artificial reef creation task, if one or all of the platforms (Figure 3.19), which resemble tables and have three different heights for the task objects to be moved onto, are moved or knocked over by the underwater robot, **5 points will be deducted from the team score.**

- If the platform under the objects to be moved for the artificial reef creation task (Figure 3.20) is moved by the underwater robot while attempting to hold and transport objects, **5 points will be deducted from the team score.**
- If any team member interferes with the cable controlling the vehicle from outside the pool and directs the vehicle, resulting in a violation detected by the referees, **50 points will be deducted from the team.**

Total Team Score = Task Points – Penalty Points

2.5. Competition Area and Workspace Details

The competition area will be supplied with 220 VAC power. Additionally, there will be a control table near the competition pool where the team whose turn it is can control their underwater vehicle. The teams will be supplied with 220 V AC voltage here. The maximum DC or AC voltage level that can be used in the designed underwater robot will be 50 V. (There are no current or capacity limits).

2.6. Underwater Vehicle Technical Specifications, Safety, and Restrictions

- The cable used by the underwater vehicles for energy, data, and control transmission should be at least 20 meters long for smooth task execution in the competition track.
- The underwater vehicle **can be controlled with or without a camera.** During the competition, drivers will be able to see the condition of the vehicle inside the pool.
- Underwater vehicles must be water-resistant to a depth of 2 meters.
- Cables used in underwater vehicles must be insulated by the teams to prevent wear and electrical leakage.
- The cable used in the underwater vehicle **should be equipped with buoyant equipment** (buoys, foam, etc.) at certain intervals to prevent it from getting tangled with task objects. Any cable tangling or getting caught on a task object is the responsibility of the competitors, and objections regarding this will be **considered invalid.**
- Before the competition, the safety of the underwater vehicles will be checked by the referees. Robots deemed unsuitable will not be allowed to compete.

- **No 220 V AC power will be allowed to be transmitted to the vehicle and/or pool for safety reasons.**
- Before the competition, robots will undergo a waterproofing test with the power off, and if any team's robot is found to have water leakage during the competition or preparation period, they will **be disqualified.**
- After the necessary checks, energy can be supplied to the vehicles.
- Battery-powered vehicles **must have an easily accessible emergency stop button**, which should cut off the power and stop the motors. There are no restrictions on the type of stop mechanism (magnetic, push-button, etc.).
- **Battery-powered vehicles must operate with a maximum of 50V DC voltage and must not exceed this limit.**
- Any battery may be used. There are no limits on current or capacity.
- Batteries must be transported in a fireproof protective bag. If the battery is embedded within the vehicle and cannot be removed, the vehicle's power must be cut off before transporting it.
- Vehicles powered externally will be supplied with a maximum of 50V.
- This supply voltage will be provided by the teams' own AC/DC converters.
- Vehicles powered from external sources **must have an emergency stop button**.
- The cables powering external vehicles must be insulated for water and environmental protection, and no cables should be exposed. The power source or cable must be equipped with fuses according to the determined voltage and current.
- The motors of the underwater vehicle must be insulated against water and should be capable of operating underwater.
- The vehicle's body and motor propeller sections must not have sharp edges or points, and any unsuitable parts must be rounded or dulled.
- Motor propellers **must not be exposed**. They **must be isolated with a protective outer shell.**

- The vehicle's attached cables should not be taut and must be resistant to sudden movements.
- Changes in the pool dimensions may lead to changes in the track or task object measurements without affecting the overall structure.
- Objections made during the competition regarding issues caused by light and sound will be **considered invalid**. The Competition Organization Committee reserves the **right to change the rules if necessary.**
- Hydraulic systems and any oil used in the vehicle compartment are **prohibited,** as they could negatively affect the continuation of the competition in case of leakage.
- **No chemicals should be allowed to mix with the pool water**. Vehicles must be designed with this **consideration in mind.**

2.7. ETHICAL RULES

- Avoid rude and impolite words and behavior.
- Refrain from insults, threats, and offensive language.
- Avoid direct insults via email, Facebook, Skype, Messenger, WhatsApp, Twitter, YouTube, etc.
- Pay attention to spelling rules and tone in petitions and objections.
- Do not engage in actions, words, or behavior that affect the functioning or motivation of other teams in the competition area.

DIRECTORATE GENERAL OF VOCATIONAL AND TECHNICAL EDUCATION

100 CENTURY OF EDUCATION

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INTERNATIONAL MEB ROBOT COMPETITION

17th ULUSLARARASI MEB ROBOT YARIŞMASI

DESIGN-BUILD (HIGH SCHOOL/UNIVERSITY) CATEGORY RULES

2025

Education, Technology, Production from Roots to the Future

CONTENT

DESIGN & BUILD (HIGH SCHOOLS/UNIVERSITIES) RULES

1. INTRODUCTION

1.1. Objective

This competition is based on competing professional skills, knowledges and programming experiences of students. Teams will provide all the products, materials, hand tools and laptops which are announced by the organization in the specifications necessary for robot construction in their province where their schools are located before the competition and will keep them ready with them. No materials will be given to the teams before the competition, only an envelope containing the information of the track where the robot will compete and the rules of the competition will be given and they will be asked to race them in competition area.

2. COMPETITION FORMAT AND EVALUATION

2.1. Application Process

Competition applications are made according to the process and principles specified in the Application Guide. Competitors who meet the conditions specified in the Application Guide will be able to participate in the competitions.

2.2. Competition Stages and Evaluation

2.2.1.Competition Stages:

The competition will last for three days and teams will consist of two competitors. On the first day, all teams will participate in the qualification exam at the same time. The teams that pass the qualification exam will settle at their tables determined by lot on the second day in the morning and make preparations for designing and programming their robots. In the afternoon of the same day, the teams will program their robots with the computers provided by the organisation and make them ready for the competition by testing them on the test track. At the end of the period, the robots will be delivered to the referees and the final ranking will be determined by the final races to be held in front of the audience on the third day.

2.2.2. Evaluation

The evaluation criteria will be announced to the teams just before the competition starts.

2.3. Tasks definitions and Success Criteria

The game principles will be announced to the teams just before the start of the competition.

Competition rules, how the competition will be carried out and scored will be announced to the teams just before the competition starts. The prepared robots will compete on the competition track in the order of draw.

2.3.1. Competency Exam

Competency exam will be held at first day of competition. All team members will sit the exam at the same time. Participation in the exam with a single team member will not be possible.

Exam will consists of multiple choice questions which are related with the following topics.

- Basic Electric & Electronics,
- Basic Digital Electronics,
- Arduino
- Arduino Shield,
- Basic Arduino Programming.

*** You can see sample questions at Appendix-1.

Teams will be sorted according to their scores at the end of exam.

If teams have same scores, the team which gives its exam sheet earlier will be listed upper than other.

If teams are still equal, the one has lower average age will be listed upper than other. Only 40 teams from top of list will get right to join “design” session of the competition.

2.3.2. Designing

Teams that successfully pass the qualification exam will be placed on the tables where they will work according to the order of lots. Competitor teams will design their robots and make them ready for programming within the specified time after they move to the work areas reserved

for them. Teams will be present at the tables with all the materials they bring with them. The characteristics of the track/platform where the competition will be held and the tasks of the robot will be given to the competitor teams in a sealed envelope just before the competition starts.

2.3.3. Programming

The teams will make their robots ready for the competition by programming them with the computer given to them by the organisation within the specified period and trying them on the test track. At the end of the period, the referee committee will receive the robots from the competitors and will deliver them again on the third day at the time of the final competition. The ranking list will be announced by the referees at the end of the competition.

2.3.4. Racing

2.3.5. The final races will be held in the indoor hall according to the order of draw in front of the audience.

3. ROBOT SPECİFİCATİONS

Robots move autonomously.

While designing robot, using any kind of module except modules announced by organization is not allowed.

Using any kind of communication modules such as wireless, bluetooth, etc is strictly forbidden.

Power unit; Using any kind of power supply on robot except LI-PO battery which announced by organization will not be allowed.

4. OTHER RULES

- The Tournament Committee reserves the right to change the rules when necessary without giving a reason.
- The computers to be used in the competition will be formatted by the school assigned by Kayseri Provincial Directorate of National Education and will be brought to the competition area in a re-installed and working condition.

- Contestants; computers, mobile phones, tablets, USB sticks, external discs, smart watches, etc. electronic devices will not be allowed to be brought with them.
- The computers that will be given to the participants by the competition organisation in the competition area will have the operating system, office application program, pdf reader program and the Arduino IDE program downloaded from https://www.arduino.cc/en/Main/Software and the necessary libraries installed. Programming will only be done using this programme. There will be no different applications and programmes other than these software. Computers will be examined by the referee committee before the competition.
- Before the start of the competition, the following products and materials to be used in robot construction will be available at the work tables and the robot will be built using the product groups specified in the list.

5. Equipments

Some of the materials will be provided by the organisation. Other materials will be brought by the competitors. Teams will be able to have twice as many materials ready with them as the specified quantities of other materials other than the tool box and hand tools. (For example, RGB Colour Sensor is specified as 1 piece and if desired, maximum 2 pieces can be brought).

5.1. Materials to be provided by the Organisation.

- **Motors;**

*DC Gear Motor 6V	2 pieces***(will be given by organization)**

- **Others**

*DC Motor Bracket	2 pieces***(will be given by organization))**
*Wheel	2 pieces***(will be given by organization)**
*Robot Body	1 pieces***(will be given by organization))**
*Ball Caster	1 pieces***(will be given by organization)**

5.2. Materials that Competitor Teams should bring with them

- **Mainboards:**

  Open source microcontroller board

  DC motor driver shield (double motor driver board)

- **Sensors:**

Object detection Sensor	6 pieces Ultrasonic or Optik
RGB Color sensor	1 piece
Line Sensor	2 pieces, Single Analog Sensor

- **Batteries;**

LI-PO Battery	1 piece 7.4V
LI-PO Charger	1 piece

- **Motors;**

Mini Servo Motor	1 piece

- **Other Materials;**

Servo Motor Bracket	1 piece
For the tip of Servo Motor	1 piece 100mm, 10mm, 3mm fleksiglass
Object Detection Sensor Holder	6 piece

- **Tool Box and Tools:**

  Inside tool box, there will be the following tools;

Tool Box	1 piece 17”
DC Power Supply	1 piece
Bread Board	1 piece
Bread Board Power Supply	1 piece
Dijital Multimeter	1 piece

Jumper Cables	2 pieces male- male, female- male 40pin 100mm	
Soldering iron	1 piece	
Soldering iron stand	1 piece	
Solder	1 piece	
Soldering Flux	1 piece	
Desoldering pump	1 piece	
Mini long nose plier	1 piece	
Mini Plier	1 piece	
Mini Diagonal plier	1 piece	
Screwdriver set	1 piece	
Glue gun and Silicon	1 piece	
Plastic Distance Set	1 piece	Plastic/Metal Distance
Screw-Nut Set	1 piece	M2 YHB Screw, Nut and Washer in sufficient quantity
USB cable (1 meter)	1 piece	compatible with board

6. Contact

The general rules regarding the competition applications and the Labyrinth Master Category are included in the 'Application Guide'. The Application Guide must be read before making an application.

Competitors should make their questions by selecting their categories from the information menu after logging into the robot.meb.gov.tr system. Questions other than category messages will not be answered and no responsibility will be accepted.

Appendix-1 SAMPLE QUESTIONS;

S-1) What is the value of resistance which has following color code: Red – Green – Yellow – silver?

a) 2 K Ω b) 200 K Ω c) 250 K Ω d) 2 M Ω

S-2) Which one is the symbol of diode?

a) b) c) d)

S-3) Which one is the decimal equivalence of number (1001 1100)2?

a) 146 b) 156 c) 166 d) 176

S-4) Which one is correct statement to activate output pin 3 of Arduino?

a) digitalWrite(3,LOW); b) digitalWrite(3,SET);

c) digitalWrite(3,HIGH); d) digitalWrite(3,high);

S-5) Which codes can be used to activate digital output 7 if value of input A0 of Arduino becomes between 300 and 500?

a)
```
if(analogRead(A0)>300 || analogRead(A0)<500)
  digitalWrite(7,HIGH);
  else
  digitalWrite(7,LOW);
```

b)
```
if(analogRead(A0)<300 || analogRead(A0)>500)
  digitalWrite(7,HIGH);
  else
  digitalWrite(7,LOW);
```

c)
```
if(analogRead(A0)>300 && analogRead(A0)<500)
  digitalWrite(7,HIGH);
  else
  digitalWrite(7,LOW);
```

d)
```
if(analogRead(A0)<300 && analogRead(A0)>500)
  digitalWrite(7,HIGH);
  else
  digitalWrite(7,LOW);
```

S-6) Which script can be used to define all pins of Arduino from 3 to 9 as output?

a) for(int i=0;i<10;i++)
pinMode(i,output);

b) for(int i=0;i<10;i++)
pinMode(i,OUTPUT);

c) for(int i=3;i<10;i++)
pinMode(i,output);

d) for(int i=3;i<10;i++)
pinMode(i,OUTPUT);

S-7) int a = 5; Serial.print(sizeof(a));

When we run the codes above , what can we see on serial port screen?

a) 5 b) 1 c) 2 d) 4

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17th INTERNATIONAL MEB ROBOT CONTEST

EGG COLLECTING ROBOT CATEGORY GUIDE

2025

Education, Technology, Production from Roots to the Future

İÇİNDEKİLER

EGG COLLECTING CATEGORY RULES

1. INTRODUCTION

This competition is carried on by racing robots that have technologies like sensors, mechanics and artificial intelligence. Two robots race in competition area at the same time. Theme of competition was inspired by turtles “caretta caretta” living under control in our country’s coasts where they laying their eggs. It will be implemented by collecting small colored eggs which are distributed to competition area and bringing them to collection fields. Scores will be given according to the number of eggs collected in a specific time.

The aim of this game is to collect all eggs which have same color with its corner area that robot started and leave them all in this area.

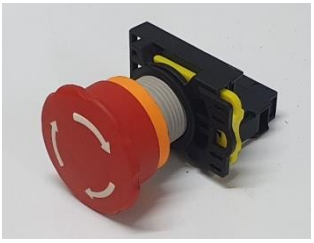
2. SPECIFICATION OF ROBOT

2.1. DIMENSIONS AND WEIGHT LIMITS

Maximum robot dimensions are 30x30x30 cm and weight limit is 3kg.

2.2. OTHER SPECIFICATIONS

There must be an accesible emergency button (red colored mushroom type push button), and 10cm lenght RGB led stript placed horizontally and has same color with its corner area. There will be no any different color light or indicator on top of robot except the color of its corner area.



Red colored mushroom type push button

Led (red, blue)

Robots must move autonomously. After starting, robot cannot split but extend. Robots which break to this rule will be disqualified. Dangerous and extremely disturbing robots or competitors may be disqualified.

3. COMPETITION AREA

3.1. DIMENSIONS OF COMPETITION AREA

- Competition area has 250x250 cm dimensions and encircled with colored frame which has 8cm height.
- Material is white hardboard.

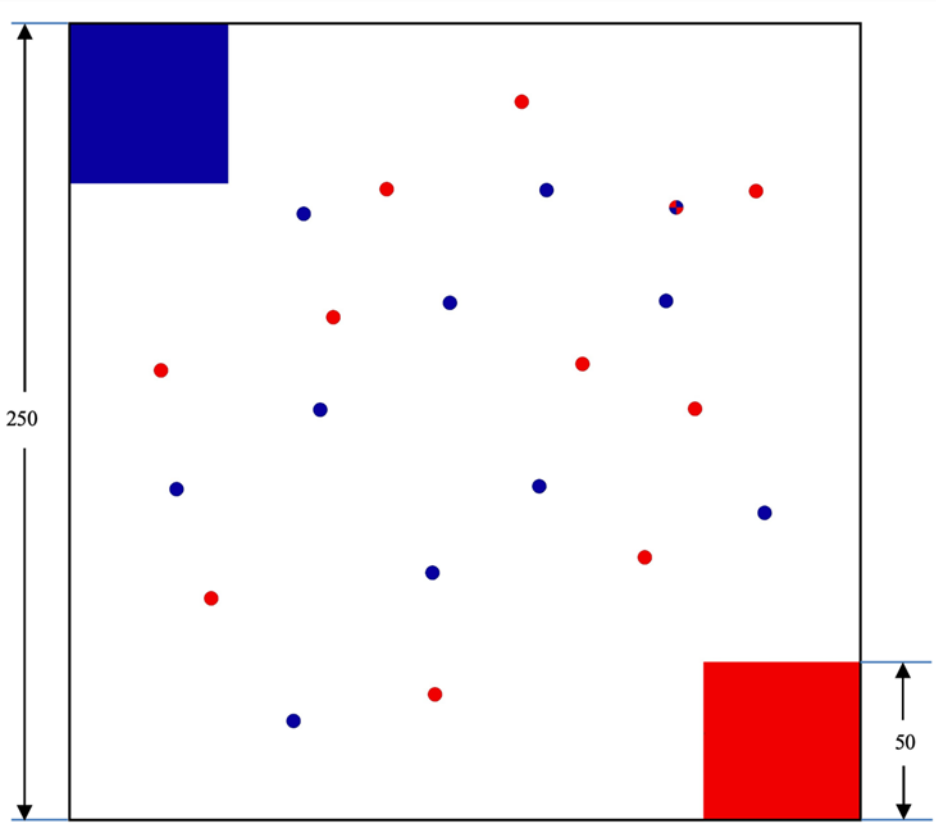


Figure 1 *Caretta Caretta Competition Area*

3.2. EGG COLLECTION FIELDS (CORNER AREAS)

Fields (red and blue) have dimensions (50x50cm) and they are located cross corners of the competition area. Remain part of competition area is white colored and all eggs include red, blue and tricky are spreaded out in this area.

3.3. CARETTA CARETTA EGGS

Eggs are cylindrical shape with 40mm diameter and 20mm height, colored red (RAL3020) and blue (RAL5013). They are made by plastic or wooden material and maximum 40gr weight. They have same color with the color of corner areas.

Red colored eggs and corner area : RAL3020

Blue colored eggs and corner area : RAL5013

Tricky egg color code : RAL5013-RAL3020

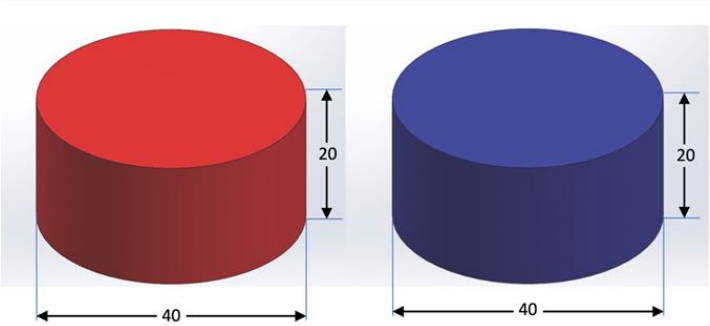


Figure 2 *Blue and Red Eggs*

3.4. TRICKY EGG

It is a same size with others but mixed colored egg which is placed randomly on ground of competition area by the judges. In white area, there is also tricky egg as 21th egg which is colored both red (RAL5013) and blue (RAL3020). It is not compulsory to take this egg from white area.

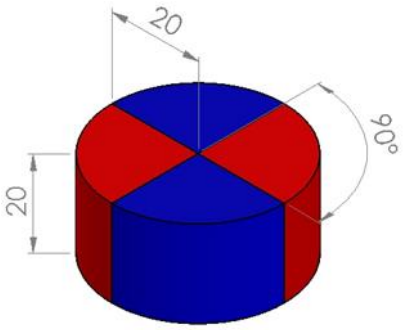


Figure 3 *Tricky Egg*

4. GAME FORMAT AND EVALUATION

4.1. ROBOT PRODUCTION REPORT

It is the report documenting that the robot that the applying student and the advisor will participate in the competition is designed by them and the production process. The report will be uploaded to the system by selecting the relevant robot name from the production

reports section under the management menu after entering the username and password information to robot.meb.gov.tr.

The report includes:

- Materials used in the construction of the robot,
- Explaining the construction process of the robot,
- The language used to program the robot,
- The total cost of the robot,
- It should include photos of the robot's production stage, its final form, the robot's name and the school's logo.

4.2. GAME

4.2.1.STARTING GAME

- Within 5 minutes, robots must be brought to judge desk when they invited to game. If robot was not brought in this period, judge announces that it lost the game.
- 10 pieces red /blue eggs and one tricky egg will be placed randomly by judge.
- The corners (starting field /collection field) are determined by the way of judge's draw lot. Robots start from the color/ corners and they have to collect eggs which are same colored with the color of it's corner.
- When judge gives the start signal, robot runs for collecting.
- The leds showing the colour/corner colour of the competitor robots determined as a result of the draw must be lit during the competition. In cases where it does not light up, it can use its 5 minute technical break right. If the leds that determine the corner colour do not light up, the robot is disqualified.
- Competitors place their robots manually in starting field. During the game, it is prohibited to touch robots. If necessary, the referees may stop and restart the game without waiting for the competition time.

4.2.2.GENERAL RULES

Eggs laid in the starting area are collected by the corner judges. A representative egg is considered collected only if the following conditions are met.

- Eggs are considered to have been laid in the egg collection area that are completely outside the robot.
- Representative eggs are also considered to have been laid if they are perpendicular or on top of each other in the collection area.
- Eggs on the line where the collection area and the white area intersect are also considered to have been laid in the area.
- If the representative egg touches the ground in the collection area and remains motionless for 1 second, it is collected by the referees. Eggs that arrive in the collection area as a result of pushing or bumping are considered to have been laid.
- If the immobilized egg in the collection area is picked up again by any robot before the referee has a chance to pick it up, the referees will accept this egg as laid by the robot that laid it first.
- The robot or robots that do not lay at least one egg in their corner at the end of the time will be deemed to have lost the game.
- During the game, the robot will lose the game if parts with a total weight of more than 10 g fall on the field.
- If the robots get stuck on each other or on the walls, they will wait until the end of the competition time.
- For the robot that is determined to have started early by the referee, the race is restarted with a warning. The robot that starts early twice is eliminated.
- No substance used in the robots should be of a nature to harm the spectators, competitors, the competition track and the competition materials. Water, oil, flammable, flammable liquids and gases and dangerous chemicals must not be used.
- The Competition Organization Committee has the right to change the rules when it deems necessary.

4.2.3. FINISHING GAME

- The game ends when the representative eggs are collected from the collection area or by the referee's decision after the completion of the 3-minute time limit set by the referees.

- The competitor who leaves 10 of his/her own balls in the white area is considered to have completed his/her task and the game is over.
- At the end of the competition, if the competitors in the field request, the competition is repeated 1 time.
- The robot that collects the most points at the end of the time is deemed to have won the game.
- In case of equality, the robot that lays its egg first wins the game.

4.2.4.TECHNICAL TIME-OUT

- At the beginning of the competition, it can be taken a technical break by the request of the competitor without moving.
- Technical time-out can be taken only 1 time in a competition.
- Technical break time is 5 minutes.

4.2.5.SCORING

Scoring is done after the robot lays at least one egg of its own color in its own corner. The judges collect the eggs gathered in the dropping area.

- If the egg left in its own area is the same as the field color, 1 point is increased;
- 2 points are deducted if the egg laid in its own area is different from the field color;
- If the penalty egg, which was laid as the 21st egg in the white area, is left in any of the collection areas, 3 points are deducted from the robot of the color left;
- Eggs of the opponent's color left in the opponent's area are credited to the opponent plus 1 point;
- Eggs of the opponent's own color left in the opponent's area have no effect on the score

4.3. MATCHING

In case the number of robots is low or with the decision of the competition organizing committee, the tournament system can be applied at any stage of the competition.

4.3.1.TOURNAMENT METHOD

The winning robot will get 3 points and the losing robot will not get any points. In case of equality of points at the end of the competition, both robots will receive 1 point each. In case of a possible point equality in the ranking at the end of the tournament, the results obtained in the competitions (average) are taken into account. If the equality continues, the lighter robot takes the top place in the ranking.

4.3.2.ELIMINATION METHOD

In elimination system, robot which gets better score then other goes to next tour.

5. WARNING FOR COMPETITORS

The general rules regarding the competition applications and the category are written in the “Application Guide”. Please read the rules carefully.

6. CONTACT

Competitors should make their questions by selecting their categories from the information menu after logging into the “robot.meb.gov.tr” system. Questions other than category messages will not be answered. The responsibility in this regard belongs to the competitors.