DIRECTORATE GENERAL OF VOCATIONAL AND TECHNICAL EDUCATION

100 CENTURY OF EDUCATION

TÜBİTAK

TİKA

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.

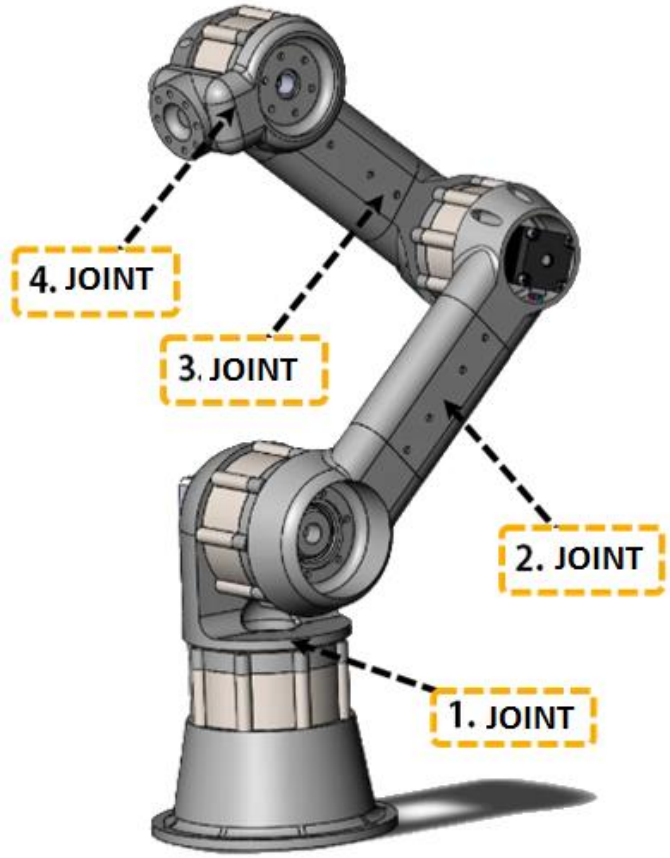


Figure 1: *Robotic arm sample*

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.

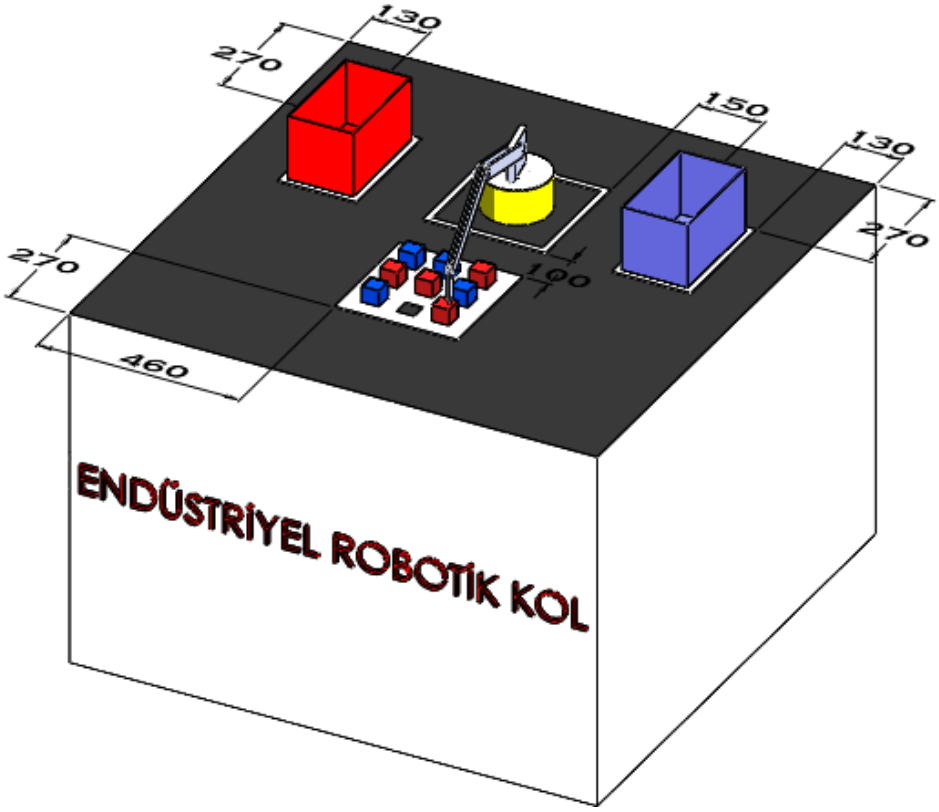


Figure 2: *Platform- isometric view*

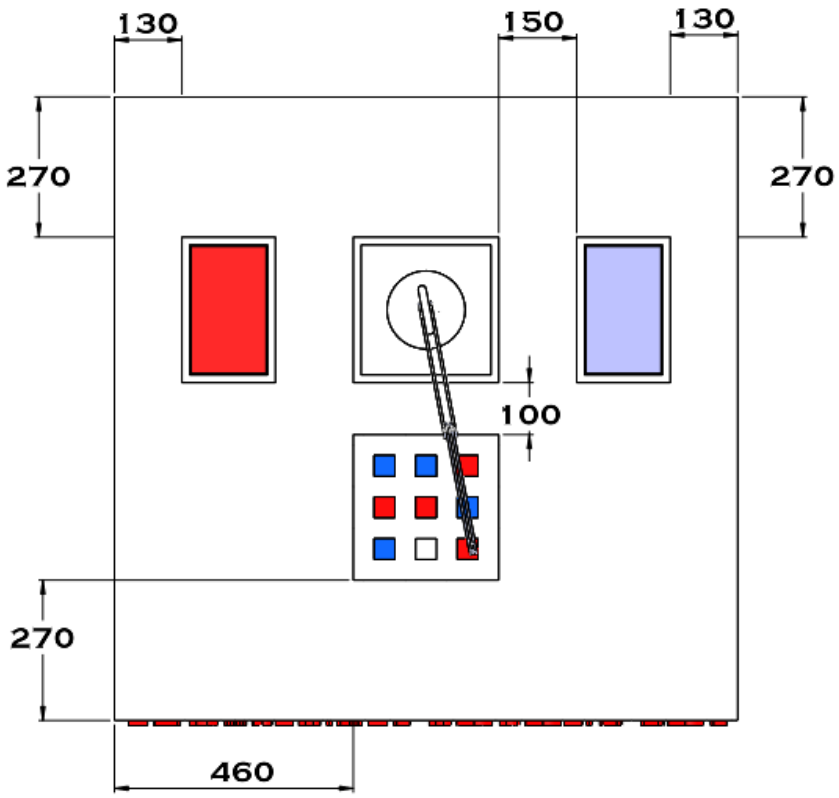


Figure 3: *Platform Top view*

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.

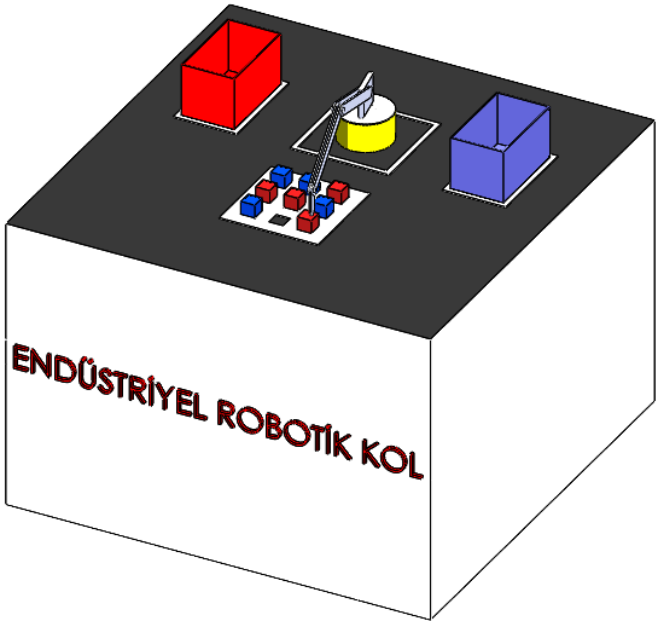


Figure 4: *Platform- isometric view*

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.

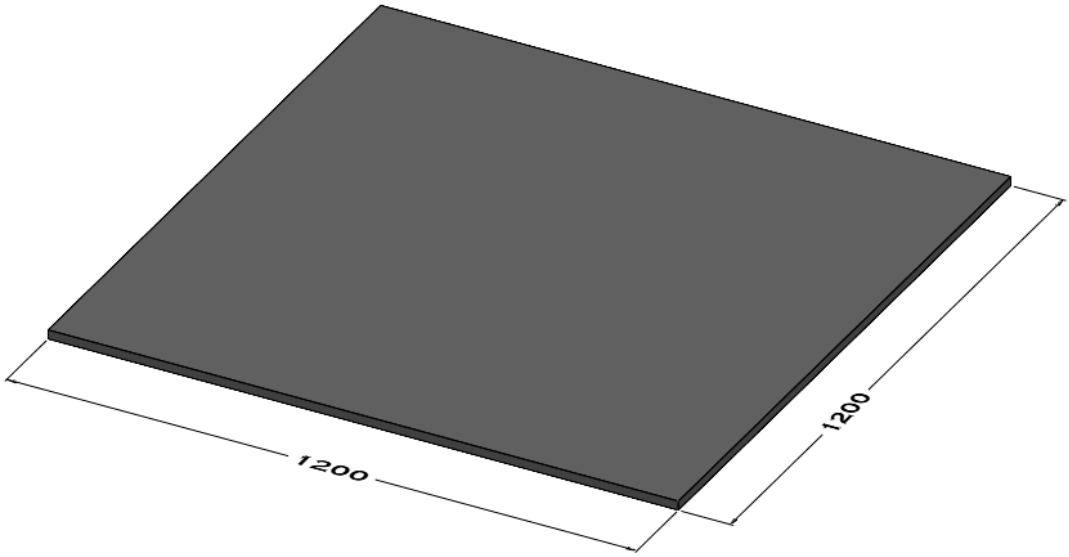
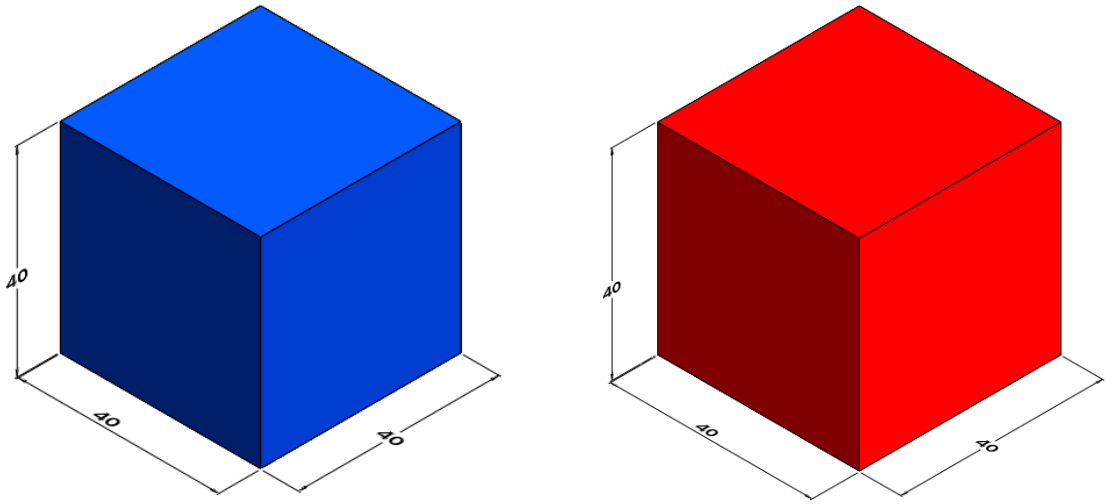


Figure 5: *Platform ground dimensions*

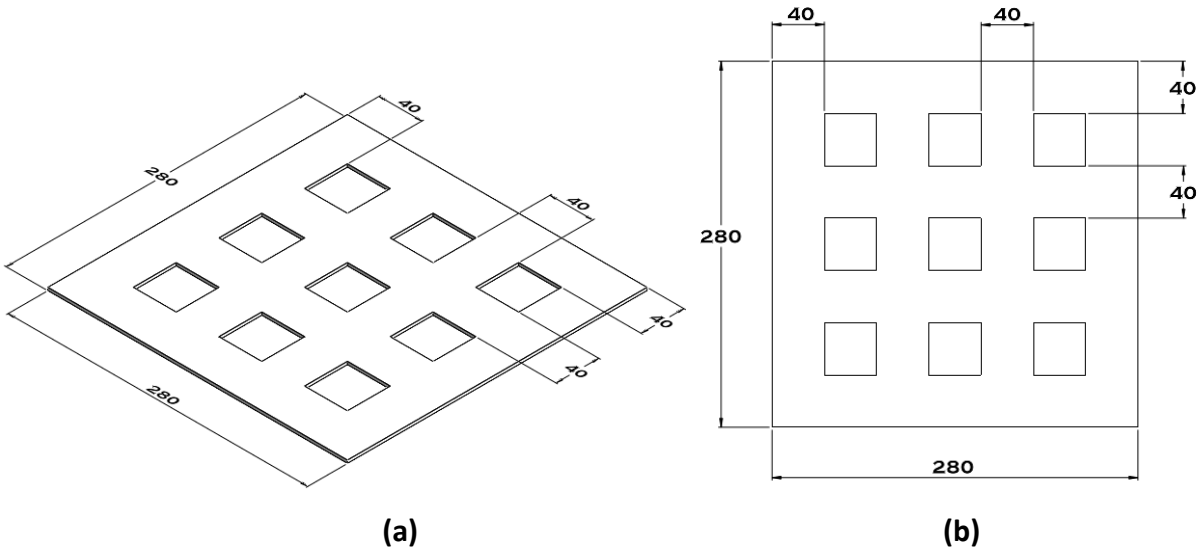
The cube blocks that the robotic arm will carry are made of 40 mm sized plexi sheets, which are durable and sturdy as well as lightweight, in blue and red colors. Figure 6 shows the images of the objects.



(a) **(b)**

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

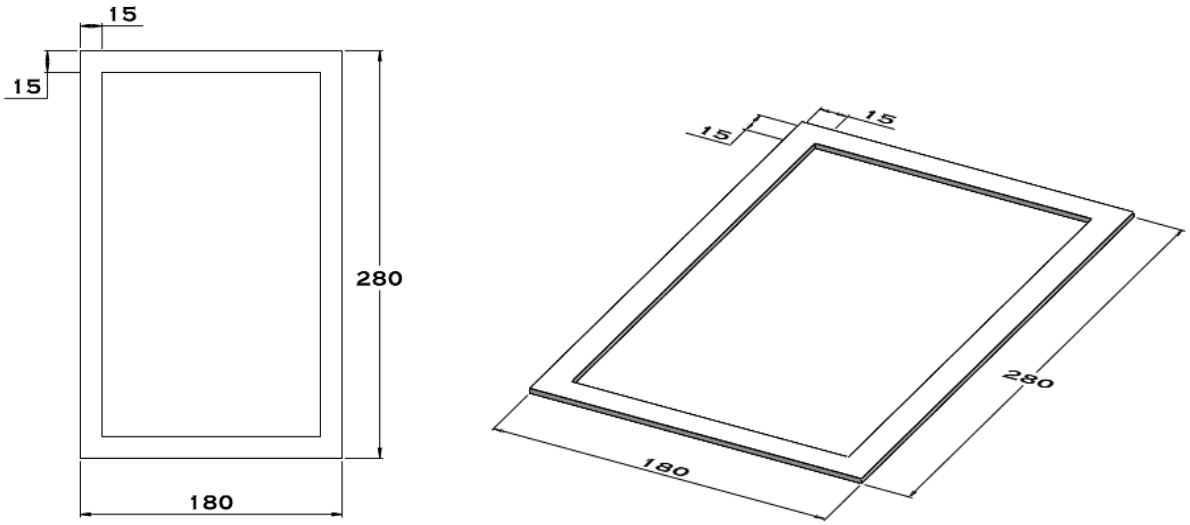
2.8 mm thick white plexiglass sheet will be used for the area where the cube blocks will be located on the competition floor. Figure 7 shows the visual containing the flexible sheet dimensions.



(a) (b)

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.



(a) (b)

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.

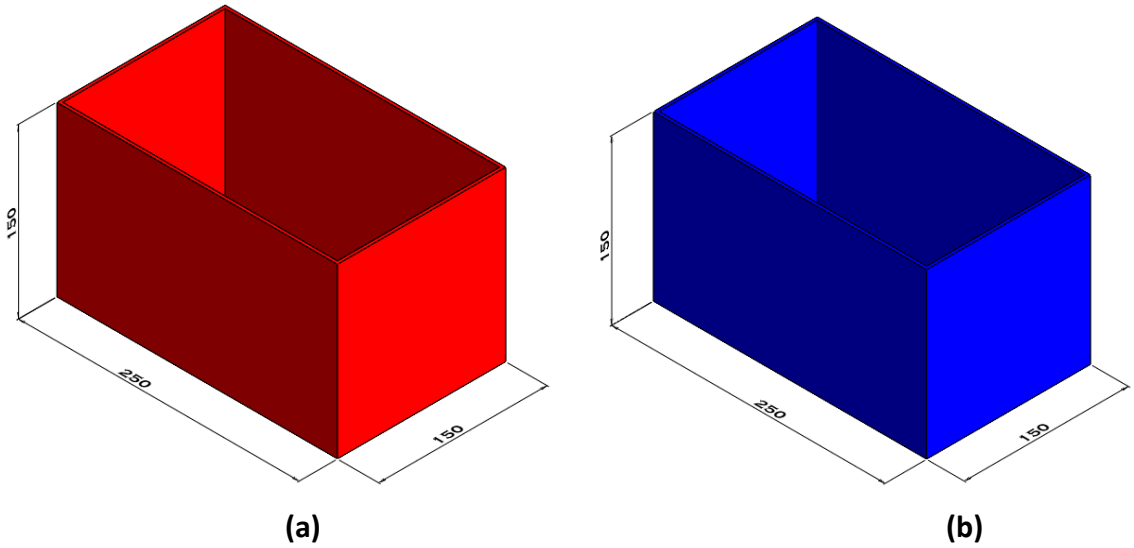


Figure 9: *Box dimensions (a-Red box b-Blue box)*

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.

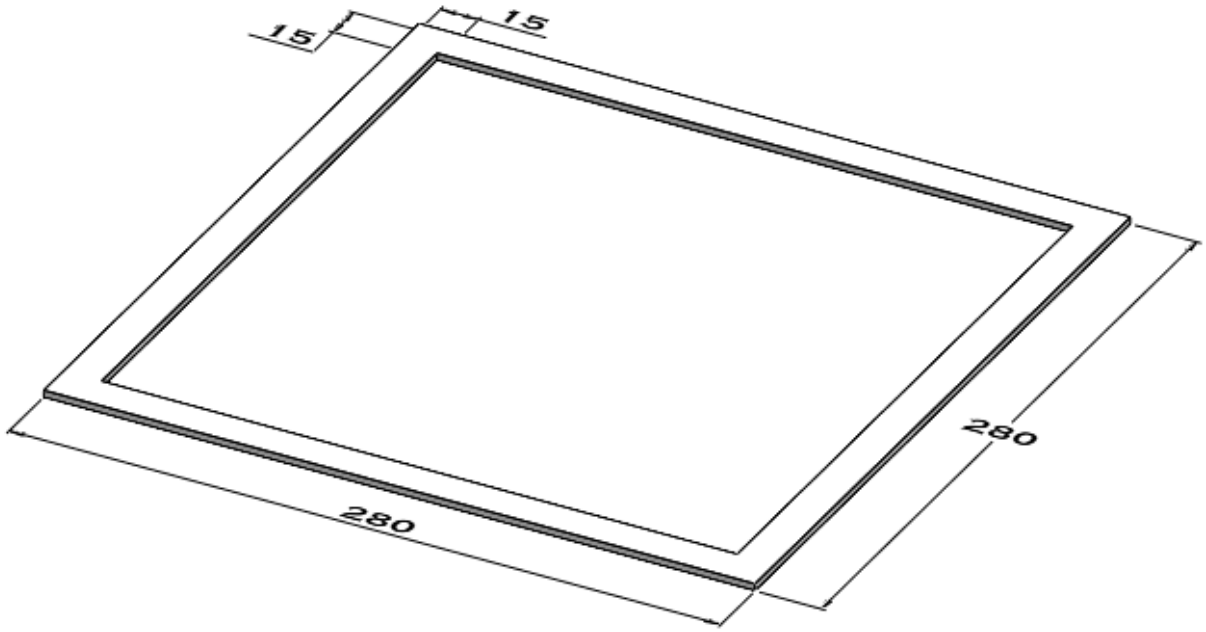


Figure 10: *Robot yerleşim yeri ölçüleri*

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.