DIRECTORATE GENERAL OF VOCATIONAL AND TECHNICAL EDUCATION

100 CENTURY OF EDUCATION

TÜBİTAK

TİKA

INTERNATIONAL MEB ROBOT COMPETITION

17th INTERNATIONAL MEB ROBOT COMPETITION

UNMANNED SURFACE VEHICLE (USV) JUNIOR CATEGORY GUIDE

2025

Education, Technology, Production from Roots to the Future

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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

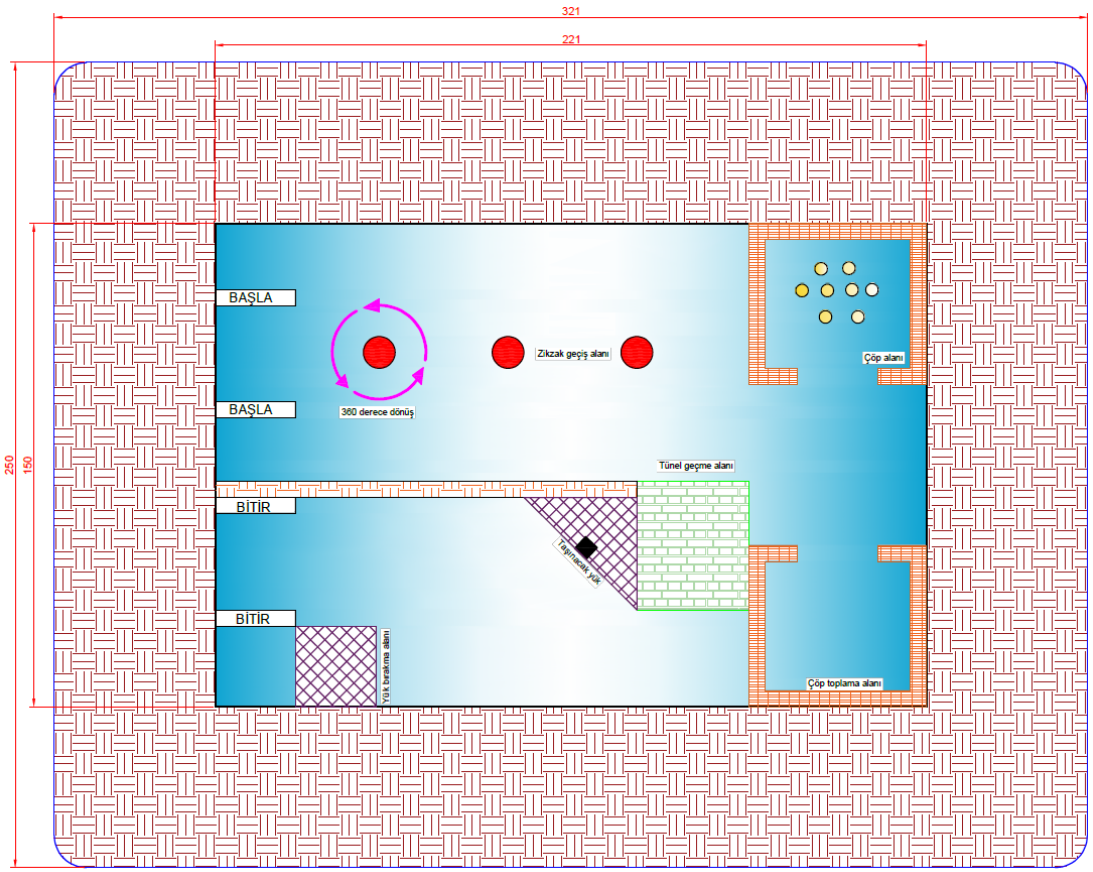


Figure 3.1: *USV Competition Pool and Mission View*

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.

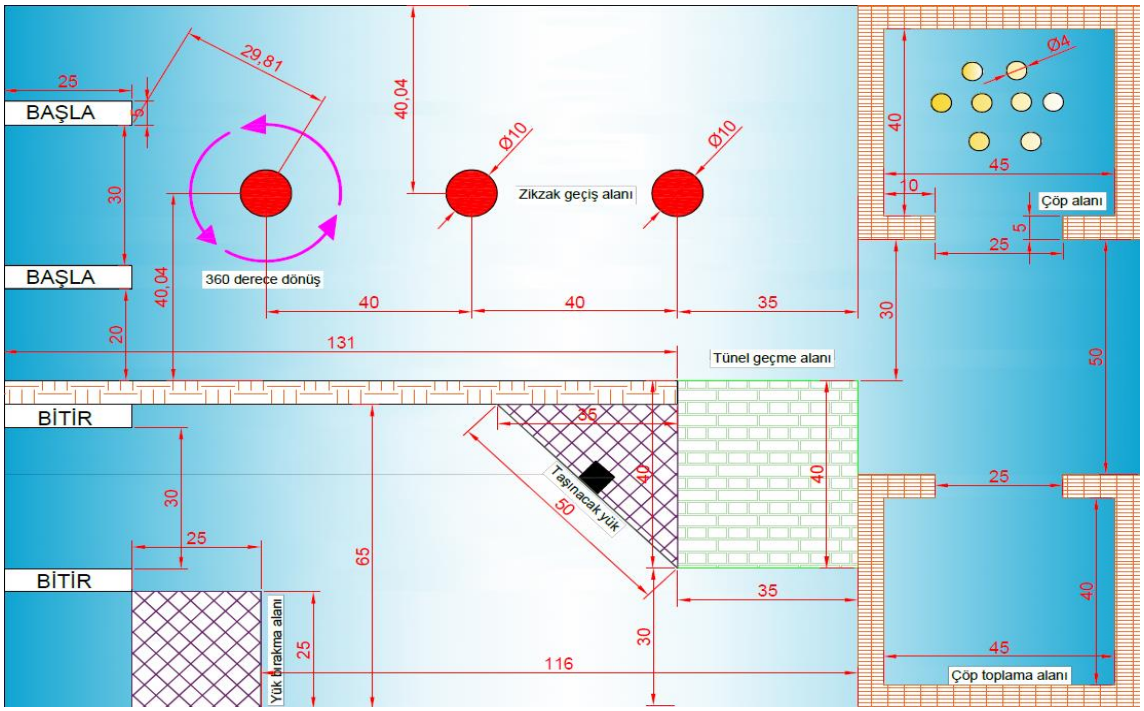


Figure 3.2: *USV Robot Competition Track*

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.

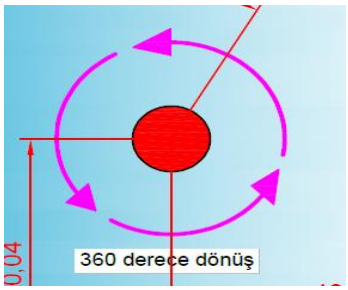


Figure 3.3: *360 Degree Rotation Platform*

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.

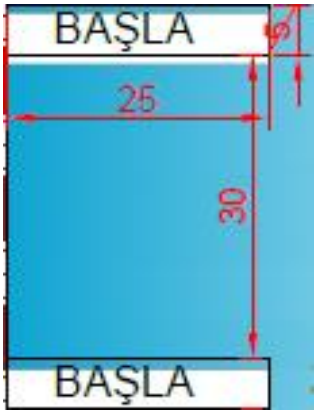


Figure 3.4: *Starting Buoy Platform*

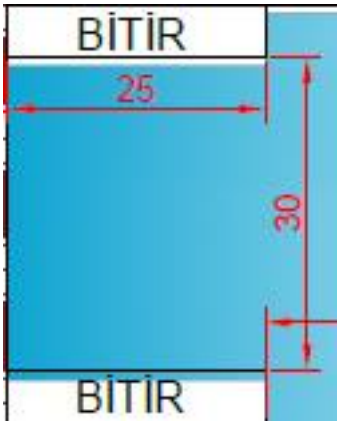


Figure 3.5: *End Buoy Platform*

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.

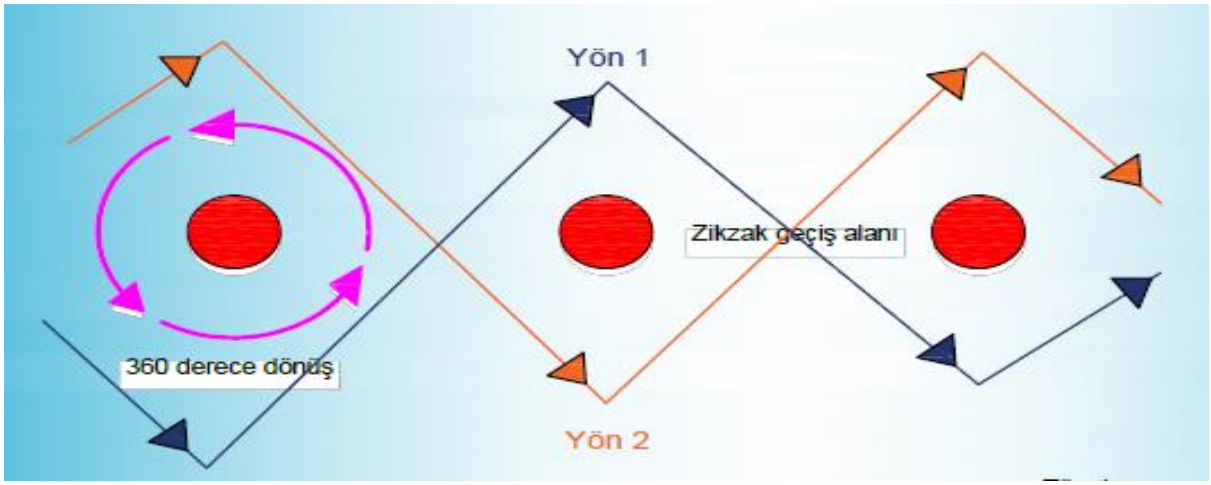


Figure 3.6: *Zigzag Transition Task*

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

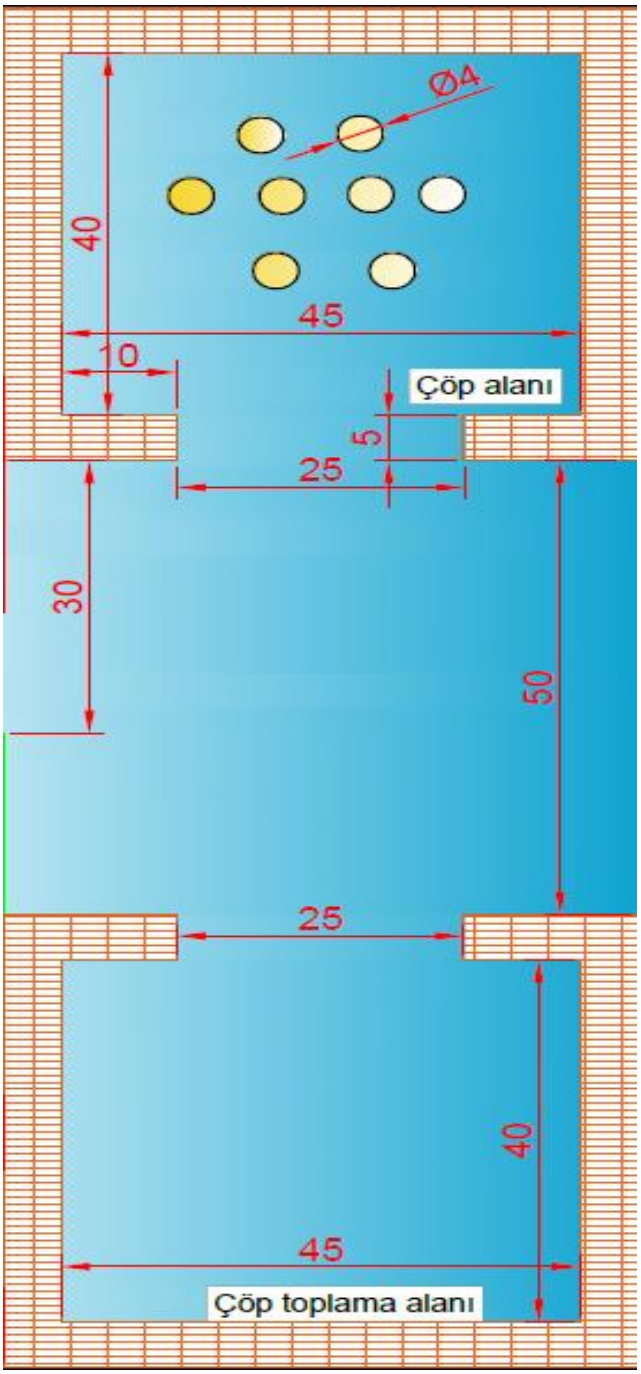


Figure 3.7: *Task Object Collection Task*

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.

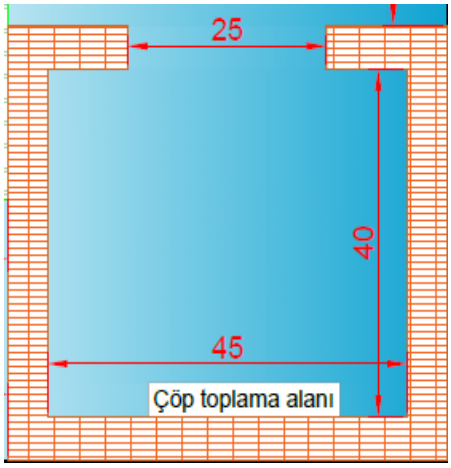


Figure 3.8: *Technical Dimensions of the Platform Top View (centimetre)*

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.

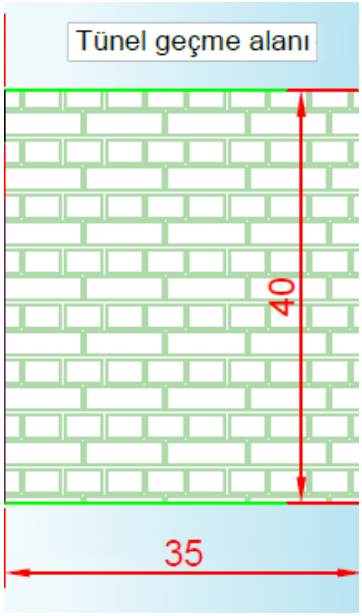


***Figure 3.9**: Tunnel Passing Task*

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.

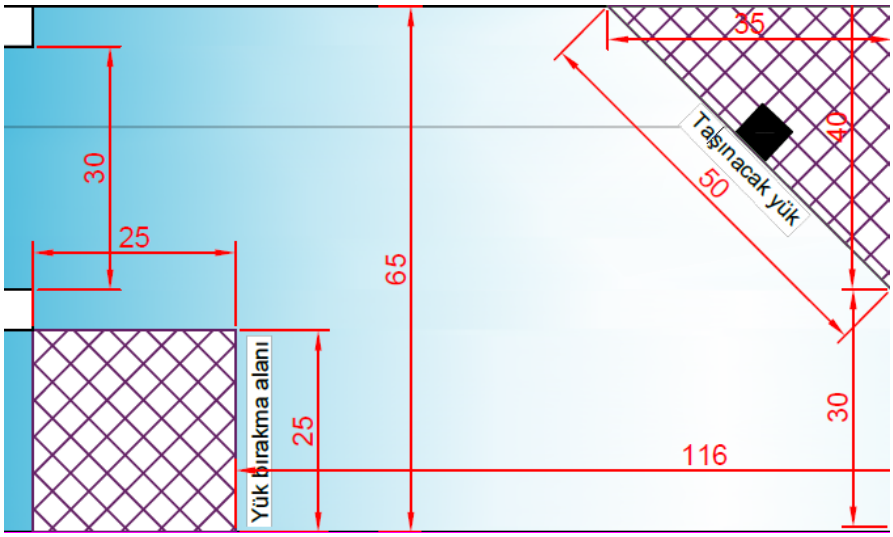


Figure 3.10: *Container Handling Task*

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.

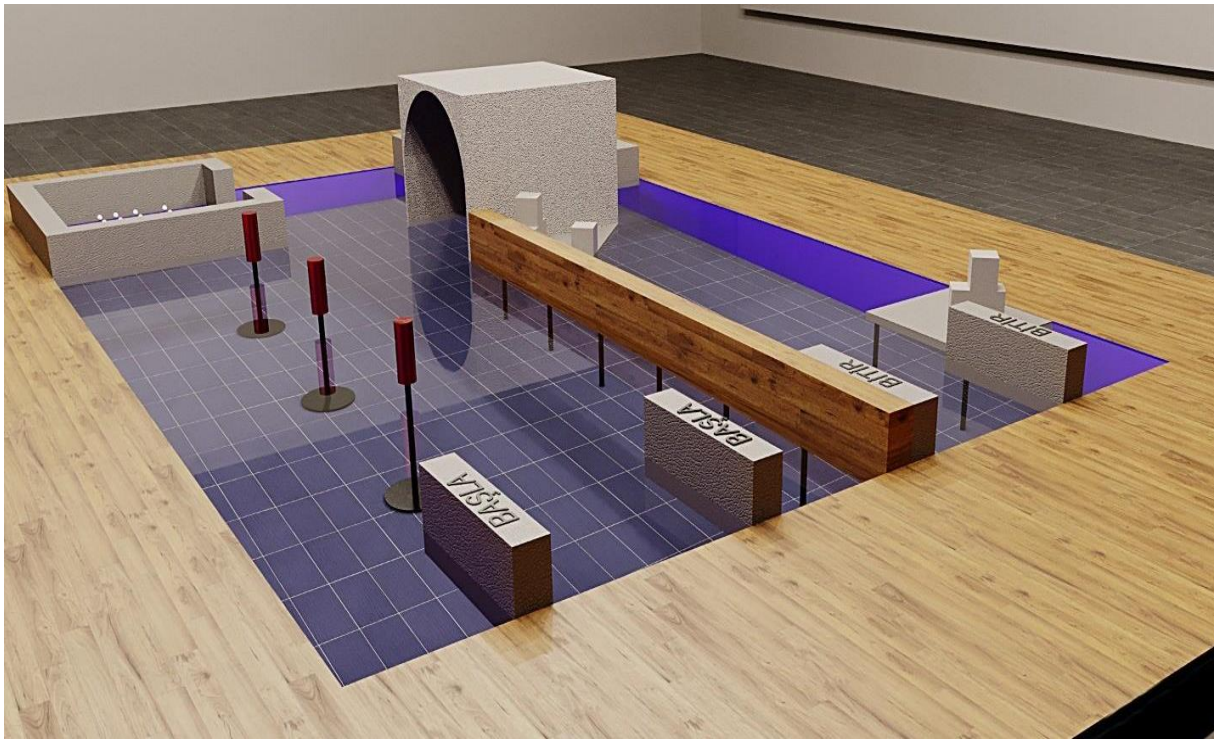
7. WARNINGS FOR COMPETITORS

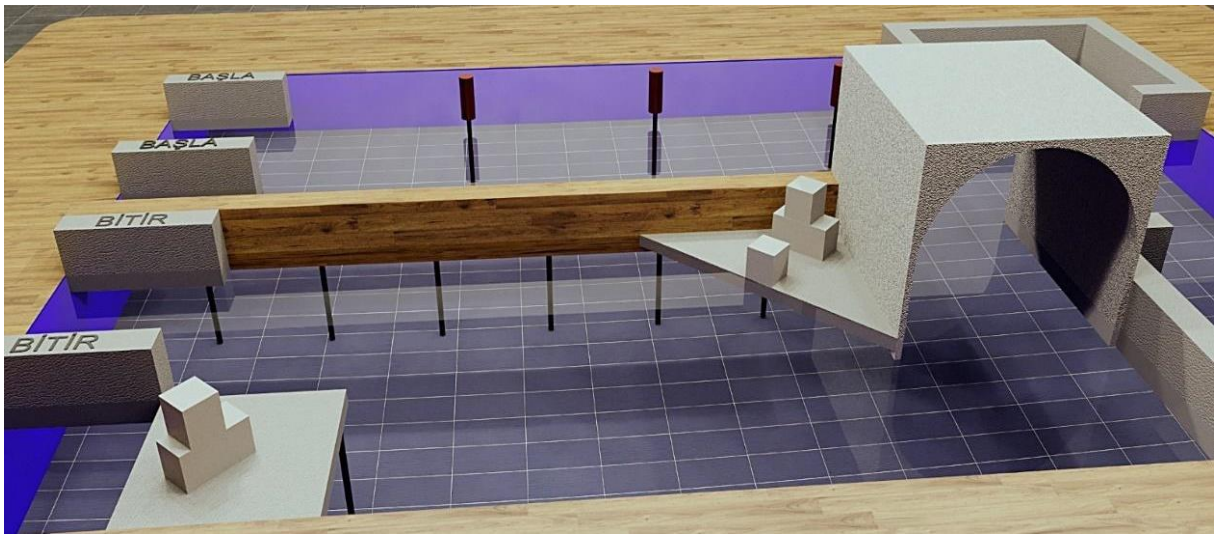
- Only Secondary School students can apply for this category.
- The general rules regarding the competition applications and the USV Robot category are included in the "Application Guide". The Application Guide must be read before making an application.

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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