REPUBLIC OF TURKIYE
MINISTRY OF NATIONAL EDUCATION
The General Directorate
of Technical and Vocational Education

16th INTERNATIONAL MoNE ROBOT CONTEST

UNDERWATER VEHICE ROBOT RULES

INTERNATIONAL MoNE ROBOT CONTEST

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UNDERWATER ROBOTS (ROV / AUV) COMPETITION

1. PURPOSE

The aim of the MEB Underwater Robots Competition is to enable our young people to design an unmanned vehicle that can fulfil the tasks given under water using today's technologies. In addition, it is to pioneer the dissemination of technological studies and research and development processes that can fulfil the underwater tasks of unmanned vehicles, which are seen as the technology of the future, at the primary and seondary school education levels. In this context, our students are expected to access and use information, analyse possible problems, produce solutions and reach new information.

2. COMPETITION THEME

In the second century of our Republic, with the National Technology Move, the number of unmanned, intelligent vehicles with high added value added to our technological infrastructure has increased in every field and the importance of disseminating the studies in this field has become more and more evident day by day. Within the scope of these dissemination activities, the MEB Underwater Robots Competition focuses on the use of unmanned vehicles 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 the underwater world, to prevent the lives of people and underwater creatures from being put at risk, and to contribute to the reduction of costs in underwater or marine studies. It will be a competition that will pioneer the development of original vehicles by spreading to a wider base throughout the country in the production and development of underwater vehicles and will bring you, our esteemed students, together about the underwater world.

3. COMPETITION SPECIALITIES

In the MEB Underwater Robots Competition, competing teams are expected to design an unmanned underwater vehicle that has the ability to move on the track to be prepared under water and can fulfil dragging tasks.

3.1 Scoring, Evaluation, Competition Tracks and Task Objects

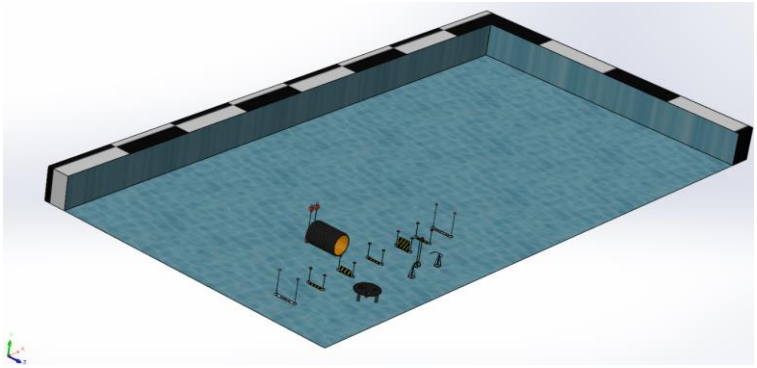


Figure 3.1: Underwater Robots Competition Pool and Mission View

The competition will be held in a pool with a depth of 140cm, a width of 1250cm and a length of 2500cm. Platforms will be placed in the pool to determine the starting and finishing 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.

The underwater vehicles of the competing teams are expected to perform four different tasks. These tasks have no order of priority and each task is subject to a scoring within itself. One of these tasks is the task of passing between two buoys attached to a total of five buoys at 3 different heights from the pool floor. Another task is to place the appropriate task objects in the gaps in the platform that looks like a coffee table placed on the pool floor. Another task is for the underwater robot to move through a pipe placed on the floor and knock over a plate connected to the lighted buoys at the other end of the pipe. The last task is to pick up the rings on a ring holder platform placed on the ground and place them on a platform placed on the ground where the rings can pass according to their color. Figure 3.2 shows a picture of the competition course

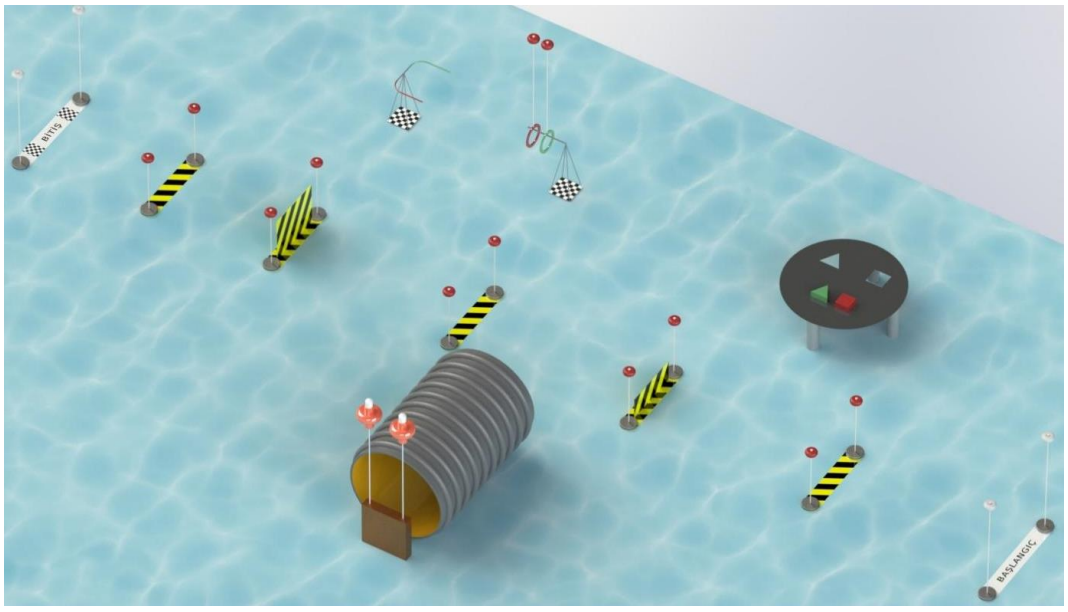


Figure 3.2: Underwater Robot Competition Track

3.1.1. Passing Between Buoys

In this task, the competitor vehicles are expected to complete the course by passing through 5 platforms prepared with two buoys in the pool. These platforms are prepared in three types and the competitor vehicle passing through each buoy platform will **add 10 points** to the team score. Failure of the vehicles to pass through any 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.

The first of these platforms will consist of a plate placed between the two buoy columns shown in Figure-3. This platform will be named as ***"Barrier-Free Buoy Platform"***.

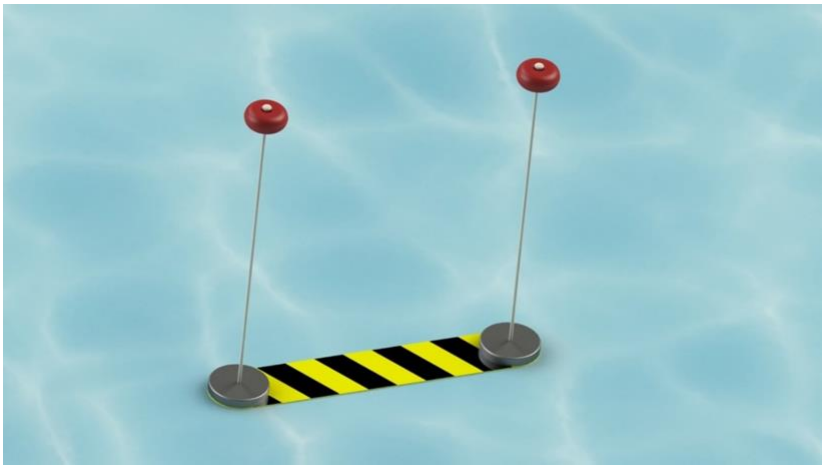


Figure 3.3: Barrier-Free Buoy Platform

The first of these platforms will consist of a plate placed between the two buoy columns shown in Figure 3.3. This platform will be referred to as the "**Barrier-Free Buoy Platform**". Three unobstructed buoy platforms will be placed in the course. While the robot's passing through these platforms will add **10 points** to the team score, the team that **does not pass** through the platform **will not receive points**, and 5 points **will be deleted** from the team score of the vehicles **that overturn or displace** the platform while passing.

The height of the buoys on the unobstructed buoy platform in Figure 3.3 from the pool floor will be 60cm and the distance between the two buoy centers will be 66cm.

Figure 3.4: 20cm Obstacle Buoy Platform

Another platform placed within the course is a 20cm high platform made of a 20cm high plate placed perpendicularly on the plate sitting on the ground between the two buoy columns. The height of the buoys from the pool floor will be 60cm and the distance between the two buoy centers will be 66cm. The picture of this platform is shared in Figure 3.4. This platform will be referred to as the "20cm Disabled Buoy Platform". One 20cm disabled buoy

platform will be placed in the course. If the vehicle of the competing team has difficulty in performing the task of passing through the 20cm obstacle buoy platform, it has the right to pass by this platform and turn to perform its other task. While the robot's passing through these platforms **will add 10 points** to the team score, the team that **does not pass** through the platform **will not receive points**, and **5 points will be deleted** from the team score of the vehicles that **overturn or displace the platform** while passing.

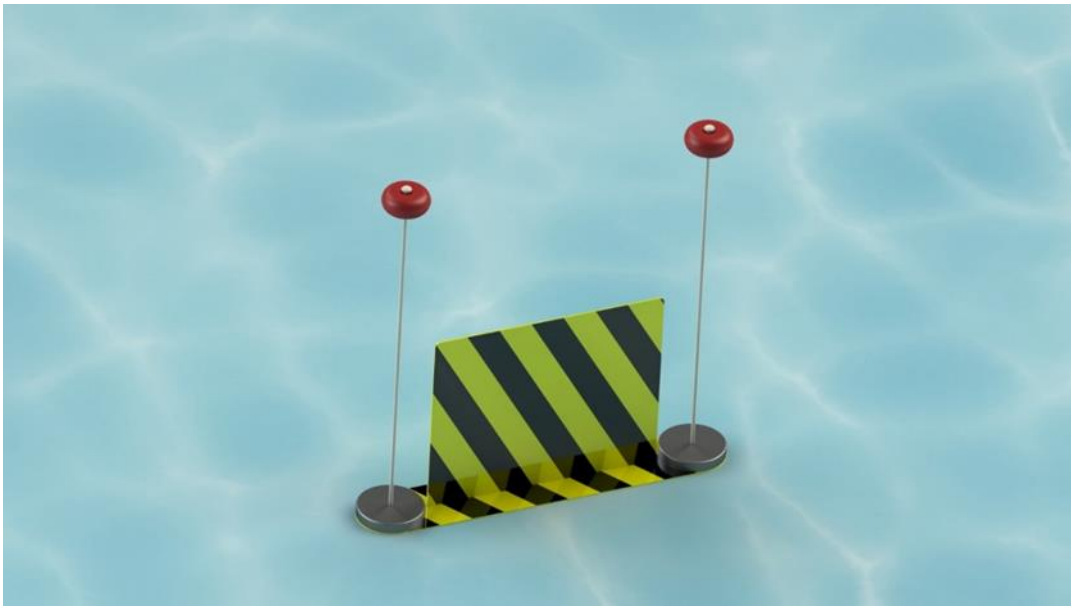


Figure 3.5: 40cm Obstacle Buoy Platform

Another platform placed in the course is a 40cm high platform made of a 40cm high plate placed perpendicularly on the plate sitting on the ground between the two buoy columns. The height of the buoys from the pool floor will be 60cm and the distance between the two buoy centers will be 66cm. The picture of this platform is shared in Figure 3.5. This platform will be referred to as the "40cm Disabled Buoy Platform". One 40cm disabled buoy platform will be placed in the course. If the vehicle of the competing team has difficulty in performing the task of passing through the 40cm obstacle buoy platform, it has the right to pass by this platform and turn to perform its other task. While the robot's passing through these platforms will **add 10 points to** the team score, the team that does not pass through the platform **will not receive points**, and **5 points will be deleted** from the team score of the vehicles that overturn or displace the platform while passing.

The team robot operator has the right not to pass the buoy platform of his choice.

After the teams' preparation time, the vehicle will be deemed to have entered the competition course by passing through the "Starting Buoy Platform" at the start of the competition. Within the preparation time given to the teams, the vehicle is expected to be in front of the starting buoy ready to start the competition. After the referee starts the competition, the competing vehicles are expected to pass the "**Finish Buoy Platform**" after completing the tasks within the competition time. Figure 3.6 shows the start buoy platform and Figure 3.7 shows the finish buoy platform.

Figure 3.6: Starting Buoy Platform

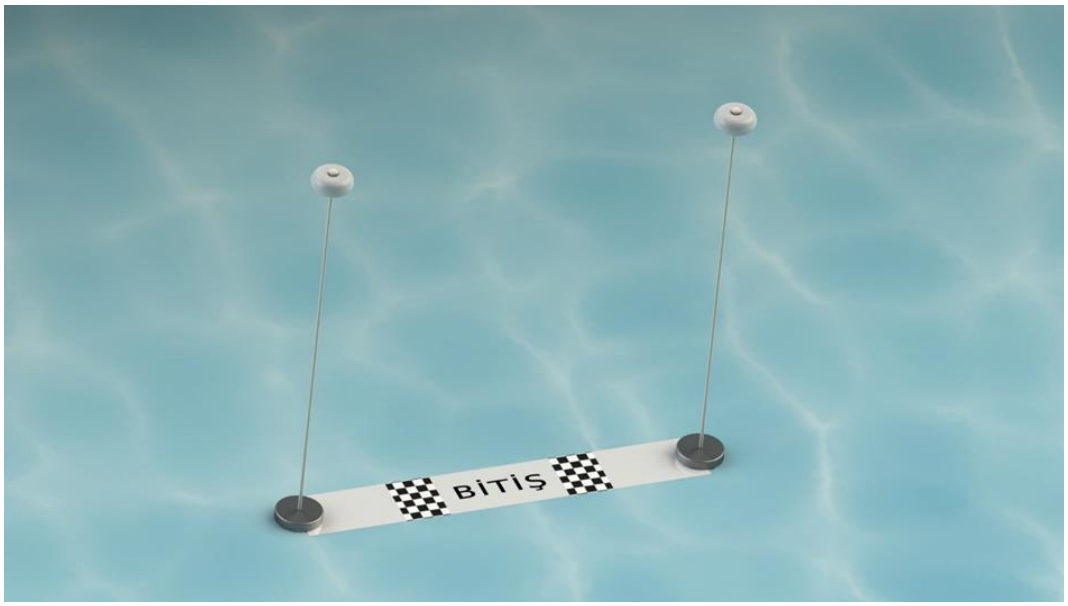


Figure 3.7: Finish Buoy Platform

The height of the buoys on the buoy platforms in Figure 3.6 and Figure 3.7 will be 100cm above the pool floor and the distance between the two buoy centers will be 86cm.

While no points will be added to the cars passing through the start and finish buoy platform, the finishing time of the cars 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. Task Object Placement Task

In this task, the underwater robots of the competitors will place objects in the form of equilateral triangles and rectangular prisms in the appropriate spaces within the equilateral triangle and square spaces opened on a platform that has the appearance of a coffee table placed on the ground. The visual of the task is shown in Figure 3.8

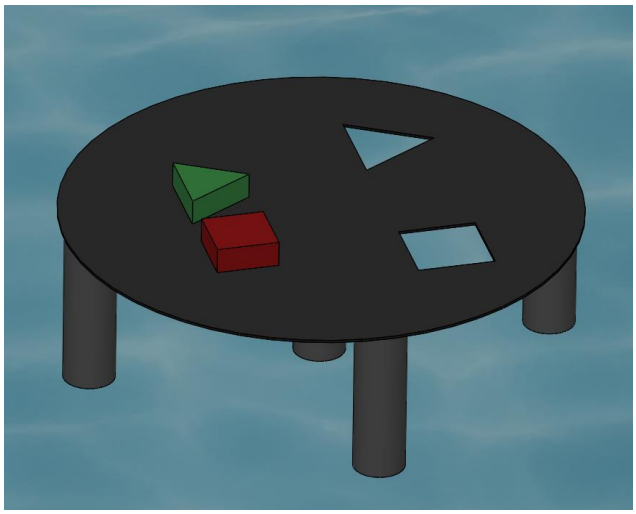


Figure 3.8: Task Object Placement Task

The height of the trestle-like platform on which the task objects are placed from the pool floor is 30cm, the diameter of the circle is 100cm and the thickness of the platform is 0.5cm. The top view technical dimensions of the platform are shown in Figure 3.9

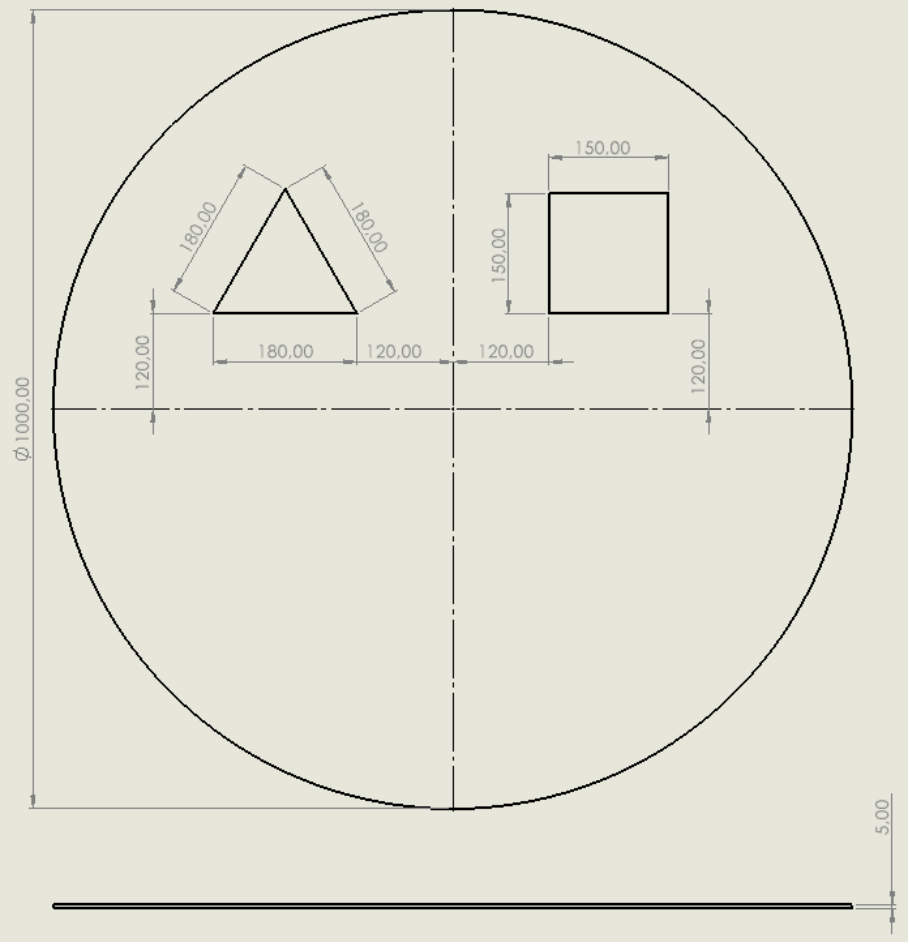


Figure 3.9: Top view technical dimensions of the platform (in millimeters)

The heights of the equilateral triangular and rectangular prisms standing on the platform and expected to be passed through the gaps are 5cm. The dimensions of the task objects are given in Table 3.1 below.

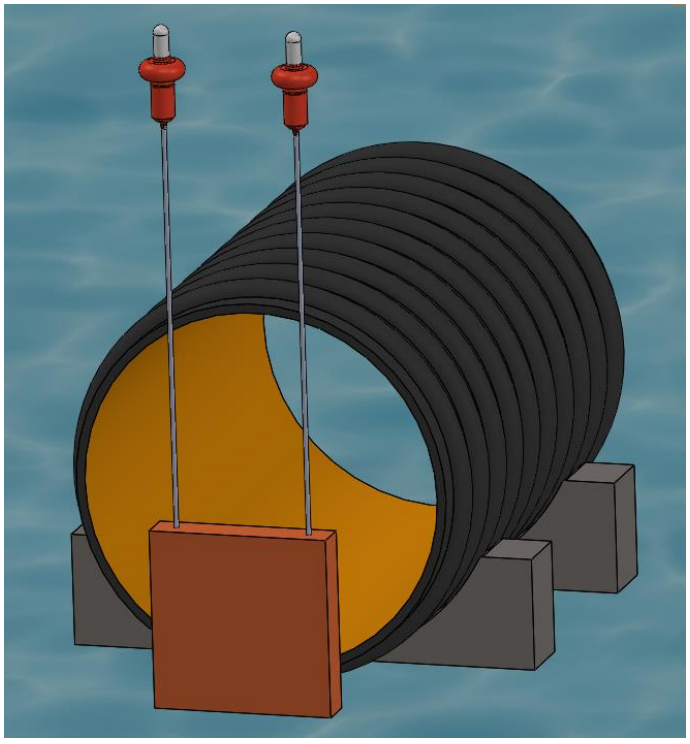
Object	Upper Surface Edge Lengths	Height(mm)
Equilateral triangle	Side lenght 150mm	50
Square prism	Side lenght 120mm	50

Table 3.1: Dimensions of equilateral triangle and rectangular prism objects

In this task, passing each object through the appropriate space adds **10 points** to the team score. If the underwater robot knocks over the platform, **5 points will be deducted** from the team score.

3.1.3. Passing through the Pipe and Tilting the Plate Task

In this task, the contestants' underwater robots; They will enter the hollow cylindrical pipe with an inner diameter of 100cm and length of 130cm placed on the ground from one end and knock down the task plate, which has a rectangular prism attached to the illuminated buoys, with a rope at the other end. The visual of the task is shown in Figure 3.10.



Picture 3.10: Task of Passing Through the Pipe and Tilting the Plate

The rectangular prism plate created for the task is 40cm wide, 40cm long and 8cm wide. The plate will be placed on the pool floor as seen in Picture 3.10, and the belly parts of the illuminated buoys, with a diameter of 10cm and a length of 21cm, will be on the pool surface. If the plate tips over, the buoys will sink underwater.

In this task, the robot passes through the pipe and knocks down the plate at the other end of the pipe, **adding 10 points** to the team score. If the underwater robot displaces the pipe platform supported by wedges, **5 points will be deducted** from the team score.

3.1.4. Ring Handling Task

In this task, the underwater robots of the competitors will be able to get the red and green colored rings with inner diameters of 15cm and outer diameters of 20cm, which are connected to the buoys floating on the pool surface with a rope, from the 35cm long rod on which they are located, and pass them on the red and green colored rod with arm lengths of 30cm on the opposite platform. The visual of the task is shown in Figure 3.11

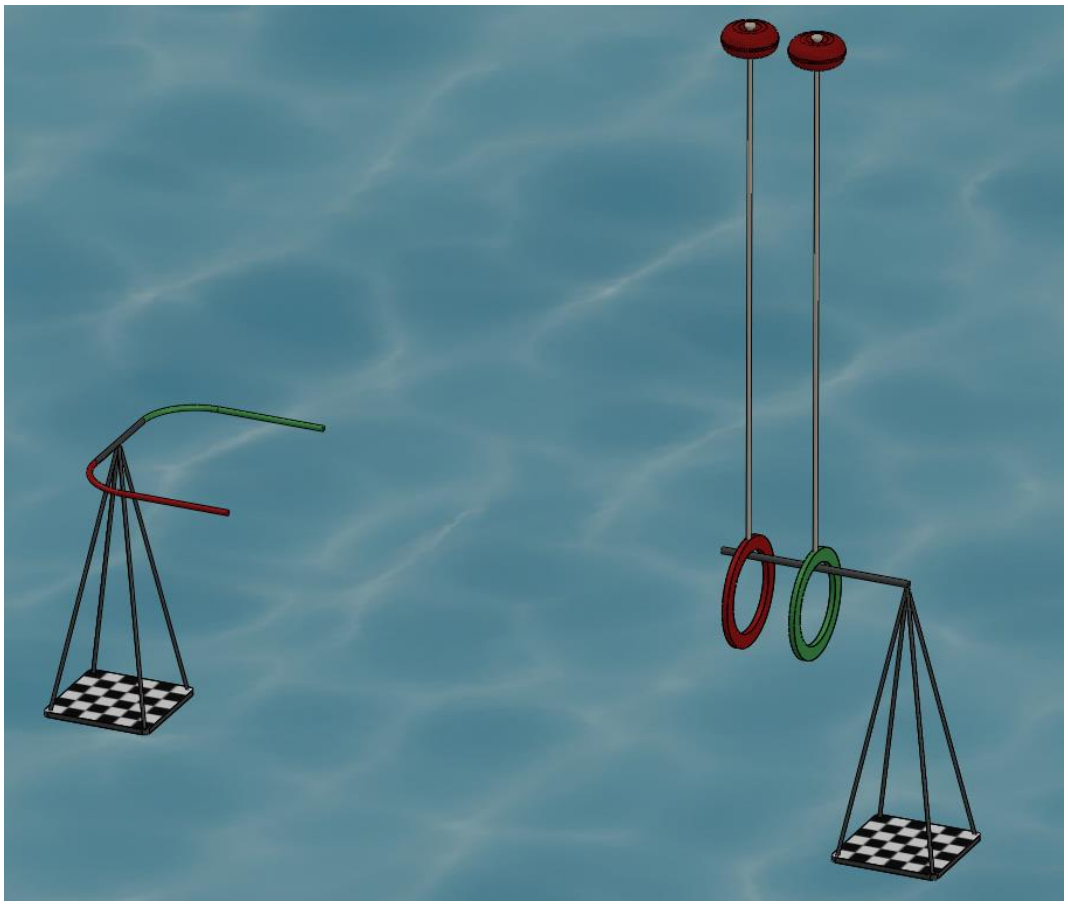


Figure 3.11: Ring Handling Task

In this task, competing teams are expected to attach each ring to the corresponding colored rod. After they are released from the bar they are attached to, they will be suspended in the pool thanks to the buoys and will not sink to the bottom.

In this task, 10 points will be added to the team score if the robot can attach each ring to the rod arms according to its color. If the underwater robot displaces or overturns the ring retrieval and ring attachment stands placed on the ground, 5 points will be deducted from the team score.

3.2. Rules

- The competition time is 8 minutes in total. At the end of this time, teams have to remove their vehicles 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 vehicle driver who is ready before the preparation time and declares to the referee that he is ready.
- Competitor teams can 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 minutes).
- Each team has the right to request one technical time-out. The technical time-out period is 5 minutes. At the end of this time, 15 points will be deducted from the team that requests a second technical time-out and the second technical time-out will be given. A maximum of two technical time-outs can be requested during the competition. The team captain will request the technical time-out from the referees. If the referees deem it appropriate, the technical time-out period will be started even without the team captain's declaration.
- The competition period of the vehicles controlled from outside the pool with the cable is stopped and the robot is removed from the pool and 50 points are deleted from the team score. Task points before that moment when the team is excluded from the competition are added to the team score. The points scored for the tasks after that moment by the team, which is later determined from the camera footage that the cable was interfered with, are deleted and **50 points are deleted from the team score**.
- The competing teams will be ranked from high to low according to the team score they earned at the end of the competition. Teams with the same score will be ranked according to their 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 lower in the ranking. If the teams with equal team points have also decided to withdraw, the ranking of the teams will be determined according to their vehicle weights. The lighter vehicle will be placed at the top of the ranking.
- The team captain has the right to request **technical break** for vehicles that get stuck on any track element in the pool or whose cable is tangled.

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

3.3. Scoring Table

Tasks	Points
Passing through 3 Unobstructed Buoy Platforms	3 x 10 Point
Passing through 20cm Obstacle Buoy Platform	10 Point
Passing through 40cm Obstacle Buoy Platform	10 Point
Task Object Placement Task	2 x 10 Point
Passing through the Pipe and Tilting the Plate	10 Point
Ring Transportation Task	2 x 10 Point
Maximum Mission Points	100 Point

Penalty points

1. **5 points will be deducted** from the team score of the vehicles that overturn or displace the disabled and unobstructed buoy platforms.
2. If the underwater robot displaces or overturns the platform carrying objects in the form of equilateral triangle and rectangular prism supported by wedges, **5 points will be deducted** from the team score.
3. If the underwater robot displaces the pipe platform supported by wedges, **5 points will be deducted** from the team score
4. If the underwater robot dislodges or overturns the ring retrieval and ring attachment stands placed on the ground, **5 points will be deducted** from the team score.
5. **15 points will be deducted** from the team that requests a second technical time-out.

Total team points = Task Points - Penalty Points

4. DETAILS OF THE COMPETITION AREA AND WORKING AREAS

220 VAC energy will be supplied in the competition area. There will also be a control desk at the edge of the competition pool where the team whose turn it is to compete will control the underwater vehicle. Here, 220 V AC voltage will be provided to the teams. **The highest DC or AC voltage level that can be used in the designed underwater robot will be 50 V. (There is no current and capacity limit).**

5. TECHNICAL SPECIFICATIONS, SAFETY AND LIMITATIONS OF THE UNDERWATER VEHICLE

- The largest separation of the underwater vehicle will not exceed 50 cm. The control of this situation will be ensured by the referees by placing the vehicles in the box with dimensions of 50x50cm when entering the competition area. The vehicle with inappropriate dimensions will not be allowed into the competition area.
- It is important that the length of the cable to be used by underwater vehicles to provide energy, data and control transmission is at least 20 meters in order to perform the tasks without difficulty on the competition course.
- The underwater 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.
- Underwater vehicles must be water resistant to a depth of 2 meters.
- The cables used in underwater vehicles must be insulated by the teams against tearing and electrical leakage.
- In order to prevent the cable used in underwater vehicles from entangling with the task objects, it will be appropriate to be equipped with buoyancy equipment (buoy, foam, etc.) at certain intervals.
- Before the competition, the safety suitability of the underwater vehicles will be checked by the referees. If deemed appropriate, the team will be able to participate in the competition.
- 220 V AC will not be allowed to be transmitted to the vehicle and/or the pool for safety reasons.
- Vehicles will be checked by the referees before being taken to the track, and vehicles that do not comply with the rules will not be allowed to enter the pool.
- Before the competition, the vehicles will be subjected to a water tightness test by the referees with the power off. Teams found to have taken water during the competition or within the preparation period given to the teams will be excluded from the competition.
- Vehicles will be energized after the necessary checks are made.
- Battery-powered vehicles must have an easily accessible emergency stop button. This button must cut off all power to the vehicle and stop the engines. There is no restriction on the creation of a magnetic rotary, push-button, etc. stop device.
- The operating voltage of battery-powered vehicles must be maximum 50V DC and must not exceed this limit.
- Any battery can be used. There is no current and capacity limit.

- Batteries must be carried in a fireproof protection bag. If the battery cannot be removed embedded in the vehicle, the vehicle must be powered off and transported.
- Vehicles that will receive their operating voltage from outside will be supplied with a maximum of 50 V.
- These supply voltages will be provided by the AC/DC converter provided by the teams themselves.
- It will definitely not be allowed to supply 220V to the vehicle and/or pool.
- Externally powered vehicles must have an emergency stop button.
- The cables of the vehicles to be supplied with external energy must be isolated from water and the external environment. There must not be any exposed cables. There must be a fuse according to the voltage and current determined on the power supply or cable.
- The motors of the underwater vehicle must be isolated against water and they are able to operate under water.
- There should not be any sharp parts and spikes on the body motor propeller parts of the vehicle, unsuitable parts should be blunted or rounded.
- Motor propellers must not be exposed. The propellers must be insulated with a protective outer shell.
- Cables connected to the vehicle must not be strained and must be resistant to sudden movements.
- High voltage devices above water and underwater system feeds must be independent.
- Changes in the size of the pool may cause changes in the track or the size of the task objects without disturbing the general structure.
- Objections to problems caused by light and sound during the competition will be deemed invalid. The Competition Organization Committee has the right to change the rules when it deems necessary.
- It is forbidden to use any oil in the hydraulic systems and the vehicle reservoir as it will negatively affect the continuation of the competition in case of leakage.
- No chemical substances should be allowed to mix into the pool in any way. Vehicles should be designed with this situation in mind.

6. CODE OF ETHICS

- Rude and unkind words and behaviors should be avoided.
- Insults, threats and bad words should be avoided.
- Direct targeting and insulting via social media tools 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.
- Situations, actions, words, etc. that will affect the functioning and motivation of other teams in the competition area. behavior should not be exhibited.