DIRECTORATE GENERAL OF VOCATIONAL AND TECNICAL EDUCATION

18th INTERNATIONAL MEB ROBOT COMPETITION

TOZKOPARAN ROBOT CATEGORY GUIDE

TÜBİTAK | TİKA

2026

CONTENTS

TOZKOPARAN ROBOT CATEGORY COMPETITION RULES

1. GENERAL INFORMATION ABOUT THE COMPETITION

1.1. Objective

Autonomous tozkoparan robots in this category follow the white lines on the black track, detect the coloured area, shoot arrows at the target with points, and attempt to complete the track in the shortest time without errors by reaching the finish line.

The Tozkoparan Robot Competition will be held over 4 rounds based on a points ranking system. There will be no elimination at the end of the 1st and 2nd rounds. At the end of the 3rd round, the points earned by the robots in all rounds will be totalled, and elimination will take place based on the 3-round total points ranking, determining which robots will advance to the next round (the final round). Depending on the number of robots participating in the competition, the number of rounds after which elimination takes place may be changed by the referees. The total points ranking will be published at the end of each round. To qualify for the fourth round, it is essential to be in the top 16 of the ranking. Based on the points ranking at the end of the fourth round, the robots that finish in the top three places will win the competition in order of 1st, 2nd, and 3rd place. Depending on the number of robots participating in the competition, the number of robots advancing to the second and third rounds may be adjusted by the technical advisors and referees.

1.2. Theme

During the Ottoman Empire, there were archers (keman: bow, keş: to pull; kemankeş: bow puller, i.e. archer) who pulled the bow so powerfully that sometimes the dusty parts of the bow would break off, which is why the kemankeş was nicknamed tozkoparan. The bowstring was made from animal intestines, and the parts where the string was attached to the bow were also called "toz". This competition theme was inspired by the kemankeş, who were very good at shooting arrows and were nicknamed tozkoparan.

This competition is carried out using robots created using mechanical, software and sensor technology. The competition will involve following a specific course, shooting at a target from a point on the course and completing the course as quickly as possible. Points will be

awarded based on the stages the robots pass through on the course and where they hit the target board.

1.3. Participation Requirements and Team Structure

Secondary school students may participate in this category. Teams may consist of two students and one supervising teacher. Supervising teachers may not enter the competition area. Only the two students on the team may enter the competition area. One student is responsible for setting up and starting the robot at the starting point, while the other teammate waits at the finish point. If the robot veers off course, the student waiting at the starting point may intervene. Only one person from each team may intervene with the robot on the competition track.

1.4. The Critical Importance of Reading the Guidelines

The International MEB Robot Competition is a contest that brings together the technical knowledge, engineering skills, and creativity of young talents. The Tozkoparan Robot category expects competing teams to design robots that are capable of moving on a specially prepared course and successfully performing archery and other given tasks.

However, reaching the top in this exciting competition does not depend solely on the robot's physical strength or coding complexity. The real success of the competition lies in the ability to carefully read and understand the guidelines covering the rules and procedures, along with the robot's technical competence.

The Application and Category Guidelines are more than just a technical guide; they are an integral part of the competition itself. Careful reading should be considered a fundamental skill of vital importance in modern engineering projects.

This is why:

The guidelines clearly define the technical constraints specific to the Tozkoparan Robot category, such as the robot's dimensions, weight, propulsion motor and electronic system limits. Failure to comply with these rules means that the robot will be disqualified from the competition, no matter how well it performs.

The scoring systems outlined in the guidelines detail the order and precision with which tasks must be performed. Teams that thoroughly read the guidelines can optimise their robots according to a task strategy that maximises points and gives them an edge over their competitors.

As the competition process is dynamic, last-minute changes to the rules or applications may occur. Therefore, it is critical that competitors do not rely solely on their initial reading but regularly follow the announcements on the International MEB Robot Competition website and the content in the Tozkoparan Robot category.

All teams applying to the Tozkoparan Robot category of the 18th International MEB Robot Competition must read the Application Guide (accessible from the "Organisation" menu at https://robot.meb.gov.tr), which contains the competition applications and general rules related to the category.

Understanding the guidelines is as challenging and important an engineering task as designing the robot. Meticulousness in this task is the first step towards success.

2. TECHNICAL SPECIFICATIONS AND CONSTRAINTS OF THE ROBOT

2.1. Dimension and Weight Constraints

There are no restrictions on the weight of the robot. However, the maximum dimensions of the robots (including the arrow-shooting mechanism) must be such that they can pass through the start and finish gates. Regardless of the length of the robot, the maximum width required for the robot to pass through the gate must be within 600 mm and the maximum height within 250 mm.

2.2. Information Regarding the Arrow-Shooting Mechanism

The dimensions of the arrow to be given to the competitor by the jury at the start of the competition are given in Figure 1 below. Competitors will construct an arrow-firing mechanism capable of shooting an arrow of these dimensions at a scored target board at a specific distance and height. This arrow-firing mechanism, constructed as desired, will be mounted on the robot and will be of a size that can pass through the start and finish gates.

2.3. Software and Control Requirements

The robots will move autonomously and shoot arrows.

3. COMPETITION AREA AND TASKS

3.1. Elimination Track (Track-A) Shape and Dimensions

Track Information:

- The dimensions and paths of the Elimination Track (Track-A) are provided in Appendix 1. (Figure-4)
- The paths on the platform are white lines on a matte black deco material (PVC Foam, Forex Panel) surface. Only the path line in the Mediterranean Wave region is black.
- Matte turquoise blue foil and matte green foil will be used for the coloured areas on the competition track.
- The platform consists of two parts: a 2900 x 3100 mm section made of 5 mm thick black matte deco material (PVC Foam, Forex Panel) on 18 mm thick laminate particle board measuring 2900 mm x 3600 mm, and a 1800 x 1000 mm section on which the 700 x 700 target board is located.. Two additional pieces of deco material material, each measuring 600 x 500 mm, are used for the race start area, where the start gate is located, and the race finish area, where the sensors that end the race are located. The joints of the pieces forming the track are covered with black matte foil. On the first part of the platform, edging 18 mm thick and 68 mm high (the height on the race surface will be 50 mm) has been applied to three sides of the particle board, excluding the start and finish sides. Including the edging, the dimensions of the first part are 2936 x 3618 mm. The total area covered by the platform is 5418x2936 mm.
- The road markings on the platform are made of white matt foil with a thickness of 20±2 mm.
- The entry and exit angles to the Mediterranean Wave on the decom material (Forex Panel) surface are 125°. After entering the track from the starting area, the robot will move by following the white lines on the black surface. Upon reaching the peak, the track line will turn black with a 20 mm white area around it. During the turn, the track lines will be white again.

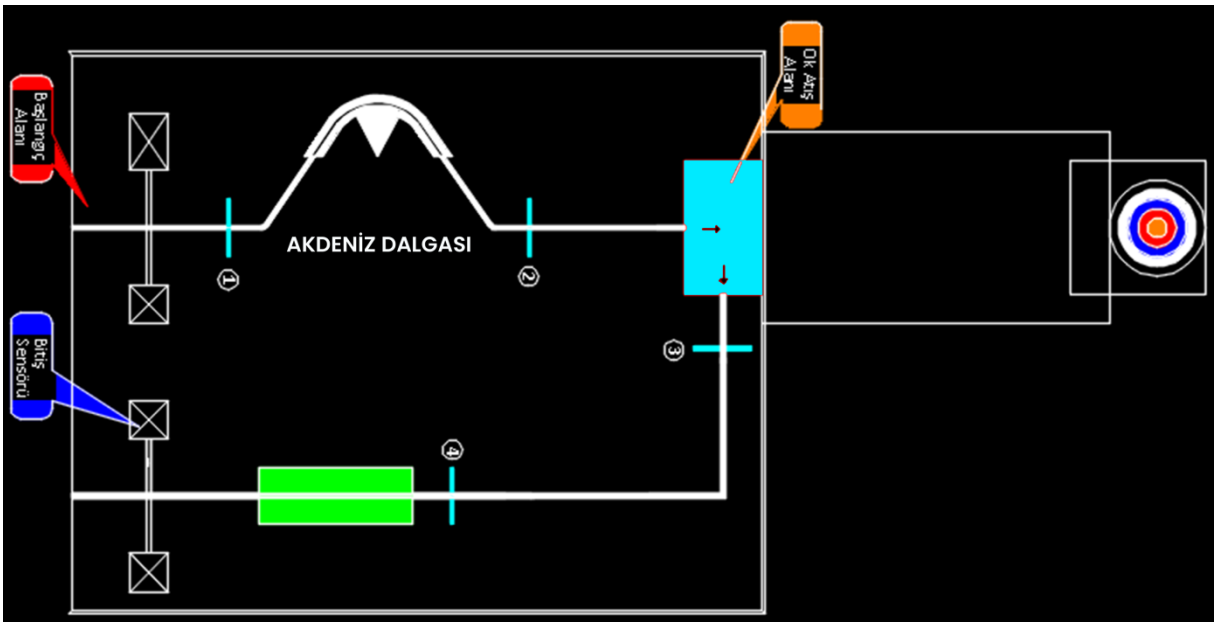


Figure 1. Elimination track

- There are four turquoise lines on the competition track. These lines are for manually repositioning the robot if it strays off the line and the competitor needs to intervene, placing it so that its front end faces the last turquoise line it crossed. When the competitor manually intervenes with the robot, it is placed on the competition area so that its front end faces the last turquoise line it left, regardless of its current position.
- Dimensions of the coloured areas: The dimensions of the turquoise blue area are 700 mm x 400 mm, as shown in Figure 3. The dimensions of the green area (Bridge) are: length 800 mm, width 300 mm, and maximum height 80 mm.
- Two competition tracks will be constructed, and the tracks will be prepared identically. In the elimination stage, two tracks will be prepared from Track A. These tracks will be named Track 1 and Track 2. Once the elimination stage is completed and the 'Final' stage begins, both of these tracks will be converted to Track B. The total area of the two tracks, including the usage areas (1000 mm), is 7418x7872 mm. There is one white start gate for each track. When the referee presses the start button to start the race, the start gate will open automatically and the stopwatch will start at the same time. When the start gate opens, the height of the upper part of the mechanism where the gate is located is 250 mm from the ground, the height of the

gap remaining at the bottom of the gate before opening is 15 mm, and the gate width is 600±3 mm.

- The finish sensor is located in the centre of the towers at the finish gate, in a transmitter-receiver configuration, 15 mm above the ground.
- The target board is directly opposite the turquoise blue area where the robot will shoot the arrow. The target board is 1600±5 mm away from the outer edge of the track. Taking into account the edging (18 mm thick particle board) surrounding three sides of the track, the target board is 1618 ±5 mm away from the end of the red zone.
- The bottom point of the target board is 400 ±3 mm above the ground.

3.2. Final Runway (Runway-B) Shape and Dimensions

- The dimensions and paths of the final track, Track-B, are provided in Appendix 2. (Figure 5)
- In the final round, unlike the elimination round, after firing in the red zone and turning right, the robot must pass through five 90° turns before the bridge.

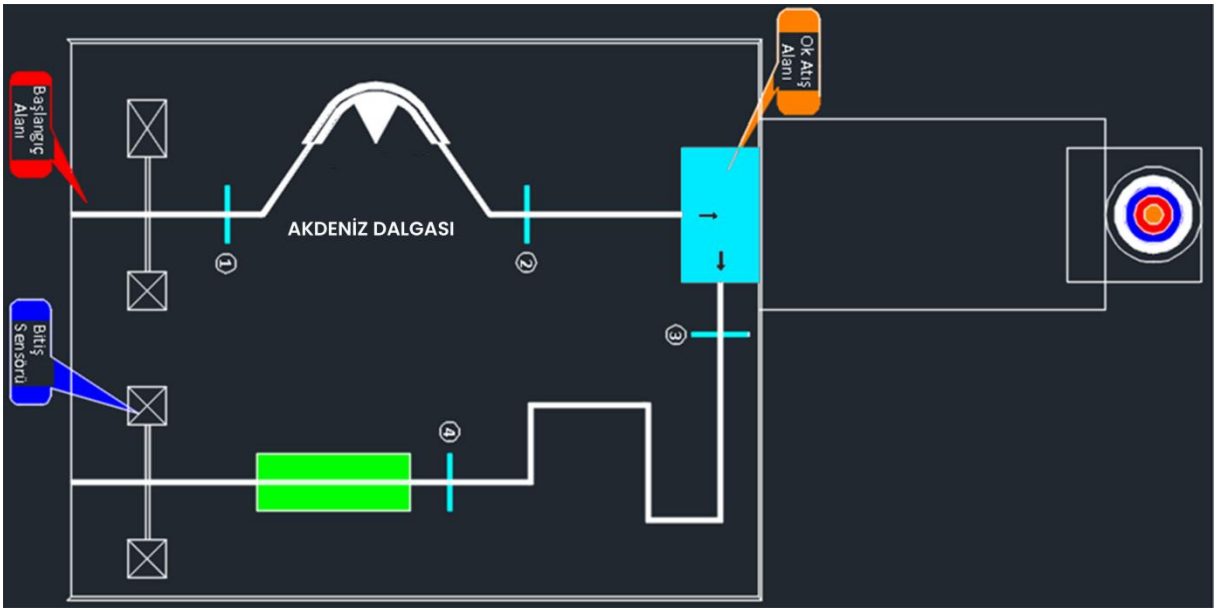


Figure 2. Final track

3.3. Information About the Arrow

The arrow consists of four parts. (Figure 3) These parts are a wooden shaft, a PLA tip printed on a 3D printer, polyethylene foam, and a female Velcro tape. The arrow shaft is 9 mm in

diameter, 180 mm long, and made of wood in the shape of a round dowel. The tip is conical in shape, 28 mm in diameter and 14.75 mm long, printed from PLA material in a 3D printer. To provide flexibility to the tip of the arrow, polyethylene foam with a conical shape, 28-20.5 mm in diameter and 12 mm thick, is glued to it. A 36 mm diameter female Velcro strip (the target board will have the male part) is glued onto the polyethylene foam. To ensure the arrowhead adheres better to the target surface, the ends of the Velcro strip are attached with string to holes drilled into the conical PLA material. The arrow weighs 8 ± 0.5 g and will be given to the competitor by the judging panel before the competition begins and placed in the robot's arrow-firing mechanism. Each robot will autonomously fire one arrow. When the arrow sticks to the target, the highest score it touches will be awarded. If the arrow does not stick to the target, the shot score will be determined by camera.

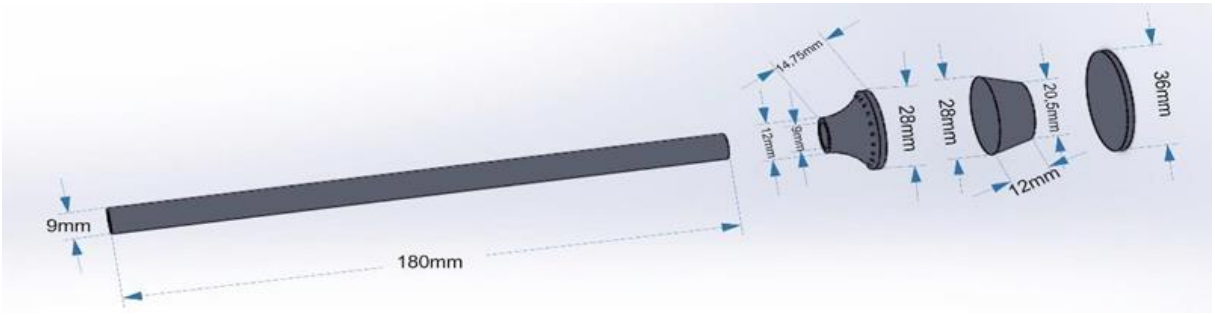


Figure 3. *Arrow Dimensions*

3.4. Information Regarding the Target Board

The target board shall be made of 700x700 mm particle board, and 12 mm thick polyethylene foam shall be glued onto the particle board to provide flexibility to the surface. The foam surface will also be covered with hook-and-loop tape (male part). The target board will be 400 mm above the ground for better archery and for audience to watch. For this purpose, legs will be attached to the target board. The scoring surface on the target board consists of five concentric circles of different colours, the largest of which has a diameter of 600 mm. These colours are, from the centre outwards, yellow, red, blue, black and white.

The size of the target face is measured using the diameter of the 5 circles surrounding each scoring zone. The tolerance for each diameter measurement must not exceed ±3 mm for the zones. (Figure 4)

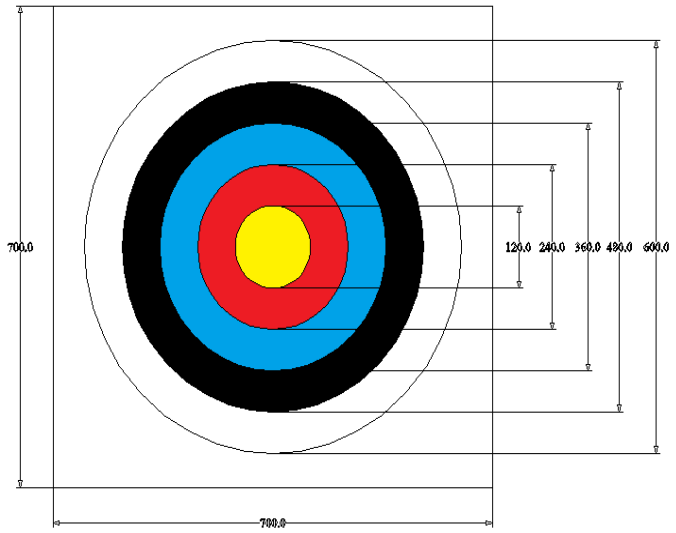


Figure 4. *Target Board and Target Face Dimensions*

3.5. Task Description and Application Conditions

- After entering the track from the starting point, the robot will pass through the "Mediterranean Wave" without activating any LEDs and reach the shooting area.
- When the robot enters the Turquoise Blue zone, the Blue LED will light up and the robot will shoot at the target. When the robot leaves the Turquoise Blue zone, the Blue LED will turn off.
- Two identical tracks (A-track) will be used in the 1st, 2nd and 3rd round elimination competitions.
- In the final round, the identical tracks used in the first three rounds will be converted into Track B and used.
- The draw will determine which robot will compete on which track (Track 1 or Track 2).
- In all rounds, robots will compete individually, and rankings will be determined based on the points they earn.
- In the elimination round, the robot will reach the exit gate by completing the following tasks in sequence after the start: "Mediterranean Wave", Turquoise Blue area and arrow shooting, 90-degree turn, bridge (green area) climbing. (Figure 1)
- In the final round, the robot will complete five 90-degree turns after the shot and reach the exit gate. (Figure 2)

4. COMPETITION FORMAT AND EVALUATION CRITERIA

4.1. Application

Competition applications are made according to the process and principles specified in the Application Guide. Middle school students and their supervisors may participate in the competitions with robots that meet the conditions specified in the Application Guide.

4.2. Competition Stages

Robots whose production reports have been approved and that have completed the draw registration will qualify to participate in the competitions.

- Robots compete in sequence. The order in which robots compete is determined by draw and announced.
- Each robot arriving at the competition area according to the order determined by the draw is weighed, and its weight is recorded. This weight is taken into account in the event of a tie in the results.
- The robot's length is not taken into account; measurements are taken inside a box with a maximum width of 600 mm and a maximum height of 250 mm, which is the maximum size required for the robot to pass through the gate.
- The track on which the Tozkoparan robot will compete is determined by a draw at the referees' table. The draw determines which robot will compete on which track (Track 1 or Track 2).
- The robot arriving at the referee's table is sent to the competition area after undergoing the necessary checks (weight and size measurements, etc.) and is given one arrow for shooting.
- The competitor places the arrow in the mechanism on the robot and places it in the starting area. The competition is started by the referee pressing the start button.
- The stopwatch will start counting when the referee presses the start button to start the race, causing the start gate to open automatically, and will stop counting when the finish sensor detects the robot upon its arrival at the finish area.

4.2.1.Preliminary round

There will be no preliminary round in this category.

4.2.2. Elimination Rounds

A points ranking will be determined over at least 2 rounds. There will be no elimination at the end of the 1st and 2nd rounds. At the end of the 3rd round, the points earned by the robots in all rounds will be added up, and elimination will be based on the total points ranking from the 3 rounds to determine which robots will advance to the next round (the final round). Depending on the number of robots participating in the competition, the number of rounds after which elimination will take place, and the number of robots advancing to the top 16 or 32, may be changed by the referees based on the number of participating robots. The total points ranking will be published at the end of each round. To advance to the fourth round, it is essential to be in the top 16 or, depending on the number of robots, in the top 32 in the ranking.

4.2.3. Final Round

On the final track, the robots that finish in the top three places according to the points ranking at the end of the fourth round will win the competition in first, second and third place respectively.

4.3. Scoring System and Evaluation

4.3.1. Stage 1 - Start Gate

Once the start gate opens, a robot that moves and crosses the starting line is considered to have started. A robot that does not start within 10 seconds or does not cross the starting line is considered to have used its first manual intervention right and receives (-5 points). If the robot does not cross the start line by the 60th second, the referee will end the competition and award the robot the base score of "100 points" and a time of "180 seconds". If the robot does not operate at the start gate and uses all 5 intervention rights there, it will be disqualified from that round of the competition on the 6th intervention. In the case of manual intervention, if the robot crosses the start line, a penalty point is awarded only once for that stage due to that error, regardless of the number of interventions (provided that the 5th intervention is not exceeded, as mentioned above), and (-5p) is deducted. The robot that crosses the first turquoise line completes this stage and receives "20p".

4.3.2. Stage 2 – Mediterranean Wave Region

When the robot reaches the Mediterranean Wave region, the path line will turn black with a 20mm white area around it. Upon turning, the path lines will be white again. If the robot deviates from the line in the specified direction of movement and cannot find the path again, it will be placed back on the track with its front facing the turquoise line immediately before the point it exited; meanwhile, the timer continues to run. If manual intervention is required due to the robot deviating from the white road line during movement on the track, a penalty of (-5p) will be applied only once for that error at that stage, regardless of the number of interventions (provided it does not exceed 5 interventions as mentioned above). A robot that crosses the second turquoise line completes this stage and receives "20p".

4.3.3. Stage 3 – Turquoise Blue Zone (Shooting Zone)

When the robot reaches the Turquoise Blue zone, it detects the Turquoise Blue zone, turns on the Blue LED, and fires. If the robot fires before reaching the Turquoise Blue area, even if the arrow hits the target, this shot is considered invalid, and a new arrow is given, continuing the race from the second turquoise line. Meanwhile, the timer continues to run. After firing, the robot turns right, leaves the Turquoise Blue zone, and the Blue LED turns off. Failure of the LED to turn off is considered an error and results in a penalty of (-5 points). If the robot is manually intervened with, a penalty of (-5 points) is given only once for that error at that stage, regardless of the number of interventions (provided that the limit of 5 interventions, as mentioned above, is not exceeded).

Robots that leave the Turquoise Blue zone and exit the line before reaching the 3rd Turquoise line, whether they have fired or not, continue the race from the 3rd Turquoise line in front of them, specifically for this zone, not the previous one. Robots that complete this stage by passing the 3rd Turquoise line receive 20 points.

4.3.4. Stage 4 – 90° Turn Zone

Elimination Round: The robot will only perform a 90° turn in this zone. If it exits the line, manual intervention is required. In case of manual intervention, only 1 point (-5p) is deducted for each intervention due to that error. (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".

Final Round: In the final round, there are 5 90° turns in this area. In case of manual intervention, only 1 point (-5p) is deducted for each intervention due to that error. (provided that the number of interventions does not exceed 5, as mentioned above) The robot that completes this stage by crossing the fourth turquoise line receives "20p".

4.3.5. 5th Stage – Green Zone (Toroslar Region)

Upon reaching the green zone, the robot will climb a bridge approximately 80 ± 5mm high. When it enters the green area, the green LED will illuminate and turn off when it exits the area. In the event of manual intervention, regardless of how many times the robot is manually intervened with, only one penalty (-5p) is deducted for that error in that stage. (provided that it does not exceed 5 interventions as mentioned above) If the robot detects the green zone, keeps the green LED lit continuously until it exits the zone, passes through the green zone, and then follows the white line to reach the finish gate, it will be awarded "20p". The competition will be completed, and the stopwatch will automatically stop the time.

4.3.6. Evaluation and Scoring System

Each robot will autonomously fire an arrow. The shot is scored based on the position of the arrowhead on the target face. If the tip of the arrow touches two colours or any dividing line between two separate scoring zones, the arrow is scored as the higher of the two zones it touches. Separately, if the arrow misses the target or hits the empty Velcro area on the target board, it is awarded "0 points". The point values for the colours on the target surface are as follows:

Colour Point Values:

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

- If, after the competition has started, an arrow falls from the mechanism in any way or is shot outside the shooting area, this will be considered an error (-5 points) and manual intervention will be permitted to place the arrow back into the mechanism.
- LEDs not lighting up in the zones or lighting up in a different colour will be considered an error (-5 points). For example: If the Blue LED does not light up in the Turquoise Blue zone and the Green LED lights up in the zone, the situation caused by the Blue LED not lighting up or the Green LED lighting up will be considered an error (-5 points).
- Robots must move on the track in the specified direction. Once the competition is started by the referee, robots are awarded a base score of 100 points. The 5 stages passed by the robot during the time it takes to move and reach the finish line will be evaluated with a total of 100 points (5X20 P). The points obtained as a result of the arrow shot will be added to this score. As the highest score on the target board is 100 points, the maximum total score that can be achieved is 300 points. Robots that do not enter the competition area and are disqualified are awarded "0 points" and a time of 180 seconds.
- If the robot makes any kind of mistake on the track, the competitor is granted a total of 5 manual interventions by the referee until the end of the competition. After the 5th manual intervention, if the 6th manual intervention is made or the robot cannot perform its task for any other reason, the competition is terminated. Robots in this situation are ranked according to the points they have received, and the maximum completion time of 180 seconds is accepted as their completion time. For each stage, regardless of the number of manual interventions made, only one error point (-5p) is given for that error in that stage.
- If the robot makes any kind of error on the competition course, a penalty point (-5p) is given for manual intervention and other non-manual intervention situations (LED not lighting up, lighting up in a different colour, shooting an arrow in the wrong place, not shooting an arrow in the red zone, etc.). Only one penalty point (-5p) is given for the same error in a stage.

4.4. Race Duration and Break Usage

- No break, maintenance, or repair time is granted for the robot called to compete during the race.
- The time will be recorded by the stopwatch on the track. The stopwatch will start counting when the referee presses the start button to start the race, causing the starting gate to open automatically. The stopwatch will stop counting when the robot reaches the finish gate, detected by the sensor, and the race will end.
- Each robot must complete the competition within 180 seconds. If the robot fails to complete the competition within this time, the stopwatch will automatically stop counting and the competition will be terminated. The competitor will be ranked according to the points they have earned in the stages completed up to that point.

5. ETHICAL AND OTHER RULES

5.1. Disqualification and Penalty Situations

- Competitors shall not enter the track wearing shoes. In order to intervene when the competitor's robot makes a mistake, the competitor shall remove their shoes and the robot shall continue the competition from the turquoise line one turn before the stage where the robot made the mistake.
- Rounds must be completed on the same day. Competitors whose turn has not yet come while the rounds are in progress must not leave the competition area. If, in exceptional circumstances, the rounds are postponed to the following day, the referees will announce this via message, mobile app notification, website announcement or public address. It is sufficient for the announcement to be made by at least one method.
- After the referees have announced the end of a round, if a competitor requests to participate in a round they missed, this will not be considered, and the robot will receive "0 points" and a "180-second" penalty time for that competition.
- The order in which the robots will compete is communicated via an on-site announcement in groups of 10. Regardless of their ranking, competitors must not leave the hall until this announcement is made. Robots that do not come to the track despite being called will not be allowed to compete if the round has ended. It is the

responsibility of the competitor and the supervisor teacher to follow the announcements made in the competition area.

- If a competitor is also competing in a second category at the same time, they will be allowed to compete within the rules specified in the Application Guide if they apply. However, if they still do not compete, they will be considered as not having participated in the round and will be given "0 points" and a "180-second" time penalty.
- Robots that have attachments other than the start button that could cause adjustments to be made, or robots that the referees believe have been adjusted, will be disqualified at any stage of the competition, regardless of whether they are in the stage. The referees have sole authority to determine whether adjustments have been made.
- The robot must not leave permanent marks on the track or damage it. If the referees decide that the robot has damaged the track, the robot will be removed from the track and the competitor will be disqualified. The referees' committee is authorised to decide on the cleanliness, order, or suitability of the maze for the competition.
- Robots that are too large to pass through the start and finish gates will be disqualified.
- Robots that can be remotely accessed will be disqualified.
- Robots that fail to appear on the track despite being called will not be allowed to compete. It is the competitor's responsibility to follow announcements and notifications.
- In cases where the robot fails to complete any of the five stages in the specified order, reaches the finish line by taking a shortcut, does not operate in the starting area, the arrow falls from the mechanism, or the arrow is fired outside the firing area, the referee may intervene manually and allow the robot to continue the race from the turquoise line one stage before the stage where the error occurred.
- At the end of the first three rounds, the total time and total score for the three rounds will be taken into account. A robot that does not participate in any round will

be given "0 points" (even though the starting score is 100) and a penalty time of "180 seconds" for that round.

5.2. Appeal Procedure

Teams may appeal against competition results or referee decisions through the system in accordance with the rules specified in the Application Guide.

- Objections made during the competitions due to the illuminated scrolling text, cameras, and lighting around the track will be deemed invalid.

5.3. Warnings and Ethical Rules for Competitors

- Referees send SMS messages to call the robots. To avoid any inconvenience in this regard, the telephone numbers of two competitors and the supervisor teacher must be recorded at the time of registration. When the parent's telephone number is recorded, the message will be sent to the parent, and the competitor will not be informed of this message.
- In the event of excessive applications for the competition, requests for early completion, or any reason (health, epidemic, temperature, etc.) preventing the completion of the competition within the specified time, an additional track may be added to the existing two tracks, or the number of rounds may be reduced.
- In the event of a tie in points, the robot that completes the course in a shorter time takes precedence; if the tie persists, the robot with fewer penalty points takes precedence. If the tie remains unbroken, the lighter robot takes precedence.

5.4. Safety Measures

- Vehicles may use any energy source that does not cause harm to the track or spectators.
- No permanent markings or signs may be left on the race track, and no damage may be caused.
- No competitors shall be present in the area where the arrow is to be shot.
- When the track has been recently cleaned, competitors must wait for the track to dry before entering it.
- Technical advisor and referee warnings must be heeded.

5.5. Authority of the Competition Organising Committee

The Competition Organisation Executive Committee has the right to amend the rules as deemed necessary.

- Changes may be made to the dimensions of the tracks during the construction phase, provided they do not compromise the overall structure.
- Any rule or track changes will be announced via the https://robot.meb.gov.tr website or the MEB Robot Mobile Application link.

6. CONTACT

6.1. Question Submission and Announcement Tracking Channel

Competitors must submit their questions by logging into the https://robot.meb.gov.tr/ system and selecting the relevant category via the 'Information' menu. Questions submitted outside the specified category channel will remain unanswered, and all responsibility in such cases lies with the competing team. For any questions, please first review the category guide at . The guide has been comprehensively prepared to answer all possible basic questions; therefore, careful and repeated reading of the guide is of great importance for the smooth progress of the process.

7. ATTACHMENTS

7.1. Elimination Track (TRACK -A)

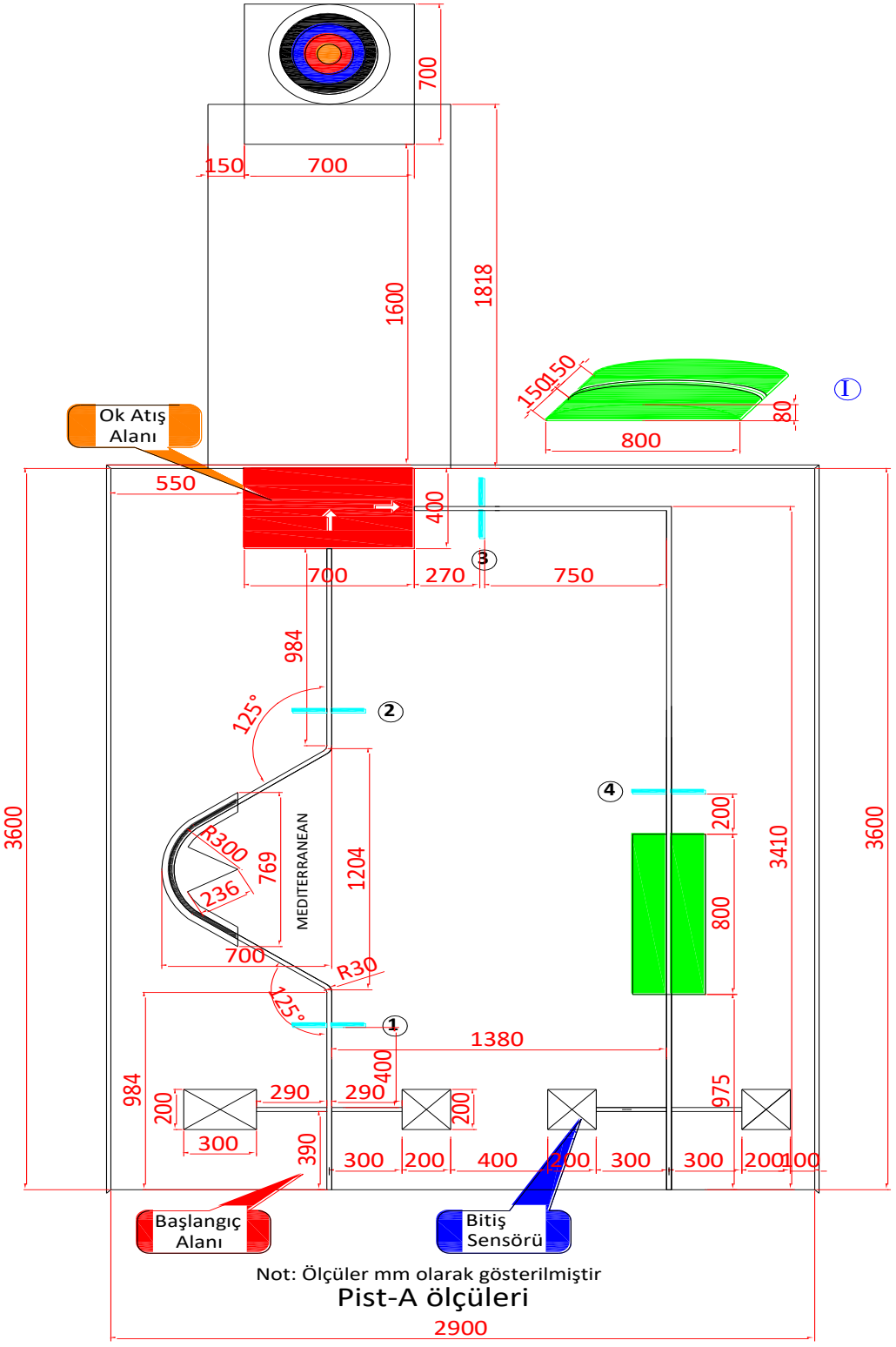
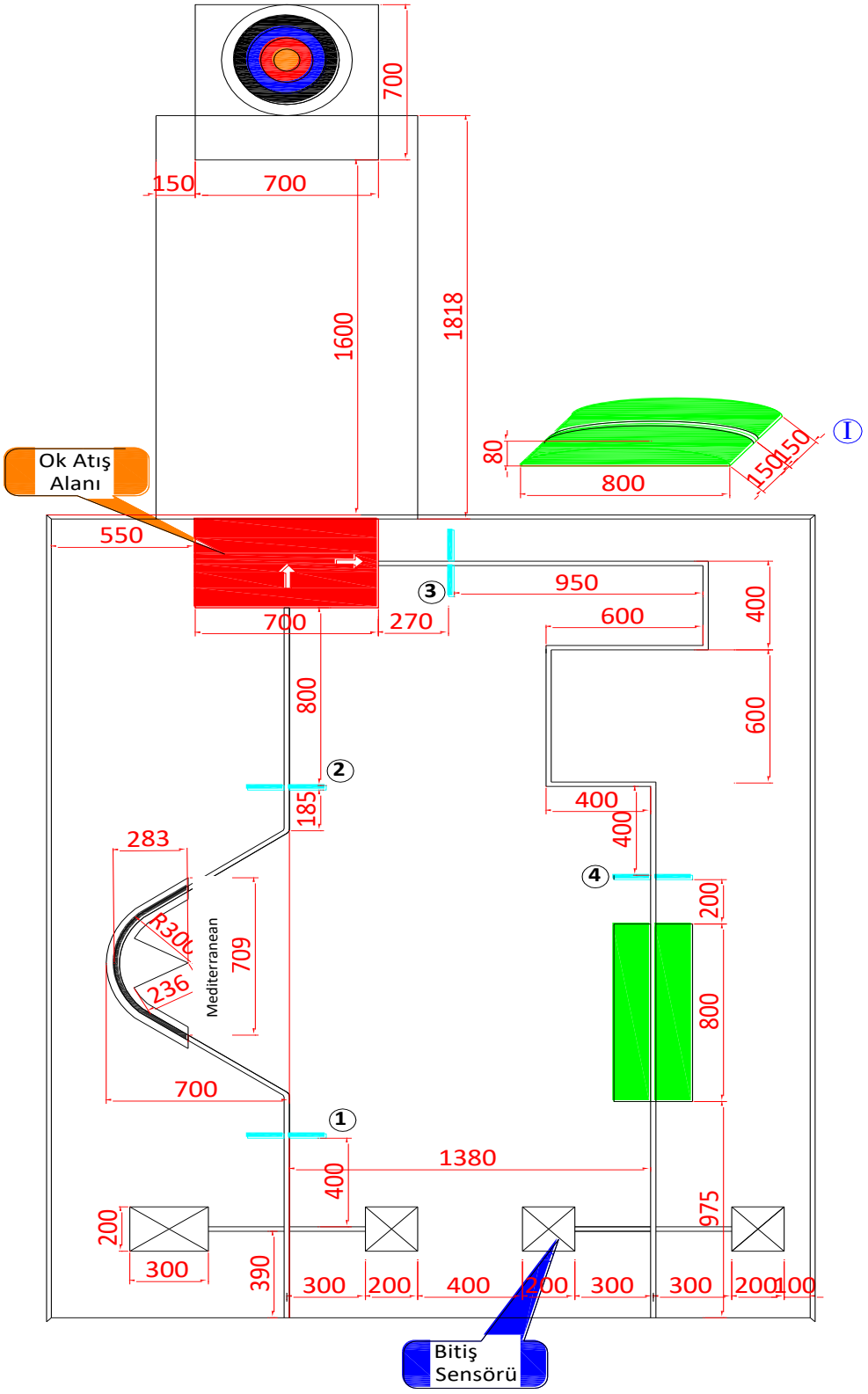


Figure 5. *Elimination Track (Track A)*

7.2. Final Track (TRACK -B)



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Pist-B ölçüleri

Figure 5. *Final Track (Track B)*