DIRECTORATE GENERAL OF VOCATIONAL AND TECHNICAL EDUCATION

100 CENTURY OF EDUCATION

TÜBİTAK

TİKA

INTERNATIONAL MEB ROBOT COMPETITION

17th INTERNATIONAL MEB ROBOT COMPETITION

LABYRINTH MASTER CATEGORY RULES

2025

Education, Technology, Production from Roots to the Future

CONTENTS

LABYRINTH MASTER CATEGORY RULES

1. INTRODUCTION

1.1. Purpose

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

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

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

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

2. ROBOT SPECIFICATIONS

2.1. Dimension and Weight limitations

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

2.2. Equipments

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

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

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

2.3. Requirements for Autonomous Operation

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

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

3. FORMAT AND EVOLUATION

3.1. Application process

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

3.1.1. Robot Production Report

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

Report as content:

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

3.2. Stages and Evaulations

3.2.1. Competition Stages

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

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

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

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

3.2.2. Evaluation and Scoring

The score calculation principles are as follows.

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

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

3.3. Task definitions and success criteria

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

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

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

3.4. Disqualifying

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

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

3.5. Safety Measurements

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

4. COMPETITION AREA

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

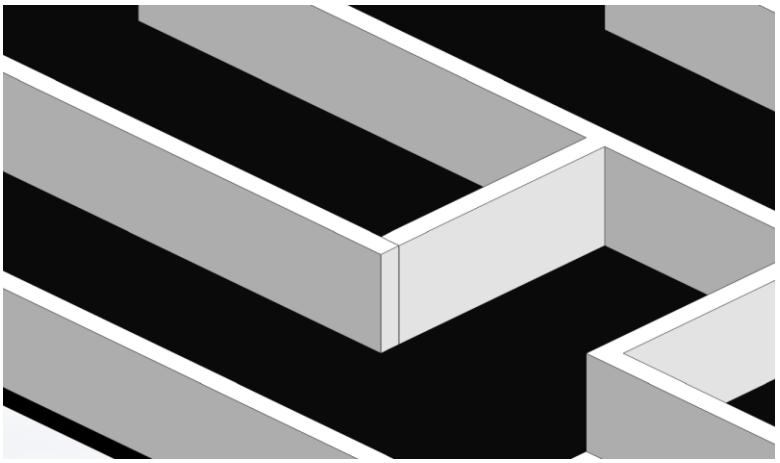

Figure 1. *Example track. It does not represent the track in the competition. The joints will be as shown in the figure.*

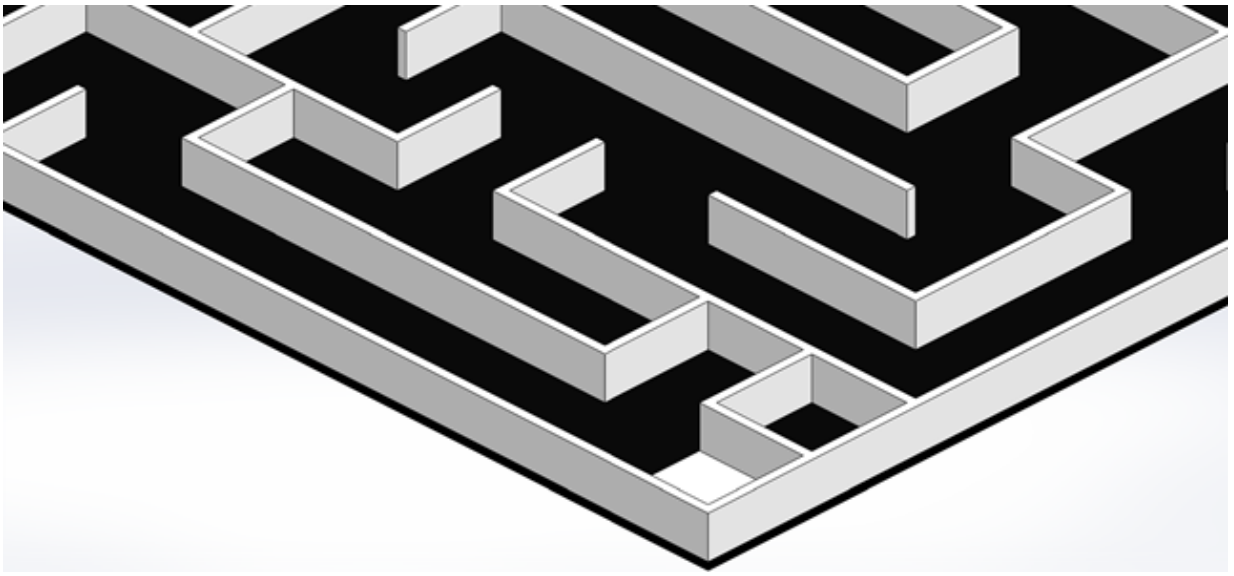

Figure 2. *Example track. Does not represent the track in the competition.*

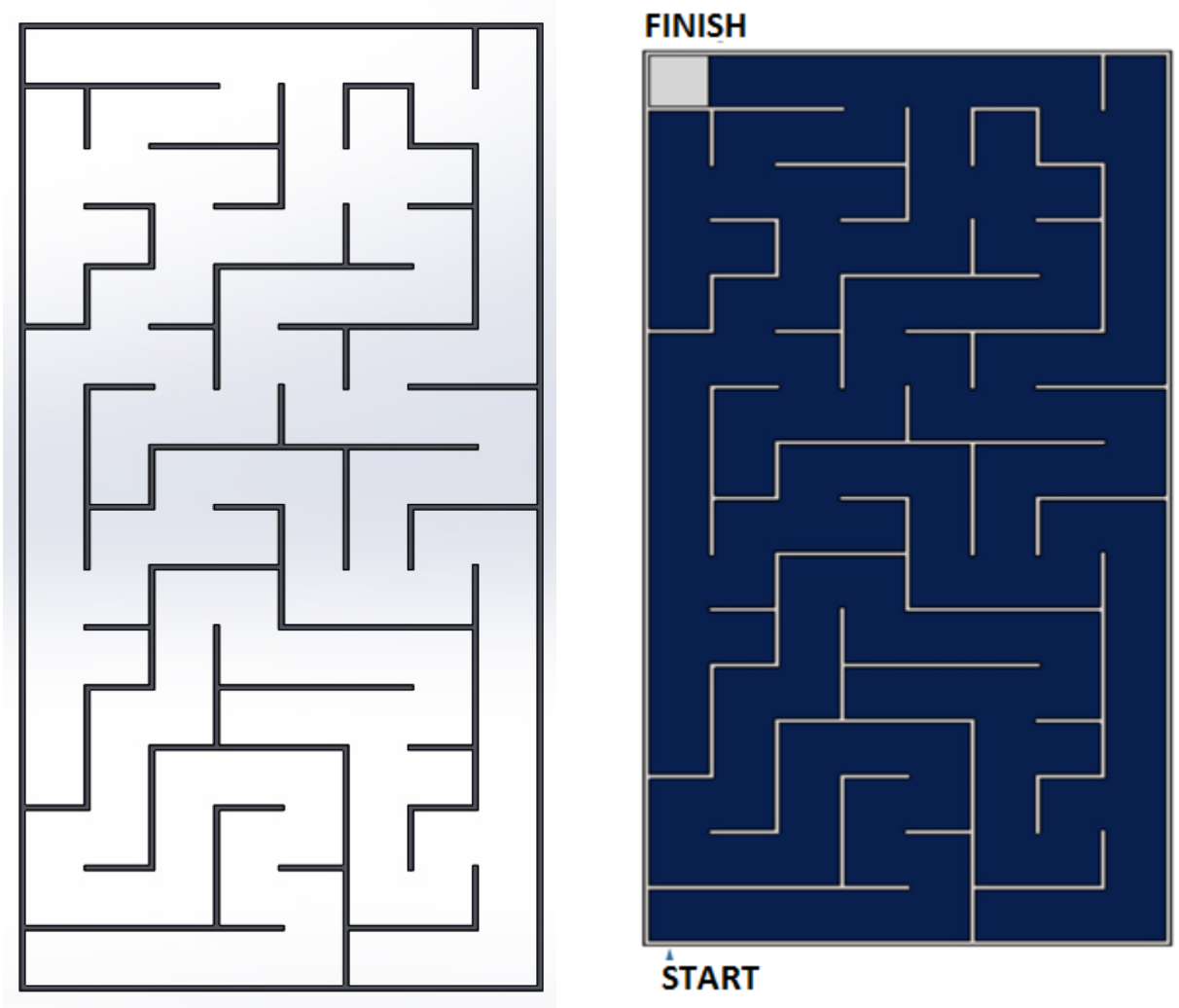

Figure 3. *Competition Track for Round One*

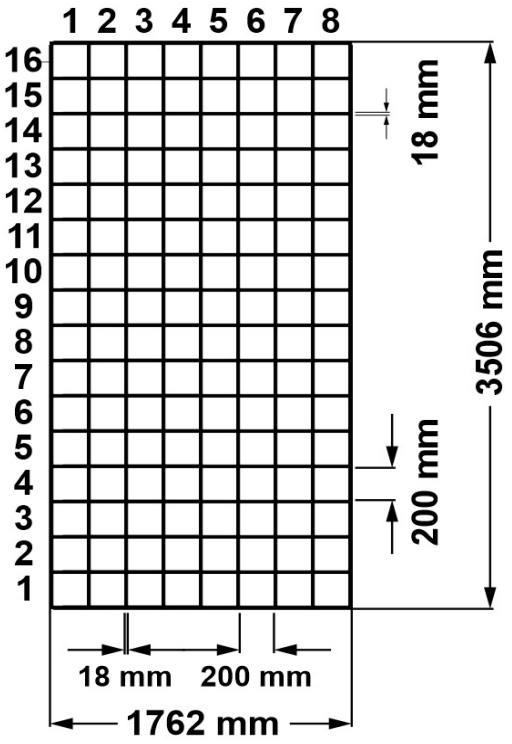

Figure 4. *Dimensions*

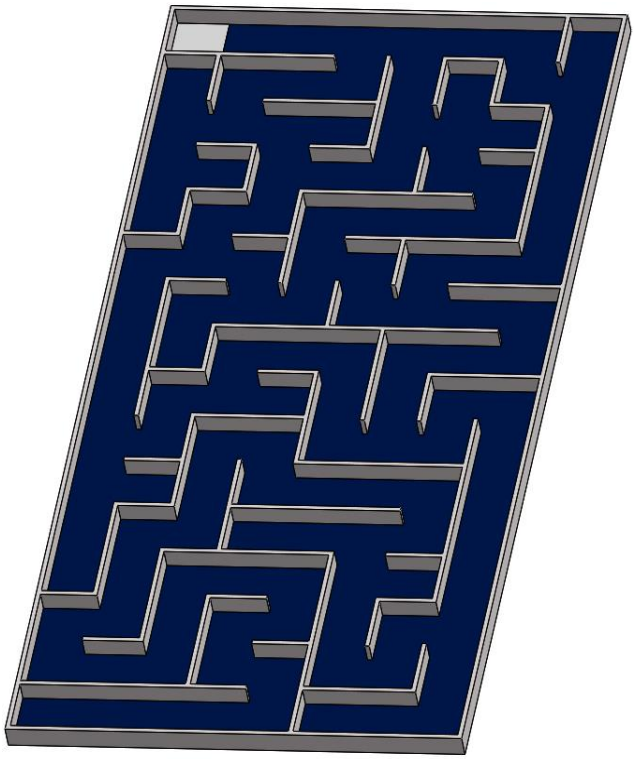

Figure 5. *3D view of the First Round Circuit*

5. CONTACT

5.1. Access to us

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

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