



İTÜRO 2023

15. INTERNATIONAL ITU ROBOT OLYMPICS

Line Follower: Road to Republic Category Rules

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YIL
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Istanbul Technical University Robot Olympics 2023

Line Follower Robot: Road of the Republic

Assignment Description:

- This category focuses on the robot's challenge of following the line through the symbol cities of Turkish War of Independence, passing the obstacles, throwing balls at the enemy units and holding the flag.

Success Criteria:

- Success in this category is defined by finishing its tour without exceeding the penalty limit and being able to throw ball to the targets.

Robot's Detail:

- The robot must not be bigger than 20 cm width, 30 cm length and 25 cm height.
- There is no weight limit.
- Robots must be autonomous.

Track's Detail:

- 1) The track was built on a white canvas by drawing the borders of the Turkey map.
- 2) There are both white background with black line and black background with white line on the line which the robot has to follow. The robot must follow the line.



- 3) Takip edilen yol üzerindeki çizginin kalınlığı 18 mm'dir.
- 4) The perpendicular distances of the obstacles between the start and Amasya-Erzurum to the line followed are 15 cm
- 5) There will be dotted lines before the dribbling, throwing and carrying duties and robots can detect the dotted lines to understand which duty they are about to start and focus on that.
- 6) The robot performs the dribbling task after 4 cuts in the path, and throwing task after 3 cuts in the path and flag carrying missions after 2 cuts on the road.
- 7) The task of throwing balls at the targets is 15 cm ahead of the maximum point that the robot can go. The targets are in a square with side lengths of 9 cm
- 8) The ball which will be dribbled/carried has a diameter of 4 cm and weight of 2-3 grams
- 9) The targets are pin shaped and have 5 cm of height, 1-2 grams of weight and 2 cm of max width
- 10) The part of the flag to be carried in contact with the ground is a cylinder with a diameter of 4 cm and a height of 2 cm.is in the form. The flag and the pole to which it is attached are placed on this cylinder. The length of this pole is 7cm. In total, the flag to be carried is 9 cm high.
- 11) It's not allowed to step on the track except the areas which are stepable
- 12) There may an error margin of 5 percent in the balls.

The Competition:

- 13) Each robot competes in turn.



- 14) The contestants whose turn it is, take their robots from the referee table and place them behind the control point in the starting area.

- 15) The contestants can place their robots anywhere behind the control point in the starting area. The robots start when the referee gives the command. The robot's time starts when it passes the control point in the starting area.

- 16) The robot will perform the ball dribbling task after 4 notches on the road, the ball throwing task into the enemy zone after 3 notches on the road, and the flag carrying task after 2 notches on the road.

- 17) After 4 notches on the road, there will be a ball on the line. The robot must detect and carry the ball either by rolling it or by picking it up on their own. The robot is expected to carry the ball to the end of the 3-notch road and throw it at the targets in the ball-throwing area. Then, it will return to the main road and continue in the direction it came from, and turn left at the junction for the final task.

- 18) After 2 notches on the road, there will be a flag on the road. The robot must carry the flag to Ankara, the final point, by dragging it without lifting it off the ground.

- 19) The competition is considered over when the robot drops the flag off at the flag drop-off point in Ankara.



Throwing Ball Duty:

- 20) The ball to be thrown can be on the ground or on the robot, depending on the choice.
- 21) The robots can make the throw using a mechanical system on the robot or using their bodies and speed. Additionally, robots can use another shooting system to make the shot.
- 22) There are a total of 3 target objects in the shape of cones, and the ball that is carried will be of a weight and size that can be dropped onto them.
- 23) The distance between the shooting point and the area where the targets are located is 15 cm.
- 24) Targets that do not fall to the ground as a result of the shot will not be included in the scoring.
- 25) The angle of the ball's shot will be the same as the line on the road. Therefore, there is no need for the robots to aim when hitting the ball.

Scoring:

- 26) Ranking is done from the robot with the highest score to the lowest. Robots with high scores are placed at the top and the score can be less than 0.
- 27) $\text{Score} = (\text{Flag drop in Ankara (20)}) + (\text{number of dropped lobuts} * 5) - (10 * \text{penalty count})$
- 28) In case of a tie in scores between robots, the time taken is considered. In this case, the robot that finishes the race in a shorter time is ranked higher than the other.



- 29) In the task of dribbling the ball, if the robot goes completely off the line or hits an obstacle, the competing robot intervenes and puts the starting point of the ball driving task 10 cm back. The robot does not continue the ball driving task, receives a penalty point, and the ball driving time is not included in the scoring.
- 30) If the robot fails to perform the ball throwing task, it receives a penalty of 15 points.
- 31) Robots have a total of 3 penalty allowances. If the penalty limit is exceeded (in the case of making the 4th mistake), the robot is not included in the ranking.
- 32) Robots must make the throw. Robots that fail to do so are not included in the ranking.
- 33) If the robot remains motionless for more than 5 seconds anywhere outside the area where it is supposed to drive or hit the ball, except for the designated locations for the ball driving and hitting tasks, it receives a penalty.
- 34) If the entire robot goes outside the line, it receives a penalty.



- 35) If the entire robot goes off the line or hits an obstacle outside the ball driving and hitting tasks, the competing robot intervenes and puts it back on the track from approximately 10 cm before the last successfully passed checkpoint. The robot receives a penalty point equal to its mistake.

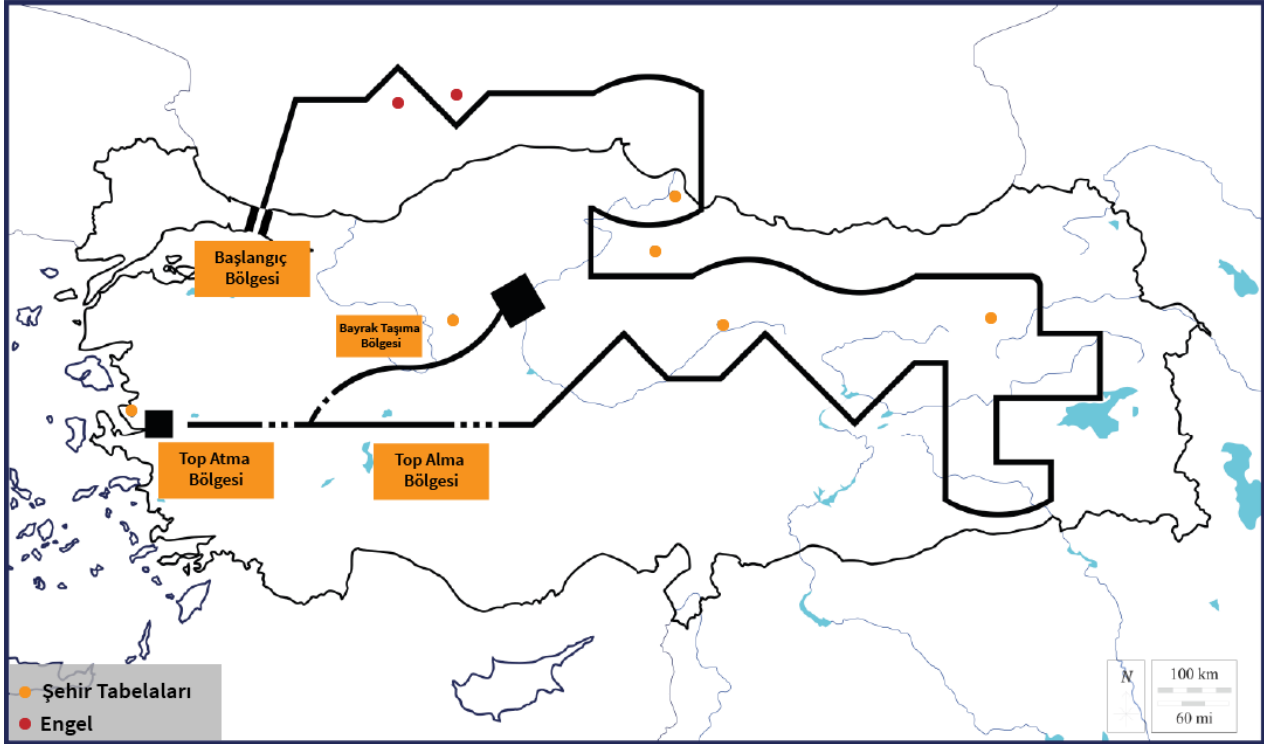


Figure 1 – Upside Look for the Pist