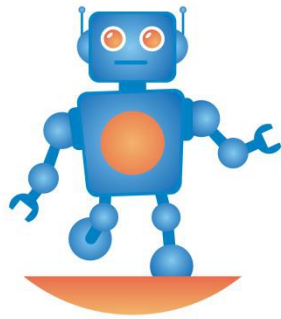


**2021 International Competition of
Autonomous Running Robots
Running-Robot 2021**



running-robot
国际自主智能机器人大赛

**Performance Competition-Treasure Hunt
Competition**

Rules and Arrangements

V1.0

Contents

Chapter 1: Competition Rules.....	1
1. Participating teams and participating robots.....	1
2. Competition scenes and tasks.....	2
3. The rounds of the competition and the calculation method of the final score.....	2
4. End conditions of each round of competition and calculation of points.....	3
Chapter 2: Competition Arrangement.....	5
1. Order of play.....	5
2. Pre-match preparation.....	5
3. Enter the game.....	5
4. In the game.....	6
5. Competition is over.....	6
6. Other instructions.....	7
Attachment – Game Scene.....	8
1. Competition scene summary.....	8
2. Tasks and scores.....	9
2.1 Win the Suspension Bridge.....	10
2.2 Through the jungle.....	11
2.3 Overcoming obstacles.....	12
2.4 Corner.....	13
2.5 Minefield.....	14
2.6 Key open.....	14

Chapter 1: Competition Rules

1. Participating teams and participating robots

Those who are willing to participate in the Treasure Hunting Competition shall organize their own teams and register with the competition organizing committee to participate in the competition.

Each participating team should have no more than 6 people (5 team members and 1 instructor).

Robots participating in the Treasure Hunt must be able to walk autonomously and intelligently (that is, take action without human intervention) in a complex environment, based on specific environmental conditions, and complete upright walking (upright walking: the robot simulates a human The soles of the feet contact the ground and support the movement of the entire body) and other action tasks of the robot.

Participating robots can be medium-footed robot platforms provided by the organizing committee of the competition or their own.

The self-contained medium-sized foot robot platform must meet the following conditions: 1. The height of the robot must not exceed 100 cm; 2. The robot must be a biped humanoid robot, not a wheeled or other form of robot; 3. The robot needs to be submitted to the competition organizing committee Filing, confirmation and approval.

2. Competition scenes and tasks

The current game scene is a simplified scene that simulates human activities. That is, starting from the starting point, automatically completing multiple tasks according to the situation on the way, until reaching the end point. Compare with the expedition team in real life, and overcome various difficulties encountered in the expedition. The process of finally discovering the treasure.

Robots are required to complete various tasks as quickly as possible within the competition time.

For descriptions of game scenes and tasks, see appendix-game scenes.

3. The rounds of the competition and the calculation method of the final score

Each participating team participates in 2 rounds of competition.

The maximum time for each team in each round of competition is 8 minutes.

After all participating teams in the first round of competition, the second round begins.

In order to ensure the fairness of the game: For random situations involved in the game, the participating teams in the same round use the same random result.

Each participating team takes the best score of the two results as the final score.

4. End conditions of each round of competition and calculation of points

In the competition, when one of the following conditions is met, the current round of competition ends:

- In the race, when the robot reaches the finish line (the finish line: the bottom of the robot's feet fully step into or exceed the finish line).
- During the competition, the participating team touched the robot.
- During the game, the robot leaves the track.
- In the game, the timer reaches 8 minutes.

When a round of competition is over, the tasks that have been completed are called "tasks completed". The results and ranking of each round of competition are calculated according to the two dimensions of primary and secondary:

- Main dimension: In the competition, the participating robots score points for completing each task (high scores indicate that the task is more difficult); the player with a higher total score (that is, completing more difficult and more tasks) wins.

- Second dimension: The time from start to end of the participating robots is the total time to complete; among all robots that have the same total score, the shorter total time (i.e. faster speed) of the robots wins.
- When the above two dimensions are the same, the participating teams are considered tied.

Chapter 2: Competition Arrangement

1. Order of play

The organizing committee will organize the participating teams to draw lots one month before the competition to determine the order of the competition.

2. Pre-match preparation

Each participating team, according to its own schedule, enters the preparation area in advance before the start of the competition, completes all preparations such as robot debugging, confirmation of the only (robot) "operator", and reports "ready" to the referee.

After receiving the "Ready" report, the referee will inspect the participating teams and participating robots to confirm that the participating teams are "Ready". If the requirements are not met, the referee has the right to request the participating team to prepare again.

10 minutes before the start of the match, if the referee cannot confirm "ready", the round will be withdrawn.

3. Enter the game

The "ready" team, carrying the robot, enters the competition area. The operator places the robot at the starting point and signals that the referee team is ready to start.

The referee declared "the start of the game" and started the timing device at the same time. The operator can start the robot only after the start of the competition is announced. If the operator starts the robot first, he will be warned by the referee; if he starts the robot first again, he will be disqualified from the competition.

4. In the game

From the start to the end of the game, only the operator can enter the field and operate the robot according to regulations. During the game, no one other than the operator can operate the robot in any way. If you violate it, you will be disqualified from the competition.

The operator guarantees that all his operations comply with the rules of the game. If any operation is found to be inconsistent with the rules of the competition, the participating team will be disqualified.

5. Competition is over

The referee declared "the game is over" according to the rules and stopped the timing device. The timing device displays the total time to complete.

After the competition, the referee is responsible for calculating the score and filling out the score report according to the rules. The participating team confirms its own score report, and the participating team takes its own robot and leaves.

6. Other instructions

If there are any changes to the competition rules, the organizing committee will notify the participating teams as soon as possible.

During the game, the referee has the right to make a ruling. If you have any objections, please raise it to the chief referee.

The organizing committee is responsible for finalizing all objections and resolving all disputes.

Attachment – Game Scene

1. Competition scene summary

The area of the playing field is 5.2 x 3.4 meters, which is at least 15 cm higher than the surrounding ground.

"Robot leaving the track" refers to the robot falling outside the track or crossing the area delineated by the corresponding checkpoint.

The main body of the track is a pitted melamine board with a grayish-white surface. In order to get close to the actual working environment of the robot, some tracks are covered with inkjet film. 3D pictures are not used for the inkjet patterns, and only 2D pictures are used to represent patterns such as grass, floor tiles, wooden floors, etc.; some tracks will be covered with carpets or rubber pads. There is a circle of fence advertisements around the track, the fence is about 50 cm from the track boundary, and there is a LOGO; there are ground advertisements on the center of the track.

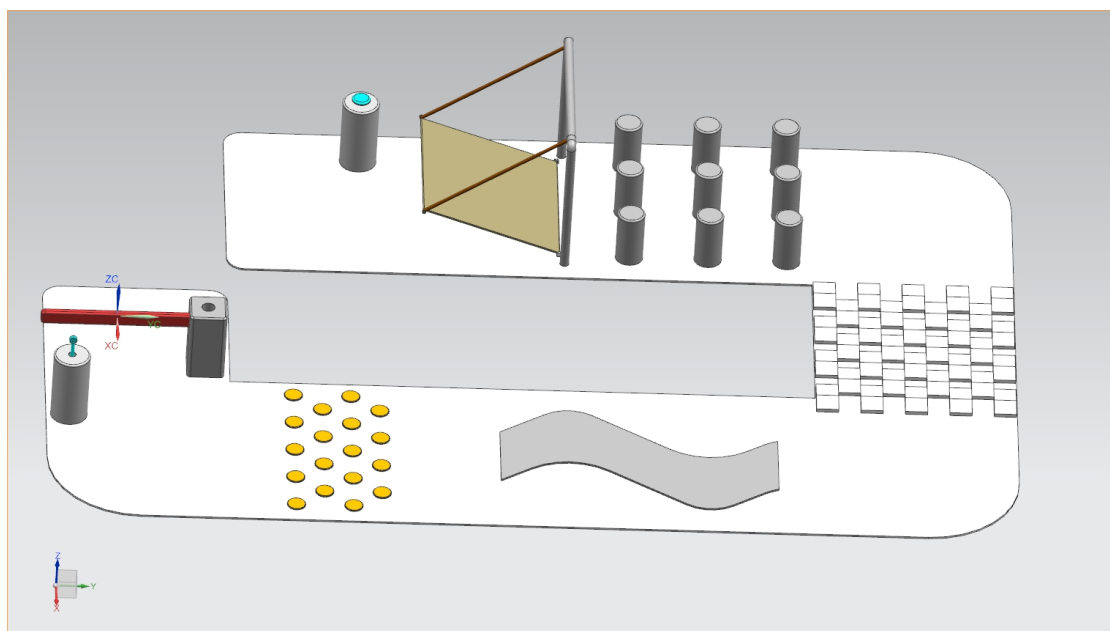
The static friction coefficient of the robot foot is about 0.1. Each team can add non-slip materials to the bottom of the robot's feet as needed.

The track has multiple mission sections. Each mission section has its own starting line and finish line; the starting line of the first mission section is the starting line of the track. The finish line of each mission is the starting line of subsequent missions; the finish line of the last

mission is the track finish line. "Place the robot at the starting point" means that the bottom of the robot's feet is close to but not touching, let alone exceeding the starting line.

The task start line and finish line are set for placing robots and measuring performance. Robots do not need to recognize these two marking lines.

Figure 1 is a three-dimensional schematic diagram of the playing field. In a real game, the order in which the tasks appear, as well as the colors of the road surface and other objects in each task, may be



different from those shown in the figure.

Figure 1: Three-dimensional schematic diagram of the playing field

2. Tasks and scores

2.1 Win the Suspension Bridge

Road conditions: a base with a diameter of 30 cm and a height of 40 cm. There is a button with a diameter of 25 cm and a height of 1 cm on the base. The length and width of the suspension bridge deck is 80x80 cm. The robot presses the button and waits for the suspension bridge to lower. After the suspension bridge is lowered, the robot walks and passes, as shown in Figure 2.

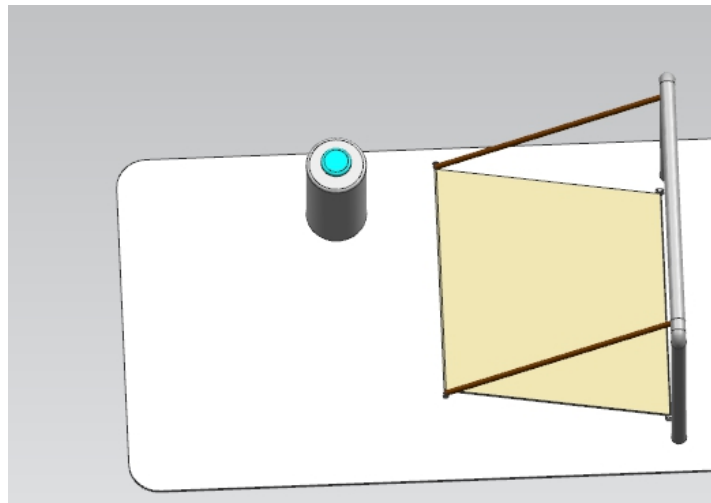


Figure 2: Schematic diagram of suspension bridge

Requirements and points:

- The suspension bridge is lowered, and the robot walks through the suspension bridge steadily, and the robot does not fall, 10 points.
- The suspension bridge is put down and walks through the suspension bridge steadily. If the robot falls down midway, 5 points are awarded.
- Pass or leave the track in other ways, get 0 points.

2.2 Through the jungle

Road conditions: 3x3 cylinders with a bottom diameter of 15 cm and a height of 60 cm. The color of the cylinder is red (RGB #FF0000). In each round of competition, the referee randomly removes one of each row of cylinders to form a channel for robots to pass through. And make sure that there is at least one column in each row as an obstacle. The top view is shown in Figure 3.

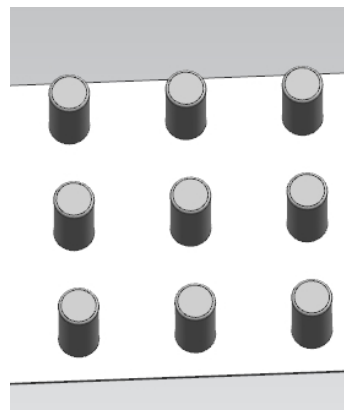


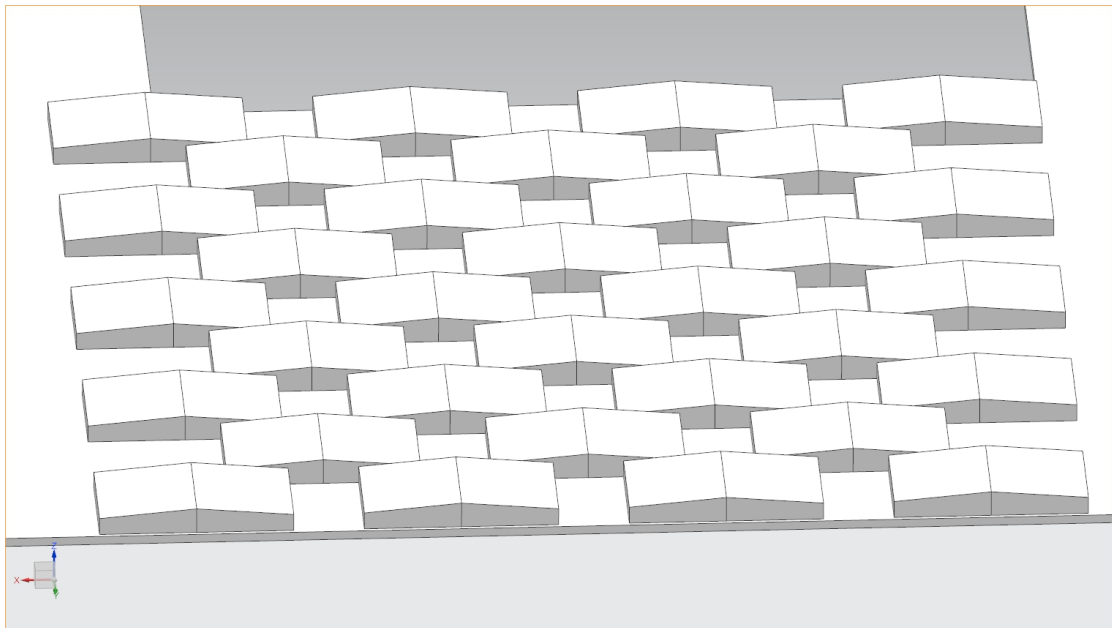
Figure 3: A top view through the jungle

Requirements and points:

- Walk steadily and pass, the robot has not fallen down, has not left the track, and has not collided with the obstacle column, score 10 points.
- Walk steadily, and the robot may fall over or collide with the obstacle column. Score 5 points.
- Passing or leaving the track in other ways or falling down through obstacles, get 0 points.

2.3 Overcoming obstacles

Road conditions: an area of 100x100 cm in length and width. In the area, there are piers with a roof slope angle of 5 degrees, a height of 2 cm, a length of 22 cm, and a width of 12 cm. The slope and the plane cross each other to form an uneven road. The top view is shown in Figure



4.

Figure 4: The top view of the thorny thorns

Requirements and points:

- Walk steadily and pass, the robot does not fall and does not leave the track, score 10 points
- Walk steadily and pass. If the robot falls over halfway and does not leave the track, 5 points are awarded.
- Pass or leave the track in other ways, get 0 points.

2.4 Corner

Pavement conditions: A bend with a straight line length of 150 cm. The bend belt is two bends with an arc length of 35 cm. The top view is shown in Figure 5.

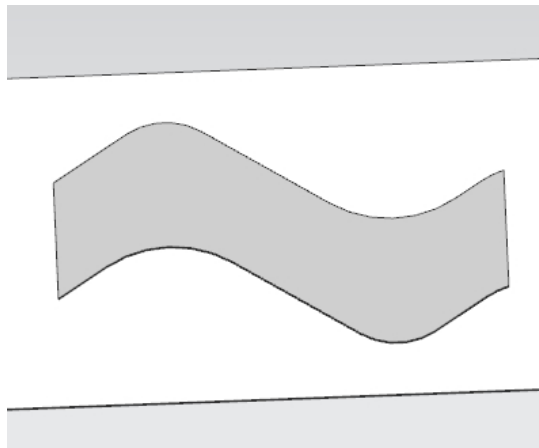


Figure 5: The top view of the curve

Requirements and points:

- Walk steadily and pass, the robot has not fallen down, has not left the track, and has not collided with the road block, score 10 points.
- Walk steadily and pass. If the robot falls over halfway and does not leave the track, 5 points are awarded.
- Pass or leave the track in other ways, get 0 points.

2.5 Minefield

Pavement conditions: an area of 120x120 cm in length and width, and a total of 18 mines with a diameter of 10 cm and a height of 1 cm are distributed in a 5:4:5:4 manner in the area. Between each mine, the center of the first row is 24 cm apart, and the center of the first and second rows is 15.5 cm apart. The top view is shown in Figure 6.

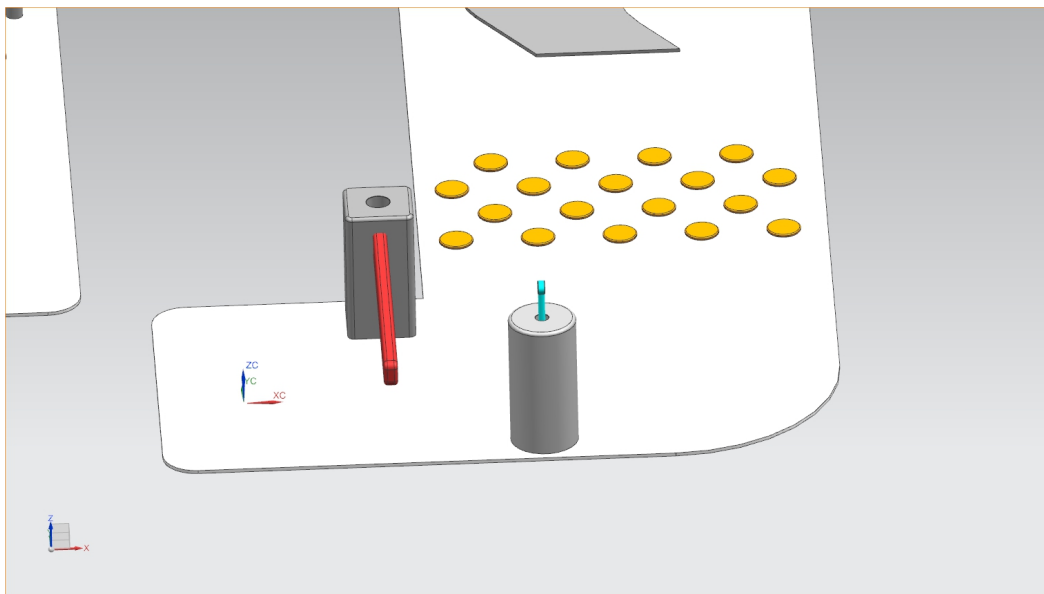


Figure 6: The top view of the mine array

Requirements and points:

- 10 points for walking steadily and without contact with landmines.
- Walking steadily and passing, the robot fell down midway, but did not collide with the mine. Score 5 points.
- Pass or leave the track in other ways, get 0 points.

2.6 Key open

Pavement conditions: an area with a length of 100x100 cm, a gate with

a height of 40 cm, a gate base of 20x20, a height of 40 cm at the top center, and a circular hole with a diameter of 7 cm. A cylinder with a diameter of 20 cm and a height of 40 cm is placed in front of the gate. A key with a diameter of 2 cm and a height of 25 cm is inserted in the center of the top of the cylinder. The robot picks up the key from the base and inserts it into the center of the top of the gate base. The gate opens automatically, and the robot can pass after the gate is opened. After passing the gate, the robot makes arbitrary movements to celebrate finding the treasure chest. The top view is shown in Figure 7.

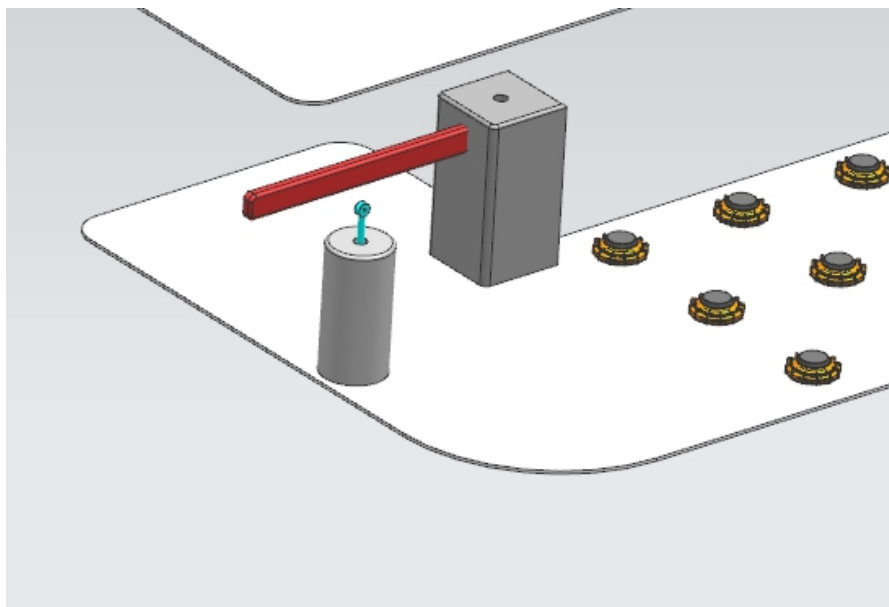


Figure 7: Top view of key opening

Requirements and points:

- Open the gate, walk steadily through and make a specified action, and the robot does not fall, score 10 points.
- If the gate is opened and the robot is walking stably through, if

the robot falls over halfway or fails to make a specified action,
5 points will be awarded.

- Pass or leave the track in other ways, get 0 points.