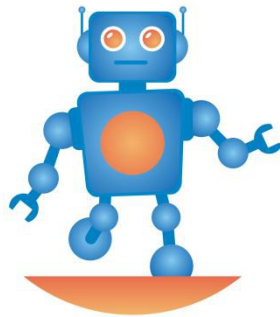


**2021 International Competition of  
Autonomous Running Robots  
Running-Robot 2021**



**running-robot**  
国际自主智能机器人大赛

**Standard 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. Competition rounds and final score calculation	2
4. End conditions of each round and calculation of results	2
Chapter 2: Match schedule	4
1. Order of play	4
2. Pre-match preparation	4
3. Enter the game	4
4. Competition	5
5. Competition is over	5
6. Other instructions	6
Attachment - Game Scene	7
1. Competition scene summary	7
2. Tasks and scores	8
2.1 Open the crossbar up and down	8

2.2 Minefield section.....	9
2.3 Section across the baffle.....	9
2.4 Crossing the door section.....	10
2.5 Cross the single-plank bridge section.....	10
2.6 Kicking into the hole.....	11
2.7 Upstairs section.....	11
2.8 Down stairs and down slopes.....	12
2.9 Section of crossing the pit.....	12
2.10 Horizontal open crossbar.....	13

# Chapter 1: Competition Rules

## 1. Participating teams and participating robots

Those who are willing to participate in the competition should 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 race must be robots that can perform upright walking and other action tasks in a complex environment, according to specific environmental conditions, autonomously and intelligently (that is, taking actions without human intervention). "Robot walking upright" refers to the robot simulating human beings, walking on the track by using only the soles of the feet (without other parts) to touch the ground and support the entire body.

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

The built-in small-footed robot platform must meet the following conditions: 1. The height of the robot must not exceed 45cm; 2. The robot needs to be a biped robot, not a wheeled or other form of robot; 3. The robot needs to report to the competition organizing committee for preparation, confirmation and approval.

## **2. Competition scenes and tasks**

The game scene is a simplified and simulated human activity scene, that is, starting from the starting point, completing multiple tasks according to the situation on the way, until reaching the end point.

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

## **3. Competition rounds and final score calculation**

- Each participating team participates in 2 rounds of competition.
- The "match time" for each team in each round is 8 minutes.
- After all participating teams in the first round of competition are over, the second round begins.
- Each team takes the best score of the two results as the final score.

## **4. End conditions of each round and calculation of results**

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

- In the game, when the robot reaches the finish line. "Robot reaches the end point" means that the bottom of the robot's feet fully step into or exceed the finish line.

- During the competition, when the participating team touches the robot.
- During the game, if the robot leaves the track.
- When the game time arrives.

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 for completing each task (a high score means that the task is more difficult); the player who gets a higher total score (that is, completing more difficult and more tasks) wins.
- Second dimension: the time from the start to the end of the participating robots is the total completion time; among all robots that have the same total score, the one with the shorter total time (that is, faster) wins.

# Chapter 2: Match schedule

## 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 check 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 game, if the referee cannot confirm "ready", the game will be withdrawn.

## 3. Enter the game

- The "ready" team will enter the competition area with the robot. The operator places the robot at the starting point and signals that the referee is ready.

- The referee announces the "start of the game" and starts 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 again, he will be disqualified from the competition.

#### **4. Competition**

- 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 competition, no one else can operate the robot in any way; any violation will result in disqualification from the competition.
- The operator is responsible for ensuring that all his operations comply with the rules of the game. If any operation does not comply with the rules of the competition, it will be disqualified from the competition.

#### **5. Competition is over**

- The referee declares "the game is over" according to the rules and stops the timing device. At this time, the timing device displays the total time to complete.
- After the competition, the referee is responsible for calculating the score and filling in the score report according to the rules. The participating team confirms its own score report, and the participating team brings its own robot away.



## 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 5x5 meters.

The track is located in the center of the playing field and is roughly U-shaped. The narrowest part of the road surface is 20 cm, the widest part is no more than 60 cm, and it is at least 15 cm higher than the surrounding ground. "The robot leaves the track" refers to the robot falling to the ground outside the track.

The main body of the track is a pitted epoxy board with a grayish-white surface. In order to get close to the actual working environment of the robot, some of the tracks are covered with film of spray painting pattern. The spray painting patterns do not use 3D pictures. 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 may be LOGO on the fence; There are ground advertisements on the center of the track.

The static friction coefficient of the robot feet is about 0.1 (each team can add anti-slip materials to the robot 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, and 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.

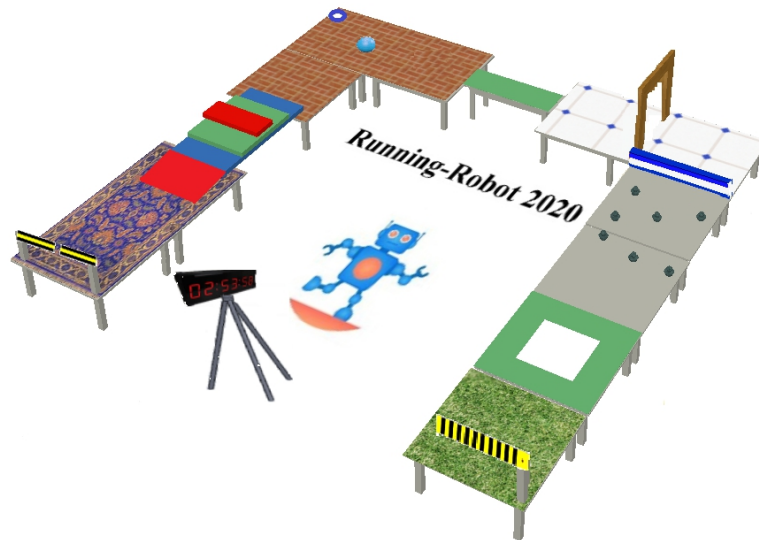


Figure 1: Three-dimensional map of the track

## 2. Tasks and scores

### 2.1 Open the crossbar up and down

Road conditions: Open up and down (90 degrees) crossbar across the track, each cycle for 5 seconds in the lowered state and 10 seconds in the raised state. The movement time for raising or lowering the crossbar is less than 3 seconds.

The width of the crossbar (W) is 7 cm, and the height from the ground to the bottom of the crossbar (H) is 20 cm. A yellow and black marking line is pasted on the crossbar, as shown in Figure 2.



Figure 2: Open the crossbar up and down

Requirements and points:

- 10 points for walking upright through the crossbar without touching the crossbar.
- Walking upright and passing the crossbar, but has touched the

crossbar, score 5 points.

- Passing or crossing the bar in other ways, get 0 points.

## 2.2 Minefield section

Road conditions: 7 cylindrical, black mines are randomly placed on the road; the distance between two centers ( $W$ )  $\geq 30$  cm. Mine diameter ( $D$ ) 2 cm, height ( $H$ ) 5 cm, see Figure 3.

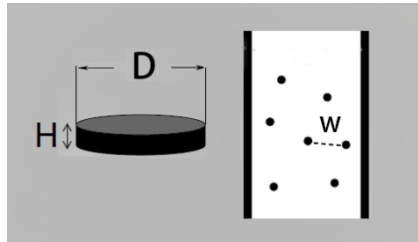


Figure 3: Minefield section

Requirements and points:

- 20 points for walking upright and passing without touching the mines.
- 10 points for walking upright and passing and touching a landmine once.
- Pass in other forms, get 0 points.

## 2.3 Section across the baffle

Road surface conditions: The baffle spans the track, the height ( $H$ ) is 10 cm, the thickness ( $T$ ) is 4 cm, and the baffle has marking lines, see Figure 4.



Figure 4: Sections across the baffle

Requirements and points:

- Across the baffle, the posture is not limited, and the baffle does not fall to the ground, score 20 points. It is allowed to move or

touch the baffle when crossing, and no points will be deducted.

- If the baffle falls to the ground when passing, 0 points are awarded.

## 2.4 Crossing the door section

Road surface conditions: door inner height (H) 62 cm, inner width (W) 30 cm, door frame width (T) 3 cm, blue marking lines are affixed to the door, and the distance between the door frame and the edge of the track is random, as shown in Figure 5.

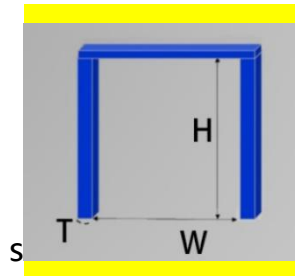


Figure 5: Section of crossing the door

Requirements and points:

- 10 points for walking upright through the middle of the door without touching the door.
- Walk upright in the middle of the door and touch the door, 5 points are awarded.
- Pass by other means, get 0 points.

## 2.5 Cross the single-plank bridge section

Road surface conditions: straight bridge, length (H) 60 cm, surface width 20 cm, see Figure 6.

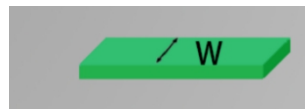


Figure 6: Crossing the single-plank bridge section

Requirements and points:

- 20 points for walking upright.
- Pass by other methods, get 0 points.

## 2.6 Kicking into the hole

Road conditions: There is a golf ball on the road. Hole diameter (D) 10 cm, 1 cm wide marking line is drawn on the edge of the hole, the distance between the hole and the ball ( $L$ )  $\leq 50$  cm, see Figure 7.

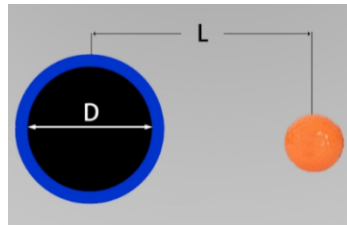


Figure 7: Section of kicking the ball into the hole

Requirements and points:

- Pass the road in any form, but kick the ball upright into the hole (multiple attempts are allowed), score 20 points.
- Pass, but not upright kick the ball into the hole, get 0 points.

## 2.7 Upstairs section

Pavement conditions: There are three levels of steps, each of which is 3 cm high (H), 40 cm wide (W), and 15 cm long (L), see Figure 8.

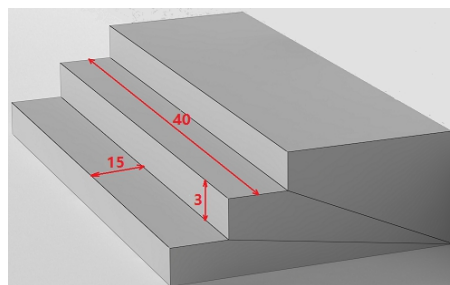


Figure 8: Stairs section

Requirements and points:

- 20 points for climbing stairs upright.
- Go up the stairs in other ways, get 0 points.

## 2.8 Down stairs and down slopes

Pavement conditions: There are two levels of steps and one level of slope. The dimensions of the steps are the same as above. The height of the slope (H) is 3 cm, the length (L) is 30 cm, and the width (W) is 40 cm. See Figure 9.

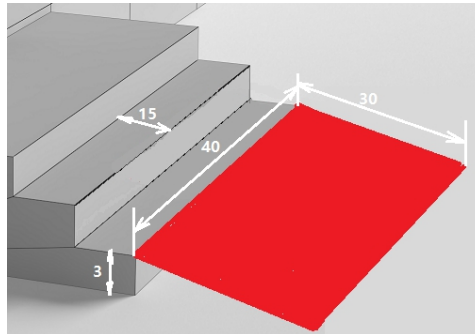


Figure 9: Slope section

Requirements and points:

- Upright down the stairs, and upright through the slope, get 20 points.
- Go down the stairs and pass the slope in other ways, get 0 points.

Stairs and slope sections are made of monochromatic panels of different colors. The three-dimensional diagram of the two is shown in Figure 10.

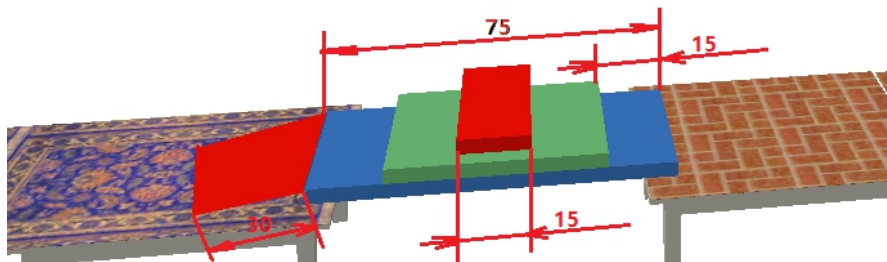


Figure 10: Three-dimensional view of stairs and slopes

## 2.9 Section of crossing the pit

Pavement conditions: green pavement, road width (W) 60 cm, total length 60 cm, there is a square pit in the middle of the road, length X width (L1 X L2) is 20X20 cm, depth (H)  $\geq$  15 cm, see Figure 11.

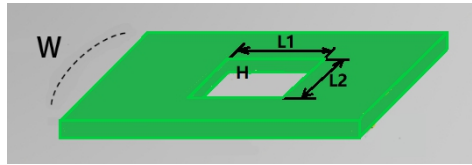


Figure 11: Section of passing the pit

Requirements and points:

- 20 points for standing upright through a pitted road.

## 2.10 Horizontal open crossbar

Road conditions: horizontally open the crossbar to traverse the track, divided into two sections, in a horizontal direction, open 90 degrees to both sides or closed. Each cycle keeps the closed state for 5 seconds and the open state for 10 seconds. The width of the crossbar (W) is 5 cm, the height from the road surface to the bottom of the crossbar (H) is 20 cm, and the crossbar is pasted with yellow and black marking lines, as shown in the figure. 12.



Figure 12: Over the horizontal open crossbar

Requirements and points:

- 10 points for walking upright without touching the crossbar
- 5 points for walking upright and having touch with the crossbar
- Pass in other forms, get 0 points