**2019 Robot Competition "Off-Road Tour" Competition Rules**

# I. Project Introduction

The purpose of the robot competition is to guide the participating teams to research, design and produce mobile robots with excellent hardware and software systems, and gradually improve the robot's multi-faceted capabilities and intelligence. The robots are required to overcome different obstacles on specific off-road venues in accordance with rules. Properly cope with the problems of multiple robots on the same cross-country, and successfully reach the end in the shortest possible time.

## Second, the event description

* 1. **Event settings: There are 3 competitions in this competition, namely the type Ⅰ, Ⅱ, and Ⅰ weight-bearing cross-country cross-country tour. Considering the actual situation in our province, the road race is cancelled. Race separately to produce three championships.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Serial number** | **name** | **Each schedule** | **Every round**  **number** | **Every starting point** | **Lane change** |
| 1 | Type Ⅰ Robotic Off-road Tour | 4 turns | 3 | ① inside / medium / outside | Not allowed |
| 2 | Type Ⅱ Robotic Off-road Tour | 4 turns | 3 | ① inside / medium / outside | Not allowed |
| 5 | Robot track off-road (type Ⅰ load) | 4 turns | 3 | ① inside / medium / outside | Not allowed |

* 1. **, Off-road process and control method**
     1. **Lane race**

The robot autonomously recognizes the track guide lines, obstacles, and the center divider, etc., and in its track, cross-counterclockwise around the center divider.

The overall projection of the robot is clearly off its guidance line, and its off-road qualification is cancelled.

## Start and stop

After the robot enters the starting point, the team members must not contact the robot during the whole process. It is required to use a non-contact method to control the startup and shutdown of the robot. Only one member of each team uses the non-contact method to control the startup of the robot. Start and stop functions. Do not move with the robot (if using the remote control, the remote control must be handed over to the referee)

## Auxiliary action in off-road process

For type I robots, the indicator light should keep flashing rhythmically;

For type Ⅱ robots, the arms should keep swinging back and forth rhythmically similar to humans.

## collision

* + 1. **Rear-end type one**

If the front robot walks normally and a rear-end collision occurs, the rear robot is the responsible party. The penalty responsible party withdraws from this off-road with a score of incomplete off-road. Other robots are assigned to the back group and make up.

## Rear-end type two

If the front robot decelerates abnormally or even stops suddenly, the front robot is the responsible party. If the game continues to be seriously affected, the referee may call "Stop" and punish the responsible party to withdraw from this off-road, and the result is that the off-road is not completed; other robots are included Back group, make-up.

## Side collision

The lane-changing robot is the responsible party. If the game continues to be seriously affected, the referee may call "Stop" and punish the responsible party to withdraw from this off-road with a score of incomplete completion of this off-road; other robots will be assigned to the latter group and make up the match.

# 3. Site, route, environment and facilities

The dimensions, marking lines and symbols, and the types and number of obstacles placed in this competition are shown in Figure 1.



8000

7000

**③**

3000

2800

**①**

**②** 1225 775

11000

**Figure 1.Robocross**

## site

The total width is ≥3 meters, of which the total width of the runway area is about 2.8 meters; the total length is ≥11 meters, of which the total length of the runway area is about 10.8 meters.

Ground surface:

The green part is carpet / felt, and the surface is required to be flat and wear-resistant. Starting and stopping lines: three. Black cloth tape, width 60mm.

Venue center divider:

Height ≥300mm, thickness 100mm, the surface is the original color of the board, and there may be graphics.

Height ≥150mm, the surface is the original color of the board, and there may be graphics.

600mm outside the field border is for the referee.

## Track / runway

The width of the guide line is about 30mm, the guide line covers the obstacle, and the center distance between the two guide lines is ≥450mm. The guide line is white textured paper.

The inner ring of the runway is rectangular; the ends of the middle ring of the runway are semi-circular with a diameter of 1450mm; the ends of the outer ring of the runway are 1450mm in diameter.

The referee lane is between the red dotted line and the track, with a width of 600mm.

## obstacle

On the road, obstacle facilities made of wooden boards are placed. Imitating the wild environment, the production of obstacles does not need to be particularly fine, and the size may have certain errors. The robots on the obstacle facilities are painted with black matte paint and white guide lines.

## Double hump

The hump is 1350mm wide and 100mm high. The cross section is 2 isosceles triangles. The distance between the two humps is 150mm.

1350



150

100

**Figure 2.Two hump perspective**

* + 1. **cliff**

600

High slope: the bottom length is about 800mm, the height is 200mm, and the width is 1.35 meters;

Low slope: the base length is about 600mm, the total height is 100mm (the platform under the slope is 50mm high), and the width is 1.35 meters. The top view is shown in Figure 1.

100

200

800

100

600

**Figure 3. Cliff side view**

* + 1. **Trapezoidal hillside**

Top view

Front view

Side view



150

1350

1200

**Figure 4. Trapezoidal peaks**

**Six-layer trapezoid:**

The first floor (bottom floor), 1.2 meters long and 1.35 meters wide;

The second floor, 1.0 meters long and 1.35 meters wide;

The third floor, 0.8 meters long and 0.9 meters wide;

The fourth floor is 0.6 meters long and 0.9 meters wide;

The fifth floor, 0.4 meters in length and 0.45 meters in width;

The sixth layer is 0.2 meters long and 0.45 meters wide. The thickness of each layer is about 25mm.

# Fourth, the robot requirements

## 4.2 Robot

|  |  |  |
| --- | --- | --- |
| **specification** | **Robot type** | |
| **Type I** | **Type II** |
| **weight** | No limit. | No limit. |
| **width** | ≤300mm. | ≤300mm. |
| **long** | ≤450mm. | ≤450mm. |
| **Exterior** | No specific restrictions, such as like a car  Or tank. | Look at the cruise like a person standing in a car. |
| **Shoulder height** |  | Rotate the axis of the shoulder to the ground  ≧ 2 times the maximum wheelbase of the robot load wheel; |
| **Arm** |  | There are left and right arms that can move independently, arm length ≧ 1/3 shoulder height. |
| **head** |  | There are heads that can move independently. |
| **Load material** | 1 liter beverage bottle, weighing about 1000  G. The robot team will fix it on the robot. |  |
| **power** | Please fully power the robot before the start of each round of competition; do not charge before the end of this round of competition,  The battery voltage must not exceed 22.4v. | |
| **Safety** | The robot must not hurt people, and must not damage the site and the environment. | |
| **Automatic deformation** | After the robot is allowed to start during the game, it will automatically deform to reduce the center of gravity, but the size must not exceed the limit, and it must return to its original shape after stopping. | |
| **other** | The structure of the robot must be able to adapt to off-road fields and obstacles.  Encourage innovative design and beautiful design. | |

* 1. **Signage**

The identification plate should be installed in a prominent position on the robot's body, without obstruction.

**●☆☆☆XXXX●**

**I**dentification plate: 10cm wide, 3cm high, white background, black border (3 pounds). The center is the name of the robot team (less than 7 Chinese characters, supplement the symbol ☆), one symbol before and behind the team name are black circles, the characters are Times New Roman, No. 1 and bold.

## Participants require:

A robot developed by school students.

## Robot name / Team name:

It is required to give a name to each robot for registration, registration, marking, identification. For example: Robot Off-Road Pioneer, Scud AK47, etc. The name length does not exceed 7 Chinese characters, and 2 letters / numbers count as one Chinese character.

## Instructor, Coach / Developer:

The instructor and team members (i.e. developers and coaches) corresponding to each robot should be specified.

# Five, scoring standards

## 5.1 Timing:

The electronic timer or stopwatch is used for timing. The robot prepares at its starting point, and the starting whistle starts to count; when it finishes the race and touches its "start and stop black line", it stops timing.

## After the race, the criteria for successful shutdown:

* + 1. At least one wheel crosses its "start and stop black line";
    2. The overall projection does not touch the obstacle in front.
  1. **R**esults: 4 times accumulated, less time wins. The order of 4 valid results is first, followed by 3 valid results, 2 valid results, 1 valid result, and finally no 1 Valid results. The robots that have not completed the entire lap are ranked according to the distance traveled, and the average time spent per lap must not exceed 50s.

## Sort results by:

According to the results of the first final, the second rematch, and then the preliminary results, the total ranking will be obtained.

**6. Schedule**

## Group competition:

Each round is a group match.

Split race, 1-3 robots per group;

The weighted race is the same as the lane race and is not described separately.

## Point of departure

The runway is divided into an inner circle, a middle circle, and an outer circle, with 3 start and stop lines, as shown in the figure. After the robot starts from the starting position, it turns around in a counterclockwise circle around the center divider;

In the lane race, each robot runs 3 times, starting from the inner, middle and outer positions of ①; the weight-bearing race is the same as the lane race, and is not described separately.

## First round (preliminary)

The results of all robots in each group are mixed and sorted to get the ranking. The top 3l robots enter the rematch; a school does not exceed 3.

## Second round (rematch)

The top 9 places go to the finals, and no more than 2 schools enter the finals.

## Third Round (Final)

When ranking in the final results, only one robot can enter the top 3 in a school.

## preparation

After the referee makes a sound "prepared", after the team members place the robots at the starting and ending lines of their respective starting points: For type I robots, the indicators should remain on;

For type II robots, the head should keep a rhythmic left-right or up-and-down swing.

After the referee makes a sound "prepared" 3 times, the robot that fails to prepare will withdraw from the game.

## set off

After the referee blows the whistle, the players of all parties control the robot to start in a non-contact manner and start off-road.

# Seven other

1.The robot team that advances to the final should submit a technical report before the start of the final, and if necessary, add a defense link. The specific requirements will be notified to each team at that time;

2.Because the registration situation is uncertain, the actual schedule will be published after registration;

3.The matters not mentioned above shall be decided by the chief and deputy referees after consulting the team leader's teachers;

4.If the above is inconsistent with the regulations of the event organizing committee, the regulations of the organizing committee shall prevail.

5.The competition venue is subject to the venue provided by the organizer.The participating robots must adapt to the venue provided by the organizer.