Worldwide Teenage Robotics Association

International Robotics Competition 2018

Belfast City Hall
19th July 2018

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General Rules
Welcome to the Worldwide Teenage Robotics Association (WTRA) International Robotics Competition 2018. This booklet gives you details of each strand of the competition and associated rules.

- All teams in all categories will have the opportunity to test their robots in the actual competition field one day before the official event.

- The categories with a requirement of rebuilding the robot on site will have 1-3 hours for reconstruction and testing.

- In all cases judges decisions will be final.

Prize Structure
The prizes available in each category are as follows:

- **Challenge 1:** Top Prize is £100
- **Challenge 2:** Top Prize is £200
- **Challenge 3:** Top Prize is £300
- **Challenge 4:** Top Prize is £500
Challenge 1 - Lego Mindstorm Speed Challenge

We are really excited about this! It is all about speed. Get your MINDSTORMS moving as quickly as possible over 400cms. There are not many rules - just go fast. And...

- You can only use LEGO MINDSTORMS parts

- You can only use one LEGO MINDSTORMS Intelligent Brick

- You must stay within the parameters of the track which is 400cms long and 50cms wide – but obviously you can shoot off the end of it in style! You will get TWO attempts on the day and your best time will be the one that counts. We will have a ‘Top Gear’ style scoreboard that will track your position!
Challenge 2 - Remote Forklift Challenge

The challenge is similar to using forklift in real life. In this challenge two teams will compete at the same time and the players remotely control the robots to transport goods from the upload area to download area.

Age Categories
• Each team is composed of 1-2 members divided into two age categories (elementary school, middle school).

Robot Requirements
• The size of forklift robot must not exceed the size of startup area. If it exceeds the startup area, the team will be asked to make modifications before cleared to compete. The robot should not contain any parts that could cause damage to the field or to the other robots. During the challenge, teams can use any form of remote control (Bluetooth, Wi-Fi ...)

Field Set Up
• The field mat which is made of PP Matt material is 150cm in width and 200cm in length and it’s divided into three function areas:
  • The starting areas are 30cm*15cm rectangles.
  • The download areas are 30cm*15cm rectangles.
  • In the middle of competition area, there are three randomly-distributed upload areas at the size of 30cm*15cm.
• The field mat is shown on the following figure:

The Course
Challenge Rules

Scoring
1. There are originally 30 goods in the competition area. They are 16 common goods (10 points for each), 8 heavy goods (20 points for each) and 6 small goods (40 points for each).
2. There are some randomly-distributed obstacles in the competition area. If the robot touches the obstacle object during the competition, the team receives a penalty of -5 points each time.
3. If the parts of the robots fall off in the competition, the competition will remain continuous. The judge will take out of the parts from the field.
4. If the goods of the robots fall off in the competition, the competition will remain continuous. The judge will give the team -1 points penalty for each time.
5. When the competition ends, all robots stop immediately. Any goods on the forklift do not count towards the total score.
6. The competition will comprise two rounds. The better of the scores in the two rounds will be counted as the final score. The team that gains highest score will be the winner.
7. If two teams have the same score then:
   - The team that gains the least amount of goods will be the winner.
   - The team that gains the more small goods will be the winner.
   - The team that gains the more heavy goods will be the winner.
   - The team that gains the more standard goods will be the winner.
   - The team that knocks on the less obstacles will be the winner.
   - The team that falls off the less goods will be the winner.
   - The team that places the goods in order will be the winner.

The Competition Format
- Teams will have 30 minutes preparation time and 3 minutes (180 seconds) competition time.
- The forklift must set off from the startup area. No part of the forklift is permitted to overhang the startup area.
- When teams are ready the judge will give the signal to start. A false start will result in a warning, two false starts will result in disqualification.
- When 3 minutes has elapsed judges will score each team.

Score Sheet

<table>
<thead>
<tr>
<th>Goods Type</th>
<th>Points Per Unit</th>
<th>Calculation</th>
<th>Sub-total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common goods</td>
<td>×10=</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy goods</td>
<td>×20=</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small goods</td>
<td>×40=</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The number of knocked obstacles</td>
<td>× - 5=</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The number of goods falling off</td>
<td>× - 1=</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

After confirmation, please sign here: Total Score:
Challenge 3 - Curling Ball Challenge

Introduction
The challenge is similar to curling, where players slide stones on a sheet of ice towards a target area which is segmented into four concentric circles, the closer the stone is to the center the higher is the score. In this challenge two teams will compete at the same time and the robot’s task is to roll golf balls to the target area in two modes (controlled mode & automatic mode).

Age Categories
Each team is composed of 2-3 members divided into two age categories (elementary school, middle school).

Robot Requirements
The robots base size should not exceed 25cm in length and 25cm in width; before the competition starts the judge will use a 25cm X 25cm box to check the robot, if they exceed the required size the team will be asked to make modifications before cleared to compete. The robot should not contain any parts that could cause damage to the field or to the other robots. During the controlled mode of the challenge teams can use any form of remote control (Bluetooth, Wi-Fi ...)

Field Set Up
The field mat which was made of PP Matt material is 120cm in width and 240cm in length and it’s divided into areas:
- Two green surfaces are the starting areas.
- Two large white surfaces are the operation areas.
- Three black dots where the golf balls are placed during the automatic mode.
- Two yellow bands are the restricted areas.
- Middle surface is the scoring area.

The Course
Challenge Rules

Scoring
1. For each ball within the red area the team is awarded 100 points.
2. For each ball within the white area the team is awarded 50 points.
3. For each ball within the blue area the team is awarded 15 points.
4. For each ball within the grey area the team is awarded 1 point.
5. If the ball stops on the border between two areas the team will be awarded the highest points.
6. For each ball left on the operation area the team will receive a penalty of (-20 points).
7. For each ball left on the restricted area the team will receive a penalty of (-40 points).
8. If the ball crosses over to the opponent’s area or crosses the borders of the field it will be rejected and moved outside the field.

Competition Format
Each team can compete for three rounds during the competition, the best score for each team will be considered the final score. Each round time is 120 seconds divided into two modes:
- The automatic mode (30 seconds).
- The controlled mode (90 seconds).
- The judge will score the round after each mode is completed, and the final score for the round is the sum of both automatic and controlled modes.

Automatic Mode
- During the automatic mode the robots are placed in the starting areas, after the start signal is given the robots should operate autonomously (no form of remote control is allowed).
- If a team member interferes with the robot after it leaves the starting area, the judge will automatically stop the robot and move it outside the field.
- If the robot crosses the restricted area the judge will issue a warning, and if the robot repeats it the judge will automatically stop the robot and move it outside the field.
- If the robot crosses the field borders the judge will automatically stop it and move it outside the field.
- After the timer is stopped the judge scores each team.

Controlled Mode
- After the automatic mode is completed and the judge finished the scoring, the two teams have 20 seconds to connect the remote controller to the robot; a team fails to connect will be disqualified.
- The three balls are placed randomly on the operation area, but in the same configuration for both teams
- When teams are ready the judge will give the signal to start.
- When a team finished rolling all the three balls to the scoring area can ask for additional balls to be placed in the operation area to score more points (one ball at a time placed randomly in the operation area, and a maximum of 5 balls).
- If a team member interferes with the robot movement after it leaves the starting area, the judge will automatically stop the robot and moves it outside the field.
- If the robot crosses the restricted area the judge will issue a warning, and if the robot repeats it the judge will automatically stop the robot and move it outside the field.
- If the robot crosses the field borders the judge will automatically stop it and move it outside the field.
- After the timer is stopped the judge scores each team.
Challenge 4 - Robot Transport Challenge

Introduction
The challenge you will have to accomplish is a transport mission; you will design a robot with the task of transporting different objects with different shapes to a defined target area, and explore your ability to program a robot that can find its way in a complex environment.

Age Categories
Each team is composed of 1-3 members divided into two age categories (elementary school, high school).

Robot Requirements
The robots base size should not exceed 32cm in length and 28cm in width; before the competition starts the judge will use a 32cm X 28cm box to check the robot, if they exceed the required size the team will be asked to make modifications before cleared to compete. The robot should not contain any parts that could cause damage to the field. (No remote control is allowed, the robot should accomplish the mission autonomously).

Field Set Up
The challenge field is 210 cm X 150 cm in size with a grid formed by lines of which the width may vary. The challenge objects are as follows:
- Object 1: wood block 1.7 cm - 2 cm in width and length, 6 cm in height, weight approximately 80 grams (Figure 3.1).
- Object 2: a golf ball placed on the inner ring of a target area (Figure 3.2) 4 cm in diameter and 0.5 cm in height.
- Object 3: the obstacle is an object 10 cm X 10 cm x 10 cm in size. (Figure 3.3).

The Course
Challenge Rules

Scoring

- If the challenge object 1 is lifted off the mat but wasn’t transported to the target area the team will be awarded 10 points for each target (30 points maximum).
- If the challenge object 1 is transported successfully to the target area the team is awarded 25 points (50 points maximum).
- If object 2 is transported successfully to the target area the team is awarded 20 points.
- If the robot crosses the finish line the team is awarded 20 points.
- If the robot touches the obstacle object during the transport the team receives a penalty of -10 points each time.
- The total score is 120 points.

Competition Format

- Each team will compete for eight rounds; the best score will be the final score to qualify to the next round.
- Each round is 2 minutes, and it starts when the judge gives the signal.
- The robot is placed in the starting area and activated when the round start, the robot must accomplish the tasks autonomously, if a team member interferes with its movement the judge stops the match and the team is disqualified.
- The target and the challenge objects position will be disclosed on the day of the competition.
- The robot must accomplish the tasks through line following method.
- During the transport the objects should not come in contact with the mat (the robot should lift the objects not drag or push).
- If the robot touches the obstacle object the team gets a penalty.
- If the robot can’t follow the line, the judge will stop the robot and move it outside the field. The timer is stopped and the judge scores each team.
- The judge scores the round after the time is up, or the robot stop.

Score Sheet

<table>
<thead>
<tr>
<th>Missions</th>
<th>Details</th>
<th>Scoring</th>
<th>Max Score</th>
<th>Actual Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lift the objects</td>
<td>Objects are lifted up and removed from target area</td>
<td>10 points for each</td>
<td>30 points</td>
<td></td>
</tr>
<tr>
<td>Put in object 1</td>
<td>Objects are put into the designated area without line crossing.</td>
<td>25 points for each</td>
<td>50 points</td>
<td></td>
</tr>
<tr>
<td>Put in object 2</td>
<td>Object is put into the designated tray.</td>
<td>20 points for each</td>
<td>20 points</td>
<td></td>
</tr>
<tr>
<td>Cross the finish line</td>
<td>The orthographical image of the robot crosses the finish line.</td>
<td>20 points for each</td>
<td>20 points</td>
<td></td>
</tr>
<tr>
<td>Knock down the obstacles</td>
<td>the robot knocks down the obstacles in the competition.</td>
<td>-10 point for each</td>
<td>/</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>