INTELLIGENT ROBOT CONTEST

1. OBJECTIVE

The participating team is required to design and build either a single or multiple autonomous robots to collect 15 objects in a competition arena. The objects consists of 7 yellow balls, 4 blue empty steel cans and 4 red boxes. The collected objects are to be delivered to 3 different goal-containers according to their respective colours within 6 minutes. The objects are placed at the right section of the competition arena according to some pattern. The competing robots either go through the tunnel that is 390mm in height or take a longer path to reach the object collecting area.

2. ROBOT SPECIFICATIONS

The overall size of all participating robots must be less than 450mm (Length) x 450mm (Width) x 900mm (Height). The overall weight of all robots must be less than 20Kg. All robots operate autonomously or they perform corporately among themselves.

Each robot has to provide a start/stop switch for the handler to commence the contest. In the case of multiple robots, the handler has to activate all the start/stop switches together. Otherwise, one of the competing robots has to provide a master start/stop switch to activate all robots. If the competing robots communicate through radio frequency (r.f.), the handler has to declare the frequency upon the submission of the entry.

Please note that no external input on selection of tactics on any robot is permitted throughout the competition. The use of external power is also not allowed.

3. COMPETITION FIELD SPECIFICATION

A 3D view of competition arena is shown in figure 1. The 2D drawings with dimensions and markings of the field, the goal-container and the tunnel are shown in figure 3, 4 and 5.

![Figure 1: The 3D View of Competition Arena](image)

4. COMPETITION LAYOUT

Figure 2A shows the example of the competition layout. There are 2 areas where the objects will be placed. The detail is as follows:

Pattern Area
- The upper area marked by the rectangle ABCD.
- Number of objects: 2 balls, 1 can, 1 box and 1 tower (Figure 2B)
- Placement of objects: fixed at the positions shown in the diagram
Random Area

- Number of objects: 3 balls, 1 can, 1 box and 1 tower (Figure 2B)
- There are 5 known regions and a fixed point in this area.
- Only 1 object will be placed within each region.
- The actual position and type of object in each region will not be made known.
- The fixed point is at the bottom right corner at which a ball will be placed.

Placement of boxes

- Standalone boxes will rest their smallest area on the platform.
- Boxes that are part of the tower will rest their largest area on the platform.
- In both cases, the longer side of the resting surface will be parallel to the Y axis.

The final object layout will be decided by the panel of judges before the competition starts and the same layout will be used for all contestants throughout the competition.

5. OBJECT SPECIFICATIONS

The table below shows the specification and other relevant information on the three objects used in this competition. Please note that all the specifications will be within the range of ± 5% error.

<table>
<thead>
<tr>
<th>Colour</th>
<th>Balls</th>
<th>Steel Cans</th>
<th>Boxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Yellow</td>
<td>Blue. The side is to be wrapped in 3M Blue Tape.</td>
<td>Red. The entire box is to be wrapped in 3M Red Tape.</td>
</tr>
<tr>
<td>Dimension</td>
<td>65mm in diameter</td>
<td>53mm in diameter 104 mm in height</td>
<td>90mm x 60 mm x 34 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>58g</td>
<td>39g</td>
<td>100g</td>
</tr>
</tbody>
</table>
### Intelligent Robot Contest

**Singapore Robotic Games 2009**

<table>
<thead>
<tr>
<th>balls</th>
<th>steel cans</th>
<th>boxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>brand</td>
<td>Wilson</td>
<td>Sangaria</td>
</tr>
<tr>
<td>type</td>
<td>Championship</td>
<td>Tomato Juice, Orange Juice, Milk Tea, etc</td>
</tr>
<tr>
<td>sold at</td>
<td>Royal Sporting House or any sports utility shops</td>
<td>DAISO at IMM or Plaza Singapura</td>
</tr>
<tr>
<td>tape</td>
<td>471 3M Blue Tape 2”</td>
<td>471 3M Red Tape 1.5”</td>
</tr>
</tbody>
</table>

6. **COMPETITION RULES**

6.1. Each entry is given 1-minute setup time to get ready and 6-minute competition time to perform. Upon the setup time is over, the handler may request for 1-minute timeout otherwise the competition time starts even through the entry is not ready. Only one timeout is given to each entry.

6.2. The handler has to place all the competing robots within the starting area. The handler is only allowed to press the start/stop switch once to start the competition. For multiple robots, handler needs to press the start/stop switches on each robot together or one after another without any waiting interval.

6.3. Once the robot is pressed, it has to leave the starting area within 30 seconds otherwise it is judged as a crash. For multiple robots, at least one robot has to leave the starting area within 30 seconds otherwise the entry is judged as a crash.

6.4. Each entry is given 5 chances of crash. A crash defines as whenever a competing robot is not able to perform such as any robot does not move or jam in the arena. When the handler wishes to restart the robot after a crash occurs, the handler needs to seek the judge’s permission to stop the robot. For the multiple robots, all robots must stop and restart. Before restart, the handler needs to empty any objects retained by the robots.

6.5. For the multiple robots using r.f. communication among them, the handler has to anticipate the interference arising in the environment. If any case happens and the interference is not able to resolve, the handler needs to bear with it to proceed for the competition.

6.6. The entry shall withdraw from the competition if the entry crashes 5 times or the 6-minute competition time elapsed or the entry is dangerous to audience.

6.7. Score will be awarded based on whether the objects found in the goals are correct. The following table shows the scores and penalties.

<table>
<thead>
<tr>
<th></th>
<th>Blue Goal (Cans)</th>
<th>Yellow Goal (Ball)</th>
<th>Red Goal (Boxes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>correct object</td>
<td>+ 6</td>
<td>+ 4</td>
<td>+ 6</td>
</tr>
<tr>
<td>incorrect object</td>
<td>- 4</td>
<td>- 4</td>
<td>- 4</td>
</tr>
</tbody>
</table>

6.8. If there is a tie, the elapse time to correctly deliver the first object will be used to determine the winner.
6.9. In the event of any ambiguity in the competition rules, the judge's interpretation shall prevail. Should a situation arise that is not addressed in the rules, the judges will decide on the matter and their decision will be final.

Figure 3: The 2D Drawing of Competition field

- **Field**: the floor: Made by luan [19], Thickness: 15mm
- **Wall**: Made by luan [19], Thickness: 12mm
- **Color**: horizontal surface=white, vertical surface=yellow (painted)
- **Step**: Made by luan [19], Height: 40mm
- **Color**: horizontal surface=white, vertical surface=yellow (painted)
- **Tunnel**: Made by acrylic plate, Thickness: 10mm
- **Guiding Line**: vinyl tape, Width: 19mm, Max. Error of width: ±2mm, Color: black
- **Box of Goal**: Thickness: 9mm, Made by luan [19], Color: blue, yellow and red (painted)
- **Bucket**: plastics
- **Net**: Green Net for baseball with 40mm x 40mm stitch
- **Frame of the Net**: pipes (diameter is 28mm)
- **Starting Area Line**: Same with the Guiding Line
Figure 4: The Drawing of Goal-container

Figure 5: The Drawing of Tunnel