



# SLIIT

COMPUTING

| BUSINESS

| ENGINEERING



Sixth Annual

# ROBOTIC COMPETITION

SLIIT

UNIVERSITY CATEGORY

**TECHNICAL SPECIFICATIONS**

Organized By  
Faculty of Engineering  
Sri Lanka Institute of Information Technology

## **Introduction**

SLIIT ROBOFEST, as the premier robotic competition in Sri Lanka, is dedicated to making the annual competition more innovative, exciting, and competitive each year. Thus, this year's competition has been designed to challenge the competitors in terms of technical aptitude, innovation, and imagination, which with no doubt, will make the competition interesting and tightly contested.

To compete, each team must design and build a fully autonomous robot with technical specifications outlined in this document. Key features of the terrain and the tasks to be performed are also delineated in this document. Based on the design and performance of the robots, an impartial panel of judges will adjudicate the competition. The decision of these judges will be the final decision.

Also, please note that any amendments to the rules will be updated on the website, [www.robofest.lk](http://www.robofest.lk). If you have any questions or clarifications you may contact the ROBOFEST organizers through email [robofest@slit.lk](mailto:robofest@slit.lk) or phone 0768526900.

## **General Rules**

1. The competition is open to students of any university or any tertiary level educational institute.
2. A team may consist of up to a maximum of five members, all from the same institution.
3. The score for each robot will be judged based on the level of performance in the given task, accuracy and timing.
4. Each team will be allowed to complete 3 attempts within 15 minutes, and the best score out of the completed attempts will be considered as the final score.
5. There will be a preliminary competition, in which ten finalists will be selected. The selected teams will compete in a final round for Gold, Silver, and Bronze medal awards.
6. Any amendments to the rules will be announced by the organizing committee and it will be updated on the website.
7. Judges of the competition are given full authority to interpret the rules and make any subsequent decisions about matters that may arise in the competition.

# Playing Field

## *Note:*

- The playing field surface, walls, and ramp will be white (matt) in color, while all lines, start/ stop points, and unloading points will be black (matt).
- While the key dimensions of each section are given, the lengths of the paths are not specified in order to assess the quality of design and decision making algorithms of the robot.
- All guiding lines on the playing field are demarcated by black lines of width 2 cm.
- A tolerance of up to  $\pm 10\%$  for dimensions listed in this document should be tolerable by the robot design.
- The flat surfaces of the platform may not be perfectly flat and may have height differentials up to 5mm.

## **1. Round One (Preliminary)**

The playing field of the first round will be divided into three sections (**Figure 1**).

Area A – Object loading and line following.

Area B – Line following, tunnel, ramp navigation.

Area C – Object Unloading.

The terrain and the key features of each of each those sections are described below.

**Figure 1** explains the starting point, box loading area, box unloading area and the stop point.

The right, left and top views are shown in **Figure 2**, **Figure 3** and **Figure 4** respectively.

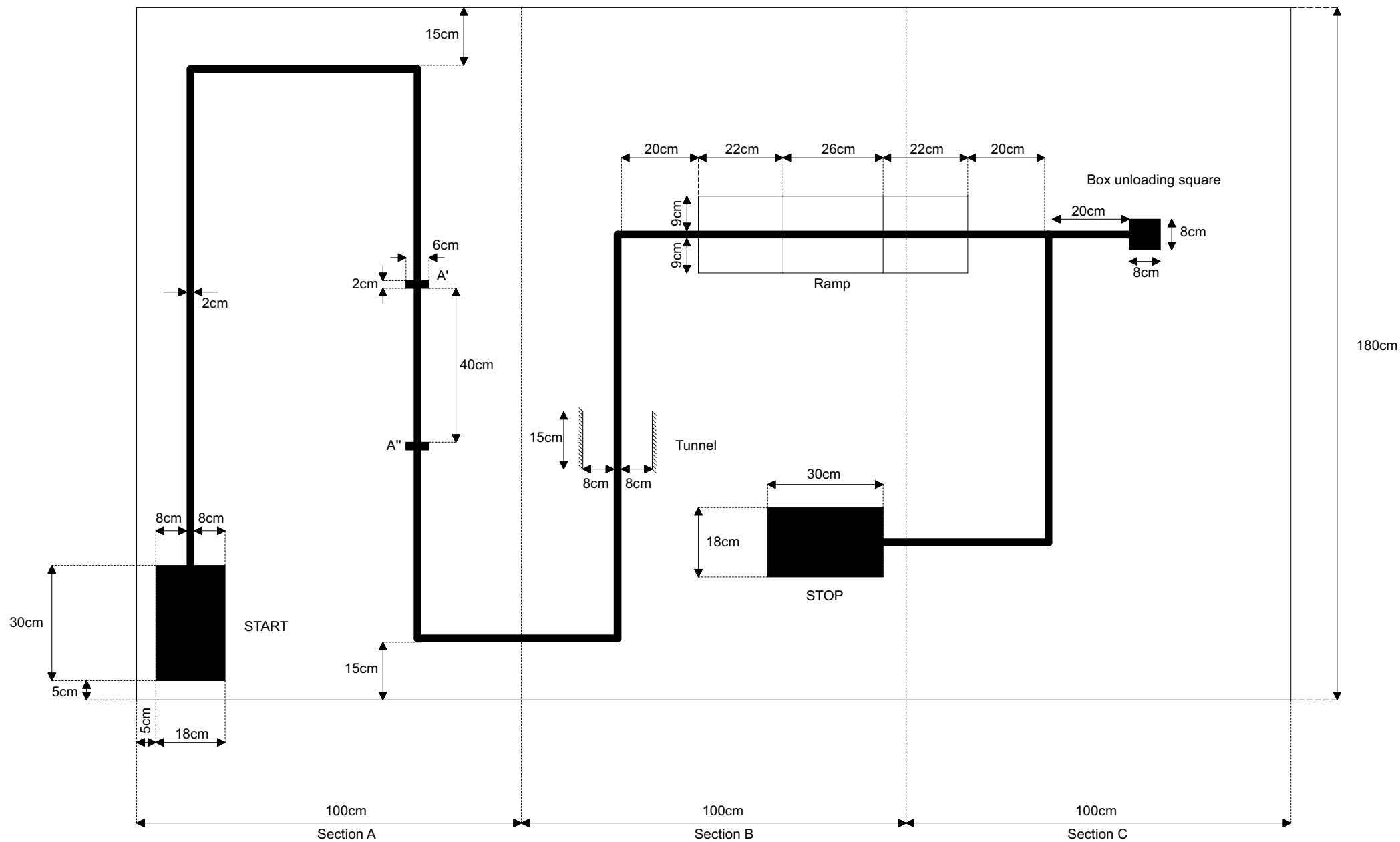
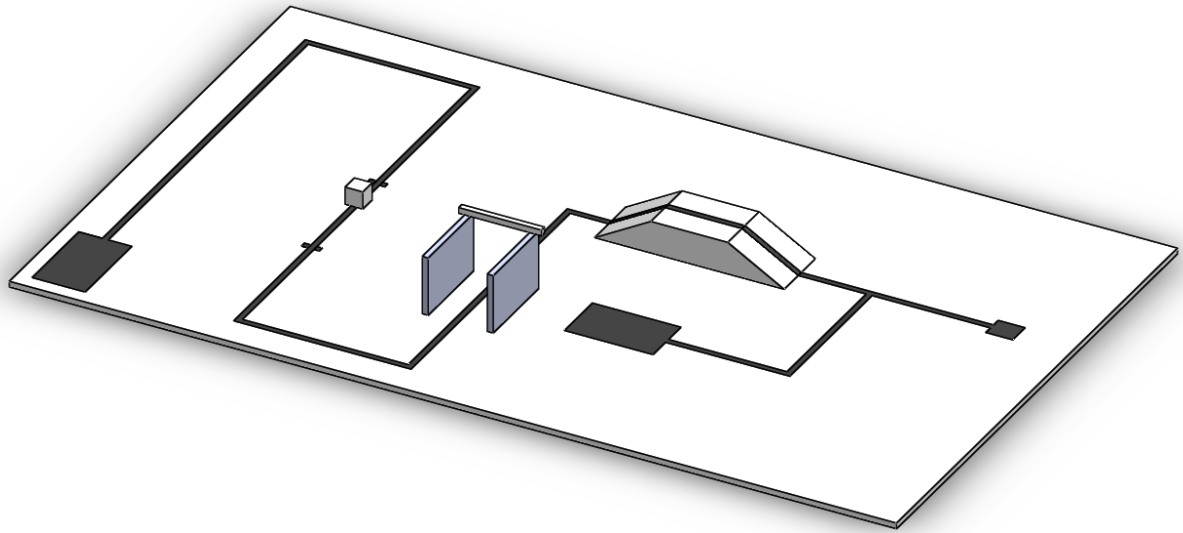
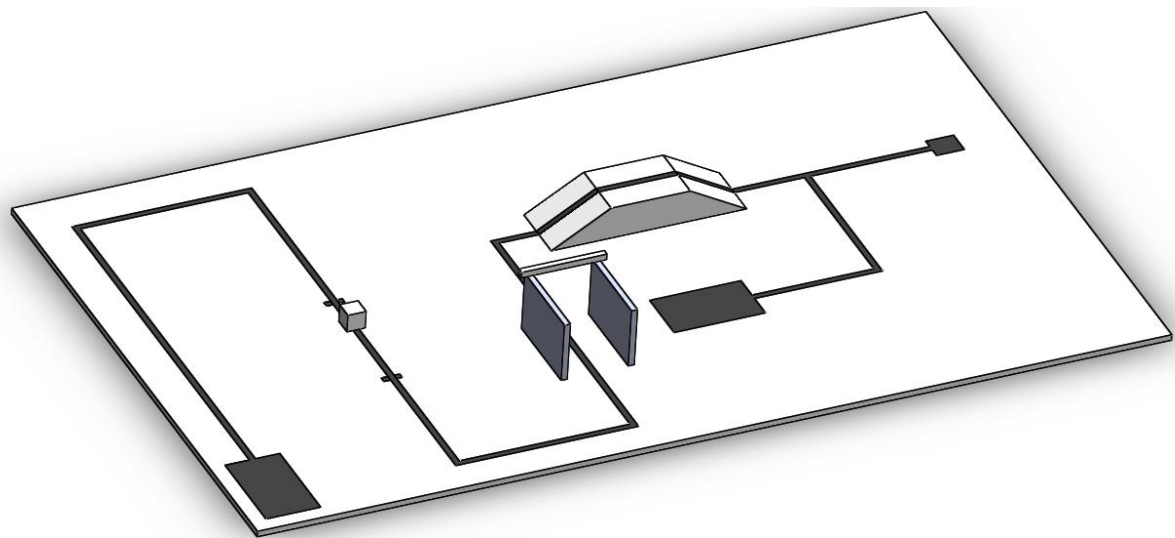


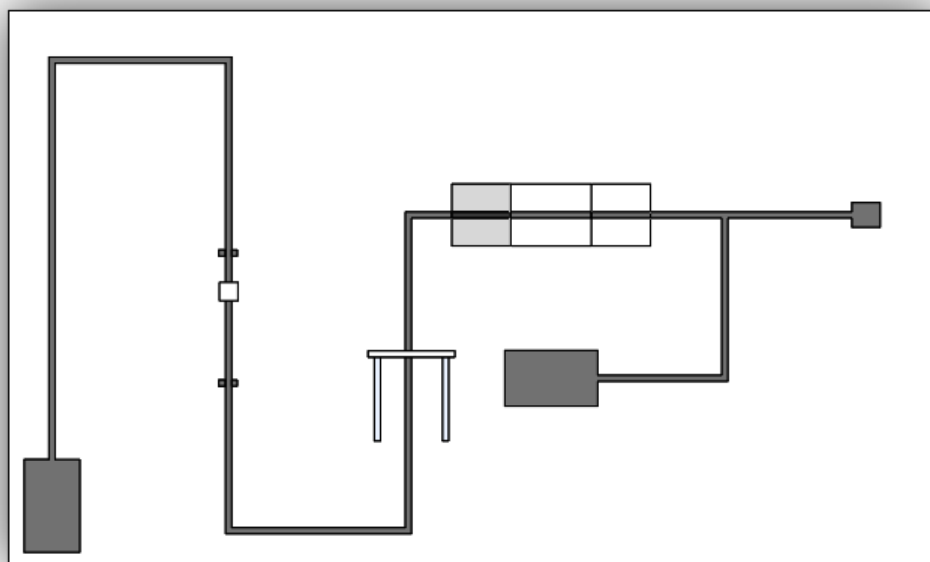
Figure 1



**Figure 2 – Right View**



**Figure 3: Left View**



**Figure 4: Top View**

### 1.1. Task – Round One

**Figure 1** explains the section A, Section B, and Section C.

1. The robot should start from the **start** point and follow the line up to A'.
2. The section from A' to A'' is the loading area where the box (white cube) is placed. Each team is given the opportunity to place the box between the two points.
3. After loading the box, the robot should follow the line to section B where it has to navigate through the tunnel.
4. After passing the tunnel it has to follow the path over the ramp and enter section C.
5. Inside section C it should unload the box at the unloading area and move to the **stop** point.
6. The robot should follow the black line at all times.

### 1.2. Rules - Round One

1. Robot should follow the line from the beginning to the end of the task. If not, scores allocated for line following in that particular section will not be awarded.
2. Marks will be separately awarded for (a) box loading and (b) carrying the box throughout the task. The robot may attempt more than once to load the box within the region labeled A' and A''. However, a penalty will be given for each extra attempt.
3. If the robot drops the payload while carrying it (after point A''), the robot can complete the task but marks for carrying the load will be deducted. However, if the robot picks up the payload again, marks for carrying will be awarded but with a penalty.
4. Robot should navigate through the tunnel **without hitting** its walls. In the case of failing to do so, no marks will be awarded for tunnel navigation.
5. Marks allocated for unloading the payload will not be awarded in the following cases:
  6. No payload to be unloaded.
  7. Unloading the payload at a wrong place (outside the unloading square).
  8. Robot has the payload but doesn't unload it in the arena.
9. Robot can adjust the box after unloading. The payload should be in the respective unloading square (8cm × 8cm) at the time of task completion in order to gain the full amount of marks allocated for unloading a box. These conditions are applicable for both boxes.

10. Judges will decide whether the boxes are placed correctly. A penalty will be given if a box is placed partially in the unloading square.
11. The Robot should completely be inside the Stop square to get marks allocated for stopping. A penalty will be given for partially stopping inside the square. If the robot fails to stop at the correct position, no marks will be awarded for stopping.

### 1.3. Attempt Terminations

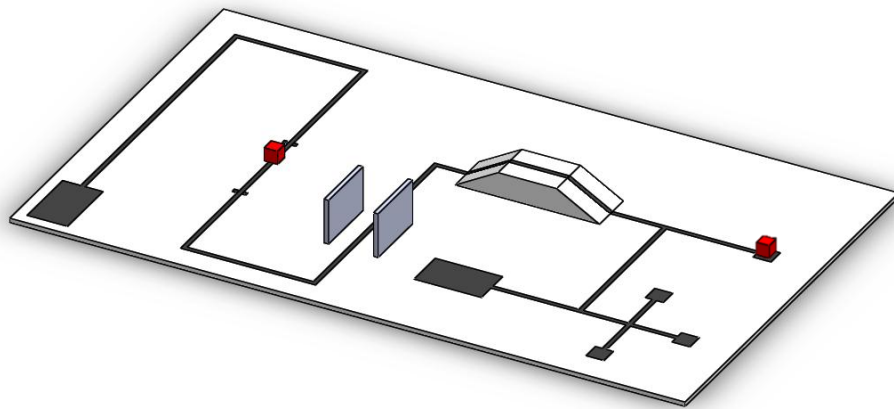
1. By **request** of the contestant.
2. At the judges **command**.
3. The robot **fails** to load the box between A' and A''. Dragging or pushing the box will not be considered as "loading".
4. Robot does **not** completely navigate through the tunnel **or** over the ramp.
5. The robot exceeds the 20 cm height restriction (applicable when navigating through the tunnel with or without the payload).
6. Robot failing to follow the line in the process of entering a new section.
7. Any type of physical interference with the robot after the round has started.

## 2. Round Two

The playing field of the second round will be divided into three sections (**Figure 8**).

1. Area A – Object 1 loading and line following.
2. Area B – Line following, tunnel and the ramp navigation.
3. Area C – Line following, object 1 unloading, object 2 loading and object 2 unloading.

The terrain and the key features of the three sections are described in **Figure 8**. The start point, **initial** box loading area, tunnel, ramp and the stop point are same as the first round. In addition to this round two has a different setup for payload unloading. The right 3D view of the round two playground is shown in **Figure 6**.

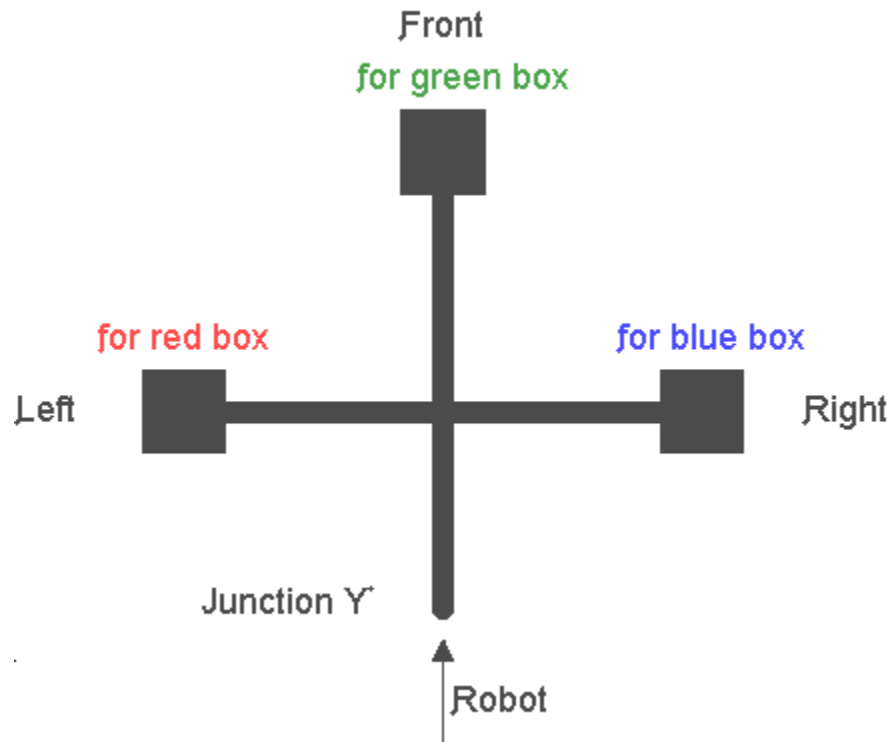


**Figure 6: Right View**

### **2.1. Task of the Second Round**

1. Two boxes out of a random set of boxes must be selected by a team member prior to the start of each round. Each box will be either red, green or blue only. After selecting the boxes programming, sensor calibration or any other hardware/software modifications of the robot is not allowed.
2. The robot should start from the **start** point and follow the line up to A'.
3. The section from A' to A'' is the loading area where the first box (colored cube) is placed. Exact placement of the box between the points are handled by judges and the place may vary between A' and A''.
4. After loading the box, the robot should follow the line to section B where it has to navigate through the tunnel.
5. After passing the tunnel, it has to follow the path over the ramp and enter section C.
6. Inside section C it should navigate to junction Y and unload the box at the correct position (according to the color of the box). The unloading area as seen by the robot is shown in **Figure 7**.





**Figure 7**

7. The robot should then navigate to the second loading area, load the second box and unload it at the correct position (according to the color of the box) of the unloading area.
8. It should then move to the stop point to end the attempt.
9. The robot must follow the line at all times.

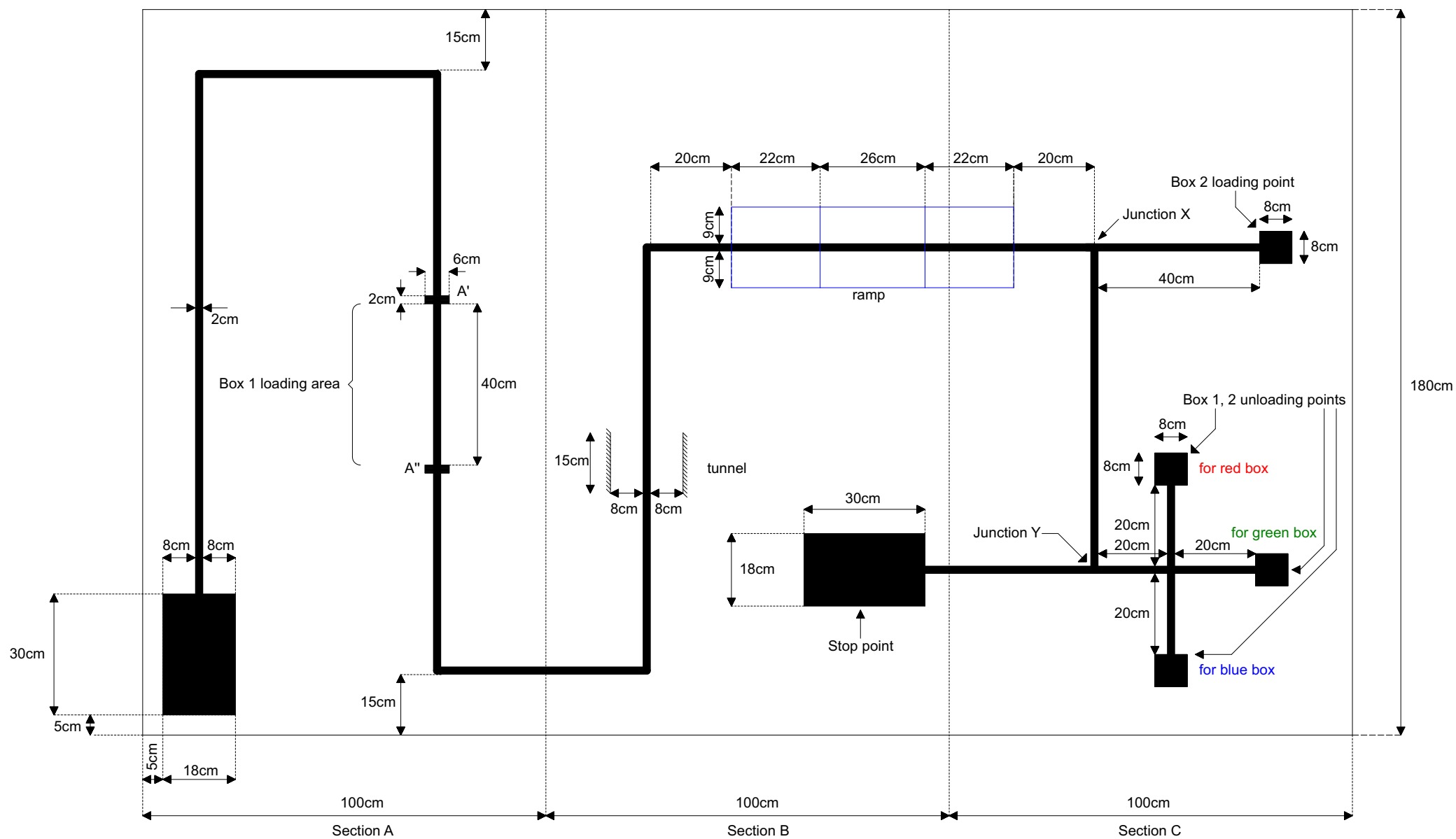


Figure 8

## 2.2. Rules - Round Two

1. Robot should follow the line from the beginning to the end of the task. If not, scores allocated for line following in that particular section will not be awarded.
2. Marks will be separately awarded for (a) loading the two boxes and (b) carrying the two boxes throughout the task. Robot can try more than once to load the first box between A' and A'', but a penalty will be given for each extra attempt.
3. If robot drops any of the two payloads while carrying it (applicable after point A'' for the first box and applicable after junction X for the second box), robot can complete the task but marks for carrying the payload will be deducted. However, if the robot picks up the payload again, marks for carrying will be awarded but a penalty will be deducted.
4. Robot should navigate through the tunnel **without hitting** its walls. In the case of failing to do so, marks will not be awarded for tunnel navigation.
5. Marks allocated for unloading the payload will not be awarded in the following cases:
  - No payload to be unloaded.
  - Unloading the payload at a wrong place (outside the unloading square).
  - Robot has the payload but doesn't unload it in the arena.
6. Robot can adjust the box after unloading. The payload should be in the unloading square (8cm × 8cm) at the time of task completion in order to gain the full amount of marks allocated for unloading.
7. Judges will decide whether the box is placed correctly, a penalty will be given if the box is placed partially inside the unloading square.
8. The Robot should completely be inside the Stop square to get marks allocated for stopping. A penalty will be given for partially stopping inside the square. If the robot fails to stop at the correct position, no marks will be awarded for stopping.

### 2.3. Second Round Attempt Termination

Causes for termination of an attempt in Round Two is the same as causes stated in section 1.3, Round One.

\* In the case of failing to load the second box, the attempt will **not** be terminated. However, every extra attempt taken to load the second box will be given a penalty.

## Robot Specifications

1. Maximum width and height of the robot should be so that it can safely navigate through the tunnel.
  - Tunnel width: 18cm
  - Tunnel height: 20cm
2. Robot must be self-navigating, with no potential for remote control.
3. The robot must be designed and built by the competitors themselves. No off-the-shelf robot kits are allowed except the following.
  - Processing Development Boards
  - Drive gear (wheels, gear box, motor)
  - Sensor module (IR, Sonar, color etc.)
4. The robot must include a start switch that will activate the robot, in order to activate the robot at the start of the contest. Once switch is turned on, no human interaction with the robot will be allowed until the end of the round.
5. The robots may be decorated according to the team's preference, as long as the maximum dimensions are not exceeded.
6. The robot should work under any ambient light conditions available on the day of the task.

## Other Relevant Information

- The Robot design should consist of its own power source. Supplying External Power is not allowed.
- Ramp incline :  $30^0$
- Payload Information
  - ✓ Dimensions : 6 cm × 6 cm × 6 cm.
  - ✓ Weight : Less than or equal to 100 grams.
  - ✓ Colour : The robot should be able to differentiate between colours Red, Green and Blue. There will be a significant difference between the three colours of the given boxes and the exact intensities will not be specified.
- All dimensions mentioned in the technical specification document will not be changed.
- The positions of the unloading areas of boxes will be as stated in **Figure 7, 8** and will not be changed.
- Dotted / Dashed lines given in the diagrams are imaginary lines for reference only. These lines will not be given in the platform.
- The platform will be surrounded by a wall of height 8 cm, white in colour with a matt finish.