



# ***ROBOFEST 2023***

**ANNUAL SLIIT ROBOT COMPETITION**

**TECHNICAL SPECIFICATIONS**

**SCHOOL CATEGORY**

Organized By  
Department of Electrical and Electronic Engineering  
Sri Lanka Institute of Information Technology



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# ROBOFEST 2023

The Faculty of Engineering of Sri Lanka Institute of Information Technology is holding its 13<sup>th</sup> annual robotics festival, ROBOFEST 2023.

The competition is open to students from schools and universities. The event is a great opportunity for the participants to showcase their theoretical and practical knowledge of robotics in an exciting and energetic atmosphere.

**Venue: Sri Lanka Institute of Information Technology, Malabe Campus**

**Date: 25<sup>th</sup> September 2023**

This year the competition will be organized in two categories:

1. University Competition
2. School Competition

## Important days to remember

02/05/2023

Team registrations open

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15/06/2023

Team registrations close

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02/07/2023-  
25/08/2023

Submission of Level 1 video

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02/09/2023

Announcement of school level finalists

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25/09/2023

ROBOFEST 2022 event day

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## **School Competition**

The competition is open for students from schools island-wide. Participants should design and implement a mobile robot capable of navigating along a playing field following lines and line maze solving. Additionally, the robot should be able to pick up, carry, and place a specified object from point A to B with colour detection.

- Level 1 – Line following, maze solving and operation of the arm.
- Level 2 – Picking, carrying, and placing an object based on the colour in addition to Level 1 criteria.

The robot that satisfies the above criteria with a minimum number of penalties within the given time limit will be the winner; being awarded with Gold and the next two robots with Silver and Bronze, respectively.

**The participants must submit a video demonstrating that their robot is capable of successfully navigating the Level 1 playing field provided in this document. The qualifying participants will then compete in Level 2 of the competition on the day of ROBOFEST 2023 at the venue.**

# Robot Development

## Robot Body Specifications

- The robot must conform to the **maximum dimensions of 15cm wide x 21cm long**, including all accessories, due to the playing field dimensions. There is **no height restriction**.
- Robots must be **self-navigating**, with no potential for remote control.
- The robot **may use wheels**. An example using two wheels *Figure 1*.
- The robot must be designed and built by the competitors alone. No ready-made modules are allowed, except for the following:
  - Drive gear (wheels, gearbox, motor, crane arm)
  - Sensor module (IR), Colour sensors
  - Microcontrollers
- The robot must be powered by batteries.
- The robot **must include a start switch** that will be activated at the start of the contest. After the robot is switched on, no human interaction with the robot will be allowed until the end of the round.
- The robot **should not be hard coded**.
- The robot should work under any ambient lighting conditions available in the playfield.
- The gripper should conform to the specifications given in *Figure 2*.
- The robot may be designed in any way as long as the maximum dimensions are not exceeded.

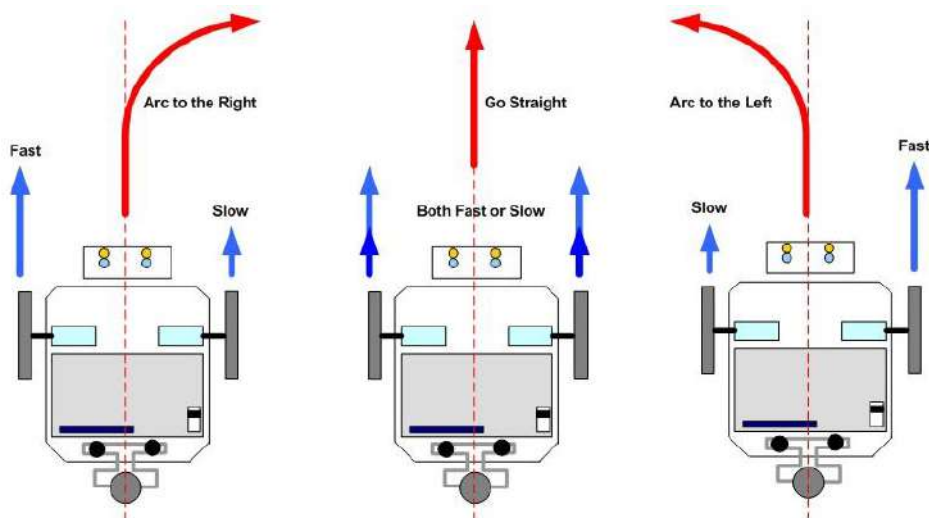
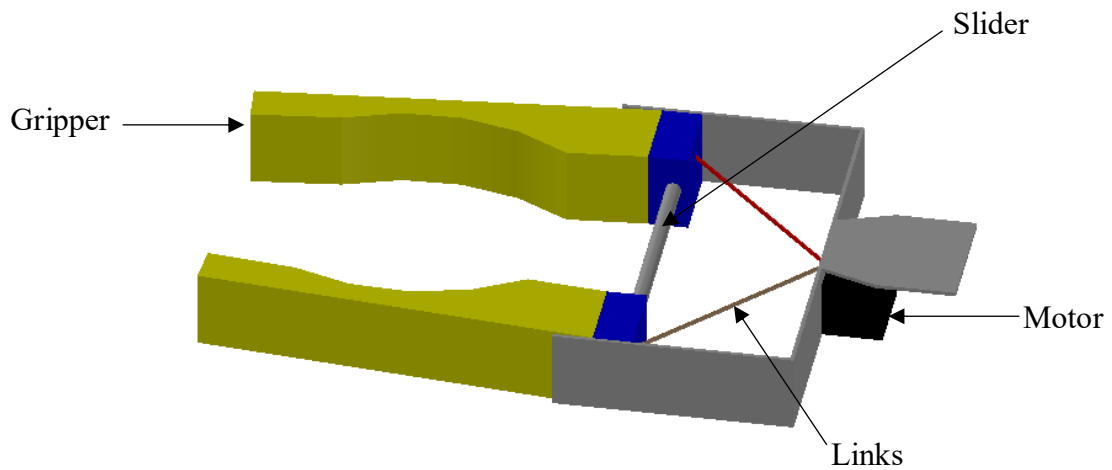


Figure 1: An example of how to make the robot turn.

## Gripper Specifications

- The crane arm should be capable of
  - Gripping movement (Retract and Extract)
  - Vertical movement (Up-Down)
- The pickup object will be a 4x4x4 cm<sup>3</sup> weighing less than 50 g wooden cube, which must be picked up by the crane using the Gripper mechanism.
- **The Gripper must be attached to the robot's arm.**



*Figure 2: An example of a possible gripper design*

# Playing Field

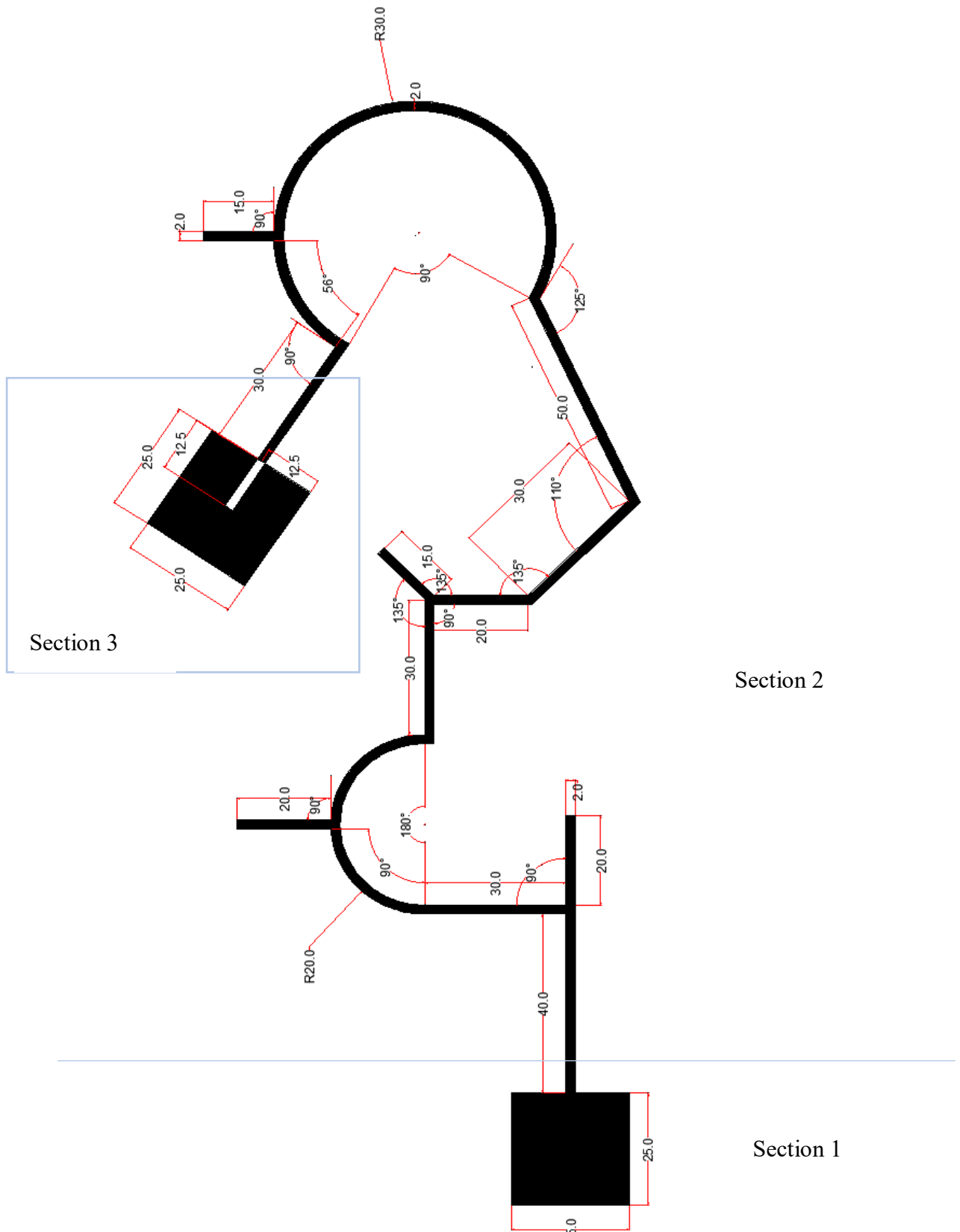


Figure 3: Level 1 playing field dimensions

The playing field will be divided into 3 sections. The robot must successfully navigate the first two sections, and it should stop at the finishing area to complete the task. The floor of all three regions will be white (matte) in colour, while all the lines and the starting and finishing areas will be black (matte). Bristol board may be used as the white background for construction.

The *Figure 3* shows the playing field for Level 1 of the competition. The participants must construct the playing field according to the given dimensions.

Please note that the **robot should not be hard coded** to follow the above path. The overall shape of the Level 2 playing field will be different. Therefore, the robot must be able to adapt to the given playing field.



## Level 1 (Online)

### Section 1 – Line Following

- The robot will start navigation from the start square and continue to navigate through section 1, following a **2 cm wide black line** (insulation tape can also be used) to the end of section 1.
- The starting block will be a **25cm x 25cm black square** as shown in Figure 4.

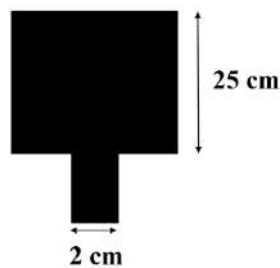


Figure 4: Start square

### Section 2 – Line Maze Solving

- Section 2 consists of a line maze including curves, angular turns ( $\geq 90^\circ$ ), and dead ends.
- Participants can use **any algorithmic technique** to solve the line maze.
- Robots should always follow the line.
- Please use **Black Colour Matte Tape** to construct the line since the Level 2 path is constructed from the above material. However, participants can use black colour insulation tape to construct the path in Level 1.

### Section 3 – Finish Area

- Once the robot reaches this area it has to stop automatically.
- The finishing area is followed up with a white line as shown in *Figure 5* below.
- The robot should navigate through the black line (2 cm) in Section 2 and guide itself through the white line (2 cm) in the finishing area and stop.

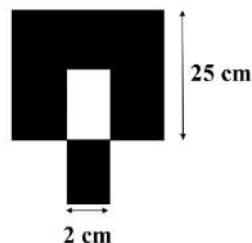


Figure 5: Finishing area

## Level 2 (At the venue)

- Level 2 will include a **pick-and-place element with colour detection** in addition to Level 1 conditions. Participants will compete on a modified playing field.
- A solid black square similar to the starting block (*Figure 4*) will be used to signify the object pick-up area. The robot must detect the square pattern and pick up the box.
- Based on the colour of the box, the robot should reach the correct square (by the directions given in advance) and place the object.
- The red colour cube drop-off zone is on the left and the blue colour box drop-off zone is on the right side.
- After the drop-off, the robot should return to pick up the square. This will be signified by the finish.

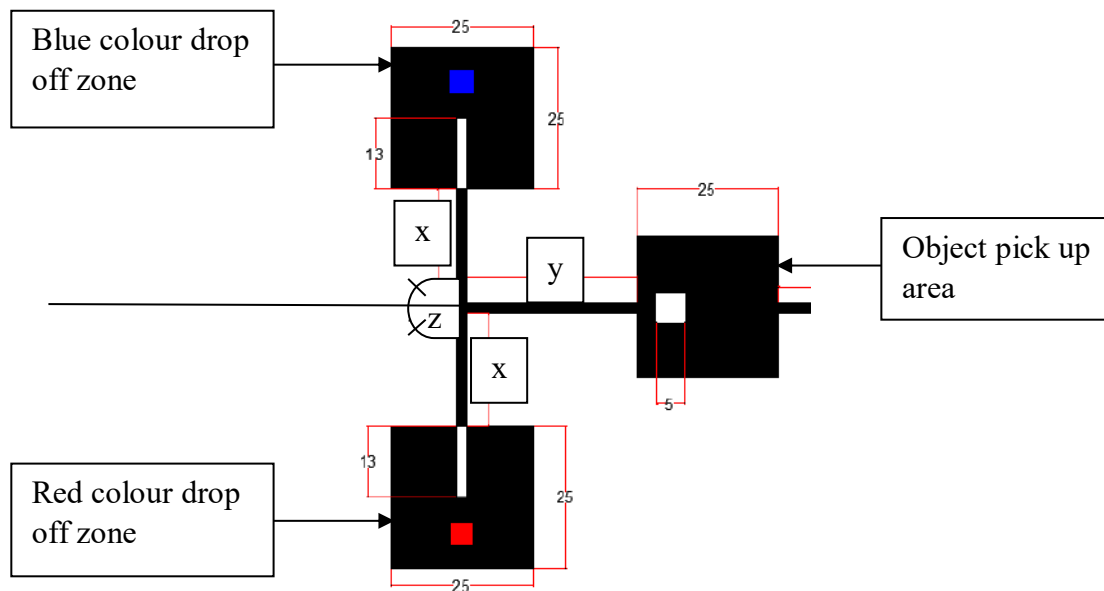


Figure 6: Level 2 Summary

- The angle  $z$  can be  $0^0 < z \leq 90^0$
- The *Figure 6* shows the summary of the pick and place competition. Please note that this is a highly simplified image and **is not representative of the actual playing field** that will be provided for the robots.
- The picked-up box can be dropped off anywhere within the drop-off zone.
- The object to be carried is **a wooden cube weighing less than 50 g.**

# Video Submission

## Specifications

- The length of the video should not exceed 5 minutes.
- The file size should not exceed 150 MB.
- The whole playing field should be visible throughout the video.
- The first 30 seconds should show the entirety of the playing field without the robot. Afterwards, the robot should be placed at the starting area and should show the dimensions of the robot using a ruler in the video.
- The robot should be continuously visible from the beginning to the end of its navigation of the course.
- In addition to that, the working of the robot arm should demonstrate separately in the video. (no need to pick up an object in Level 1)

## Links

Registration Link - <https://forms.gle/FfS8SFPK2oH6wuDE6>

# Scoring

## Level 1: Criteria Used

- Time taken and accuracy of the robot will be key criteria in Level 1. The robot should always follow the line.
- Operation of the arm
- Each robot is given **5 minutes** to reach the finishing area.

## Level 2: Criteria Used

- Time is taken and the accuracy of the robot will be considered. The robot should always follow the line.
- Each robot is given **10 minutes**, and **3 attempts** to reach the finishing area.
- Additionally, the overall construction of the robot will be considered. This includes shape, resource utilisation, and performance.
- For the Pick and Place section, the robot will be judged according to the following:
  - Time taken and the number of attempts to pick up the object.
  - How well the object is secured by the crane mechanism.
  - Time taken and the number of attempts to place the object at the correct drop-off area.
- The school teams should be accompanied by a teacher in charge and a parent.
- The school teams **must** participate in the competition in their school uniforms. Participants failing to comply with the rules and regulations will not be granted permission to enter the venue.
- **The decision of the panel of judges will be the final and no correspondence will be entertained.**

# Team Organization

## Forming a Team

1. Create a team with a maximum of **five members**. Solo entries are also accepted.
2. Make up your **Team Name**.
3. The **name of the teacher in charge** who will accompany the team should be provided.
4. A letter from the Principal must be submitted including the participants' names.
5. Design your **promotional materials** for your team.

## Event Coordinators

**Mr. Nisal Weerasinghe**

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**Ms. Buddhika Weerawardhana**

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**Deadline for Applications: 15/06/2023**