



TECHNO ODYSSEY

**UNIVERSITY CATEGORY
TECHNICAL SPECIFICATIONS**

Organized by
The IEEE IAS of SLTC Research University and SEDS SLTC



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INTRODUCTION

The Techno-Odyssey Robotic Challenge, an innovative robotic competition in Sri Lanka. This competition has been designed to challenge the competitors in terms of technical aptitude, innovation, and imagination.

Which no doubt will make for an interesting and tightly contended competition. To compete each team must design and build two robots, a Primary Robot and an Assistant Robot, with the technical specifications outlined in this document. Robots should be able to pick up and carry objects within the arena. Key features of the competition and the tasks to be performed are also delineated in this document. Based on the design and performance of the robots, a panel of judges will adjudicate the competition. The decision of the judges will be the final decision.

BACKGROUND STORY

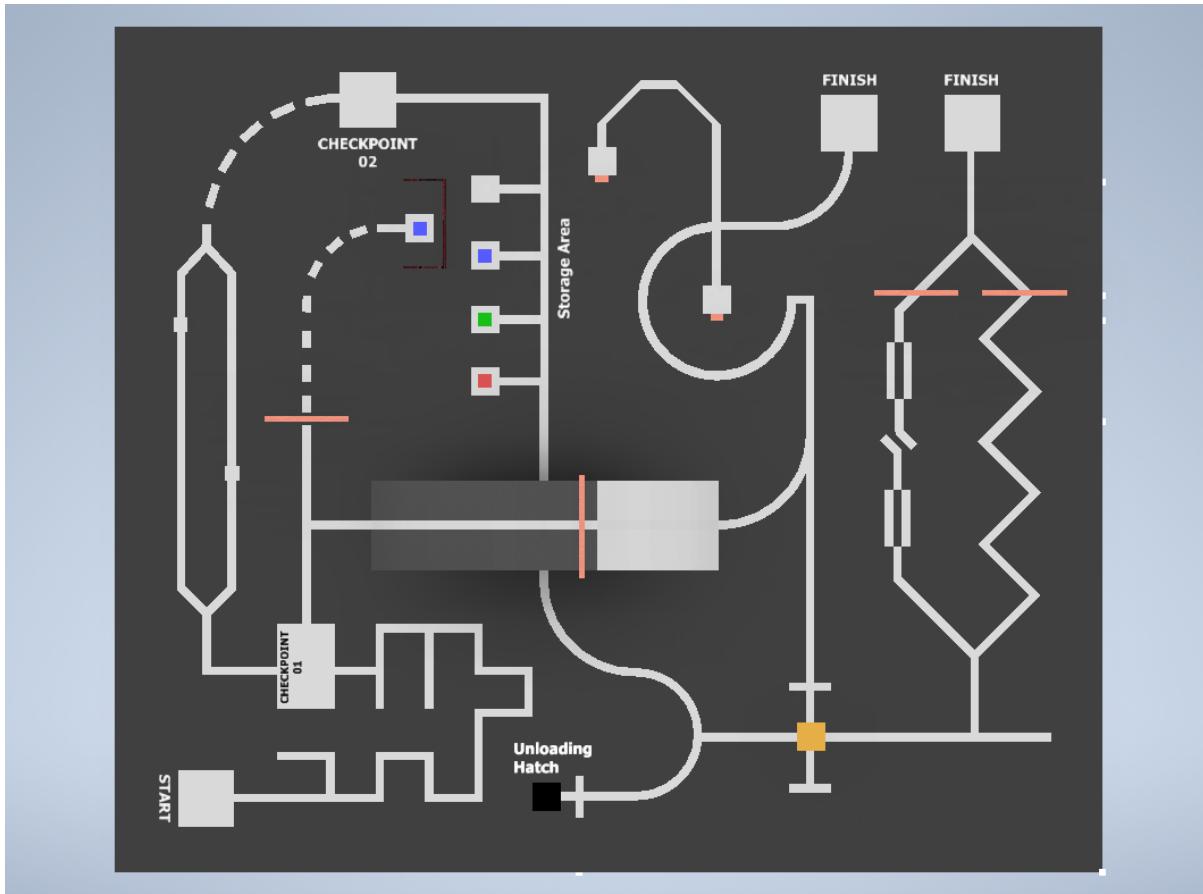
Once upon a time, in a far-off land, there was a small country that had developed nuclear reactors for a scientific experiment. The leaders of the project were worried that the reactors could be unstable and explode if they were not maintained and stored under the specified safety standards, so they decided to build a facility to store and maintain their own nuclear reactor cores.

However, as the facility was being built, a group of scientists and engineers from the country discovered a flaw in one of the reactors in the facility that could potentially cause a nuclear explosion if the reactor was not moved into the underground cooling hatch.

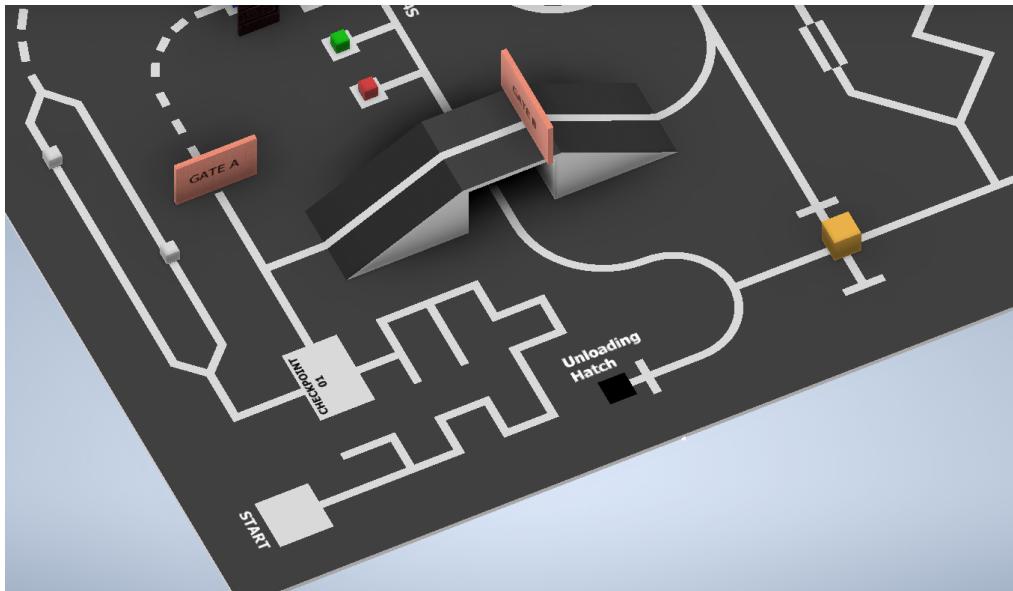
The group of experts then immediately alerted the leaders of the project and urged them to halt the development of the reactors and redesign it, addressing the flaw. The leaders listened to the experts and halted the development.

The leaders then formed a committee of scientists and engineers to come up with a design of robots for picking up the unstable nuclear reactor core and moving it into a safe place and thus preventing a nuclear explosion. Imagine you guys are the team of engineers and design two robots to move the unstable nuclear reactor core to the safe cooling hatch. The primary robot should do the picking up and carrying. The other assistant robot should support the primary bot to complete its task.

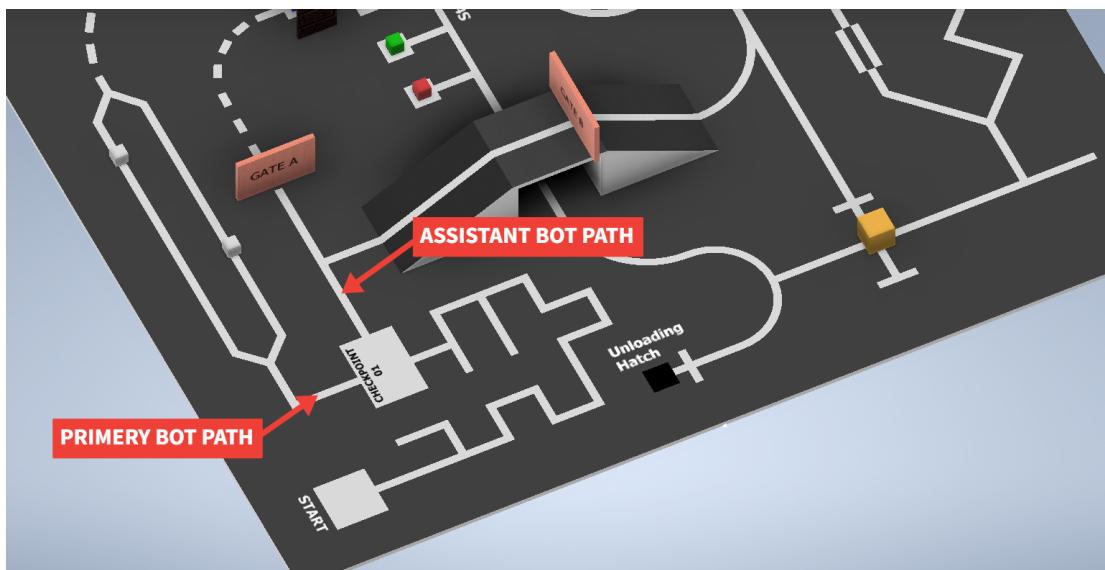
TASK OF THE COMPETITION



- The competition task should be achieved using two autonomous mobile robots. As the background story says, robots should be programmed to prevent nuclear fallout.
- In the beginning, each of the robots should start from the start square. **Primary robot should carry the assistant bot on top of it.**
- After both robots are placed on the start square, the team members can activate both robots and begin the attempt. The timer will start as soon as the robots leave the starting square.
- To enter the checkpoint-01 primary robot has to successfully navigate through the line without getting lost. Robot should only move on lines.

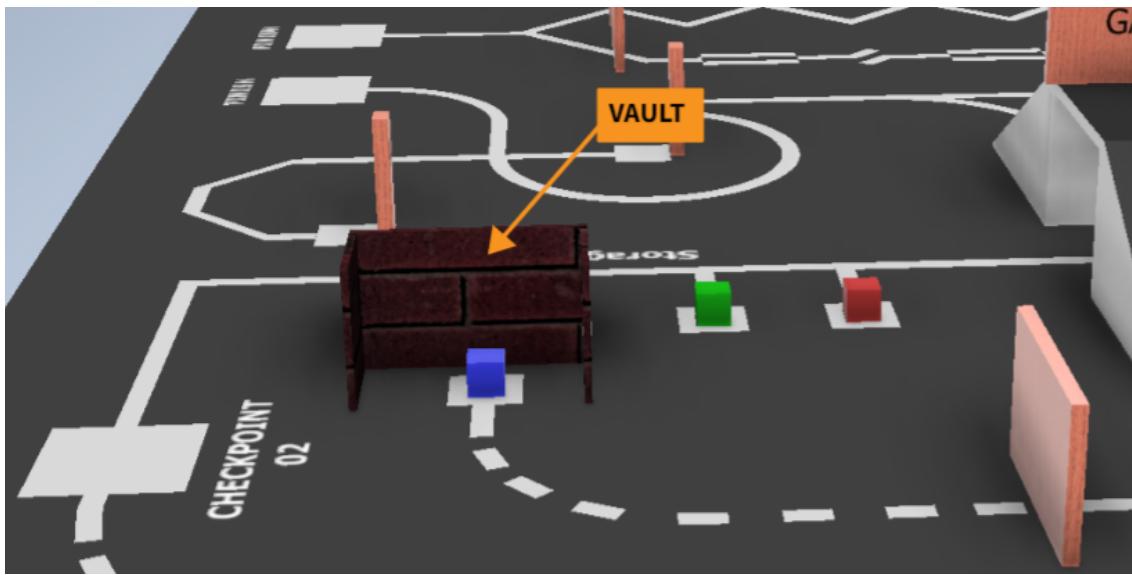


- After reaching checkpoint-01 the assistant bot can unload itself from the primary bot and begin its own journey.
- There are two separate paths for the primary bot and assistant bot. Each robot should go through the correct path.

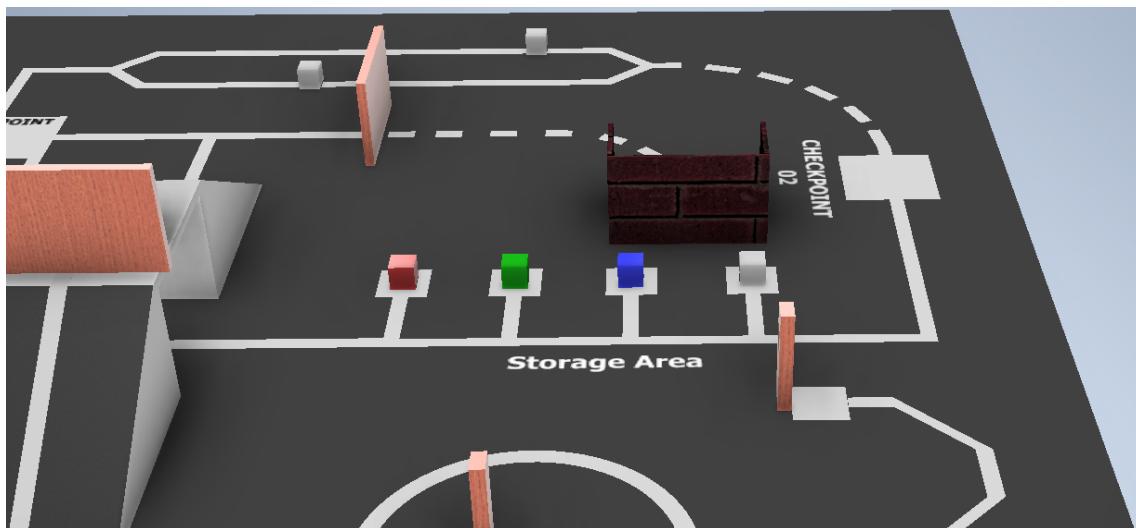


- The Primary robot's path splits into two lanes and there are some obstacle boxes on each lane. The primary robot should be able to bypass those obstacle boxes by changing lanes or any other way however the obstacle boxes cannot be touched by the primary robot.
- Meanwhile the assistant robot should navigate along its path towards the vault. But the vault is behind the gate-A which is initially closed.

- When the primary robot reaches checkpoint 02, Gate-A will be automatically opened and the assistant robot can move forward.
- There is a shipping crate (colored box) inside the vault. The assistant robot should be able to **detect its color and send that color information to the primary robot**, that's the exact color of the shipping crate which contains the unstabilized nuclear reactor core.



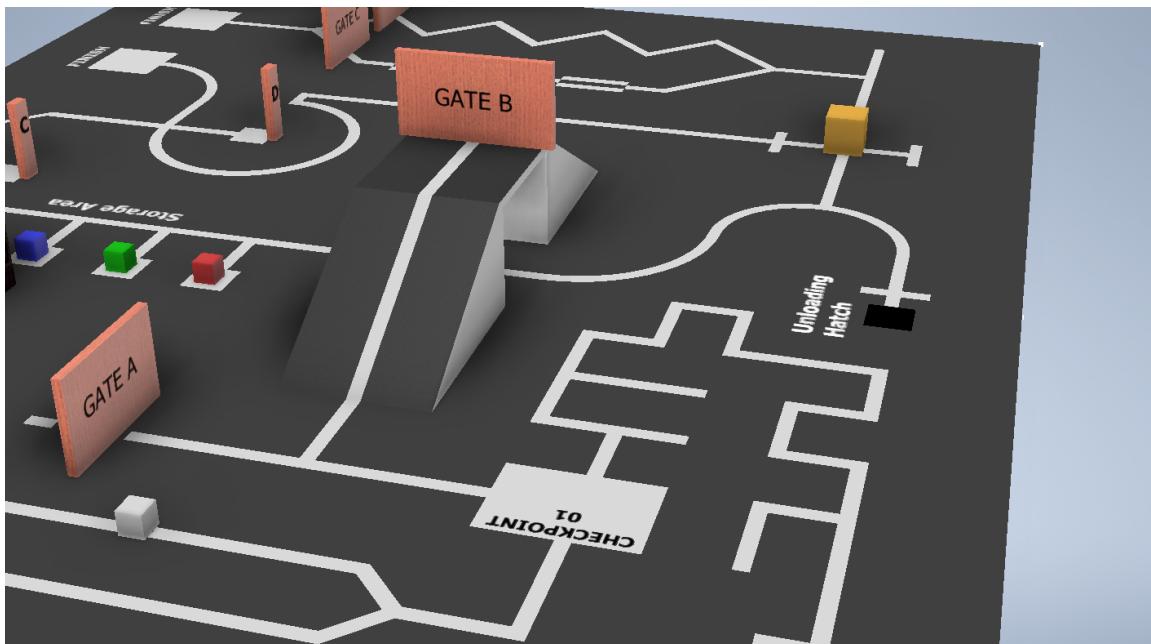
- The primary robot should navigate to the storage area. There are 4 colored shipping crates (boxes) in the storage area. As previously mentioned all of those boxes contain a nuclear reactor core but only one of them is unstabilized and hazardous. The color of the box inside the vault exactly matches the color of the hazardous shipping crate in the storage area.



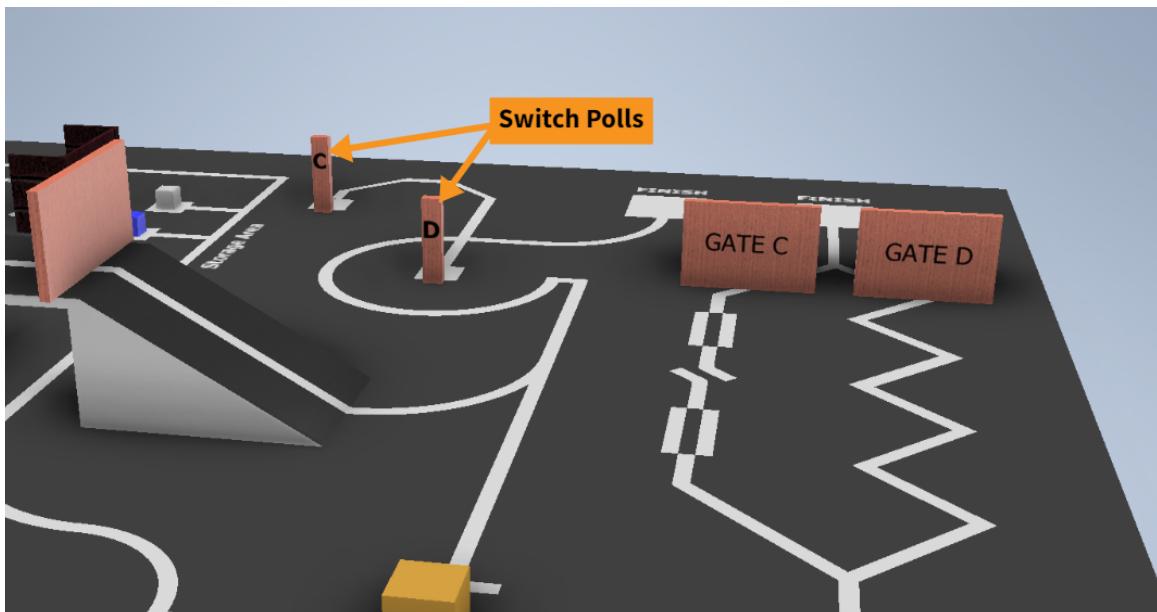
- Next, the primary robot should identify the hazardous crate according to the color. Then the robot should pick up the crate and carry it to the safe zone. At the safe zone there is a hatch with a label “unloading area”. After reaching the unloading area, the robot should drop the hazardous shipping crate through the hatch.



- If it's done correctly the GATE B will open automatically. So the assistant robot can cross the bridge and move to the other side of the arena.



- After the bridge crossing, the assistant robot should **turn right at the junction** and **push the yellow obstacle box away from the primary bots path** and return back to its path and continue towards the finish squares.
- There are two **switch polls** on the path. Each one for the GATE C and Gate D. **The assistant bot should activate one of the switches or both.** (Letter on the side of the switch poll indicates which gate it controls.)

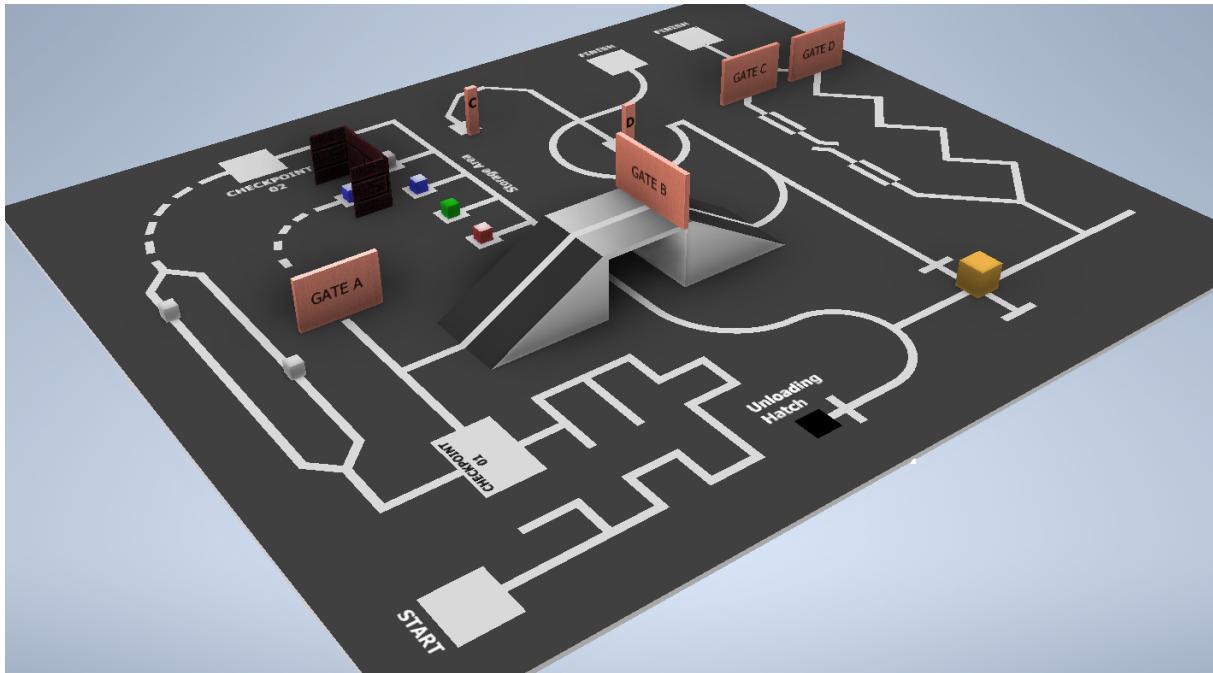


- To activate the switches, the robot should lightly touch the switch poll. (When the switch is activated the color of the switch poll LED will change)
- After that, the assistant robot can reach the finishing square.
- Now the GATE C or D or both are open and the primary robot can navigate ahead.
- There are two paths to navigate to the finishing square. One is a bit tricky but short in length. The other path is simple but a little bit long. However, the primary robot can choose any one of those paths and go to the finishing square to end the attempt.



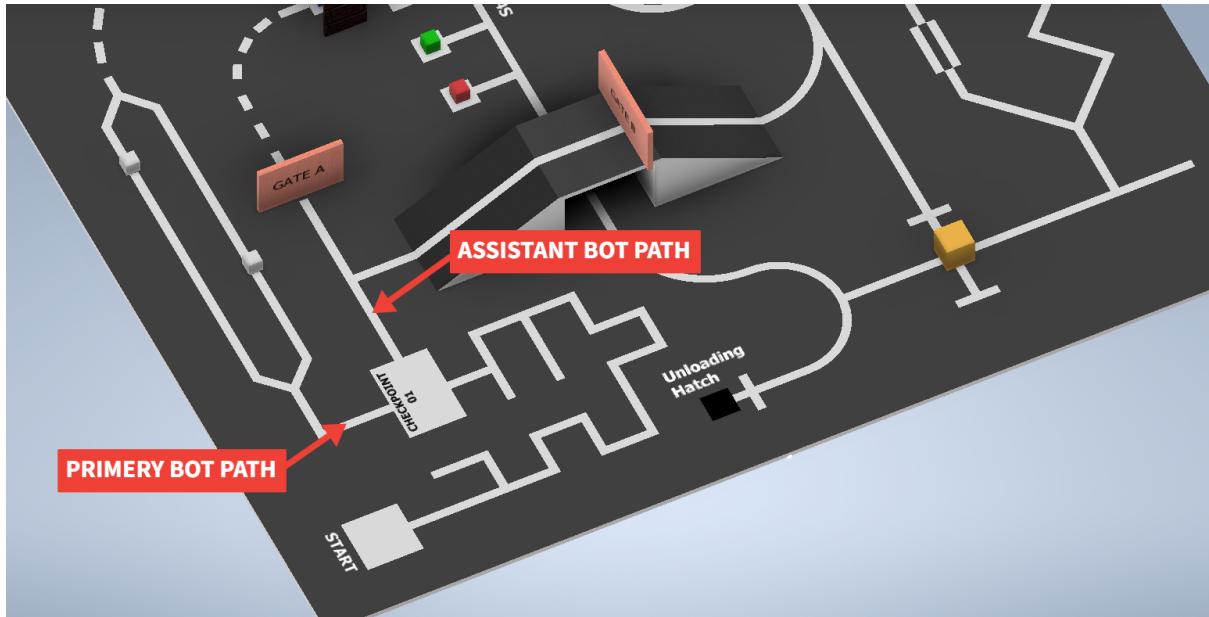
- The timer will be stopped when both robots reach the finishing squares.

ARENA SPECIFICATIONS



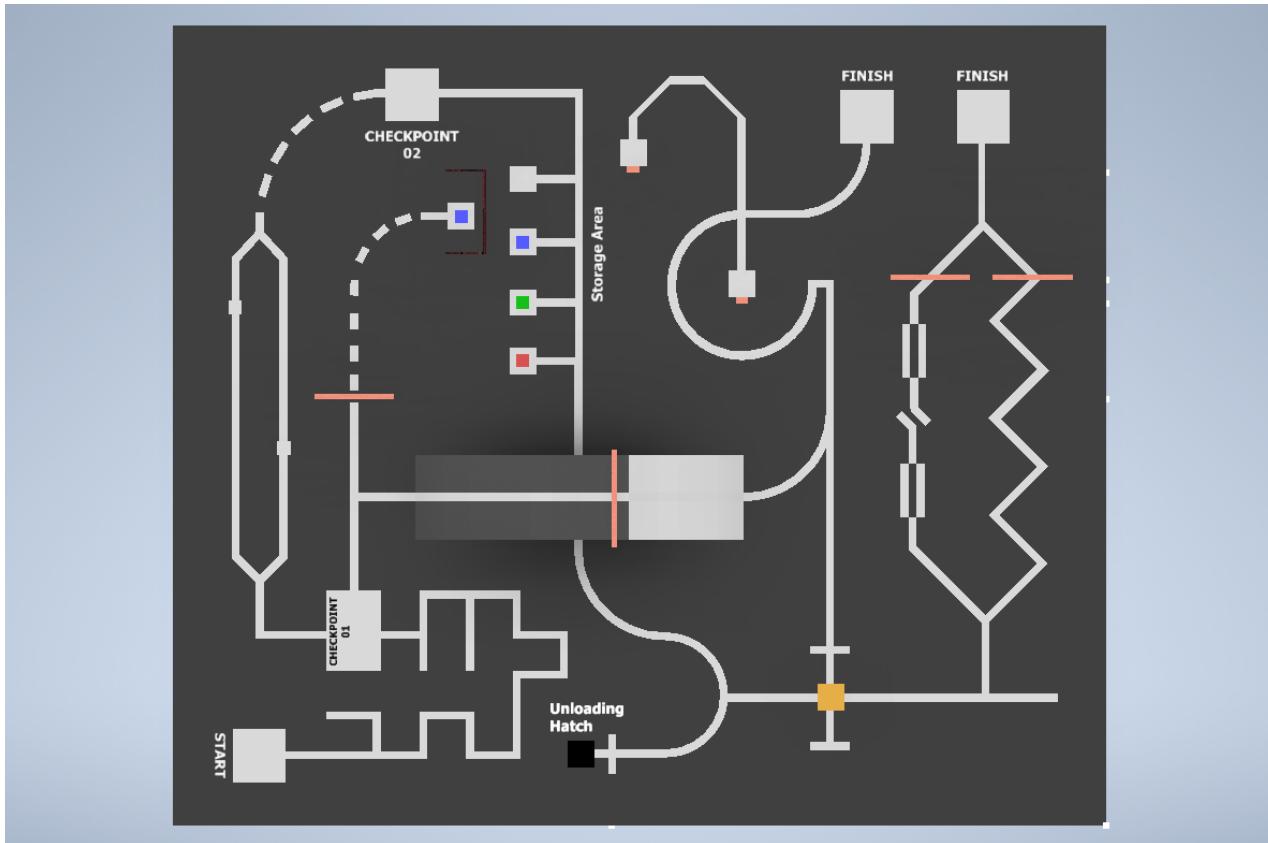
Arena will be opened to the public on **22 and 23 April** for calibrations and testing.
(Venue - SLTC City Campus, Trace Expert City, Maradana)

- At the beginning both robots should start together at the start square.
- Next robot should navigate through the line grid.
- Robot **cannot move on the grid intersections which have black squares.**
- **Position of those black intersection squares will be different on the competition day.**
- At the end of the line grid, there is a large white area. It is the first checkpoint.
- **Every line is 3 cm in width.**
- From the checkpoint, **there are two separate paths for the primary bot and the secondary bot.**

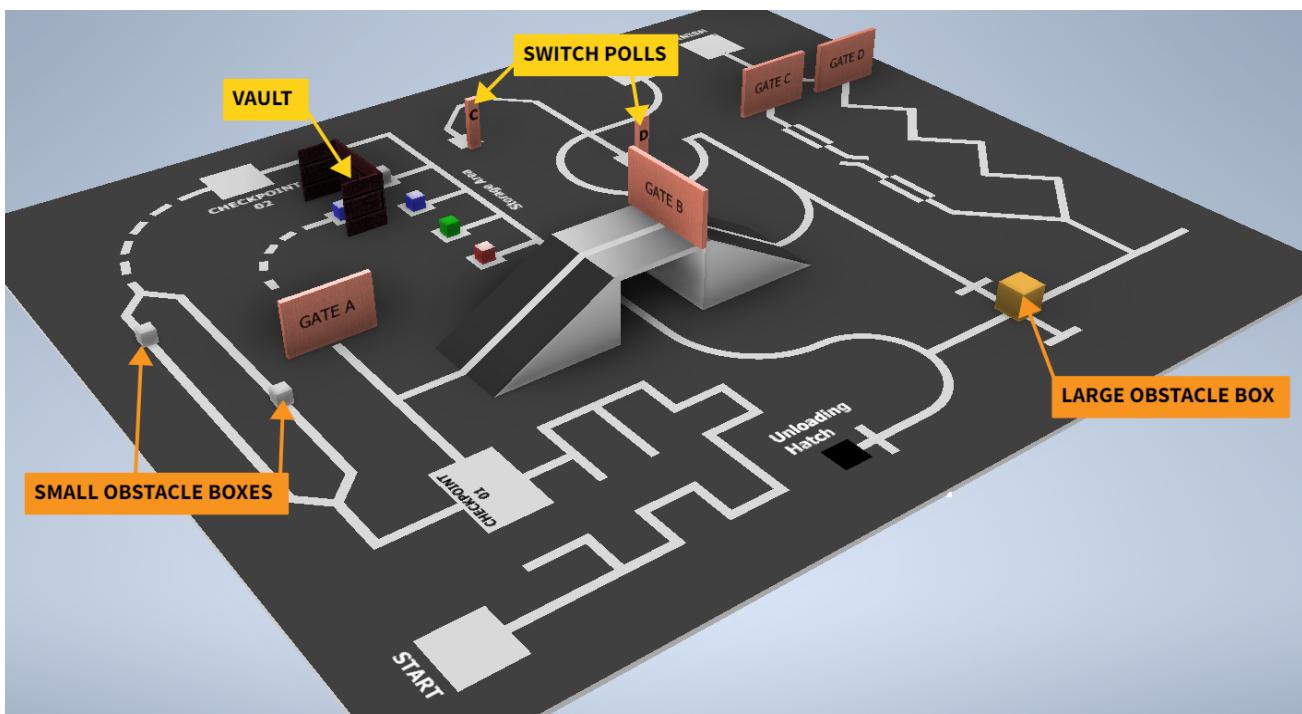


- There are 4 gates in the arena that will be **automatically opened** after completing the specific tasks. (For more details read the "Task" section)
- There are three types of boxes,
 - a. Small Obstacle boxes (white)
 - b. Large obstacle box (Yellow)
 - c. Other colored boxes - Red, Green, Blue and Grey (shipping crates that contain nuclear reactor cores)
- **Small obstacle boxes and other colored boxes (shipping crates) have the same dimensional profile (5 cm x 5 cm x 5 cm).**
- **Large obstacle box (Yellow) is 10 cm x 10cm x 10cm.**
- There will be two or three obstacle boxes in the primary robot lane.
- The unloading hatch is square-shaped and 10cm in length on each side.
- There are 2 switch poles in the arena. Each switch opens the letter specified gate. (A single light touch will activate the switch)
- 3D models and all the other dimensions of the arena are given below.

The surface of the actual arena in the competition might differ from the pictures provided.



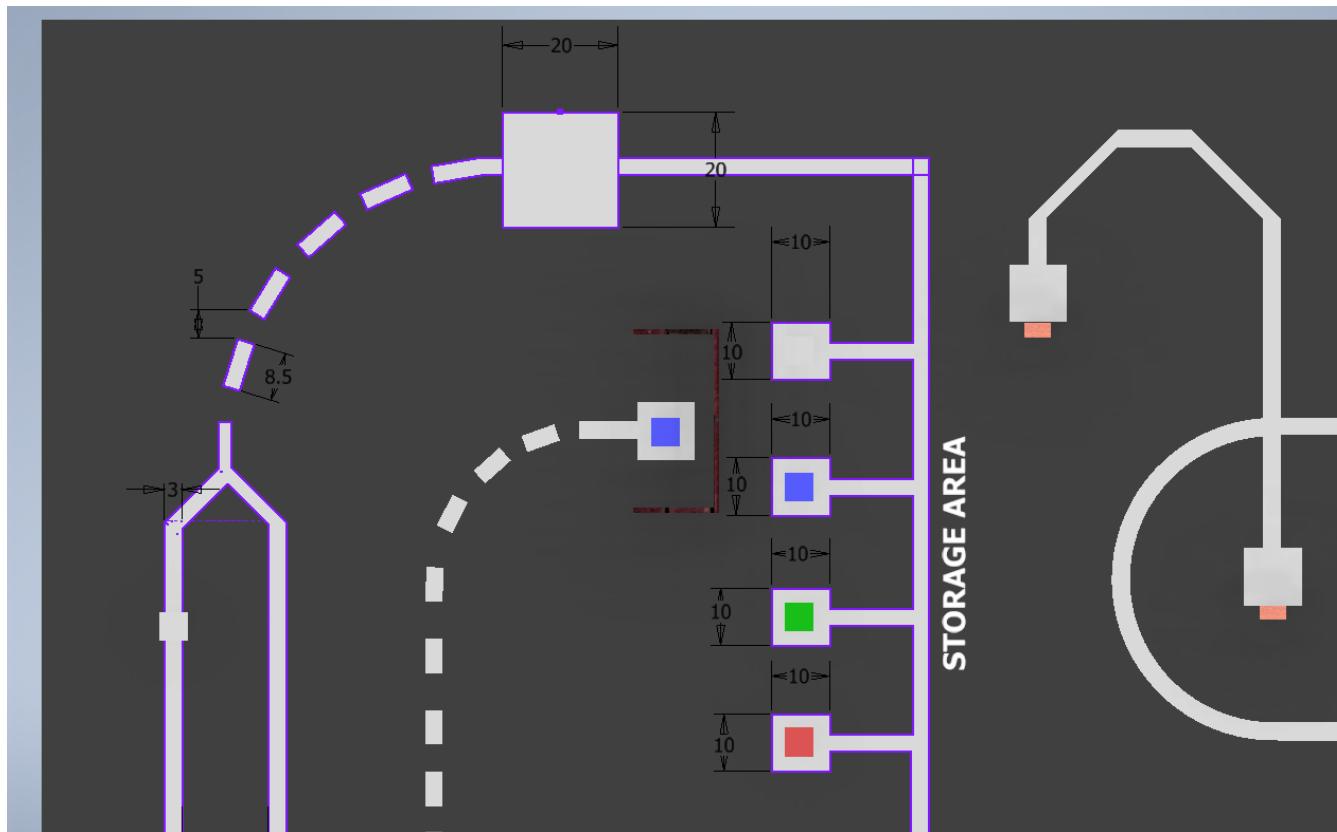
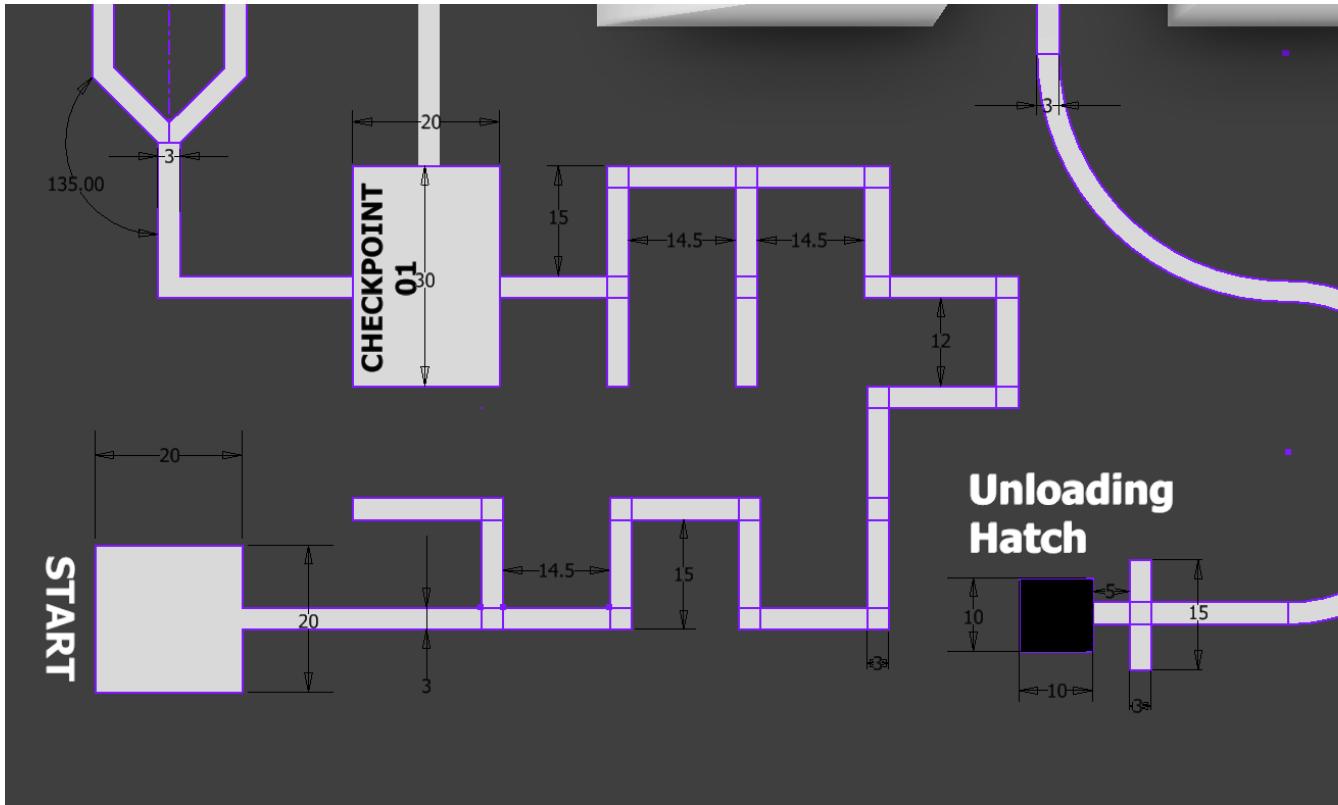
Top View of the Arena

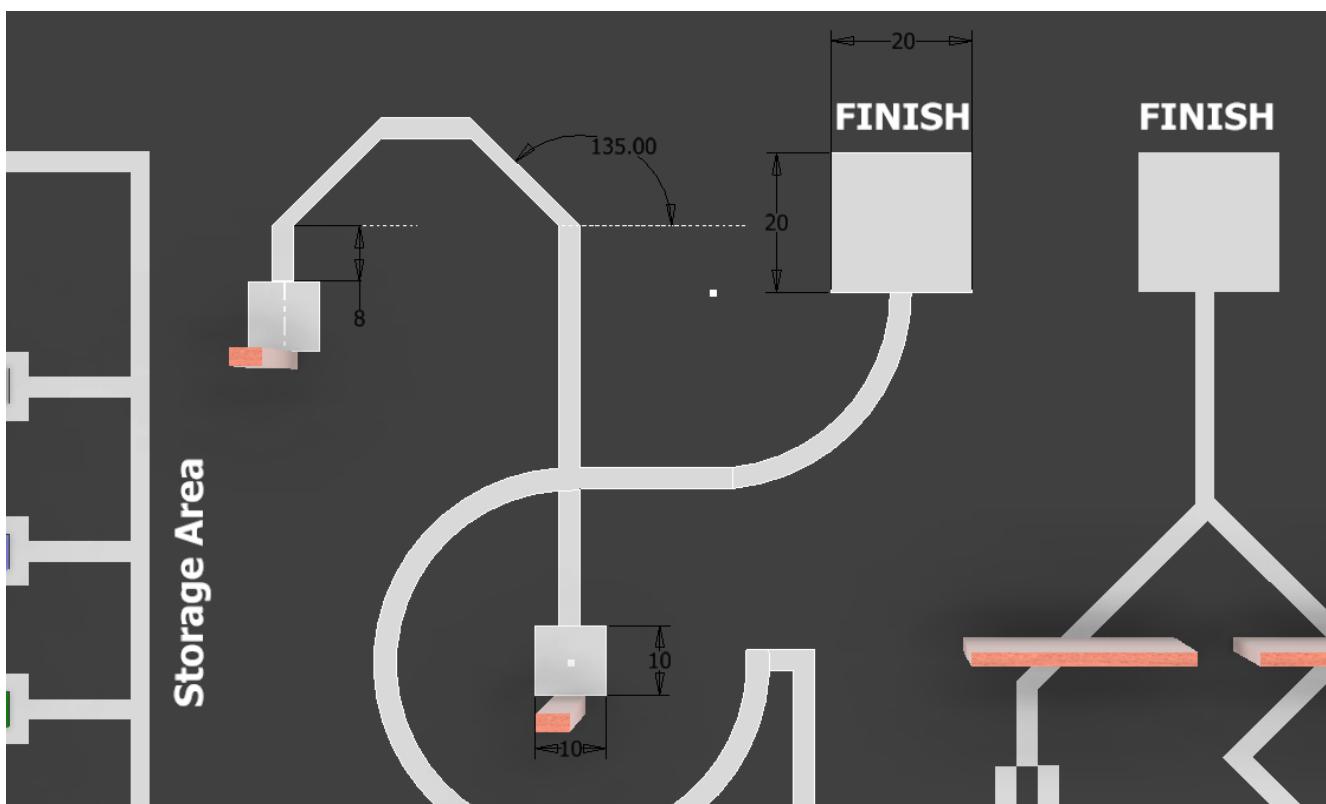
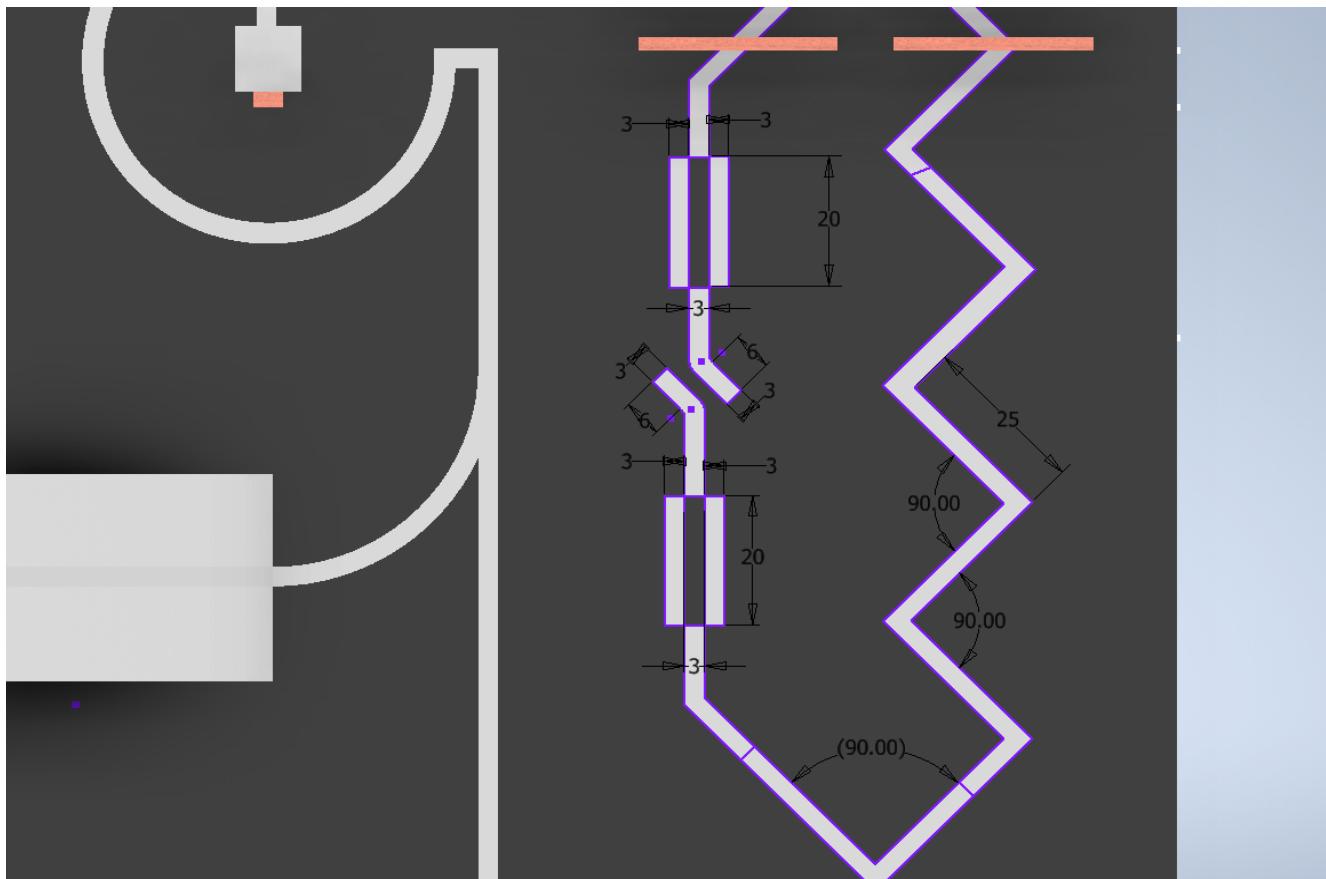


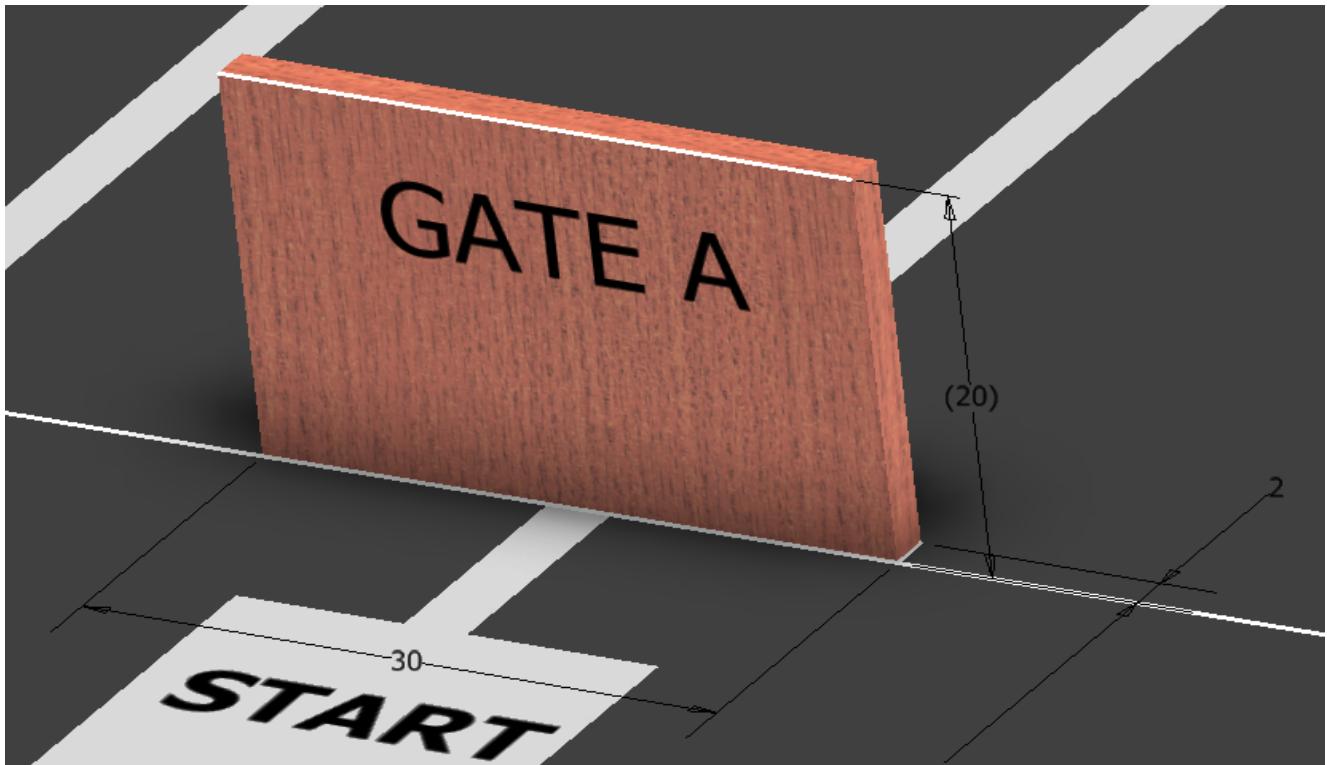
3D View of the Arena

Dimensions and Properties

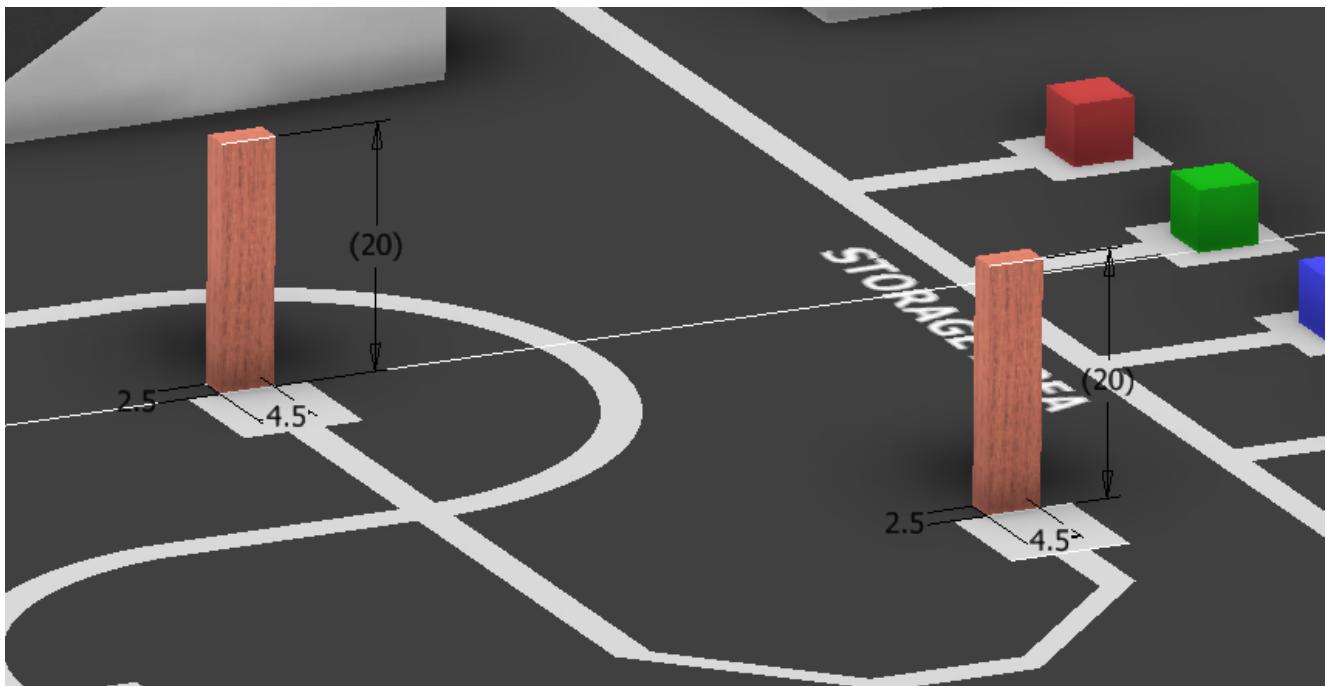
All the dimensions are in **Centi-Meters** (cm).



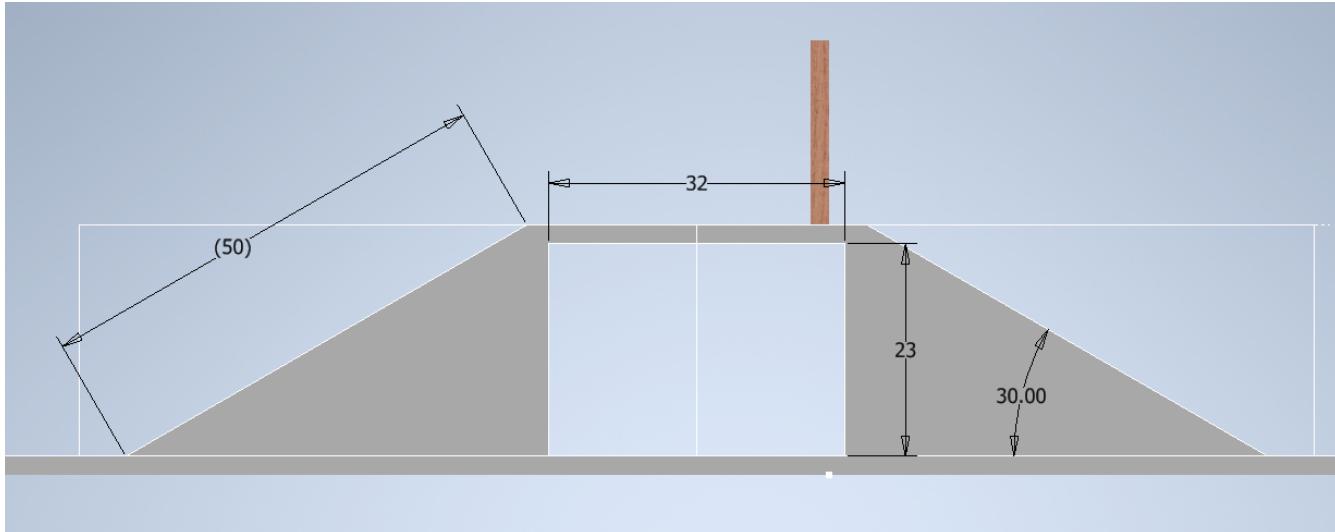




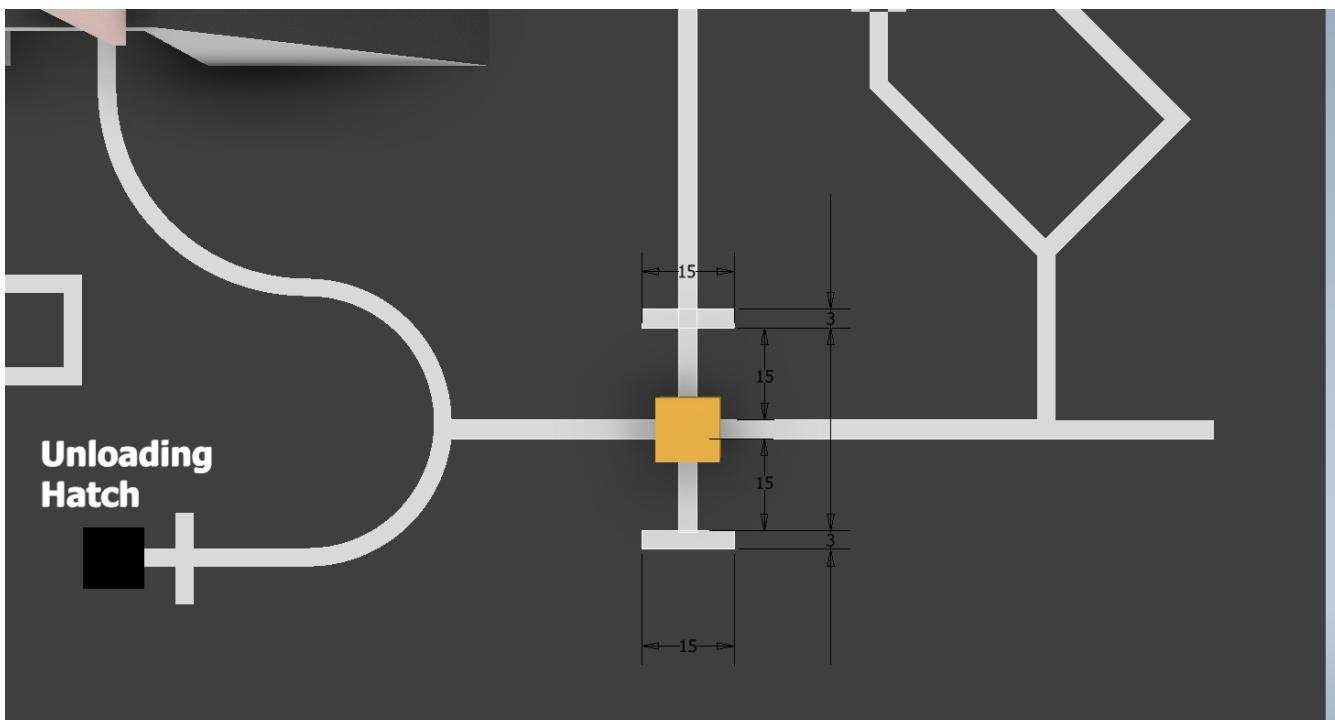
Gate dimensions



Switch pole dimensions



Bridge dimensions



Dimensions around large obstacle box

GENERAL RULES

- Both of the robots should only start the competition at the start square.
- The timer will be stopped when both robots arrive at their finishing squares.
- The robot should not cause any damage to the arena. Any kind of damage to the gaming platform would lead to disqualification.
- Robots should not leave any of its components behind in the arena.
- A total time of 15 minutes will be allocated for a team.
- A team can take up to 3 attempts within the next 15 minutes.
- The first 5 minutes are given for any kind of calibration and hardware changes of the robot.
- If they fail to finish calibrating within these 5 minutes, the extra time taken will be deducted from the time allocated for the three attempts.
- Once robots finish the attempt, remaining time is added as a timing bonus.
- We will provide a time schedule for the competition, the next team must report before the previous team completes the task.
- Software and Hardware changes are not allowed after placing the robot on the stage until the first attempt is over. If your robot faces technical malfunction in the first attempt, your team can fix it before the second and third attempts. If you couldn't repair your robot within 5 minutes, You can get your remaining attempts after the end of the primitive competition rounds, but there will be a penalty for the total points collected in the future attempts.

- You are not allowed to feed in any data regarding the arena, positions of the obstacles and the box colors during the software change.
- During any part of the task, if a robot deviates from a line and fails to return within 20 seconds, human intervention would be allowed, and the next trial has to be taken as a new attempt. You can also take a new attempt before the 20 seconds with the permission of the judges.
- Hardware changes are not permitted between attempts.
- The main robot can move the box using any means without damaging the arena.
- Players cannot manually alter the orientation of the primary robot or the assistant robot during an attempt. Players are not allowed to communicate with the main robot or the assistant robot by any means (i.e. button presses, radio communication, and optical communication). Such actions will result in immediate disqualification.
- No timing bonus will be given unless both robots complete the task.
- There will be checkpoints in the arena, Marks will be added when robots reach a checkpoint after completing a task. But in each new attempt, the robot will have to start from the very first task and continue.
- If two teams complete the task with exact same timing those teams will compete again at the end of the current rounds.
- **The decision of the panel of judges will be final.**

ROBOT SPECIFICATIONS

- The dimensions of both robots should not exceed 20 cm x 25 cm x 20 cm (width x length x height). The robots which do not address these criteria would be disqualified.
- Both robots should be completely autonomous without any sort of remote control.
- Only electronically powered robots are allowed, also **robots should be powered by internal power sources**. External power supplies are not allowed.
- Primary Robot should be capable to perform the following tasks:
 - Carrying a 5cmx5cmx5cm wooden box along the arena.
 - Communicate with the assistant robot.
 - Follow the continuous lines and dotted lines.
 - Identify the colors of the boxes.
 - Detect obstacles in the arena.
- Assistant Robot should be capable to perform the following tasks:
 - Follow the continuous lines and dotted lines.
 - Communicate with the primary robot.
 - Identify the colors of the boxes.
 - Detect obstacles and barriers in the arena.
 - Climb up and down on a 30 degrees angled non-slippery surface.
 - Push the obstacle box.
- Competitors can use readymade chassis, microcontroller boards, sensor modules, and other electronic modules.
- The robot should be able to operate under the provided indoor lighting conditions.
- The robots should not leave any of their components behind in the rest of the arena.
- If the judges consider that your robots have a high risk of damaging or sulling the arena, they will not permit them to run.

INITIAL QUALIFICATION REQUIREMENTS

1. Size is within the limit (Each robot should fit inside a 20 cm x 25 cm box with a 20 cm height constraint).
2. No external communication or manual inputs.
3. Battery voltage should be less than 24V.
4. Robots shouldn't damage the arena, and judges have the full authority to terminate the run in such cases.
5. No losing parts.
6. No leaking oils or other substances.

JUDGING

- The judges can ask for an explanation of any mechanism on the robot and there would be an immediate disqualification of defaulters of any kind.
- Robot's code will be checked upon the request of judges.
- Penalties will be mainly given,
 - (a) For inaccurate line following and obstacle detection.
 - (b) For incorrect color identifications.
 - (c) If the robot failed to carry the boxes.
 - (d) For lost communication between the two robots.
- The final judging criteria will be given on competition day.
- All of the participants will receive a valuable certificate at the end of the competition.**

TEAM ORGANIZATION

Forming a Team

1. Create a team with a maximum of **five members**. Solo entries are also accepted.
2. Students from different educational institutes can form a team.
3. Make up your own Team Name.
4. All students possessing a valid identity card (Soft copy or Hard copy), issued by the respective educational institutes are eligible to participate in the event.
5. All the members of the team should not exceed 28 years of age.

University Category Competition Coordinators

Thilina Madushan

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Please don't hesitate to contact us if further information or assistance is needed.

Deadline for Applications: 15th April 2023

Our Official Website : <https://www.seds.sltc.ac.lk/projects/technomind/>

Registration Link: <https://forms.gle/7byuNS2r49Y9gXcq7>