SLR 2025

SRILANKAN ROBOTICS CHALLENGE 2025

Technical Specifications

School Category

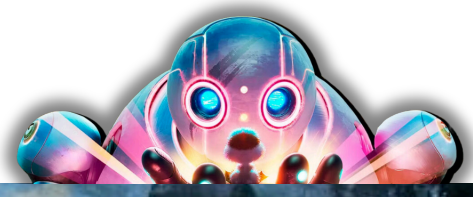
ENTC
Electronic and Telecommunication Engineering

SCHOOL CATEGORY

The field of Robotics has acquired much interest for the past two decades and with the breakthroughs in the field of AI and sensor technologies, it has gained unprecedented traction in the present day. The Electronic Club of the University of Moratuwa and the Department of Electronic & Telecommunication Engineering initiated the 1st Sri Lankan Robotics Challenge (SLRC) in 2012 and continued its legacy for 11 consecutive years making it one of the longest-running and pioneering Robotics festivals organized in Sri Lanka.

The goal of the SLRC is to bring together all robotics enthusiasts from all over the country and provide them with a platform to showcase their skills in a competitive arena. In the School Category, the primary focus is to spark school students' interest in robotics while fostering their creativity and problem-solving abilities, encouraging them to apply these skills to real-world challenges in the field.

Your task will be to build a robot capable of completing the specified challenges while adhering to the guidelines outlined in this document. The competition will include tasks including line following, object detection, and metallic object retrieval. Starting this year, a special Hidden Task has been introduced, requiring on-the-spot coding to further test competitors' problem-solving abilities. Winners will be entitled to valuable cash prizes and certificates awarded by the University of Moratuwa. This is a call to all school students eager for a challenge! Seize this opportunity to showcase your technological skills to a nationwide audience and make your mark!



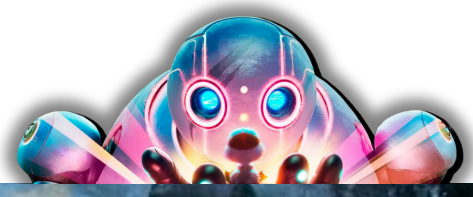
FAR AWAY ON A REMOTE ISLAND...

A robot designated ROZZUM-7134, created by the Universal Dynamics company, became stranded after its transport ship was wrecked in a catastrophic accident. While exploring the unfamiliar forest, inhabited only by animals who were initially alarmed by the robot's presence, ROZZUM-7134 discovered a vulnerable gosling named Brightbill in need of care.

Over time, the robot; now affectionately known as **Roz**, became a caretaker and friend to Brightbill and a clever fox named Fink. Roz's primary tasks were feeding Brightbill and teaching him how to swim and fly, all while adapting to the wild environment. With the help of the island's animal inhabitants, Roz successfully prepared Brightbill for his migration, ensuring he was ready to thrive on his own, thus completing all of his given tasks. In the process, Roz transformed from a machine into a beloved member of the island's community.

After Brightbill departed, Roz no longer had tasks to accomplish. She retreated to her dome for the winter, entering hibernation mode to conserve her battery life. The animals of the forest also settled into their shelters, preparing for the long, cold months ahead. But as the winter grew harsher with each passing day, the freezing temperatures became unbearable. Many of Roz's animal friends struggled to survive in their shelters as the icy storms raged on.

Unaware of the worsening conditions outside, Roz remained in her hibernation mode as her solar panels were unable to recharge in the absence of sunlight. It wasn't until her loyal friend, Fink the fox, braved the storm to wake her that Roz learned of the animals' danger. Without hesitation, Roz ventured into the relentless blizzard and One by one, she searched for her freezing companions, carrying them back to her warm, protective dome.

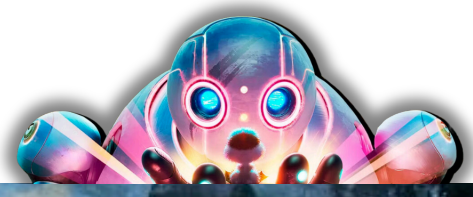


However, as Roz pushed herself to save more animals, her battery level dropped dangerously low, falling below 10%. Her systems began shutting down to preserve power, including her cognitive subsystem. Unable to think clearly, Roz found herself immobilized in the bitter cold. Meanwhile, many animals were still out there, battling the storm, relying on Roz to save them. Time was running out, and Roz needed a solution.

Soon, Roz devised a solution: she accessed a secret backdoor in her communication system to contact one of her human developers. You, an engineer who had worked tirelessly on the Rozzum Robot series for Universal Dynamics, had implemented this very backdoor as a precaution for situations where the robots might encounter grave danger. Now, Roz's urgent message reached you. With her cognitive subsystems nearing shutdown, she asked for your help to save her animal companions. Recognizing the critical situation and moved by Roz's determination, you decided to step in and guide her remotely to rescue the remaining animals.

Time is of the essence. Roz's battery is rapidly draining, and every moment counts. Your first task is to assess the situation: head to the dome and count the animals Roz has already saved. This will help you calculate how many remain out in the freezing cold. Using this information, you must determine the best path to reach the trapped animals. The journey will not be easy as the visibility is poor due to the relentless storm, and the path is fraught with unexpected challenges. But Roz's advanced hardware and your quick thinking can overcome any obstacle.

Also be prepared as there is a hidden task lie along the way, testing your ability to navigate Roz through her remaining challenges. These tasks are solvable using Roz's existing hardware and most probably with the existing programming, so no external tools are needed—only your sharp problem-solving skills and a brave, determined heart. The fate of Roz's friends depends on you. Can you save them all before her battery runs out? The clock is ticking, and the storm isn't letting up. You need to act fast!



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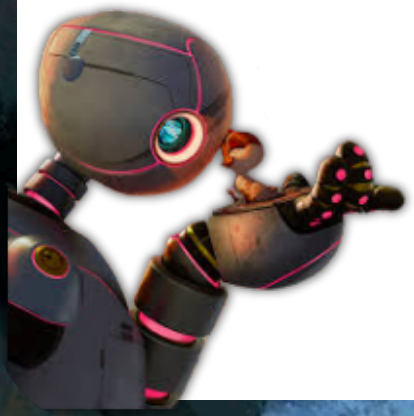
CONTENT



TASK

In this year Sri Lankan Robotics Challenge, School Category task contains following sub-tasks.

- Line following while counting boxes
- Dashed line following
- Hidden task
- Metalic object picking

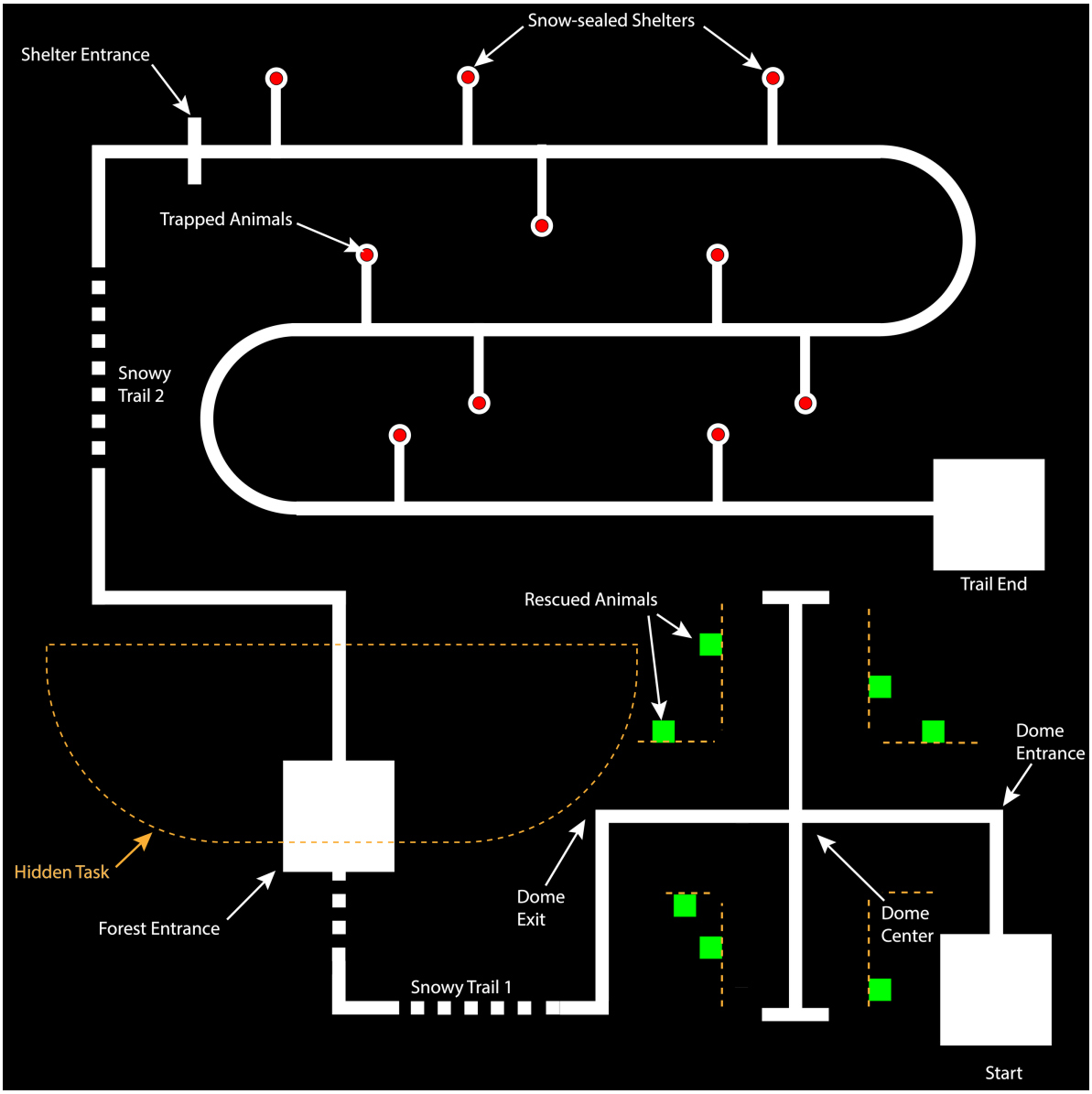
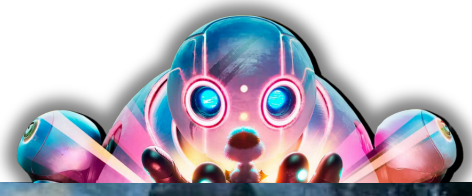


Figure 1 - Sample Arena drawn to scale



After gaining control of Roz, your first task is to inspect the dome and count the number of animals she has already rescued. You will need to traverse the entire dome and keep track of each animal you encounter. As you count, you need to indicate the total number of animals counted so far using LEDs.

Counting rescued animals

- After placing the robot in the starting square, the robot must move to the “Dome Entrance” turn. From there, the counting task will begin.
- The rescued animals are represented by boxes of similar dimensions, placed at equal distances on both the left and right sides of the given path.
- The robot needs to move along all the lines leading up to the “Dome Exit” turn, while counting the number of boxes it encounters along the way. Each tower should be counted only once, even if it is revisited during the traversal.
- The robot must not knock over or displace any of the boxes while counting.

Table 1 - LED sequences for the numbers

Number	Binary Representation	LED 4 (Left-most LED)	LED 3	LED 2	LED 1 (Right-most LED)
0	0000	Off	Off	Off	Off
1	0001	Off	Off	Off	On
2	0010	Off	Off	On	Off
3	0011	Off	Off	On	On
4	0100	Off	On	Off	Off
5	0101	Off	On	Off	On
6	0110	Off	On	On	Off
7	0111	Off	On	On	On
8	1000	On	Off	Off	Off

- As the robot counts the towers, it must display the current count using 4 LEDs in the sequences outlined in **Table 1**. Table 1 represents the LED sequence for each number between 0 to 8 (binary number format).
- Each time the robot detects a previously uncounted box, it should increment the displayed number by one and maintain that value on the LEDs until it identifies the next box. If the next box is a previously revisited one, then the displayed number should remain the same and no changes should occur.
- After the "Dome Exit" the counting task will end and robot needs to **display the counted number until it reaches the next turn.**
- After that,before entering the snowy trail, the robot should **display the remainder** obtained by dividing the final counted value by 4 (modulus 4) using the LEDs. The LEDs **should remain lit** in the corresponding binary sequence until the robot reaches the "Forest Entrance"

Example:

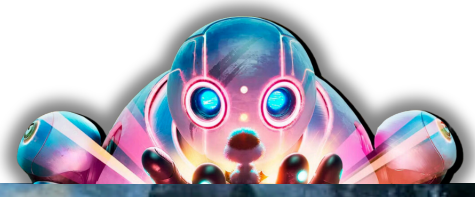
If Roz counted 6 boxes during traversal:
Remainder to display = Remainder of 6 ÷ 4 = 2
LED sequence = **0010 (Off, Off, On, Off)**
= LED sequence for number 2 from table 1

Navigating Snowy Trails

- From the "Dome Exit" turn, guide Roz along the snow-covered path, up to the "Forest Entrance" square.
- At some sections, the path will be poorly visible due to snow which is represented by the dashed line as "Snowy Trail [_]" in the diagram (Figure 1).
- The robot needs to follow the dashed lines and reach "Forest Entrance" while displaying the numbers using the 4 LEDs as mentioned previously.

Hidden Challenge

- At the "Forest Entrance", you will face a hidden challenge, which will only be revealed on the day of the final competition.

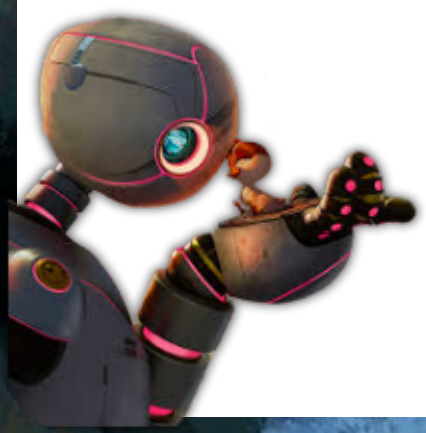


- Before the arena trials begin, you'll have 30 minutes time to program and test your robot in the competition arena. However, once the competition starts, no further modifications will be allowed.

Once the hidden challenge is completed, navigate the robot along the dashed line labeled *Snowy Trail 2*, which winds through the forest, leading to the area where the animals are trapped. The entry to this area is marked by the point labeled *Shelter Entrance*. From this point forward, your objective is to rescue as many animals as possible before reaching the *Trail End* square.

Rescuing Trapped Animals

- Along the path, **2-rupee coins** (marked by red circles in Figure 1) will be placed at a fixed distance from the line, representing trapped animals.
- The robot must navigate the path, collect the coins, and transport all collected coins to the *Trail End* square



ARENA SPECIFICATIONS

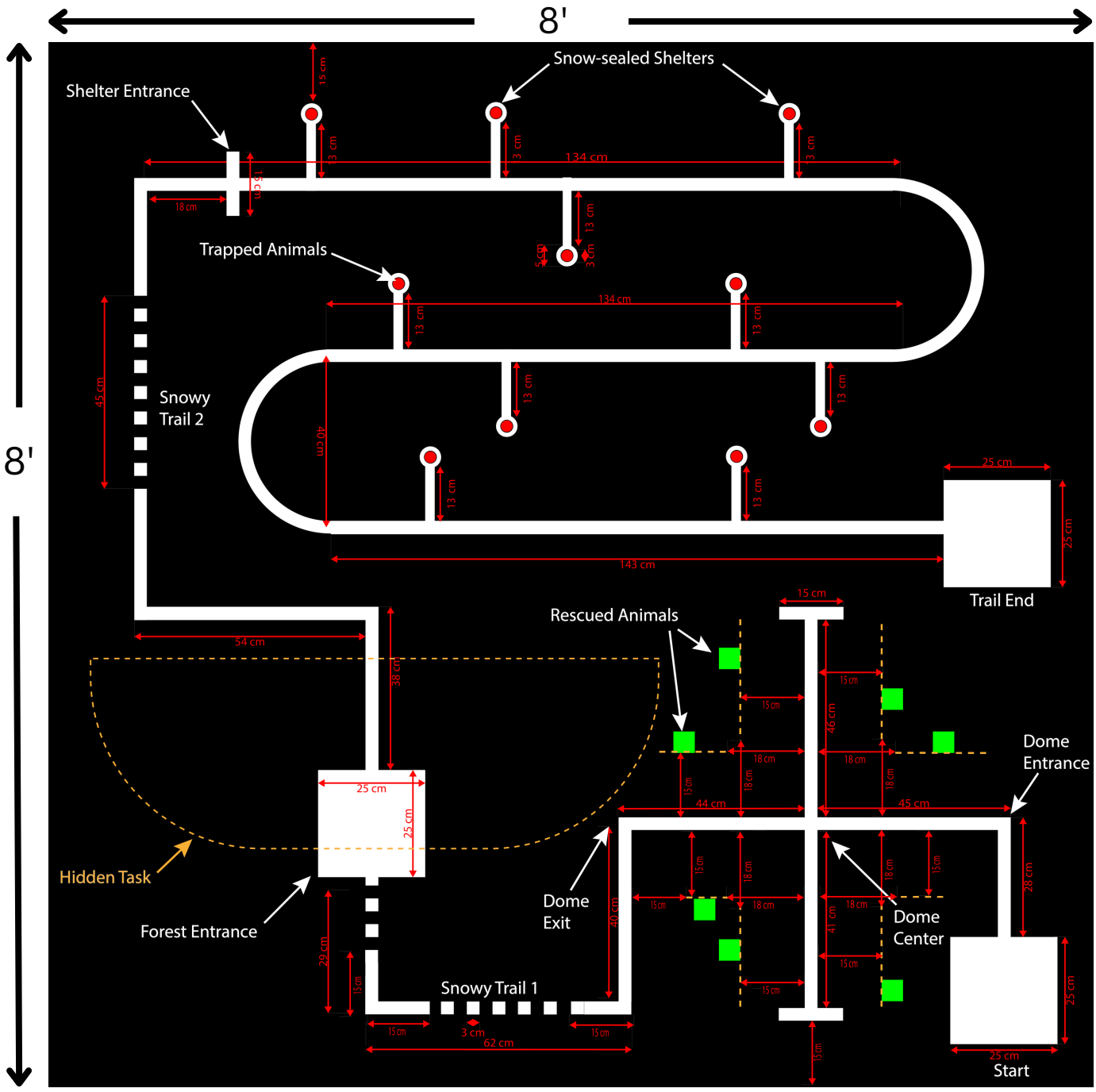
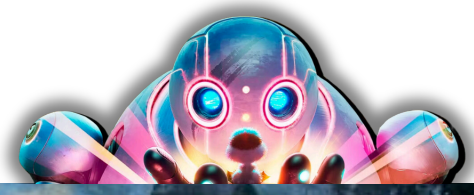


Figure 2 - Sample Arena drawn to scale with dimensions



Key Arena Specifications

- *Start, Forest Entrance and Trail End* squares are white squares of **25 cm x 25 cm.**
- Line segments are white lines with a **width of 3 cm** on a black background.
- Since the whole arena can't be constructed on a single board, there can be slight differences in height at the boundaries of the 8 ft x 4ft (240 cm x 120 cm) boards.
- The minimum distance between the **edges of the lines and the edges of the arena will be 15 cm**.
- The surfaces of the lines and the walls will be matte-finished. The type of sticker used will be "**buffel**" stickers.
- All dimensions mentioned throughout this document are subject to a maximum error margin of ±0.5 cm.
- The minimum length of a straight line segment will be **20cm**.
- There will be a T-shaped layout as given in Figure 3 where there's an end of a line with top part of the T being a **15 cm**.

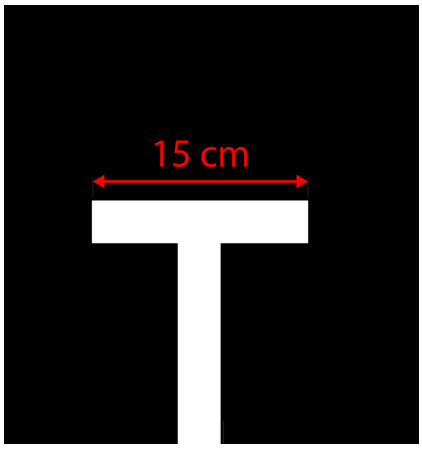


Figure 3 - End of line

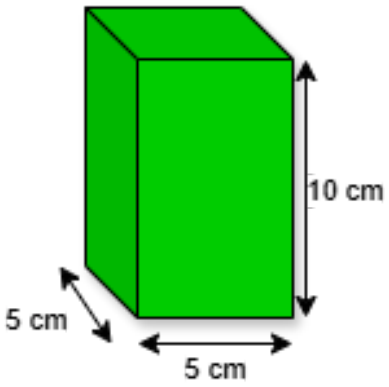
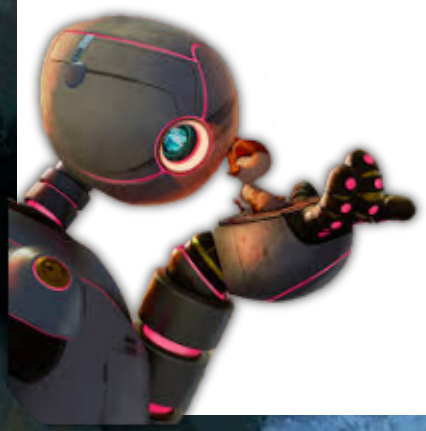


Figure 4 - Box Dimensions



Task-specific Arena Specifications

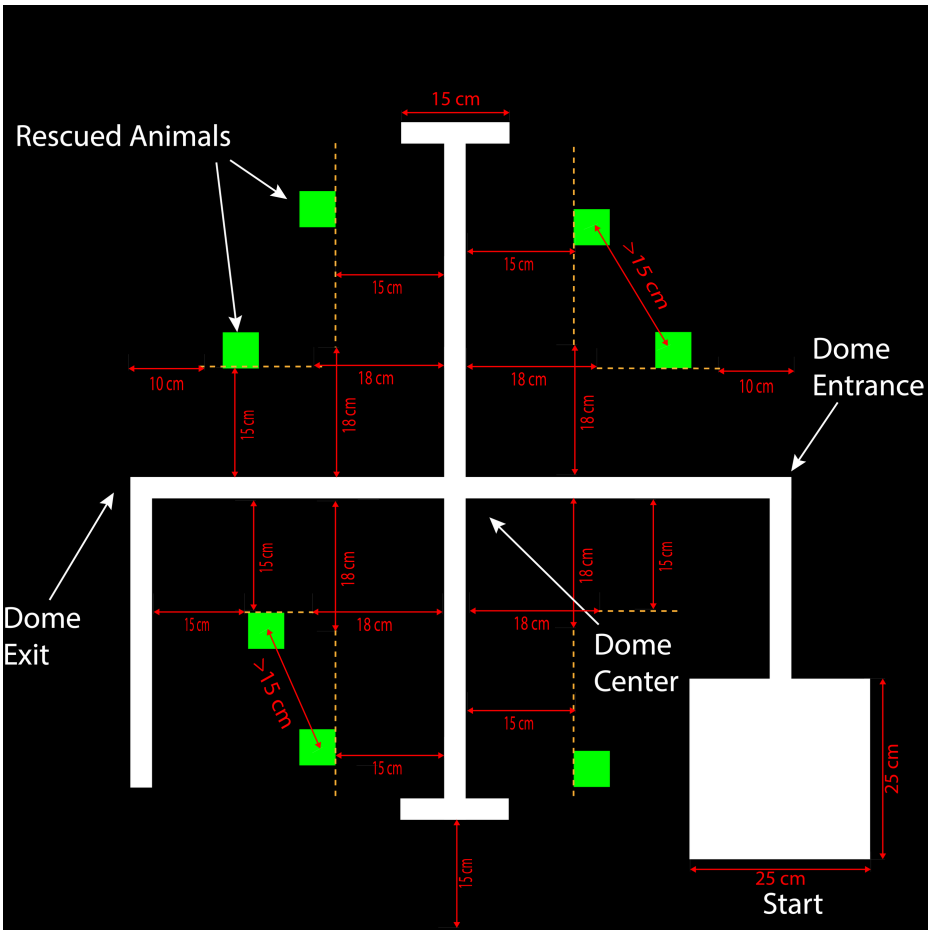
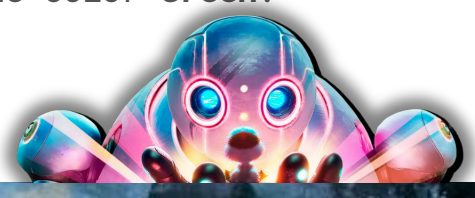


Figure 5 - Box Counting Task

- In the box-counting task, each contestant will have a different number of boxes placed in the arena, with a **minimum of 1 and a maximum of 8.** The center-to-center distance between any two boxes will be **at least 15 cm**. Boxes will only be positioned in the designated areas marked by **orange dotted lines** in Figure 5**.**
- Each box will have dimensions of **5 cm × 5 cm × 10 cm (L × W × H)** and will be positioned **exactly 15 cm** from the line edges. However, near the Dome Center, no boxes will be placed within an 18 cm distance from the line edges. As shown in Figure 5, this means there will be a **39 cm × 39 cm square area centered around the Dome Center where no boxes are placed**.
- The overall line layout will remain the same and the junction is **not symmetrical**.
- The boxes are of the color **Green**.



- Both dashed lines sections *Snowy Trail 1* and *Snowy Trail 2* will have similar dimensions, with gaps and dashes matching the specifications provided in Figure 7.
- The hidden task will be located at the designated spot shown in Figure 6 and will fully comply with the Key Arena specifications.

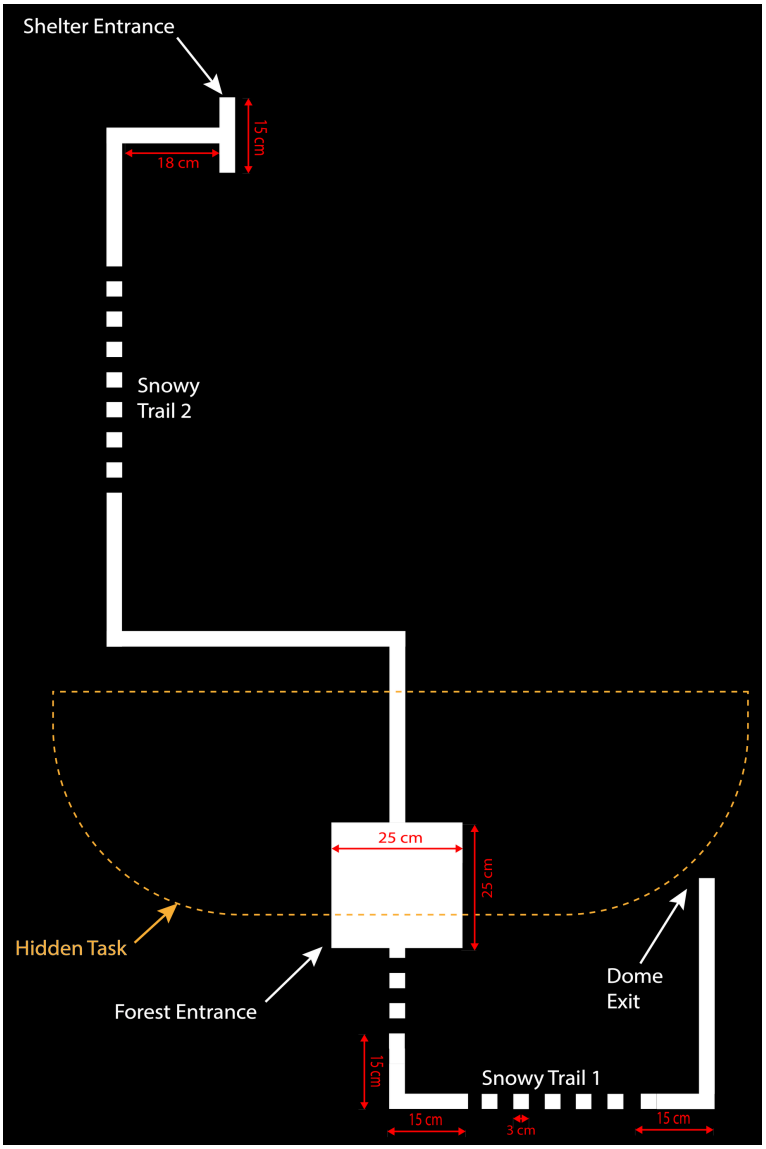


Figure 6 - Dashed Line Following & Hidden task

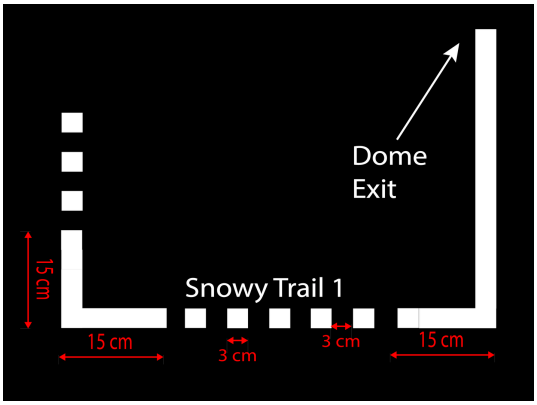


Figure 7 - Dashed line dimensions

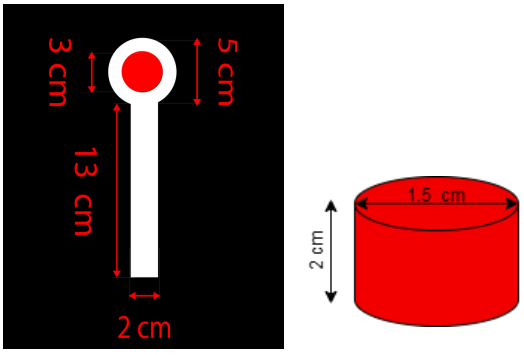


Figure 8 - Branch and support dimensions

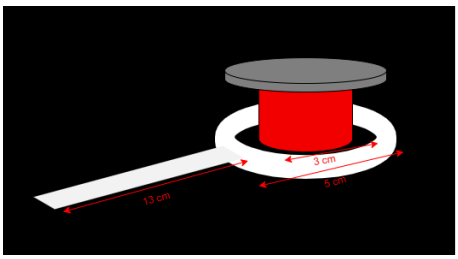


Figure 9 - Coin Placement

- The metallic object-picking task involves collecting standard 2-rupee coins, each with both metallic faces exposed. A **total of 10 coin**s will be placed within a branch-like line structures as shown in Figure 8, with all branches having uniform dimensions.
- Each coin will be placed on a **support cylinder**, as shown in Figure 8, with a **diameter of 1.5 cm and a height of 2 cm**. This support will elevate the coin 2 cm above the arena surface. Horizontally, the center of each coin will be positioned **15.5 cm from the line edge** (13 cm + 2.5 cm), as illustrated in Figure 9.
- The robot's path will follow the layout in Figure 10, featuring semi-circular lines with a 40 cm diameter. However, the exact **placement of the coins and branches may vary**.

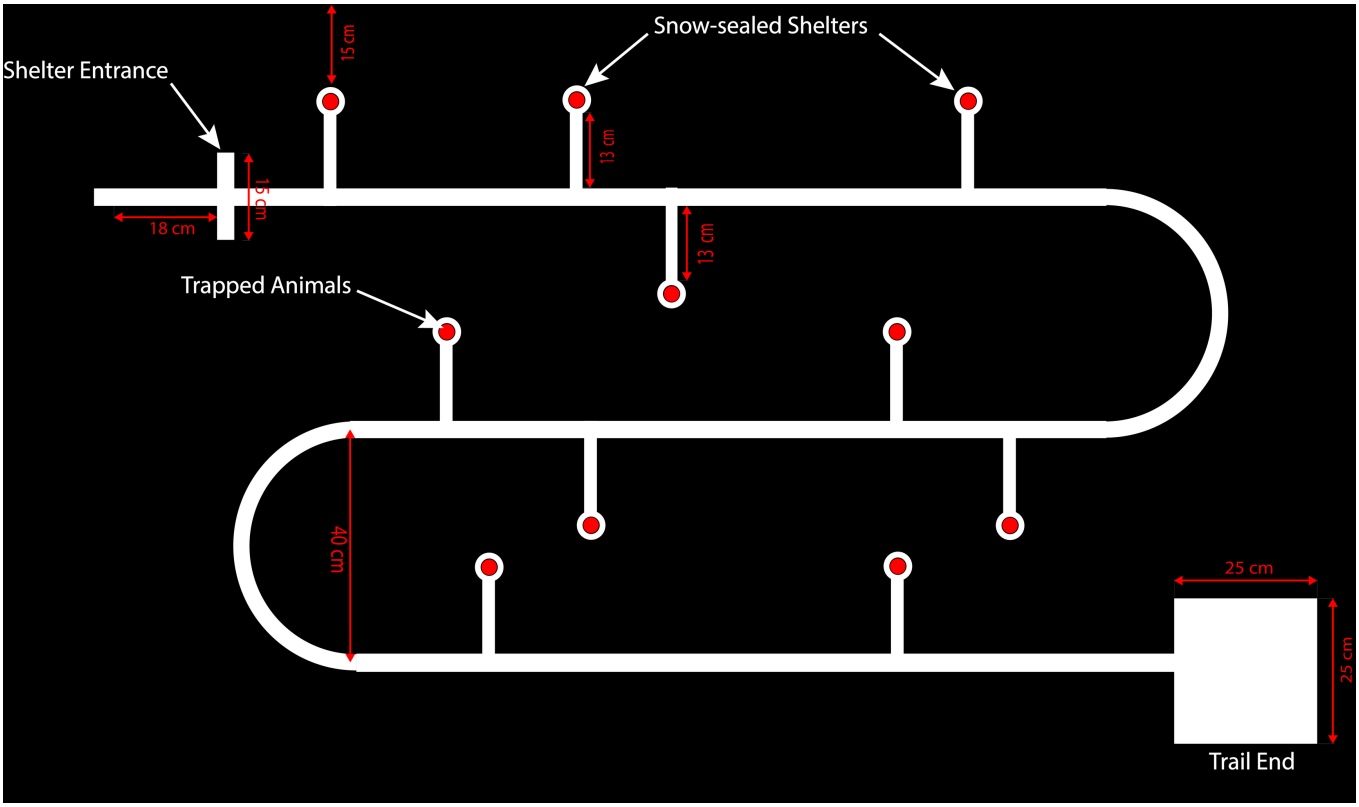
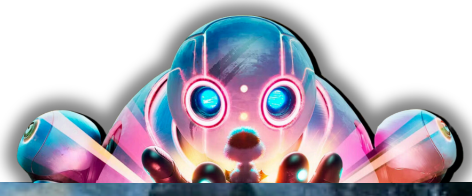


Figure 10 - Metalic Object Picking Task



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ROBOT SPECIFICATIONS

- The robot's dimensions **must not exceed 25 cm x 25 cm** (width x length) at the start of the competition, and this will be verified before the first round by placing the robot inside a 25 cm x 25 cm box.

- **During operation, extensions** that temporarily exceed the initial size constraints are allowed to be deployed; however, these extensions must retract to remain within the given dimensions when the robot starts at the starting square. There are no limitations on the robot's height.

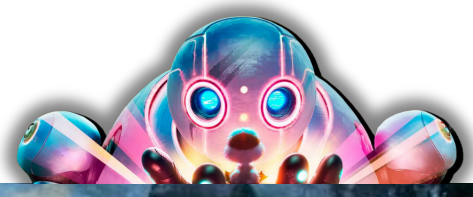
- The robot **should be completely autonomous**. Any remote control would lead to the disqualification of the robot.

- The robot should be powered with an internal power supply with a **supply voltage not exceeding 24V**. The final unit, including the power source, should be within the dimensions specified above.

- The robot must be **built entirely by the team members**. Therefore, no off-the-shelf Lego kits or assemblies are allowed except for the readymade processing boards, sensor modules, drive gears, arm/gripper, and other electronic modules.

- The robot **should not cause any damage** to the platform (arena). Any damage to the arena leads to disqualification. If the judges feel that a robot has a high risk of damaging the arena, they can deny the attempt.

- The robot should be **activated using a single start switch** placed on the robot itself. Therefore, the robot should have a simple starting procedure.



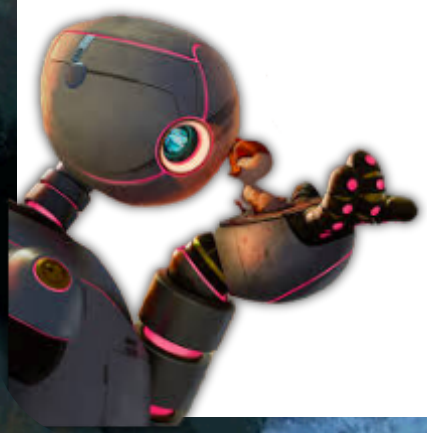
- The starting procedure of the robot should not involve giving the robot any manual force or impulse in any direction.

- The robot should be able to **operate under provided lighting conditions**. The robot cannot transform into two robots during gameplay.

- There must be a **clear way to indicate when the robot has completed its task**. This will be used to measure the completion time (e.g., by turning on an LED). You can reuse the existing LEDs that was utilized for previous tasks.

- The minimum distance between the middle of the lines and the edges of the arena will be 15 cm. The robot should be designed such that it won't fall out of the arena.

- The robot should not leave any of its components behind in the rest of the arena.



RULES AND REGULATIONS

General

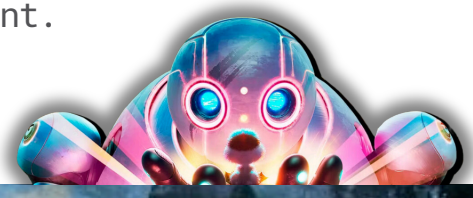
- There won't be any arena changes once a round has started. All teams will compete in the same arena with an identical layout, except for variations in the number of boxes for the first task.

- Each team must **designate one member** responsible for programming the robot for the hidden task. After the hidden task is revealed, the appointed member must **report within five minutes**, as the hidden task programming session will commence simultaneously for all teams.

- During this session, the designated member is strictly prohibited from seeking external assistance, whether in person or via any messaging platforms. While contestants are permitted to browse the internet, the use of AI chatbots or Large Language Models (LLMs) is strictly forbidden. The organizers will closely monitor all participants, and any violation of these rules will result in immediate disqualification from the competition.

- All teams will be given a fixed preparation period, **typically 30 minutes for coding and arena testing** before the official trials begin. Once this period ends, robots must be returned to the organizers. Teams will receive their robots again only when they are called for their attempt.

- If a robot fails to complete a task, the team may choose to **skip that task and reposition the robot at a designated checkpoint to continue with the next challenge**. For example, if the robot is unable to complete the hidden challenge, the team may opt to skip it and start from the *Forest Entrance* square to proceed with the subsequent tasks. However, opting to skip a task will result in a **penalty of 100 points**, which will be deducted from the team's overall score. Currently, the *Forest Entrance* square is the only designated checkpoint.



- Note that restarting from a checkpoint will be counted as a new attempt.

- The contestants must be prepared to start **within 5 minutes** after the call; if not, the attempt is lost.

- A team should place the robot entirely inside its starting square at the start of its run. **When the judges give the signal, the robot can be switched on**. From then on, the robot should navigate autonomously. The contestants should not manually alter the orientation of the robot during the gameplay. Additionally, the contestants should not communicate with or control the robot during an attempt.

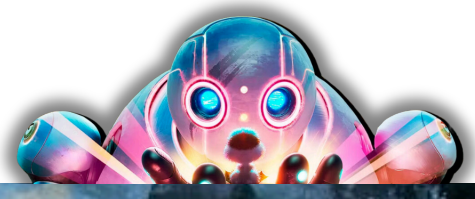
- A **maximum of 4 attempts** are given in a single round, and the overall time (The total time of all attempts taken) will be counted.

- A **maximum time of 15 minutes** (period of gameplay) is allocated per team. Therefore, all the attempts are reserved for this period only.

- Program or hardware modifications of the robot are **not allowed** within this 15-minute.

- The time taken to travel from Start square (Dome entrance) to the end square is called the **total run time**. The clock will start when the judges give the signal to start. The clock will stop when the robot reaches the End square (Trail End), and a proper indication is issued by the robot that it has completed the tasks. (e.g., lighting existing LEDs in a specific sequence)

- The clock **will not be paused** during an attempt.



- If the robot drifts out of the line to the extent that no part is on top of the line, the judges will consider it as **jumping out of line**. However, if the robot finds its way back to the line on itself, it can continue, provided that the distance skipped by the robot along the line is less than 30 cm. The judges may deduct points in this case. If the robot does not find its way back to the line within a skipped distance of 30 cm. which would be considered the end of that attempt, you will be allowed to remove the robot from the arena.

- In the box-counting task, contestants must place an indication or clearly specify when asked, which LED represents the LED1 (the left-most LED) and which represents the LED4 (the right-most LED) in the LED sequence in Table 1.

Calibration

- Two additional minutes before the gameplay period of 15 minutes is given for the calibration of the robot.

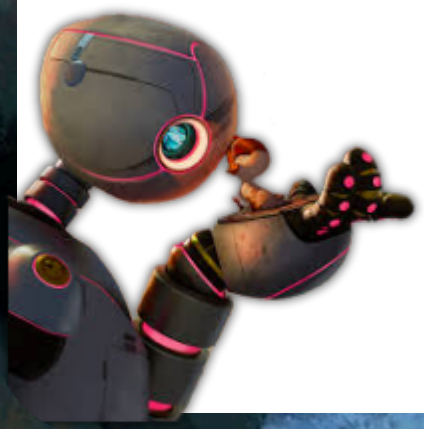
- The robot is permitted to use only the section of the arena from the starting square to the first left turn for calibration.

- Calibrations can only be done through external adjustments of the robot. Therefore, program changes nor hardware part replacements are not allowed. 4. The team can request the start of their first attempt before the calibration period ends. The gameplay period of 15 minutes will start at that moment. (The remaining calibration time will not be added to the 15 minutes given for the three attempts)

- If a team fails to finish calibrating within these 2 minutes, the extra time taken will be deducted from the period of gameplay of 15 minutes.

TEAM COMPOSITION & ELIGIBILITY

- A team can have a maximum of 5 members and a minimum of 1 member. Students from different schools can form a team, but the team should register under one school name.
- Each team member should be 20 years or below to be eligible to compete, and a student can only represent one team.
- All members of the team should be attending school or after A/Ls but should not be selected to attend nor registered at a university at the time of their participation in the competition.
- All the team members should have a valid document to prove their eligibility to participate in the competition.
- Multiple teams could compete, representing the same school, but one team can only submit one robot.
- Violation of the above conditions would lead to disqualification



MARKING CRITERIA

- Box Counting

  Let n be the total number of boxes placed in the arena for a contestant.
  - If the robot correctly counts n boxes while properly incrementing the LEDs - **120 points**
  - Any deviation from n will result in a deduction of **120/n points per error** from the maximum score of 120.
  - The final score for this task will be between 0-120 points. The overall score for this task **won't be negative**.

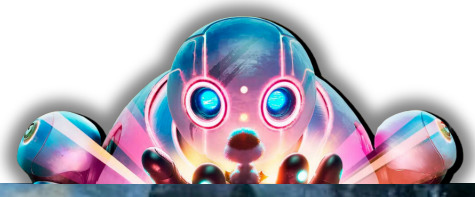
- Dashed Line following
  - No deviation while the remainder displayed- **90 points**
  - Incorrect remainder displayed - **(-10 points)**
  - If any deviation occurs, the score will be determined by the judges on a scale of **0 to 90**.

- Hidden task - **Maximum of 90 points**

- Metallic Object Picking
  - Each coin collected and successfully delivered to the Trail End square - **20 points**
  - Each coin picked up but not successfully stored - **8 points**
  - Maximum score for this task- **200 points**.

- Time bonus will be considered only if all the tasks are completed.

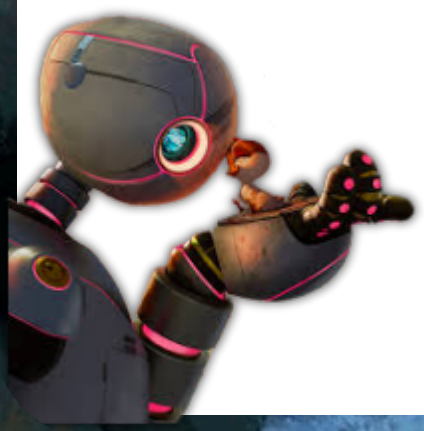
- Penalty marks may be imposed for any damages to the arena and can cause disqualification in extreme cases.



- If a robot remains in the arena performing tasks beyond the allocated time limit, and the judges decide the robot is performing satisfactorily, the robot will not be removed. But a penalty of **0.5 point per every additional second** will be deducted from the contestant's overall score.

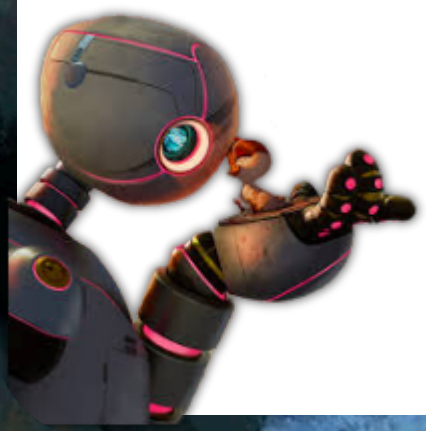
- Even if the judges allow the robot to continue performing beyond the allocated time limit with the penalties, the total time, **cannot exceed 20 minutes**. If the robot is still performing tasks after this extra 5 minutes, it will be immediately removed from the arena, regardless of its progress.

- Please note that this marking criteria may subject to modification during the final competition, and the judges' decisions regarding marks will be final.



JUDGING

- Each team member may be questioned about their robot; every member should clearly understand and be able to explain the robot's working principles and mechanisms. There would be an immediate disqualification of defaulters of any kind.
- If any such fraudulent activity is detected, you will be permanently banned from competing in SLRC.
- The code will be checked for hard coding upon judges' request. You should be able to provide a laptop with the code if the need arises.
- No timing bonus will be awarded unless the robot successfully completes the task. If the robot is still performing in the arena when the time limit is exceeded, any additional time will be considered under the penalty outlined in the Marking Criteria section of this document.
- The decision of the panel of judges will be the final decision.



CONTACT DETAILS

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Special Note

- Please **don't assume** anything about the task or the arena if it is not specified in this document. Contact us if you need any clarification.
- This is **version 1** of the task document. Please be updated on the **WhatsApp group** and the **SLRC website** for further updates.
- Depending on the number of registrations, an elimination round may be introduced. If so, teams will be notified, and the task document will be updated accordingly.