SLRC 2025

SRILANKAN ROBOTICS CHALLENGE 2025

Technical Specifications

University Category

ENTC
Electronic and Telecommunication Engineering

SLRC 2025

University Category

Robotics is an ever-evolving field in electronics. With new opportunities emerging in both local and international scale, it is of utmost importance to train and nourish the young minds of Sri Lanka. The Electronic club of University of Moratuwa, alongside the Department of Electronic and Telecommunication Engineering, has launched the Sri Lankan Robotics Challenge (SLRC) for eleven consecutive times as the longest and pioneering robotics festival in Sri Lanka.

As the **12th iteration** of SLRC draws near, anticipate an exciting and a fierce battle between robots to seek the winner.
The University Category Competition, designed exclusively for undergraduates, seeks to be a catalyst for learning, interaction, and the expression of a profound passion for robotics. Beyond the thrill of the competition, winners are set to receive substantial cash prizes and certificates.

In this forthcoming challenge, participants are challenged to engineer robots capable of overcoming a series of intricate obstacles. This competition isn't just about testing technical skills—it's a platform for innovation, pushing the boundaries of robotics in Sri Lanka. With SLRC 2025 on the horizon, we invite all enthusiasts to be part of this exciting journey. It's more than just a challenge; it's a gathering of brilliant minds, a showcase of creativity, and a celebration of technological progress.

SLR 2025

CONTENT

1. Task Description

In the year 2045, humanity's ambition to colonize Mars saw its first substantial step when a team of astronauts arrived on the Red Planet to establish a human settlement. Their mission focused on building a greenhouse capable of producing food for the next wave of settlers, who are scheduled to arrive in three months. However, a catastrophic sandstorm struck, devastating most of the settlement and claiming the lives of all but one astronaut, Mark. Mark managed to repair the greenhouse, but he faced the enormous task of managing it alone with limited resources. His only companion was Ares, an industrial robot designed for heavy-duty tasks. To survive and ensure the mission's success, Mark programmed Ares to assist with essential greenhouse operations, including harvesting, sorting, warehouse management, and watering plants

In this year's Sri Lanka Robotics Challenge your mission is to build and program the Ares bot to perform a set of real-world like operations.
The **Sri Lankan Robotics Challenge 2025** consists of **six key tasks** as shown in figure 1.1 which, the robot Ares must autonomously complete:

1. **Plantation Task** – Navigate a grid, pick up potatoes, and exit.
2. **Muddy Road & Ramp** – Maneuver through randomly placed obstacles and climb a ramp.
3. **Collection point Task** – Identify red/blue baskets using AprilTags or barcodes and sort potatoes.
4. **Old store Task** – Locate and retrieve the good potato crate.
5. **New warehouse (Hidden) Task** – An unknown challenge revealed 30 minutes before competition.
6. **Outdoor Task** – Identify and water the dry pot.

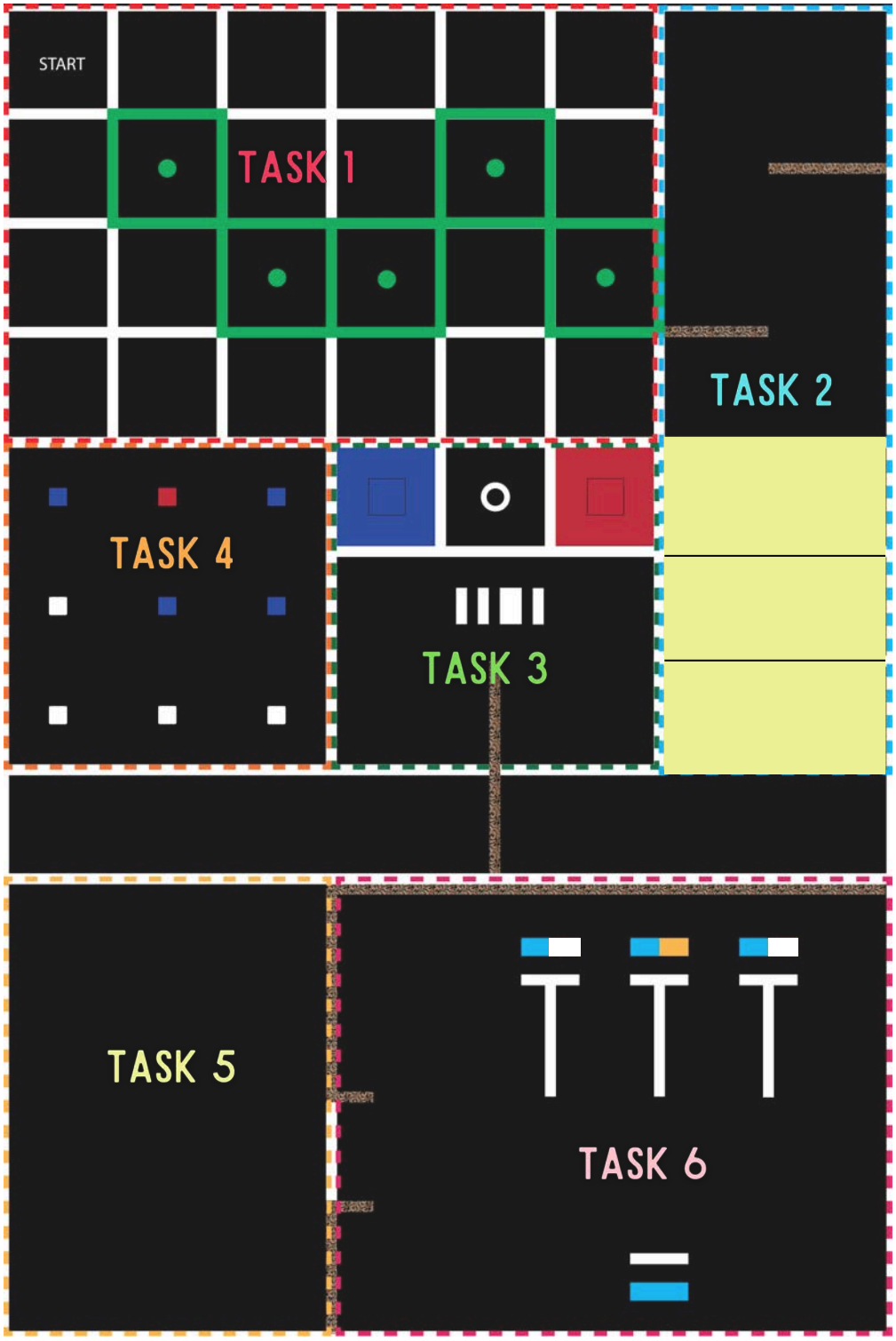

figure 1.1 - Task regions of the arena

Task 1: Plantation Task

The first challenge takes place in the greenhouse, where a **6x4 grid** marks the potato plantation as shown in figure 1.3. The grid, delineated by **white lines 3cm** wide, represents the pathways for navigation. Each square cell measures **30 x 30 cm**.

The robot begins in the first cell of the grid, with the **first row and first column free of obstacles** to facilitate initial navigation. **Five plants** are located within the grid, one plant per column of the rest of the grid. Plants will be located at the center of the respective cell. A cell with a plant is marked with **green** color sticker strip with a width of **3 cm**

Each plant is represented by a **green cylinder**, **5 cm** in height and diameter (figure 1.2), with a cavity at the top holding a standard ping pong ball. The balls symbolize potatoes, with yellow balls representing good potatoes and white balls representing bad potatoes. The robot must navigate the grid, collect all the potatoes, and exit the plantation, marking the completion of the first task.

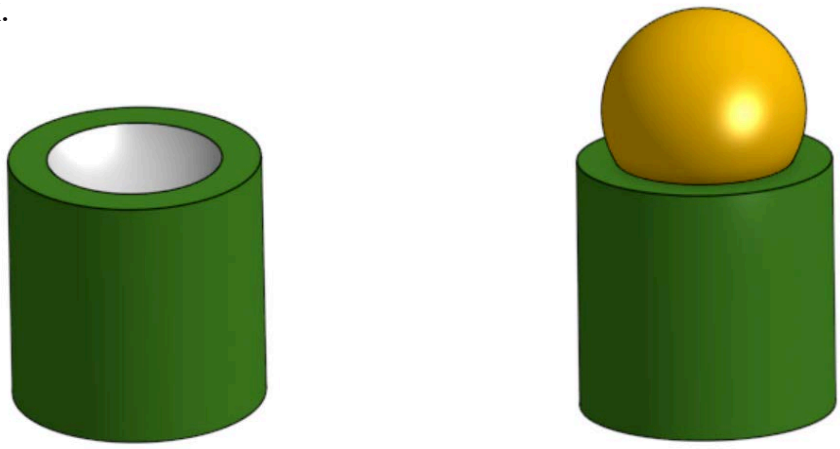

figure 1.2 - Plant diagram (left), Plant with Potatoe (right)
(refer chapter 2 for dimensions)

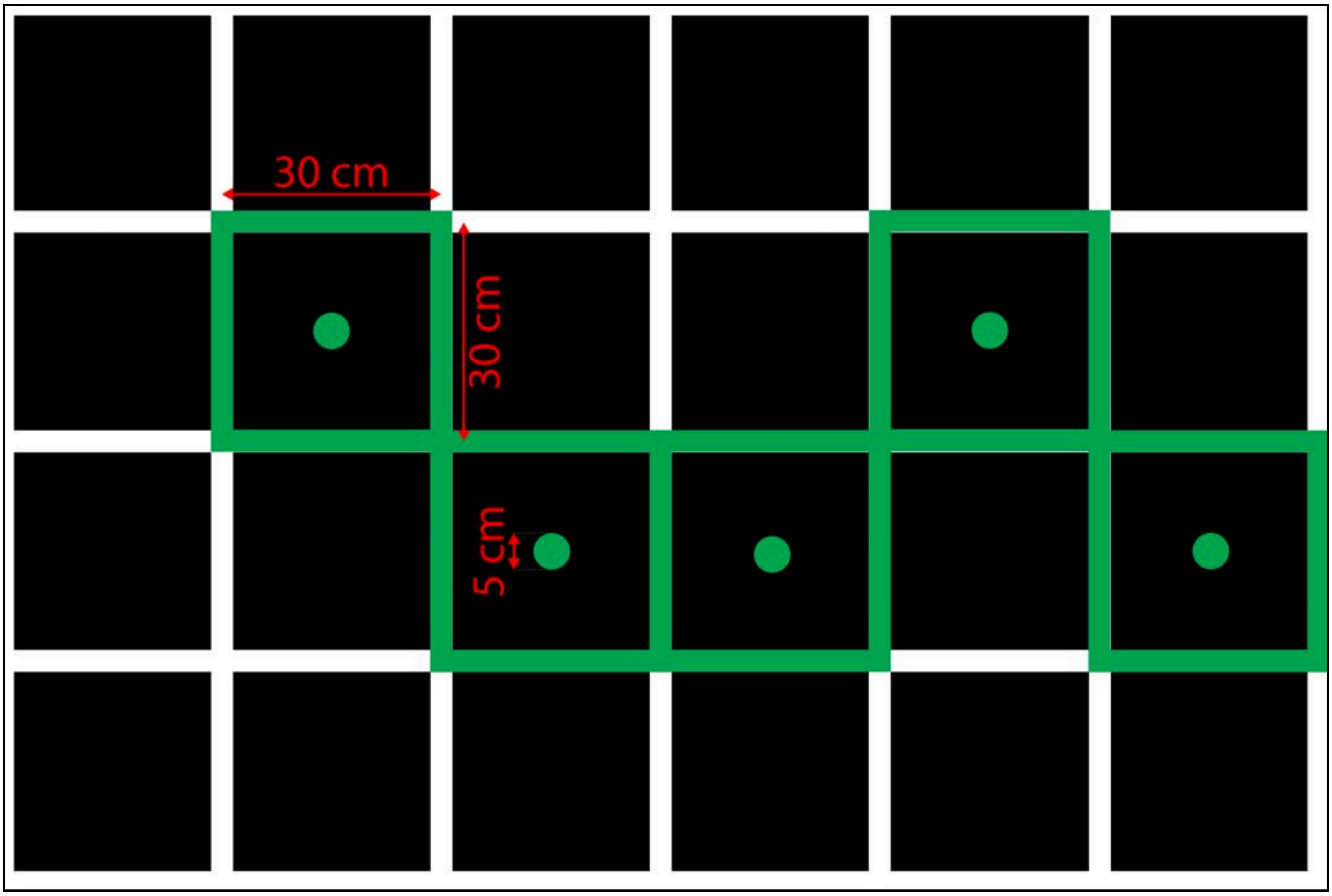

figure 1.3 – Plantation Task Region

Task 2: Navigate the Muddy Road and Ramp

After leaving the plantation, the robot must traverse a muddy road (figure 1.4) featuring broken walls placed in random locations. All these wall segments are **white coloured and 10 cm high** with a thickness of approximately 2.5cm.The **Maximum length of such a wall segment is 30 cm.** The robot must maneuver through gaps, which are **at least 30 cm wide**, to proceed. After this, the robot must climb a ramp (with maximum of **20 deg inclination**) and descend safely to reach the collection point and warehouses. This task tests the robot's adaptability to unpredictable terrains and its ability to handle changes in elevation as it can be abundantly seen on Martian terrain.

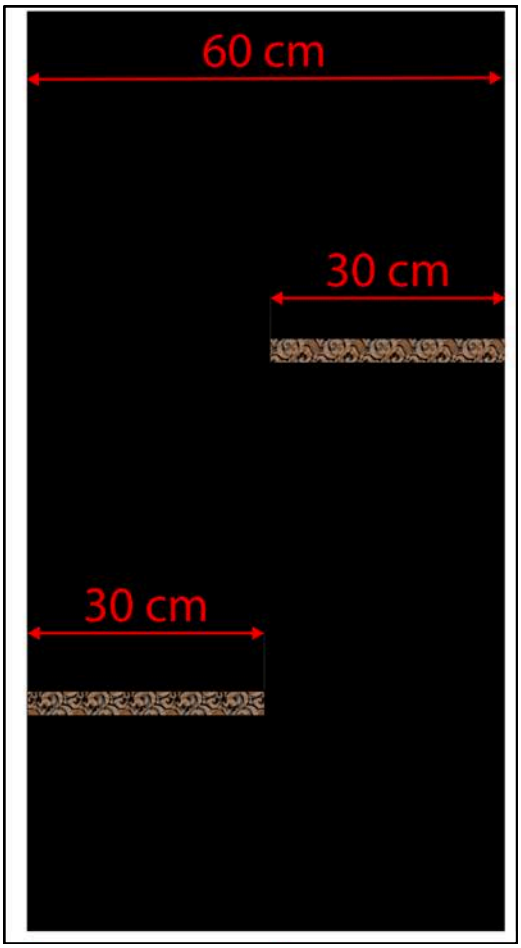

figure 1.4 - Muddy Road

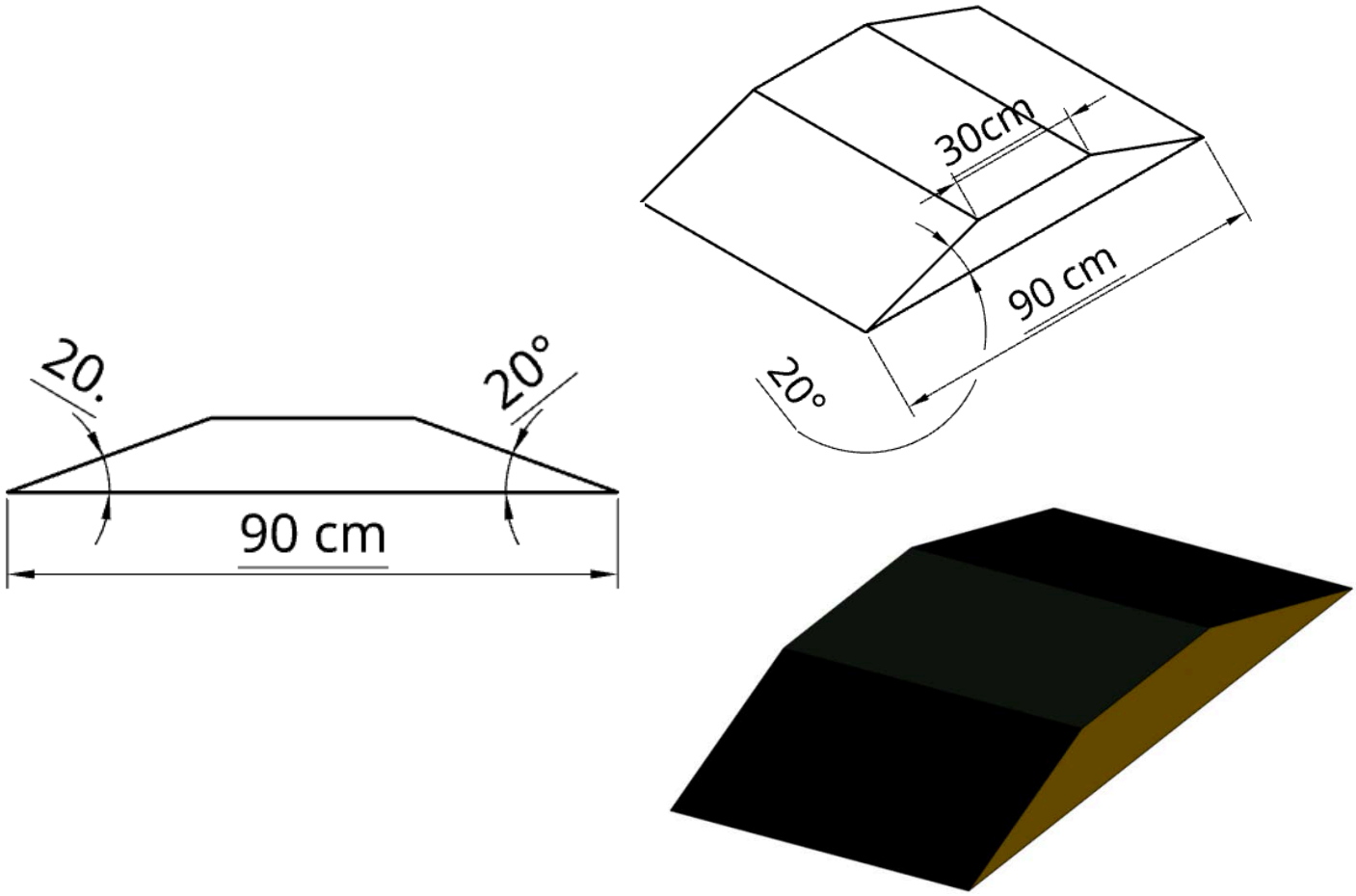

figure 1.5 - Ramp Dimensions
(refer chapter 2 for dimensions)

Task 3: Collection Point Task

Upon reaching the collection point, the robot encounters two baskets located in grid cells as indicated in figure 1.7 one painted **red** and the other **blue**. The robot must determine which basket is designated for good potatoes and which is for bad potatoes.

This information can be obtained by scanning the number on either a signboard (as shown in the figure 1.6-left) with an AprilTag (refer: *https://bit.ly/apriltag-imgs*) or the barcode marked on the floor in front of the collection point (as shown in the figure 1.7). The sign board is placed on the **middle cell** between the blue and red cells in the collection point.The barcode on the floor consists of **white stripes spaced 3 cm** apart. The **most significant bit (MSB) is positioned on the leftmost side, while the least significant bit (LSB) is on the rightmost side** (For example barcode displayed in figure 1.7 is number 2). Refer Table 1.1 for the relationship between bit value and strip width. There should be a clear method to display the identified number.

If the number is even, good potatoes should be placed on red basket and bad potatoes on blue basket (refer figure 1.6 -right) with dimensions both **15 cm * 15 cm * 5 cm**. Similarly, if number is odd, good potatoes on blue basket and bad potatoes on red. Once the robot identifies the correct basket for each type of potato, it must sort and place the potatoes accordingly.

table 1.1 - Barcode Strip value

Stripe Width	Binary Value
3 cm	0
6 cm	1

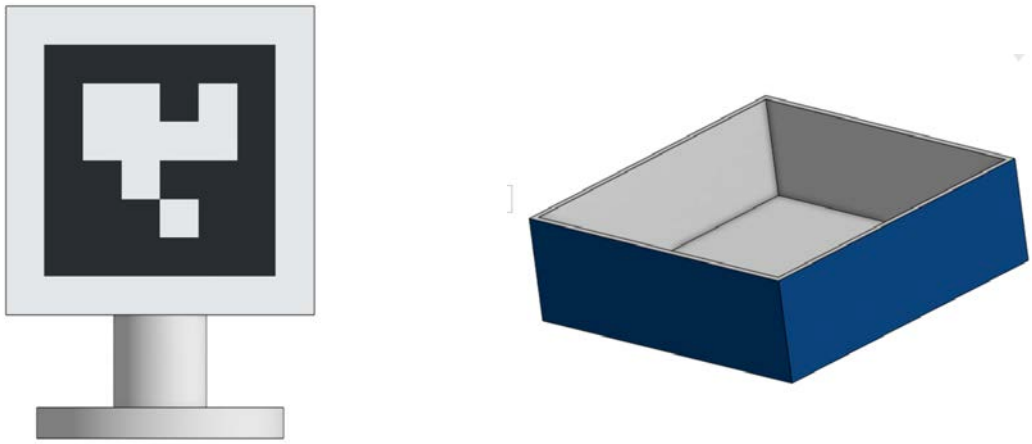

figure 1.6 – April Tag Base (Left), Sorting Basket (Right)

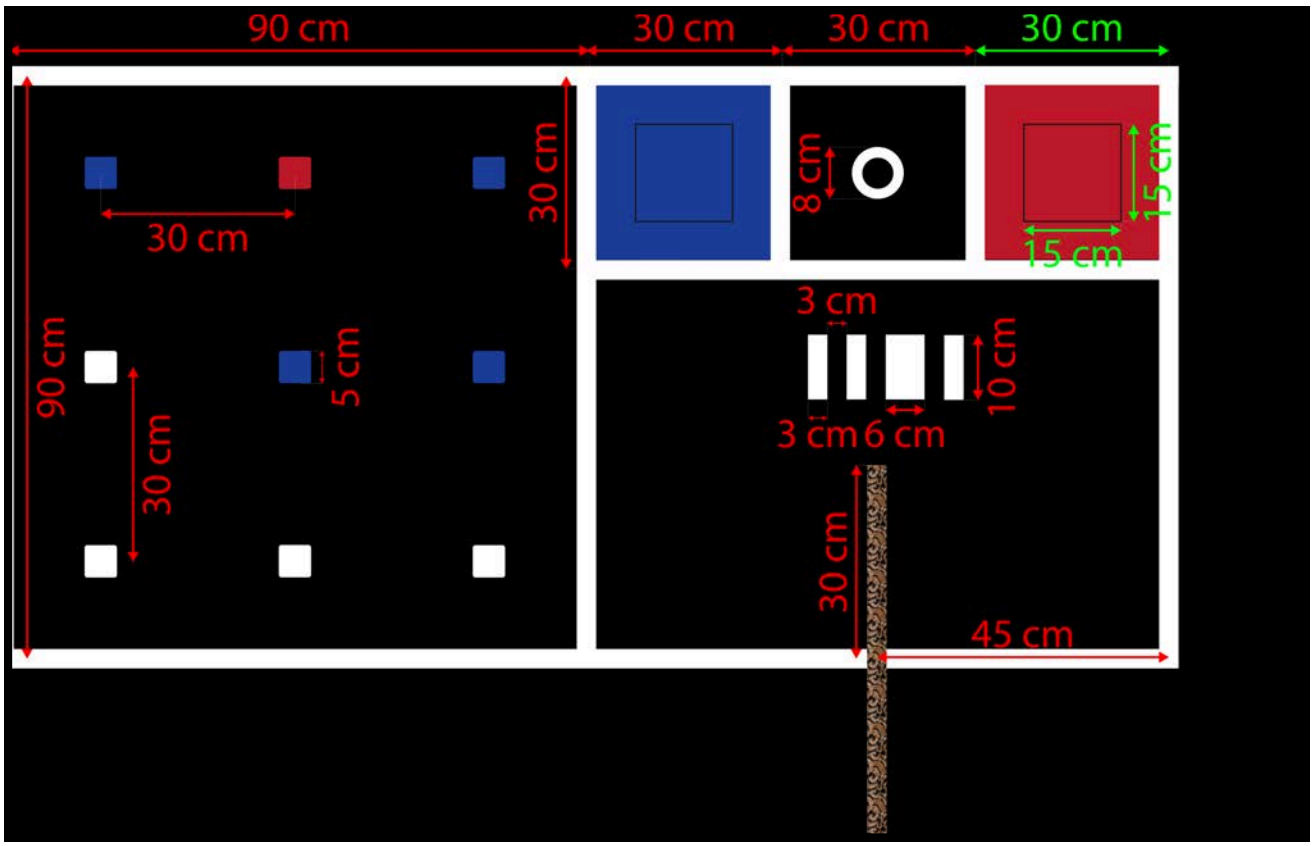

figure 1.7 – Task 3 and Task 4 Regions

Task 4: Old Warehouse Task

The next challenge takes place in the old warehouse, a **90x90 cm** area divided into a **3x3 grid**. Each grid cell measures **30x30 cm**, with white **5x5 cm patches** marking the center of each cell. Crates, measuring **5x5x5 cm**, are placed on these patches. (figure 1.7) A **maximum of five crates** can occupy the warehouse at any given time. **Only one** crate contains good potatoes, while the others hold bad potatoes.

The robot must identify and locate the crate with good potatoes, which is colored in the same color as it was found in the previous task. As in the scenario given, red crate contains the good potatoes while the other 4 blue crates contain bad potatoes. The robot must then pick up the crate with good potatoes, completing the fourth task. Robot should make way to pick the crate with good potatoes by neatly moving and stacking the other crates on the white patches of the old warehouse.

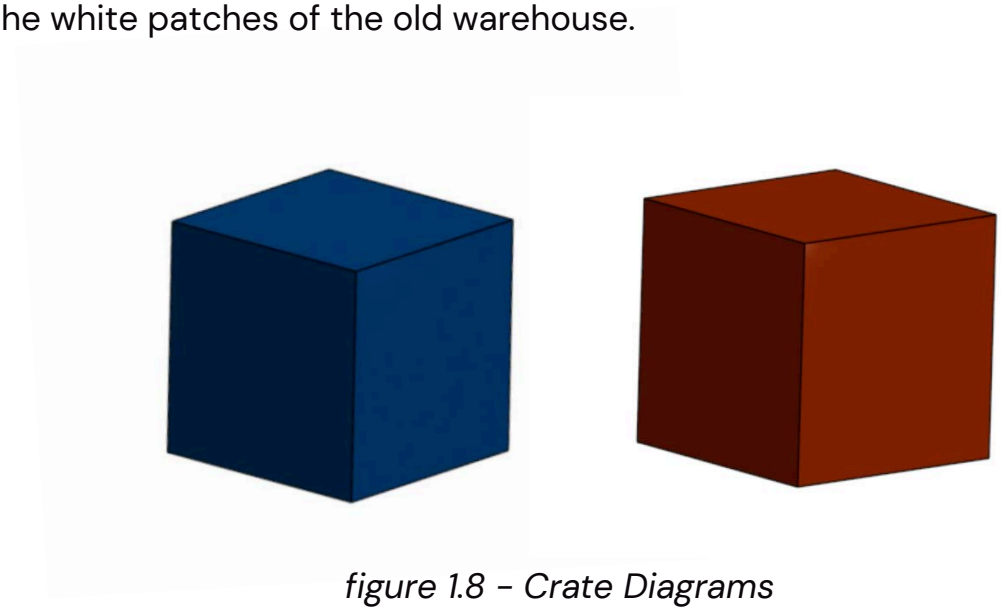

figure 1.8 - Crate Diagrams
(refer chapter 2 for dimensions)

Task 5: New Warehouse (Hidden) Task

In this hidden task, the robot enters a newly opened warehouse with designated storage areas for crates. The robot has no prior information about this space, making the task a test of adaptability and real-time decision-making. Upon completing the hidden objective, which will be revealed just before starting the competition, the robot must locate an opening on one side of the warehouse and exit to the outdoor section. The competitors must program for this task within 30 minutes on site before the competition rounds begin. This task emphasizes the robot's ability to explore unknown environments and respond to unexpected challenges.

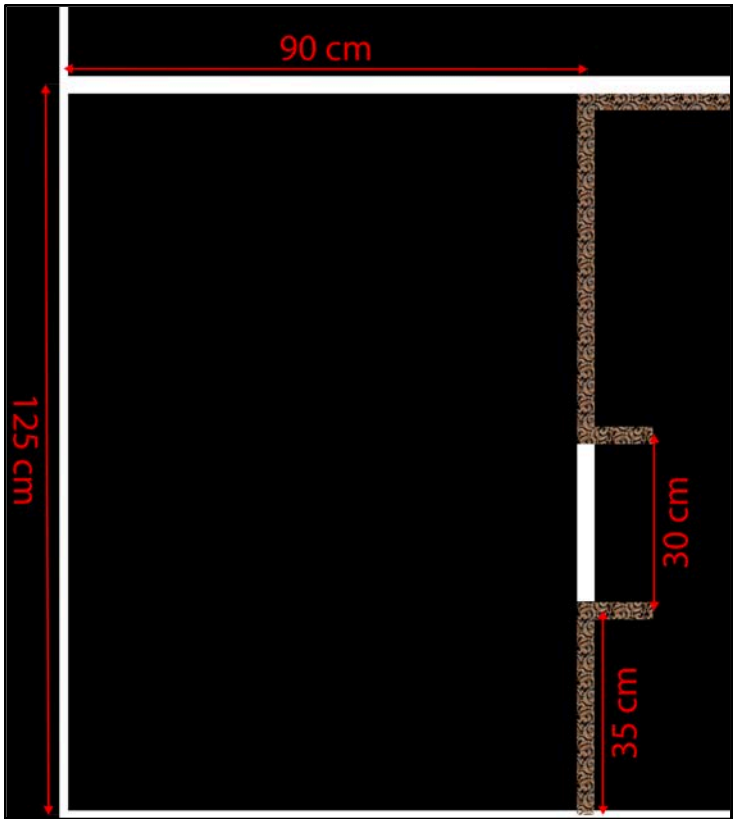

figure 1.9 - Hidden task region

Task 6: Outdoor Task

In the final task the robot must water a dry pot. A water tank with dimensions **5 cm x 5 cmx 16 cm** (as shown in figure 1.10 - right)) is positioned to the robot's right, with a **white line 3 cm wide** placed **5cm in front of the tank** for alignment. Three plant pots are located to the robot's left, each a cuboid (dimensions - **5 cm x 5 cm x 16 cm**) with two equal compartments as shown in figure 1.11. The right compartment contains soil, while the left is designated for water. Only one pot has dry soil; the other two are already watered. As shown in the figure 1.10-left, the dry pot will be marked with a **yellow** sticker on top of the soil compartment, whereas the watered pots will have a **white** sticker covering the top of their soil compartments. The robot must identify the dry pot, collect water from the tank, and fill the water compartment to a **height of 3 cm**. Upon completing the task, the robot should provide a clear completion indication using an appropriate method. Outdoor area dedicated for Task 6 is separated from the rest of the arena by **white** color wall segments which are **10 cm high .** Note that the surface in the outdoor area **can be slippery** due to spilled water.

Once this task is complete, the end of the mission is marked by playing the chorus of **"Starman" by David Bowie**, as featured in The Martian movie.

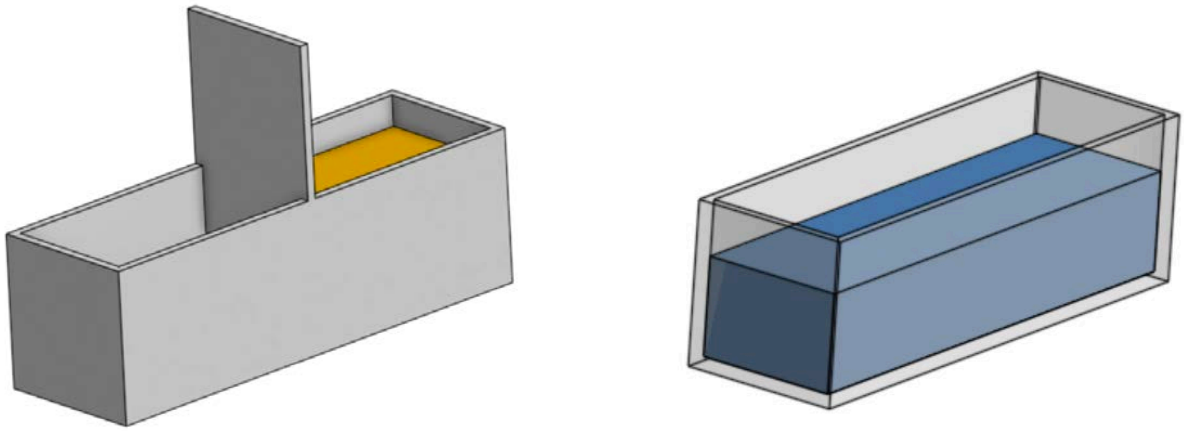

figure 1.10 - Plant pot (left), water tank (right)
(refer chapter 2 for dimensions)

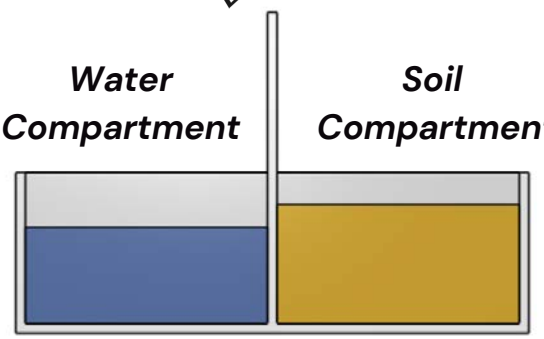

figure 1.11 - A watered Plant pot Side view (refer chapter 2 for dimensions)

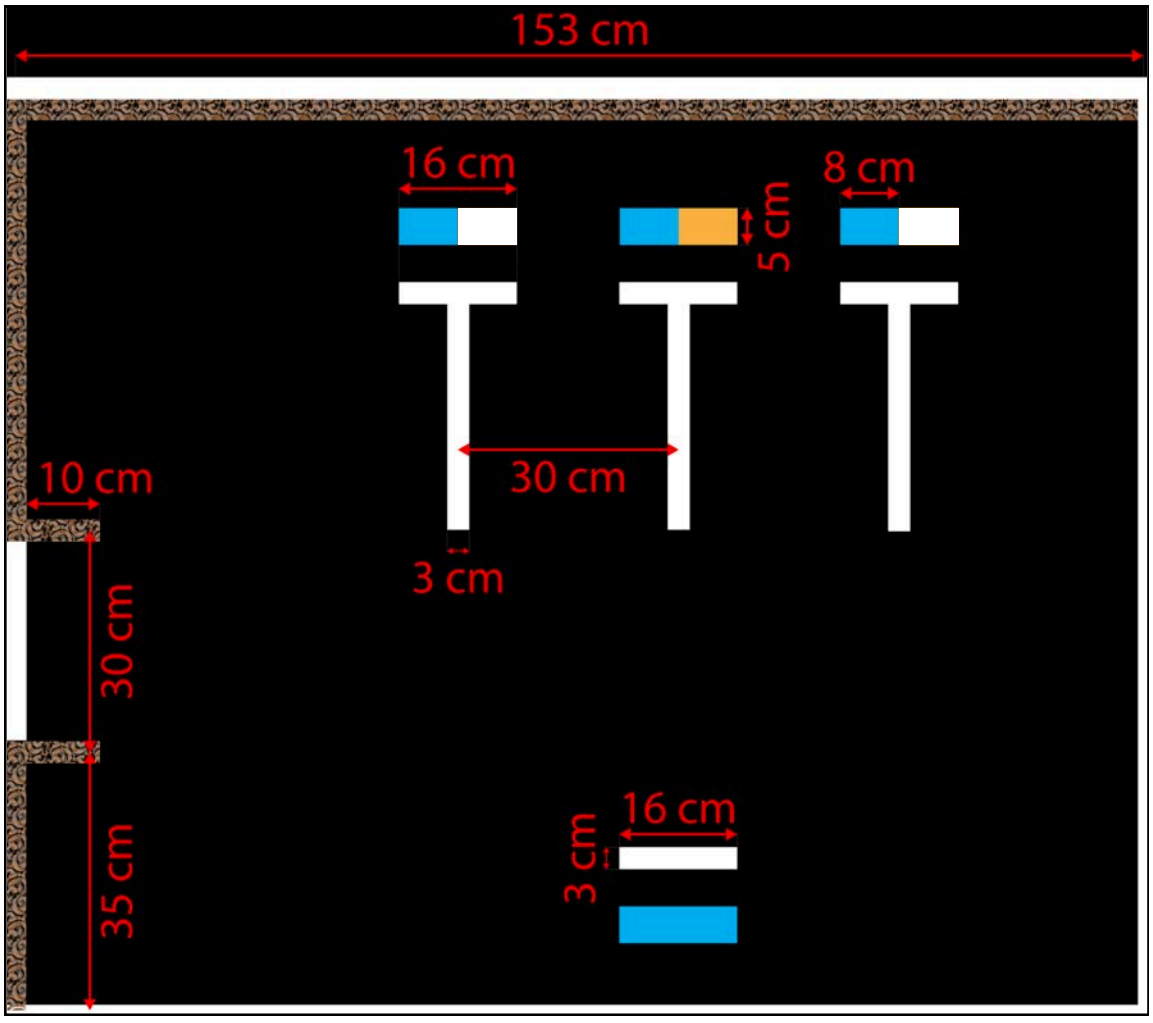

figure 1.12 - Outdoor Task region

2.Arena Specifications

- The arena consists of three 8 ft x 4 ft (240 cm x 120 cm) boards such that the **final arena size is 12 ft x 8 ft** (480 cm x 240 cm).
- The surface can be slightly uneven at the places where two boards are connected.
- The arena will be black, and the lines will be white if not mentioned otherwise.
- The width of all the lines will be **3 cm** .
- The surfaces of the lines and the walls will be matte-finished. The type of sticker used will be "buffel" stickers
- Minimum distance **between two walls will be 30 cm.**
- All dimensions mentioned may deviate by a maximum of 0.5 cm.

https://bit.ly/SLRC_Assets

View the SLRC Assets Onshape document to go through the dimensions and drawings of the Arena Assets.

3.Robot Specifications

- Dimensions of the robot should **not exceed 25 cm x 25 cm** (widthxlength). It will be tested before the start of 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 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, 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. A team can use any preferred method for wall object detection; however, the robot must not exert a force on the object, likely to cause damage. For example, the robot must not scratch, damage or destroy the objects in the arena.

- 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.
- **The outer boundary lines of the complete task grid will coincide with the arena edges.** The robot should be designed such that it won't fall out of the arena. The robot should not leave any components behind in the rest of the arena.

4. Team Composition and Eligibility

- A team can have a **maximum of 5 members** and a minimum of 1 member.
- Undergraduates from different state or private universities can form a team, but the team should register under one university name.
- Each team member should be **under 28 years** of age to be eligible to compete, and **one undergraduate can only represent one team**.
- All team members should be **registered or selected to register as undergraduates** of any state or private university in Sri Lanka 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 university, but one team can only submit one robot.
- Violation of the above conditions would lead to disqualification.

5.Rules and Regulations

5.1 General

- All the teams must submit their robots to the organizers **15 minutes before** the start of the first round. Hidden task will be revealed after all teams submit their robots. Any team which fail to submit the robot before hidden task reveal will automatically be disqualified.
- The robot will be handed back to each team after revealing the hidden task **for 30 minutes**. After 30 minutes the robot should be placed on the organizer table within 2 minutes.
- During programming, the members are 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.
- Note that the testing arena may be different to the final arena.
- There won't be any arena changes once the round has started. All teams will have the same arena.
- 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 the starting square** at the start of their 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. In addition, the contestants should not communicate with or control the robot during an attempt.
- There will be a checkpoint at the end of hidden task so that if the robot fails to complete till the final task you can choose to restart from the checkpoint. Note that **restart from this particular checkpoint will also count as an attempt.**
- A maximum of **3 attempts** (Including restart from checkpoint after the hidden task) 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. If the robot exceeds the time limit of 15 minutes, your robot will be removed from the arena.
- Program or hardware modifications of the robot are not allowed within this 15 minutes.
- The clock will not be paused during attempts. Total time from starting the robot to final completion indication will be considered.

5.2 Calibration

- **Two additional minutes** before the gameplay period of 15 minutes is given for the calibration of the robot.
- The robot can **only use the plantation area** for the calibration.
- Calibrations can only be done through external adjustments of the robot. Therefore, program changes nor hardware part replacements are not allowed.
- 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 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.

6.Marking Criteria

- Marks will be allocated based on the table provided for completion of each task.

Task	Marks
1 - Plantation Task	100
2 - Muddy Road & Ramp	100
3 - Collection point Task	200
4 - Old store Task	100
5 - New warehouse (Hidden) Task	200
6 - Outdoor Task	300

- Additional marks will be **awarded by judges** based on outstanding robot design, smoothness in navigation and effectiveness of strategies and mechanisms used.
- **Time bonus** will be considered only if all six tasks are completed.
- Penalty marks may be imposed for any damages to the arena and can cause disqualification in extreme cases.
- Please note that this marking criteria may subject to modification during the final competition, and the judges' decisions regarding marks will be final.

7. 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.
- Judges may inquire about the programming of the hidden task.
- The robot's code will be checked for hard coding upon judges' request.
- No timing bonus will be given unless the robot completes the task.
- If the robot is not performing well, the judges may ask to stop the current attempt. However, the team will still be given all three attempts. If this happens in all three attempts, the total run time of 15 minutes may not be allowed.
- The decision of the panel of judges will be the final decision.

8.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.
- 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.
- This is version 1 of the task document. Please be updated on the WhatsApp group and the SLRC website for further updates.