



SLR(2024



*SRI LANKAN ROBOTICS
CHALLENGE 2024*

TECHNICAL SPECIFICATIONS

SCHOOL CATEGORY

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Robotics has been a critical interest of the local and international community for the past two decades, with its innovative concepts and applications. Initiated by the Department of Electronic and Telecommunication Engineering and the Electronic Club of the University of Moratuwa, the 11th annual Sri Lankan Robotics Challenge (SLRC) is a groundbreaking robotics festival in Sri Lanka.

The SLRC aims to bring together robotics enthusiasts from all over the country to showcase their skills and compete in various challenging events. With a focus on promoting creativity and problem-solving, the competition serves as a platform for students and professionals alike to exchange ideas and push the boundaries of robotics technology.

The School Category Competition aims to provide school children with an opportunity to learn, engage, and showcase their passion for robotics. The winners will be entitled to valuable cash prizes and certificates from the University of Moratuwa. Your task is to build a robot that can successfully conquer the given challenge with the knowledge you have gained through SLRC workshops and self-learning. This year's challenge will be a fierce battle between two teams.



Somewhere in the multiverse....

In the shadows of the Marvel Universe, a covert mission is underway. Hydra (Team Red), the sinister organization led by the red-skull , and S.H.I.E.L.D., Earth's premier defense agency (Team Blue), find themselves locked in a relentless race to acquire the legendary Tesseract, a mysterious energy cube of unimaginable power.

The stage is set within an underground facility, hidden from the prying eyes of the world. The Tesseract, a pulsating green cube, rests atop a secure pedestal. Teams Hydra and S.H.I.E.L.D. have deployed their elite robotics agents for this perilous mission. Each team starts at the gate of the underground facility, ready to navigate a treacherous path.

The primary objective is clear – retrieve the Tesseract and secure it at the power station . The agents, equipped with advanced technology and stealthy navigation systems, tread cautiously through the ground facility. But the facility holds secrets and challenges for those daring enough to enter.



Team S.H.I.E.L.D (Blue)



Team Hydra (Red)



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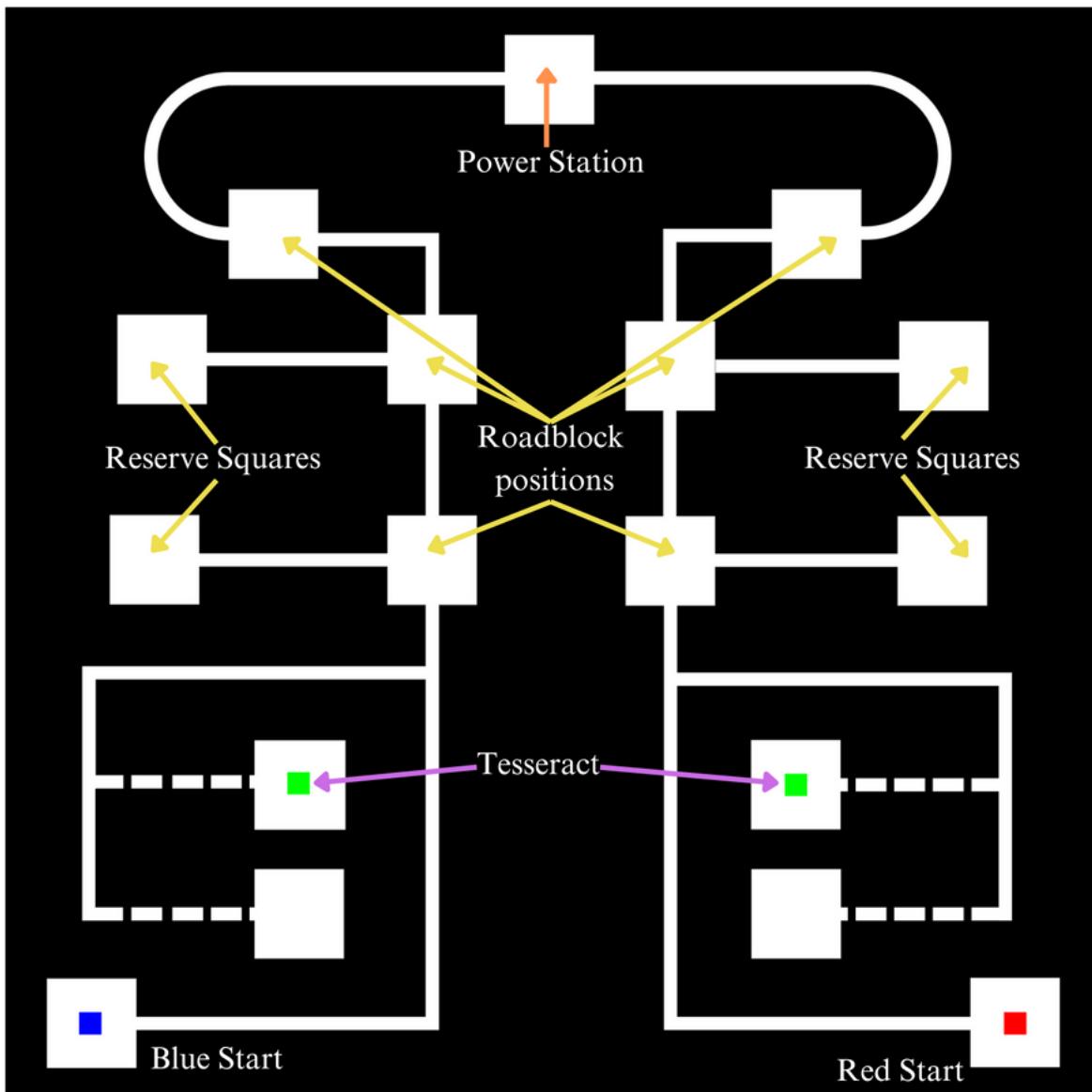
01 TASK

Figure 3: Sample Arena (Drawn in to scale)

A moment before your mission starts you will be assigned to a team, either team Hydra (red) or team S.H.I.E.L.D. (blue). Journey starts as two teams navigate the treacherous underground paths in the facility to locate the tesseract.



Retrieving the tesseract

- You have to start at the designated square and navigate the lines to locate the underground room with the tesseract.
- Tesseract can be placed in any of the two underground rooms in the facility.
- Paths can have straight lines, curved lines, dotted lines and 90-degree corners.
- All the line segments that you encounter will have similar specifications as given later.

Navigating the treacherous dungeons of the underground facility and retrieving the Tesseract will not be sufficient for a team to win the race for harnessing cosmic energy. Teams need to place the tesseract in the arc reactor in the power station before the other team does so. But, the road towards the power station is blocked by heavy roadblocks. It is essential for you to come up with a strategy to clear up the path and move the tesseract to the power station quickly and safely.

Clearing up the path towards power station

- Three critical positions along the path serve as potential roadblock locations. Two roadblocks will be placed randomly at the start of an attempt for each team.
- Roadblocks can be either Red or Blue.
- If the robot stumbles across a roadblock, they can place them in adjacent reserve squares linked to the roadblock positions.
- Also, they can store **only up to one roadblock** of their **own color** in their own mobile storage at a time.



- Teams can carry the tesseract with the gripper/ arm mechanism or store it in a mobile storage they carry on themselves. But the Tesseract cannot be placed in a **reserve square**.
- Robots can use their own mobile storage as a reserve to remove and place **one roadblock of their own color**. Storing an **opposing color roadblock in the mobile storage will result in gem deduction**.
- When a team enters the power station first it is deemed as **the sole owner** of the power station as long as the majority of their robot's body is inside the white square. If the other robot also tries to access the power station at that time and make contact with the robot in the power station it will be **respawned** in the starting position.

After clearing a path for themselves, they can take the tesseract and race to the power station. The two teams are locked into the most fearsome race in the Marvel universe to get hold of the power of Tesseract for themselves. Only the fastest and most strategic agent will be able to place the tesseract in the reactor of the power station and harness the energy of space.

The strategic gameplay becomes evident here, shaping the narrative of the intense race for the coveted tesseract. Teams choose either to clear the path first or pick the tesseract first and every decision will count for the final result.

Points are calculated for completion time , precision in handling the Tesseract and smooth navigation. In this covert Marvel saga, victory is not just about claiming the Tesseract; it's about outsmarting the opponent and proving superiority in the clandestine arts.

Scoring

If a team is able to place the Tesseract in the base during the given time period, then that team will automatically win the round and it is called a K.O and the round will end at that very moment. Gems will be calculated for the other team up to that point. If no team is able to place the Tesseract, the winner is decided based on the amount of gems earned during the gameplay.

In a normal gameplay teams can earn Gems as below:

- Pick and Place the Tesseract in the mobile storage - **300 Gems**
- Only Picking up the Tesseract - **150 Gems**
- Pick and Place a similar color roadblock in the reserves earns - **50 Gems**
- Pick and Place an Opposing color roadblock in the reserves earns - **50**

Gems

- Pick and place similar color roadblock in the mobile storage earns - **100 Gems**
- Pick and place an opposing color roadblock in the mobile storage deducts - **50 Gems.**

Judges will allocate separate marks for the following subtasks depending on the robot's performances (Smoothness, robustness and efficiency).

- Line following - **100 Gems Max**
- Dotted Line Following - **100 Gems Max**
- Box picking mechanism - **100 Gems Max**

Time bonus will be calculated only if the teams have finished the given task (including the elimination round). Time will be measured with an **accuracy of one second**. This will be used for the match ups in case multiple teams successfully finish their game.

- Time Bonus - **(Set time - Time taken by the robot) x 1 Gems**
- Set time is 300 Seconds for the elimination round.
- Set time is 600 Seconds for the following rounds.
- The set time might be subjected to changes depending on the overall performances of the robots. Any further updates will be notified.

02 ARENA SPECIFICATIONS

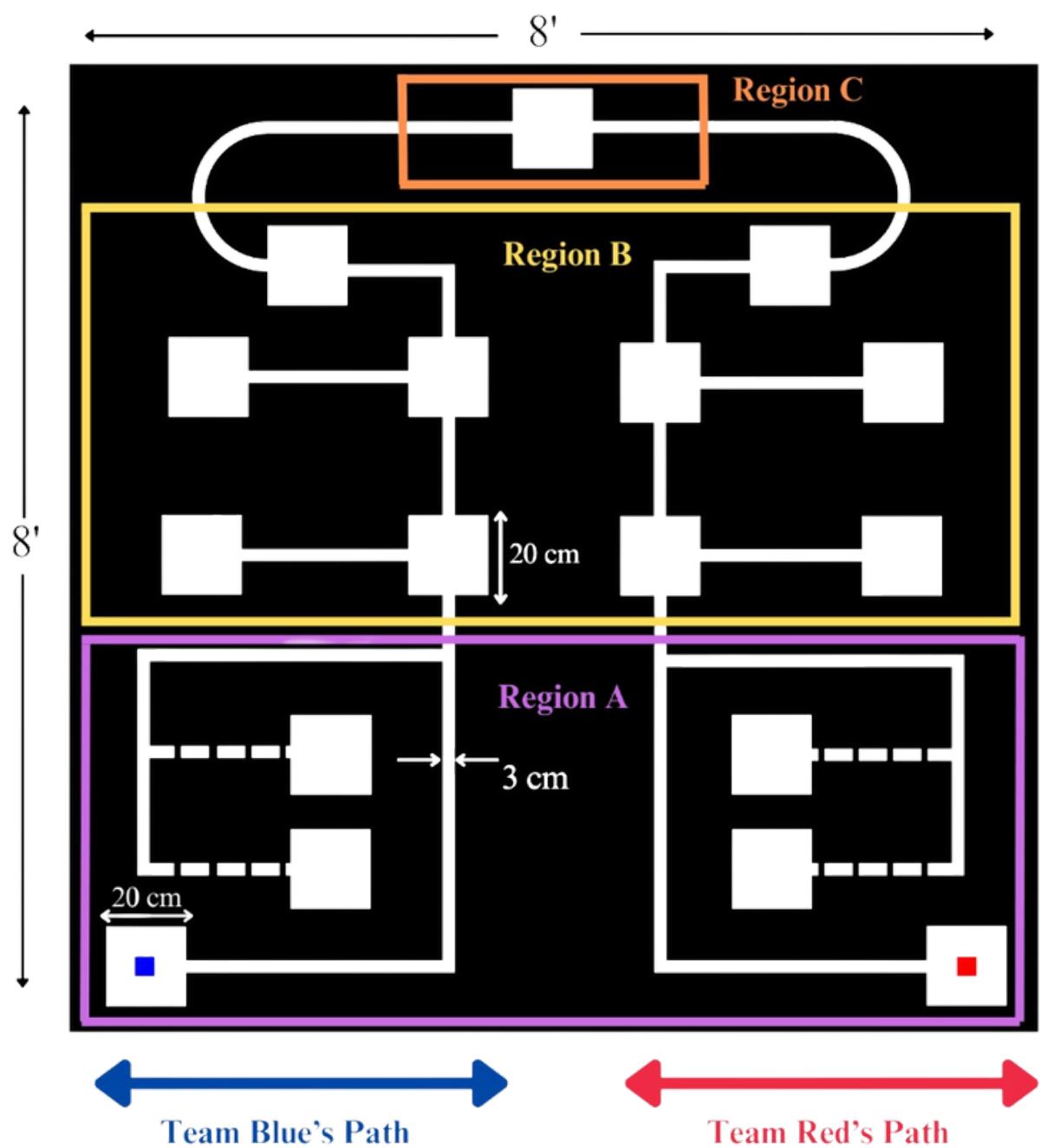


Figure 4: Arena Specifications and arena regions

The arena will consist of two different paths for the two teams competing in a game. A team will have to place their robot in the starting square that matches their alliance's color. A path mainly consists of three regions,

- Region A: Underground facility
- Region B: Roadblock Station
- Region C : Power Station

Region A will be aligned to the following specifications:

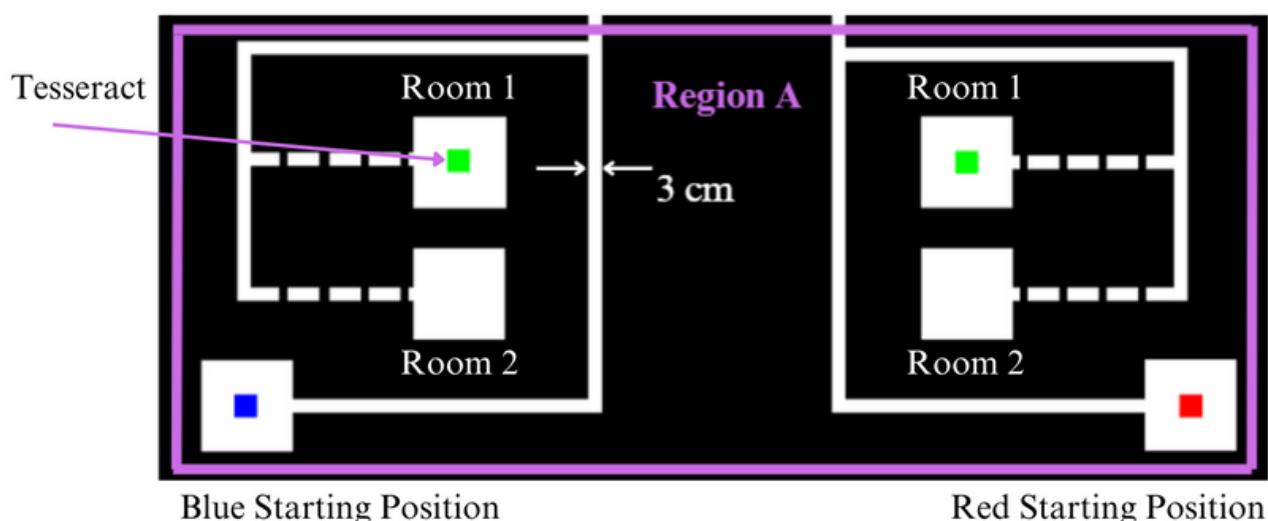


Figure 5: Region A Specification

- All the white lines will have a **width of 3cm**
- All the white line paths will have a minimum distance of 20 cm.
- The arena will consist of Straight Lines, Dotted lines and 90 degree junctions
- All the white squares will be **20 x 20 cm²**
- Tesseract dimensions will be **5 x 5 x 5 cm³** and will weigh **15g ± 5g**
- Tesseract will be colored in **Green**.
- Tesseract can be placed **in any of the two** underground rooms
(Except in the elimination round in which only one room will be available)

Region B will be aligned to the following specifications:

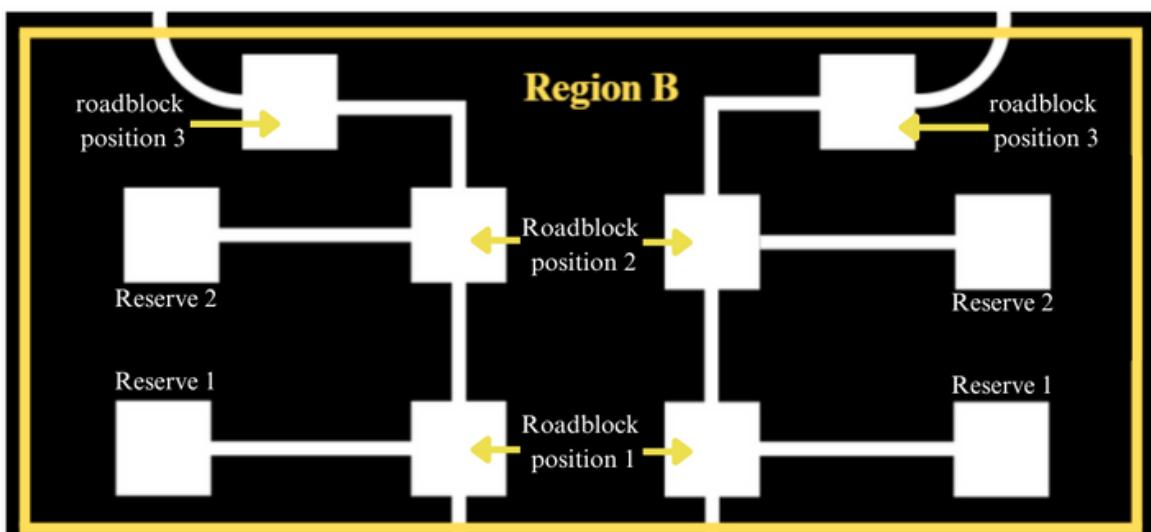


Figure 6: Region B specification

- All the white lines will have a width of 3cm
 - All the white line paths will have a minimum distance of 20 cm.
 - The arena will consist of Straight Lines, Dotted lines and 90 degree junctions
 - All the white squares will be $20 \times 20 \text{ cm}^2$
 - Roadblocks will be **5 x 5 x 5 cm³** in dimensions and will weigh **15g ± 5g**
 - Roadblocks will be **either Red or Blue**.
 - A **maximum** of two roadblocks will be placed in the three roadblocks positions.
 - First two roadblocks' positions will be connected to reserve squares and the robot can place roadblocks in the reserve square to clear up the path.
 - Third roadblock position will not be connected to a reserve square though it may contain a roadblock.

Region C is just a white square called the power station with above mentioned specifications where a robot can place the Tesseract and finish the game. The team who **first** reach the power station and place the Tesseract will win.

03

ROBOT SPECIFICATIONS

- Dimensions of the robot should **not exceed 20 cm x 20 cm** (width x length). It will be tested before the start of the first round by placing the robot inside a 20 cm x 20 cm box. There is no height limitation.
- 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 ready-made 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.
- Robot's alliance **can only be changed by manual switches** after the organizers provide the team color for a given game. Team can use the calibration time or time in front of the organizer desk to perform this operation.

- 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 should be a way to **indicate that the robot has completed its task.** This will be considered to measure the time and indicate the winner incase of a tight encounter between two teams. (eg. turn ON a LED bulb)
- 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.

04

RULES AND REGULATIONS

General

- There won't be any arena changes once a round has started. All teams will have the same arena.
- All the teams must submit their robots to the organizers 15 minutes before the start of the elimination round and the first round. After that, the robot will be given to the relevant teams only for their attempts at the game.
- The contestants must be prepared to start within 5 minutes after the call; if not, the attempt is lost.
- A robot should be able to switch their alliance (Red/Blue) **only using mechanical switches**. There will be no chance to upload any program after placing the robot on the organizer's desk.
- A team should place the robot entirely inside their own 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. Additionally, the contestants should not communicate with or control the robot during an attempt.
- After the calibration period both teams will only get one legal attempt for a given game. If both teams fail to navigate the lines due to technical or difficulties in the arena, A restart will occur at judges' decision.

- The time taken to travel from each start square to the power station is called the **total run time**. Separate clocks for both teams will start when the judges give the signal to start. The clock will stop when the robot reach the power station and place the tesseract on the white square. A proper indication (Using a LED) should be issued by each robot that it has completed the task.
- 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 in line following segments, 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.

Calibration

- Both teams will get access to the line starting from their respective starting square to the first junction which leads to the underground facility for calibrations.
- Teams can use this time to manually switch and change their alliance according to the given game fixture.
- Calibration time will be **only 2 minutes** for both teams.
- Calibrations can only be done through external adjustments of the robot. Therefore, program changes or hardware part replacements are not allowed.
- If a team fails to finish calibrating within these 2 minutes, they will be **penalized with 30 Gems** and will be given another 5 minutes. But if a team fails to complete the calibrations and move onto the game they will be disqualified.

05 FIXTURES

- All the games will happen as a duel in which one team will play as Team Blue(S.H.I.E.L.D) and other team as Team Red (Hydra). The teams will have to pick their robot from the organizer's desk and randomly pick their alliance in front of the organizers. Then the organizer's will place a sticker on both robots depicting their alliance in the game.

Elimination Round

- There will be an elimination round where teams will have to place their robots in the arena without the need to have any alliance.
- Only 16 teams will be selected from the elimination round.
- Teams will have to navigate in the underground facility and reach room 1 and pick the tesseract.
- Then the robot has to turn back and reach the starting position to place the tesseract in the starting position.
- Gems will be calculated as per the scoring rules mentioned in the Task section.
- Also teams can opt to store the tesseract in the mobile storage for additional points.
- The robot has to visually indicate that they have finished the task at the end.
- The selected 16 teams will be ranked based on their performance and the ranking will be used for the player draft in the first round.

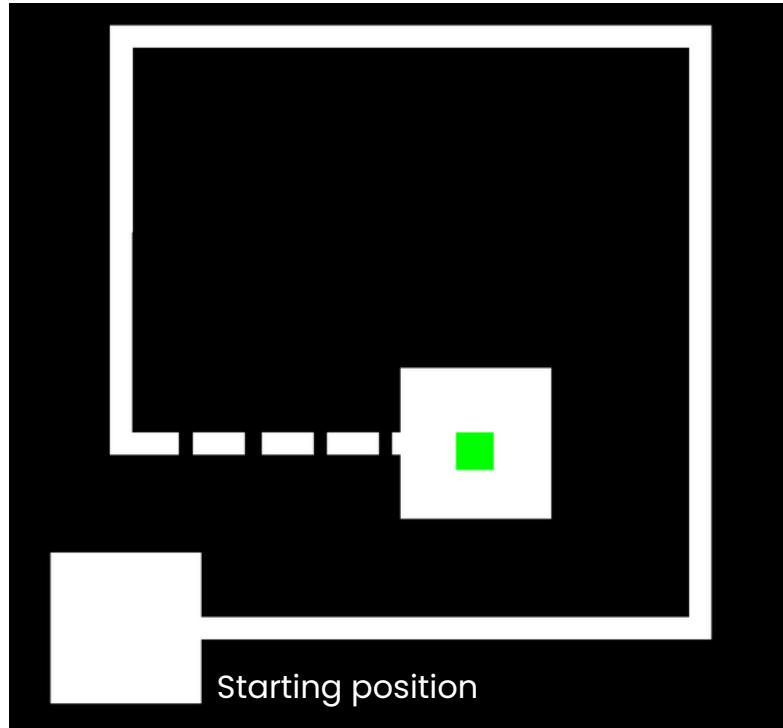


Figure 7: Arena for elimination round

First Round

- 16 teams will compete in duals.
- Teams will be divided into 4 groups according to the rankings of the elimination round. Two games will be played in each group.

	Game 1		Game 2	
	1 st	16 th	12 th	5 th
Group A	1 st	16 th	12 th	5 th
Group B	2 nd	15 th	11 th	6 th
Group C	3 rd	14 th	10 th	7 th
Group D	4 th	13 th	9 th	8 th

Table 1: First round draft

- In each group, group toppers will compete with the last in the group in game 1 and middle teams will compete with each other in game 2.
- Winners of the two games will move on to the next round.
- Two team leaders have to present at the organizer's desk within 5 minutes after calling their names.
- Organizer's will let team leaders randomly pick their alliance.
- Winners of the first round will move on to the Quarter Final Round

Quarter Finals Round

- 8 teams will compete in duals.
- Winners of each group in First Round will be drafted in the Quarter Final round as follows,
- Winners of the Quarter Final rounds will move into the Semi Final Round.

QF1	Group A, Game 1 Winner	Group D, Game 2 Winner
QF2	Group A, Game 2 Winner	Group D, Game 1 Winner
QF3	Group B, Game 1 Winner	Group C, Game 2 Winner
QF4	Group B, Game 2 Winner	Group C, Game 1 Winner

Table 2: Quarter finals draft

Semi Finals Round

- 4 teams will compete in duals
- Winners of each group in First Round will be drafted in the Quarter Final round as follows, (Team Leaders will have to randomly pick their alliance prior to a semi final game)

SF1	QF 1, Winner	QF 4, winner
SF2	QF 2, Winner	QF 3, Winner

Table 3: Semi finals draft

Third Place Play-off

- Two losers of the semi final rounds will compete face to face for the 3rd place.
- Leaders of the two teams will have to select their alliance randomly.

3rd Place	SF 1, Looser	SF 2, Looser
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Table 4: Third place play-offs draft

Final Round

- Two winners of the Semi Final Rounds will race face to face to win the ultimate battle for the tesseract.
- Team leaders will have to toss a coin and select their alliance prior to the Final game.

Final	SF 1, Winner	SF 2, winner
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Table 5: Finals draft

Note: The above fixture may be subjected to changes due to the number of registrations and other factors. Modifications will be updated in due course.

06 TEAM COMPOSITION AND 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.

07 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 given unless the robot completes the task.
- The decision of the panel of judges will be the **final decision**.

08 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.