

Game Field:

In the figure given below, colors are shown just for indication and sample arena is shown:

- The field consists of an area having dimensions of 4720 mm×4740 mm. The whole arena will be made of wood.
- The game field consists of a manual zone, an automatic bot zone, a manual starting zone, transfer zones (TZ1 and TZ2), an auto start line, a block zone, a metal plate, a ring, an inclined platform, a deposit zone and thermocol sheet.
- **Manual Start Zone:** The manual bot must start the game from this zone.
- **Auto Start line:** The autonomous bot will start from this line (indicated as auto start line).
- **Grid:** This zone will consist of white grid lines on a black surface. The lines will be equally spaced. There are nodes at the intersection of two white lines at some places. Nodes are black squares of dimension 30 mm×30 mm. Position of nodes will be revealed during the game. Squares in the grid will have dimension of 300 mm×300 mm. The thickness of each white line is 30 mm. Only the autonomous bot can navigate in this zone.
- **Blocks:** There will be three types of blocks Nexus block placed at the block zone, Key block placed in grid, Calypso block placed at the first intersection of white grid lines after the bridge. The dimensions of all the blocks used in the whole game will be 150 mm×150 mm×80 mm (l×b×h). The blocks will be completely white.
- **Manual zone:** It is indicated by green color. Only the manual bot can maneuver in this zone.
- **Autonomous Zone:** It is indicated by black color. Only the autonomous bot can maneuver in this zone.
- **Restricted Zone:** In this zone, the manual bot cannot enter without throwing the ball into the ring. If the bot is unable to do it, then it will have to incur a penalty to enter this zone.
- **TZ1:** It is the zone where the autonomous bot will drop the Key block.
- **TZ2:** It is the zone where the manual bot will drop the Nexus block.
- **Block Zone:** Nexus block will be placed here.
- **Ring:** A vertical hole of diameter 300mm which is placed at the corner beside the block zone.
- **Pit:** A pit of depth 80 mm will be present in the manual zone. There will be two types of pits. Dimensions of the pits are as shown in the figure 6.
- **Block Adjuster:** It facilitates the placement of blocks by the bots in the transfer zone.
- **Deposit Zone:** Autonomous bot will deposit the Calypso block in this zone.
- **Loading Zone:** Balls will also be loaded to the manual bot in this zone.
- The centre of vertical ring is 350mm from the ground while the centre of thermocol sheet from the ground is 225mm.

- There is an inclined plane having an inclination of 15 degree, with a horizontal base length of 300mm, a horizontal plane of length 350mm and width 430mm continuing the inclined plane. The path of the autonomous bot is obstructed by the plank. This plank is rested at 90 degrees and has to be dropped down by the manual bot.
- After dropping down the plank, there might be considerable gap between the joints (up to 1cm).
- The diameter of the plastic ball to be thrown will be 60 mm having maximum weight of **20 grams**. The blocks are made of non-magnetic material and will have a maximum weight of **100 grams**.

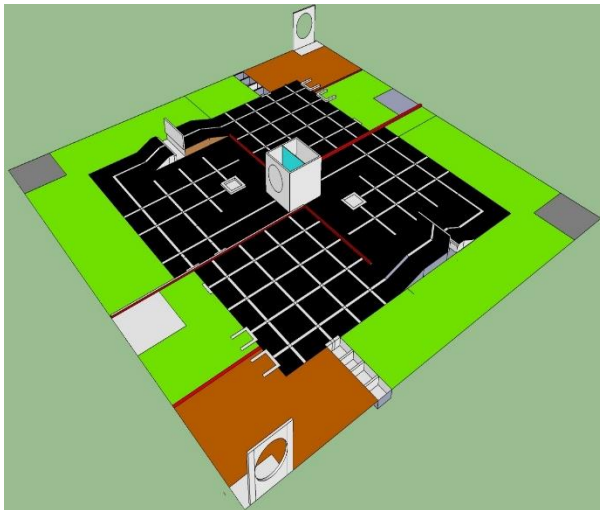


Figure 1: Arena

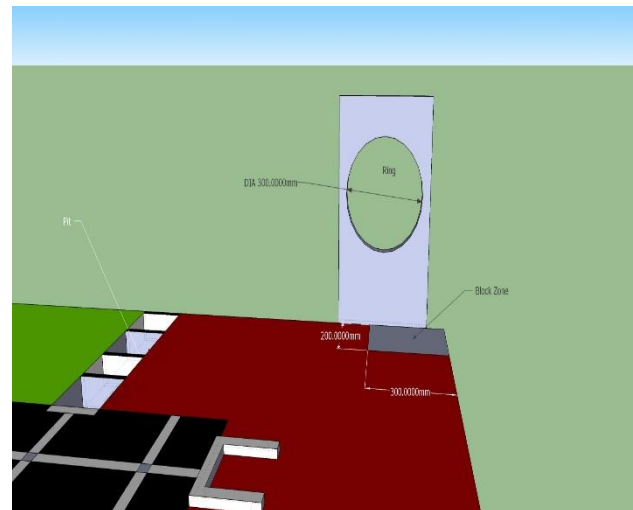


Figure 2: Ring

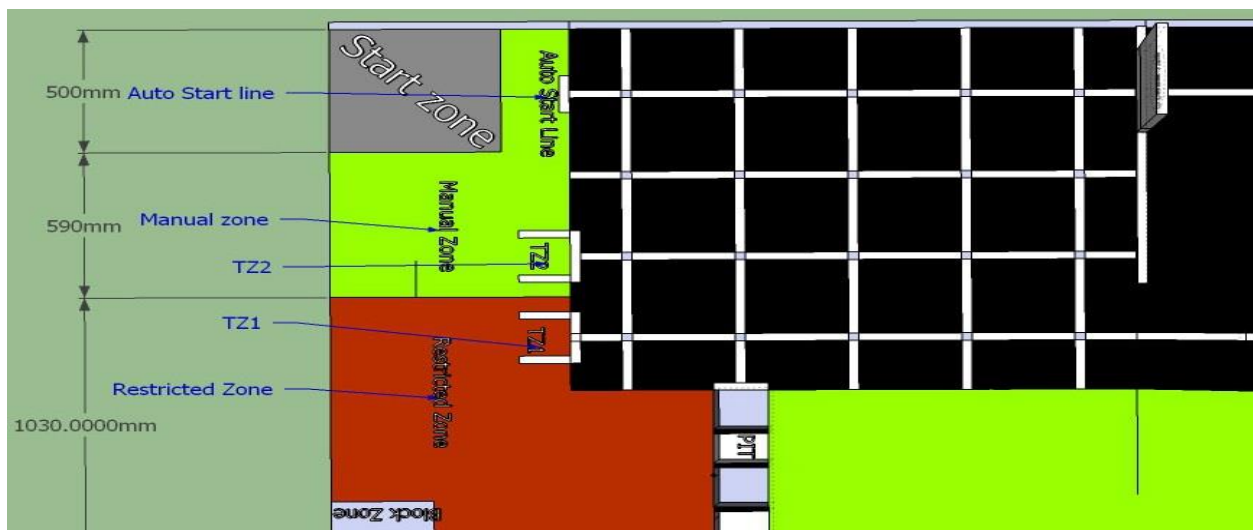


Figure 3: Starting

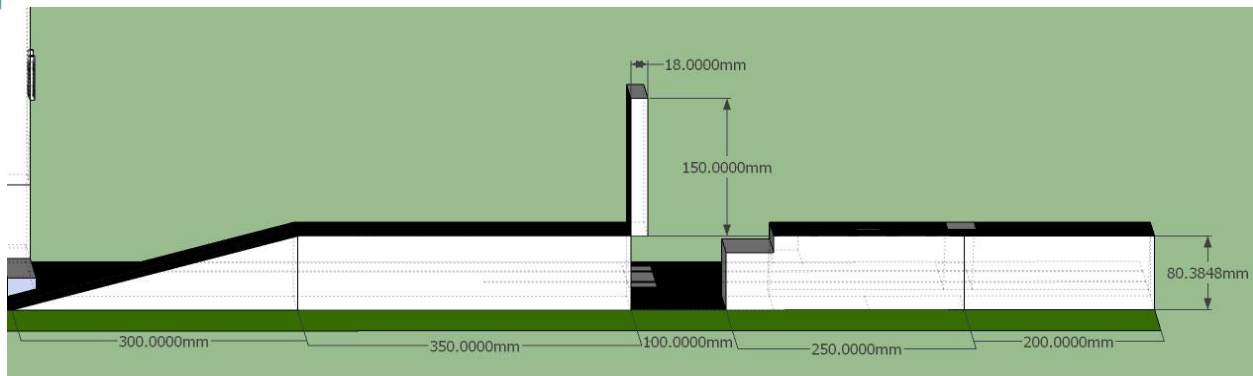


Figure 4: Plank Dimensions

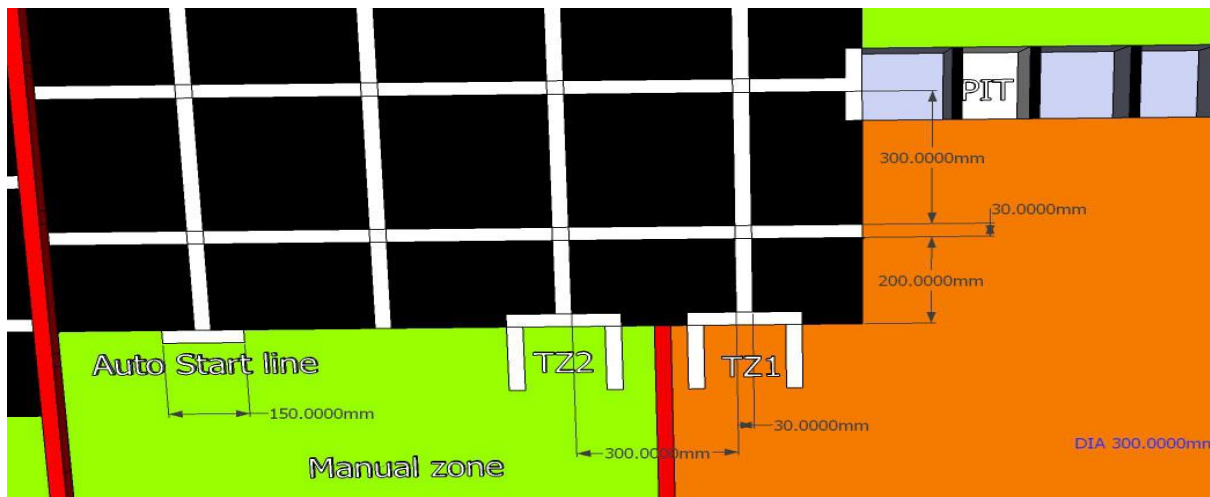


Figure 5: Grid Dimensions

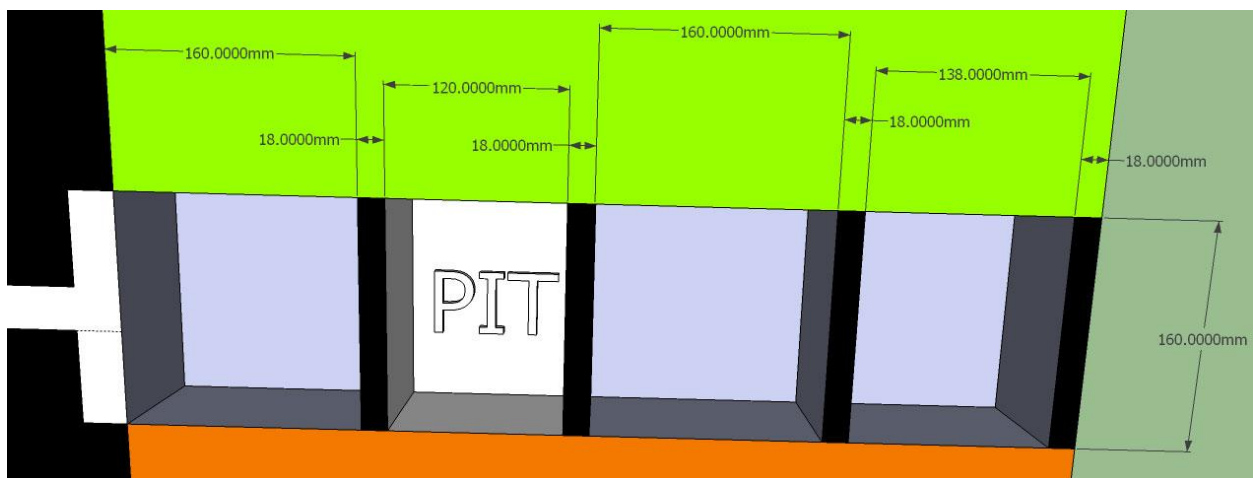


Figure 6: Pit

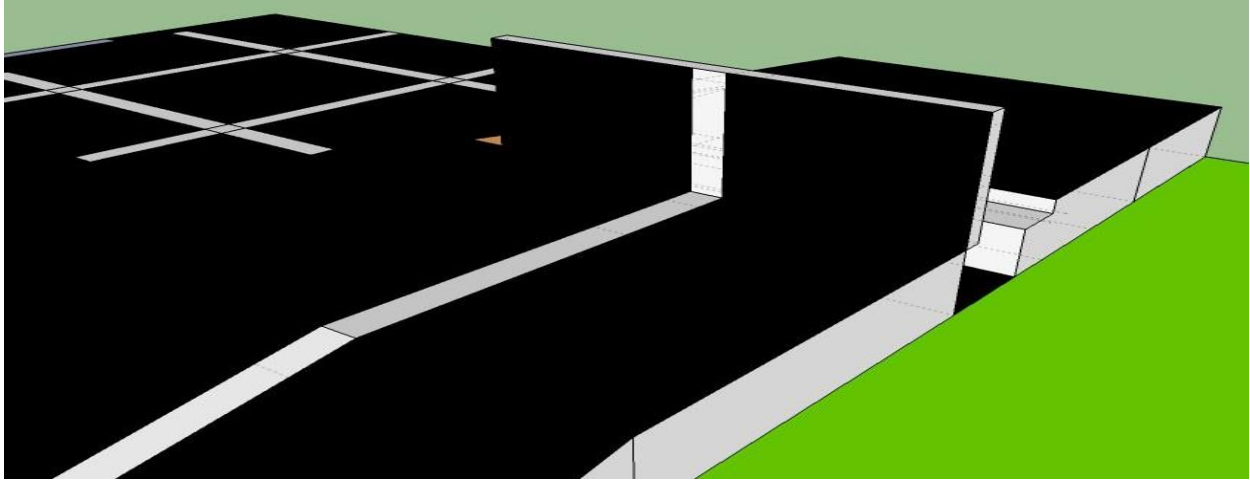


Figure 7: Plank

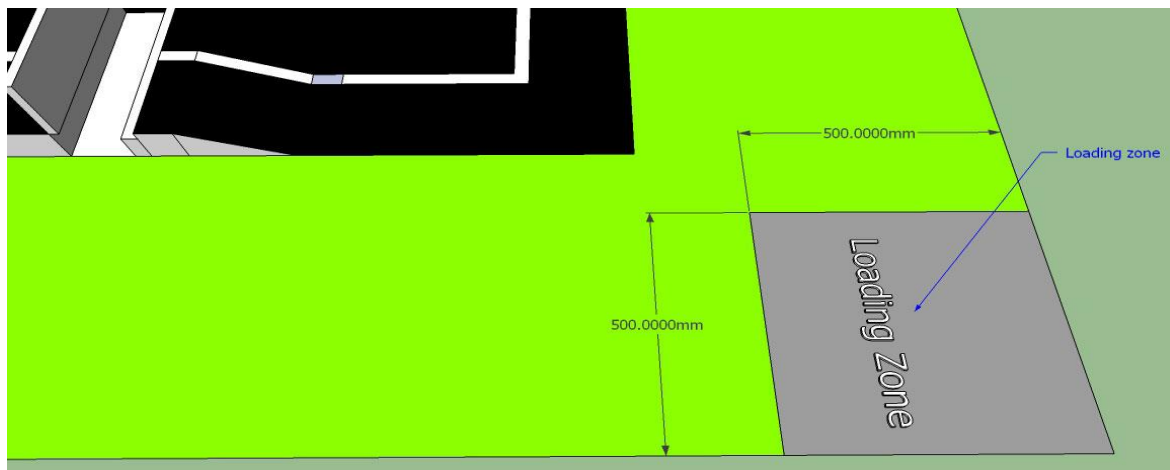


Figure 8: Loading Zone

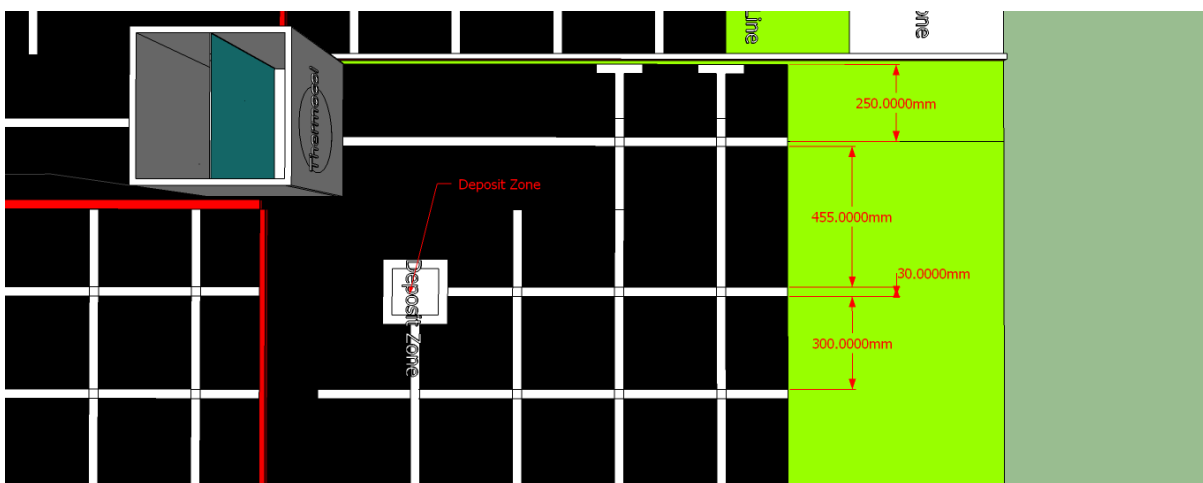


Figure 9: Deposit Zone

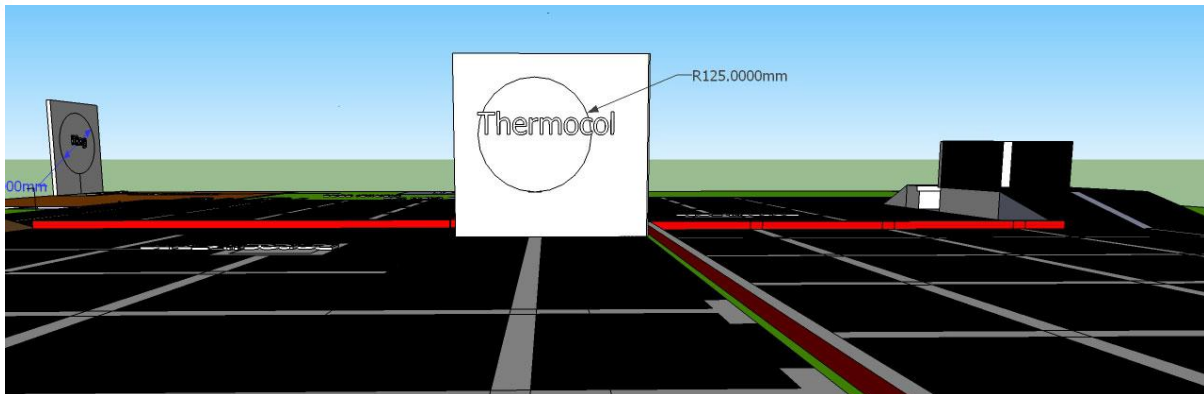


Figure 10: Thermocol Sheet

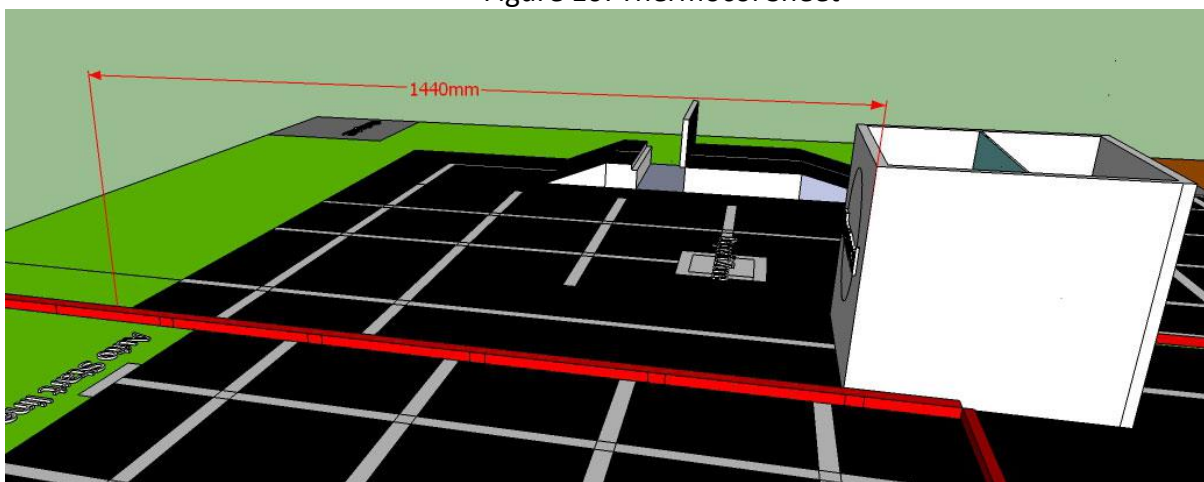


Figure 11: Final Shooting distance



Figure 12: End Structure

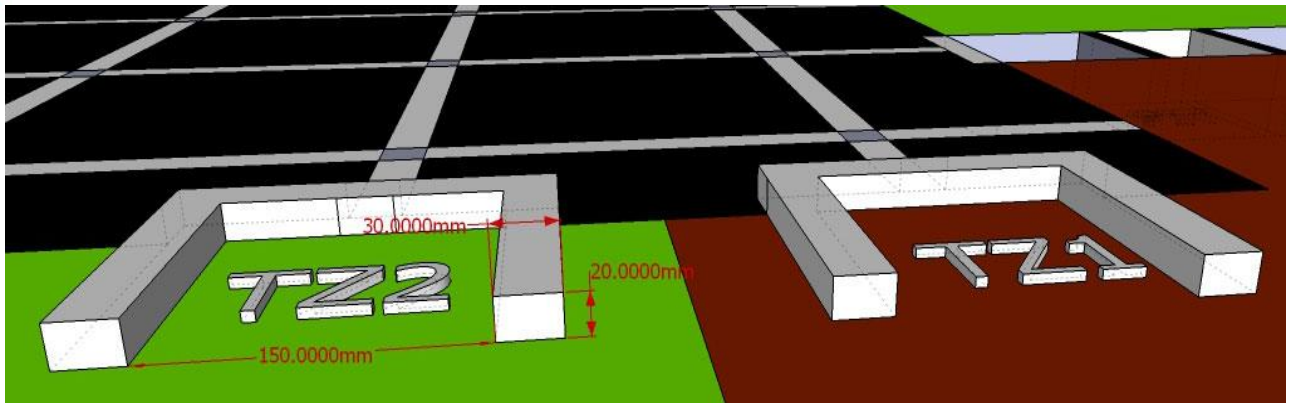


Figure 13: Transfer Zones

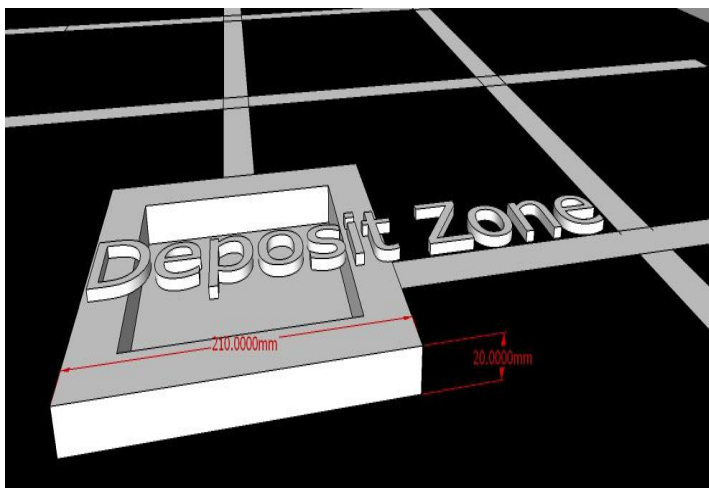


Figure 14: Deposit Zone Block Adjusters

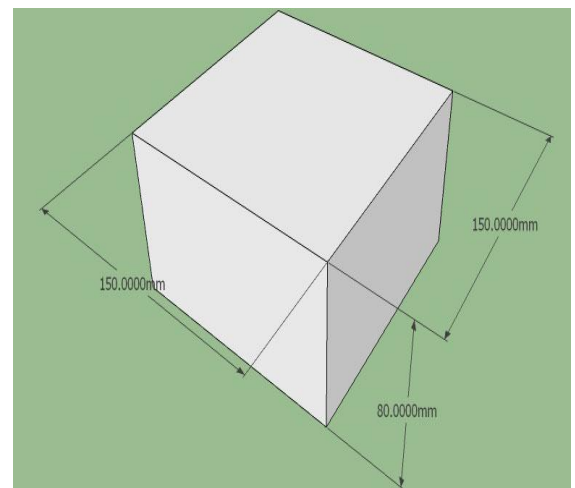


Figure 15: Block

Note: The dimensions of the arena would be accurate to within 5% or 20 mm, whichever is less. Assembly joints on the arena floor will not involve steps greater than 0.5mm.

**Light conditions at the venue might not be uniform.*

Bot Specifications:

Autonomous Bot:

- The autonomous bot must be completely autonomous.
- After the autonomous bot starts, no team member is allowed to touch the bot.
- The autonomous bot should fit within a box of size **250 mm×250 mm×300 mm** (l×b×h). Bot must be started individually by only one on-board switch. However, a team may have separate on-board switches for restart. This switch has to be shown before the run to the organizers.

- During the run, the autonomous bot can expand itself provided it does not damage the arena in anyway. Autonomous bot is not allowed to leave anything behind or make any marks while traversing in the autonomous zone. Any bot found damaging the arena will be immediately disqualified.
- Autonomous bot should not split into two or more units.
- Teams are allowed to use readymade micro-controller boards/readymade sensor kits. However teams are not allowed to use readymade Lego kits or any such assemblies.
- The starting procedure of the bot should be simple and should not involve giving the bot any manual force or impulse in any direction.

Manual Bot:

- Teams can use **wireless** or wired remote control for controlling the bot.
- Only one team member is allowed to control the manual bot in the game field.
- During the start of the run, the manual bot must fit within a box of dimension **400 mm×400 mm×500 mm** (l×b×h).
- The bot must be stable and be able to stand on its own at the beginning of the run when put in the manual start zone. Bots not fulfilling this criteria will be disqualified.
- The manual bot should not split into two or more units during the entire match.
- The manual bot should have an on-board power supply.
- The external remote control used to control the bot is not included in the size constraint.
- The manual bot cannot be constructed using readymade Lego kits or any readymade mechanism. However, readymade gear assemblies can be used. Violating this clause will lead to disqualification of the team.

Power Supply:

- Both the bots have to use an on-board power supply. No external power supply will be allowed.
- Each team should bring its own power supply for both the bots.
- The potential difference between any two points should not exceed 24V DC.

Controls:

- The grid solving autonomous bot must not receive any input from anywhere outside the arena.
- The manual bot should receive signal only from a single remote control.
- No wireless communication between the autonomous bot and the manual bot is allowed. No sort of communication i.e. visual or radio wave that includes any physical or optical signal provided by the manual bot is allowed. The team is responsible for proving this to the organizers. If any wireless communication is detected, then the team will be disqualified.

GAMEPLAY:

- Manual bot must start at the manual start zone while autonomous bot at the auto start line.
- The manual bot will throw a ball into a **vertical ring** before entering into the restricted zone. In case it is not able to hit the target, it will incur a penalty for entering into the restricted zone if the team wants to proceed further in the game.
- The autonomous bot has to solve the grid by following the white lines while avoiding the nodes and must carry the Key block from a location on the grid to the transfer zone (indicated as TZ1). The manual bot will carry this block to fill the pit.
- The manual bot will transfer the Nexus block from the block zone to the other transfer zone (indicated as TZ2). The autonomous bot will carry the Nexus block to fill the other pit.
- Now the autonomous bot will move towards the inclined plane.
- The manual bot will **cross the pit** and will move forward to complete the path of autonomous bot by dropping the plank.
- The autonomous bot will travel through the inclined plane and will cross the completed track on the platform.
- The autonomous bot will now climb down the wedge and will move forward to **collect the Calypso block** and deposit it in the deposit zone.
- The autonomous bot will have to **hit the thermocol sheet** having diameter 250 mm at the end structure to expose the metal plate.
- As the circular metal plate area is exposed, the manual bot will **throw a ball into it**.

GAME RULES:

Note: The teams will have to submit their autonomous bot before the start of the competition. Only those teams which submit their autonomous bot will be allowed to participate. The autonomous bot will be handed back to the team during the time of their run. They will be given 2 minutes to do any hardware changes if they wish. Under no circumstances they will be allowed to make changes in their code.

- The maximum time given for completing the task is **6 minutes**.
- Before the start of the run, a dry run of **5 minutes** will be given to the autonomous bot. During the dry run, the autonomous bot can explore the entire grid to find the position of the nodes. The bot should give a visual/audio signal at the end of the dry run. **The plank will be dropped down manually by organizers for the dry run.**
- If the time for the dry run exceeds 5 minutes, then the extra time taken for the dry run will be deducted from the actual run time of 6 minutes. No advantage will be given if the dry run ends before 5 minutes.

- At the end of the dry run, the autonomous bot will be given to the team. Then the team has to place the **manual and autonomous bots together** at **their starting point** and then the game starts.
- Autonomous bot is allowed to move only in the autonomous zone at all times.
- Manual bot is allowed to move only in the manual zone.
- Blocks should not be **dragged** by any of the bots of competing team. If found so, a penalty of 50 points will be incurred.
- **A maximum of 3 balls can be preloaded into manual bot** before the start of the match.
- If a team requires more balls to complete the task, the team will be given more balls (maximum three at a time) any number of times, but the bot has to come to the start zone or the loading zone to load the balls. The balls will be loaded by the organizers. In this whole process, timer will not be stopped.
- **The speed of the ball** thrown should be within the permissible limits.
- In case of wired mechanism of the machine, the wire must be slack at any point of time during the game. The total length of wire extending from the remote control to the machine must be of minimum 3 meters.

CHECKPOINTS:

1. Autonomous Bot Checkpoints:

- **First checkpoint:** If the Autonomous bot deviates before crossing the first intersection of the two white lines, the bot has to start from the starting point with a penalty of 35 points.
- **Second checkpoint:** Once the autonomous bot successfully deposits the key block in the transfer zone 1 (TZ1).
- **Third checkpoint:** Autonomous bot deposits the Nexus block into the pit.
- **Fourth checkpoint:** Autonomous bot deposits the Calypso block into the deposit zone.

2. Manual Bot Checkpoints:

- **First checkpoint:** Once the manual bot deposit the Nexus block into the transfer zone 2 (TZ2).
- **Second checkpoint:** Manual bot crosses the pit.

Restarts:

- The teams are given **3 restarts each** for the autonomous bot and the manual bot.
- However, there are no restrictions on the number of restarts for the dry run.
- If any bot wants to take a restart at any point, it will start from the previous cleared checkpoint and the block will be placed back at its previous position.

- In a restart, the timer will not be set back to zero and time will not be paused.
- During restarts for the autonomous bot, a contestant cannot feed any information to the bot. However, contestants are allowed to adjust sensors (gain, position etc.) and make repairs. A contestant may not alter a bot in a manner that alters its weight (e.g. removal of a bulky sensor array or switching to lighter batteries to get better speed).
- All restarts for autonomous bot and the manual bot require the approval of the organizers before the bot can be removed from the arena. If the bots were handled within the arena without approval, the run will be terminated.
- A block is said to be deposited in a particular zone if any part of the block is in contact with that deposit zone.

General Rules:

- Team members will not be allowed to handle the blocks. Only organizers are allowed to handle the blocks in any situation. The team will be disqualified if the blocks were handled within the arena without the approval of the presiding organizers.
- The bot is not allowed to leave anything behind while traversing the grid. It should not make any marks on the floor of the arena. Any bot found damaging the arena will be immediately disqualified.
- Only two members of the team are allowed to handle the bots. Participants are not allowed to keep anything inside the arena other than the manual and autonomous bots.
- Laptops/personal computers are not allowed near the arena. Other Wi-Fi, Bluetooth, etc. devices must be switched off. The organizers hold the right to check for these devices and their usage and disqualify the team.
- The organizers may stop any bot at any time if they feel that it is performing or is about to perform any action that is dangerous or hazardous to people or equipment. No robot is allowed to use any flammable, combustible, explosive or potentially dangerous processes.
- The time measured by the organizers will be final and will be used for scoring the teams. Time measured by any contestant by any other means is not acceptable for scoring.
- In case of any disputes/discrepancies, the organizer's decision will be final and binding. The organizers reserve the rights to change any or all of the above rules as they deem fit. Change in rules, if any will be highlighted on the website and notified to the registered teams.

Judging:

- Teams will be awarded 50 points for successfully shooting the ball into vertical ring.
- Teams will be awarded 40 points for depositing the Key block in the TZ1.
- Teams will be awarded 40 points for dumping the Key block in the pit by the manual bot.

- Teams will be awarded 30 points for transferring the Nexus block from block zone to TZ2.
- Team will be given 50 points for depositing the Nexus block from TZ2 into the pit.
- Teams will be given 30 points if the manual bot successfully crosses the pit over the two blocks.
- Teams will be awarded 40 points if the autonomous bot crosses the blocked path.
- Teams will be awarded 40 points for successfully placing the Calypso block into the deposit zone.
- Team will be awarded 30 points for hitting the thermocol sheet and displacing its position by the autonomous bot at the finish point.
- Teams will be awarded 60 points for successfully shooting the ball into the exposed circular metal plate area.
- Every time the autonomous bot crosses a node, it incurs a penalty of 25 points.
- If the autonomous bot deviates before crossing the first intersection of two white lines, the bot has to start from the auto start line with a penalty of 35 points.
- If the autonomous bot enters into the manual zone or the restricted zone, it incurs a penalty of 25 points.
- If any part of the manual bot enters into autonomous bot zone, it incurs a penalty of 25 points.
- If any of the two bots of a team enters into opponent's zone, it will incur a penalty of 30 points.
- If the manual bot opts to enter the restricted zone without throwing a ball into ring, teams will incur a penalty of 30 points for entering into the restricted zone.

Final Score:

- **Total points** earned in the game $+2 \times B$ (where $B=360$ seconds – the time taken by the team to complete all the tasks in seconds).
- **Time bonus will only be given if team completes all the task within stipulated time duration of 360 seconds.**
- The team with the maximum score wins the match.

Eligibility:

All students with a valid identity card of their respective educational institutes are eligible to participate in the event.

Team Specification:

A team may consist of a maximum of 5 participants. Students from different educational institutes can form a team.

Certificate policy:

Certificate of excellence will be awarded to the top 3 teams. Certificate of participation will be given to all the participating teams scoring minimum 80 points. Disqualified teams will not be considered for any certificates.