

Game Field:

- The field consists of an area having dimensions of 3550 mm×2150 mm. The whole arena will be made of wood.
- The game field consists of a manual zone, an automatic robot zone, a manual bot starting zone, transfer zones (TZ1 and TZ2), an auto start line, a block zone, a drum, a ring and an inclined platform.
- **Manual Start Zone:** The manual bot must start the game from the start zone.
- **Auto Start line:** The autonomous bot will start simultaneously from the line indicated as Auto start.
- **Grid:** It is indicated in black and white colors. Only the autonomous bot can navigate in this zone. This zone will consist of white grid lines on a black surface. The lines are equally spaced. At some places, there are nodes at the intersection of two white lines. Nodes are black squares of dimensions 30 mm×30 mm. Position of nodes will be revealed before the match. Each cell of the grid will be a square with inner dimensions 300 mm x 300 mm. The thickness of each white line is 30 mm.
- **Blocks:** There will be two types of blocks Nexus block placed at the block zone, Key block placed in grid. 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, manual bot cannot enter without throwing the ball into the ring. If it is not able to do it, then it will have to incur a penalty to maneuver in this zone.
- **TZ1:** It is the zone, where autonomous bot will drop the Key block.
- **TZ2:** It is the zone, where 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 5.
- The centre of vertical ring is 350mm from the ground while the centre of metallic plate from the ground is 225mm.
- **Block Adjuster:** It facilitates the placement of blocks by the bots in the transfer zone.
- 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 incline 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 a considerable gap between the joints (up to 1cm).

- The diameter of the plastic ball to be thrown will be 60mm having maximum weight of 20 grams. The blocks are made of non-magnetic material and will have a maximum weight of **100 grams**.

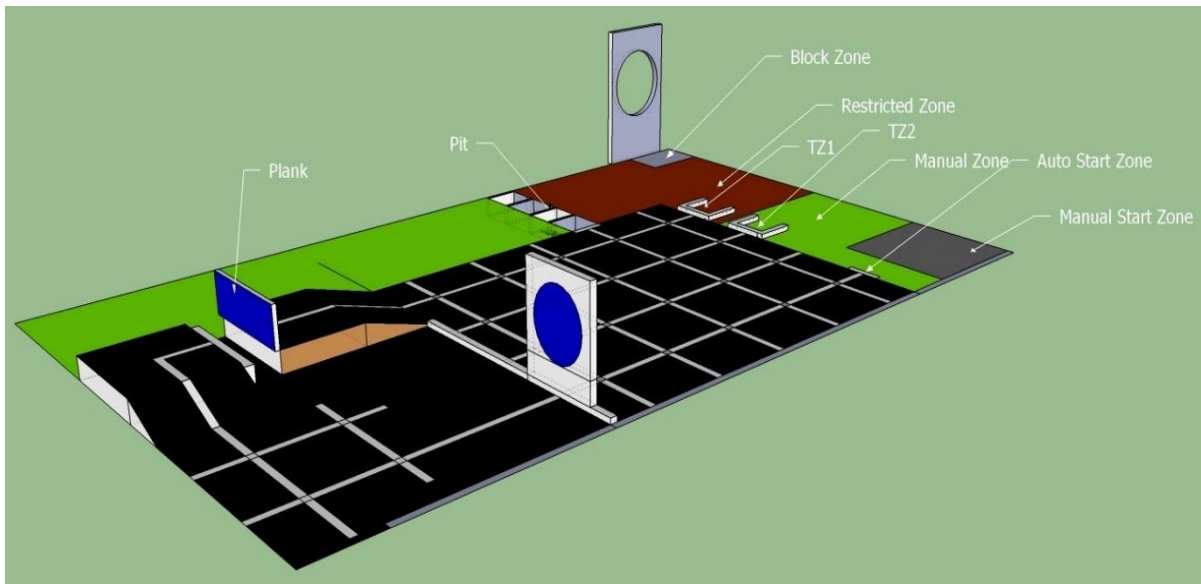


Figure 1: Arena



Figure 2: Starting Zones

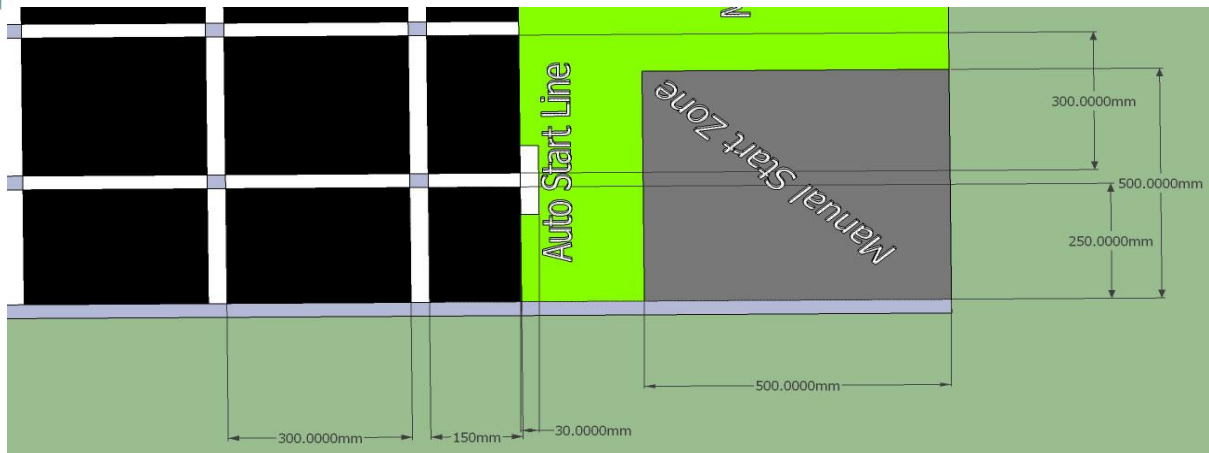


Figure 3: Manual Start Zone

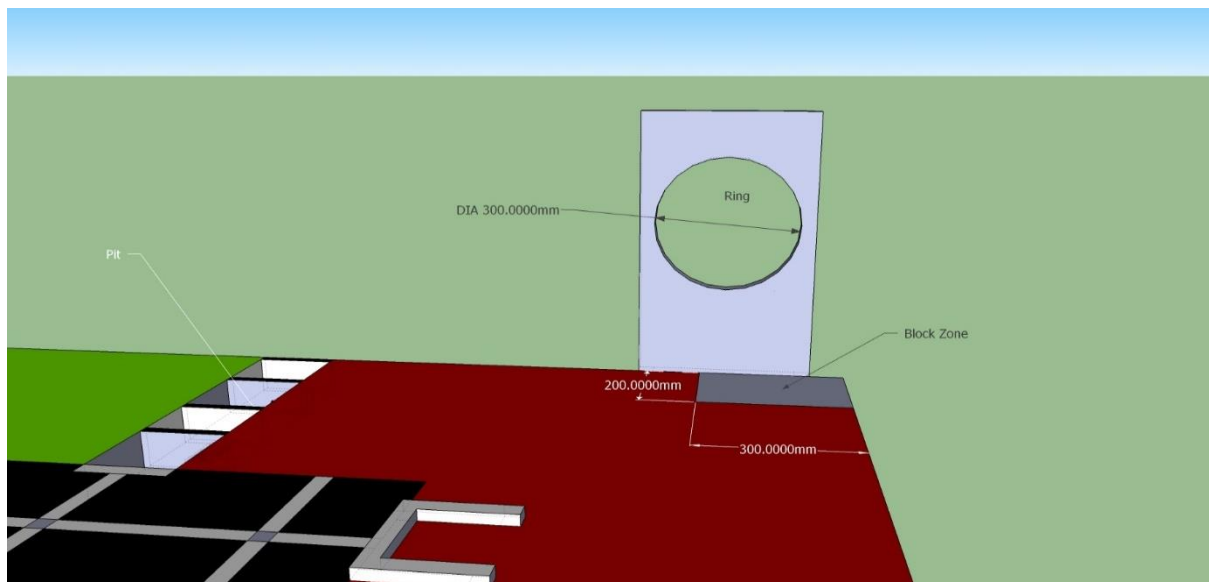


Figure 4: Ring

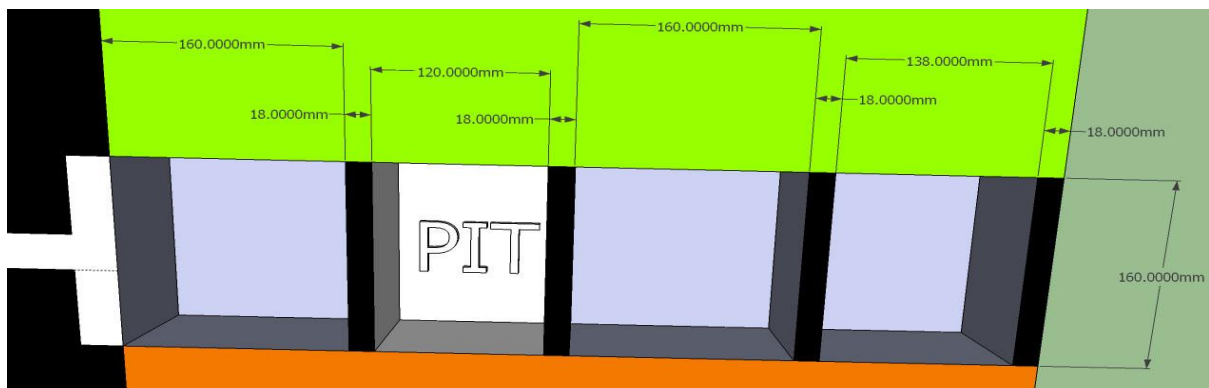


Figure 5: Pits

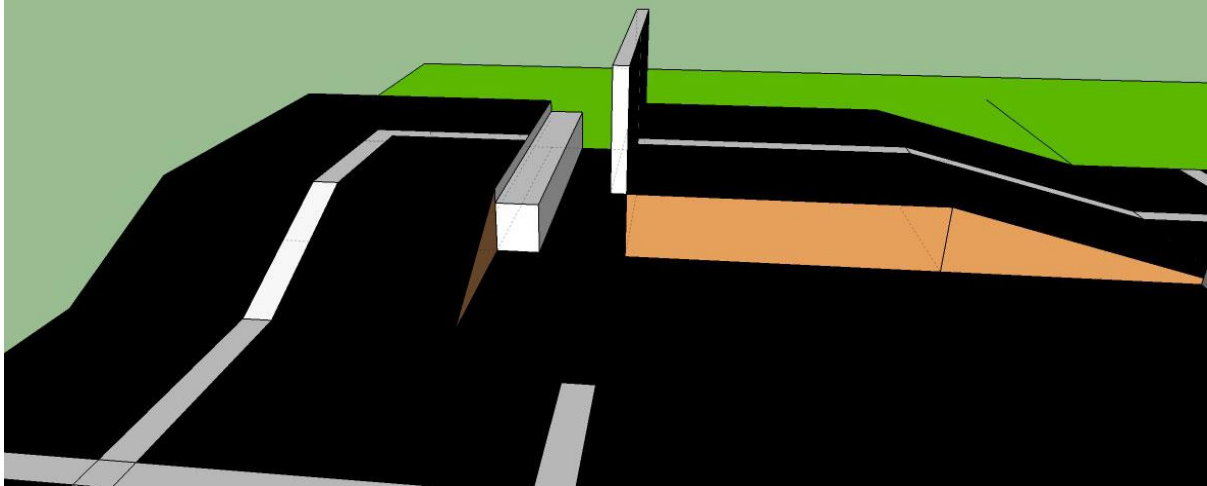


Figure 6: Plank

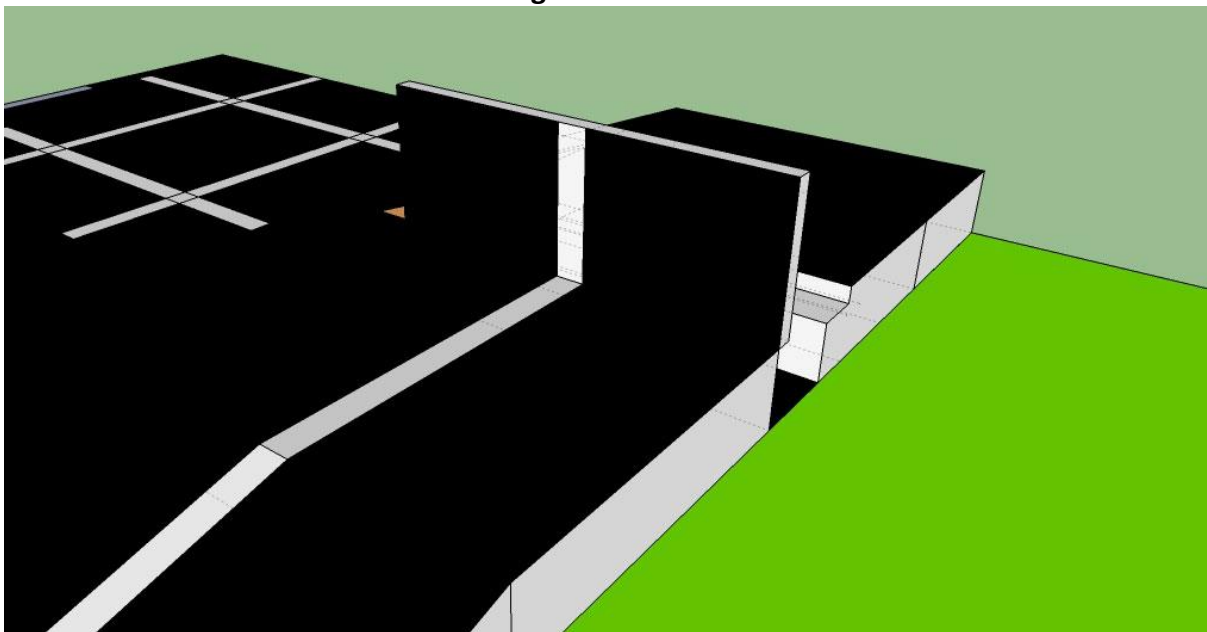


Figure 7: White line on the plank

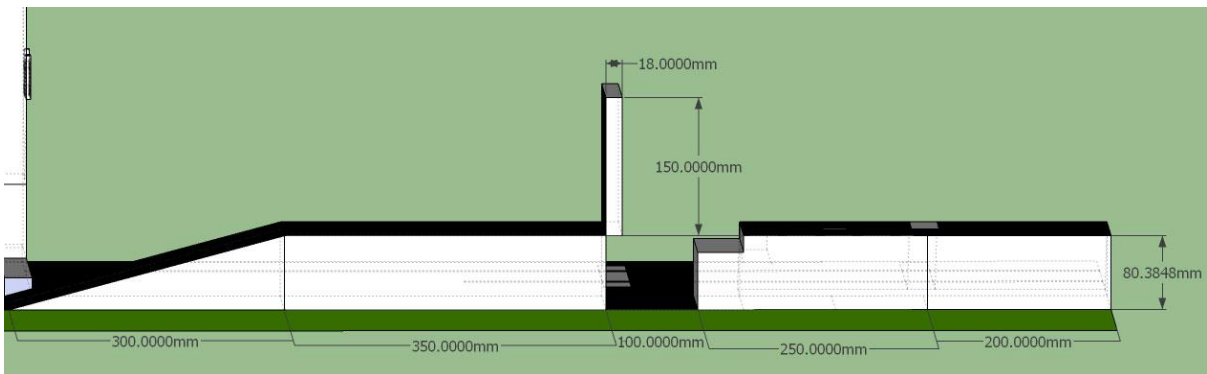


Figure 8: Inclined Platform and Plank Dimensioning

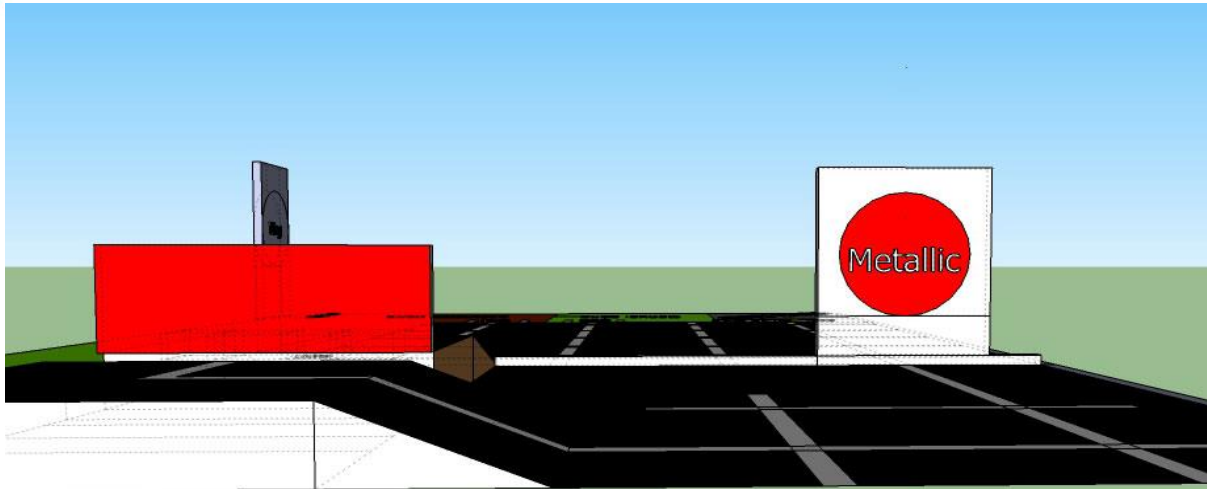


Figure 9: Metal Plate

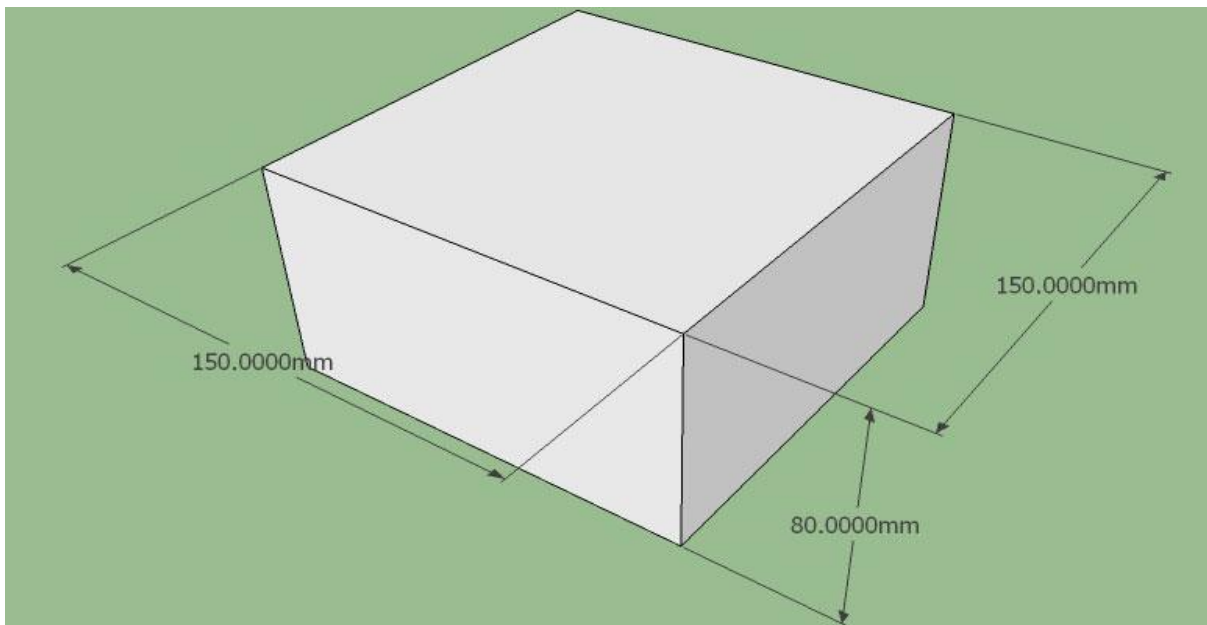


Figure 10: Block

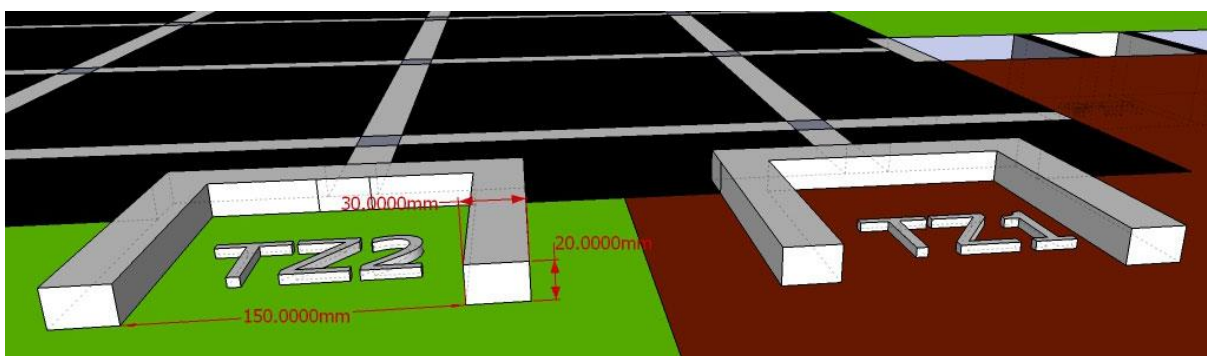


Figure 11: Transfer Zone

NOTE: The dimensions of the arena would be accurate to within 5% or 20mm, 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.*

**In the figures, colors are shown just for indication and sample arena is shown.*

Bot Specifications:

Autonomous Bot:

- Autonomous bot must be completely autonomous.
- After the autonomous bot starts, no team member is allowed to touch the bot. The autonomous robot should fit within a box of size 250mm×250mm×300mm (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 to the organizers before the run.
- 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 cube of dimension 400mm×400 mm×500mm (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 these criteria will be disqualified.
- The manual bot should not split into two or more units during 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.
- Manual bot should strictly move in the manual zone.

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 bots.
- The potential difference between any two points should not exceed 24V DC.

Controls:

- The grid solving autonomous bot should 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 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 the autonomous bot at the autonomous bot start line.
- The manual bot will throw a ball into a vertical ring before entering into the restricted zone. In case the ball is not able to go through the ring, it will incur a penalty for entering into 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 this 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 down 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 ring the metallic plate.

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 will they 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 manually by the organizers for the dry run.
- If the time for the dry run exceeds 5 minutes, then the extra time taken for dry run will be deducted from the allotted 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 manual bot and autonomous bot together at the 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 the competing team. If found so, a penalty of 50 points will be given.
- A maximum of 3 balls can be preloaded into the manual bot before the start of match.
- If a team require mores balls to complete the task, the team will be given more balls (maximum three at a time) any number of times, but it has to come to the start zone to load them. 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 the 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 two white lines, the bot has to start from the starting point with the 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.

2. Manual Bot Checkpoints:

- **First checkpoint:** Once the manual bot deposits the Nexus block into 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 to 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 any 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 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 disqualified immediately.
- 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 the 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 the 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 to all. 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 via email.

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.
- Teams will be given 50 points for depositing the Nexus block from TZ2 to the pit by the autonomous bot.
- 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 30 points for ringing the metallic plate by the autonomous bot at the finish point.
- 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 starting point with the penalty of 35 points.
- If the autonomous bot enters into the manual zone or restricted zone, it incurs a penalty of 25 points.
- If any part of the manual bot enters into the autonomous bot zone, it incurs a penalty of 25 points.
- If manual bot opts to enter into the restricted zone without throwing a ball into vertical, the team will incur a penalty of 30 points.

Final Score:

- Final score = Points earned in the game + $2 \times B$ (where $B=360$ seconds-time taken by team to complete all the task in seconds).
- **Time bonus will only be given if team completes all the task within the stipulated time duration of 360 seconds.**
- Team with 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 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 a minimum of 80 points. Disqualified teams will not be considered for any certificates.