INTERNATIONAL ROBOTICS CHALLENGE - FINALE

Task:

1. There will be two bots, a manual bot and an autonomous bot. They need to coordinate with each other to complete the task.
2. The autonomous bot has to solve the grid by following the white lines while avoiding the nodes and has to climb over the Inclines creating its path and has to climb over the See Saw.
3. The manual bot has to walk over the pit of wooden planks , transfer the block to the deposit zone, help the autonomous bot reach its final position and put the flag in the wet sand.
4. A maximum of 6 minutes will be allotted to each participating team.

Game Field:

1. The game field consists of an arena having dimensions **4640 mm X 4640 mm**. Complete arena is divided into 2 parts for 2 teams.
2. It also contains a manual bot zone, manual start zone, a bridge containing wooden planks, wooden inclines, blocks, autonomous start zone, autonomous bot zone common zone, an empty pit, a flag, a See Saw, deposit zones, a gate, a pit containing dry sand and another pit containing wet sand.
3. **Manual Zone:** Only the manual bot can maneuver in this zone. (It is indicated by green color in the arena)
4. **Autonomous Zone:** Only the autonomous bot can maneuver in this zone. (It is indicated by grids in the arena)
5. **Manual Start Zone:** The manual bot must start the game from this zone.
6. **Autonomous Start Zone:** The autonomous bot must start the game from this zone.
7. **Grid:** This zone consists of white grid lines on a black surface. The squares of the grids have inner dimensions of 300mm X 300mm. The width of white lines is 30mm. There are three elements in grid
    - **Node:** There are some nodes at the intersection of two white line at some places. The nodes are black squares of dimensions 30mm X 30mm.
    - **Deposit Zones:** There are two deposit zones of depth 150 mm x 150 mm x 100 mm in autonomous zone as shown in figure 5. Manual and autonomous bots will have to transfer the blocks into deposit zone.
    - **Block Base**: Position of two blocks will be indicated in grid as shown in figure 5. The dimension of each block base is 150mm x 150mm.

(Note: This is a sample arena. In order to avoid hardcoding, position of nodes and blocks will change after some interval of time. During dry run the autonomous bot has to identify the position of nodes and blocks. However position of deposit zones will remain fixed as shown in. figure 5).

8. **Pit of wooden planks:** The dimensions of the pit is 600 mm X 200 mm and would contain stripes of **200 mm x 50 mm x 10 mm** (lxbxh) .
9. **Blocks:** There are two types of thermocol blocks used in the gameplay, namely, Lego 1 and Lego 2. Manual bot would find the Lego 2 block just after crossing the pit containing

wooden planks. .Lego 2 is the block that the autonomous bot will encounter in its zone.

10. **Gate:** As shown in figure 10.

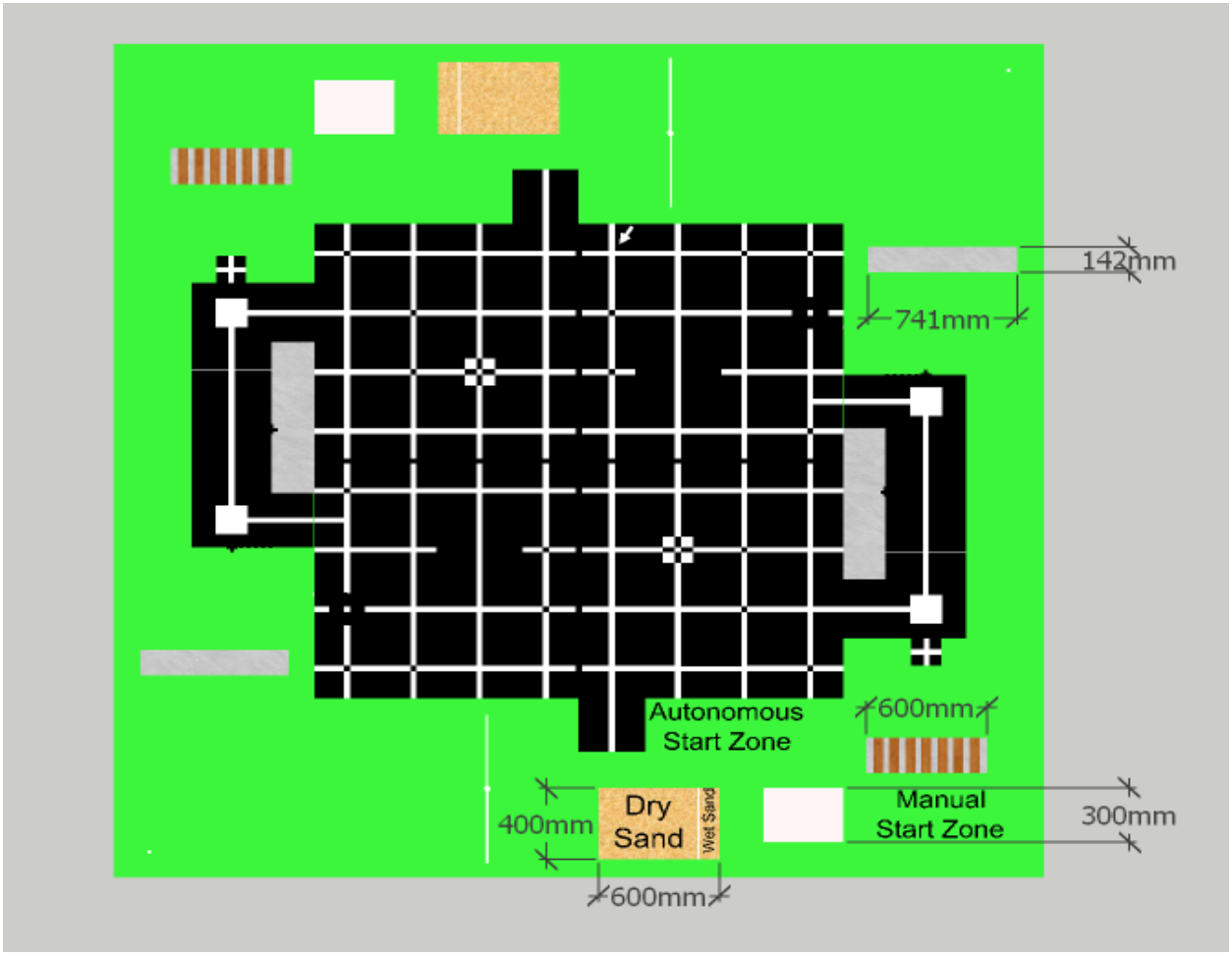

Figure 1 : Top view of the arena

11. **Bridge:** It has the deposit zone 2 as shown in the figure 7 and 8.
12. **Pit containing sand:** It has a dimension 600mm x 400mm (lxb). It contains dry sand in the 600mm x 300mm part and wet sand in 600mm x 100mm part as shown in figure 4.

Note:

- ***The dimensions of the arena will be accurate to within 5% or 20 mm, whichever is less.***
- ***The diameter of the sticks may vary within +/- 10 mm.***

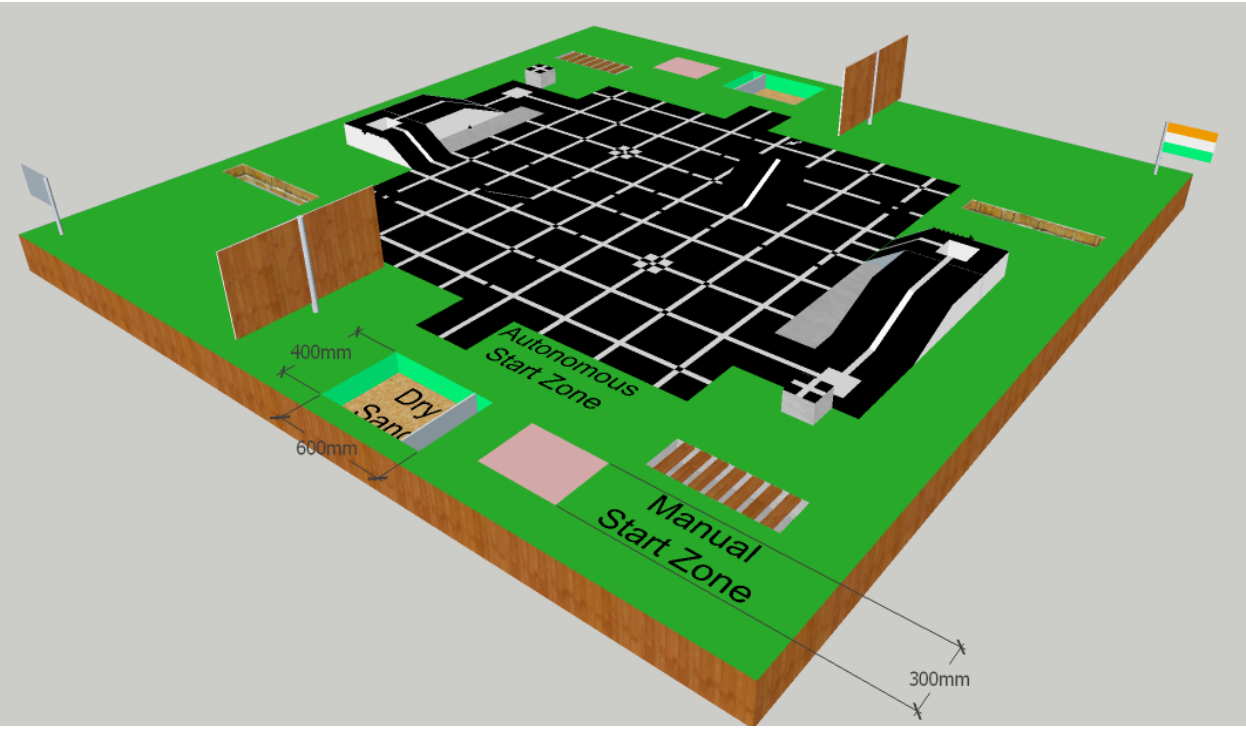

Figure 2 : Isometric view of the arena

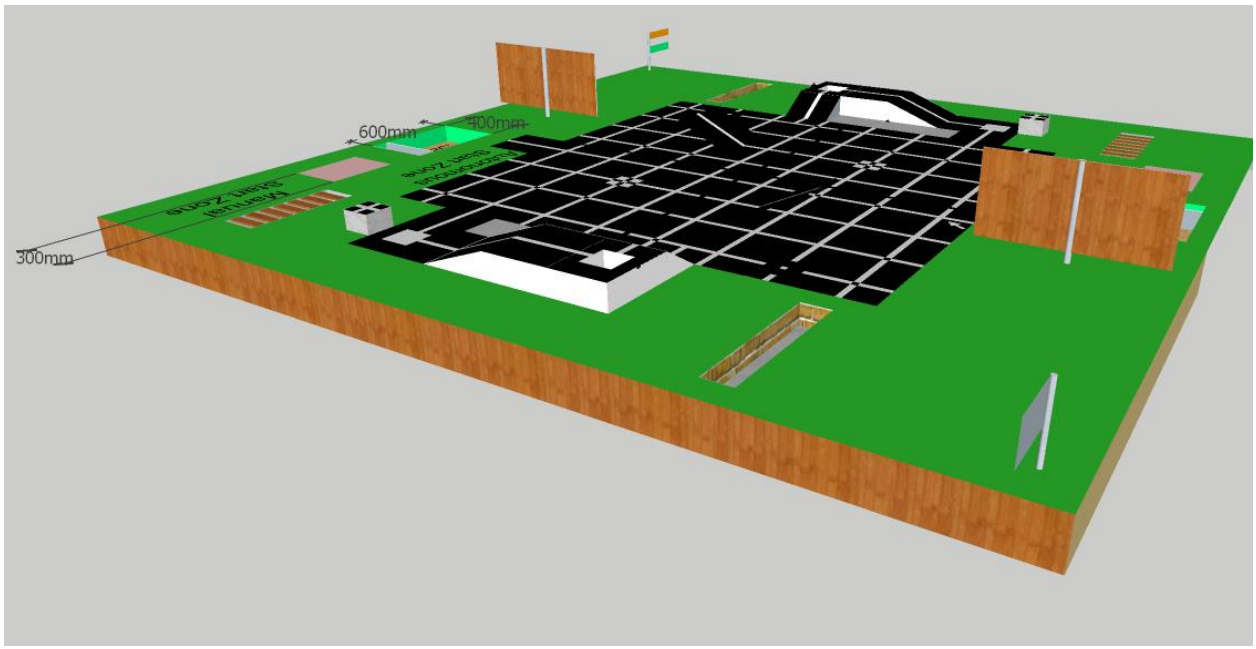

Figure 3 : Isometric view of the arena

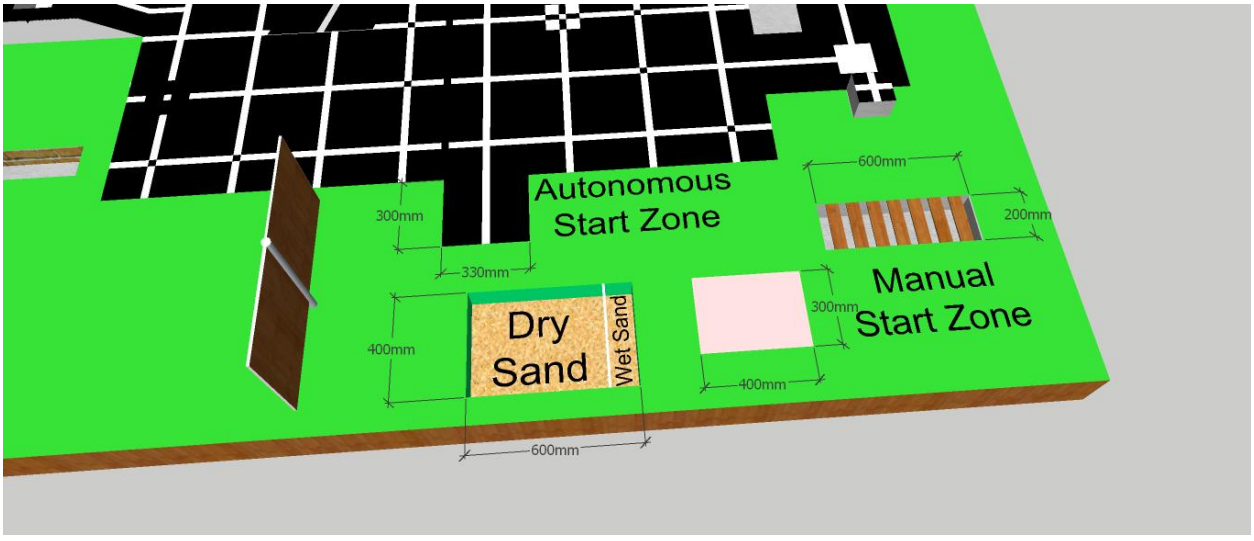

Figure 4 : Manual and Autonomous start Zones of the arena

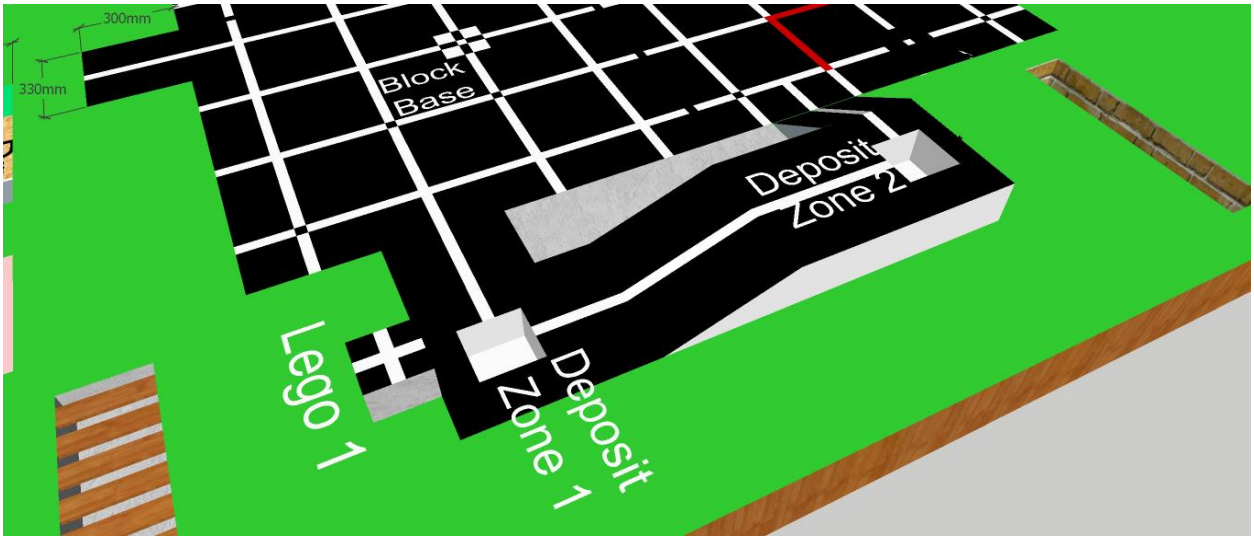

Figure 5 : Position of Blocks and Deposit zone

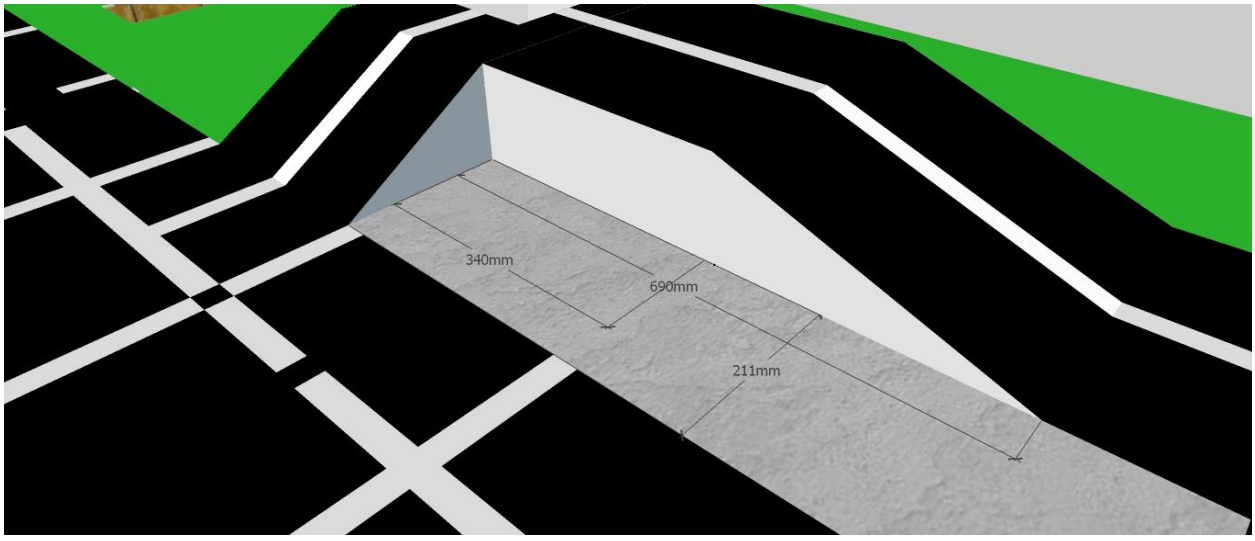

Figure 6 : Bridge Dimensions

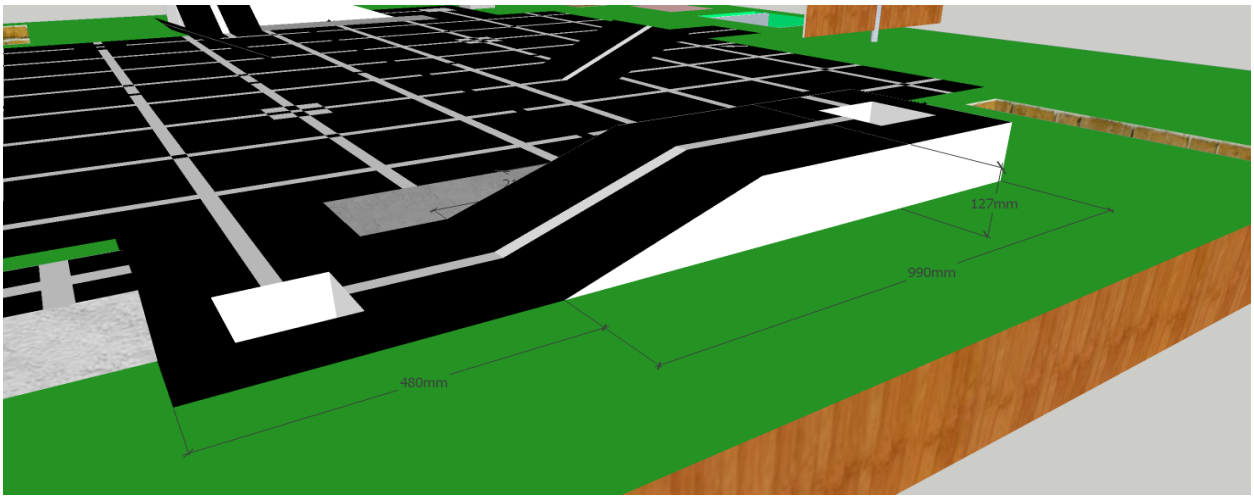

Figure 7 : Bridge Dimensions

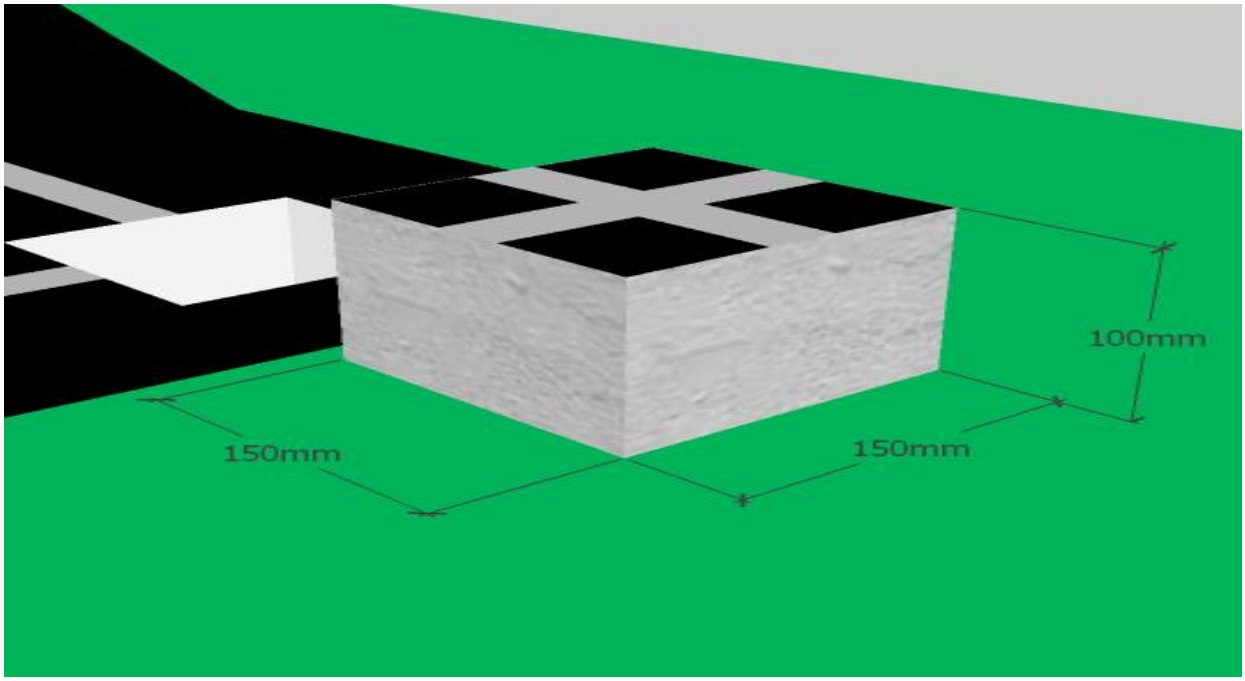

Figure 8 : Block Dimensions

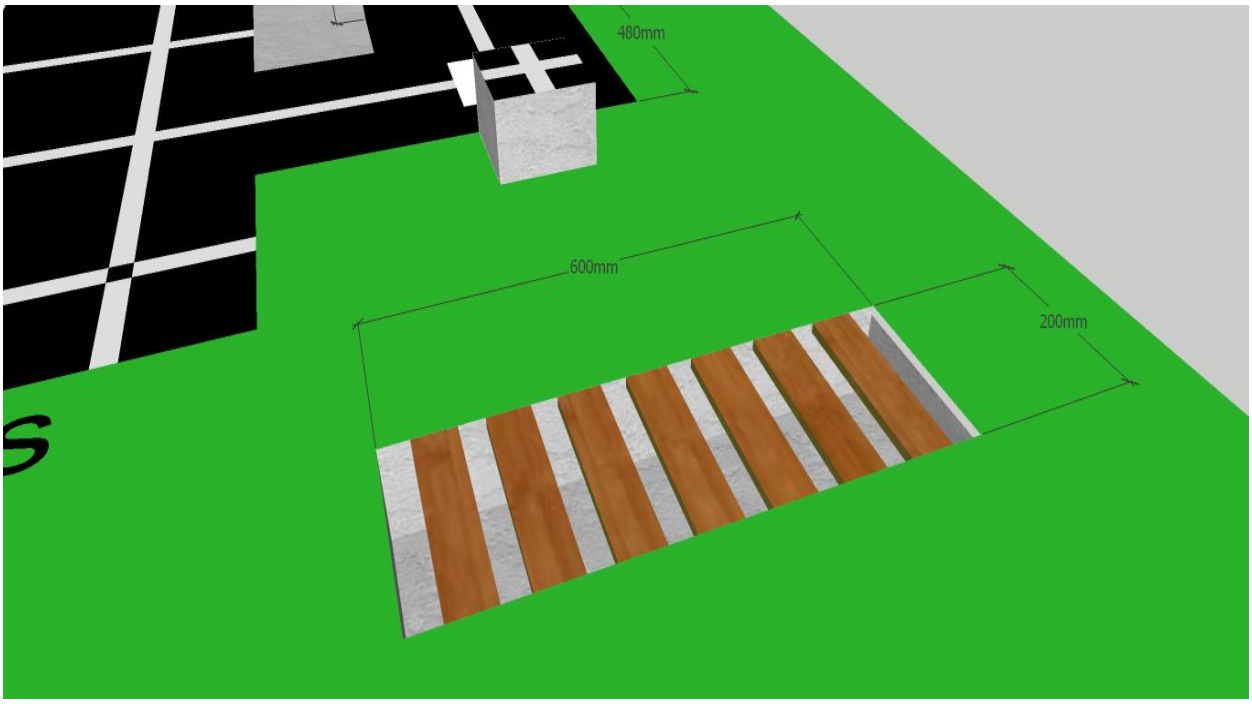

Figure 9 : Wooden planks

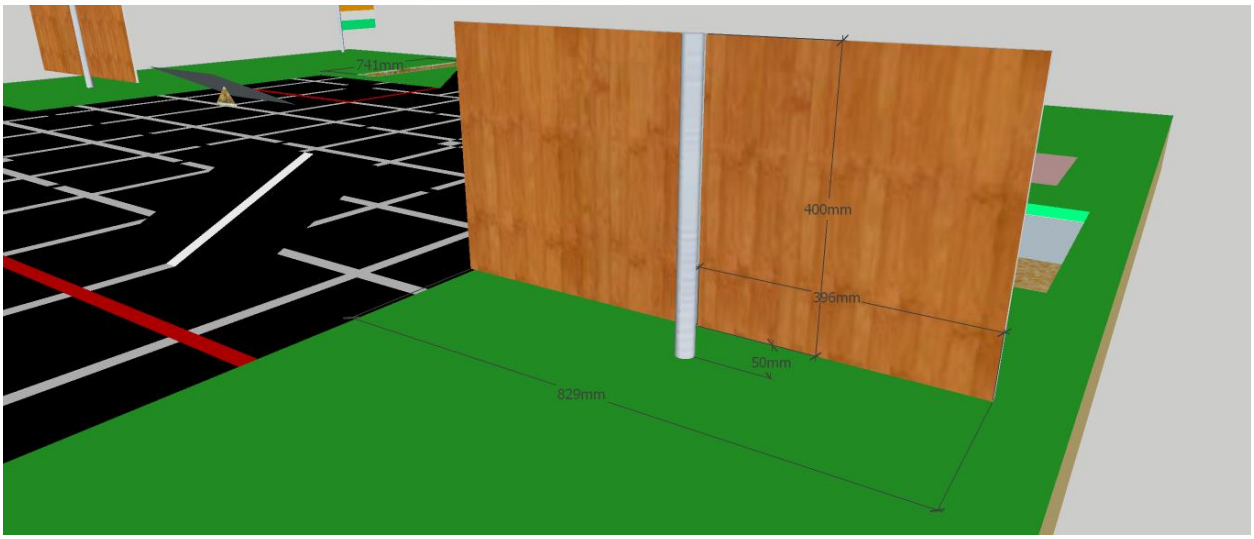

Figure 10 : Gate Dimensions

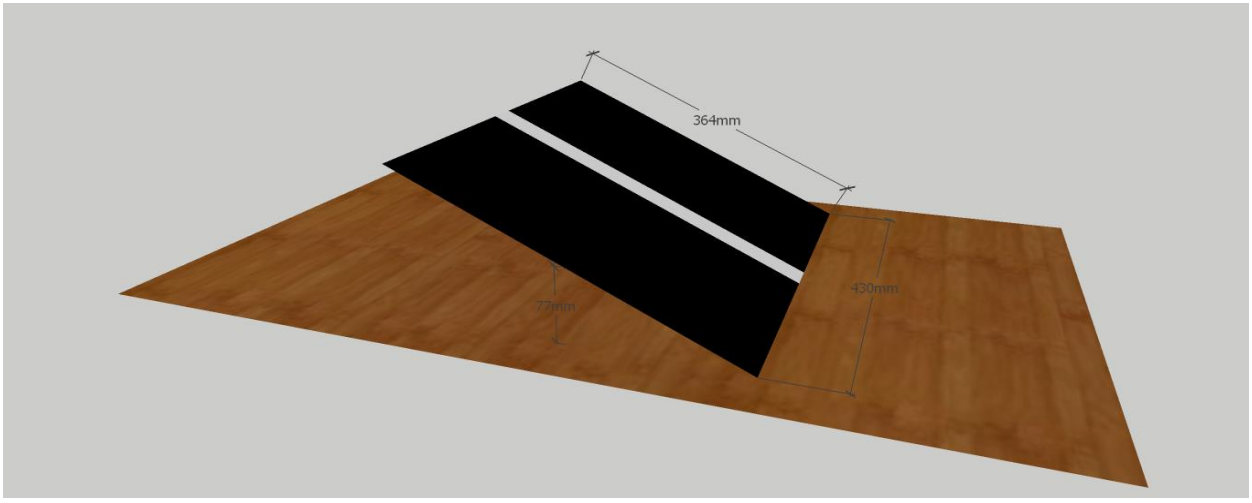

Figure 11 : See Saw Dimensions

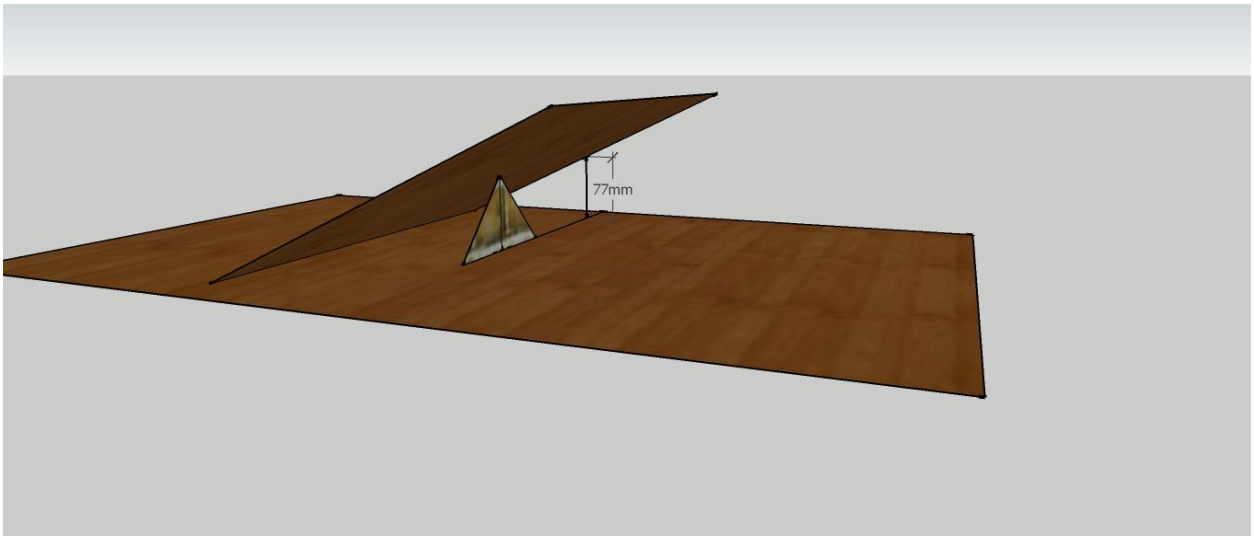

Figure 12 : See Saw Dimensions

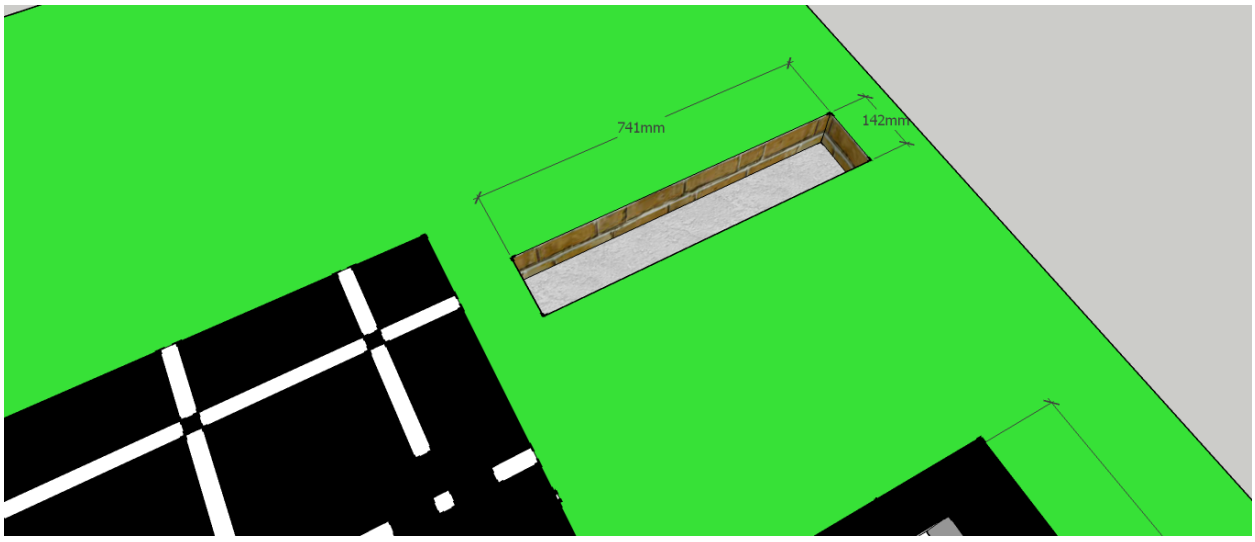

Figure 13 : Hollow barriers for Manual Bot

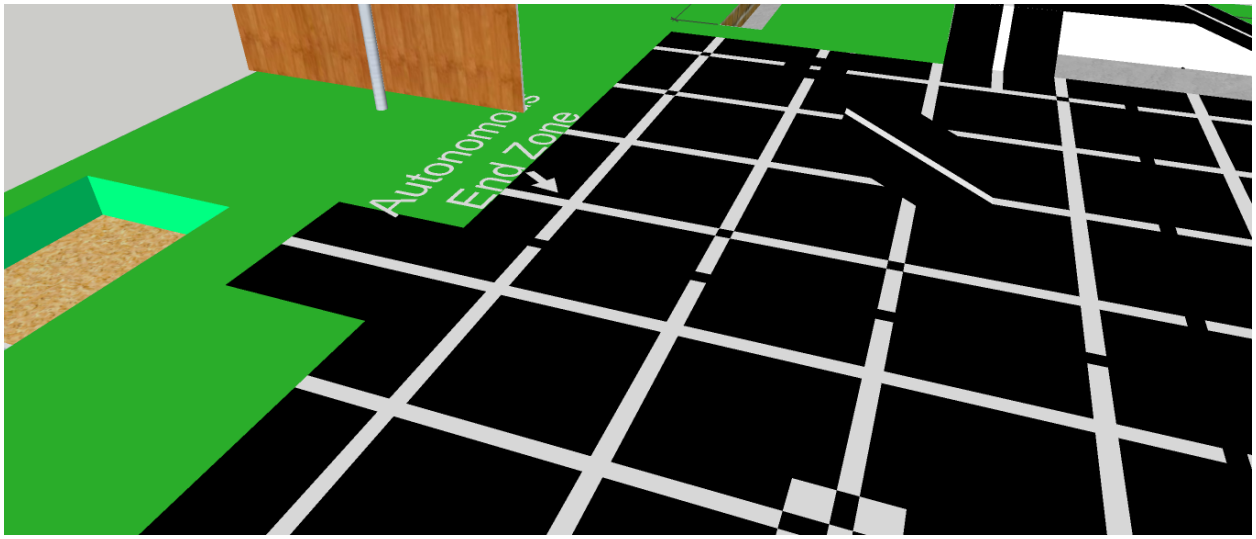

Figure 14 : End Zone for autonomous Bot

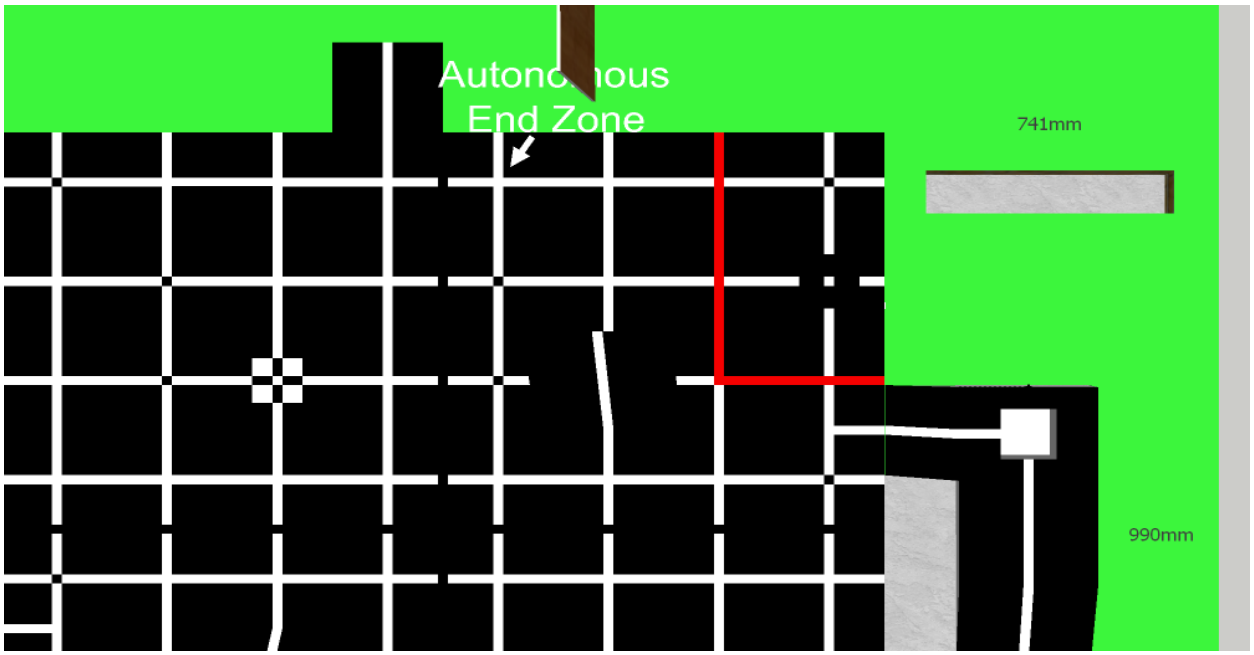

Figure 15 : Permitted area for the manual bot in autonomous zone

(Note : There would not be any red color in the arena. It is used only for reference)

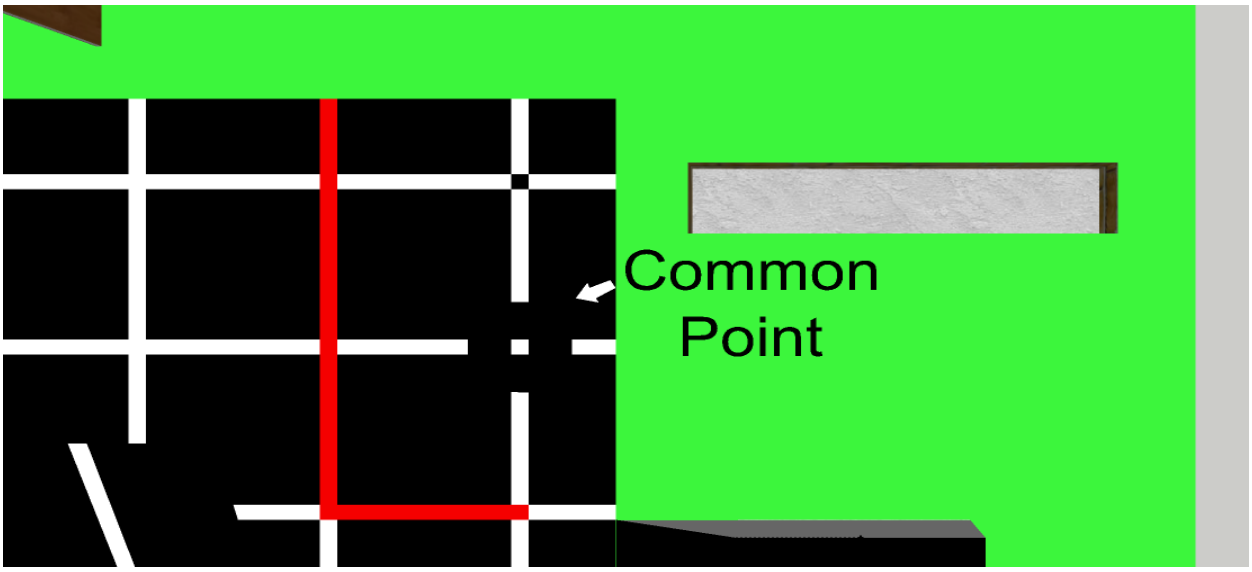

Figure 16 : Common point

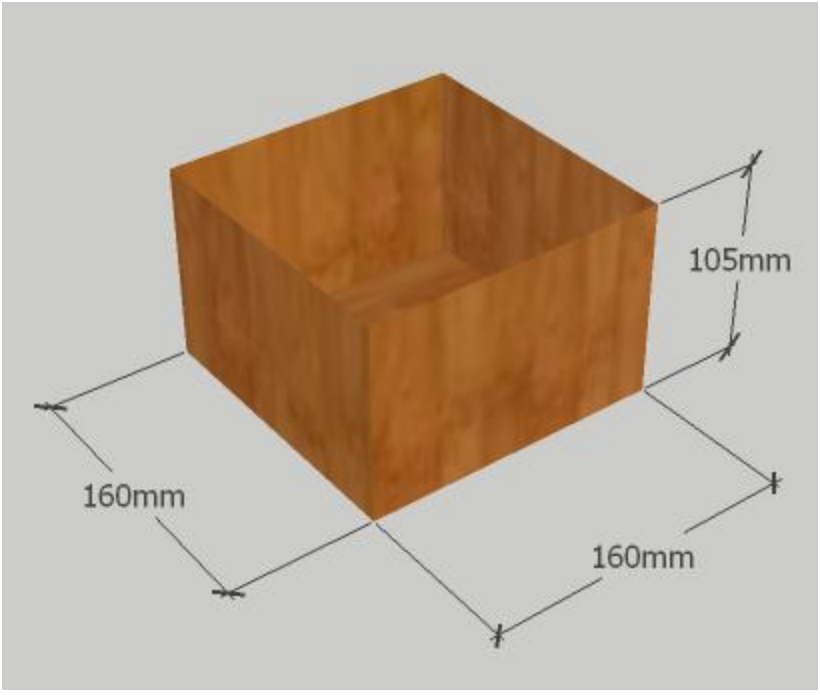

Figure 17 : Deposit zone

Bot Specifications:

Autonomous Bot:

1. The autonomous bot must be completely autonomous with just one switch to start/reset it.

2. The dimensions of the autonomous bot are such that it completely fits in a box of dimensions 300mm X 250mm X 200mm (l x b x h). The size of the gripper is not included in this constraint. 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.

3. The bot can expand itself during the run provided that it does not damage the arena in any case. It is not allowed to leave any part or any mark behind while moving forward on the arena. If found so, the team will be liable for disqualification.

4. Autonomous bot should not split into two or more units.

5. Teams are allowed to use ready made micro-controller boards/readymade sensor kits. However teams are not allowed to use readymade Lego kits or any such assemblies.

6. 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:

1. Teams can use both wired as well as wireless remotes. In case of wired bots, the length of wire should be such that it always remains slack at any instant of time. If the participants use wireless mechanism then it is mandatory to use a dual frequency remote.

2. Only one member from the team is allowed to control the bot.

3. During the start of the run, the manual bot must fit within a box of dimension 400mm x 300mm x 400mm (l×b×h).

4. The external remote control used to control the bot is not included in the size constraint.
5. 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 criterion will be disqualified.

6. The manual bot should not split into two or more units during the entire match.

7. The manual bot should have an on-board power supply.

8. 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:

1. Both the bots must use an onboard power supply. No external power supply will be allowed.

2. Each team should bring its own power supply for both the bots.

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

Controls:

1. The grid solving autonomous bot must not receive any input from anywhere outside the arena.

2. The manual bot should receive signal only from a single remote control.

3. Communication between the autonomous bot and the manual bot of any form like visual or radio wave that includes any physical or optical signal is not allowed. The team is responsible for proving this to the organizers. If any wireless communication is detected, then the team will be disqualified.

Gameplay:

1. The manual bot starts from the manual start zone and the autonomous bot starts from the autonomous start zone.

2. The manual bot first encounters along the pit containing wooden planks. If the bot fails to cross this, it will be allowed to skip the pit but with a penalty of 25 points. After crossing the pit, the manual bot would find Lego 1 block that it has to transfer to deposit zone 1. It is allowed to enter the autonomous zone only for depositing the Lego 1 block in the deposit zone 1. However it is not allowed to go through the incline and stay in the autonomous zone after depositing the Lego 1 block.

3. Meanwhile, the autonomous bot must start from the autonomous start zone. It has to solve the grid by following the white lines, avoiding the nodes.

4. Autonomous bot has to find the Lego 1 block in the autonomous zone, carry it over its head and then reach to deposit zone 2 in the incline. (Note that the autonomous bot cannot cross the deposit zone 1 unless the manual bot drops the Lego 1 block in it).

5. Once the manual bot deposits the Lego 1 block in the deposit zone 1, the autonomous bot can now cross it and reach the top of the incline carrying the Lego 2 block. The Autonomous bot has to deposit the Lego 2 block in deposit zone 2.

6. The autonomous bot, after crossing the incline, has to get down from the incline to the grid.

7. Meanwhile the manual bot has to walk beside the incline and reach to the other side of the incline.
8. The autonomous bot has to solve the grid and reach the common point. It is supposed stop and manual bot is supposed to push the autonomous bot to the next grid position avoiding the nodes. The Manual bot should not go beyond the the permitted are as shown in the figure 15 . Otherwise a penalty of 25 points will be imposed.

9. The manual bot is supposed to collect the flag from the manual zone, go through the propeller and finally put the flag in the wet sand (figure 4) to finish the gameplay.
10. Meanwhile the autonomous bot is supposed to move through the See Saw (Note : The Manual bot can avoid crossing the See Saw. Crossing the See Saw will give an extra 40 points) and reach the ending point.

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.

1. The maximum time given for completing the task is 6 minutes.

2. After the autonomous bot starts none of the team members will be allowed to touch it.

3. 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 and blocks (Lego 1 block and Lego 2 block). The bot should give a visual/audio signal at the end of the dry run. Lego 1 block will be manually placed in deposit zone 1 at the time of dry run.

4. 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.

5. Autonomous bot is allowed to move only in the autonomous zone at all times.

6. Manual bot is allowed to move only in the manual zone except the time of depositing the Lego 1 block in the autonomous zone and. Though it is allowed to move in the permitted (figure 15) area for a limited time but it should not damage the grid. A penalty of 20 points will be imposed if the manual bot is found damaging the grid.

7. Blocks should not be dragged by any of the bots of competing team. If found so, a penalty of **20** points will be incurred. (Block is considered to be dragged if it is dragged through a distance of 20 mm)

Checkpoints:

Autonomous bot checkpoints:

1. 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 20 points.

2. Second Checkpoint: After the autonomous bot crosses deposit zone 1, it will be placed just after the deposit zone 1 if it takes any restarts.

3. Third Checkpoint: After the bot successfully crosses the incline, it will be placed just after the incline if it takes any restarts.

4. Fourth Checkpoint: If the autonomous bot successfully crosses the See Saw, it will be placed just after the See Saw if it takes any restarts.

Manual Bot Checkpoints:

1. First Checkpoint: When the manual bot successfully crosses the pit containing wooden planks.

2. Second Checkpoint: When the manual bot successfully deposits the block 1 in deposit zone 1.

3. Third Checkpoint: When the manual bot reaches the common point, it will be placed at the common point during any kind of restarts.

4. Fourth Checkpoint : If the manual bot successfully pushes the manual bot to the next grid of the common point, it will be placed just after the hollow pit.

Judging:

1. Teams will be awarded 30 points for successfully crossing the pit containing the wooden planks.

2. Teams will be awarded 30 points for successfully depositing the Lego 1 block in deposit zone 1.

3. Teams will be awarded 40 points for successfully depositing the Lego 2 block in deposit zone 2.

4. Teams will be awarded 60 points if the autonomous bot successfully crosses the incline (Note : Points will be given only after the autonomous bot gets down from the incline).

5. Teams will be awarded 50 points if the autonomous bot is successfully pushed by the manual bot from common point to the next grid point.

6. Teams will be awarded an extra 40 points if the autonomous bot successfully crosses the See Saw.

7. Teams will be awarded 30 points if the manual bot successfully opens the gate and goes through it.

8. Teams will be awarded 40 points if the manual bot successfully crosses the dry sand pit and 30 points will be given if it successfully put the flag in the wet sand (Note the flag should be making at least 30 degree angle with the arena floor to get the points).

9. Every time the autonomous bot crosses the node , it incurs a penalty of 25 points and has to start from last checkpoint
10. 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 20 points.
11. If the autonomous bot enters into the manual zone, it incurs a penalty of 25 points.

12. If any part of the manual bot enters into autonomous bot zone, it incurs a penalty of 25 points except the time of pushing the autonomous bot and depositing the Lego 1 block in the deposit zone 1.
13. A penalty of 20 points will be imposed if the manual bot is found damaging the grid.
14. Blocks should not be dragged by any of the bots of competing team. If found so, a penalty of **20** points will be incurred.

Final Score:

1. Let S= Total Score

   A= Total points earned in performing all tasks B= 360- total time taken to complete the run C= Total penalty incurred

   Therefore, S= A + B - C

   Note: B will be considered only if a team completes all the tasks within the stipulated period of 480 seconds

2. Team with maximum points will win the round.

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 maximum of 5 members. Students from different educational institutes can form a team.

Certificate Policy:

1. Certificate of excellence will be awarded to the top 3 teams.
2. Certificate of participation will be given to all the teams qualified for finale except the top 3 teams.
3. Disqualified teams will not be considered for any certificates.