

INTERNATIONAL ROBOTICS CHALLENGE – ZONAL

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 transfer the blocks to the deposit zones. The bot also has to help the manual bot to cross the incline and reach the manual finish zone.
3. The manual bot has to walk over the balls, transfer blocks to deposit zones and climb over inclines.
4. Maximum of 8 minutes will be allotted to each participating team.

Game Field:

Note: In the figures given below, colors are shown just for indication of sample arena. The actual colors may be different for the manual zone.

1. The game field consists of an arena having dimensions 4800mm X 2400mm (lxb).
2. It contains a manual zone, a manual start zone, a pit containing tennis balls, wooden inclines, thermocol blocks, an autonomous zone, an autonomous start zone, deposit zones and a gate.
3. **Manual Zone:** Only the manual bot can maneuver in this zone. (It is indicated by green colour 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 the grid
 - **Node:** There are nodes at the intersection of two white line at some places. The nodes are black squares of dimensions 30mm X 30mm.
 - **Block Base:** Position of two blocks will be indicated in the grid as shown in figure 5. The dimension of each block base is 150mm x 150mm.
 - **Deposit Zones:** There are three deposit zones of depth 100mm in autonomous zone as shown in figure 6. Manual and autonomous bot will have to transfer the blocks into deposit zone.

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

8. **Pit:** The dimensions of the pit are 540mm x 470mm and would contain tennis balls of diameter 67 mm. It would contain a maximum of 56 balls.
9. **Blocks:** There are three types of thermocol blocks used in the gameplay, namely, Secret block, Cover block and Key block. Secret block is the first block that the autonomous bot will encounter in its zone. Manual bot would find the Key block just after crossing the pit containing balls. The autonomous bot would find the Cover block after it returns back from the restricted zone. The dimensions of each block used in the gameplay is 150mm X 150mm X 100mm.
10. **Restricted zone:** It is the zone between the 2 inclines as shown in figure 8.
11. **Gate:** As shown in figure 10.

12. **Bridge:** The inclined surface of the bridge is covered by 80-grits sandpaper to provide sufficient frictional force. It has restricted zone in between the two inclines as shown in figure 8 and figure 9.

Note:

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

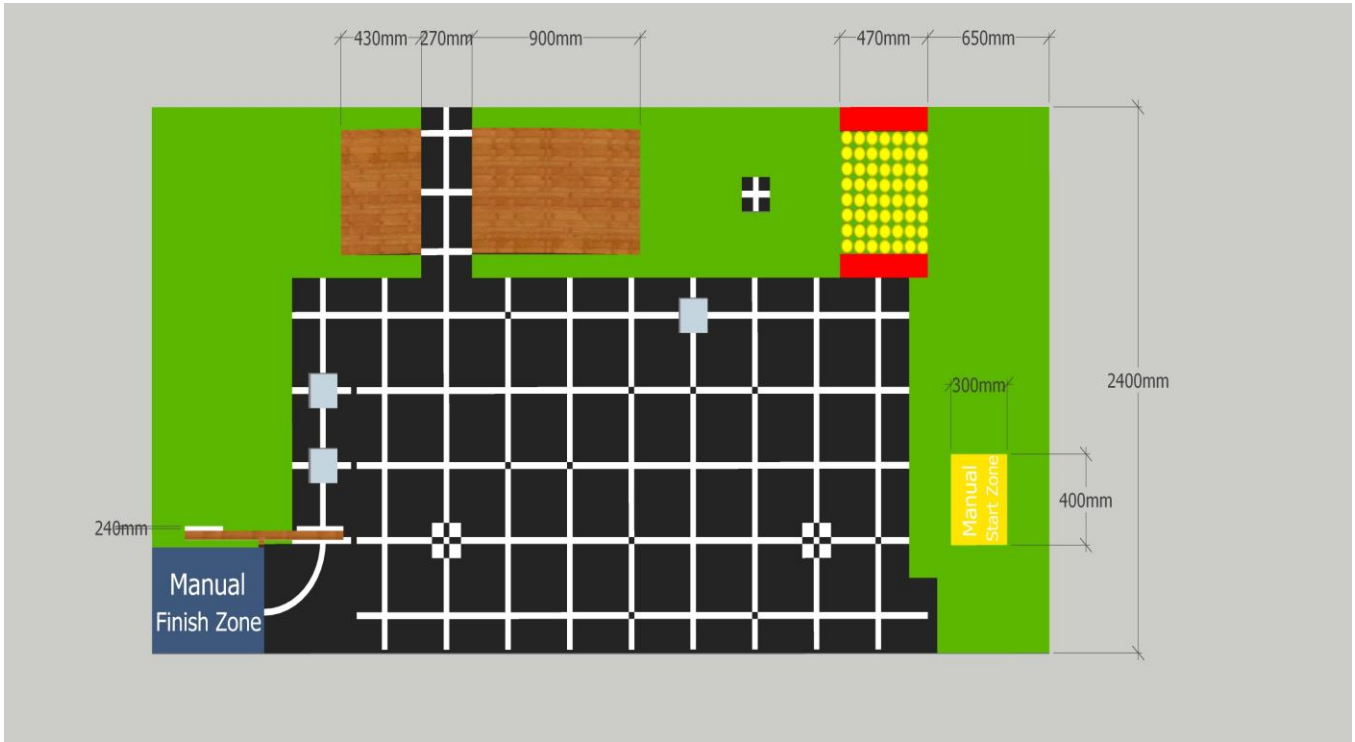


Figure 1: Top view of complete arena

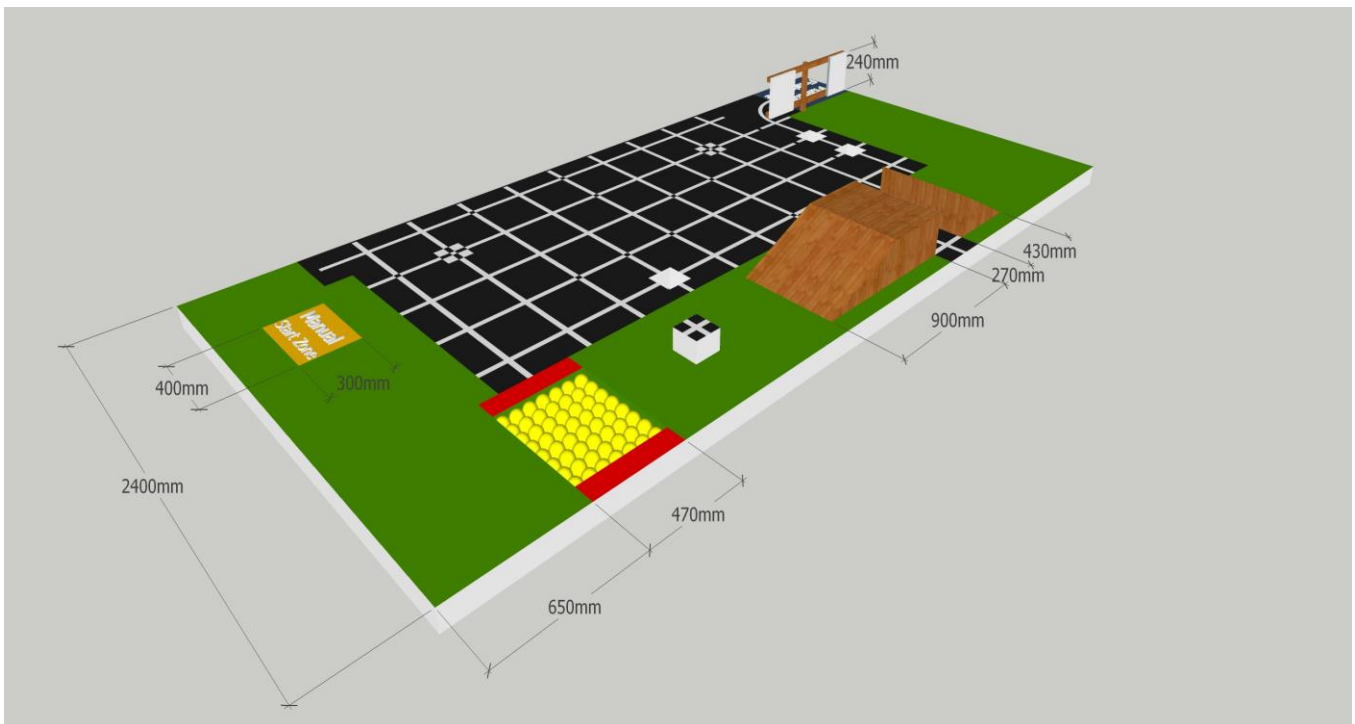


Figure 2: Isometric view of complete arena

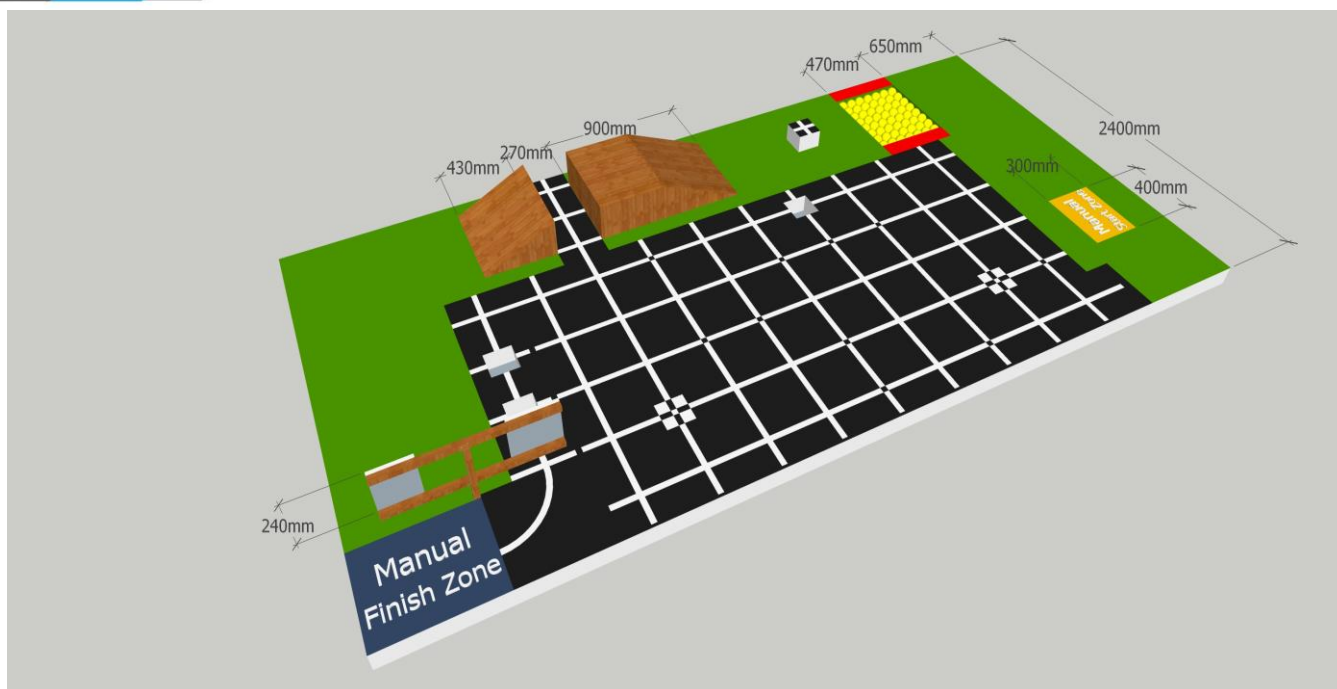


Figure 3: Isometric view of complete arena

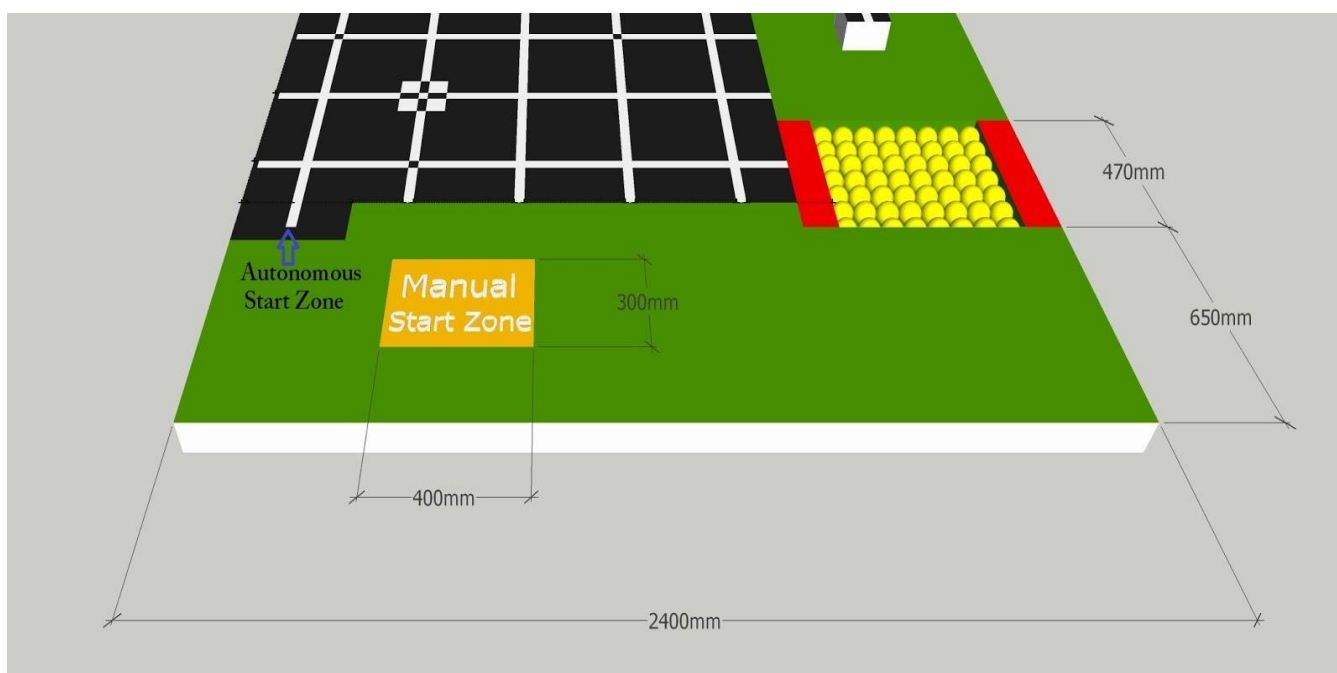


Figure 4: Manual start Zone and autonomous start zone

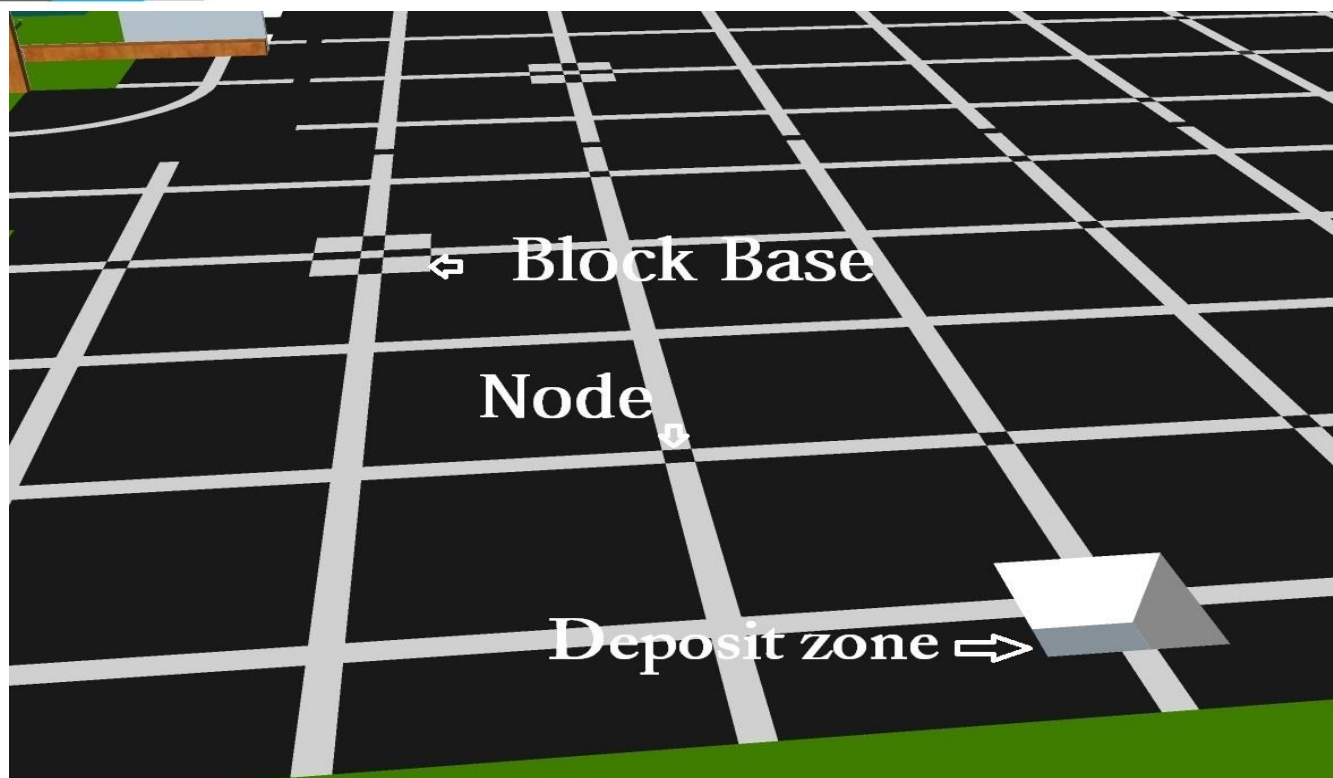


Figure 5: Nodes, Block base and Deposit Zone

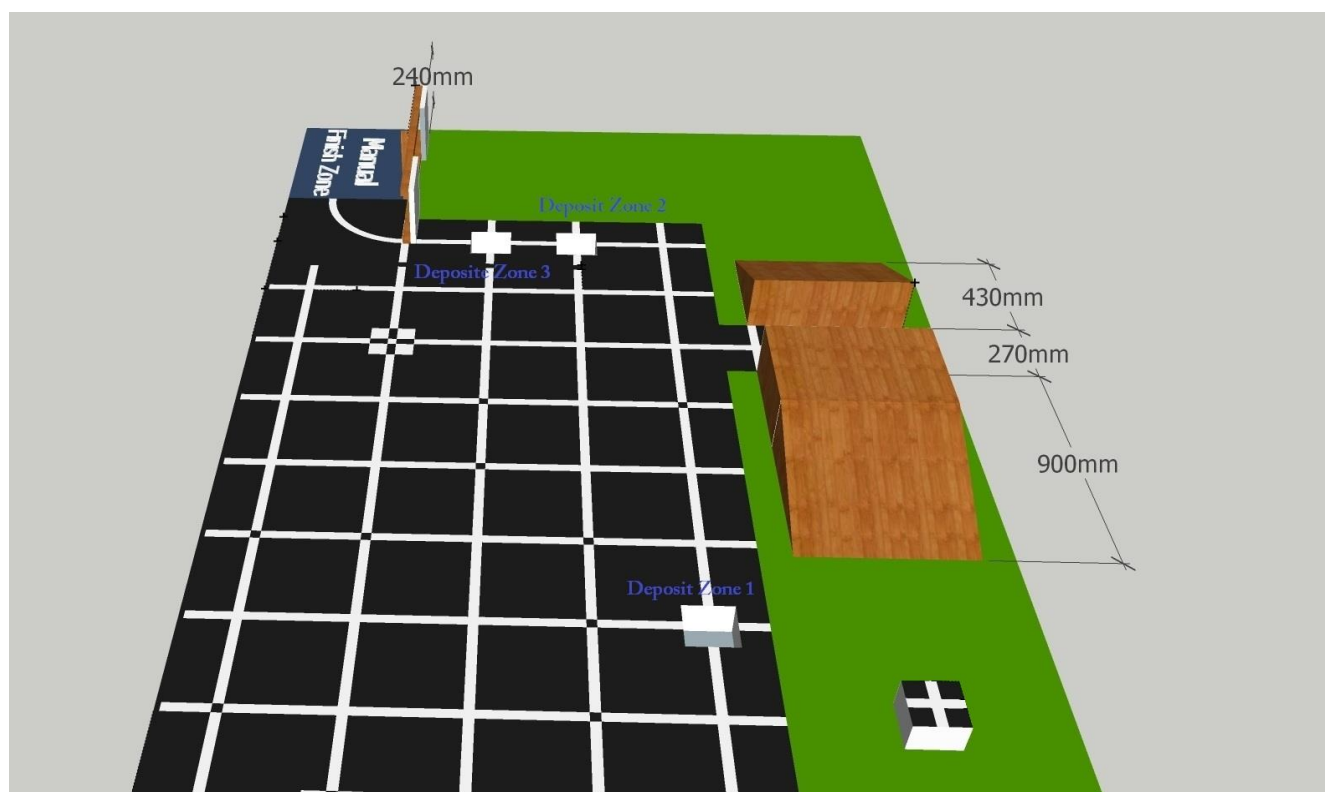


Figure 6: Deposit Zones

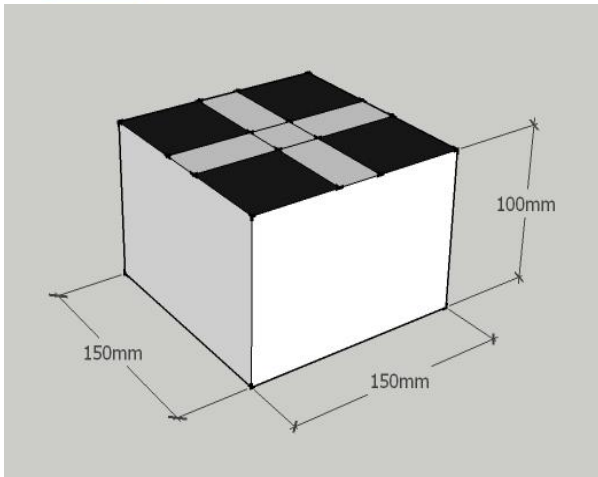


Figure 7: Block Dimensions

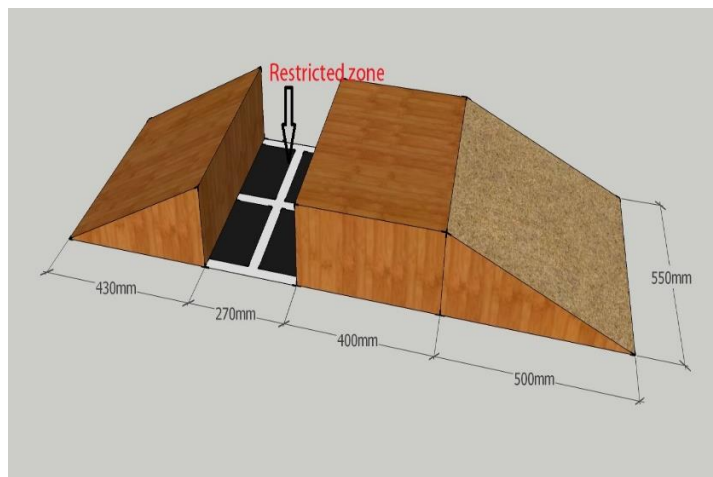


Figure 8: Bridge dimensions

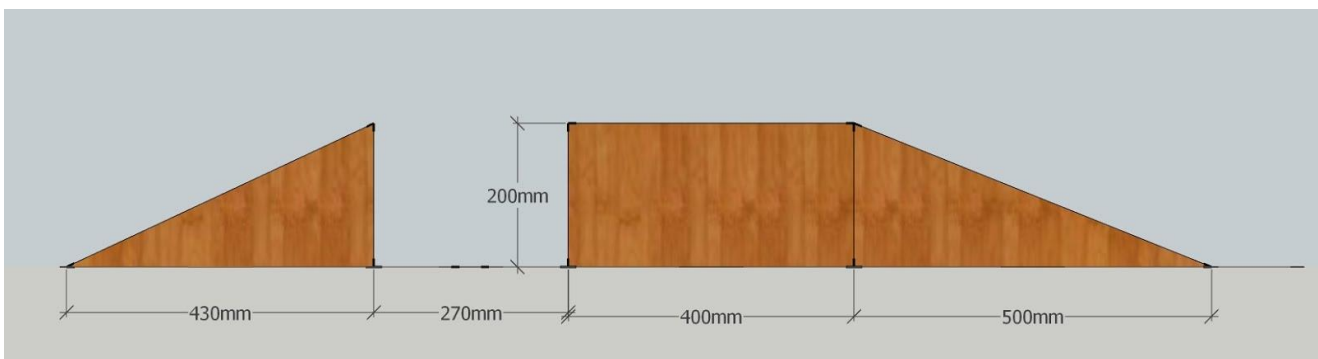


Figure 9: Side view of bridge

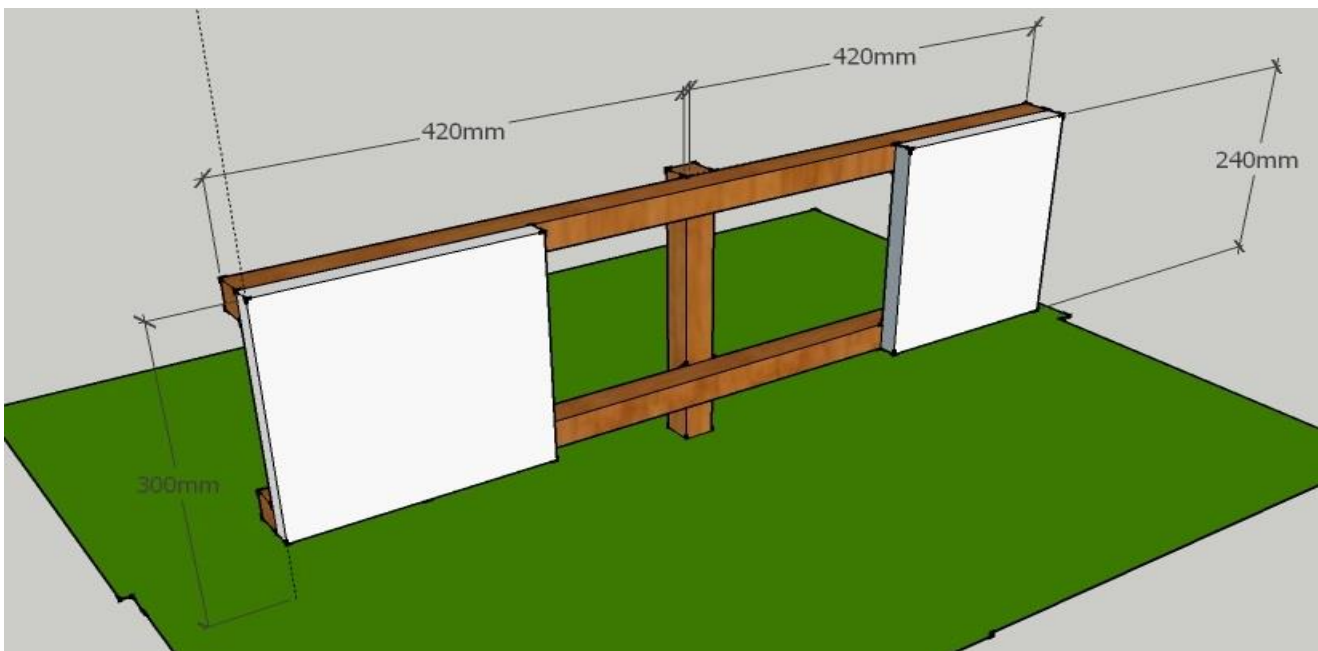


Figure 10: Gate

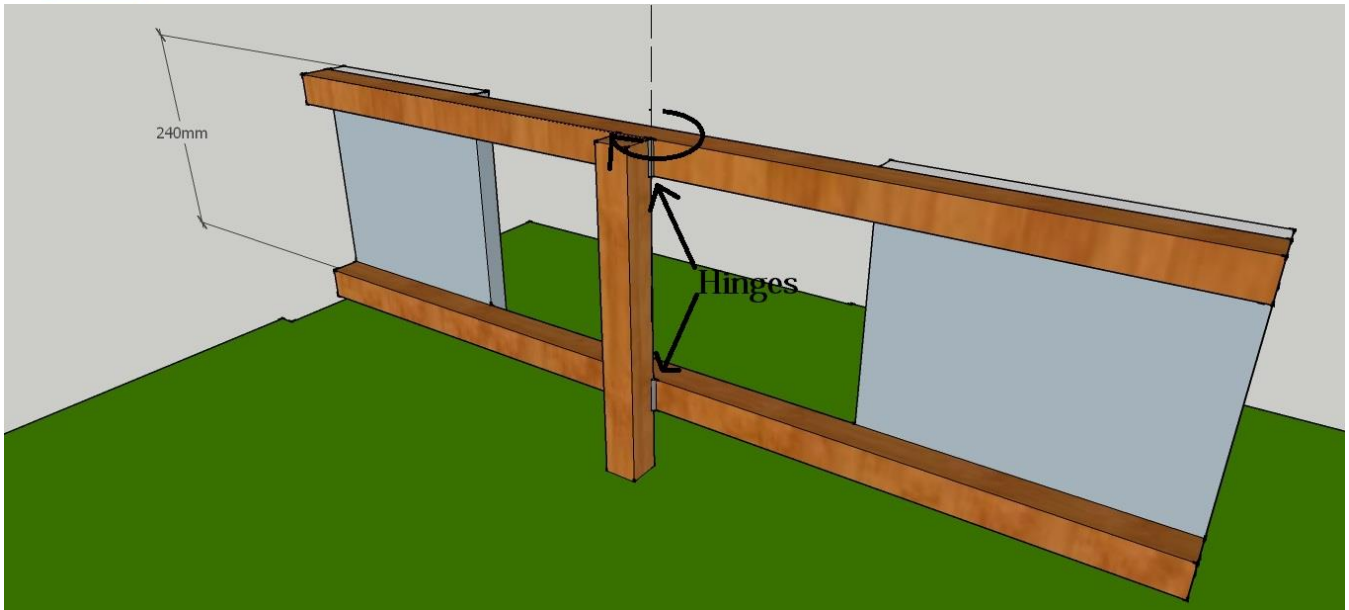


Figure 11: Gate

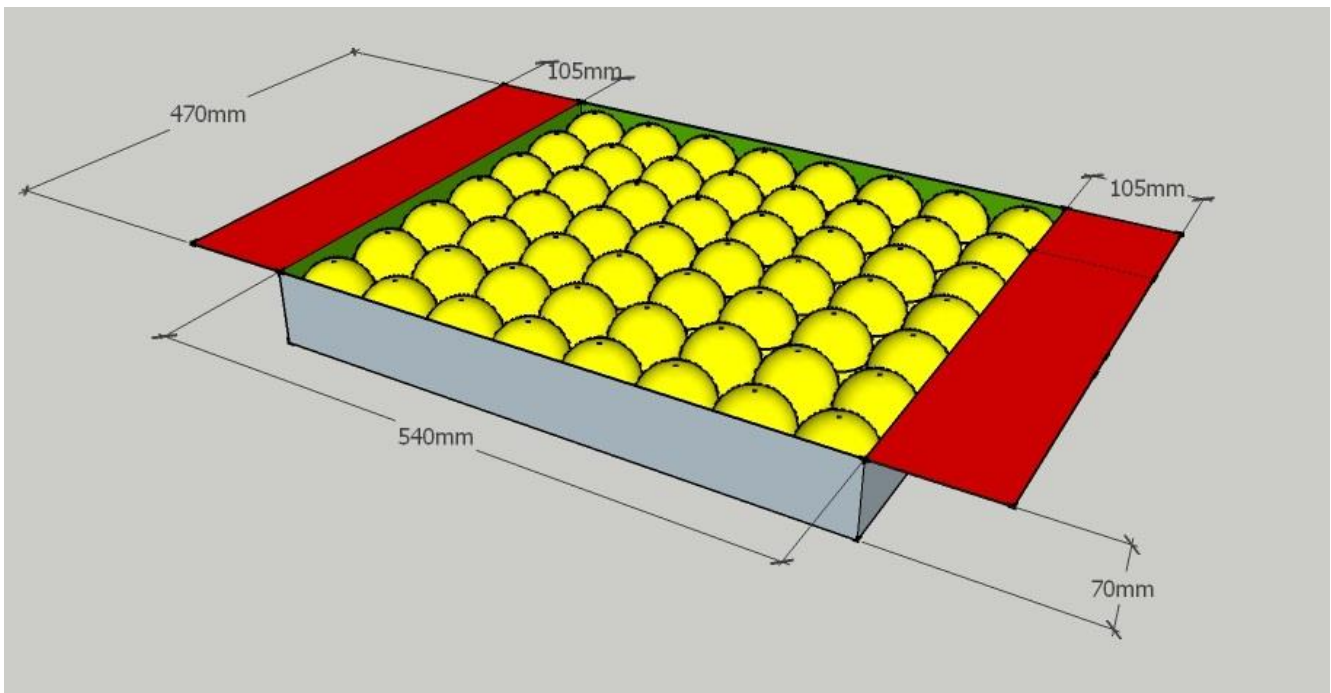


Figure 12: Pit

Bot Specifications:

Autonomous Bot:

1. The autonomous bot must be completely autonomous with just one switch to start/reset it.
2. After the autonomous bot starts none of the team members will be allowed to touch it.

3. The dimensions of the autonomous bot should be 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.
4. 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.
5. Autonomous bot should not split into two or more units at any moment during the gameplay.
6. 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.
7. 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 (lxbxh).
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 this criteria 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 for both the bots.

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 the pit containing balls. If the bot fails to cross this, it will be allowed to skip the pit but with a penalty of 30 points. After crossing the pit, the manual bot would find the Key block that it has to transfer to deposit zone 1.
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 Secret block, carry it over its head and then reach to deposit zone 1. (Note that the autonomous bot cannot cross the deposit zone 1 unless the manual bot drops the Key block in it).
5. Once the manual bot deposits the Key block in the deposit zone 1, the autonomous bot can now cross it and enter the restricted zone. The manual bot has to pick up the Secret block placed over the head of the autonomous bot in the restricted zone and cross over it.
6. The manual bot, after crossing the incline, has to deposit the Secret block in deposit zone 2.
7. Meanwhile the autonomous bot has to take the Cover block. Once the manual bot successfully deposits the Secret block in deposit zone 2, the autonomous bot can now cross over it and deposit the Cover block in deposit zone 3.
8. The autonomous bot now has to move to the Gate and rotate it about the hinge which will make way for the manual bot to reach the manual finish zone.

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 8 minutes.
2. 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 (Secret block and Cover block). The bot should give a visual/audio signal at the end of the dry run. Blocks will be manually placed in deposit zones at the time of dry run.
3. 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 8 minutes. No advantage will be given if the dry run ends before 5 minutes.
4. 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.
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.
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.

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. Bot will be placed just after the deposit zone 1.

3. Third Checkpoint: When the autonomous bot successfully allows the manual bot to cross over it. Bot will be placed just before the starting of the restricted zone facing opposite to the restricted zone.
4. Fourth Checkpoint: The autonomous bot successfully drops the Cover block in deposit zone 3.

Manual Bot Checkpoints:

1. First Checkpoint: When the manual bot successfully crosses the pit containing balls.
2. Second Checkpoint: When the manual bot successfully deposits the Key block in deposit zone 1
3. Third Checkpoint: When the manual bot crosses the incline
4. Fourth Checkpoint: When the manual bot transfers the Secret block in deposit zone 2

Restarts:

1. The teams are given 3 restarts each for the autonomous bot and the manual bot.
2. However, there are no restrictions on the number of restarts for the dry run.
3. 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.
4. In a restart, the timer will not be set back to zero and time will not be paused.
5. 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).
6. 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.
7. 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:

1. 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.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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.

7. 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:

1. Teams will be awarded 30 points for successfully crossing the pit containing the balls.
2. Teams will be awarded 40 points for successfully depositing the Key block in deposit zone 1.
3. Teams will be awarded 40 points for successfully depositing the Secret block in deposit zone 2.
4. Teams will be awarded 40 points for successfully depositing the Cover block in deposit zone 3.
5. Teams will be awarded 60 points for successfully crossing the incline.
6. Teams will be awarded 40 points if the autonomous bot is successful in opening the gate for the manual bot to go to the opponent's side.
7. Every time the autonomous bot crosses the node, it incurs a penalty of 25 points and has to start back from the last checkpoint.
8. 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.
9. If the autonomous bot enters into the manual zone, it incurs a penalty of 25 points.
10. If any part of the manual bot enters into autonomous bot zone, it incurs a penalty of 25 points.

Final Score:

1. Let $S = \text{Total Score}$
 $A = \text{Total points earned in performing all tasks}$
 $B = 480 - \text{total time taken to complete the run}$
 $C = \text{Total penalty incurred}$
Therefore, $S = A + B - C$
Note: B will be considered only if a team completes all the tasks within the stipulated period of 480 second
2. Team with maximum points will win 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 maximum of 5 members. Students from different educational institutes can form a team.

Certificate Policy:

1. Top two teams will be qualified for Grand Finale to be held at Techfest during 2nd to 4th of January 2015.
2. Certificate of participation will be given to all the participating teams scoring minimum 100 points.
3. Disqualified teams will not be considered for any certificates.