

INTERNATIONAL ROBOTICS CHALLENGE

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 transfer zones. The bot also has to help the manual bot to cross the incline.
3. The manual bot has to cross over the curved bridge, put the block in the pit and then throw a ball into desired area.
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 **4570 mm X 4620 mm**. Complete arena is divided into 2 parts for 2 teams.
2. It also contains a manual bot start zone, manual zone, autonomous start zone, autonomous zone, wooden curved bridge, transfer zone, gate, wooden inclines, blocks, a pit, war zone and wooden box.
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 four 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. See fig 9.
 - **Transfer Zone:** There is a transfer zone of dimension 150 mm x 150 mm in manual zone as shown in figure 10. Manual and autonomous bots will have to transfer the Clone block in transfer zone.
 - **Pit:** Position of copy block is set in autonomous zone. Position of the pit is as shown in figure 11. The dimension of the pit is 160mm x 160mm x 100mm. The manual bot has to deposit the Clone block in the pit.
 - **Jedi Zone:** There is a Jedi zone of dimension 150mm x 150mm in the autonomous zone as shown in the figure 12. Autonomous bot has to transfer the Darth Vader block in Jedi zone.

(**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 pit will remain fixed.)

8. **Blocks:** There are two types of thermocol blocks used in the gameplay, namely, Clone block and the Darth Vader block. Clone block is the first block that the autonomous bot will encounter in its zone. Autonomous bot would find the Darth Vader block in front of the wooden box (Death Star) and transfer it to Jedi zone. The dimensions of Clone block are 150mm x 150mm x 100mm while that of Darth Vader block are 150mm x 150mm x 200mm.
9. **Curved Bridge:** The bridge is made of wooden planks of dimensions 50mm x 500 x 10mm (lxbxh) at a distance of 10 mm from each other as shown in the figure 16.
10. **Gate:** The autonomous bot has to open it to clear the path for manual bot. Figure 20
11. **Incline:** As shown in the figure 18.
12. **War Zone:** The manual bot has to shoot a ball from this zone into the Death Star. See figure 4.
13. **Death Star (Wooden Box):** As shown in the figure 22.

Note :

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

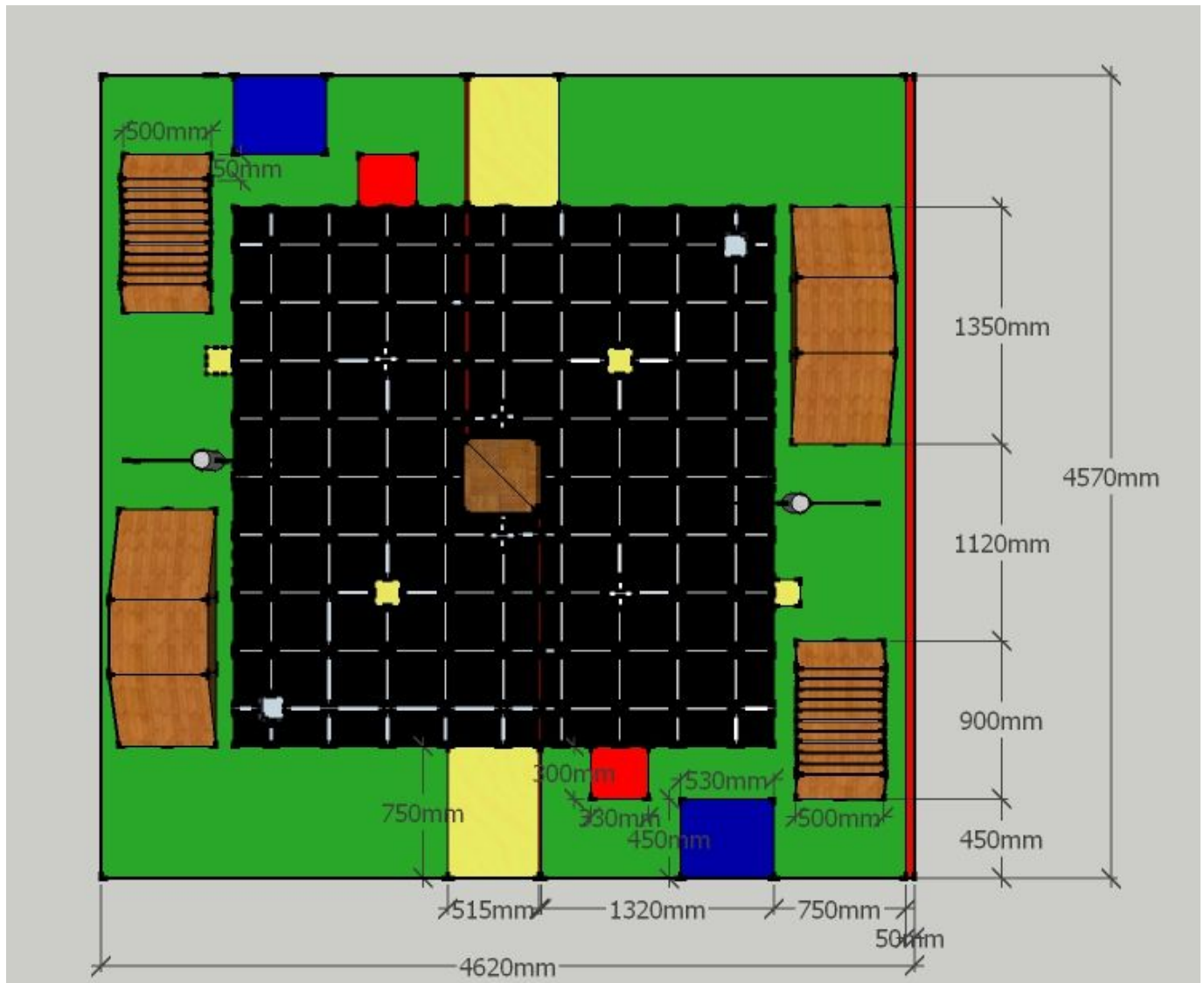


Figure 1: Top view of the complete arena.

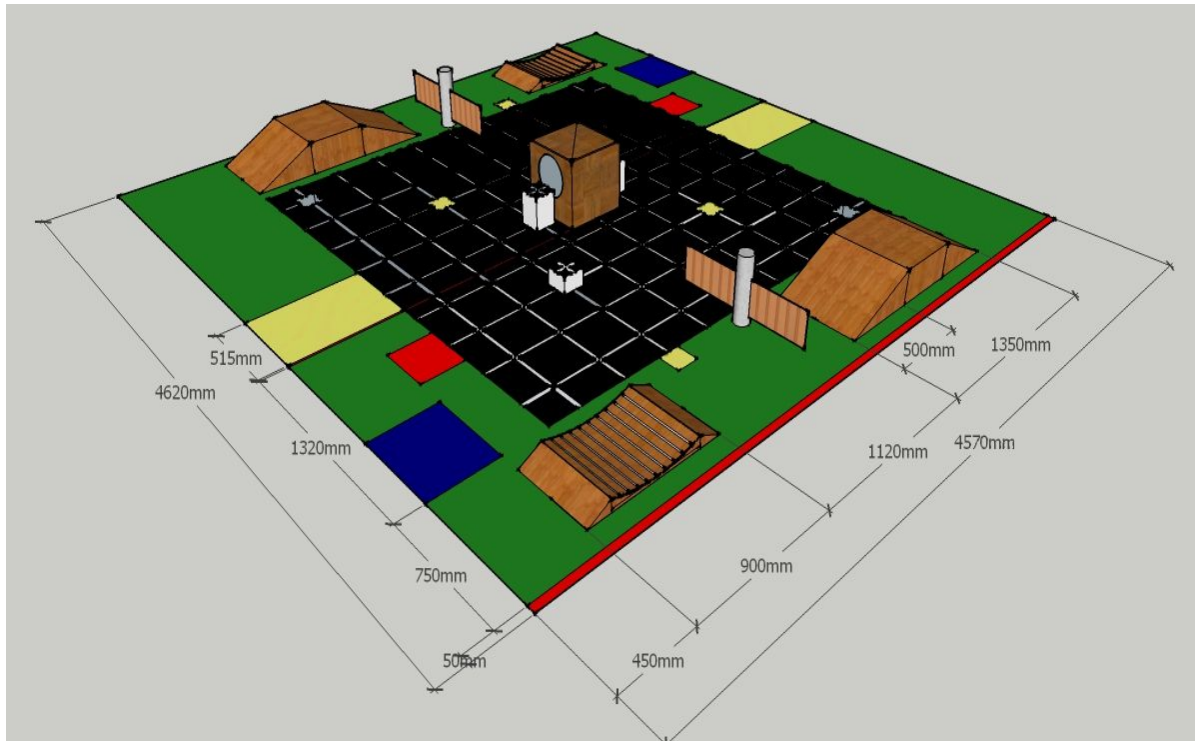


Figure 2: Isometric view of complete arena

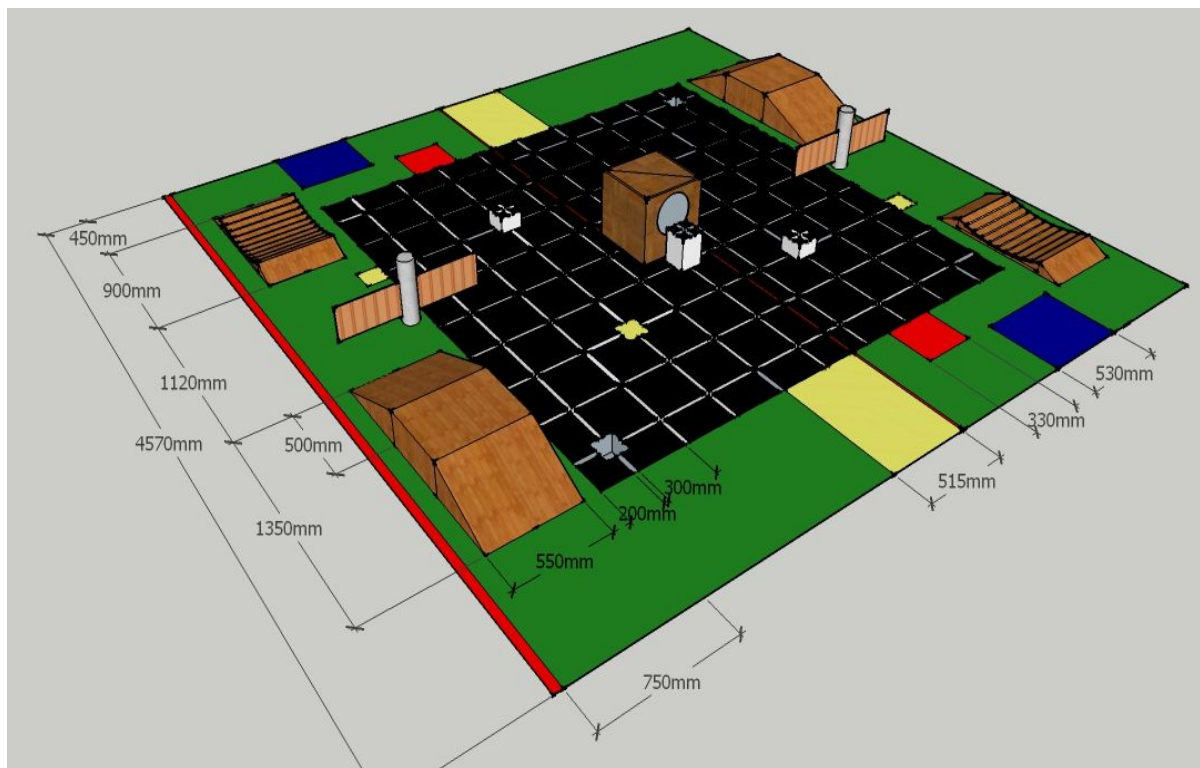


Figure 3: Isometric view of complete arena

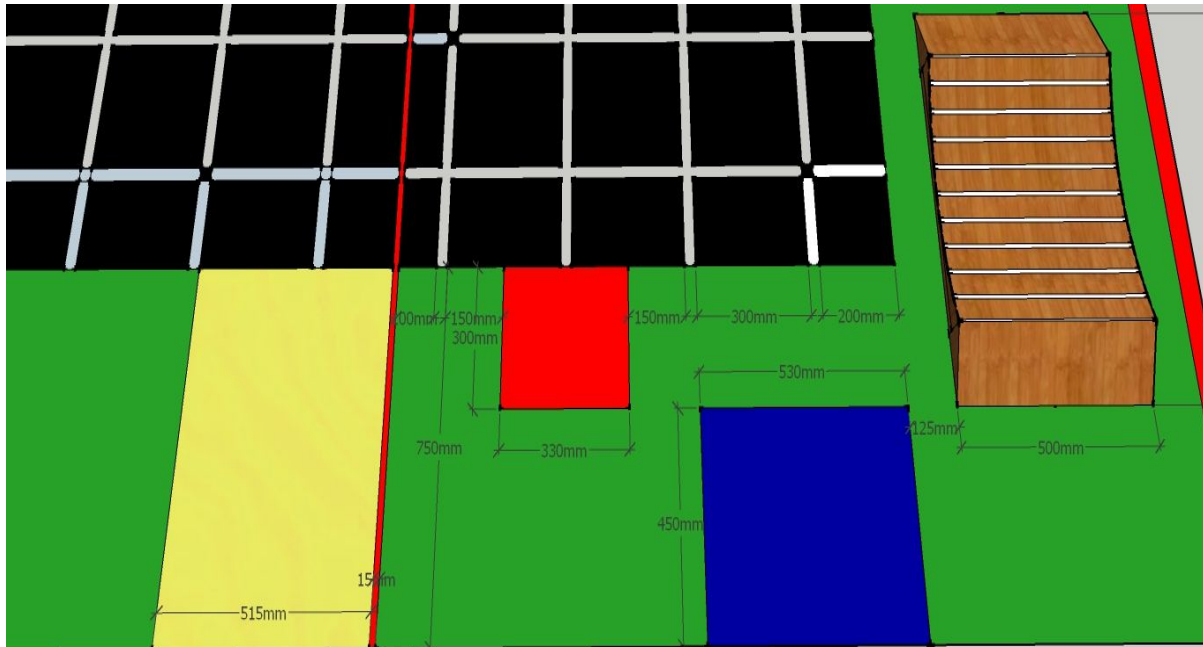


Figure 4: Autonomous start zone (red), manual start zone (blue) and war zone (yellow)

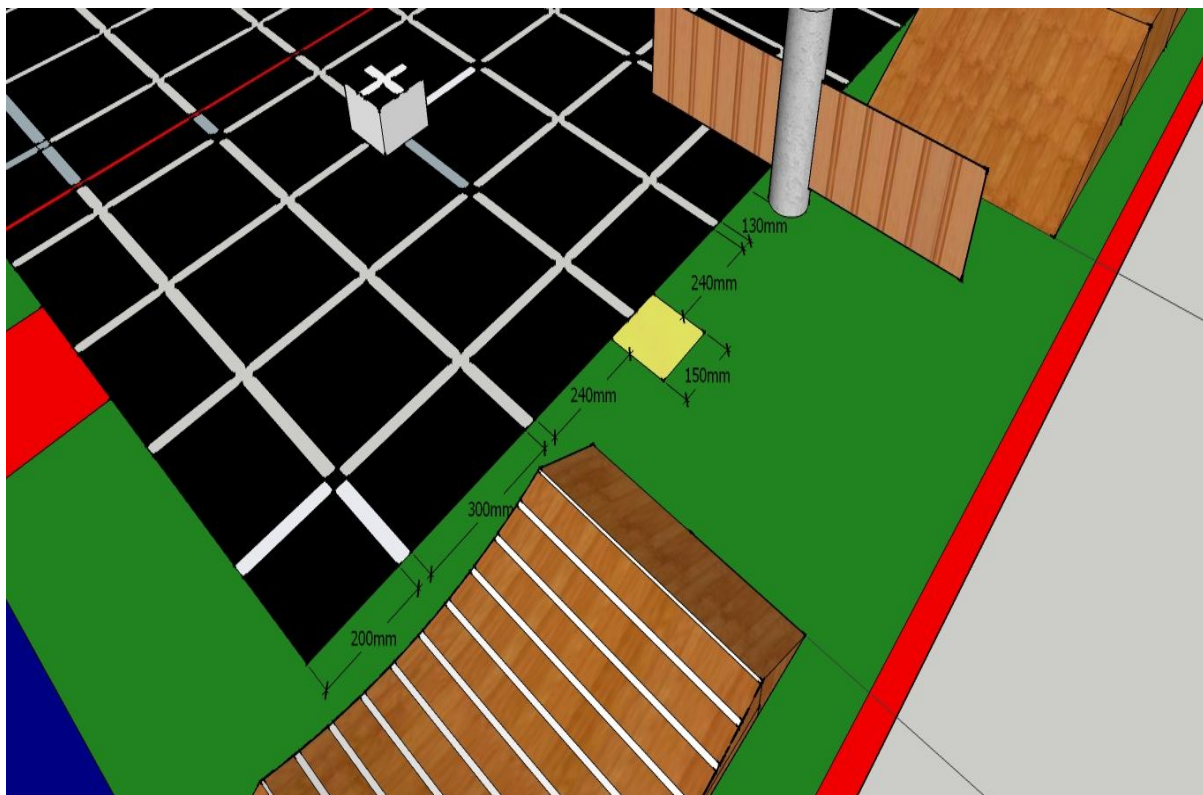


Figure 5: Dimensions of the arena

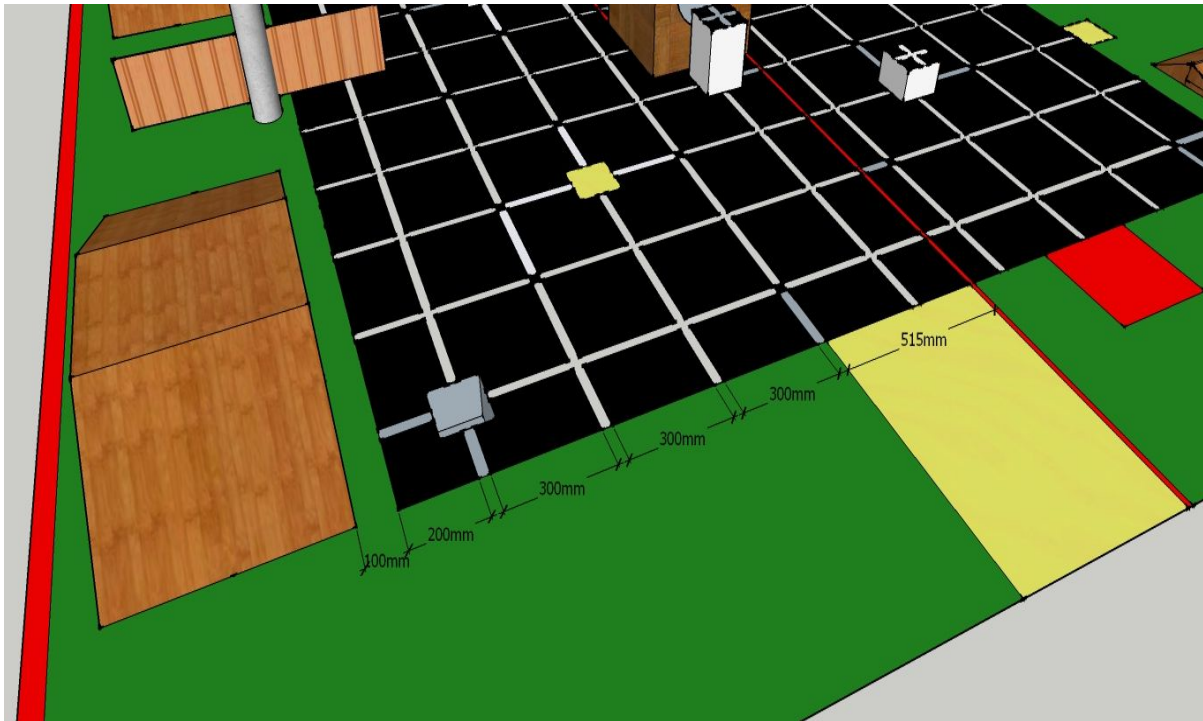


Figure 6: Dimensions of the arena

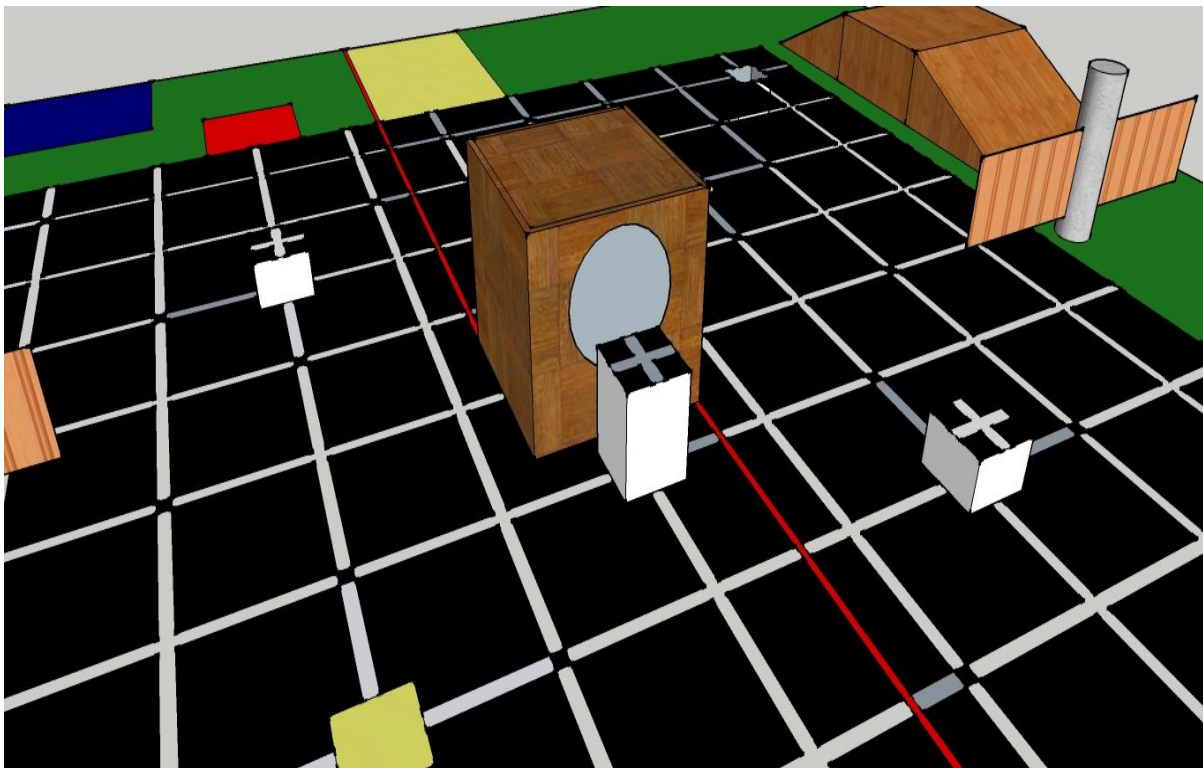


Figure 7: Position of the blocks

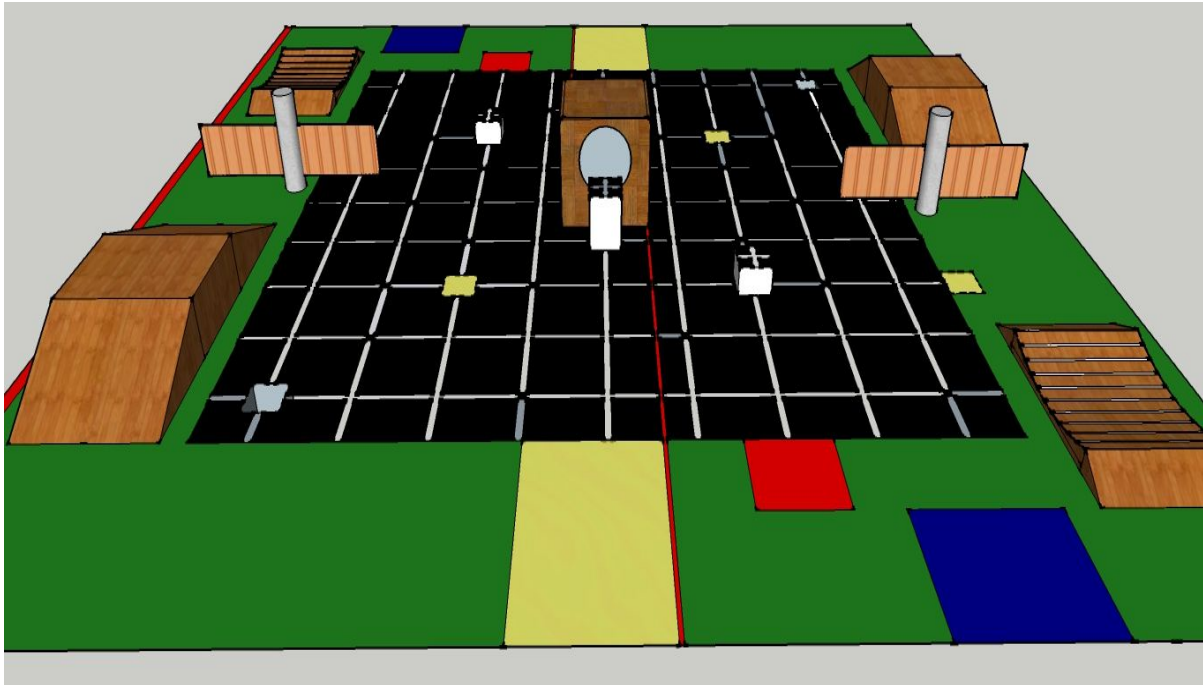


Figure 8: Front view of the arena

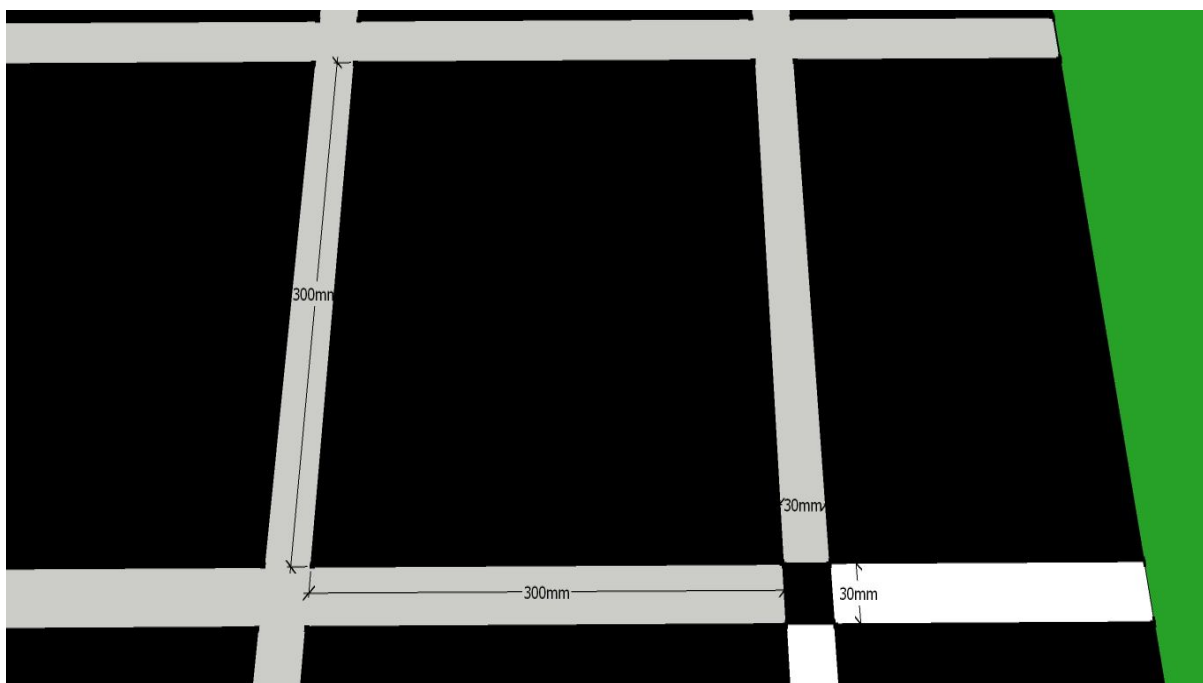


Figure 9: Nodes and grid dimensions

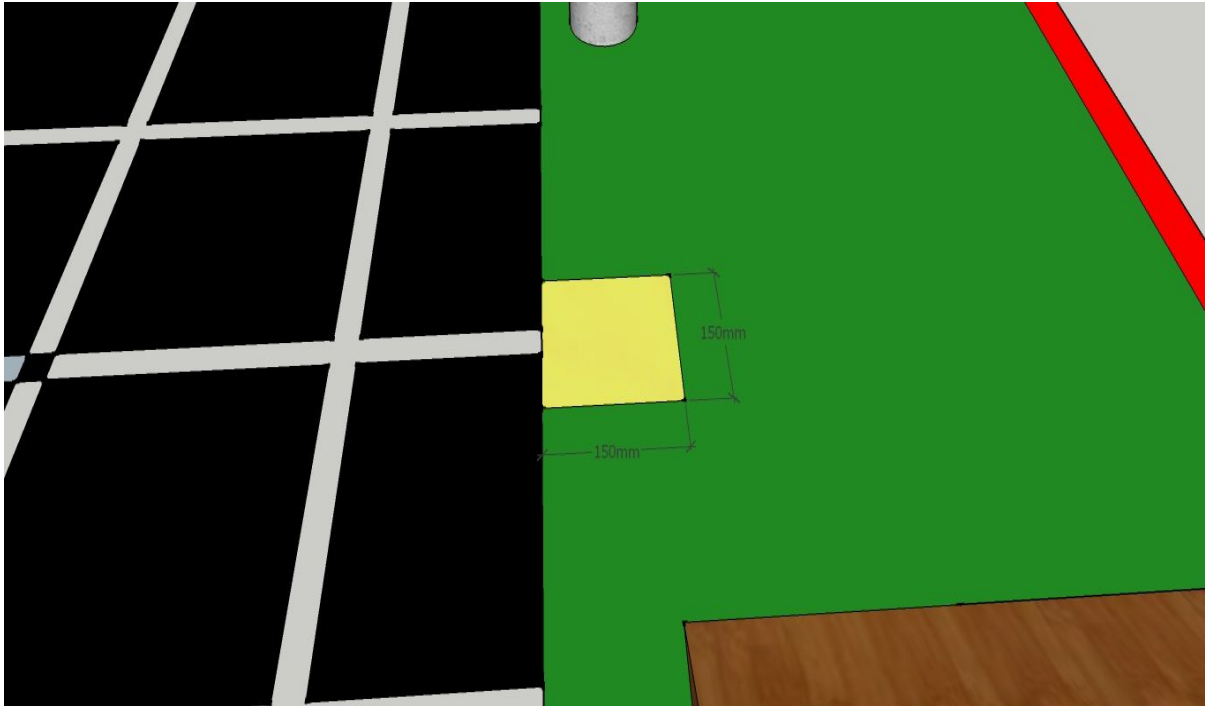


Figure 10: Transfer zone

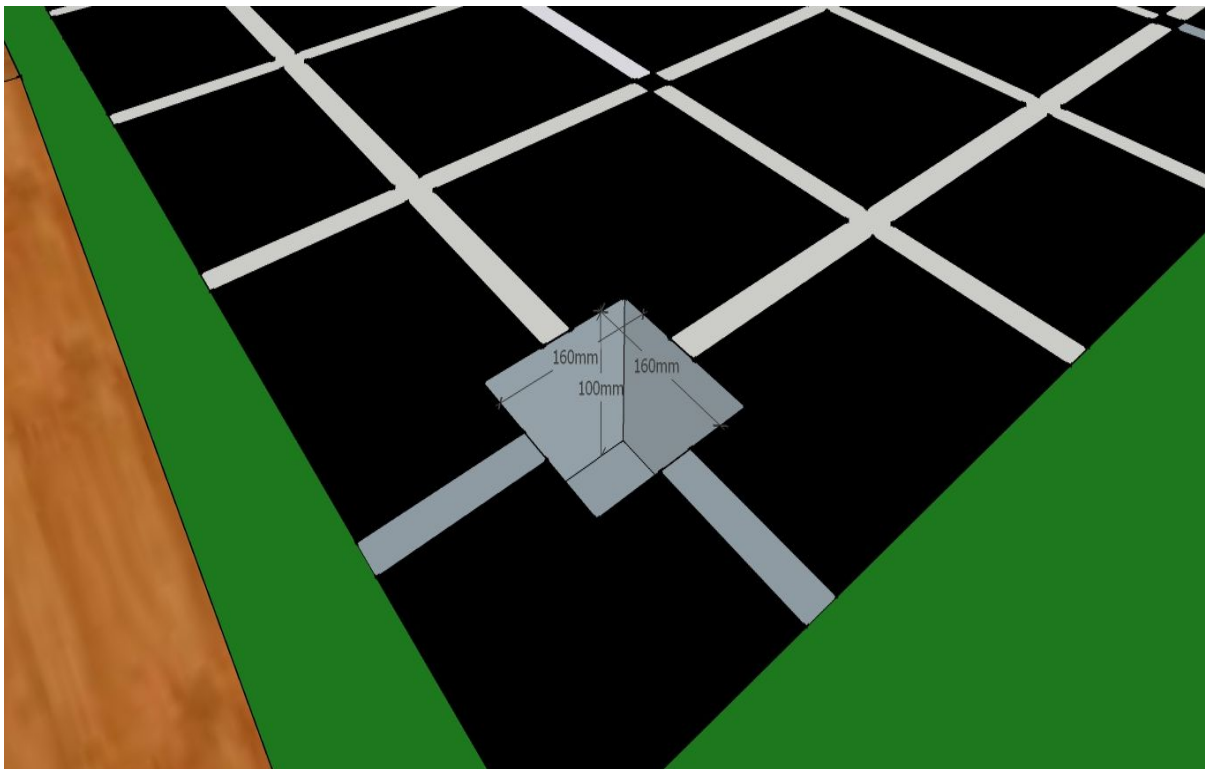


Figure 11: Pit

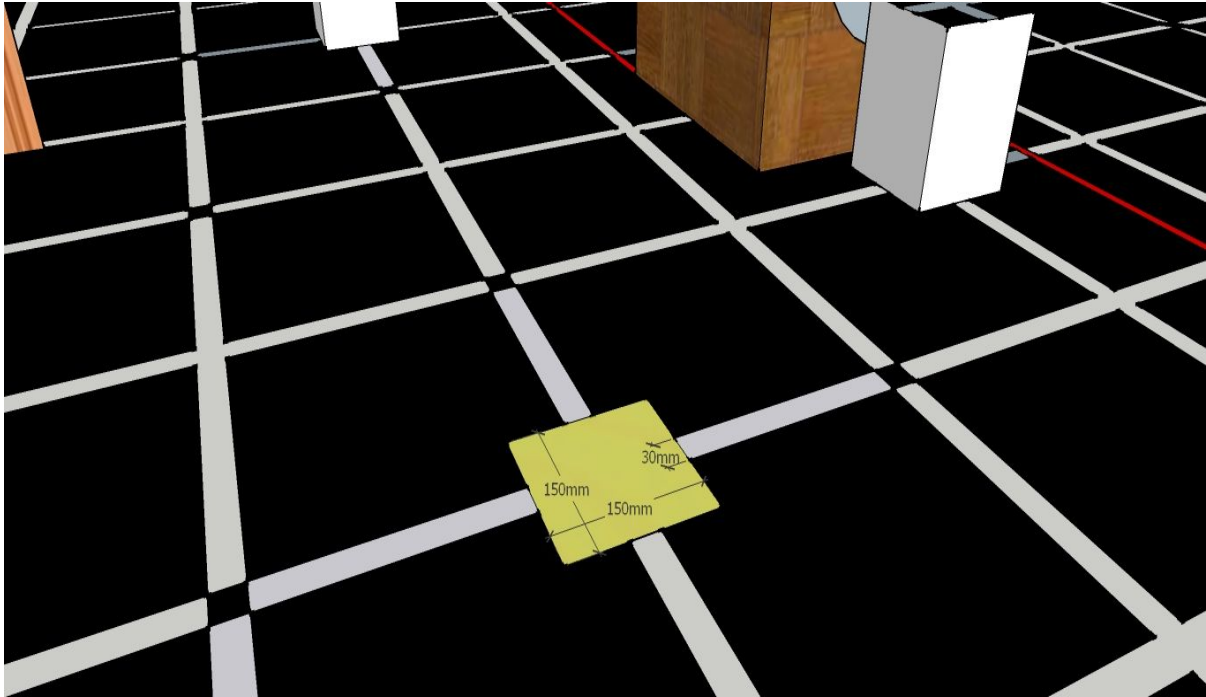


Figure 12: Jedi Zone

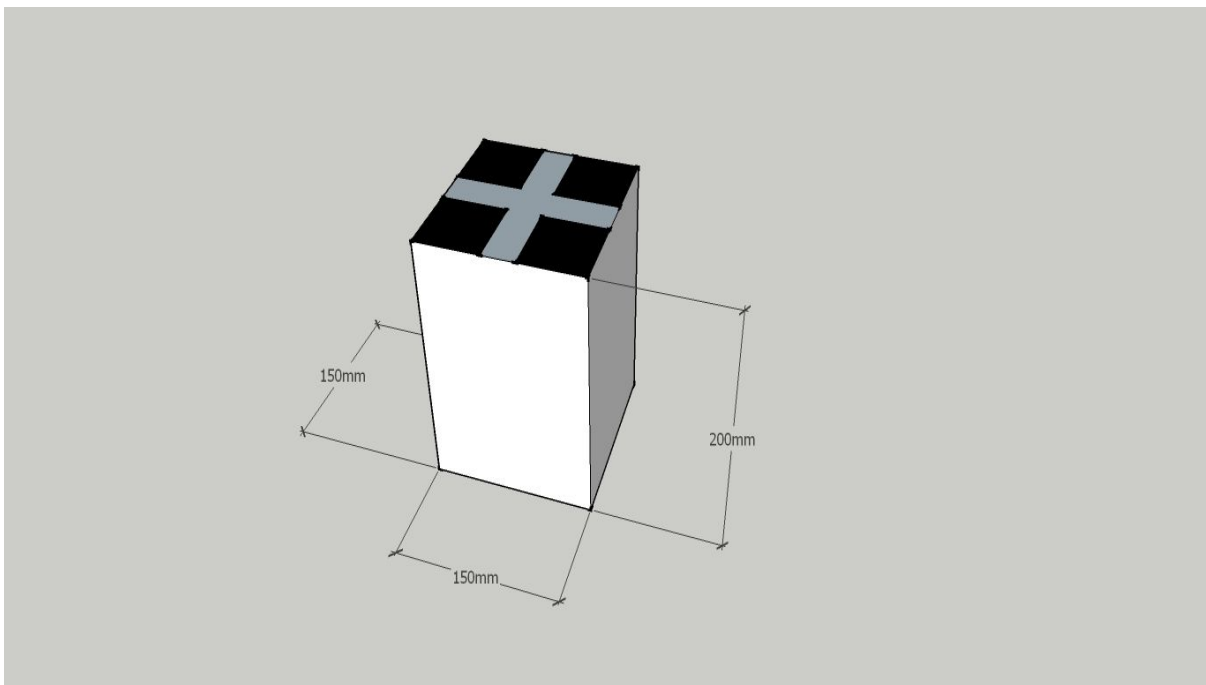


Figure 13: Darth Vader block

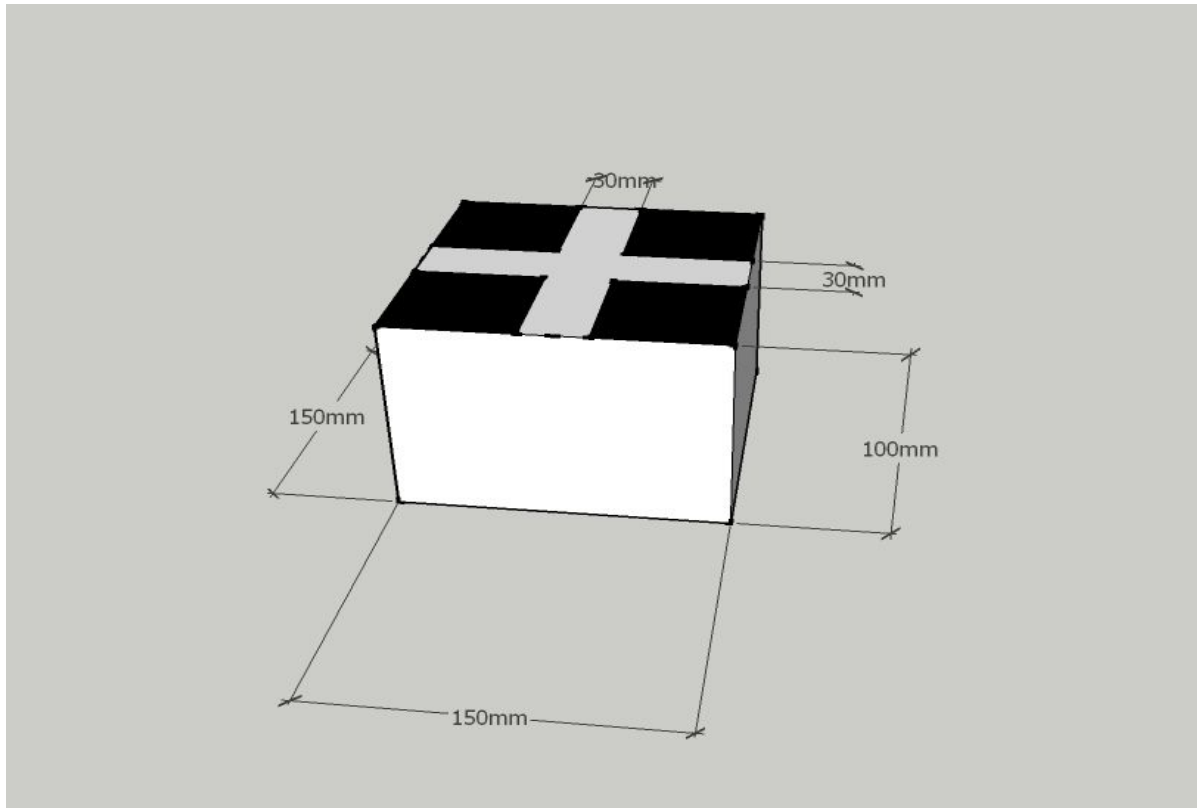


Figure 14: Clone block

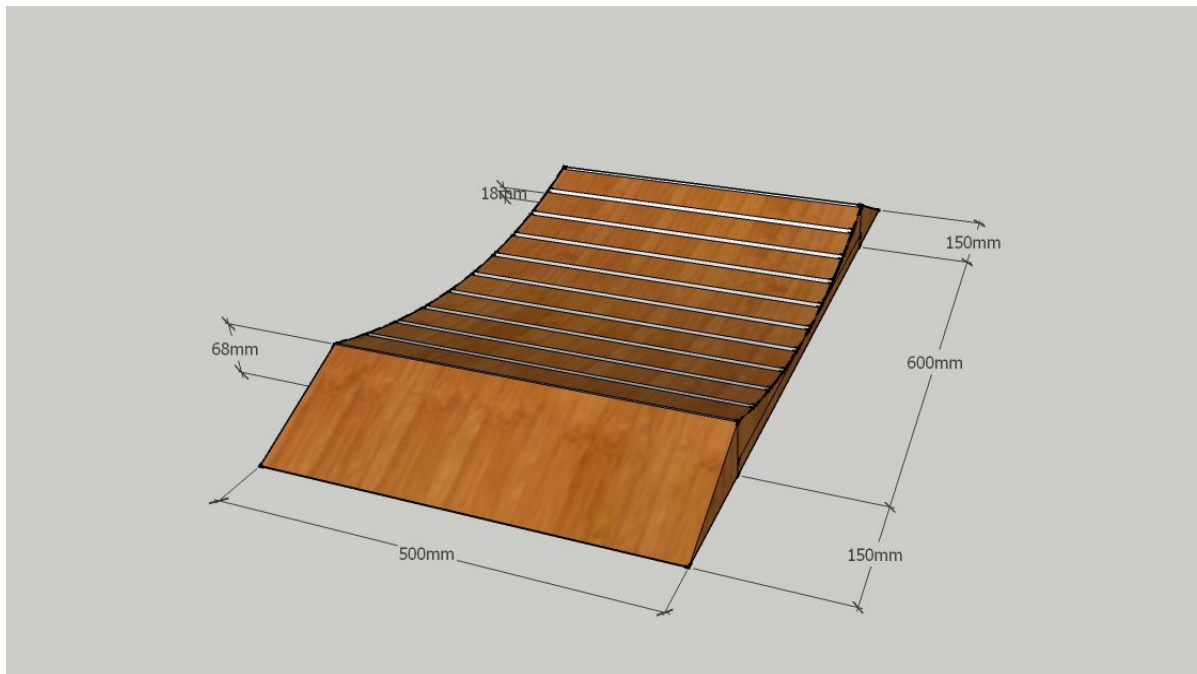


Figure 15: Curved Bridge

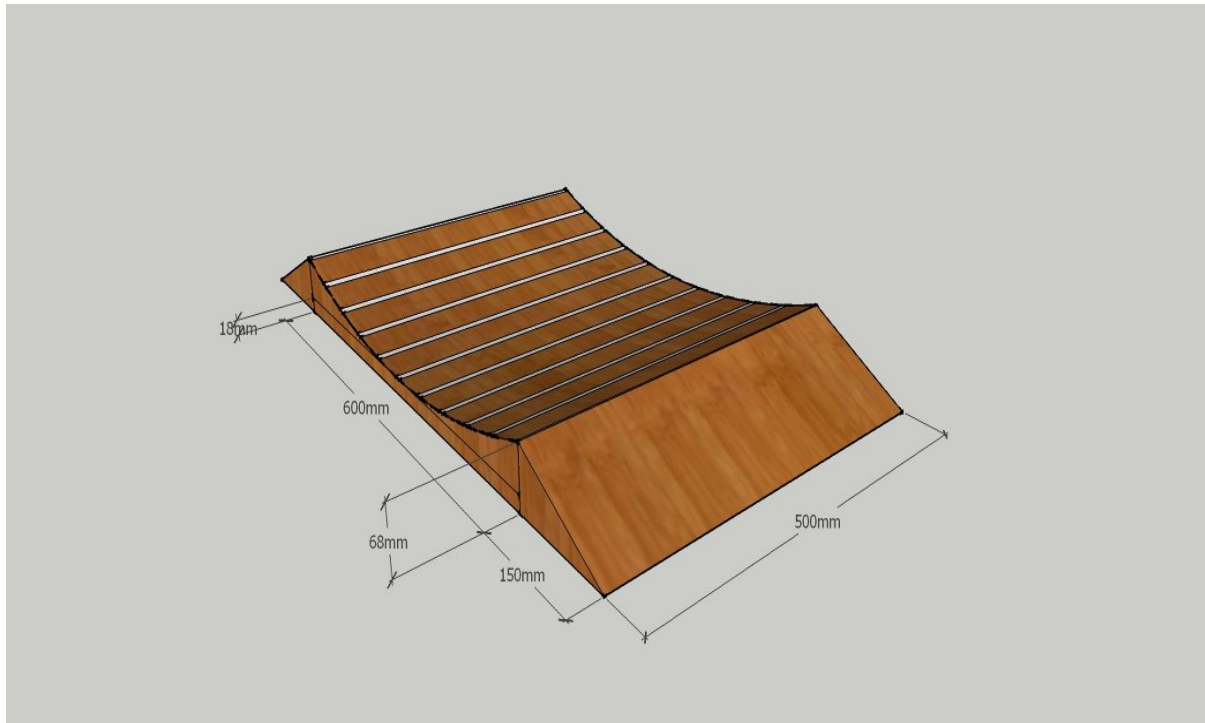


Figure 16: Curved Bridge

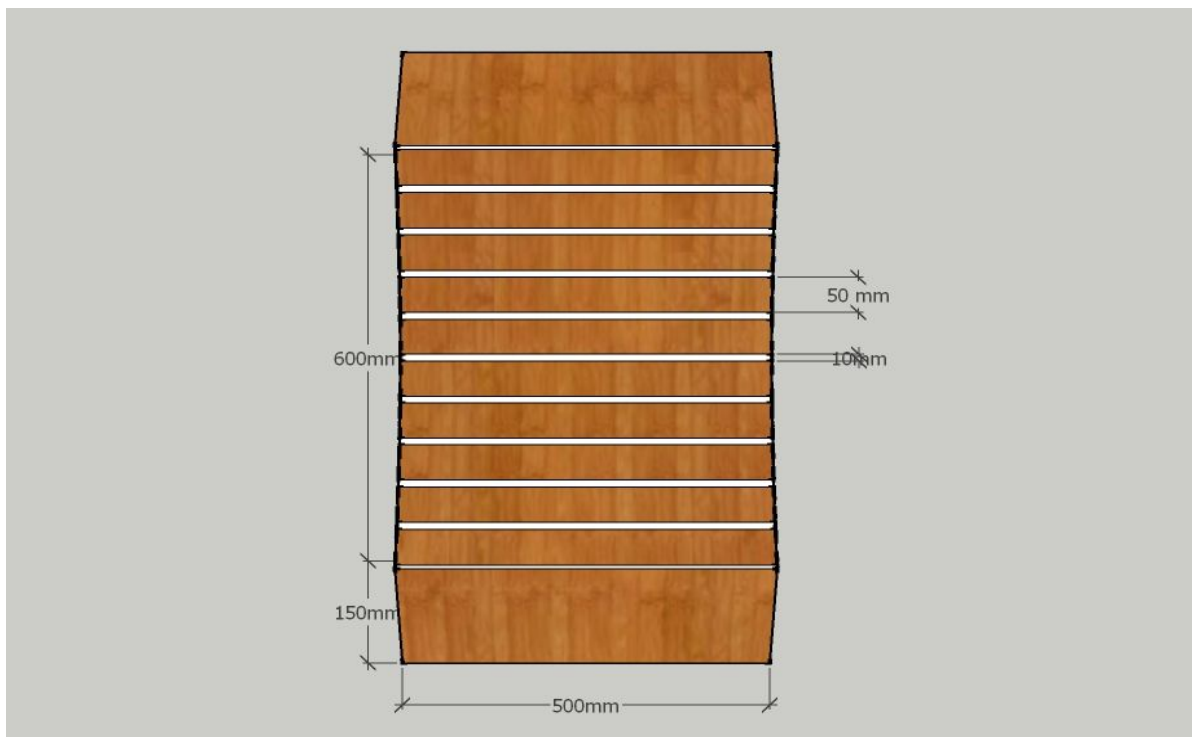


Figure 17: Curved Bridge (top view)

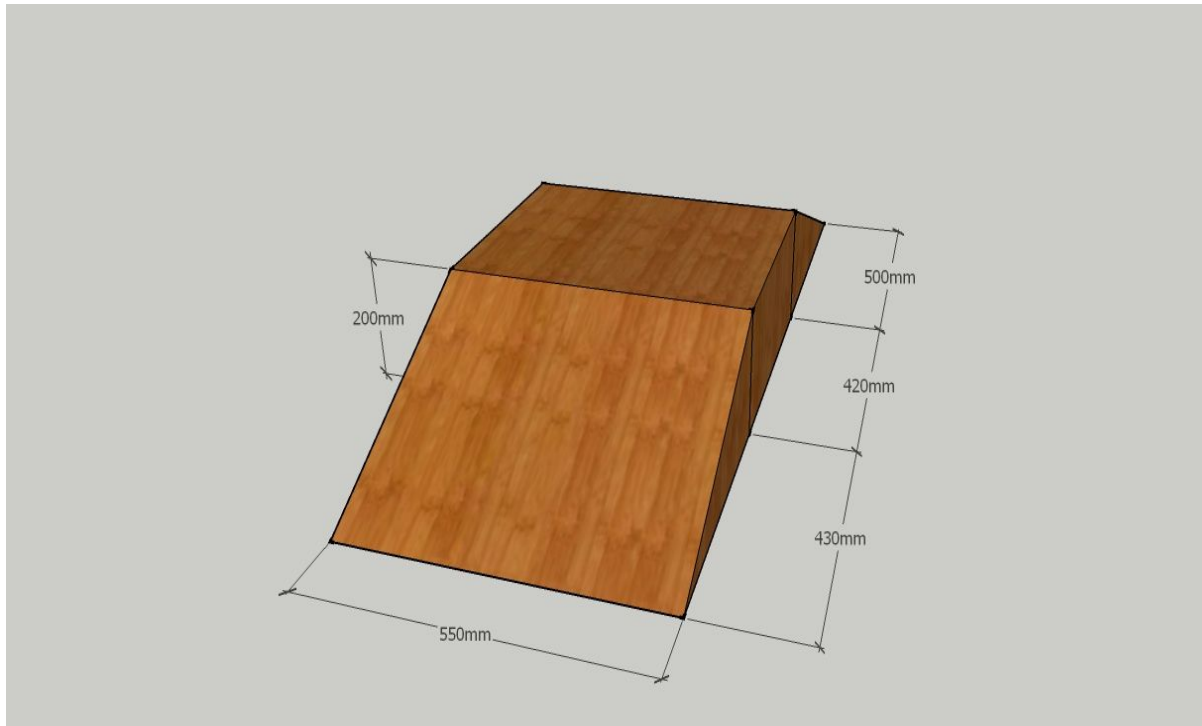


Figure 18: Incline

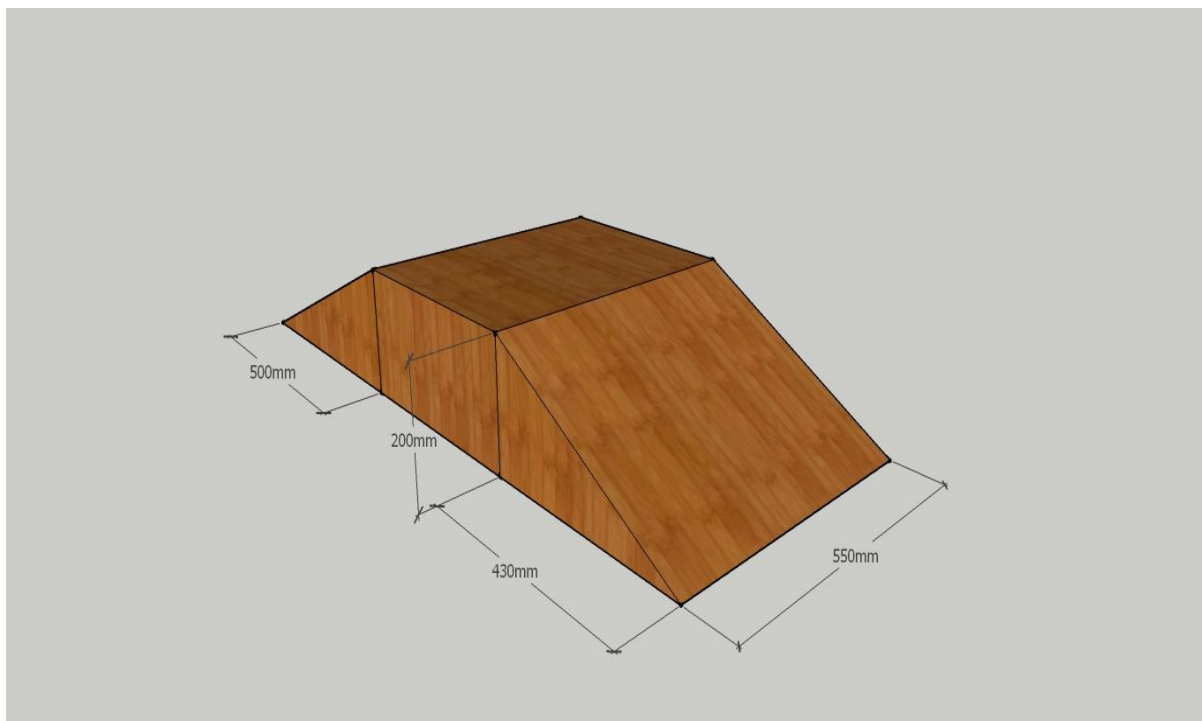


Figure 19: Incline

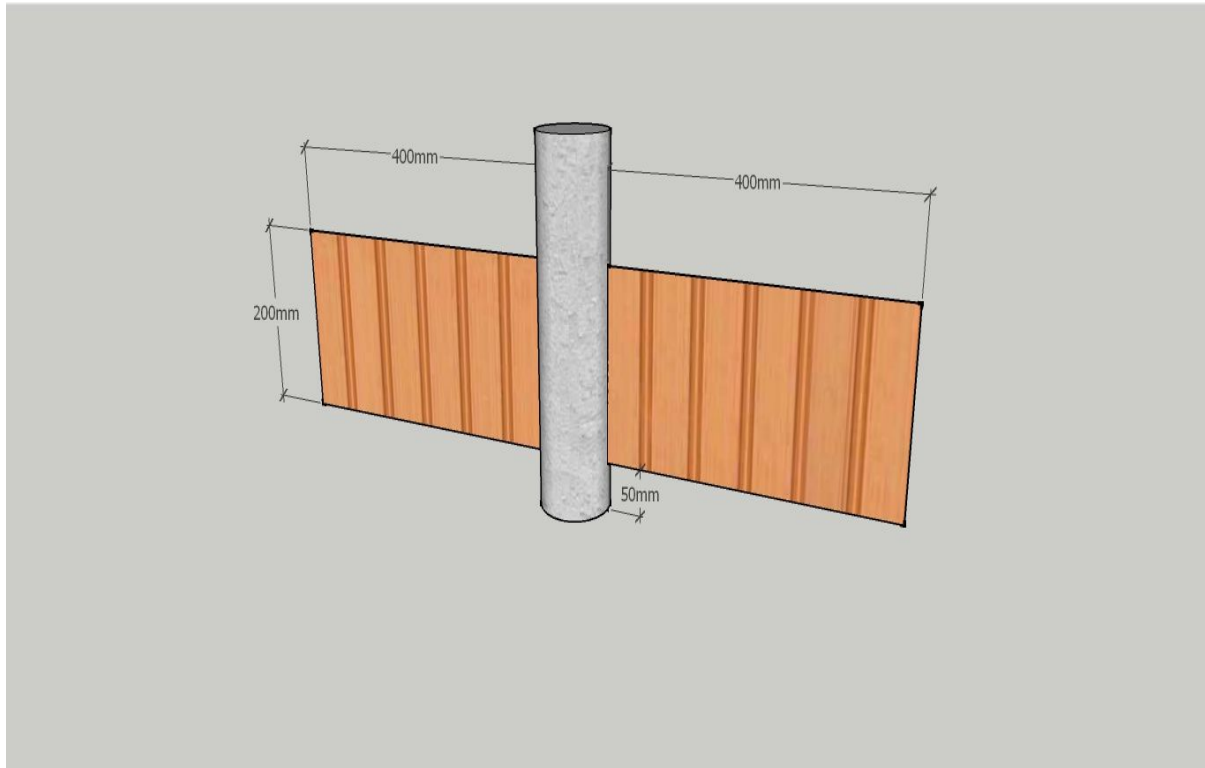


Figure 20: Gate

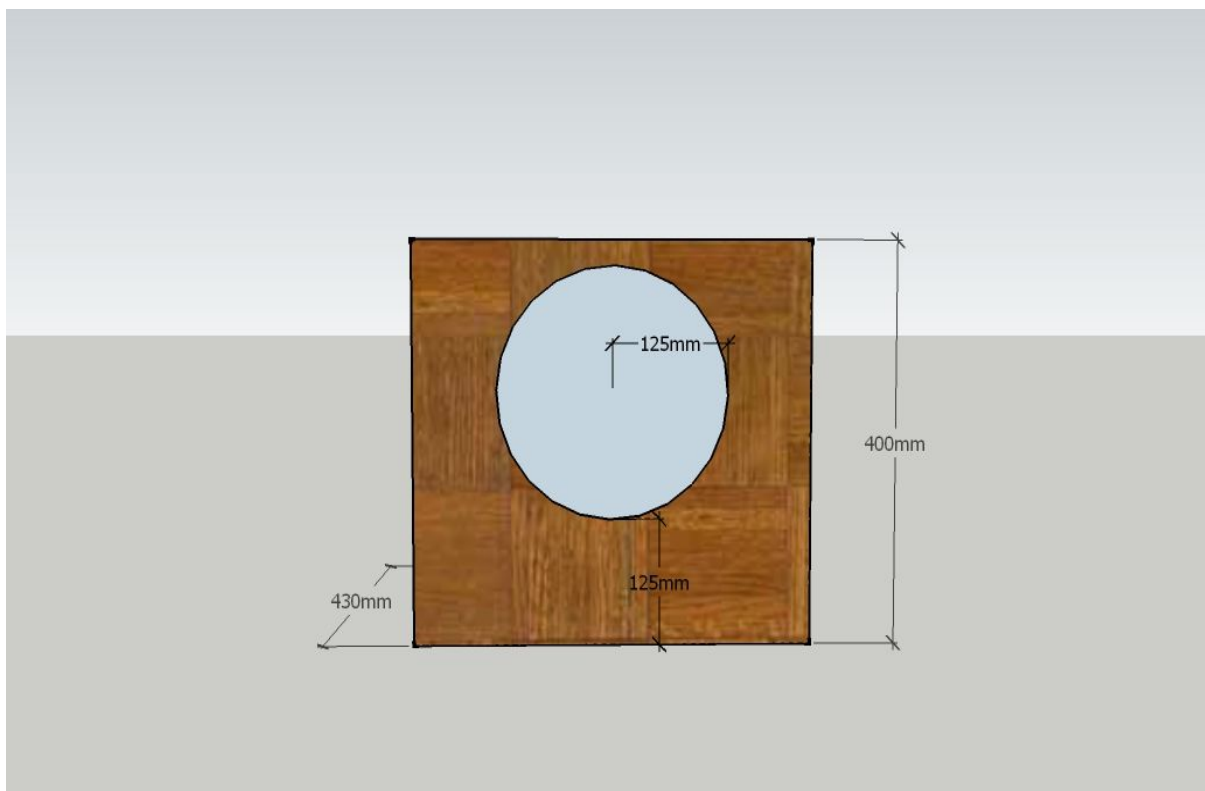


Figure 21: Death Star

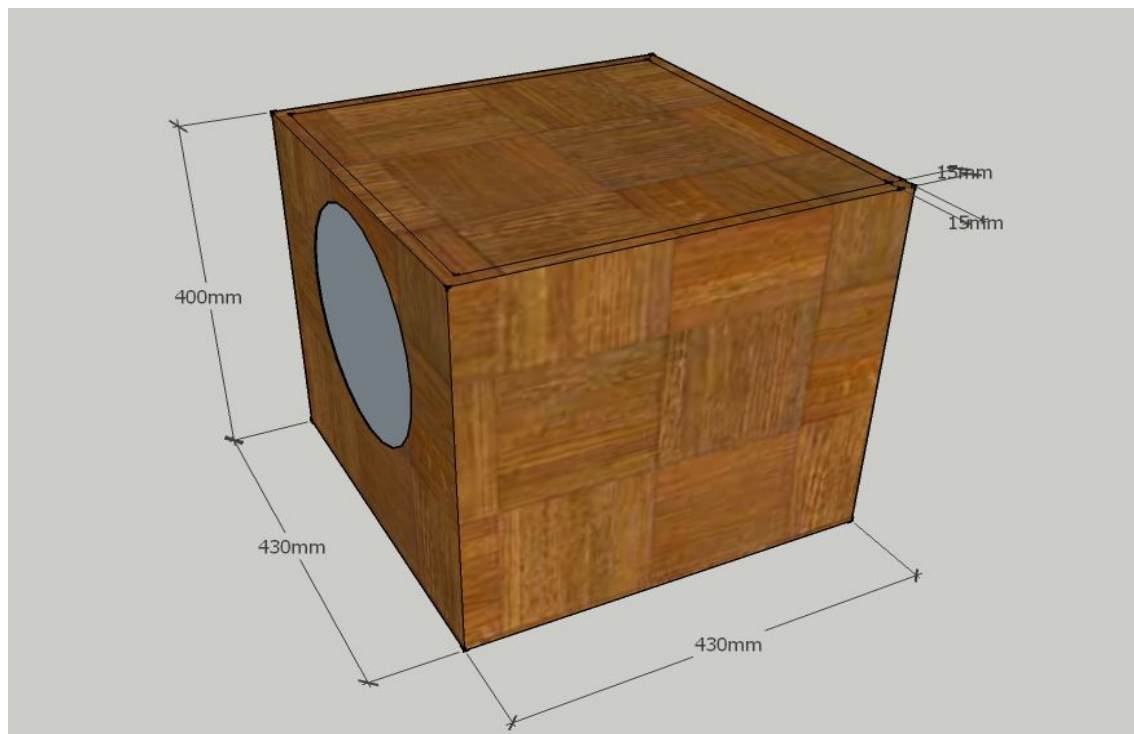


Figure 22: Death Star

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 readymade 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). It must have a ball throwing mechanism.
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.

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 curved wooden bridge. If the bot fails to cross this, it will be allowed to skip the task but with a penalty of 30 points. After crossing

- the hanging bridge, the manual bot have to wait for the autonomous bot at the transfer zone.
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 Clone block in the autonomous zone, carry and then reach to the transfer zone to deposit it there. After depositing the Clone block, the autonomous bot have to move towards the gate and push it to clear the path of the manual bot and then wait for the manual bot at the pit.
 5. The manual bot has to pick up the Clone block from the transfer zone, carry it, cross over the incline and deposit it in the pit and then proceed to the war zone.
 6. Once the manual bot deposits the Clone block in pit, the autonomous bot can then proceed toward the Darth Vader block. (Note that the autonomous bot cannot cross the pit unless the manual bot drops the Clone block in it).
 7. The autonomous bot have to then move toward the Darth Vader block, carry and drop it into the Jedi zone.
 8. As soon as the autonomous bot drops the Darth Vader block into the Jedi zone, the manual block will mark the victory of the allied side by projecting a ball (bomb) into the death star.

(Note: The balls loaded in the manual bot's canon will be of plastic of diameter 70 mm with +/- 15% error)

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 (Darth Vader block and Clone block). The bot should give a visual/audio signal at the end of the dry run. Clone block will be manually placed in the pit 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. 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.
6. Autonomous bot is allowed to move only in the autonomous zone at all times.

7. Manual bot is allowed to move only in the manual zone.
8. Blocks should not be dragged by any of the bots of competing team. If found so, a penalty of 20 points will be incurred.
9. A maximum of 2 balls can be preloaded into manual bot before the start of the match.

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 transfer zone. Bot will be placed just after the transfer zone.
3. Third Checkpoint: After the bot successfully crosses the pit, it will be placed just after the pit if it takes any restarts.
4. Fourth Checkpoint: If the autonomous bot successfully picks up the Darth Vader block, it will be placed just before the Darth Vader if it takes any restarts.

Manual bot checkpoints :

1. First Checkpoint: When the manual bot successfully crosses curved bridge.
2. Second Checkpoint: When the manual bot successfully picks up the Clone block.
3. Third Checkpoint: When the manual bot successfully crosses incline.
4. Fourth Checkpoint: When the manual bot successfully deposits the Clone block in the pit.

Judging :

1. Teams will be awarded 40 points for successfully crossing the curved bridge containing the wooden planks.
2. Teams will be awarded 30 points for successfully depositing the Clone block in transfer zone.
3. Teams will be awarded 30 points if the autonomous bot successfully opens the gate and goes through it.
4. Teams will be awarded 60 points if the manual bot successfully crosses the incline (Note : Points will be given only after the manual bot gets down from the incline).
5. Teams will be awarded 40 points for successfully depositing the Clone block in the pit.
6. Teams will be awarded 40 points for successfully depositing the Darth Vader block in the Jedi zone.

7. Teams will be awarded 50 points if the manual bot is successful in firing the ball in the inner circle of the death star and 30 points to hit the outer box of the death star.
8. Every time the autonomous bot crosses the node, it incurs a penalty of 25 points and has to start from last checkpoint.
9. 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 25 points.
10. If the autonomous bot enters into the manual zone, it incurs a penalty of 25 points except the time of placing the Clone block in the transfer zone.
11. If any part of the manual bot enters into autonomous bot zone, it incurs a penalty of 25 points except the time of depositing the Clone block in the pit.
12. A penalty of 20 points will be imposed if the manual bot is found damaging the grid.
13. 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 :

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 360 seconds.

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.