Task

(Use Figure 2 as reference for the various coloured zones)

1. Before the game starts each team will be given a dry run which is described later.
2. The task involves two bots- one manual and one autonomous.
3. It is a one on one game. Two teams will be playing at the same time in two different arenas having a common zone in between. The gameplay involves checking the speed, efficiency and synchronisation between the two bots
4. At the start of the game, the manual bot must carry the autonomous bot with it. The autonomous bot should not be in any kind of motion during this time and should not touch the ground.
5. The manual bot will start from starting area (yellow area) and then drop the autonomous bot in the autonomous landing zone (red area). After dropping the autonomous bot, the manual bot cannot proceed to the next task until the autonomous bot keeps the 'intruder' block in the Intruder Transfer Zone (blue area). During this time manual bot can take the position to receive the intruder block.
6. The autonomous bot has to solve the grid by following the white line and avoiding the nodes and must carry the intruder block from a location on the grid to the intruder transfer zone (blue area).
7. Once the intruder block is deposited by autonomous bot in the Intruder Transfer Zone, the manual bot will pick up the intruder block and place it in the Intruder Deposit Zone located in the common zone (pink area).
8. Then the manual bot will pick up the key block from the Common zone and place it in the key transfer zone (Transfer zone shown in green). The exact position where key block should be deposited by the manual bot will be declared before the dry run.
9. After this the autonomous bot will the carry key block to the key installation location and place the block there to unlock the secured zone (Orange area). After unlocking the secured zone the autonomous bot will return to the transfer zone.
10. Simultaneously the manual bot will assemble the two broken parts of the (Type-C and Type D) to form an assembly of two blocks kept one upon another at the transfer zone of cube (assembly of Type-C and Type-D block).Assembly can be made either at the Common zone or at cube transfer zone.
11. When the cube is ready at the transfer zone by manual bot, the autonomous bot will pick the CUBE, enter the secure zone which has been unlocked earlier (brown area) and drop the CUBE to save the Earth.

Arena Details

The arena is made of wood. The arena will be a combination of 2 individual arenas, each being connected side by side at the common zone (see figure 1 and 2)***. In the figure 2 colours are shown just for indication and sample arena is shown in figure 13.*** The individual arenas will consist of:

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1. **Grid**: It is indicated in black and white colour in figure 2.Only autonomous bot can navigate in this zone. This zone will consist of a **6x 7** squares grid of white 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 30mm x 30mm. Position of nodes and intruder block will vary for different games. Each cell of the grid will be a square with inner dimensions **270 mm x 270 mm**. The thickness of each white line is **30 mm.**
2. **Manual Zone:** It is indicated by wooden pattern in figure 2. Manual bot is restricted to this zone during the entire length of competition.
3. **Autonomous Landing Zone**: It is indicated by red colour. It is the zone where the Manual bot will drop the autonomous bot.
4. **Common Zone:** It is indicated by pink colour in figure 2. It is area common between the two manual zones where the "key" blocks and cube (individual units) are kept. Blocks are arranged in the zone as shown in **Figure-5**. Total 6 blocks are present in this zone three for each team and two empty spaces for placement of the Intruder blocks. Thus, there are two units each of:

- Key block
- Bottom Half assembly block.
- Upper Half assembly block.

Faces of blocks in the common zone are towards floor as shown in figure.

5. **Transfer Zone:** Transfer Zone is indicated by green colour in **Figure 2.** It is the zone where key block and CUBE (assembly block) are deposited by the manual bot and the autonomous bot picks them. There are four locations to deposit the key block and assembly block. Exact locations where manual bot would be required to deposit two blocks will vary and are not fixed. They will be declared just before the start of match and at other two locations dummy block will be placed to confuse the autonomous bot. During the dry run autonomous bot can explore the positions where the key block and assembly block will be kept by manual bot with help of indicators provided as explained later.
6. **Intruder transfer zone:** It is indicated by blue colour in figure 2. It is the zone where autonomous bot deposits the intruder block and manual bot collects it.
7. **Special Zone:** It is indicated by brown colour in figure 2. Only autonomous bot can navigate in this zone. It has to firstly keep the key block in the orange area and after that only it can enter the secured zone and secure its CUBE (assembly block). Only one team can secure its CUBE (assembly block) because there is place for only one CUBE at the securing point. Dimensions as shown in **Figure-4a,4b.**
8. **Components in the arena:**
   Block Type A or Intruder Block - The colour of all the 6 sides of the block will be white. One such block will be placed randomly in the grid. The block will be placed such that it coincides with the centre point of a grid intersection as closely as possible. Dimensions - **100 mm x 100 mm x 100 mm (Figure-10)**
   Block Type B or Key – The colour of 5 sides of block are black and one side of block is white. The block will be placed in common zone such that its white face is towards the floor. Dimensions - **100**

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mm x 100 mm x 100 mm. As shown in **Figure-8.**

Block Type C or Bottom Half assembly block - It will form the lower part of assembly. It has a square pole in the centre of it to facilitate bonding of the cube (assembly) that is to be made. Block is completely black except its one face which is white. White face of block is towards floor. As shown in **Figure-8.**

Block Type D or Upper half assembly block- It will form the upper part of assembly. A square hole with side very near to that of pole in Type C will be present at centre in Type D to properly form the assembly. It is completely black. As shown in **Figure-9.**

Dummy Block- Dummy block is placed at the two positions in the Transfer zone, where assembly block and key block are not to be placed by manual bot. There are two dummy blocks, one of them is identical to assembly block and other one is identical to key block.

The blocks are made of non-magnetic material and will have a maximum weight of **60 grams**. The pictures of the blocks are given below.

Block Adjuster- It facilitates the placement of blocks by manual bot in the transfer zone. As shown in **Figure-6.**

Autonomous bot dropping point- It facilitates the landing of autonomous bot. As shown in **Figure-7.**

9. 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 0.5 mm.
10. Light conditions at the venue might not be uniform.

Bot Specifications, Dimensions and Fabrication

Autonomous Bot

1. Only one autonomous grid solving bot per team is allowed.
2. The autonomous bot must fit within a cube of dimensions 220mm x 220mm x 220mm (l x b x h).
3. Bot must be started individually by only 1 on-board switch. However, a team may have a separate on-board switch for restart. This switch will have to be shown before the run to the organisers.
4. The autonomous bot must be stable and must be able to stand on its own when put in the Autonomous landing zone (red area). Bots not fulfilling this criterion will be disqualified.
5. During the run, the autonomous bot can expand itself provided it does not damage the arena in anyway. However, it is not allowed to leave anything behind or make any marks while traversing the grid. Any bot found damaging the arena will be immediately disqualified. The final decision is at the discretion of the organisers.
6. The autonomous bot should not separate or split into two or more units. All bots/units which are touching each other or are at the starting zone will be considered as one bot.
7. The methods of collection and delivery of the blocks are at the discretion of the team. However, the teams damaging the blocks will be disqualified.
8. The teams are allowed to use ready-made micro-controller boards/ready-made sensor kits. However the teams are not allowed to use ready-made Lego kits or any such assemblies.

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9. The starting procedure of the bot should be simple and should not involve giving bot any manual force or impulse in any direction.

Manual Bot

1. Only 1 manual bot is allowed per team.
2. During the start of the run the manual bot must fit within a cube of dimension 400mm x 400 mm x 400 mm (l x b x h).
3. The bot must be stable and must stand on its own at the beginning of the run when put in the starting point. Bots not fulfilling this criterion will be disqualified. The bot is only allowed to keep autonomous bot inside it and there should be no separate part of manual bot splitting up from it.
4. The manual bot should be remote controlled and the connection between bot and remote should be wired.
5. The manual bot should have an on-board power supply.
6. The external remote control used to control the bot is not included in this size constraint.
7. The on-board power supply on the bot must fit within the size constraint.
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 the disqualification of the team.
9. The manual bot should strictly move in the manual zone.

Power Supply

1. The bots have to use an on-board power supply. No external power supply will be allowed.
2. Each team shall bring its own power supply for all its bots.
3. The potential difference between any two points on any of the bots must not exceed 24 V DC.

Controls

1. The grid solving autonomous bot should not receive any input from outside the arena.
2. The manual bot should receive signal only from single remote control.
3. No wireless communication between the autonomous bot and the manual bot is allowed. The team is responsible for proving this to the organisers. If any wireless communication is detected then the team will be disqualified.

Rules

Game Rules

NOTE - The teams will have to submit their grid solving bot before the start of the competition. Only those teams which submit their grid solving bot will be allowed to participate. The grid solving 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.

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1. The maximum time given for completing the task is **6 minutes**.
2. Before the start of the run, a **dry run of 5 minutes** will be given to the grid solving bot. During dry run the grid solving bot can explore the entire grid to find the position of the nodes and positions where the key block and the assembly will be placed. Indicatiors will be given at locations where key block and assembly block will be deposited by manual bot in the form shown in **Figure-1** below (autonomous dry run arena). During the dry run dummy blocks won't be present on the arena. Also the indicator line will be removed once dry run is completed.
3. The bot should give a visual/audio signal at the end of dry run.
4. 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.
5. At the end of dry run the autonomous bot will be given to the team and team has to place manual bot and autonomous bot together at the 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 (wooden area).
8. Type A block (intruder block kept at random location in the grid) has to be deposited in the intruder transfer zone (blue area) by the autonomous bot.
9. Type B block (key) has to be first lifted from common zone (pink area) and kept in the transfer zone (green area). The orientations of block will be such that its white face is towards floor. Please note that the Type B block can be touched by the manual bot only when the Type A block has been moved out of the grid and placed at the intruder collection cell/zone.
10. If any part of the block is in contact with the autonomous bot, the autonomous bot is said to carry that block.
11. During the run, every bot can carry only one block.

Checkpoints

First Checkpoint –

Once autonomous bot successfully enters the grid area from manual bot i.e. autonomous bot has been placed properly in the red area and it successfully crosses the first intersection of the two white lines i.e. complete bot has crossed the intersection. If a team wants to restart between placement of autonomous bot in the red area and if teams wants to restart before autonomous bot has crossed the white line completely then team can take restart from red area but it incurs a penalty of 35 points.

Second Checkpoint -

Once the autonomous bot successfully deposits the intruder block in the intruder transfer zone.

Third Checkpoint -

Once the manual bot deposits the key block in the transfer zone.

Fourth Checkpoint -

When autonomous bot successfully unlocks the secured zone i.e. it places the key block at orange area.

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Fifth Checkpoint -
When manual bot assembles the cube by placing Type-D block on Type-C block to form a rigid assembly.
Sixth Checkpoint -
When manual bot deposits the cube in the transfer zone.

Restarts

1. The teams are given 3 restarts each for every autonomous bot and the manual bot.
2. However, there are no restrictions on the number of restarts for the dry run.
3. If a team opts for a restart before first checkpoint then it has to start all over again from the manual starting point.
4. If the autonomous bot opts for a restart, then all the blocks will be restored at locations as per the checkpoint chosen by the team , and autonomous bot will be placed in the autonomous dropping zone(red area).
5. After manual bot has successfully unloaded the autonomous bot, it can take a separate restart from manual starting point.
6. If manual bot asks for a restart during a task the block will be placed at the previous position.
7. In a restart, the timer will not be set back to zero and timer will not be paused.
8. During restarts for autonomous bot, a contestant cannot feed information about the grid to the bot. However, contestants are allowed to: Adjust sensors (Gain, Position etc.), make repairs. However, 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). The organisers shall arbitrate.
9. All restarts for autonomous bot and the manual bot require the approval of the organisers before the bot can be removed from the arena. If the bots were handled within the arena without approval, the run will be terminated.
10. 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 organisers are allowed to handle the blocks in any situation. The team will be disqualified if the blocks were handled within the arena without approval of the presiding organisers.
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 bot and autonomous bots.

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4. Laptops/personal computers are not allowed near the arena. Other Wi-Fi, Bluetooth, etc. devices must be switched off. The organisers hold the right to check for these devices and their usage and disqualify the team.
5. The organisers 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 organisers 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 organisers' decision will be final and binding. The organisers 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

Scoring System

1. Team will be awarded 50 points each for proper successful entry of autonomous bot from manual bot.
2. The team will be awarded 25 points for depositing the intruder block at intruder transfer zone.
3. Team will be awarded 25 points i.e. for placing intruder block in the common zone.
4. Team will be awarded 30 points for depositing key block from common zone to key deposition area.
5. Team will be awarded 40 points for unlocking the secure zone i.e. successfully placing key block at the orange area.
6. Team will be awarded 50 points for assembling the cube.
7. Team will be awarded 30 points for depositing the cube in transfer zone by manual bot.
8. Team will be awarded 100 points for placing the cube in the secure zone by the autonomous bot. After this the task is over.
9. The timer will stop as soon as the task is considered to be completed.
10. Every time the bot crosses a node, it incurs a penalty of 25 points.
11. If a team wants to restart between placement of autonomous bot in the red area and before autonomous bot has crossed the white line, it incurs a penalty of 35 points.
12. Every time the autonomous bot enters the manual zone, it incurs a penalty of 25 points.
13. Every time any part of the manual bot crosses the first white line adjacent to the transfer zone (first vertical white line from right side in figure 2) and it incurs a penalty of 25 points.

A team can score maximum 350 points in a game.

- This will be a one on one match; team which completes the task first will be the winner.
- In case no team finishes the task, team with highest points will be the winner. To evaluate in this case differential marking has been done at various checkpoints.
- In case of a tie, the team who has taken least time will be the winner.

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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 teams who have qualified for IRC finale. Disqualified teams will not be considered for any certificates

Figures

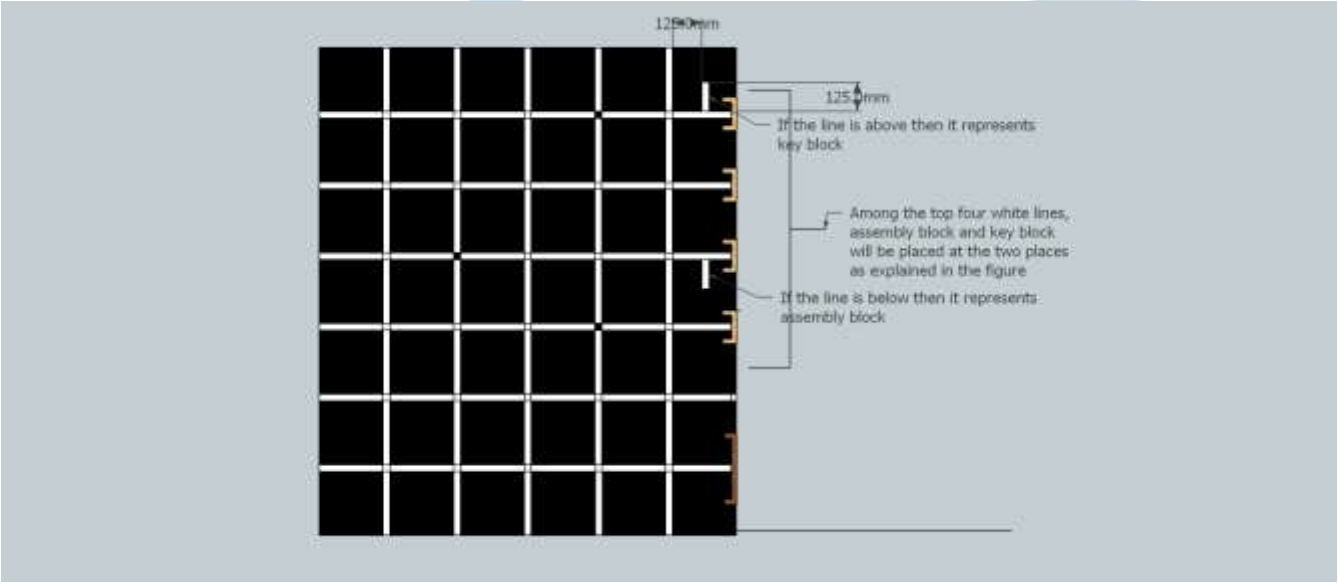

Figure 1: Autonomous bot mapping arena

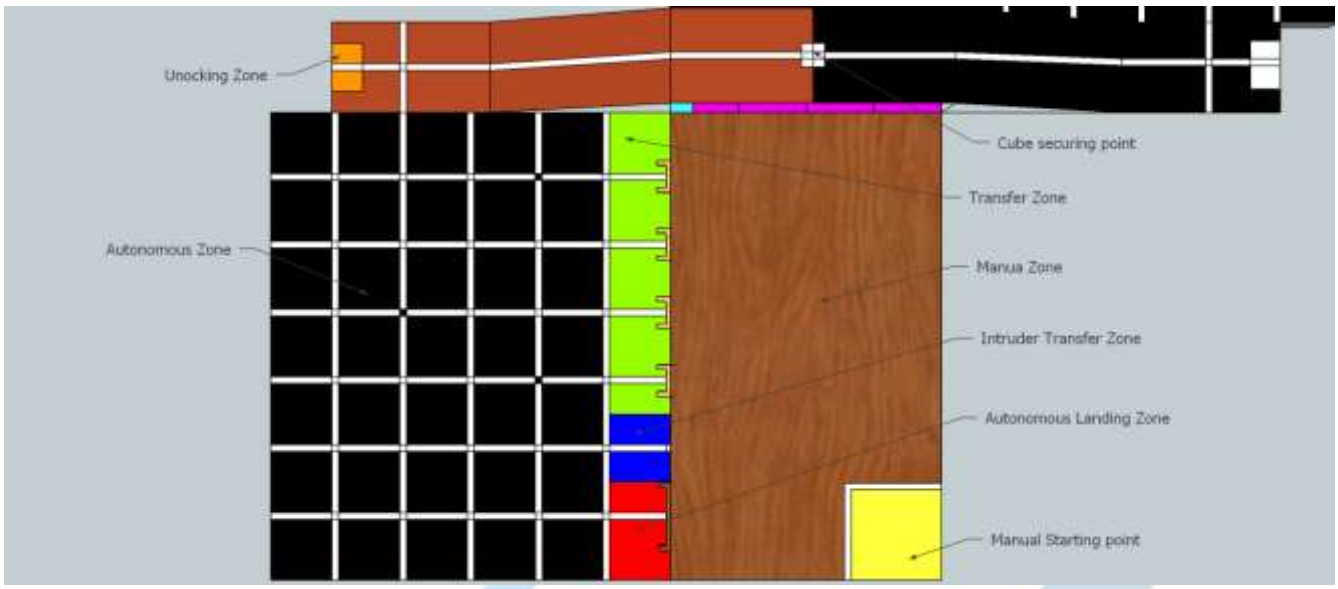

Figure 2: Coloured arena for description

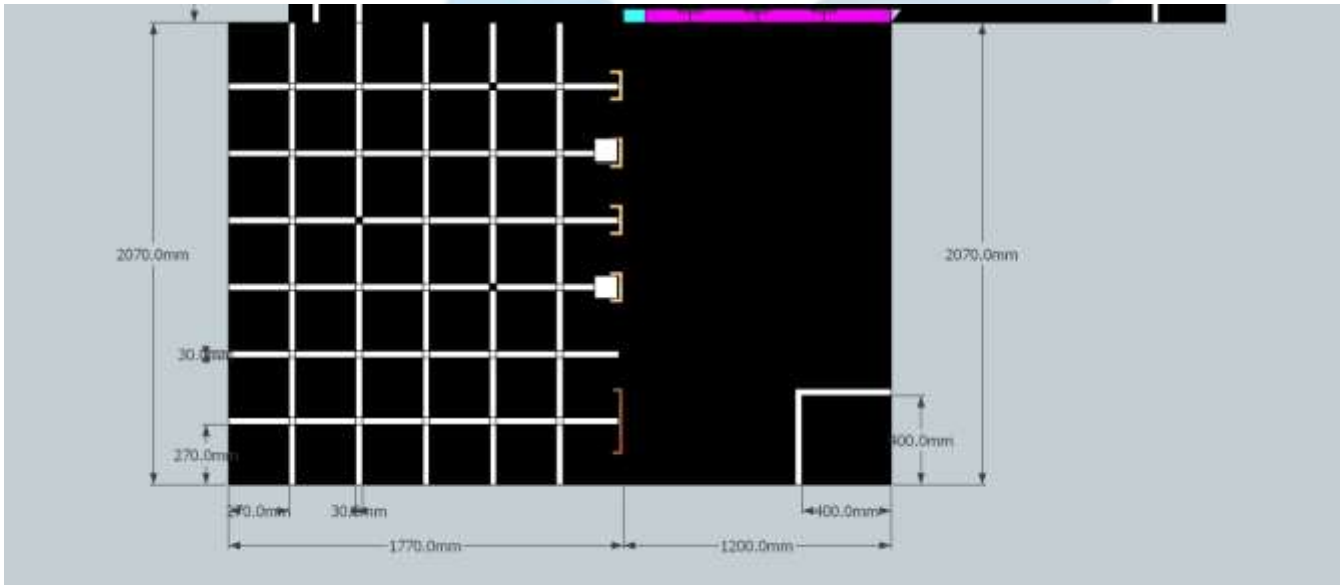

Figure-3: Manual zone and grid dimensions

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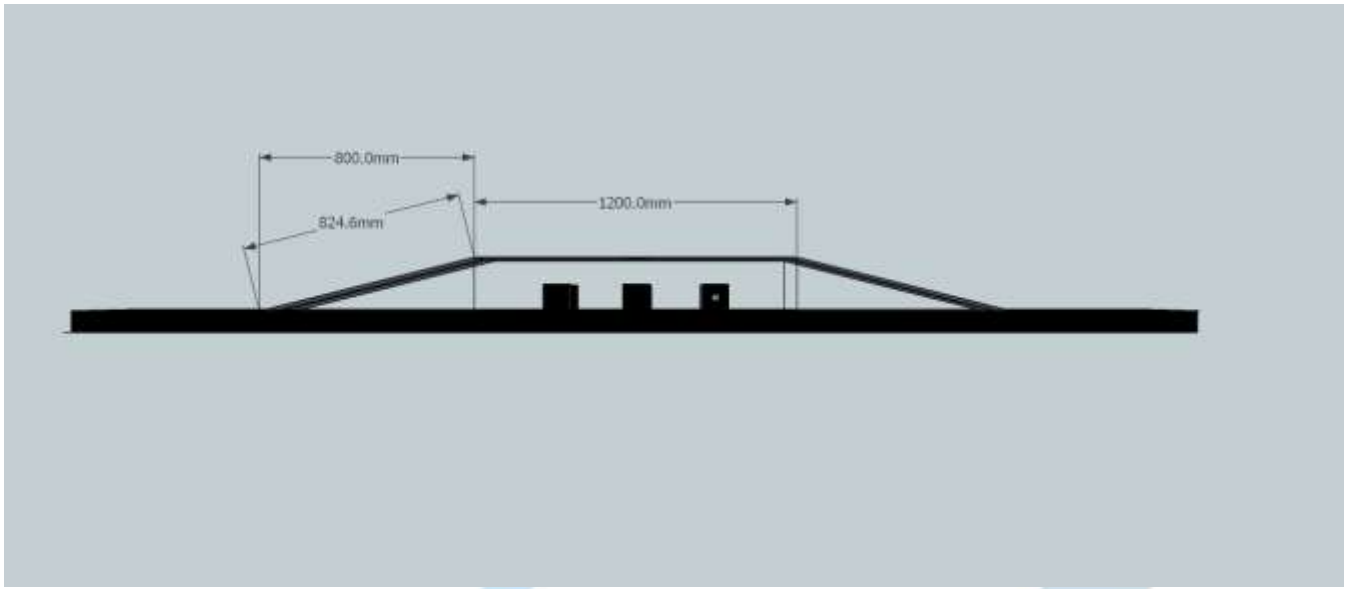

Figure-4a: Special task area side view dimensions

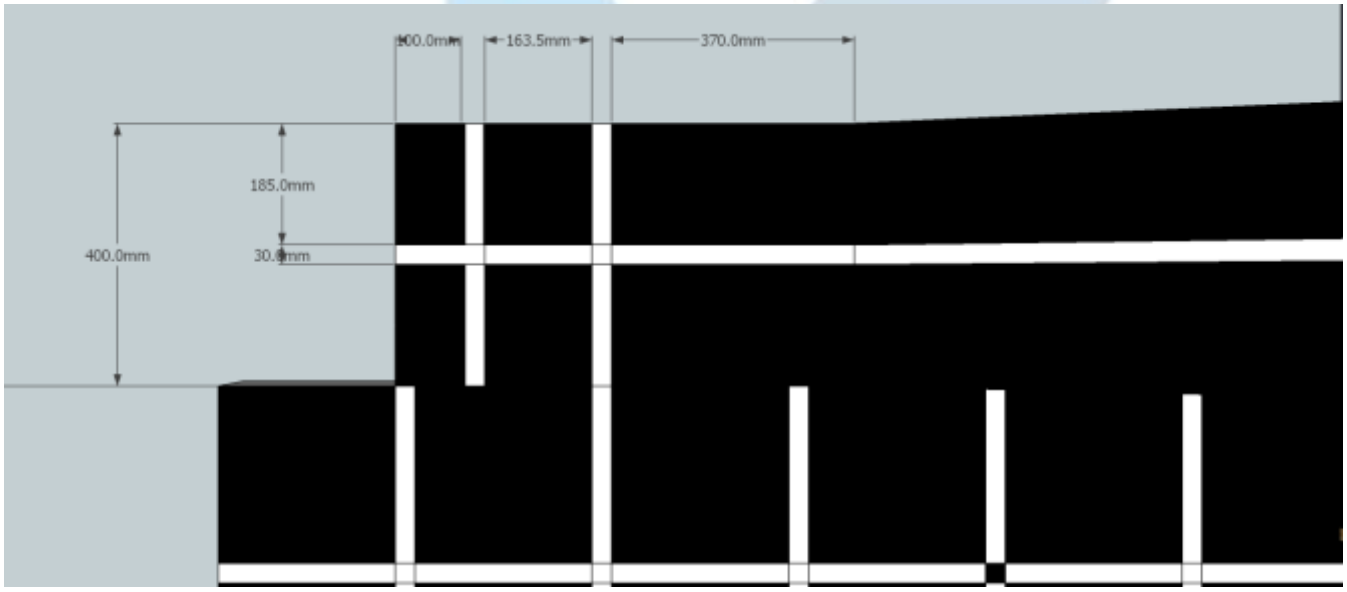

Figure 4b: Special task area top view dimensions

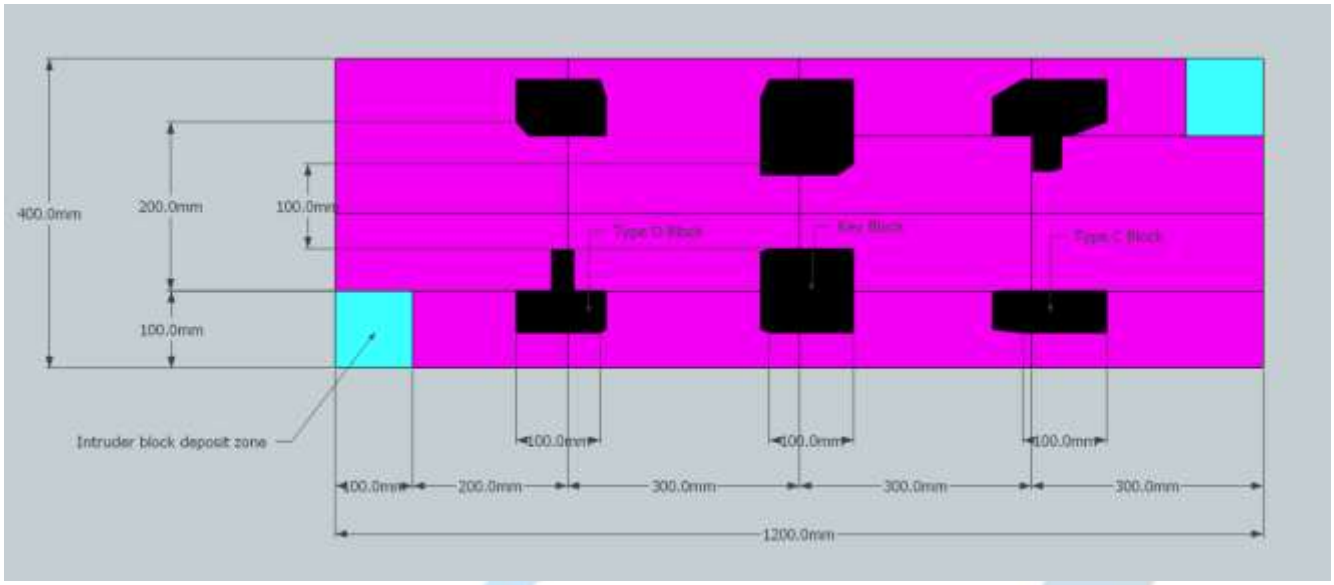

Figure-5a : Common Zone arrangement

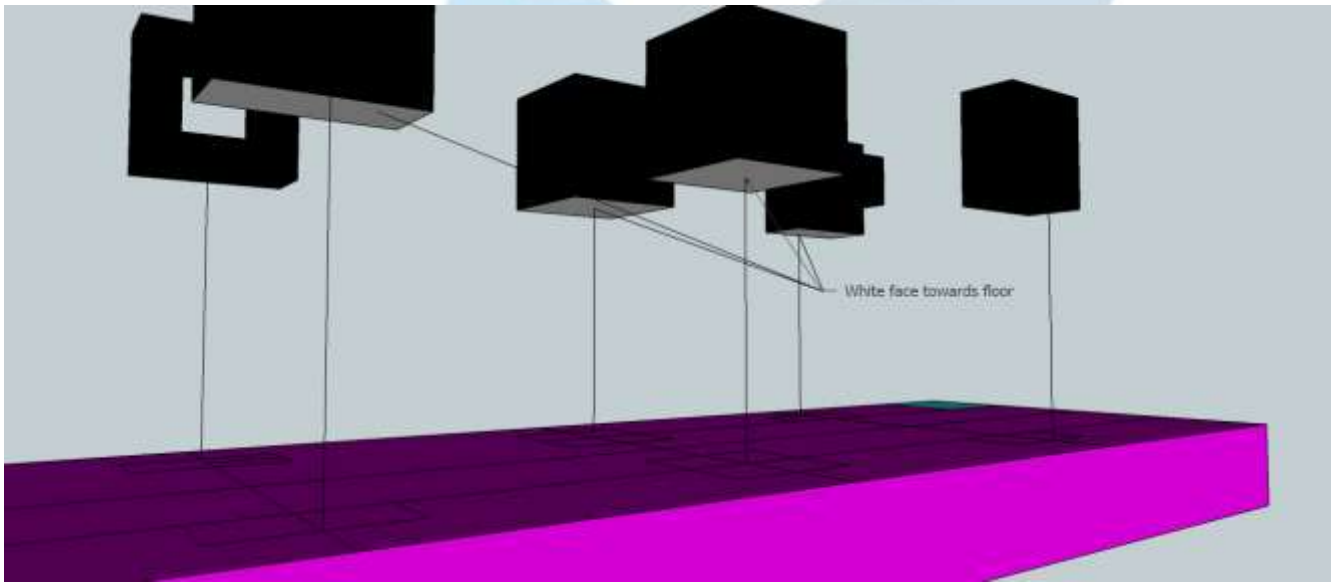

Figure-5b: Common Zone Bocks in air

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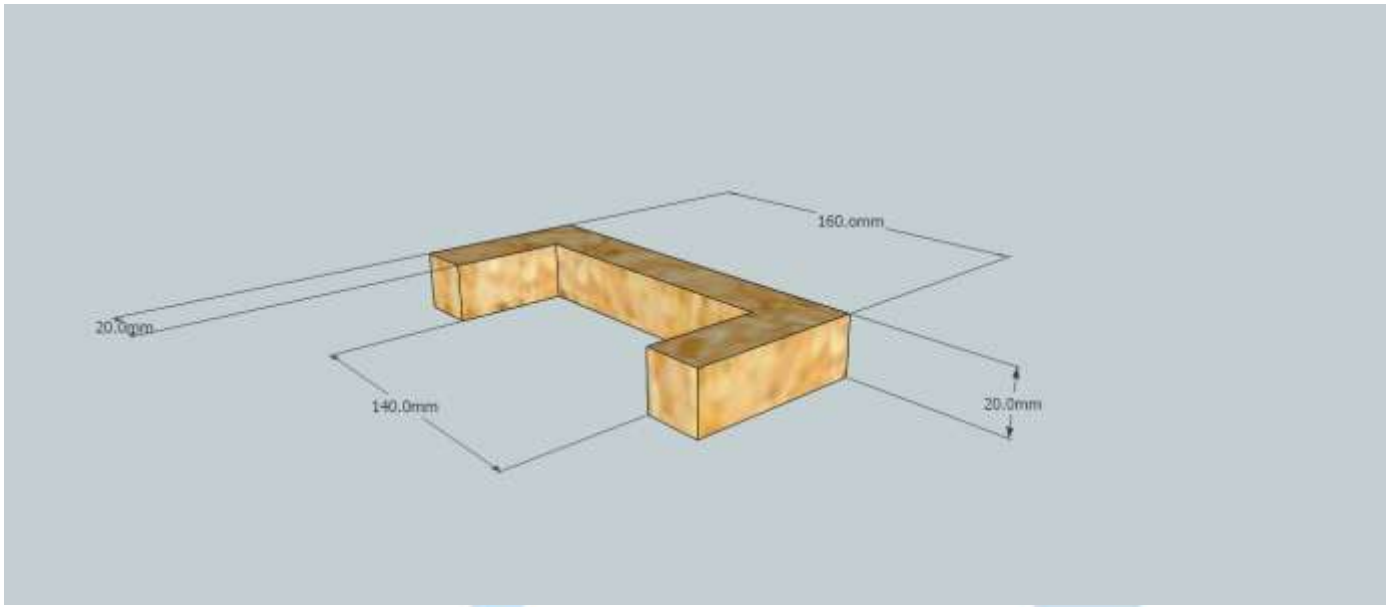

Figure-6: Block stopper

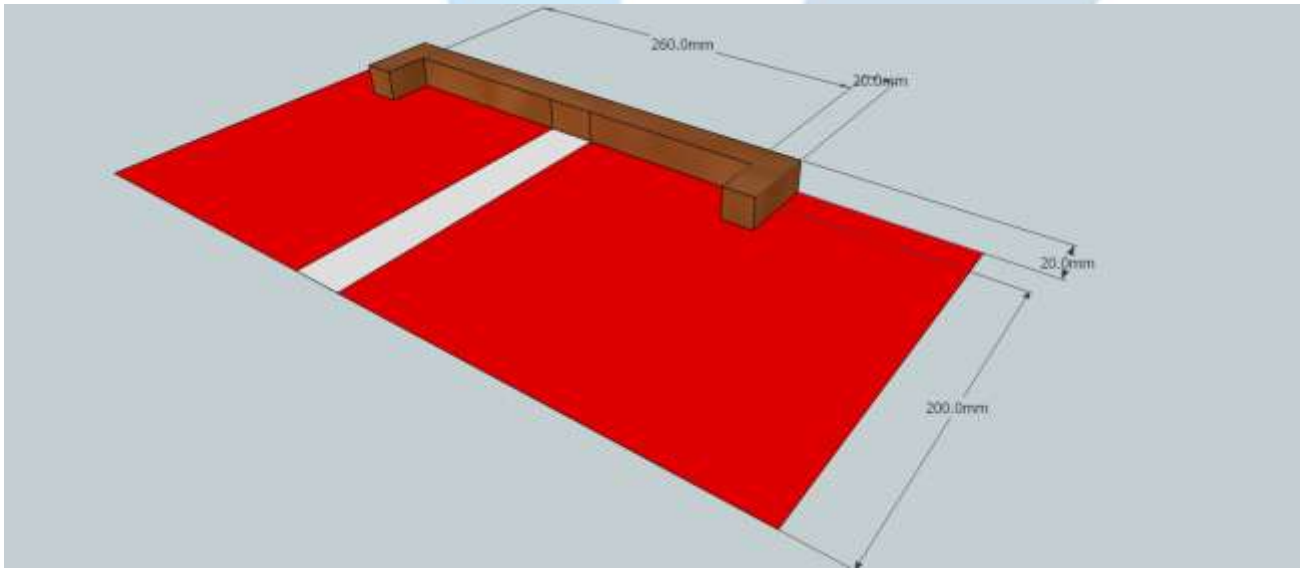

Figure-7: Autonomous landing zone

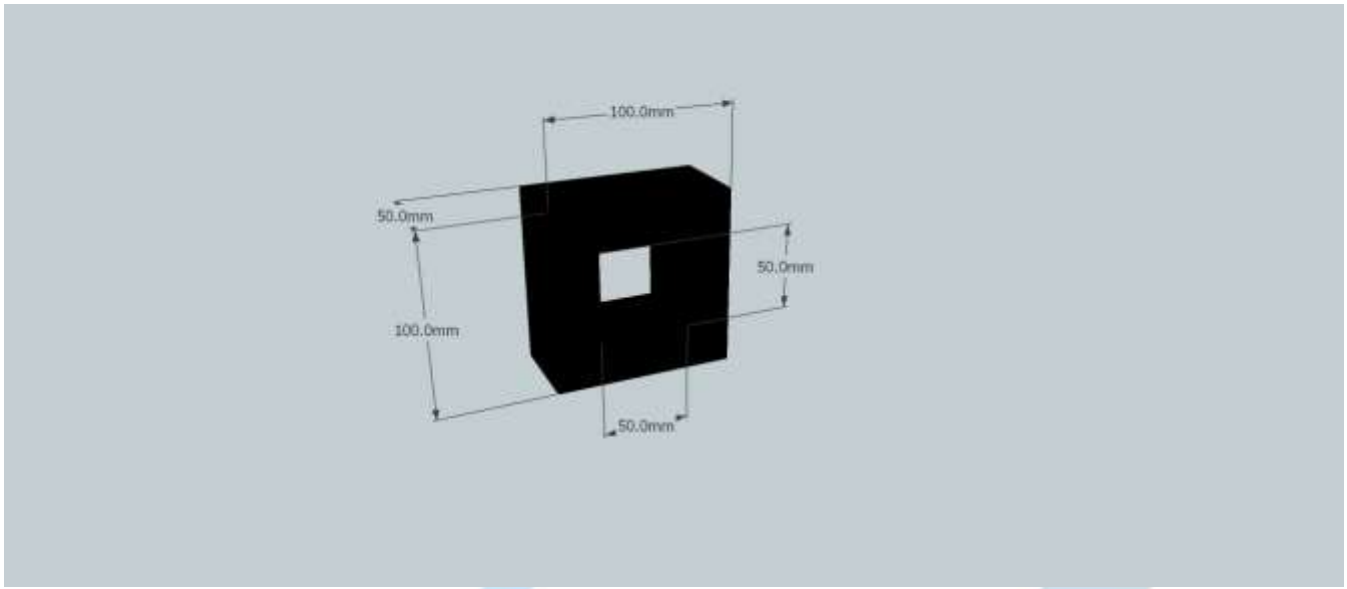

Figure-8: Upper Assembly block (Type D block)

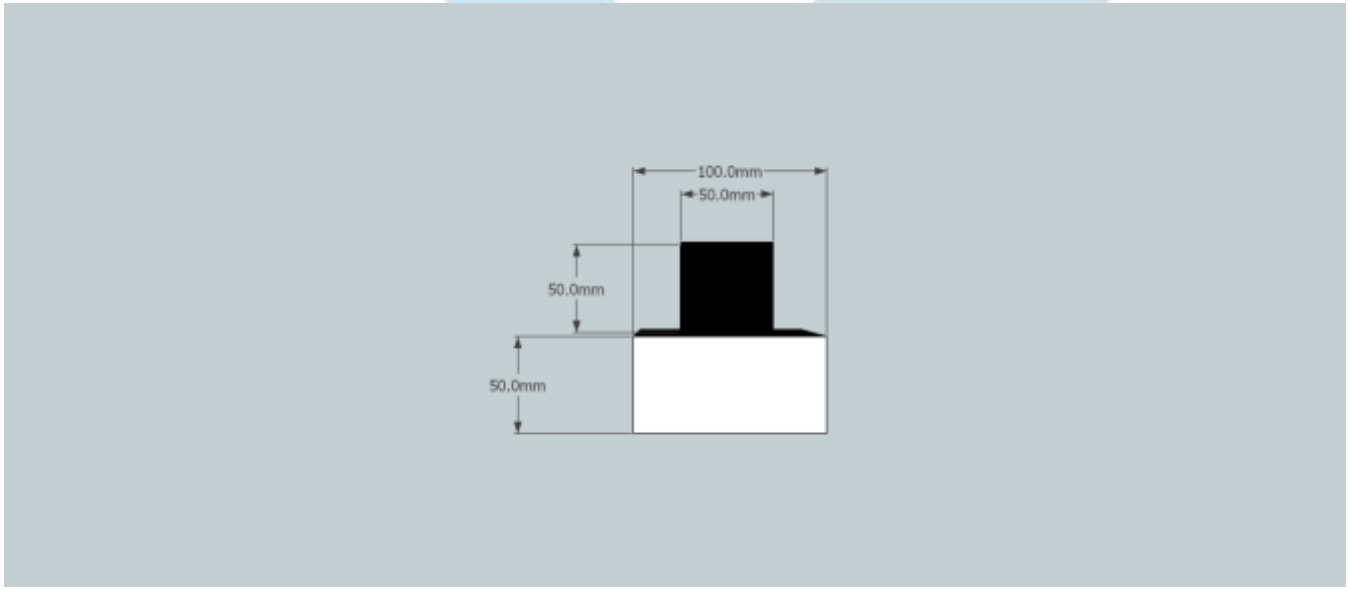

Figure-9: Lower Assembly block (Type C block)

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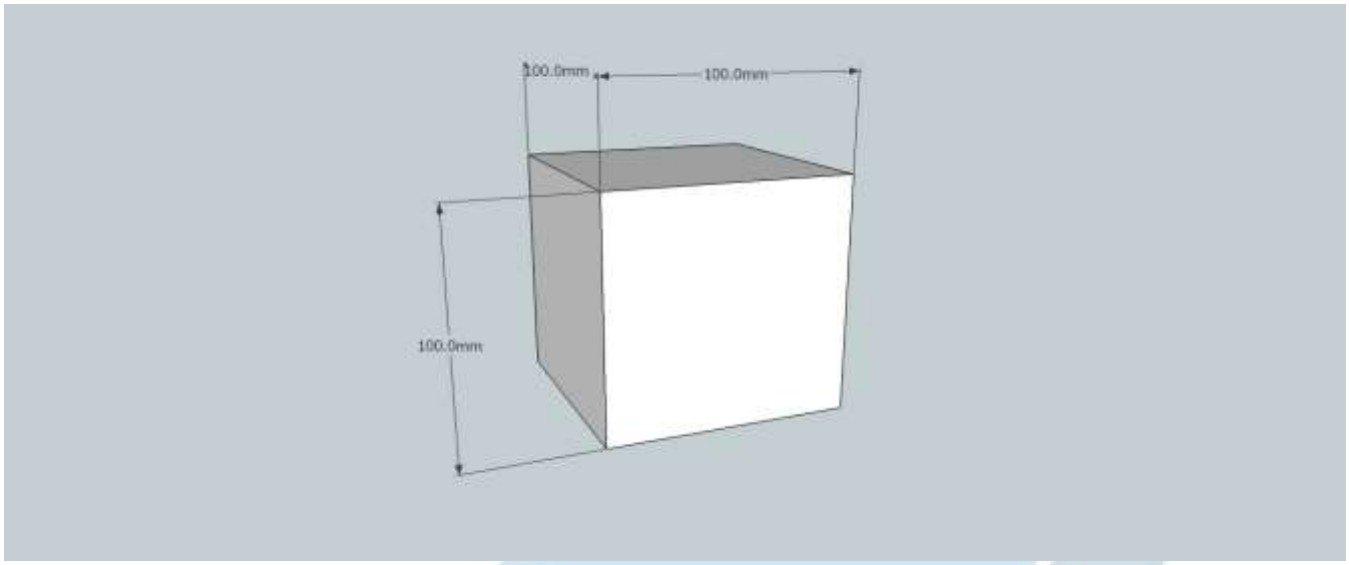

Figure-10: Intruder Block (Type A block)

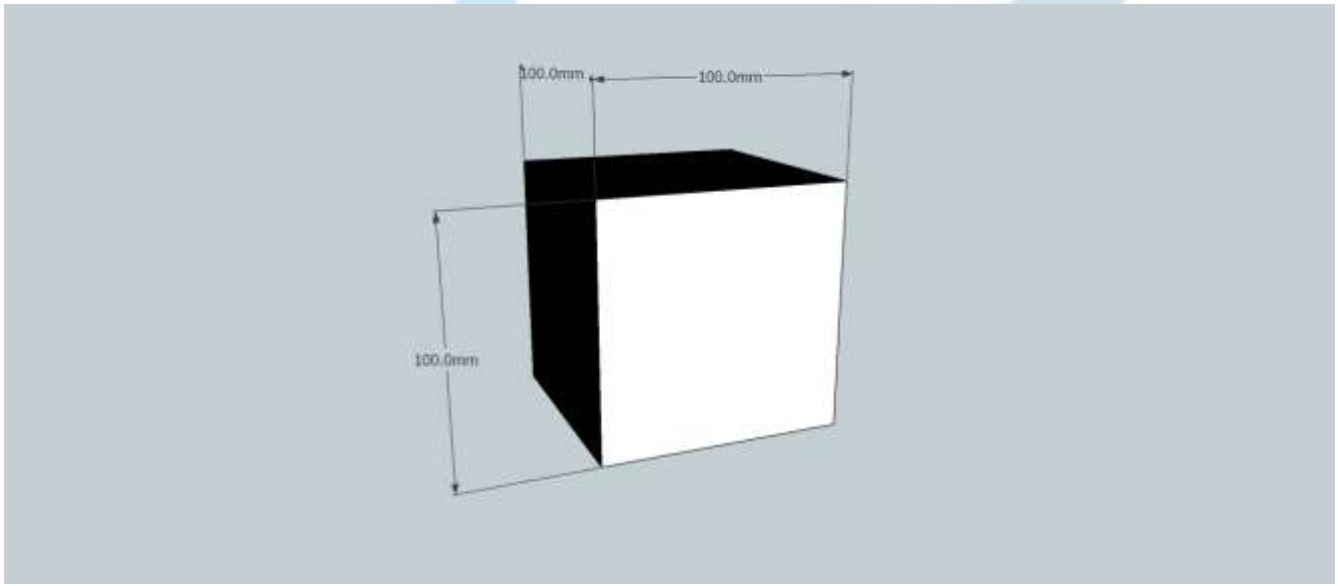

Figure-11: Key block

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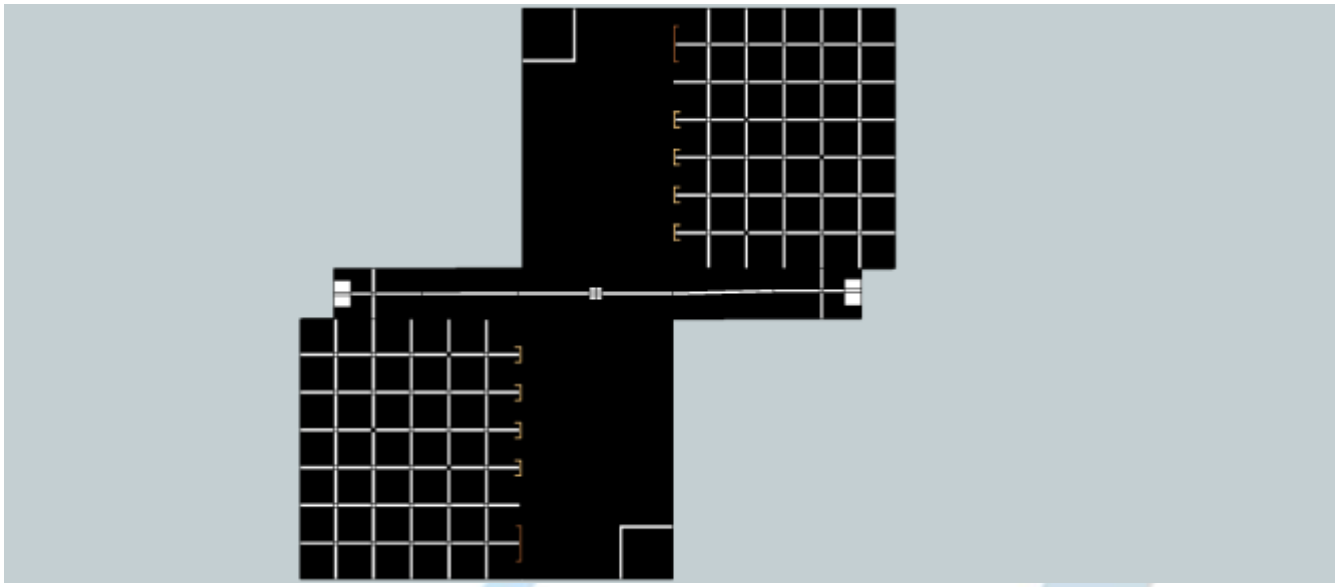

Figure-12: Actual Arena top view

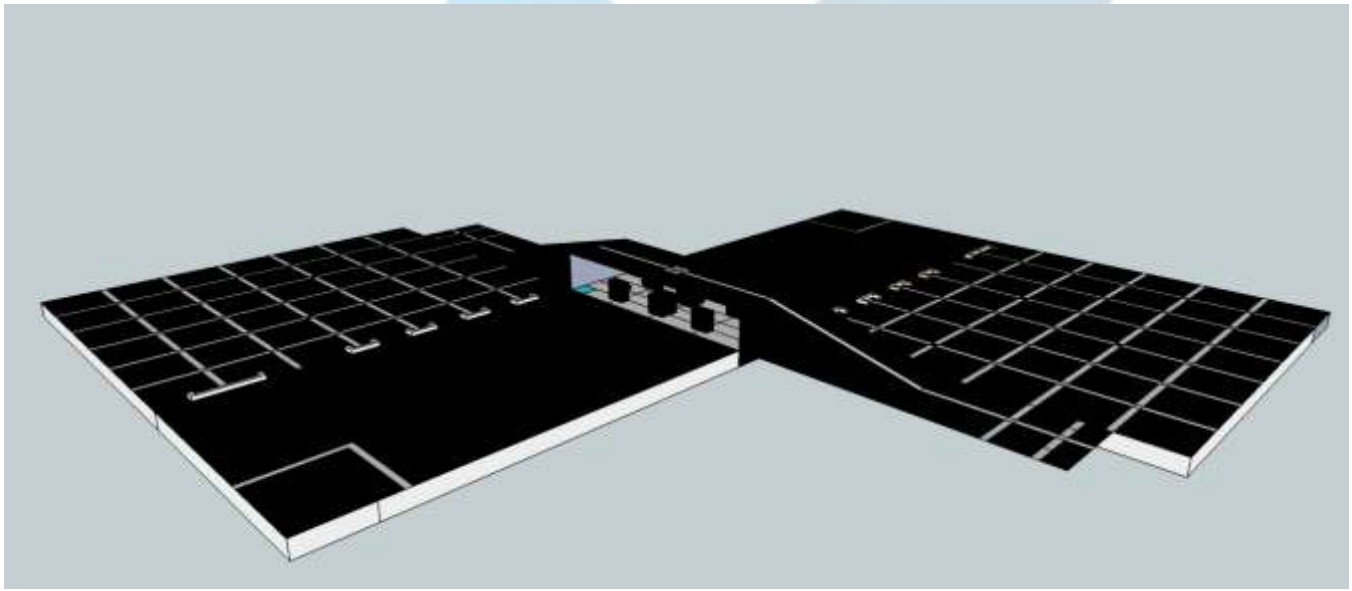

Figure-13: Actual arena isometric view

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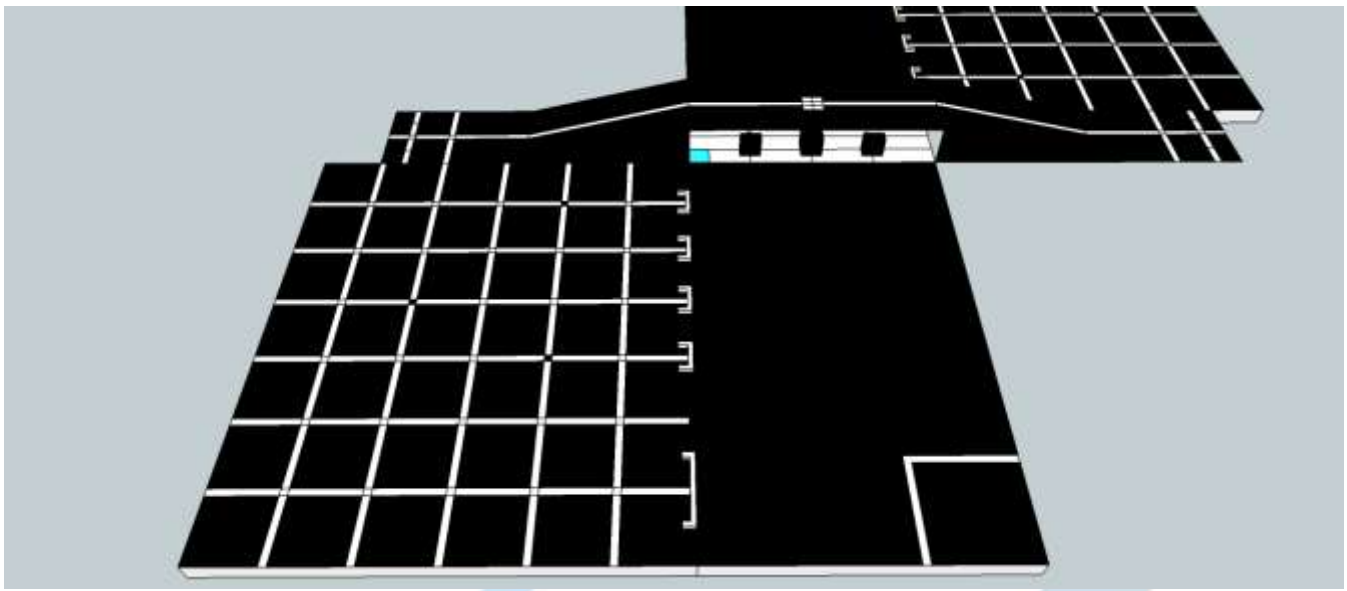

Figure-14: Actual arena side view

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