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 node, with help of image processing transfer blue block in a transfer zone which would be based on the direction of arrow on the sign board, put red block in red pit, cross the incline and Seesaw, transfer the Lego with Techfest logo to transfer zone.

3. The manual bot has to cross curved and regular bridge, transfer the blocks from transfer zone to pits and throw magnetic dart on the target.

4. A maximum of 7 minutes will be allotted to each participating team.

Game Field:

1. The game field consists of an arena having dimensions 4800 mm X 2400 mm. Complete arena is divided into 2 parts for 2 teams.

2. It also contains a **manual bot zone**, **manual start zone**, **autonomous zone**, **autonomous start zone**, **inclines**, **wooden curved bridge, blocks**, **pits**, **sign board, a Seesaw, aiming zone** and **target**.

3. **Manual Zone**: Only the manual bot can manoeuvre in this zone. (It is indicated by green colour in the arena)

4. **Autonomous Zone**: Only the autonomous bot can manoeuvre in this zone. (Grids in the arena indicate it)

5. **Manual Start Zone**: The manual bot must start the game from this zone. (fig. 20)

6. **Autonomous Start Zone**: The autonomous bot must start the game from this zone. (fig 21)

7. **Grid**: This zone consists of white grid lines on a black surface. The squares of the inner grids have inner dimensions of **300mm X 300mm**. For grids on edges refer to fig. 3 and fig 4. 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. (Example: Fig. 23)

- Transfer Zones: There are 3 transfer zones of depth 160 mm x 160 mm in manual zone as shown in figure 9 & 10. Manual & autonomous bots will have to transfer the blocks into one of two transfer zones 1 or transfer zone 2 & transfer one block in transfer zone 3.

Representation?

- Block Base: The initial position of Lego 3 block is set in manual zone as in figure 10. Positions of Lego 1 and Lego 2 blocks will be indicated in grid as shown in figure 7. The dimension of each block base is 150mm x 150mm.

*24

- Photo point: Figure 23 shows the position of photo points. Nodes will not be present at these points. They can be used to take images of Legos 4,5 and 6.

- Pits: Position of pit 1 is as shown in figure 12 and position of pit 2 is in figure 11. The dimension of the pit is 160mm x 160mm x 100mm. The autonomous bot has to deposit the red block in pit 1. The manual bot has to deposit the Lego 1 block in the pit 2.

(Note: This is a sample arena. In order to avoid hardcoding, position of nodes and block bases for Lego 1 & 2 will change after some interval of time. During dry run, the autonomous bot has to identify the position of nodes and block bases of Lego 1 & 2. However, position of transfer zones will remain fixed as shown in. figure 9 & 10).

...and pits

8. Blocks: There are five blocks used in the gameplay, namely, Lego 1 (Fig. 13), Lego 2 (Fig. 14), Lego 3(fig.10) Lego 4, Lego 5 and Lego 6 (figure 22).

9. Sign Board: The position of Sign Board is as shown in fig 5. It would have on it a solid black coloured arrow in white square background as shown in the figure. (Note: Node would not be present at of the exact grid point in front the sign board)

10. Curved Bridge: The Bridge is made of wooden planks of dimensions 50mm x 500mm x 10mm (lxbxh) at a distance of 10 mm from each other as shown in the figure 16.

11. Inclines: Incline 1 has the deposit zone 2 as shown in the figure 18. Incline 2 is for manual bot to cross as shown in figure 17.

12. Aiming Zones: Aiming zone is shown in figure 25. Manual bot has to aim for the target being completely in this area.

13. Seesaw: The location of seesaw is as shown in figure 8. Crossing seesaw will grant extra point as mentioned below in further details.

12. Waiting Zone: The location of waiting zone is shown in fig 25. Manual bot will have to wait in it after placing the block in pit 3 until the autonomous bot picks one of the Legos of 4,5 or 6.

14. Target: Manual bot has to hit the target corresponding to the block whichever the autonomous bot moved i.e. either 4,5 or 6. The centres all three targets are aligned with the mid-point of the grid line exactly in front of it. Its distance is 1720 mm from the aiming zones as shown in fig 26. (fig. 6)

Images-

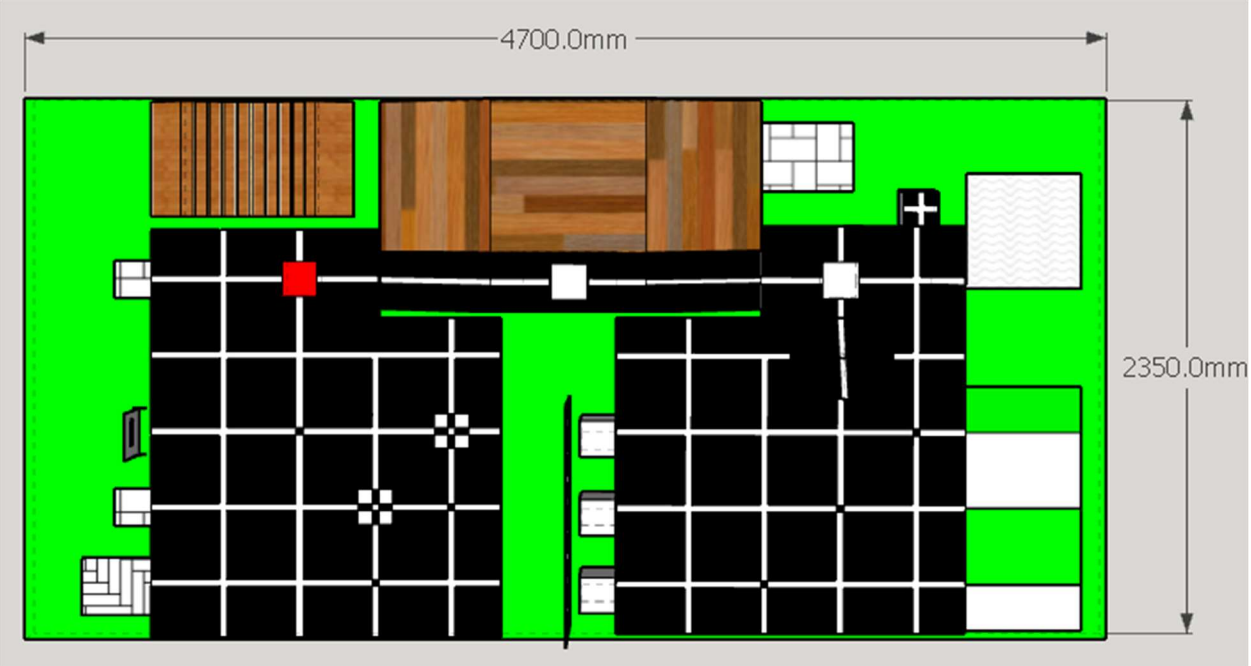

Fig. 1

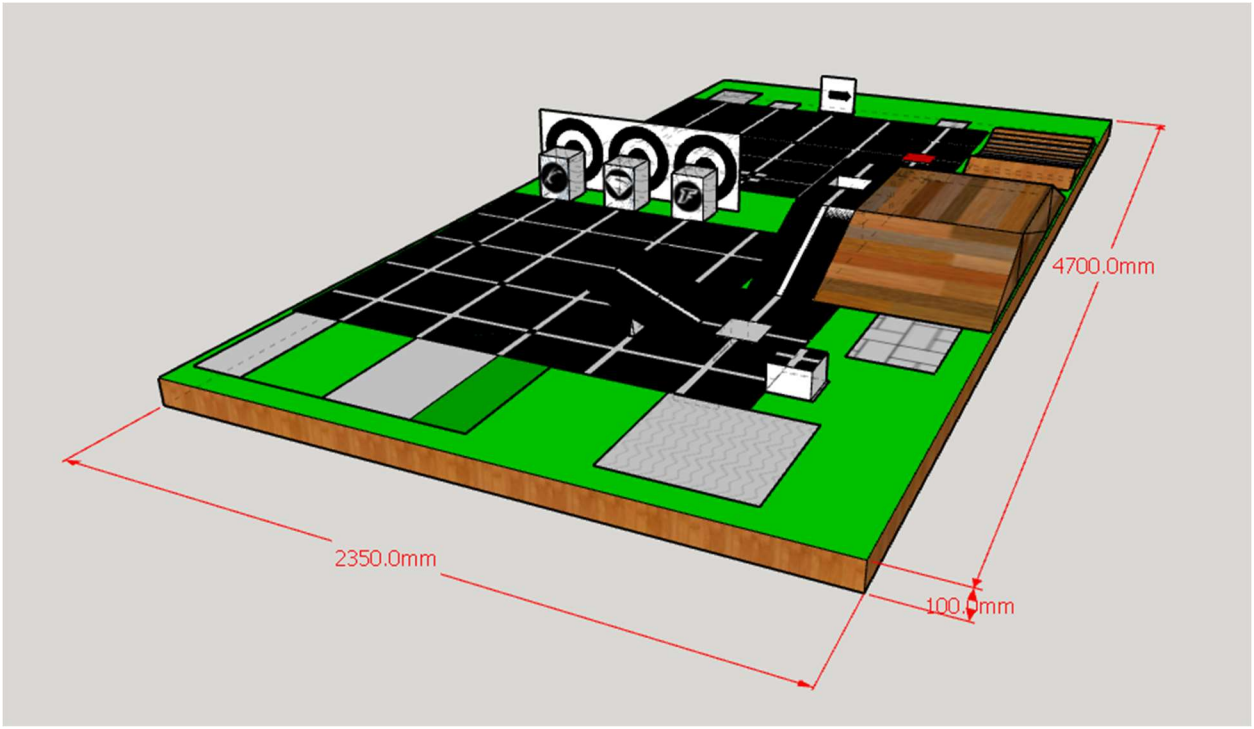
4700.0mm
2350.0mm
100.0mm

Fig. 2

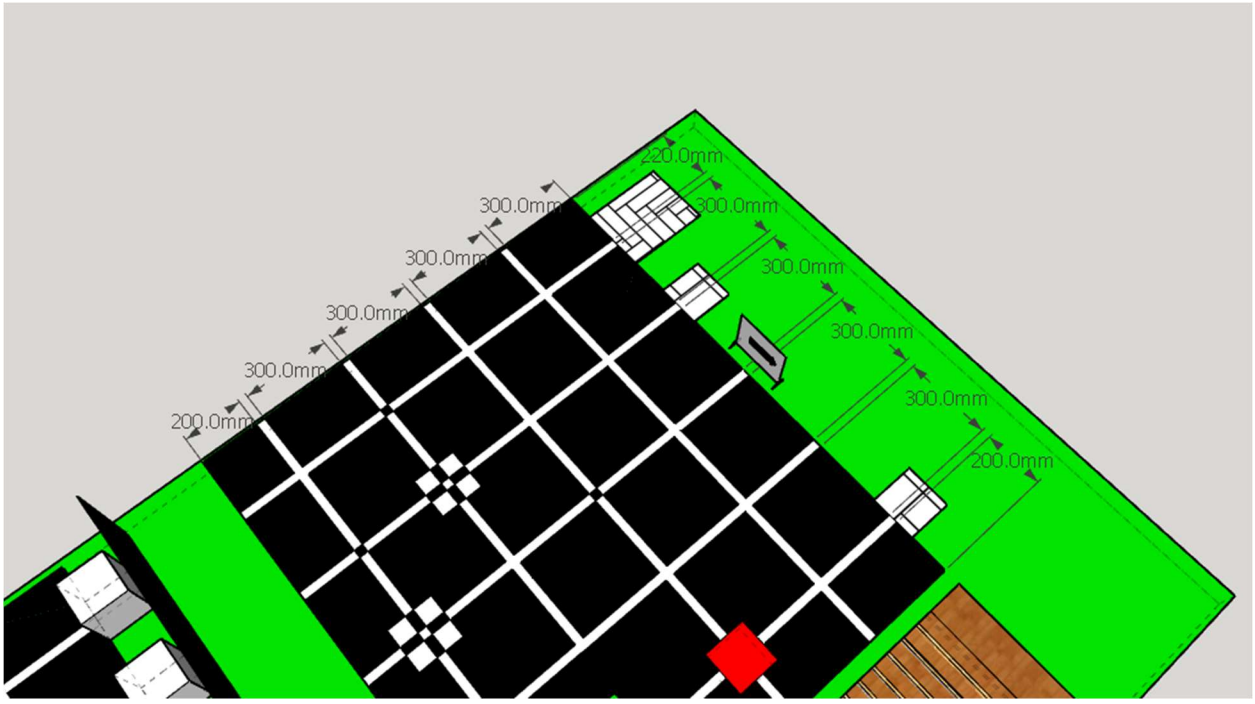
220.0mm
300.0mm
300.0mm
300.0mm
300.0mm
300.0mm
300.0mm
300.0mm
300.0mm
200.0mm
200.0mm

Fig. 3

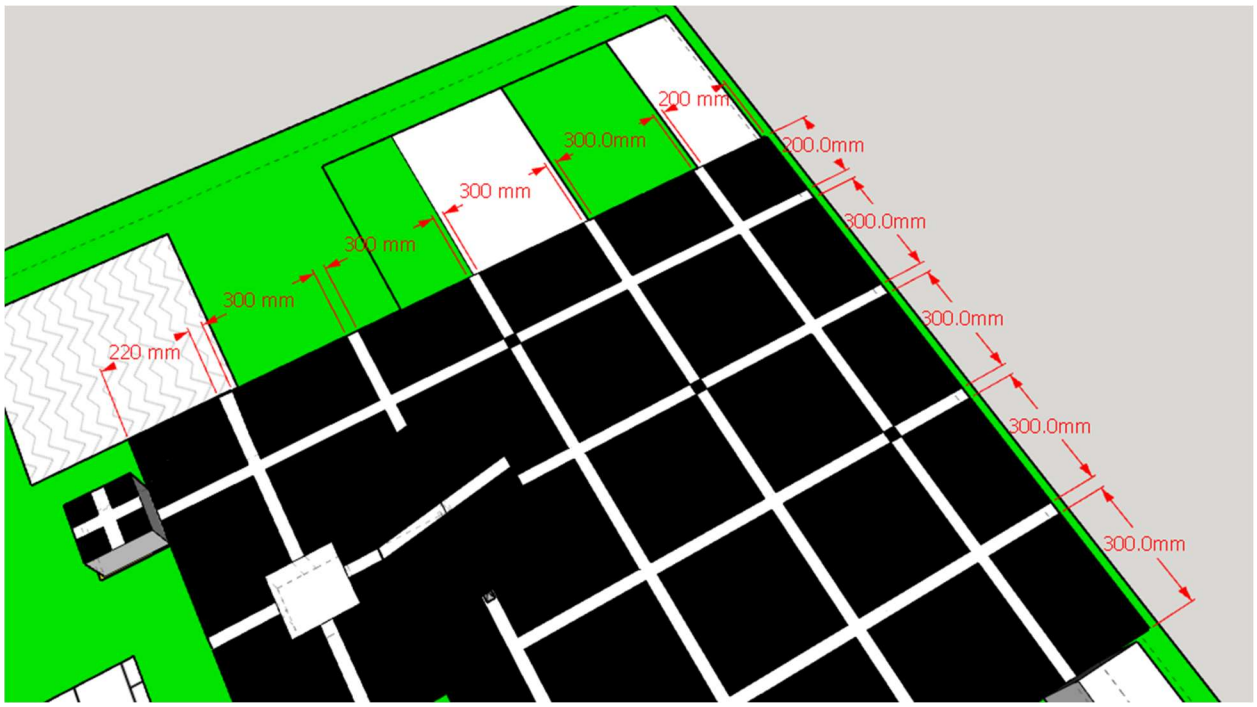
200 mm
300.0mm
300 mm
300 mm
300 mm
220 mm
200.0mm
300.0mm
300.0mm
300.0mm
300.0mm

Fig 4

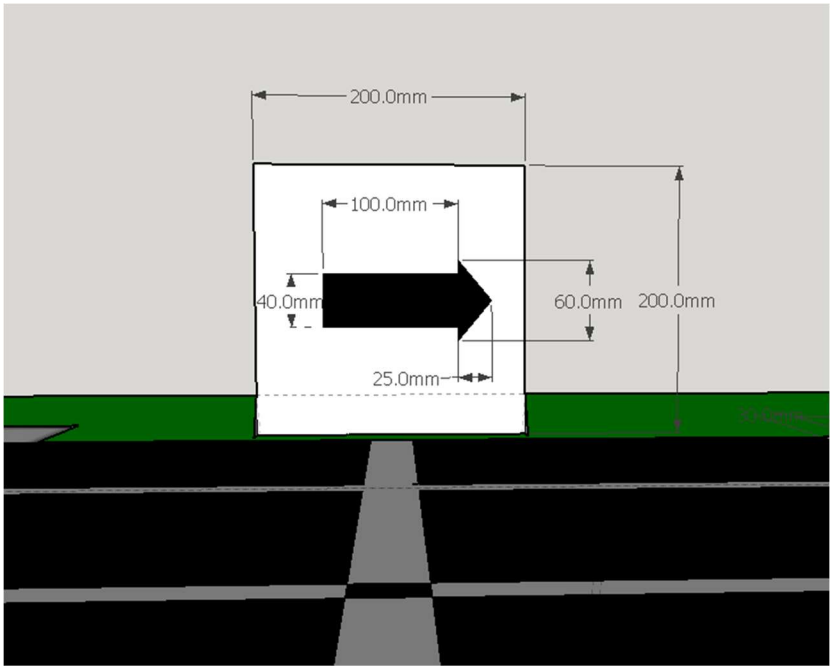
200.0mm
100.0mm
40.0mm
60.0mm
200.0mm
25.0mm

Fig 5

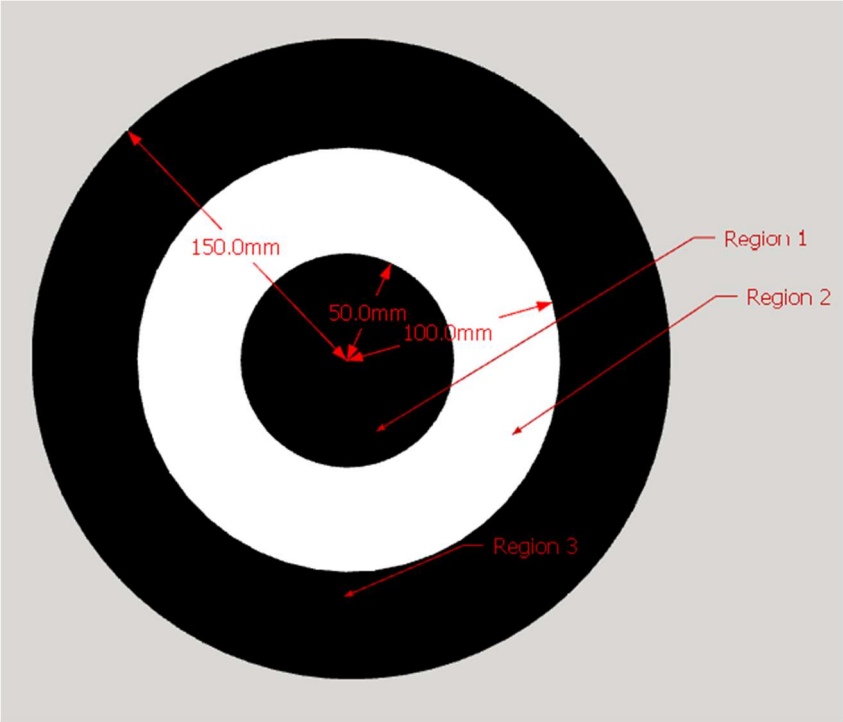
150.0mm
50.0mm
100.0mm
Region 1
Region 2
Region 3

Fig 6

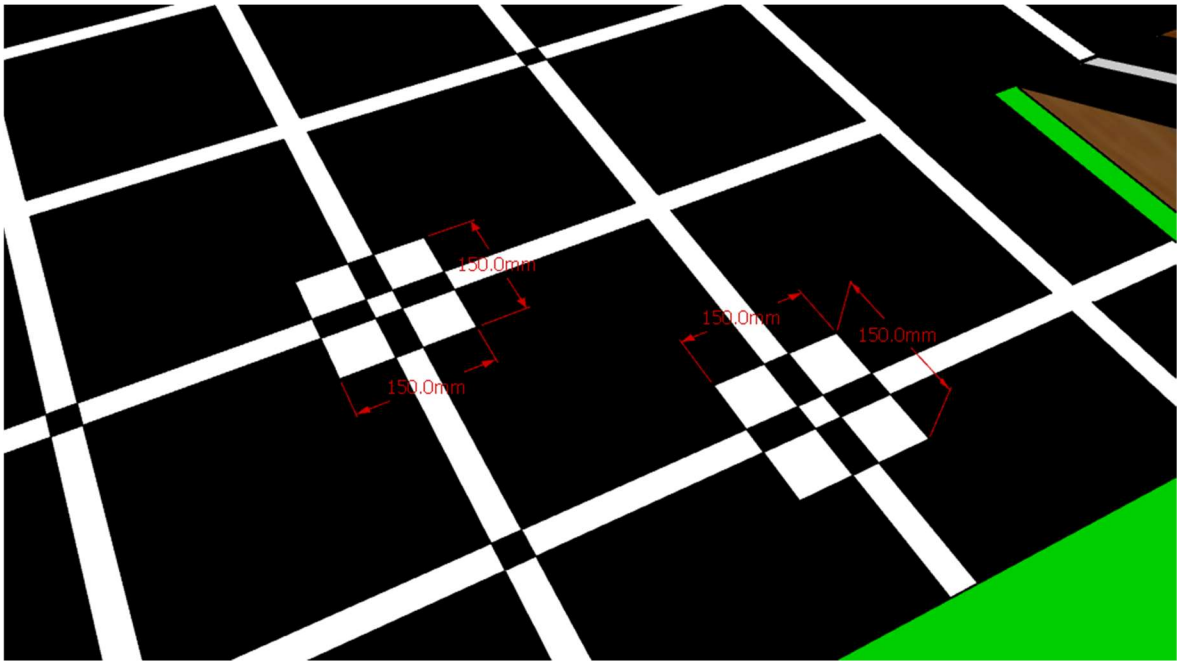
150.0mm
150.0mm
150.0mm
150.0mm

Fig. 7

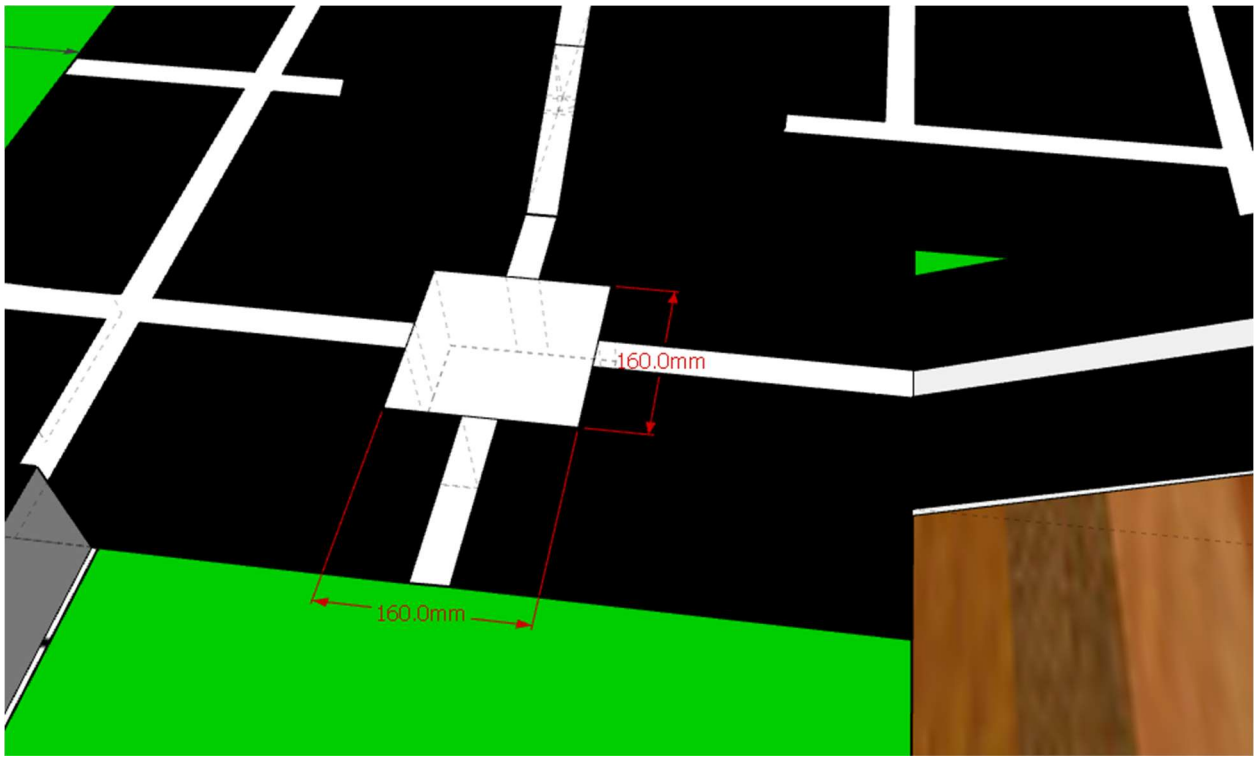

Fig. 8

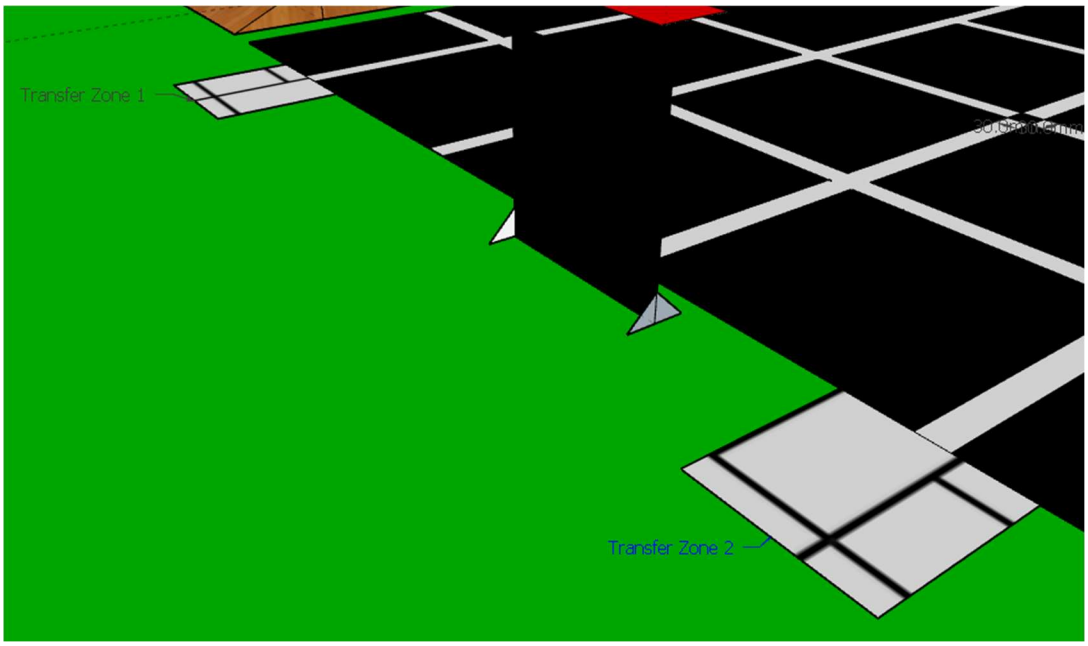

Fig 9

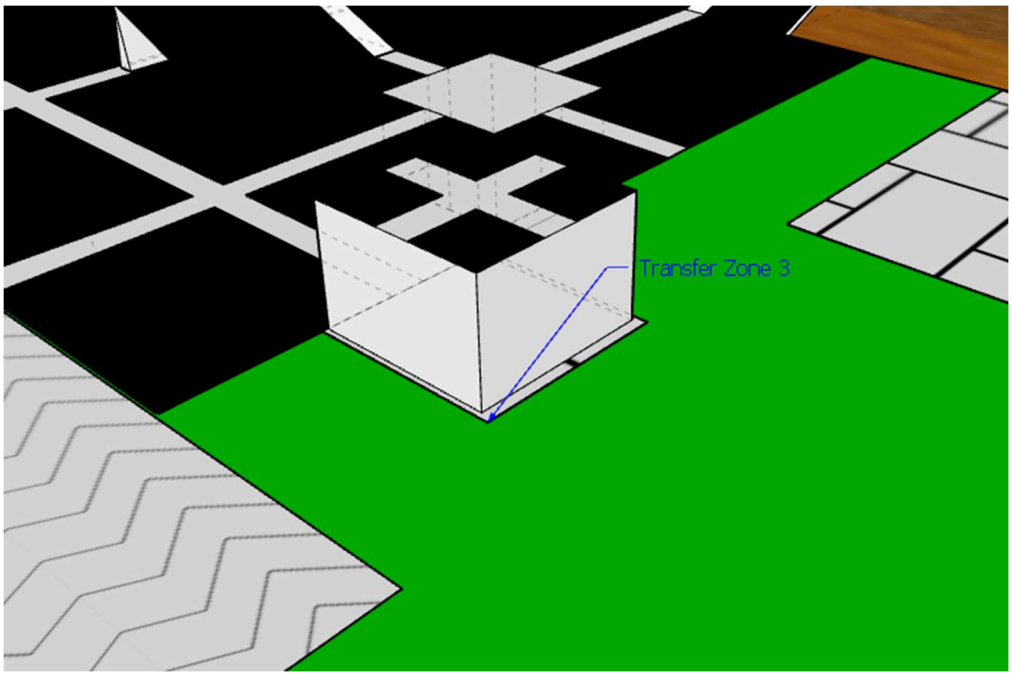

Fig 10

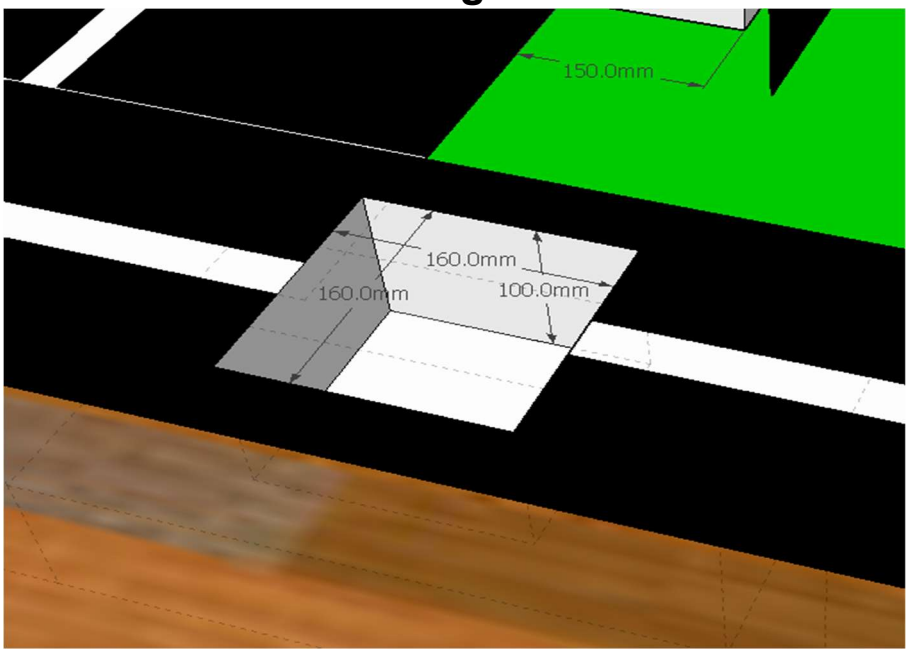

Fig 11

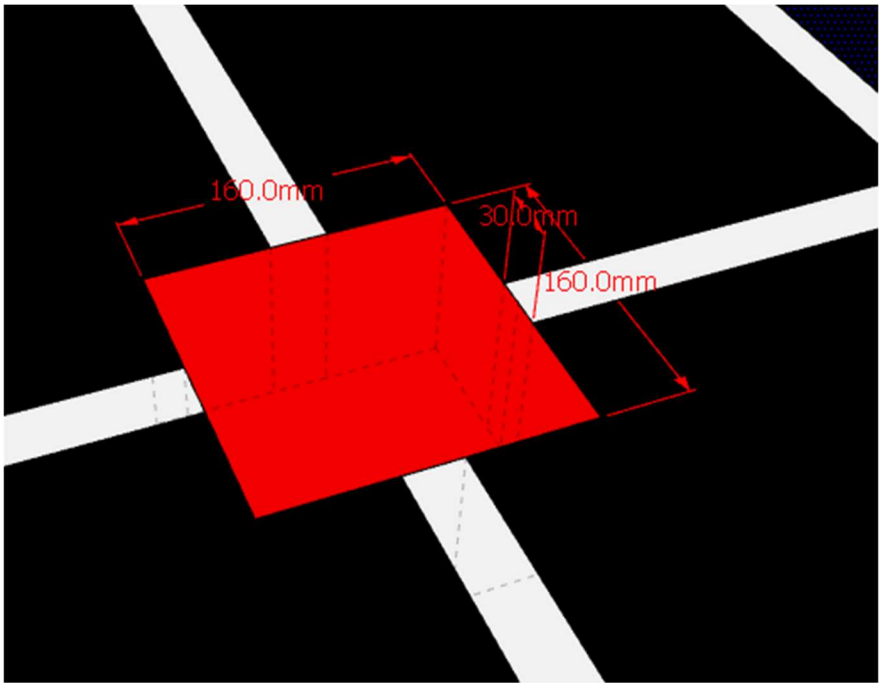

Fig 12

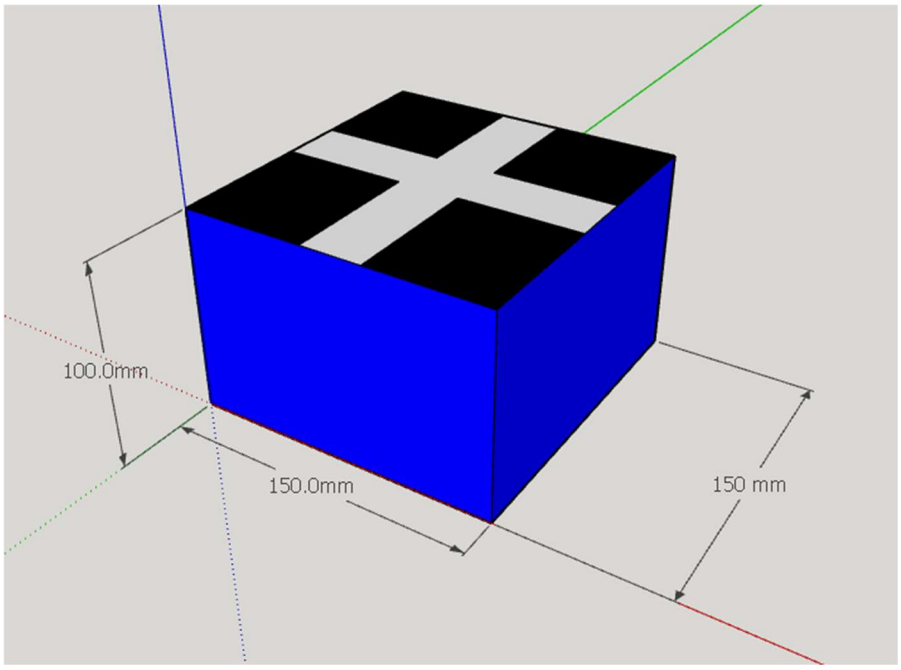

Fig 13

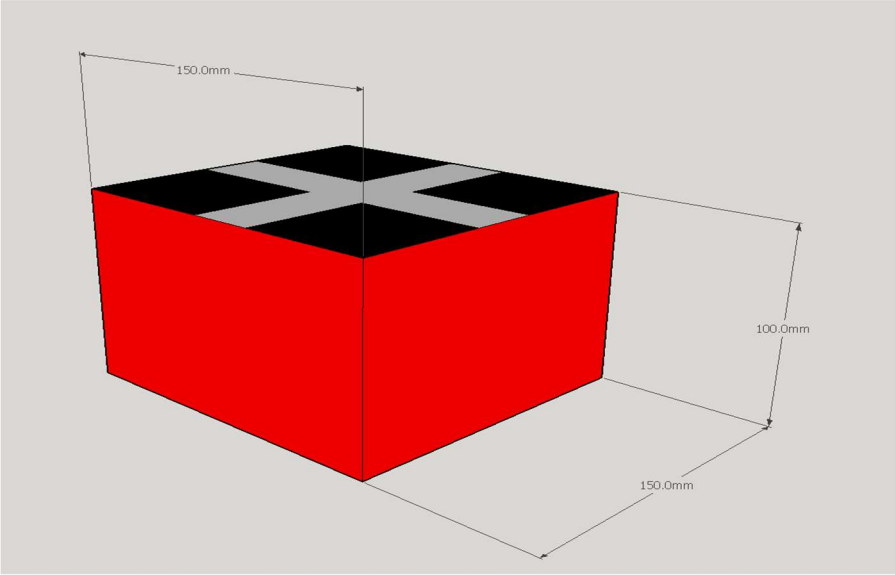

Fig 14

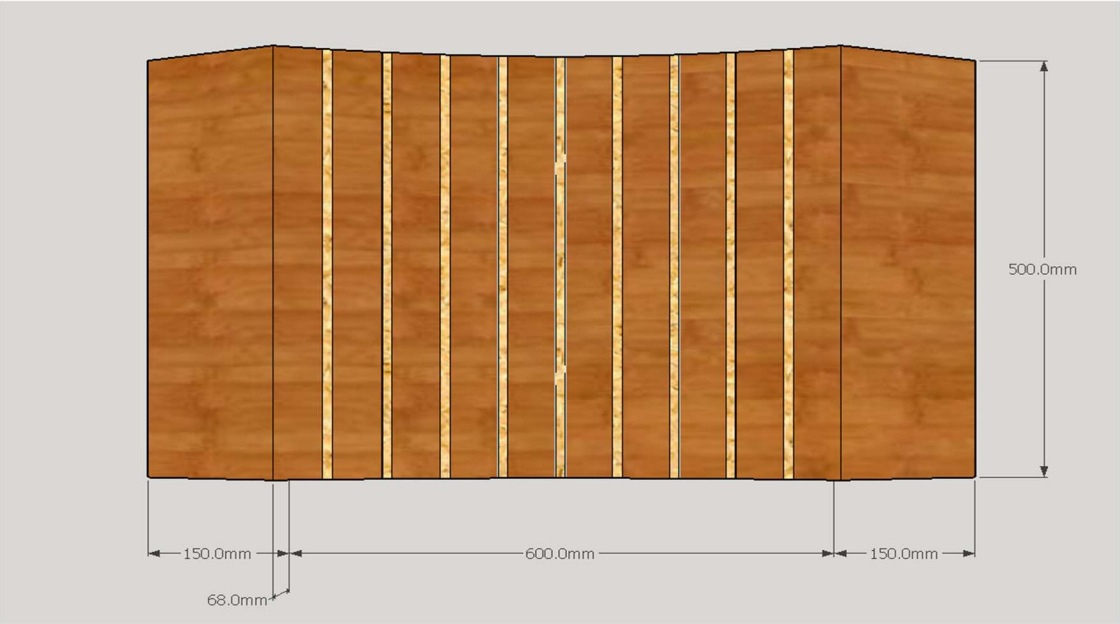

Fig 15

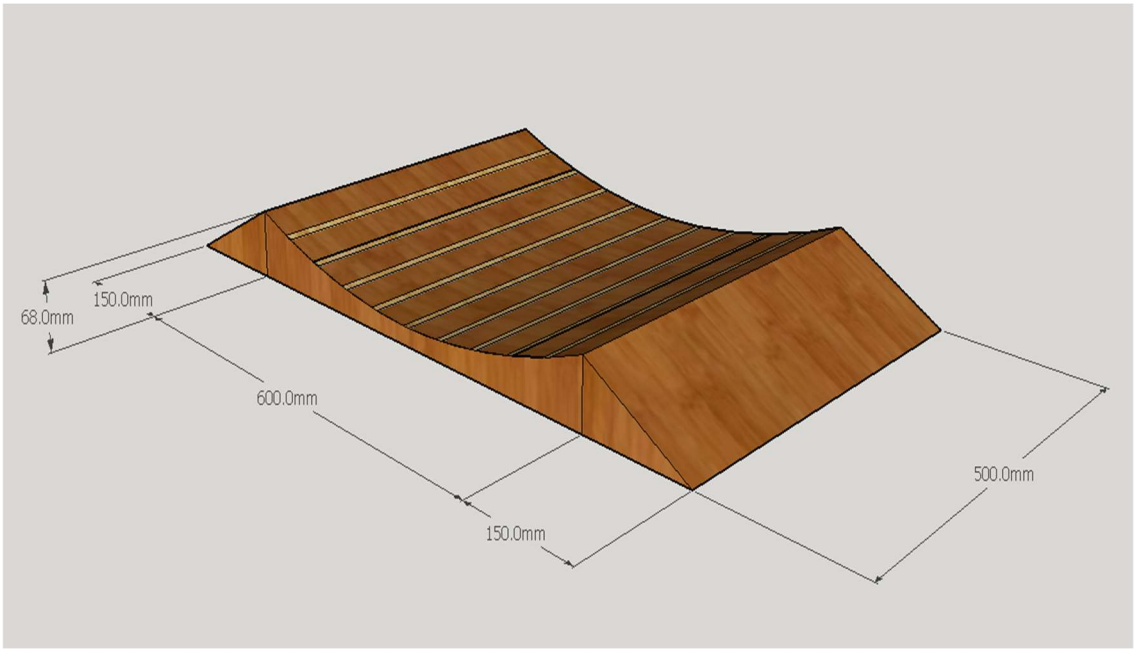
68.0mm
150.0mm
600.0mm
150.0mm
500.0mm

Fig 16

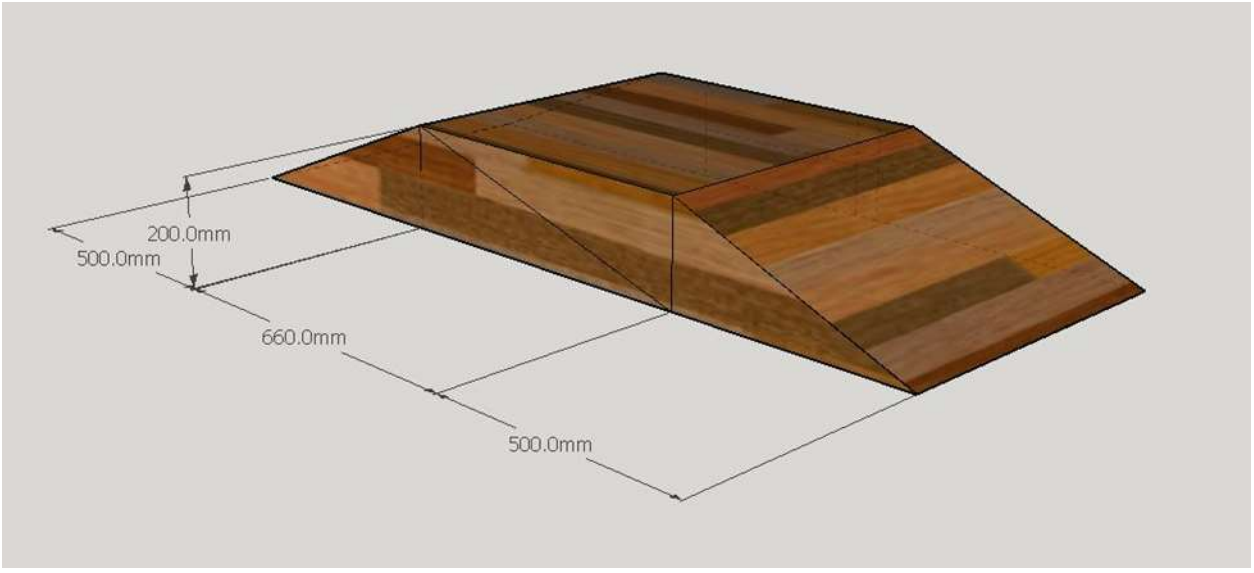
200.0mm
500.0mm
660.0mm
500.0mm

Fig. 17

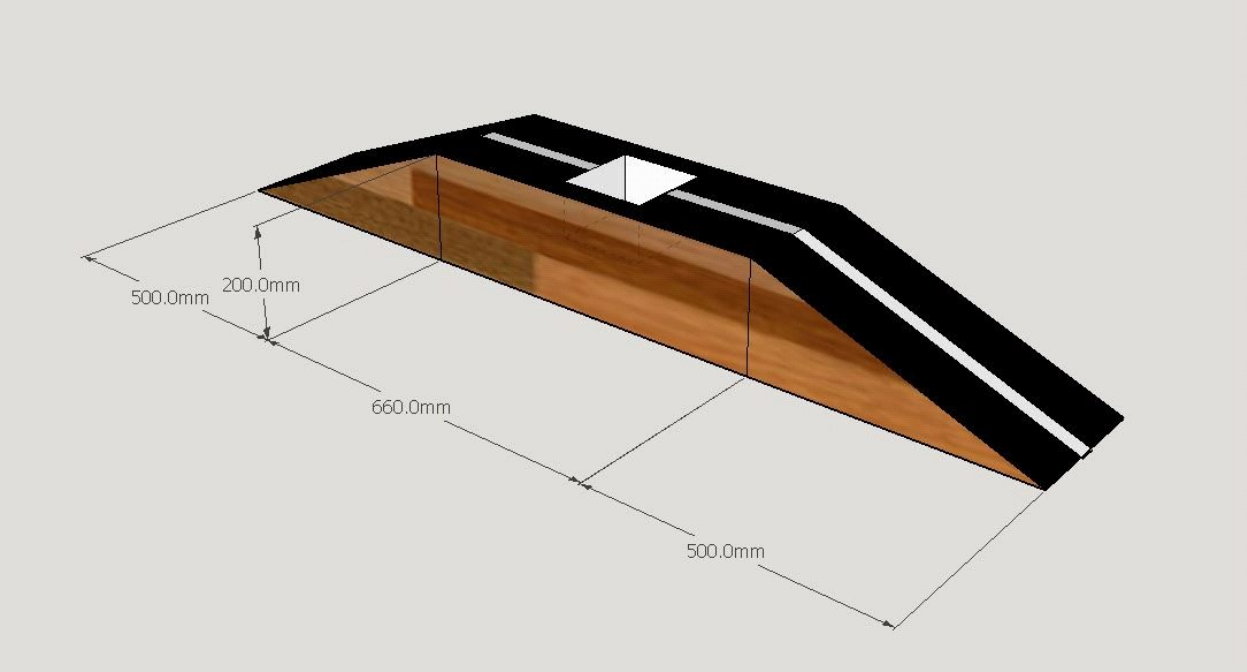

Fig. 18

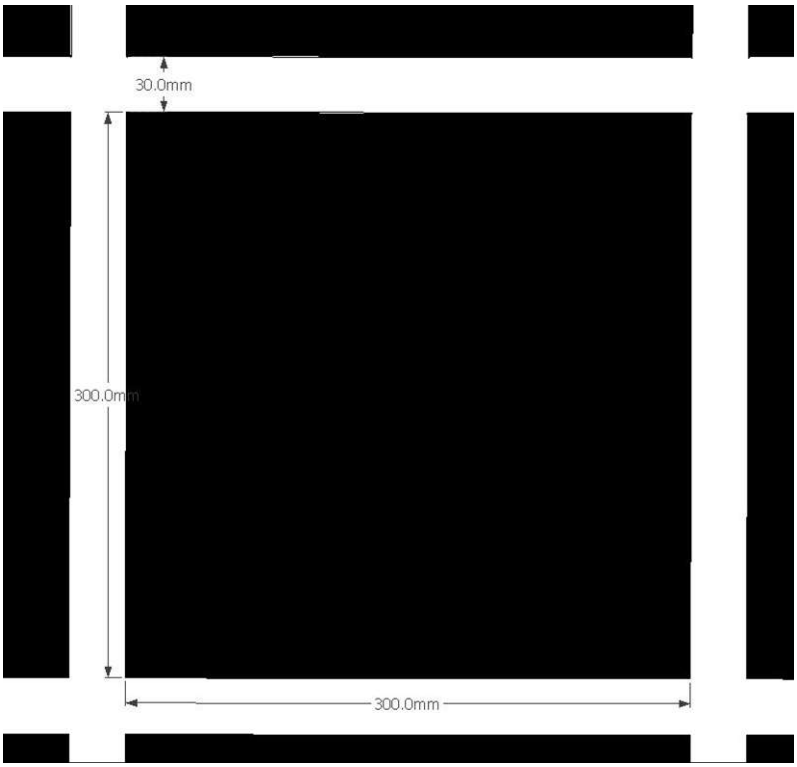

Fig. 19

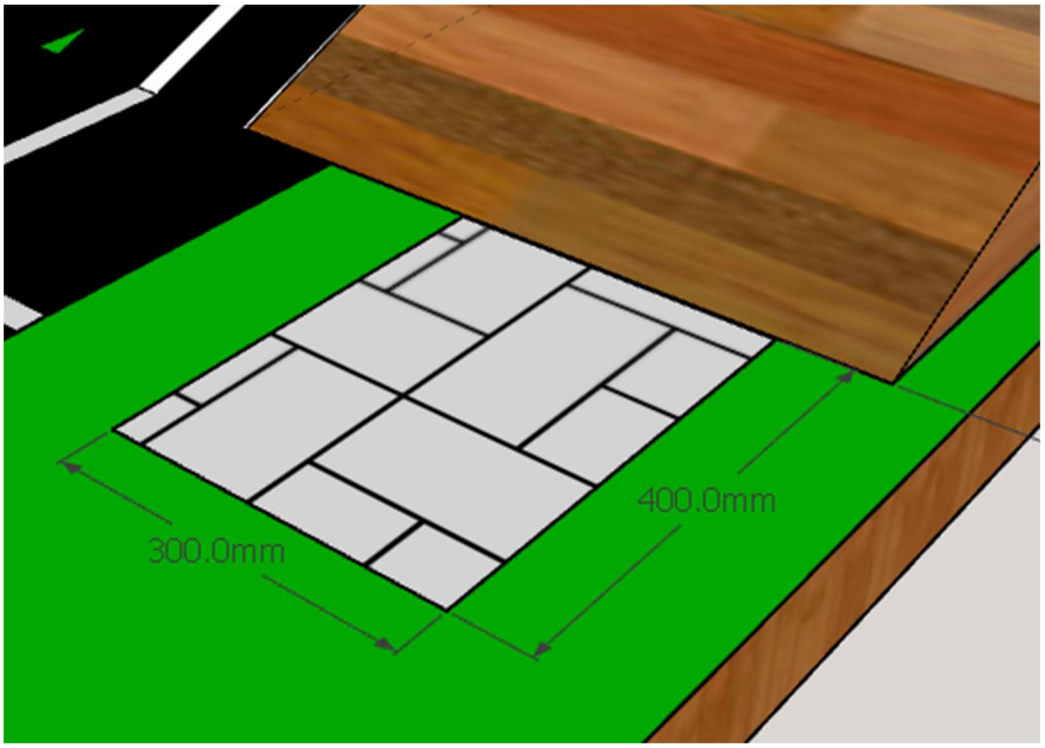

Fig. 20

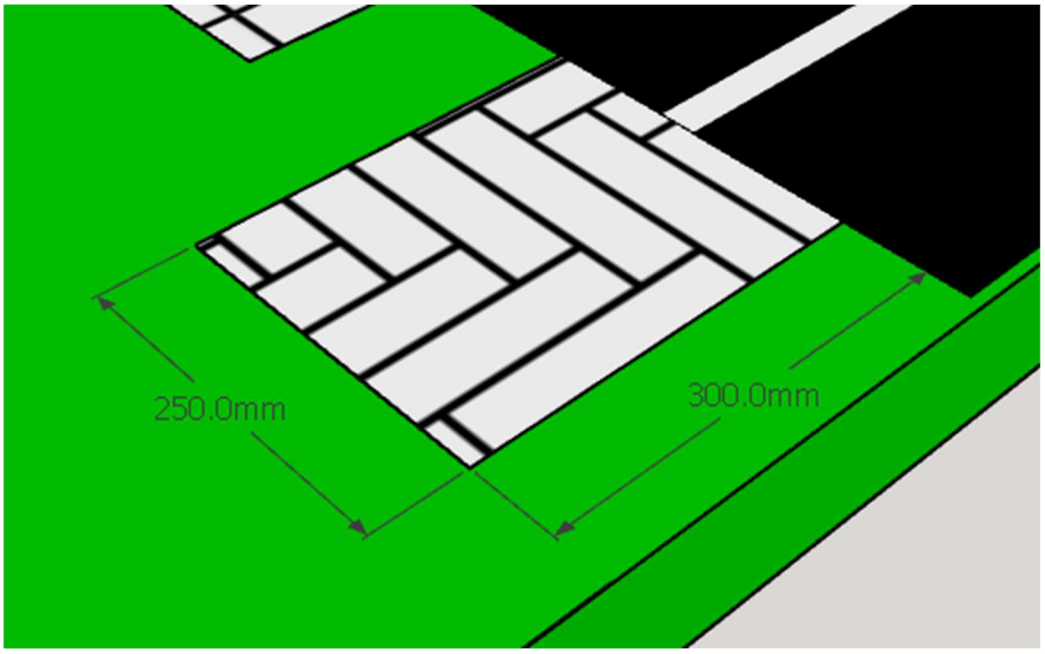

Fig. 21

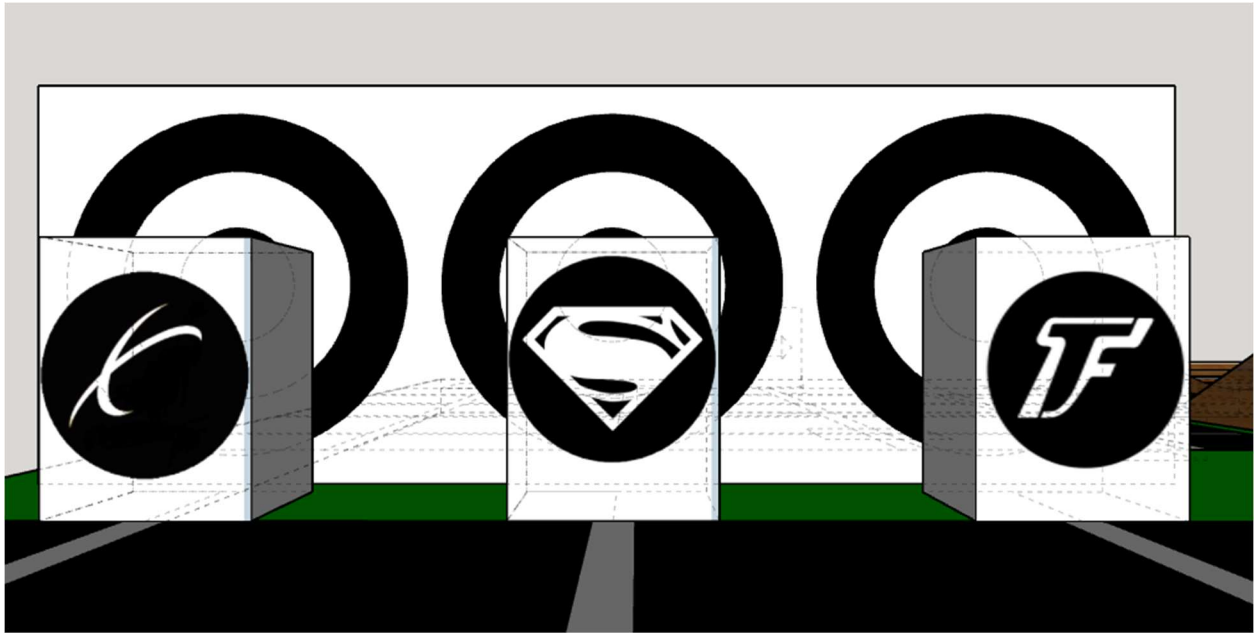

Fig. 22

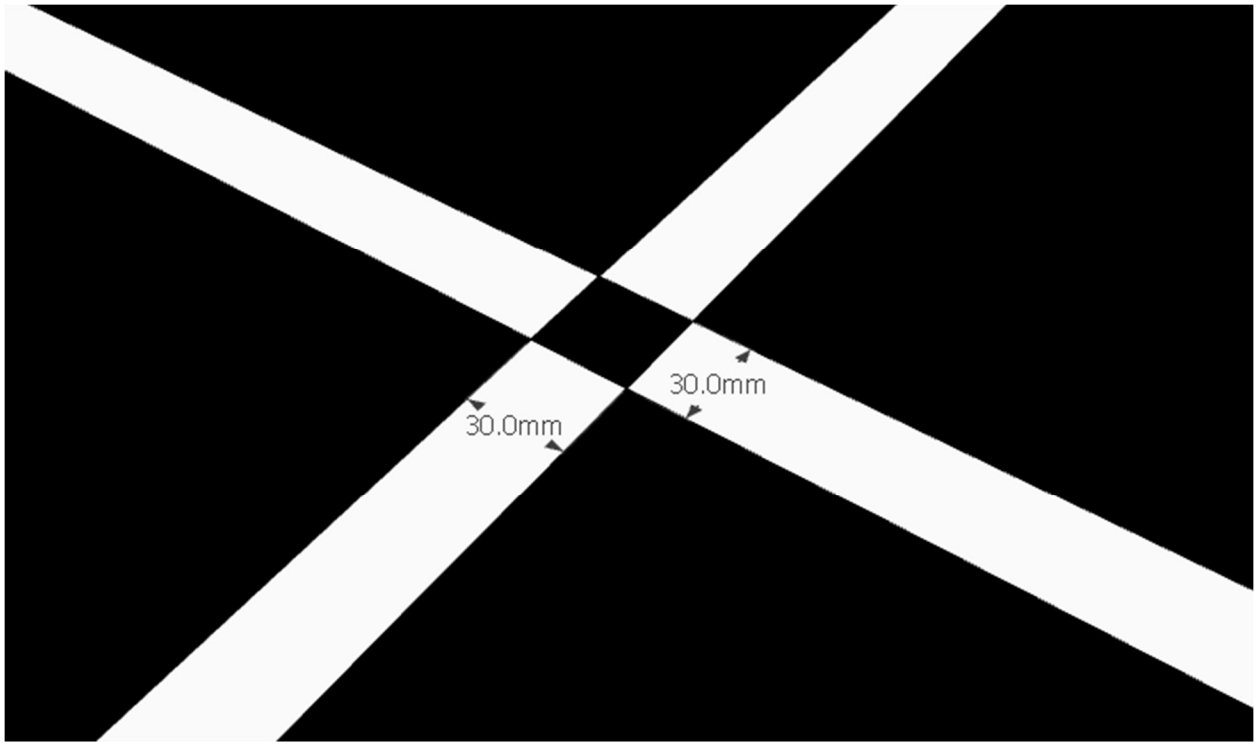

Fig. 23

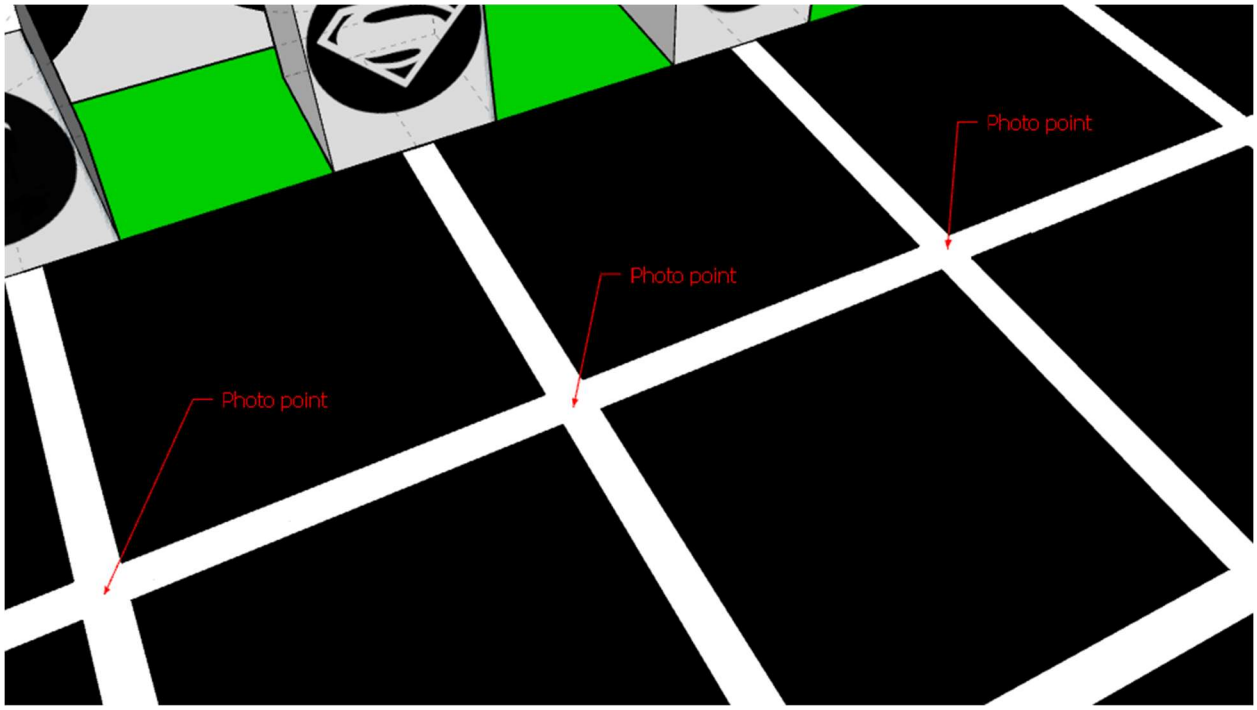
Photo point
Photo point
Photo point

Fig 24

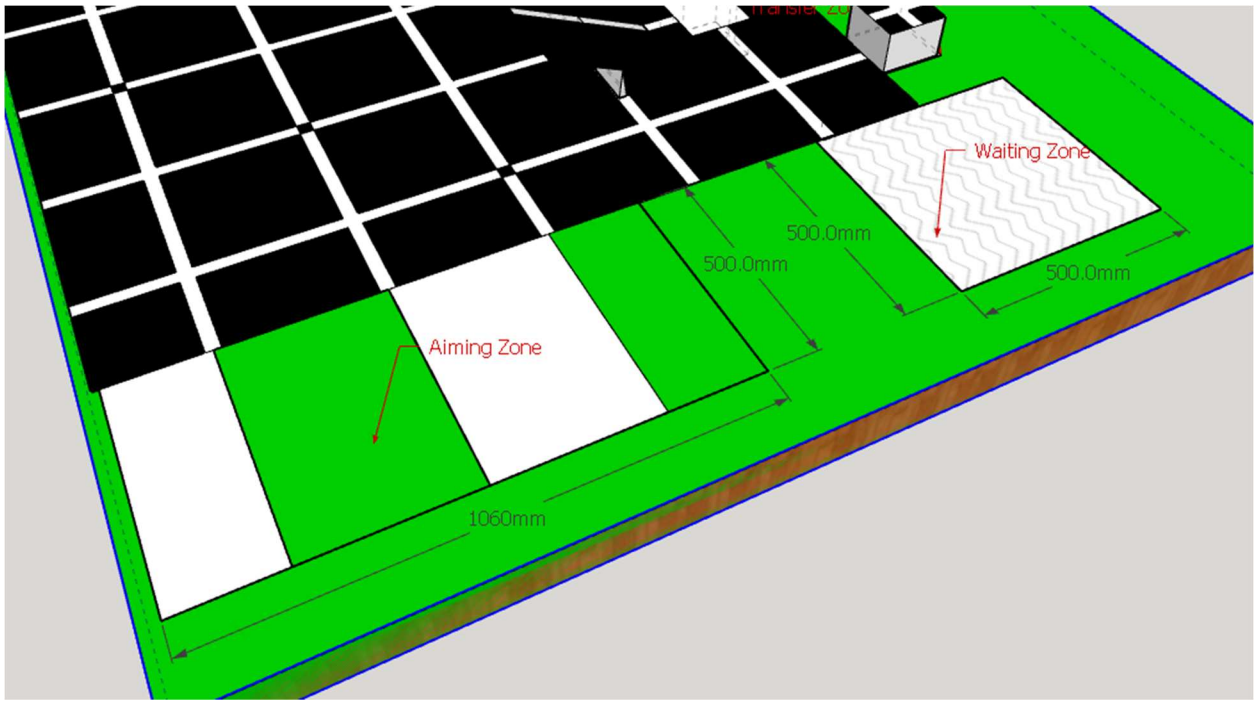
Waiting Zone
500.0mm
500.0mm
500.0mm
Aiming Zone
1060mm

Fig 25

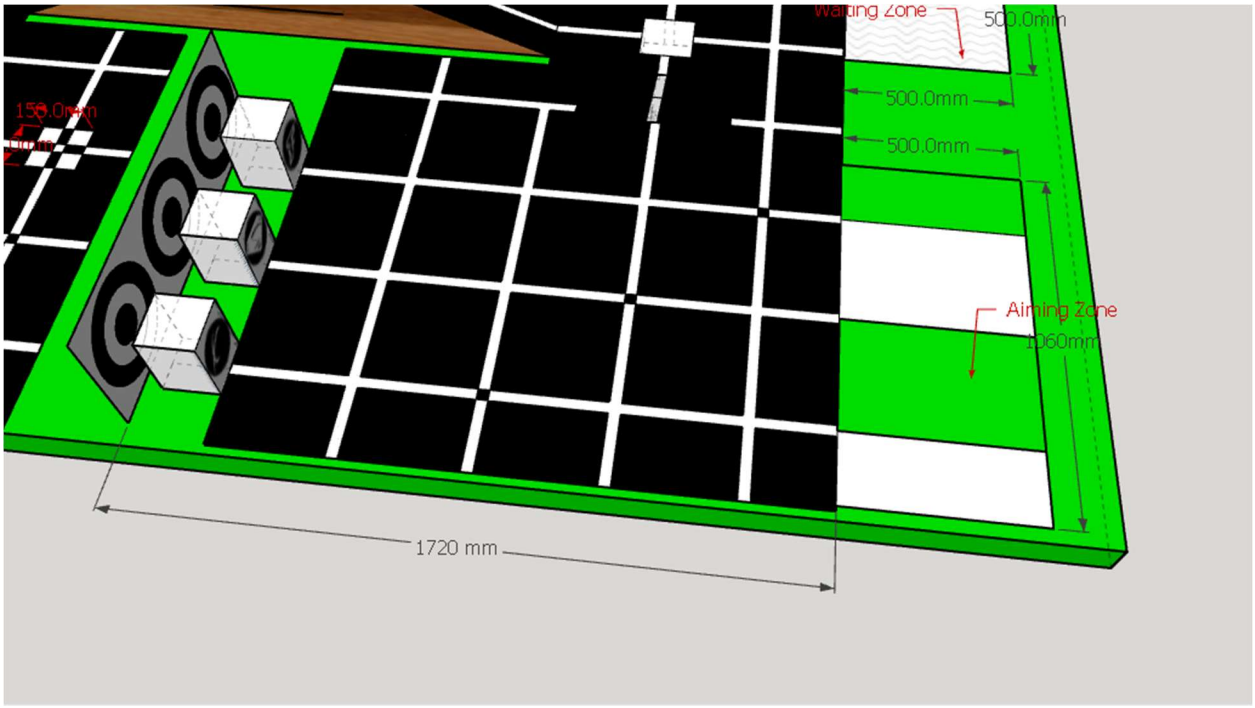
Waiting Zone
500.0mm
500.0mm
500.0mm
Aiming Zone
1060mm
1720 mm

Fig 26

Fig. 27

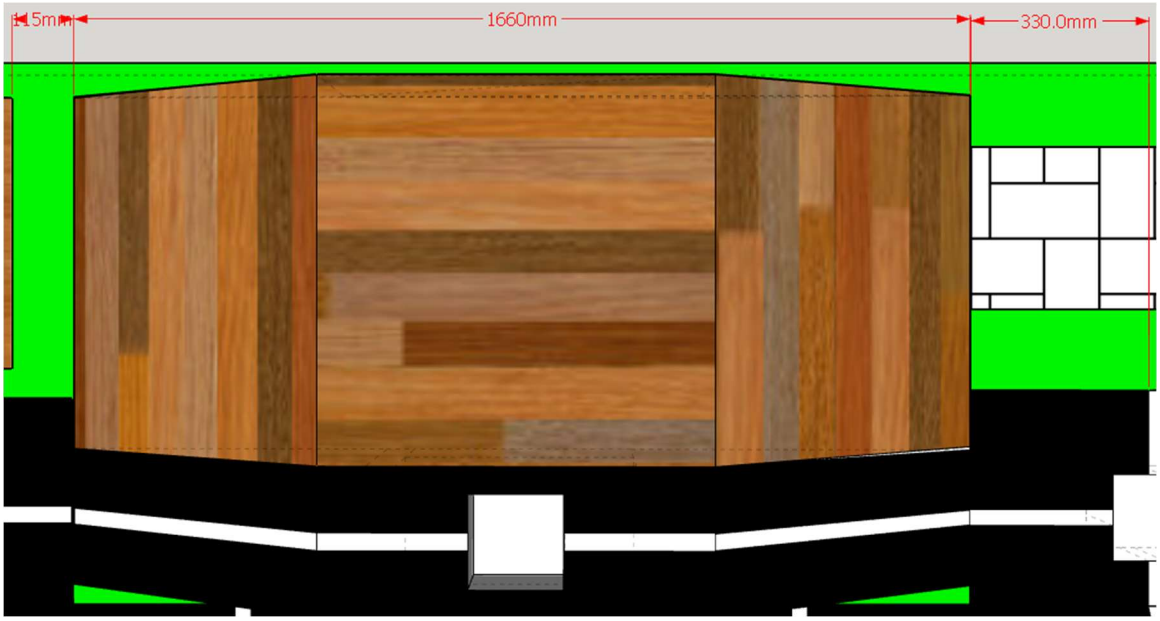

Fig 28

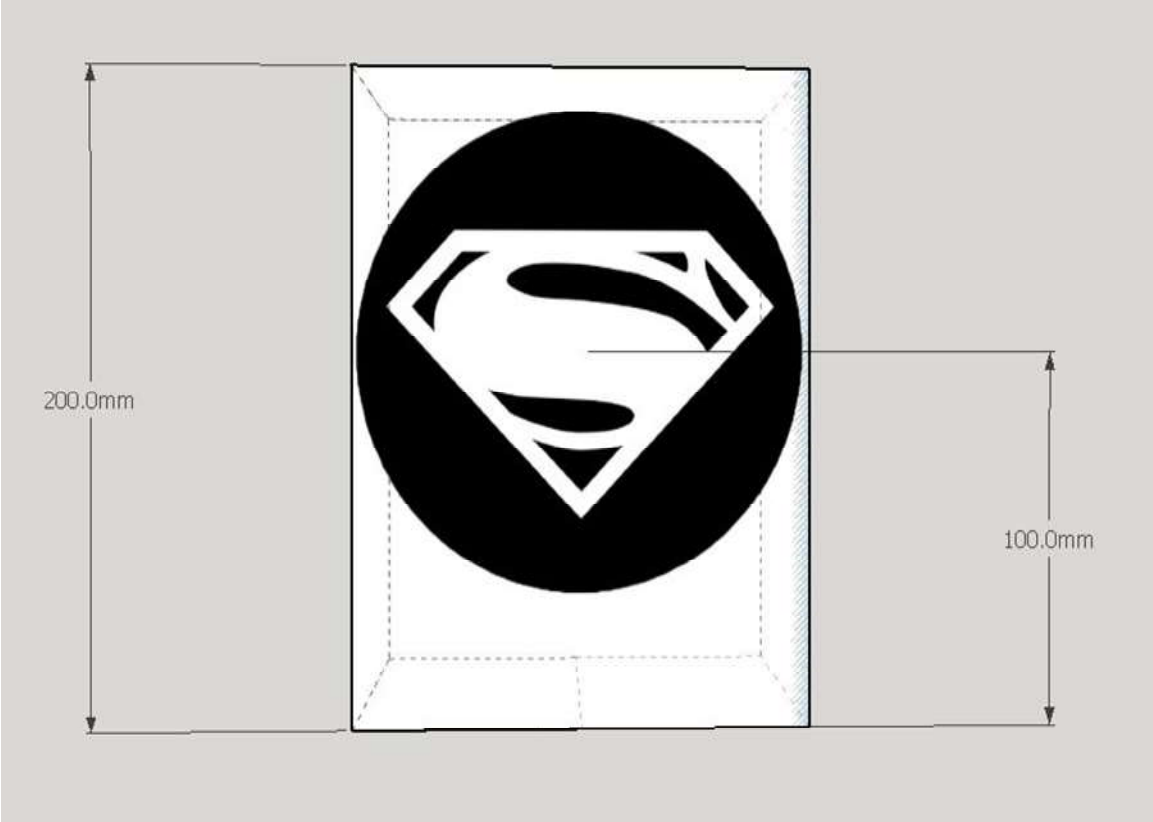

Fig 29

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.

7. To perform image processing, participants can use any controller and can interface with PC wirelessly, but participants won't be allowed to interact with PC or the bot

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 criterions 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 on-board 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 3 except wireless computer interface

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 incline. The manual bot will then encounter the curved bridge. If the bot fails to cross this, it will be allowed to skip the incline but with a penalty of 30 points, it will be allowed to cross the curved bridge but with a penalty of 30 points.

3. Meanwhile, The autonomous bot must start from the autonomous start zone. It has to solve the grid by following the white lines and avoiding the nodes, the blue block has to be deposited in the transfer zone towards which the arrow on the sign board points i.e. either transfer zone 1 or transfer zone 2 also, it has to look for red block and place it in red pit (fig 12) and thus cross the red pit.

order immaterial

4. The manual bot then will carry the blue block deposited in transfer zone 1 or 2 (fig 9) till the top of incline 2 (fig 17) by crossing curved bridge again. And deposit this block in pit 2 (fig 11)

5.The autonomous bot will then climb the incline, cross the pit 2 in which block is placed by the manual bot and get down the incline.

6.Manual bot then will place then block present in transfer zone 3 to pit 3 (fig 10).

7.Autonomous bot will decide whether to cross the Seesaw or not for bonus points or go over the pit 3 in which block 3 is placed by the manual bot. Then, after solving the grid following white lines from photo points it will check image on which Lego of 4,5 & 6 is same as the image in figure 27 and place that block in transfer zone 3.

8.Meanwhile, the manual bot will be in waiting zone until the autonomous bot picks up any of Lego 4,5 or 6. Then it will move to the aiming zone corresponding to the block picked and throw a magnetic dart at the corresponding target. (Note: The specifications of the dart is up to participants.)

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. They will be allowed to make changes in their code under any circumstances.

1. The maximum time given for completing the task is 7 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 2 block). The bot should give a visual/audio signal at the end of the dry run. Both

the blocks will be manually placed in deposit zone 1 & deposit zone 2 respectively 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 7 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. However, 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 or more)

Checkpoints:

Autonomous bot checkpoints:

- 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.
- Second Checkpoint: If the autonomous bot has placed any of the blue or red block in transfer zone. It will take a restart at grid intersection just in front of the correct deposit zone.
- Third Checkpoint: If the autonomous bot has put the other block in pit 1. It will be placed on the non-empty red pit if it takes any restarts.
- Fourth Checkpoint: If the autonomous had descended from the incline.
- Fifth Checkpoint: If the autonomous bot successfully crosses the Seesaw, it will be placed just after the See Saw if it takes any restarts.

Manual Bot Checkpoints:

- Checkpoint 1: When the manual bot has crossed the incline and curved bridge.
- Checkpoint 2: When the manual bot has crossed the curved bridge when carrying the blue block.
- Checkpoint 3: When the manual bot has placed the blue block in pit 2.
- Checkpoint 4: When the manual bot has placed the block 3 in pit 3.

Judging:

1. Teams will be awarded 120 points for successfully identifying the blue block and successfully placing it in the transfer zone which the arrow on signboard points to.

2. Teams will be awarded 50 points for autonomous bot successfully depositing the red block in pit 1.

3. Teams will be awarded 40 points if the autonomous bot successfully crosses the incline (Note: Points will be given only after the autonomous bot gets down from the incline).

4. Teams will be awarded 60 points if the autonomous bot will successfully transfer the block with correct image to transfer zone 3.

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

6. Teams will be awarded 30 points if the manual bot successfully crosses the incline (Note: Points will be given only after the manual bot gets down from the incline) and 30 points if the manual bot successfully crosses the curved bridge (Note: Points will be given only after the manual bot gets down from the curved bridge). (PS: Starting from manual zone and returning back by crossing the incline and curved bridge manual bot can be awarded maximum 120 points)

7. Team will be awarded 20 points if the manual bot transfers the block 3 to pit 3.

8.Team will be awarded 50 points if the magnetic dart from manual bot hits and sticks the region 1 on target, 35 points if the magnetic dart from manual bot hits and sticks the region 2 on target and 20 points if the magnetic dart from manual bot hits and sticks the region 1 on target (Note: If the dart hits the boundary points corresponding to inner region will be considered)

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 depositing the blue block in the deposit zone 2 and depositing the block 3 in the deposit zone 3.

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= _- 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 _ 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.