INTERNATIONAL ROBOTICS CHALLENGE (IRC)

Task:

1. Teams have to make two robots, a manual bot and an autonomous bot, which should coordinate with each other to complete the given task.

2. Autonomous bot has to solve the maze by following walls of the maze. Bot also needs to identify positions of different blocks, scan QR code and help manual bot for its further tasks.

3. Manual bot has to clear the way of autonomous bot by transferring blocks into specified zones. The bot further needs to tackle with other obstacles and shoot a magnetic dart on the target.

4. A maximum of 8 minutes will be alloted to each participating team.

Game Field:

1. The game field consists of an arena having dimensions 4070 mm X 3626 mm.

2. It contains a **manual bot zone, manual start zone, autonomous zone, autonomous start zone, inclines, blocks, blocks with QR code, a tray with balls, hurdles, trapezium with a cuboidal hollow part(pit), a Seesaw, deposit zones** and **target.**

3. **Manual Zone:** Only the manual bot can maneuver in this zone. (It is indicated by green color in the arena, fig.1)

4. **Autonomous Zone:** Only the autonomous bot can maneuver in this zone. (Maze in the arena indicates it, fig.1)

5. **Manual Start Zone:** A manual bot must start the game from this zone with dimensions 400mm x 300mm. (fig.13)

6. **Autonomous Start Zone:** The autonomous bot must start the game from this zone(fig.5)

7. **Maze:** This zone consists of white walls on a black surface. Two parallel walls are separated by 300mm as shown in fig.8. Entire maze is covered by a wall from outside. The walls of the maze are 10 cm high and 1.5 cm thick (with 5% tolerance).

8. **Deposit Zone:** There are 5 deposit zones D1, D2, D3, D4, D5.
D1, D2, D3 consists of a square portion to deposit block at height of 20 cm as shown in fig.9
D4 (fig. 15) consists of a cuboidal frame with 4 sections where manual bot will put block 1 or block 2 as per number given by autonomous bot after scanning the QR code of block 3.
D5 consists of a pit with dimensions 230mm x 230mm x 100mm (l x b x d) as shown in fig.14 .

9. **Hurdles:** There are 4 cuboidal hurdles in a manual zone with dimensions 300mm x 10mm x 15mm (l x b x h) as shown in fig.10.

10.**Tray with balls:** Its dimensions are given in fig.12. The diameter of balls will range from 10.0mm to 25.0mm.

11. **Blocks:** There are 2 types of blocks
Coloured block: It has dimensions of 220mm x 220mm x 100mm(l x b x h) as shown in fig.4.
Block with QR code: It has dimensions of 220mm x 220mm x 220mm(l x b x h) as shown in fig.7.

12. **Seesaw:** There will be a seesaw in the manual zone with dimensions as shown in fig.16.

13. **Throw Line:** Manual bot has to throw a **magnetic dart** from behind the ‘’Throw Line’ on the target which is 1500mm from the plane of the target as shown in fig.17.

14. **Target:** It consists of a 240mm x 240mm square target (fig. 17) which is divided into 4 sections. The manual bot has to throw a magnetic dart to target (1,2,3 or 4) corresponding to the number given by autonomous bot after QR scanning of block 4.

NOTE: This is a sample arena. A position of blocks, walls, and other elements may be different in actual arena of competition but actual dimension and numbers of elements will remain the same as mentioned above.

Figures:

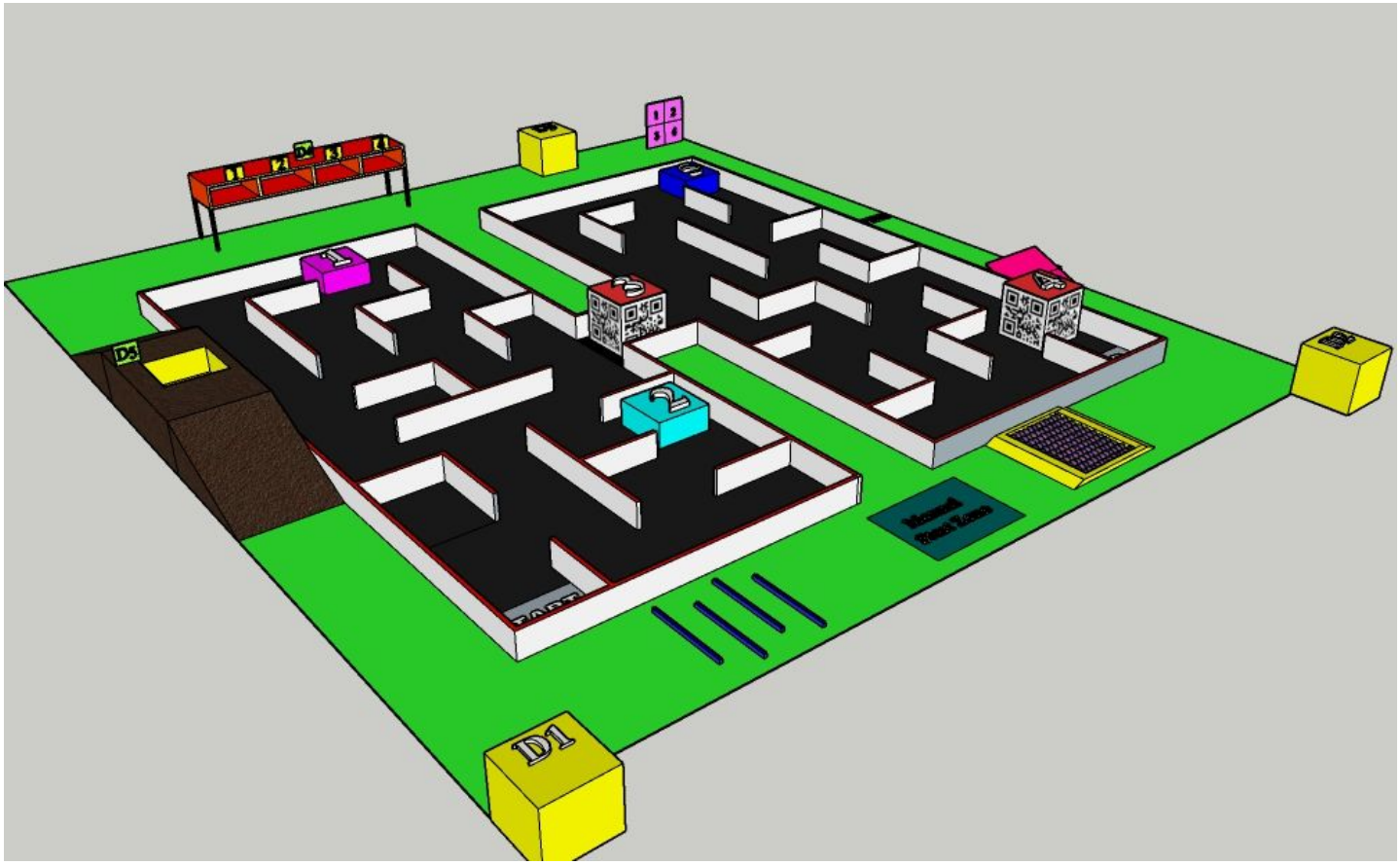

Fig. 1

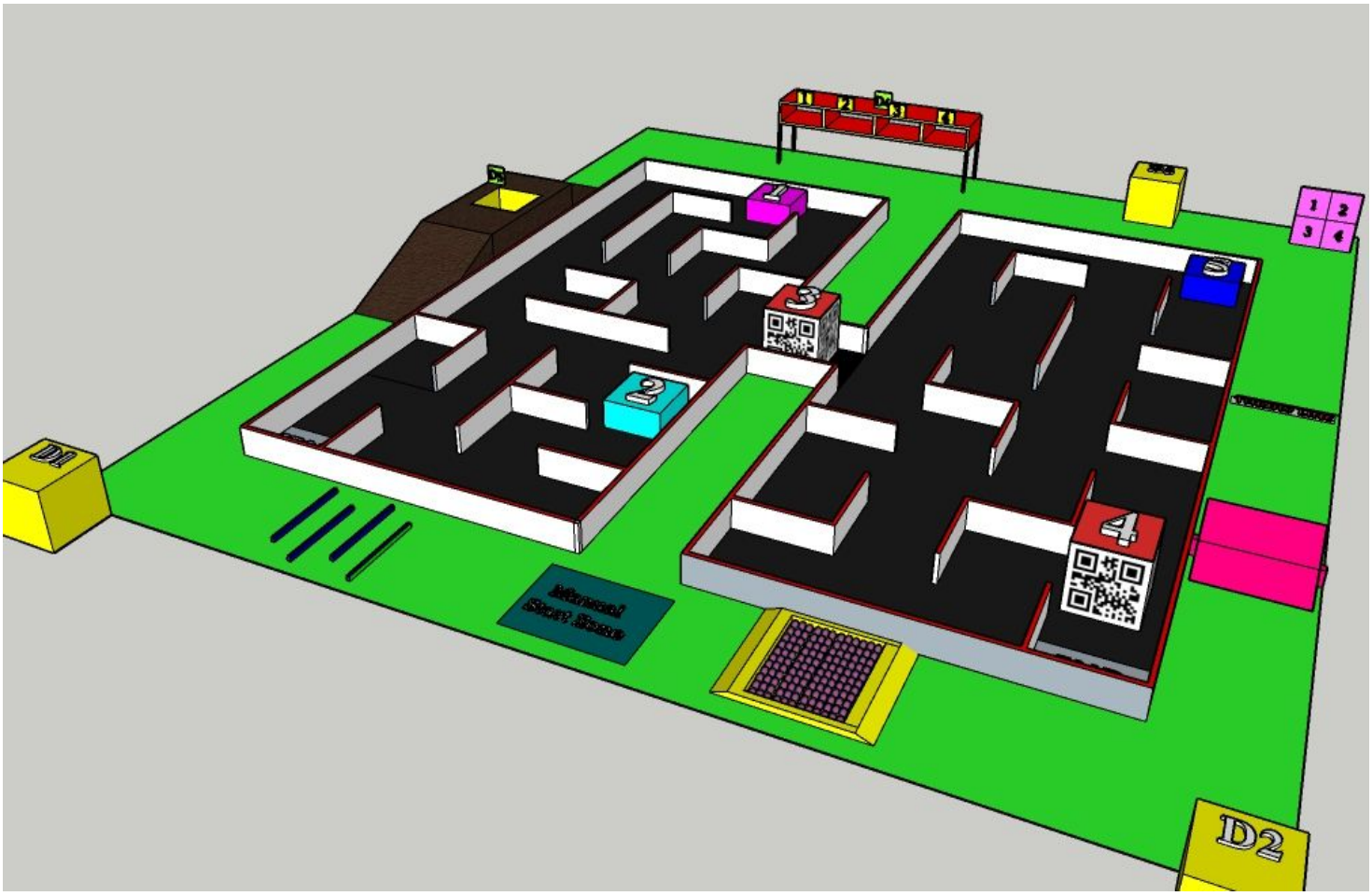

Fig.2

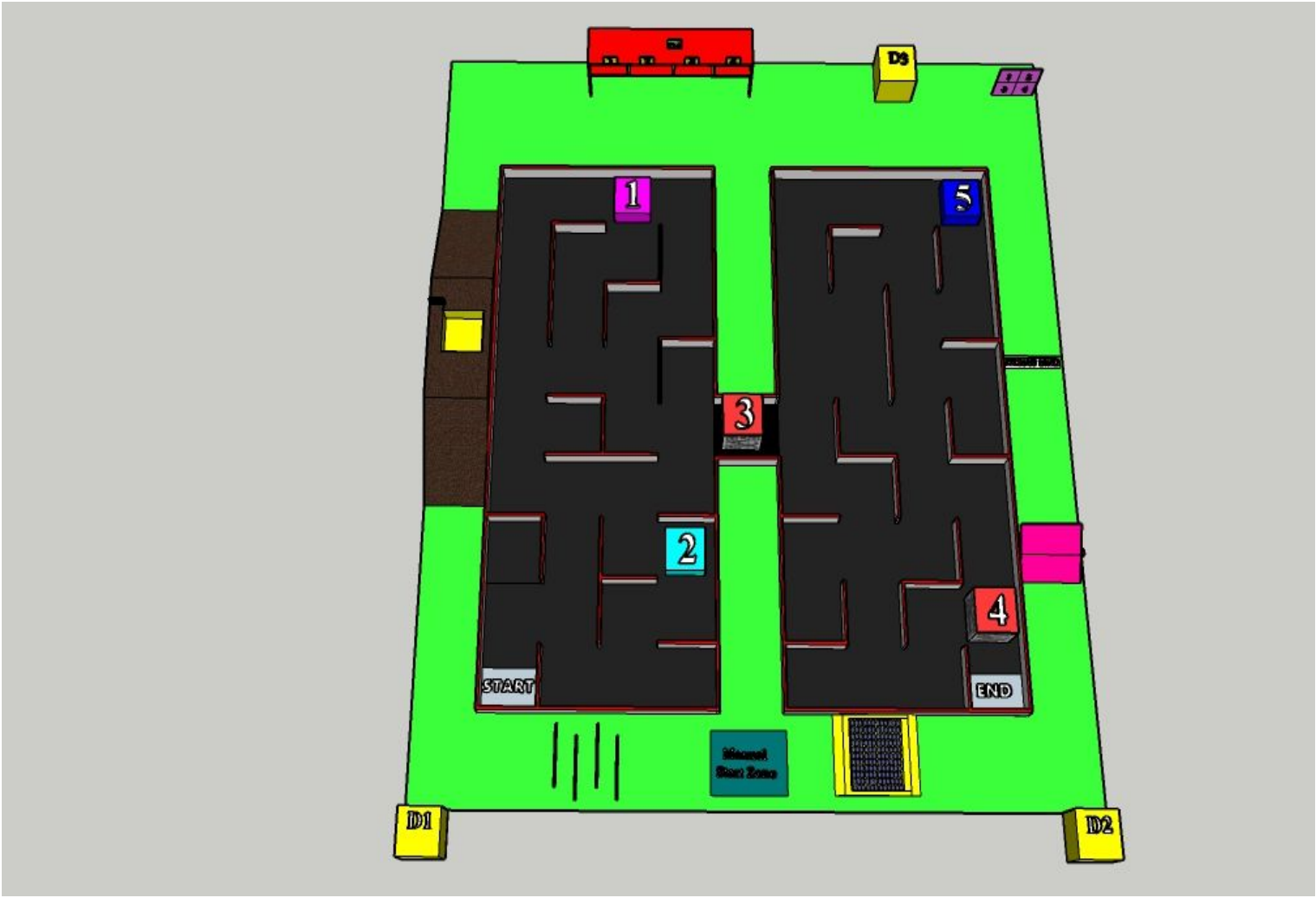

Fig. 3

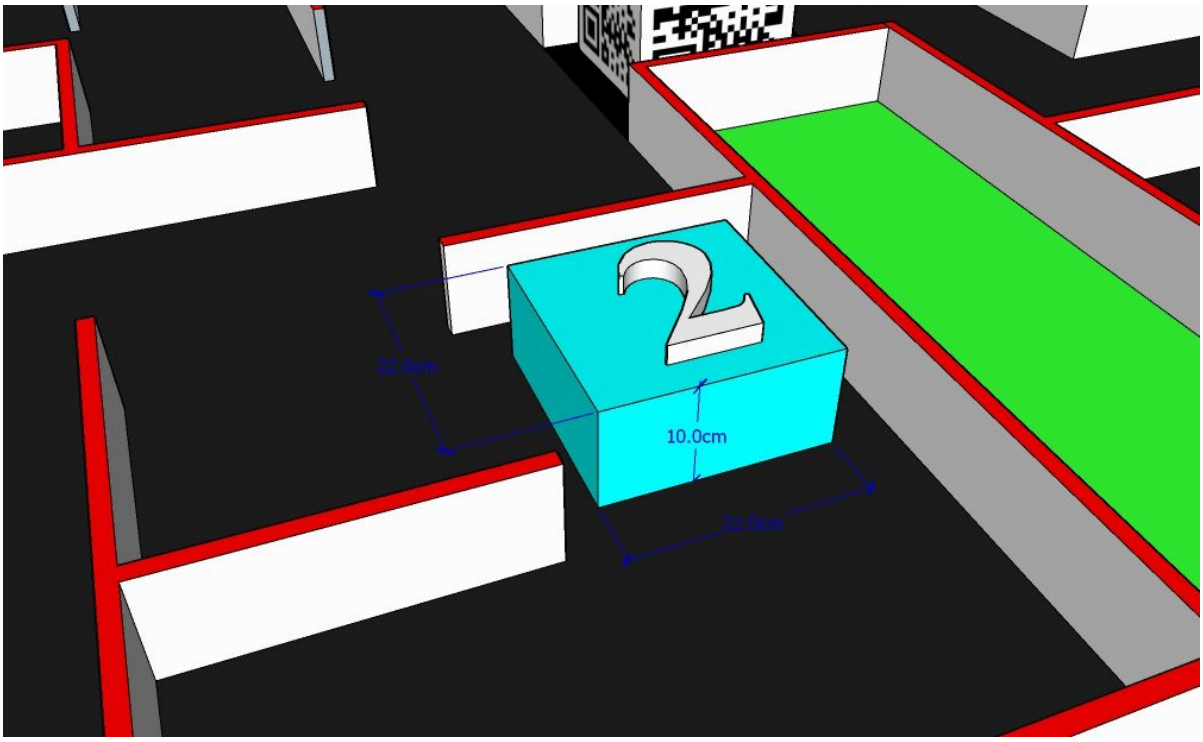

Fig.4

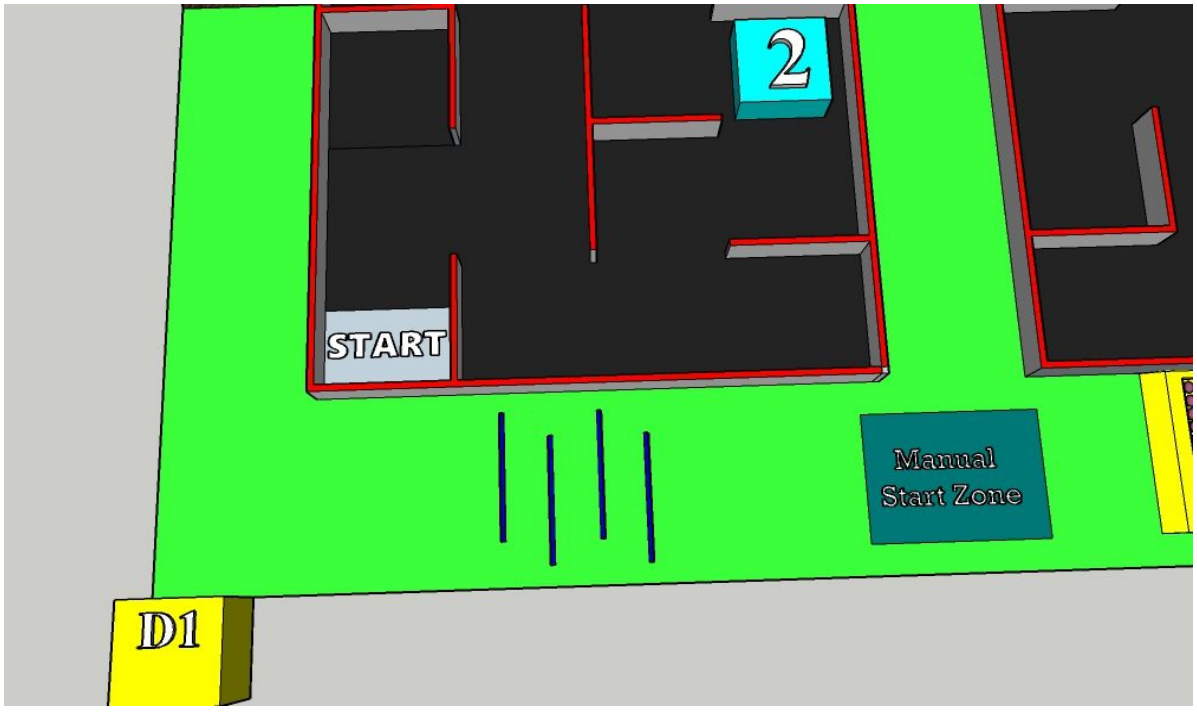

Fig. 5

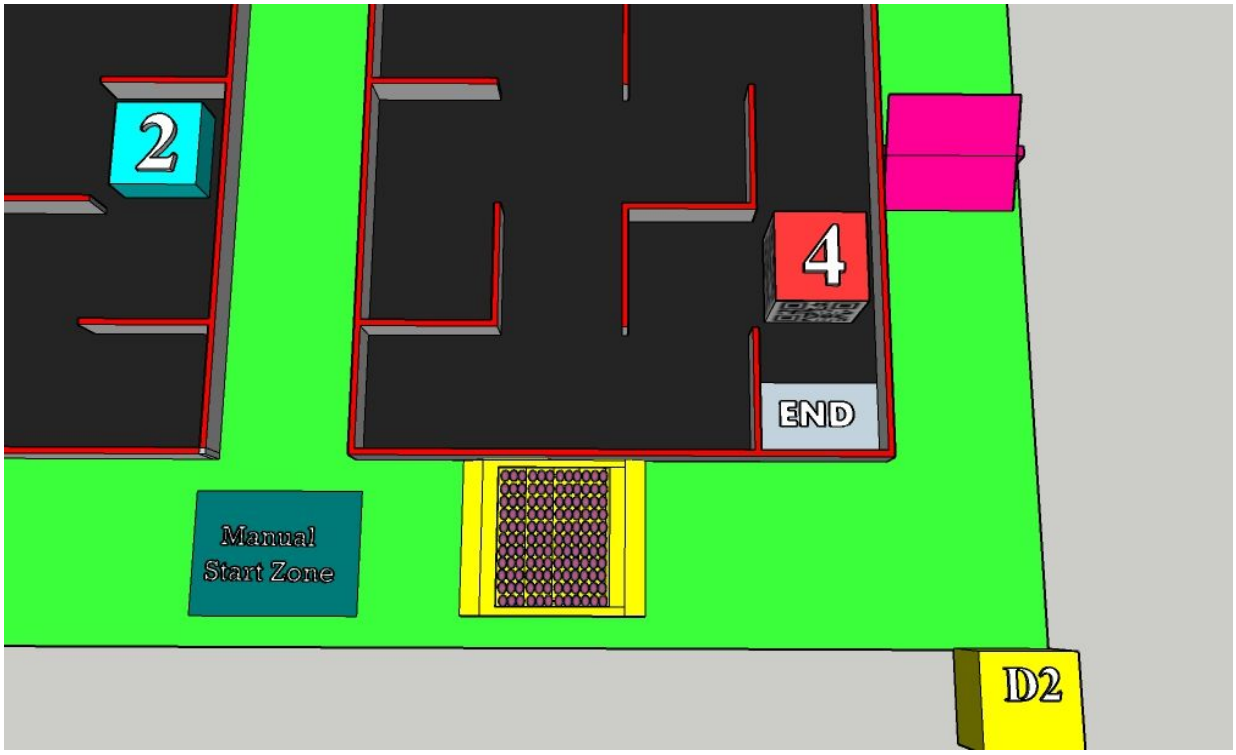

Fig. 6

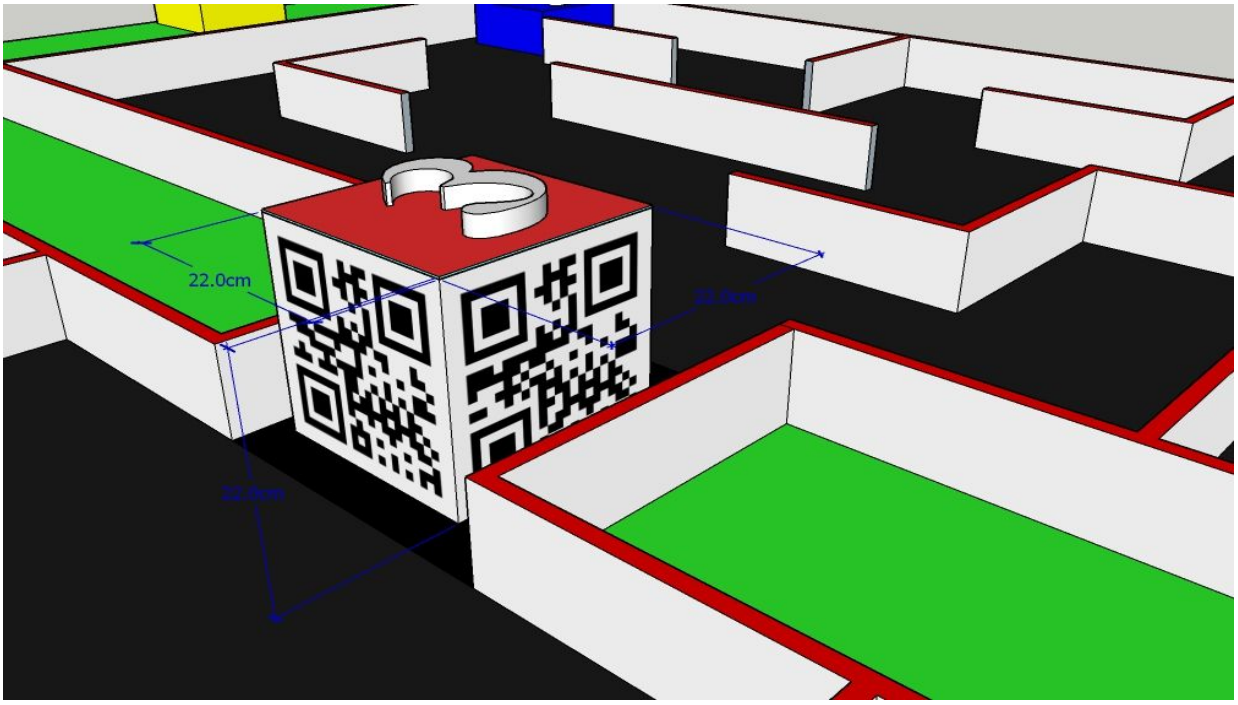

Fig.7

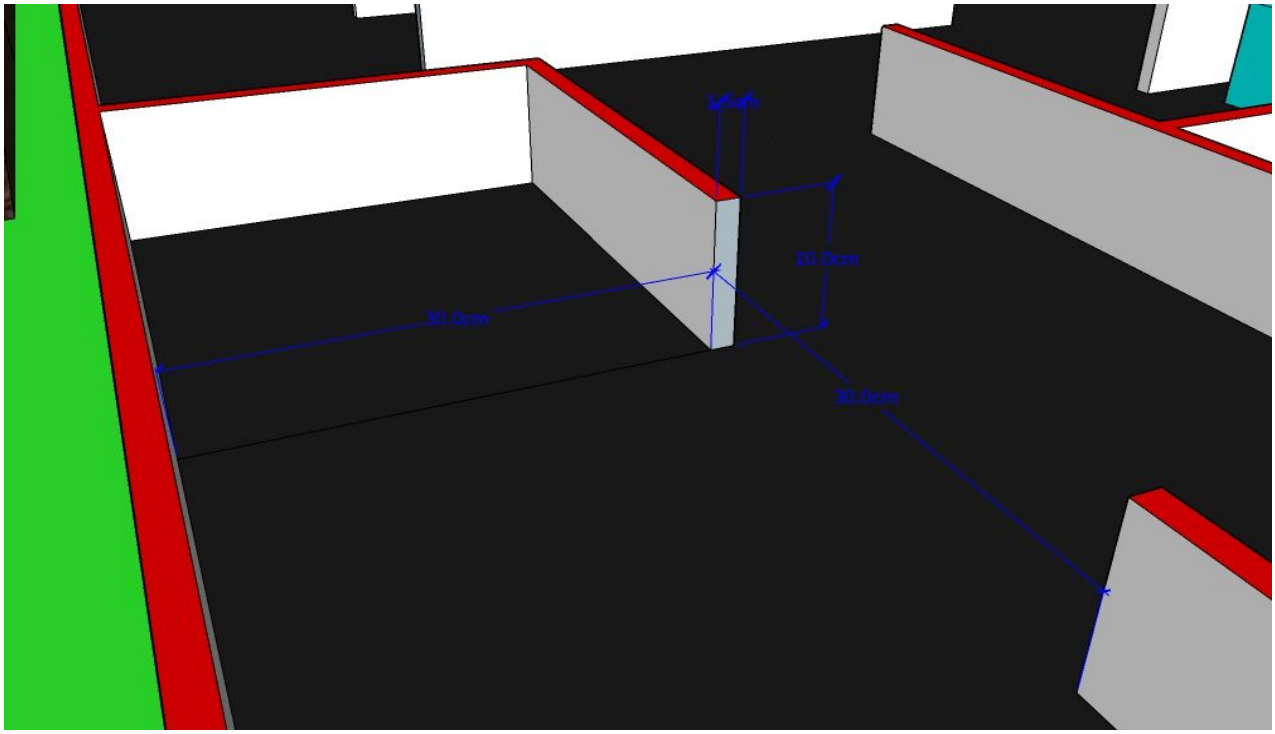

Fig.8

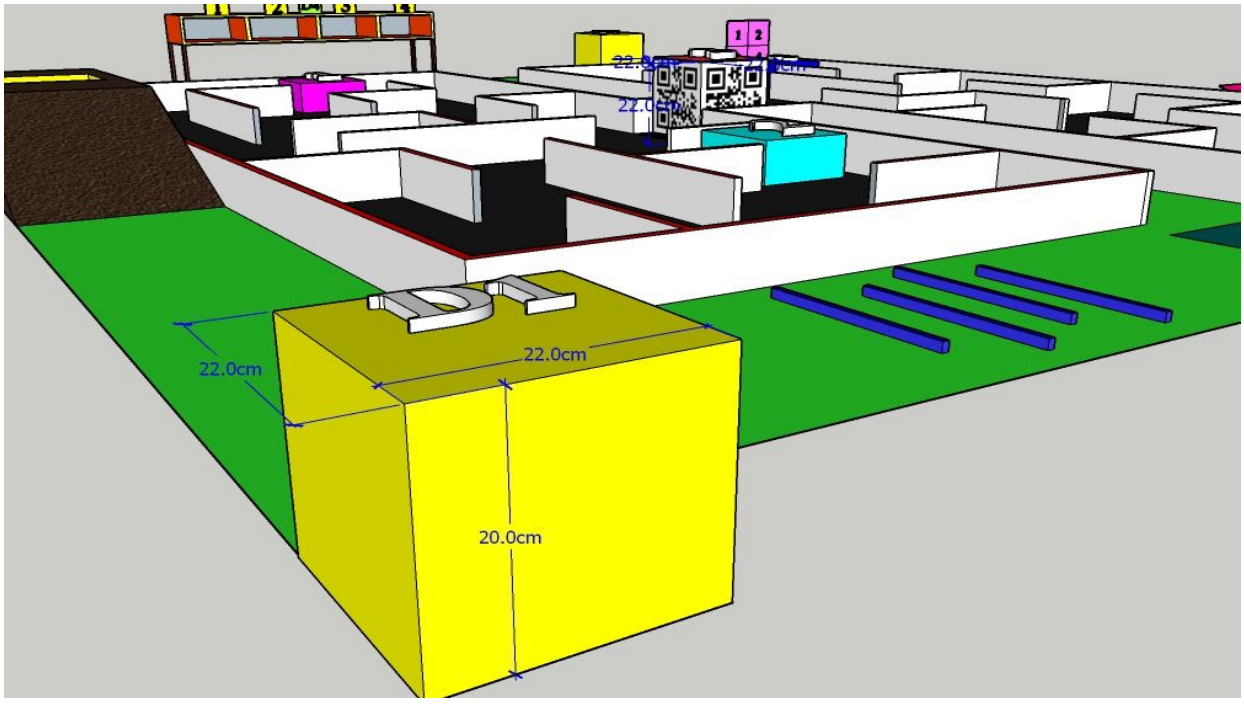

Fig.9

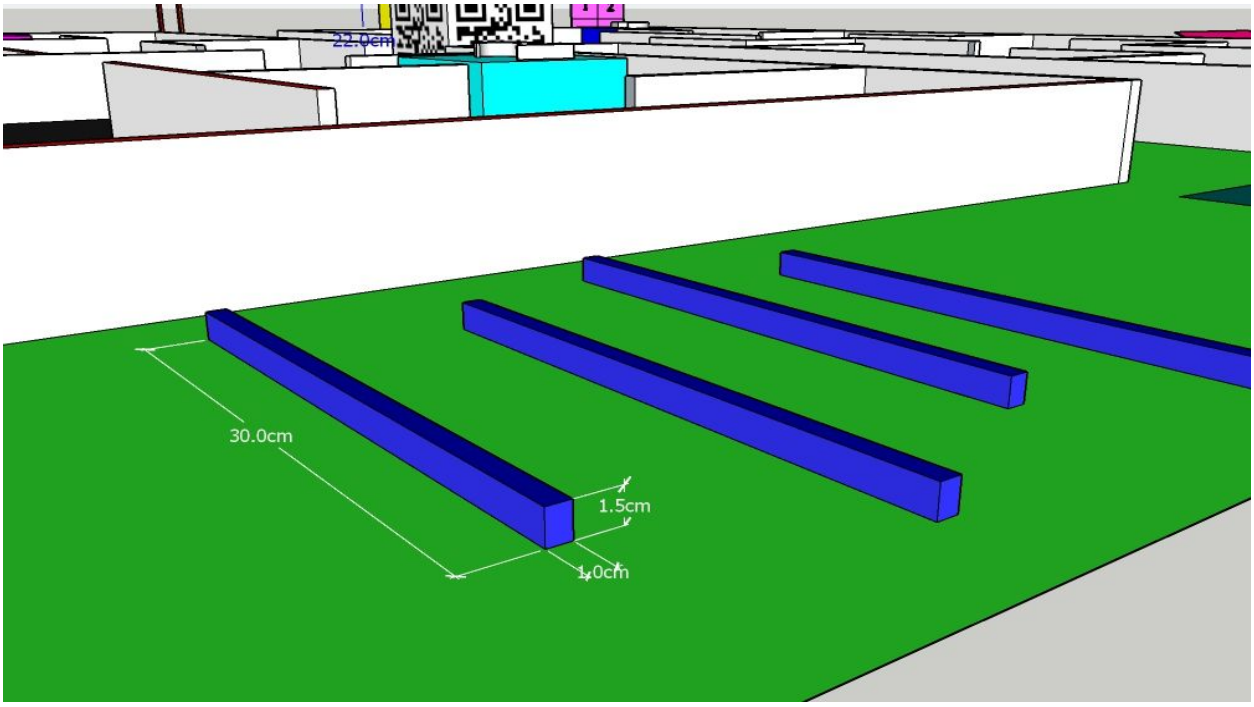

Fig. 10

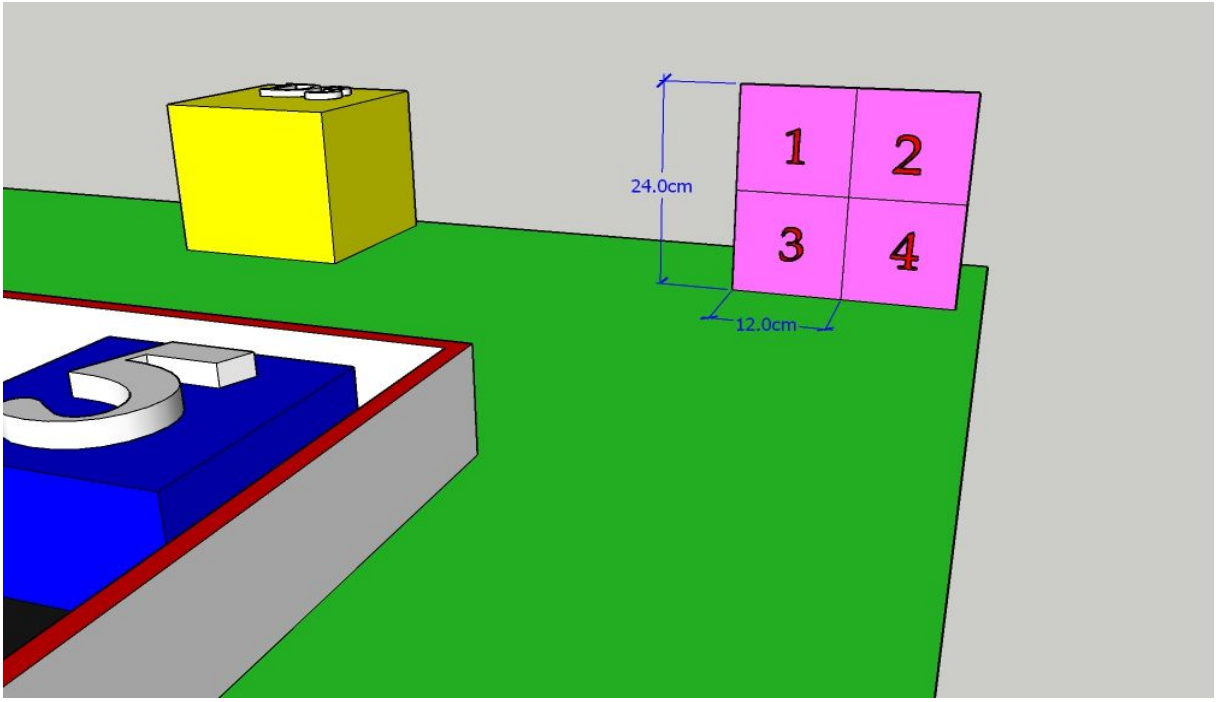

Fig.11

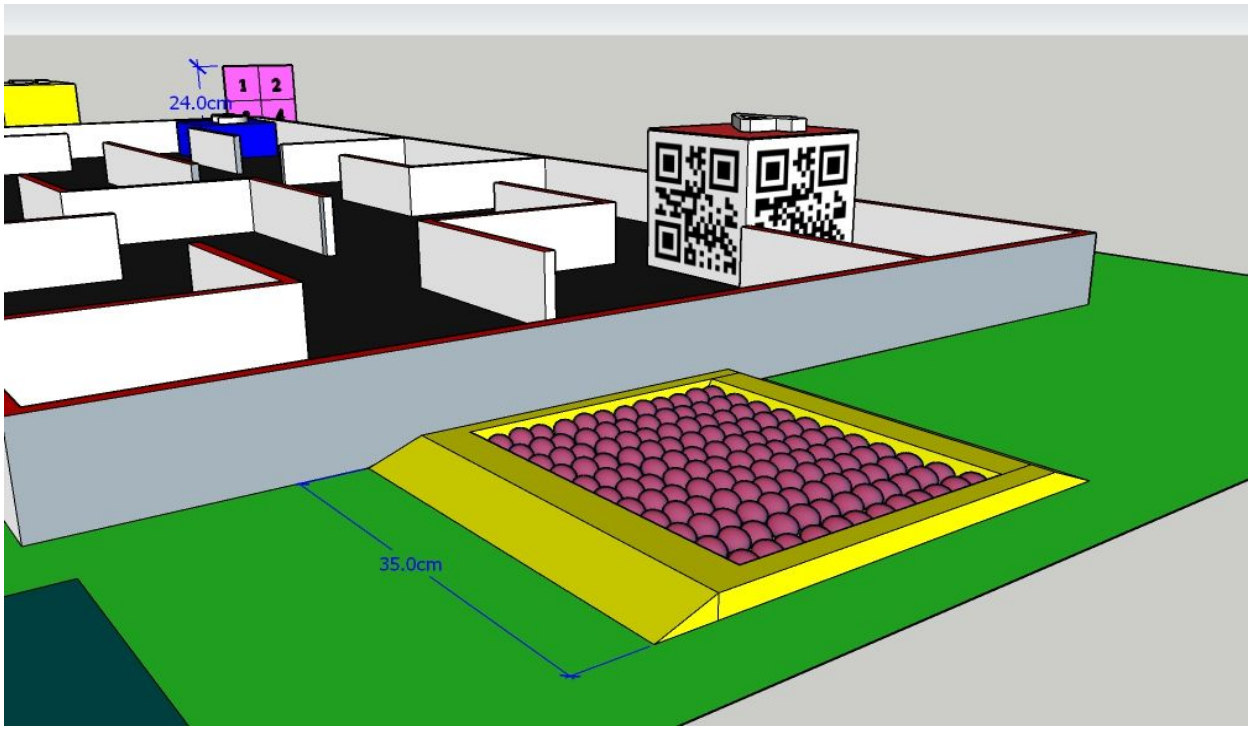

Fig.12

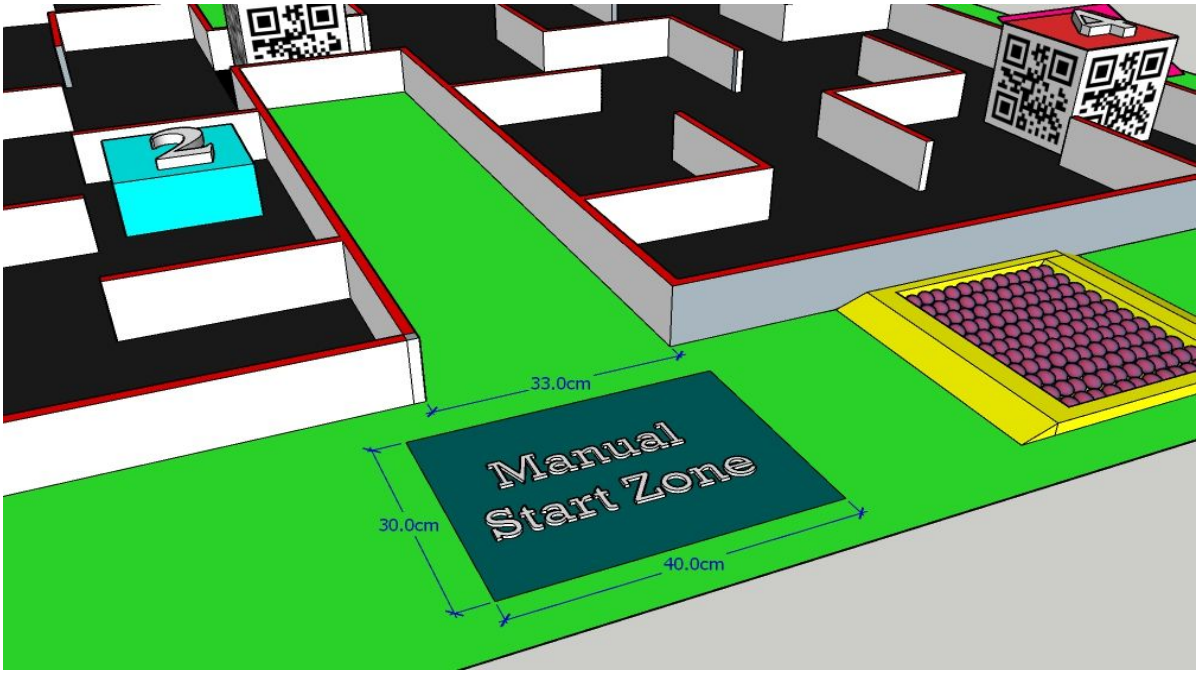

Fig.13

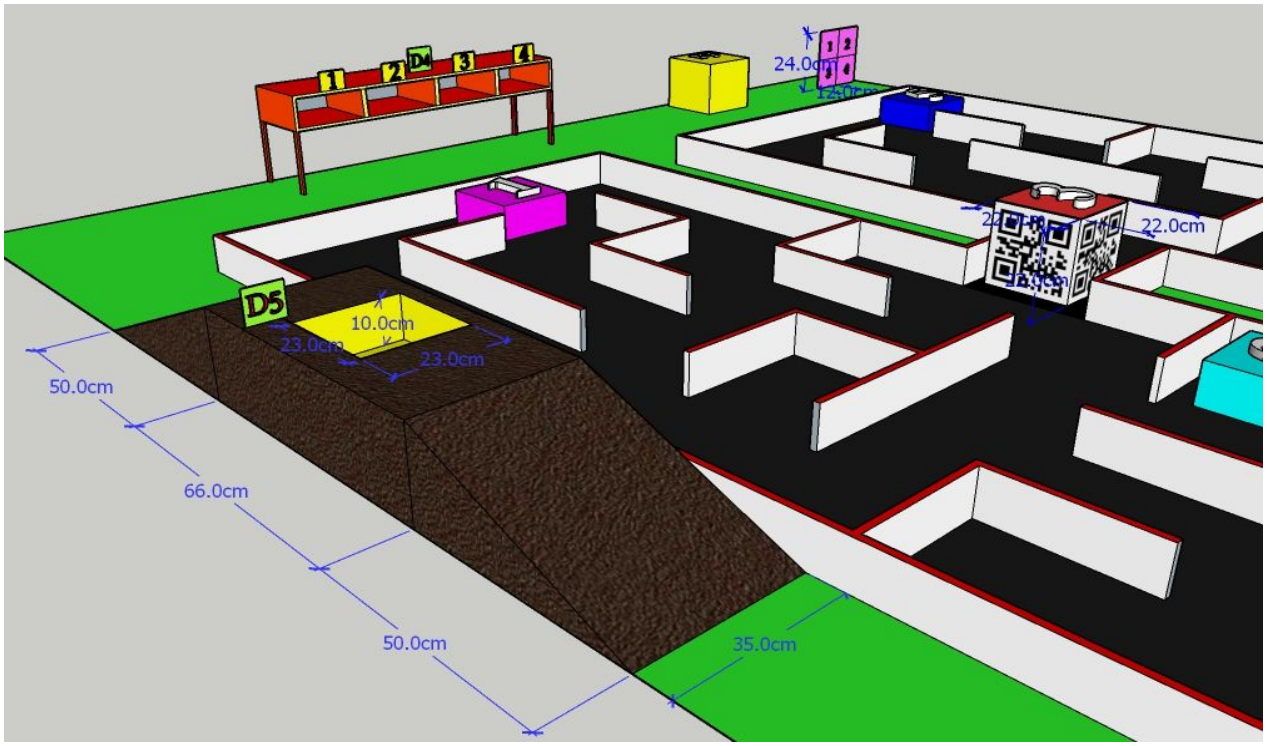
1
2
D4
3
4
24.0cm
22.0cm
D5
10.0cm
23.0cm
23.0cm
50.0cm
66.0cm
50.0cm
35.0cm

Fig.14

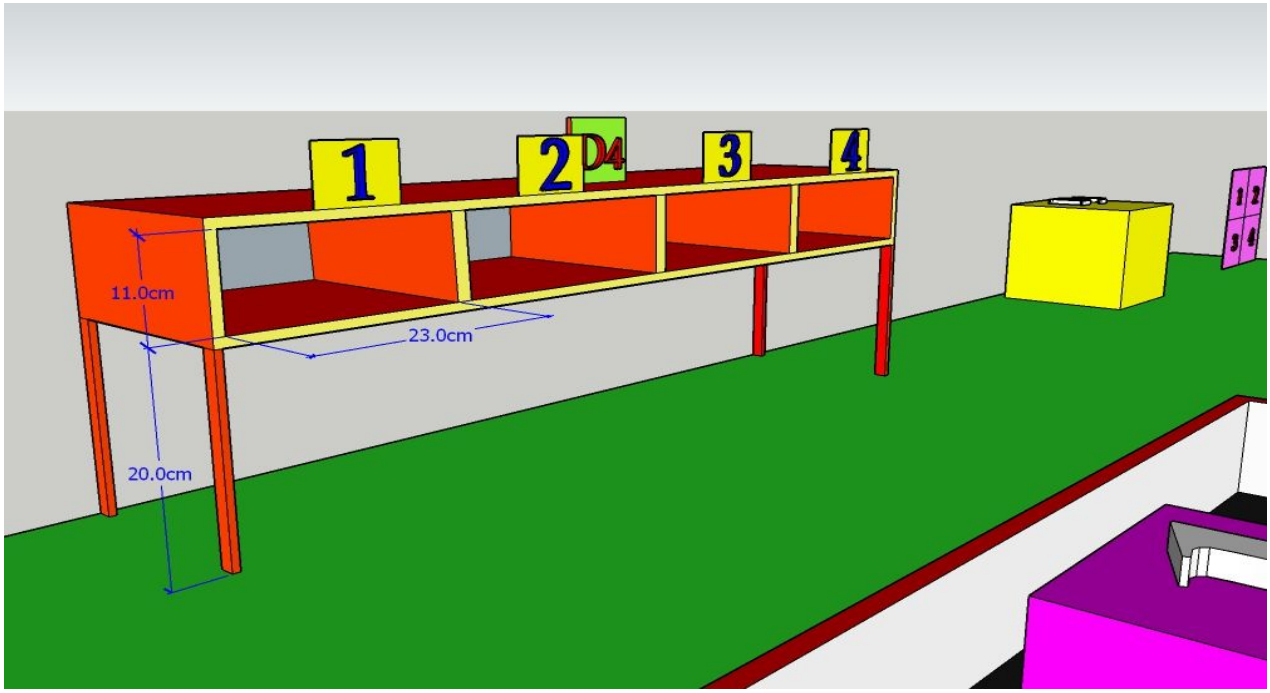
1
2
D4
3
4
11.0cm
23.0cm
20.0cm

Fig.15

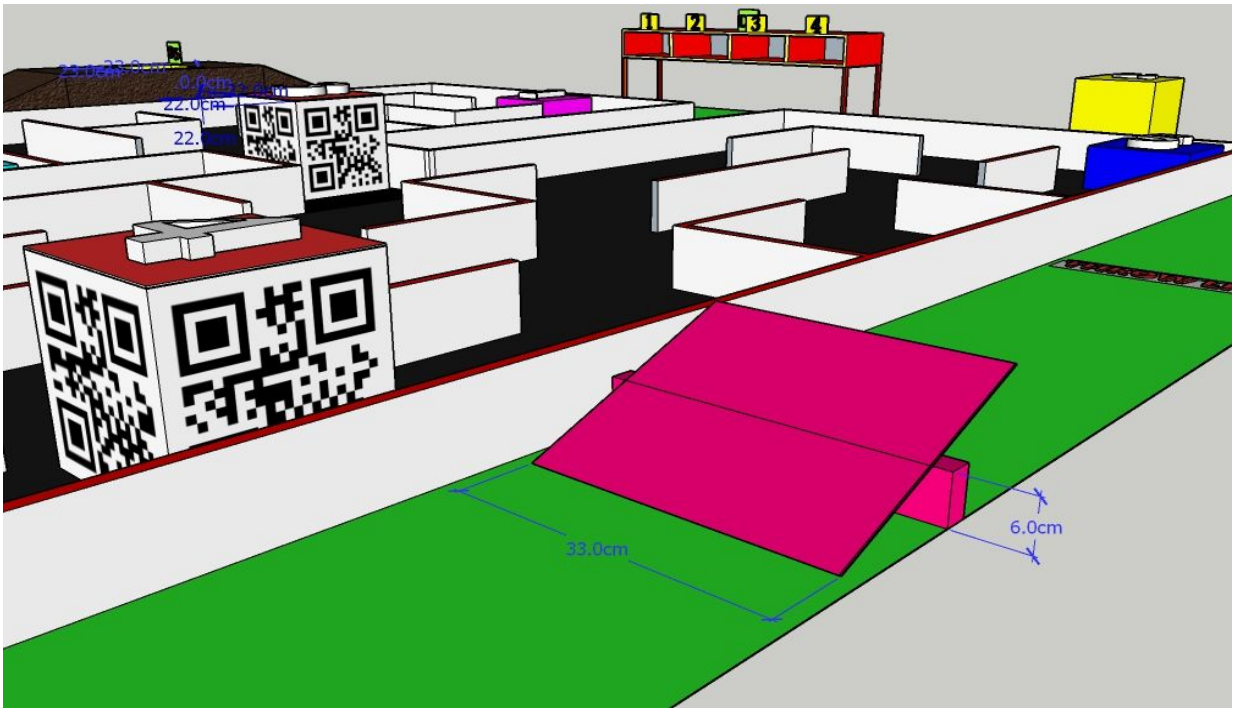

Fig.16

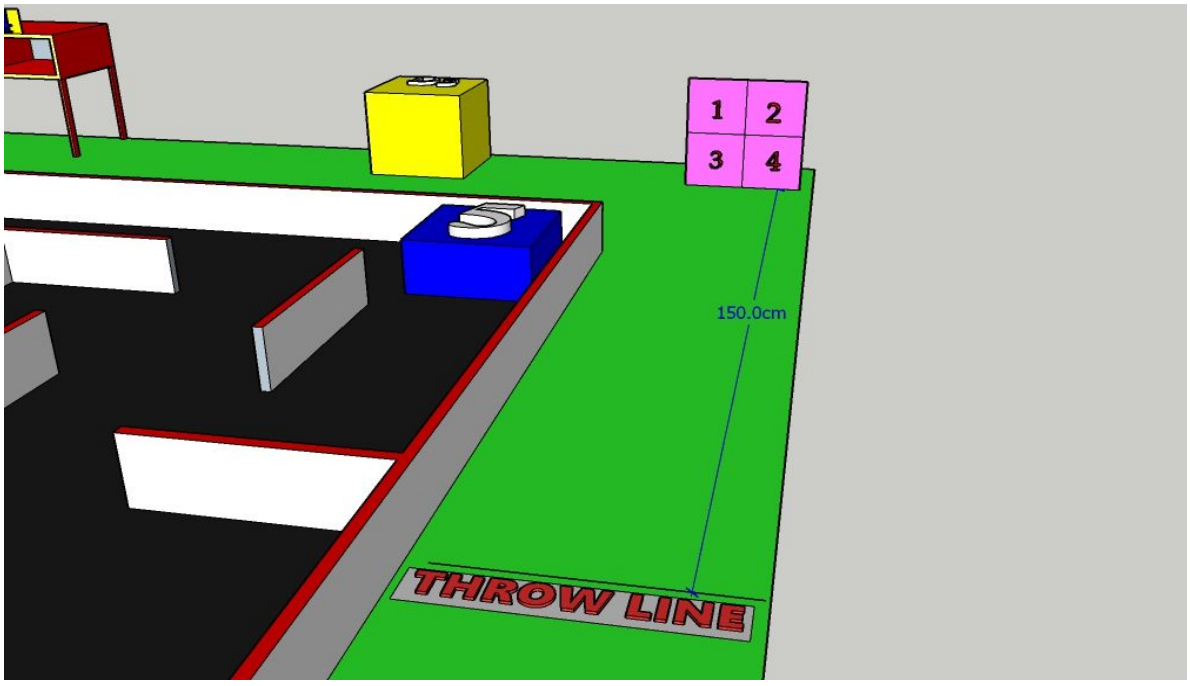

Fig.17

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 260mm X 260mm X 260mm (l x b x h). The bot must be started individually by only one onboard switch. However, a team may have separate onboard switches for a 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 or penalty. Decision rests on the organisers and will be final and binding for all.

4. An autonomous bot should not split into two or more units.

5. 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 QR code scanning, participants can use any controller or 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 of the team is allowed to control the bot.

3. The manual bot must fit within a box of dimension 400mm x 300mm x 200mm (l×b×h). The size of the gripper is not included in this constraint. The external remote control used to control the bot is not included in the size constraint.

4. The bot must be stable and should 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.

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

6. The manual bot should have an onboard power supply. 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 of the arena 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 autonomous bot has to solve the maze by identifying the position of colored blocks(blocks 1,2,5) and blocks with QR code (blocks 3,4). Autonomous bot has to reach and stop in front of the blocks in minimum time. It should follow shortest path in order to avoid time loss.

3. The autonomous bot has to reach block 1 or block 2 and stop in front of it till manual bot lift it in order to clear the path for maneuvering. The manual bot will put that block(1 or 2) in deposit zone 5 (fig.14)

4. Then autonomous bot will go for another block (1 or 2). The manual bot will lift that block to clear the path for autonomous bot. The manual bot will wait for QR code scanning . The autonomous bot will then go for block 3 which has QR code. The autonomous bot will scan QR code to give a number (1 or 2 or 3 or 4). Now, a manual bot will put that block(1 or 2) in deposit zone 4 (D4) in section 1 or 2 or 3 or 4 as per the number given by QR code scanning.

5. The manual bot will then lift block 3 (block with QR code) and put it on deposit zone 3 (D3). Meanwhile, the autonomous bot will move further to solve the maze.

6. The autonomous bot has to reach block 5 and stop in front of it till the manual bot lifts it. The manual bot will put block 5 on deposit zone 2. The manual bot must choose a path which includes a see-saw, tray with balls etc. Participants are allowed to adjust the see-saw as per orientation of manual bot so that it can ascend on a see-saw.

7. Meanwhile, the autonomous bot will reach block no. 4 and scan the QR code. QR code scanning will give a number(1 or 2 or 3 or 4) which will help manual bot to throw a dart on the corresponding target. The manual bot will then put block 4 on deposit zone 1 (D1).

8. The manual bot will throw a magnetic dart from behind the throw line on the target as per number allotted after QR scanning.

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 won’t be allowed to make changes in their code under any circumstances.

1. The maximum time given for completing the task is 8 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 maze to find positions of the blocks. **When bot will stop in front of the block, a team member will lift the block so that autonomous bot will continue its dry run.** The bot should give a visual/audio signal at the end of the 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 8 minutes. No advantage will be given if the dry run ends before 5 minutes.

5. The autonomous bot is allowed to move only in the autonomous zone at all times and the manual bot is allowed to move only in the manual zone

6. Blocks should not be dragged by any of the bots of the 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:

- Checkpoint 1: If an autonomous bot deviates before it stops in front block 1 or block 2 OR doesn't stop in front of the block, it has to restart again at autonomous start zone.
- Checkpoint X: If autonomous bot successfully stops in front of block P (P=1,2,3,4,5) till manual bot lift that block. So if an autonomous bot faces any issue in the further maze it has to restart at previous block position where he stopped successfully.

Manual bot checkpoints:

- Checkpoint 1: If manual bot successfully put the block (1 or 2) in deposit zone 5 (D5), it will be placed just after the pit (D5)
- Checkpoint 2: If manual bot crosses hurdles
- Checkpoint 3: If manual bot travel across the tray having balls
- Checkpoint 4: If manual bot crosses see-saw.

Judging:

A- 30 points will be awarded if autonomous bot identifies and stops in front of colored block i.e 30 points each time bot stops successfully in front of a colored block
B- 5 points for lifting a block to clear the path of autonomous bot.
C- 60 points will be awarded if autonomous block scan QR code i.e. points for each scan
D- 20 points will be awarded each, if manual bot keeps the block on D1 or D2 or D3
E- 35 points will be awarded if manual bot put the block in deposit zone 4
F- 20 points will be awarded if manual bot put the block in deposit zone 5 (pit)
E- 40 points will be awarded if manual bot throws dart accurately on the section as per QR scanning
G- 10 points will be awarded if manual bot is not able to throw a dart at accurate section but throws on any of the 4 sections

Penalties
H- 30 points will be deducted if the manual bot gets stuck at see-saw or tray having balls or hurdles and couldn't go through it. A manual bot will be given a chance to move further but points will be deducted.
I- 20 points will be deducted If autonomous bot touches or drags any of the blocks.
J- 30 points will be deducted if the manual bot is found damaging the maze.

Final Score

X=A+B+C+D+E+F+G
Y=H+I+J
Z (Time Bonus) = 480 - Total time taken to complete the task

Final Score=X-Y+Z
***Note*: Z (Time bonus) will be considered only if both bots complete all the tasks**

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 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. E-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.

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