



TECHNOVANZA

Taking technology to society

VJTI ROBOTICS CHALLENGE

Mumbai's Dabbawalas: Lunch Box of Hard work and Love

The concept of innovation is not just about developing new technology.

In fact, the work of Mumbai's Dabbawalas shows just that.

Hailing from the hustle bustle of the city, from the main roads to smallest of gallis, Dabbawalas of Mumbai save the day for thousands of working people in their lunch times. From a simple dabba delivery service with only 100 employees in 1890, the number of Mumbai's Dabbawalas has grown to more than 5000 and more than **200,000** deliveries are made daily. They are a great model for the saying- Frugal innovation goes beyond clever R&D. With almost zero capital investment, the Dabbawalas provide a highly efficient service which has turned them into a ₹40-45 crore industry.

A traditional Dabbawala, dressed in a white kurta and with the iconic '**Gandhi Topi**' on his head, makes his way through the crowds of Mumbai to deliver lunches. Every day, for a very modest fee, the Dabbawalas collect freshly cooked meals from their customers' homes and from canteens from all over Mumbai. The Dabbawalas have a very elaborate '**coding system**' which is inscribed on the lids of the dabbas which assists the Dabbawalas in the delivery process. The dabbas are **mounted on bicycles** and local deliveries are made first. The ones to be taken to farther places are sent via trains and are collected at one of the **sorting** points and are categorized according to their destination. They are then handed over to the Dabbawalas of the zone who further deliver it to the correct customer depending upon the code on the dabba. With so many dabbas consumed in the city every day, the amount of leftover food is also high. A certain amount of the food they deliver is never eaten, or even barely touched. This perfectly good food, as much as 16 tons per day was wasted, while the street children of Mumbai were starving. Thanks to the '**Share My Dabba**' initiative by the Dabbawalas, this leftover food finds its way to the starving stomachs in the city. Anyone who wishes to donate their food can simply place a sticker saying '**Share**' on the dabba of uneaten food. The Dabbawala pick up the dabbas after lunch as usual. Here, charity volunteers meet them, quickly separate the dabbas with 'Share' stickers, remove the food in them to give to the hungry street children, and then quickly repack the dabbas so the Dabbawala can get them back to the customers' home on schedule.

Dabbawalas take pride in completing their deliveries correctly and on time. Mumbai's Dabbawala organization has been recognized and celebrated for their amazing order accuracy. They have been granted ISO9000 status and awarded the **Six Sigma** by Forbes magazine in 1998 for their 99.999999% accuracy. This recognition is a symbol of their great precision and hard work. Even Harvard University has taken up a case study on these amazing people who hardly make any mistake in almost 6 million deliveries.

INTRODUCTION:

Team Specification: A team can consist of maximum 6 participants. Students from different educational institutes can form a team.

CERTIFICATION:

1. Certificate of Participation will be awarded to all the teams. Certificate of Excellence will be given to the top three teams.
2. Disqualified teams will not be considered for any certificates.

Cash Prize of INR 70,000 to be won.

Certificates will be given on the spot.

FREE Registration for all the events and non-commercial exhibition.

CHARACTERS:

Sakharam Bhau (M) -: Dabbawala who travels via road (Manual robot).

Tukaram Bhau (A) -: Dabbawala who travels via train (Auto robot).

ARENA:

- The field consists of an area having dimension $6.3\text{m} \times 6.8\text{m}$.
- The game field consists of-
 1. Virar Station (VR).
 2. Andheri Station (AD).
 3. Borivali Station (BO).
 4. Chhatrapati Shivaji Maharaj Terminus (CSMT).
 5. Churchgate Station (CCG).
 6. Dadar Station (DA).
 7. Home and Canteen (H / C).
 8. Share My Dabba Zone (SMDZ).
 9. Tribute Zone (TZ).

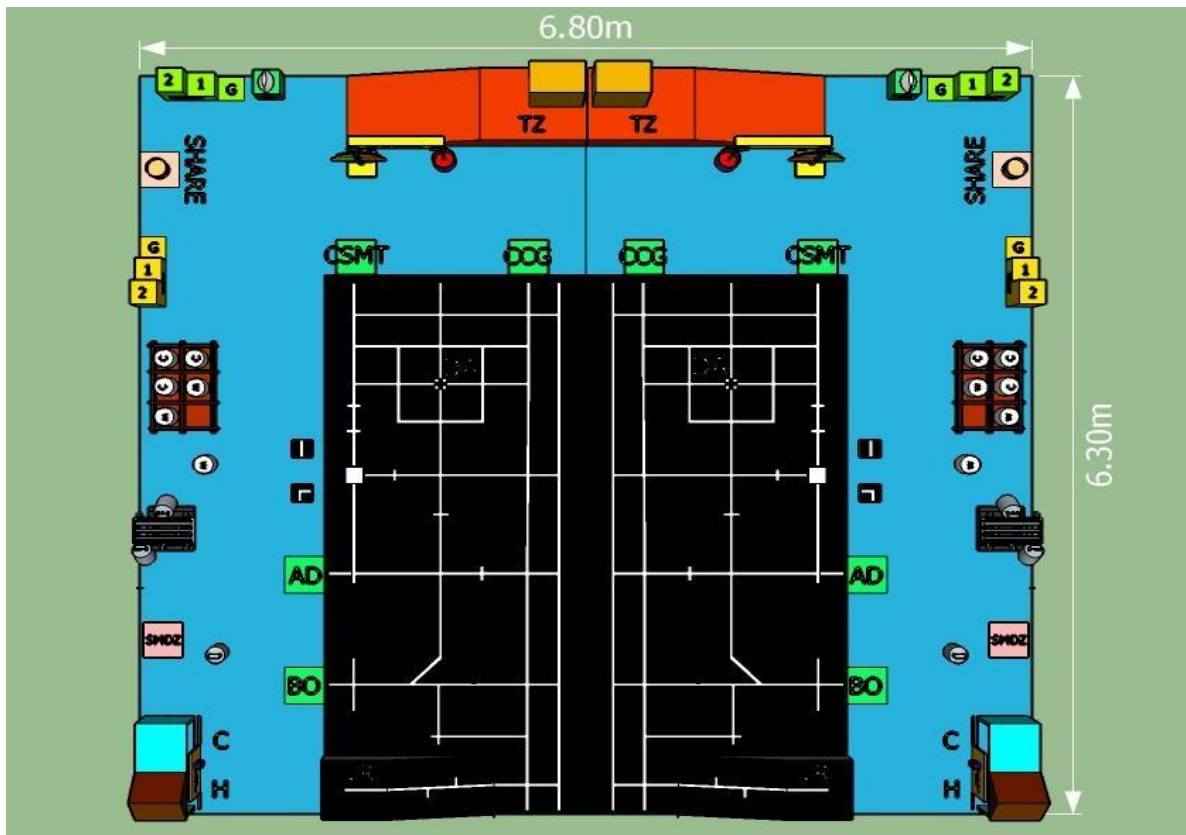


FIG 1: TOP VIEW



FIG 2: FULL ARENA

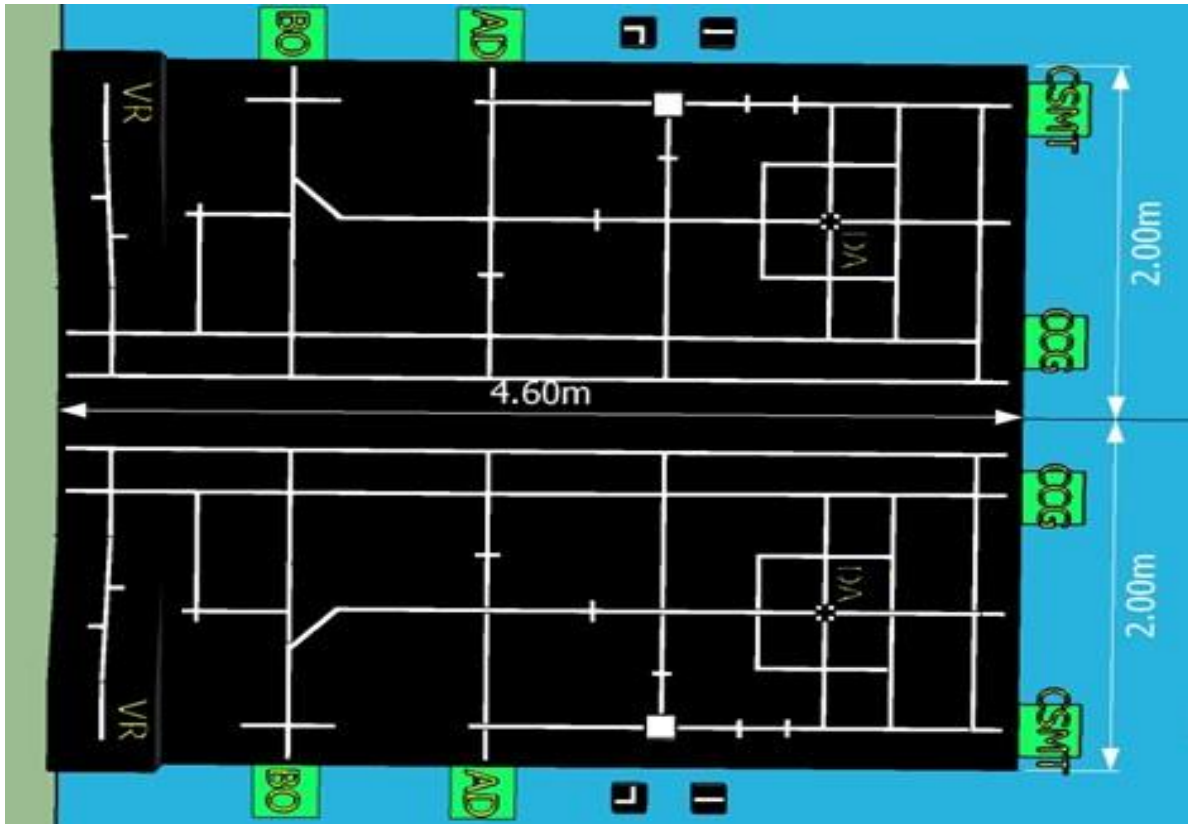


FIG 3: AUTO ARENA

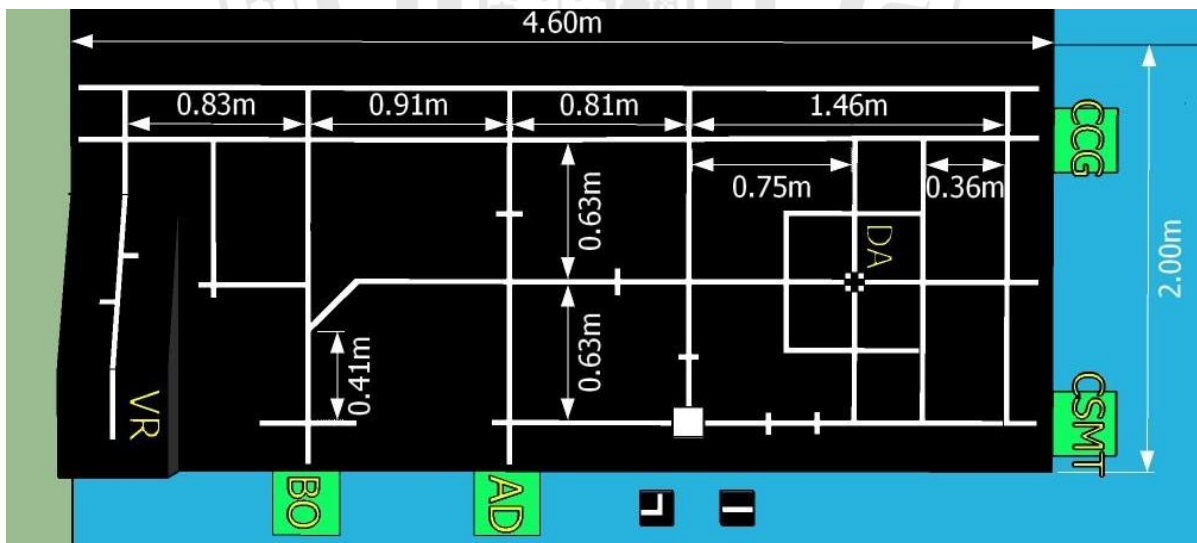


FIG 4

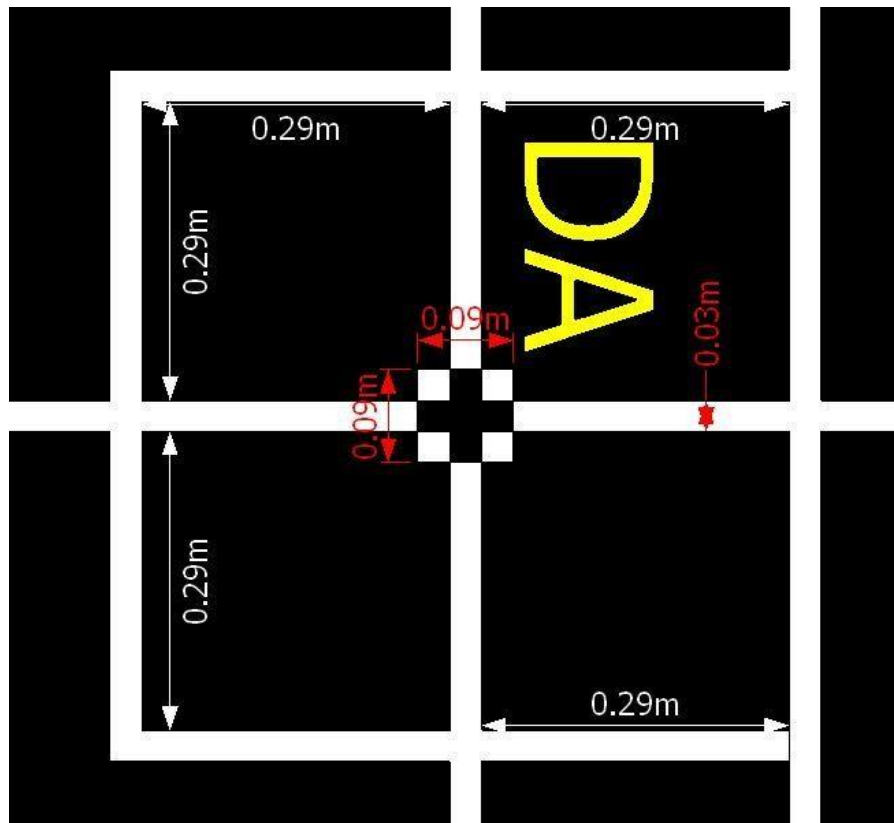


FIG 5: DADAR JUNCTION

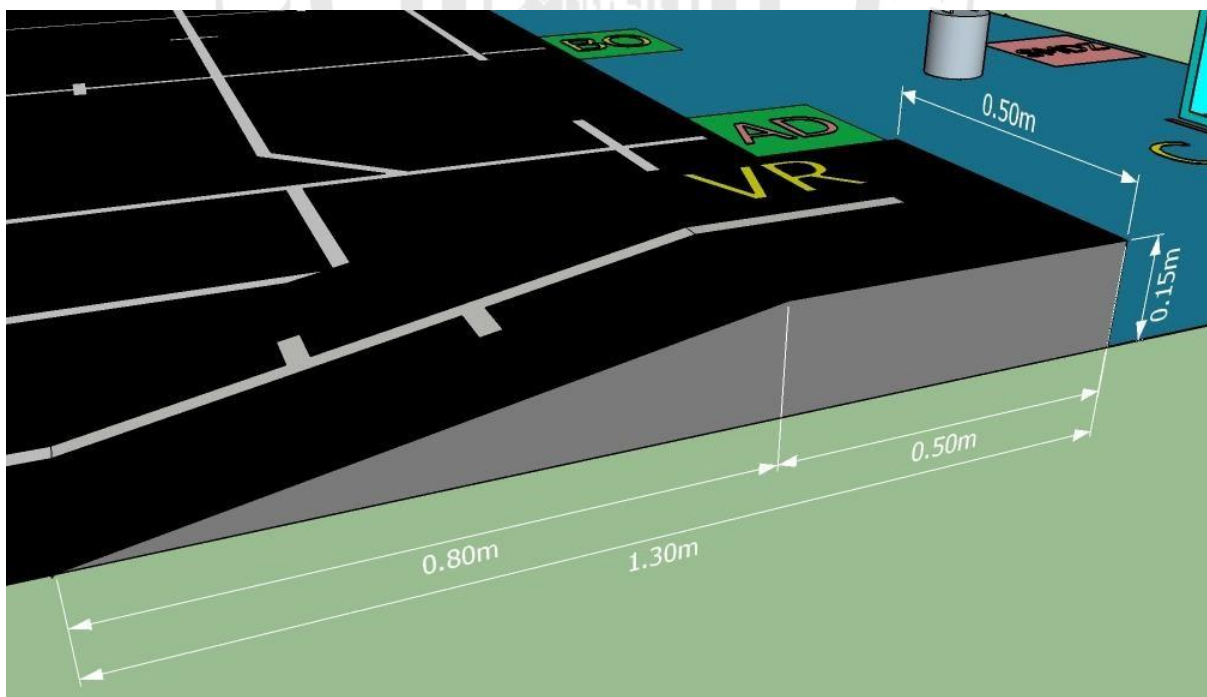


FIG 6: AUTO RAMP

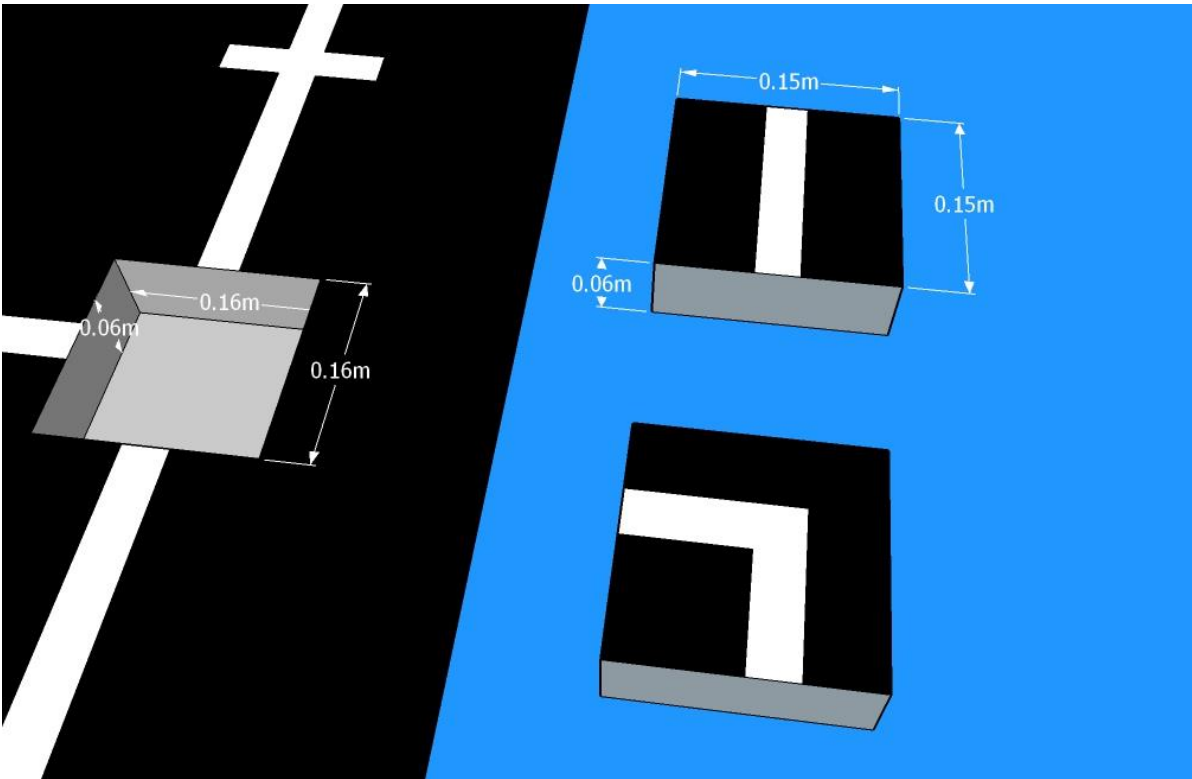


FIG 7: AUTO TRACK CAVITY

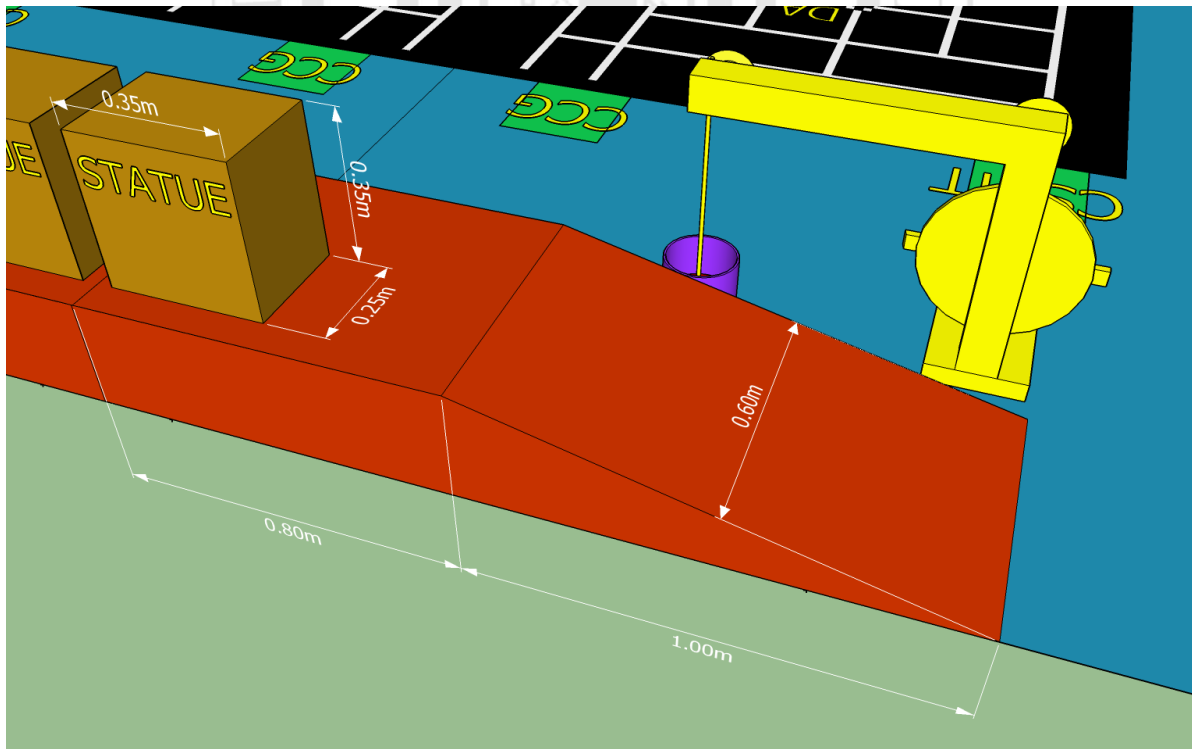


FIG 8: MANUAL RAMP

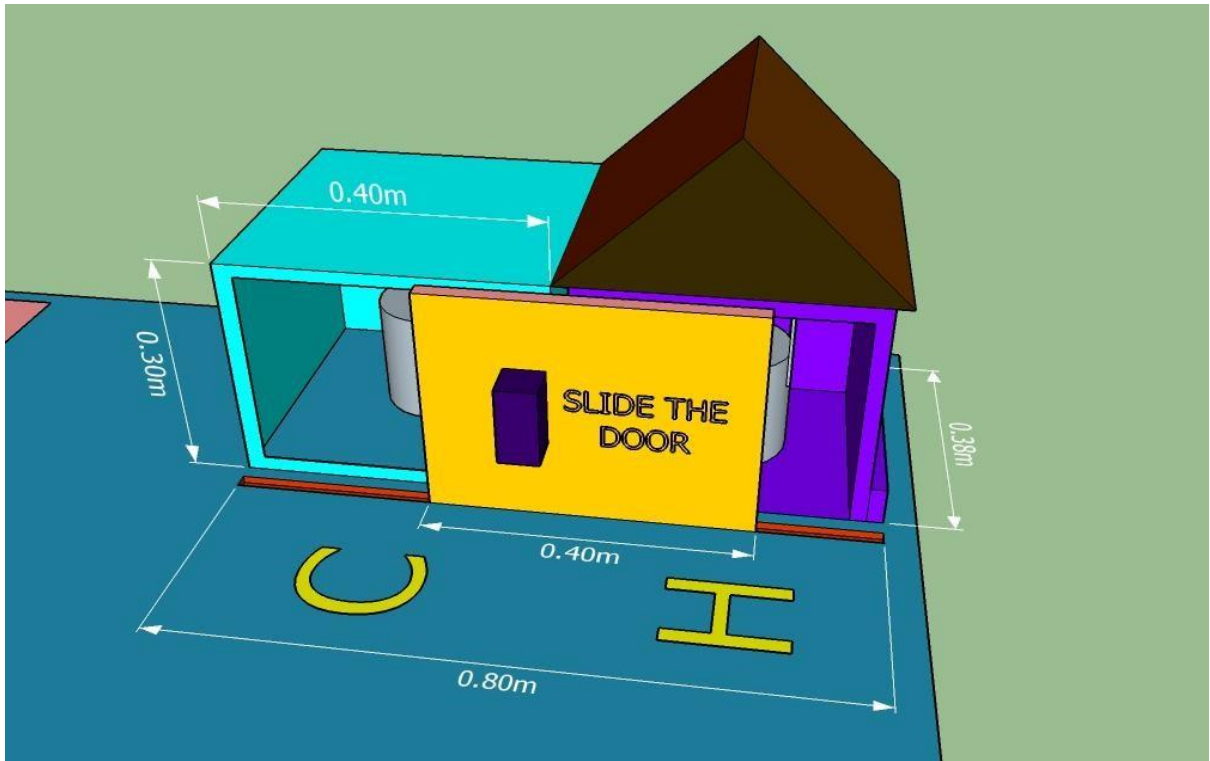


FIG 9: HOUSE AND CANTEEN

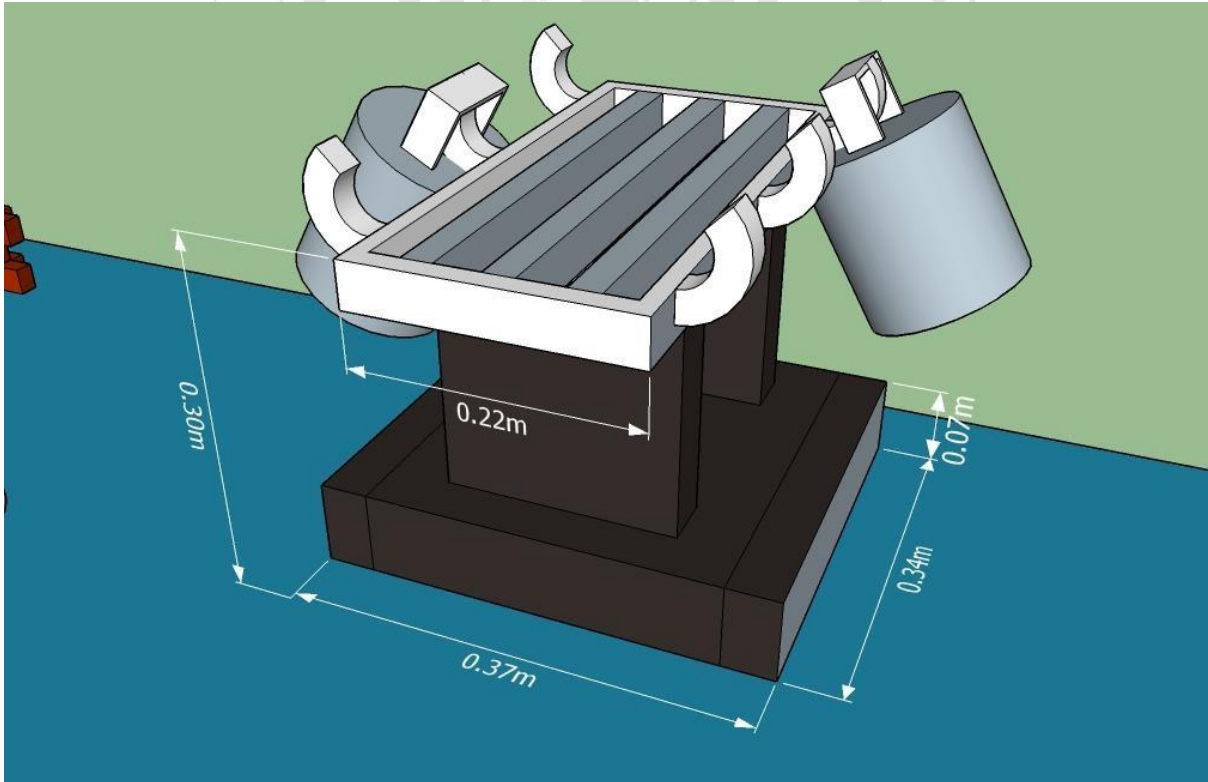


FIG 10: CYCLE CARRIER

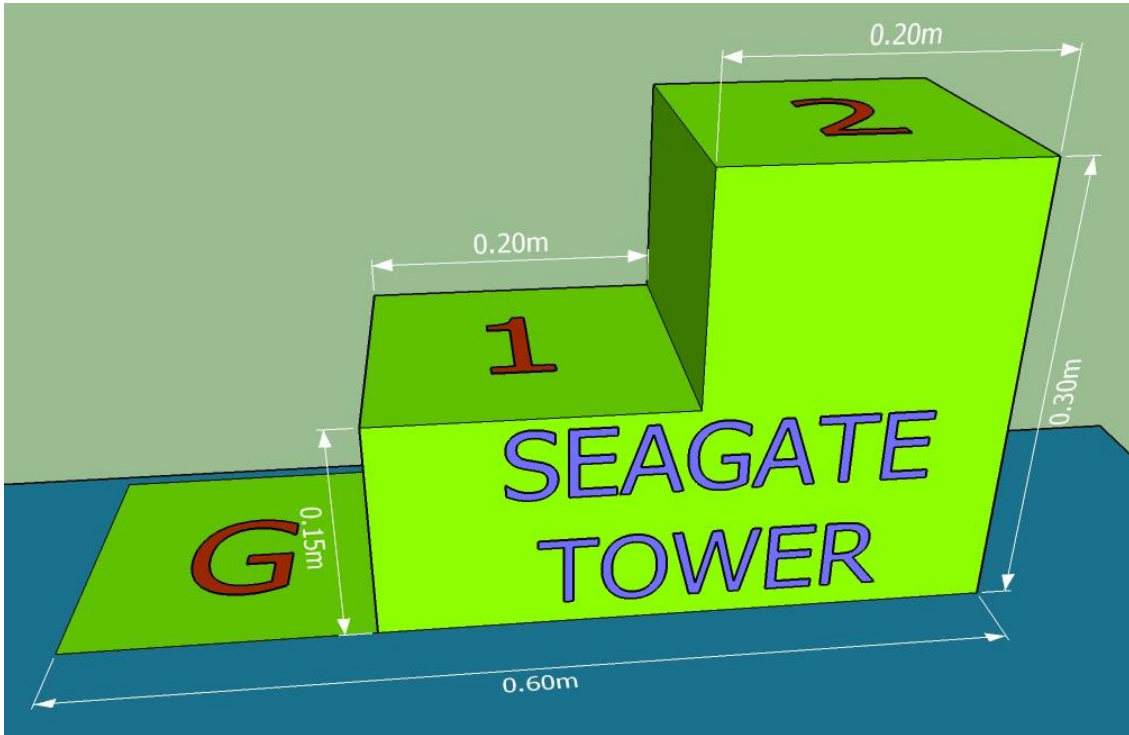


FIG 11: DESTINATION TOWER

NOTE: EXPRESS TOWER HAS SAME DIMENSIONS

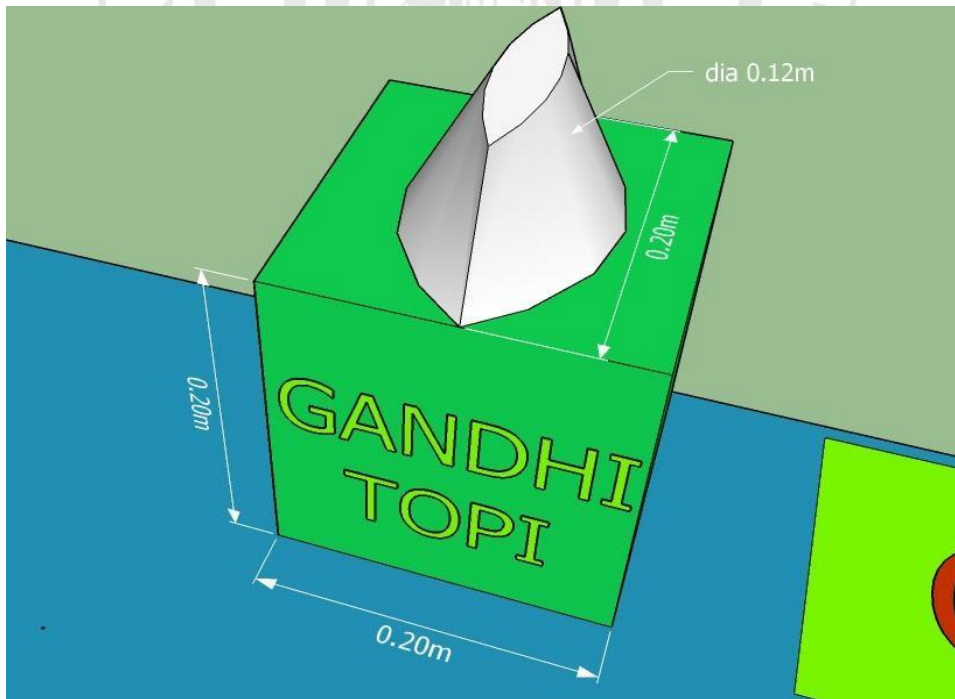


FIG 12: GANDHI TOPI

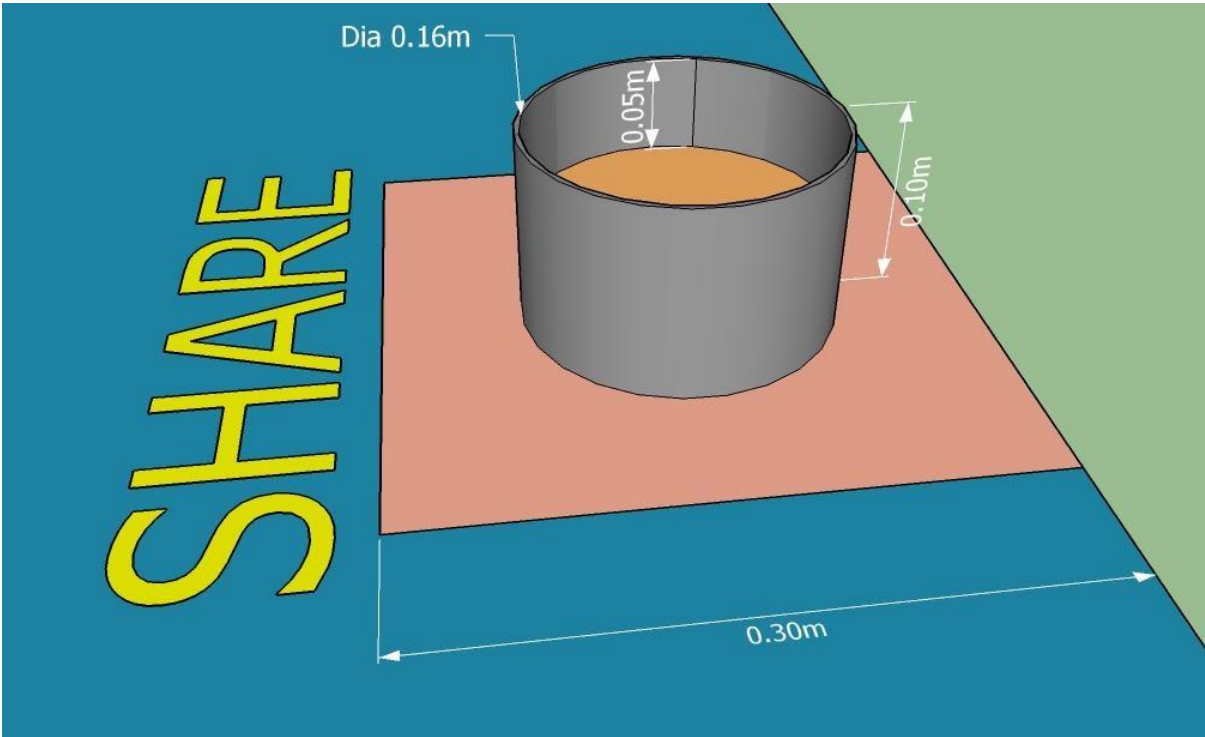


FIG 13: DABBA TO BE SHARED

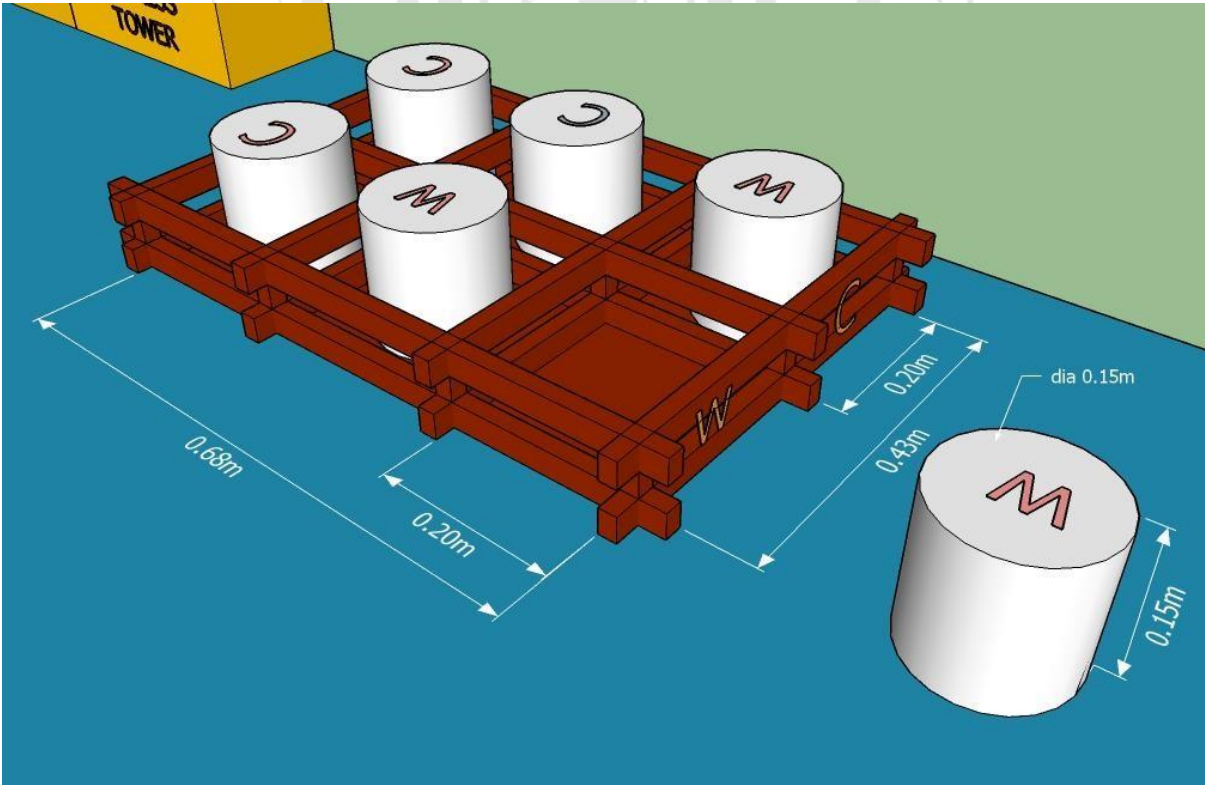


FIG 14: SORTING TRAY

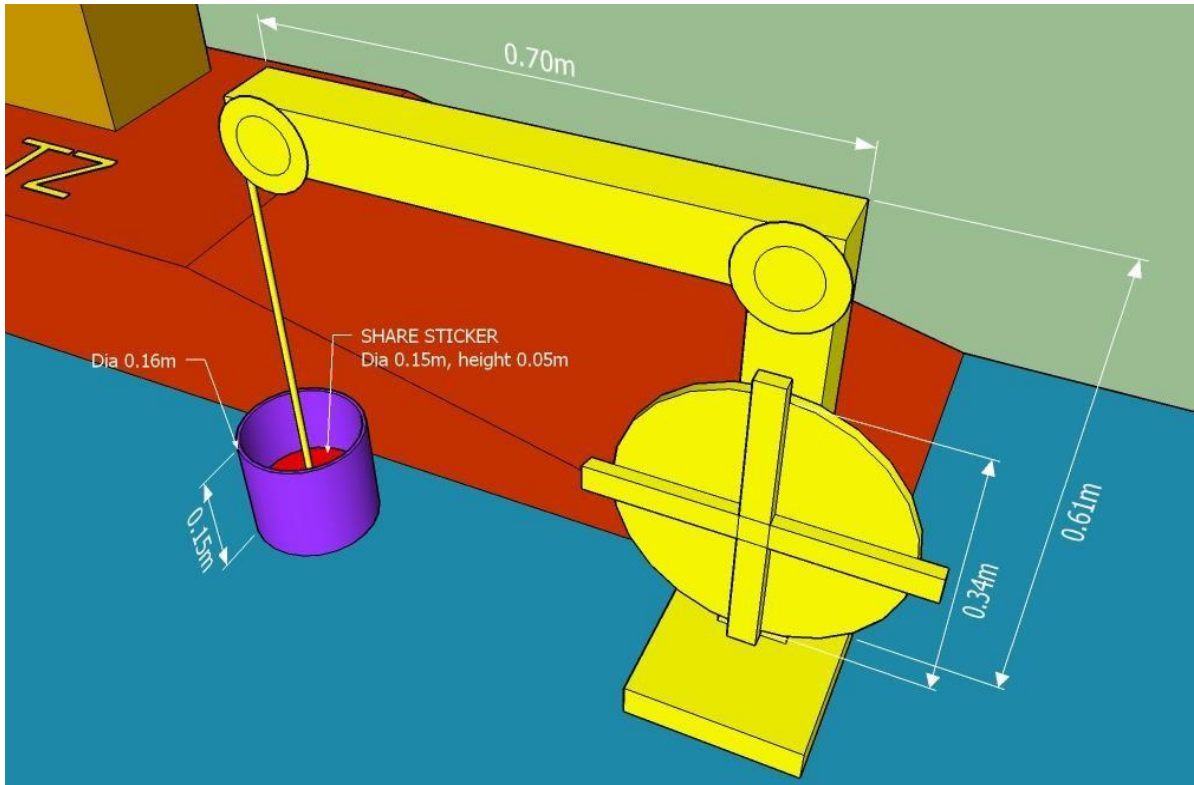
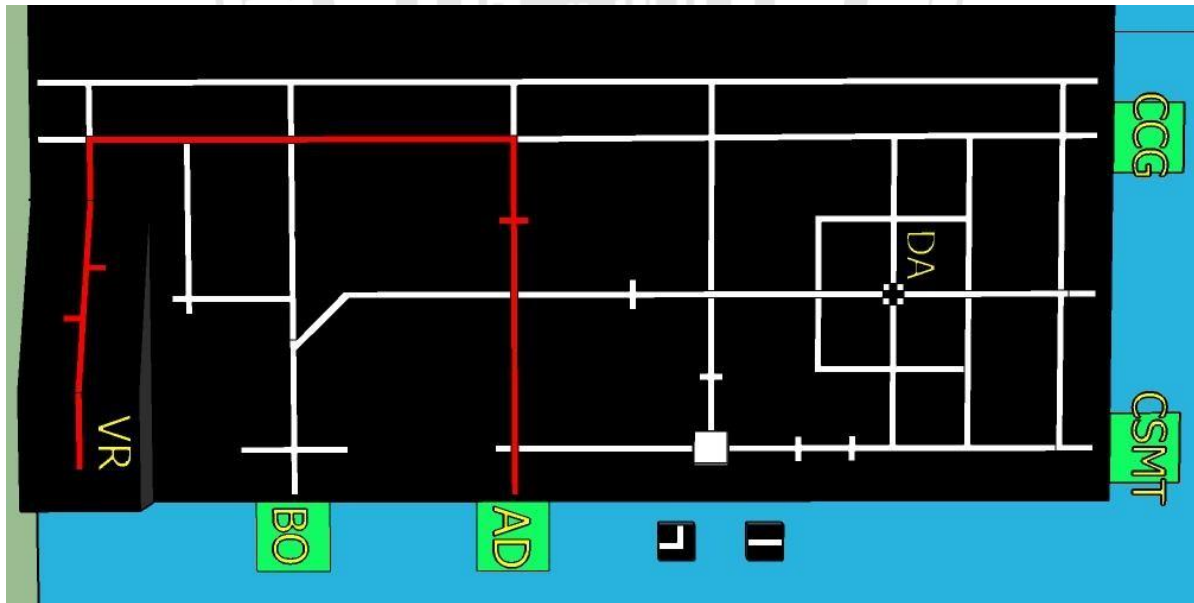


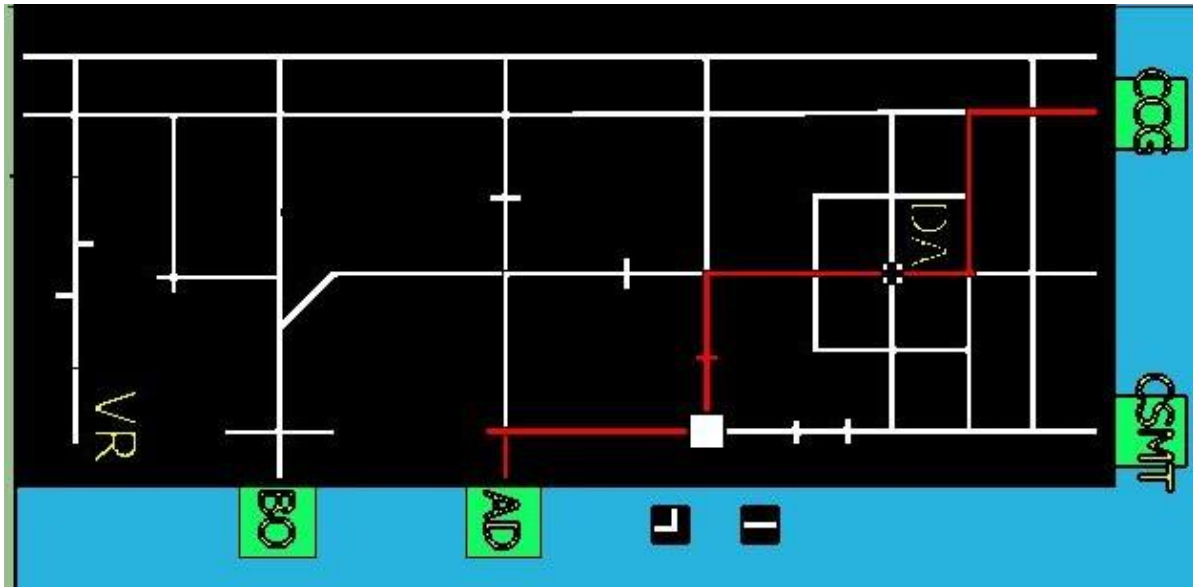
FIG 15: SIX- SIGMA TASK

AUTO PATHS:

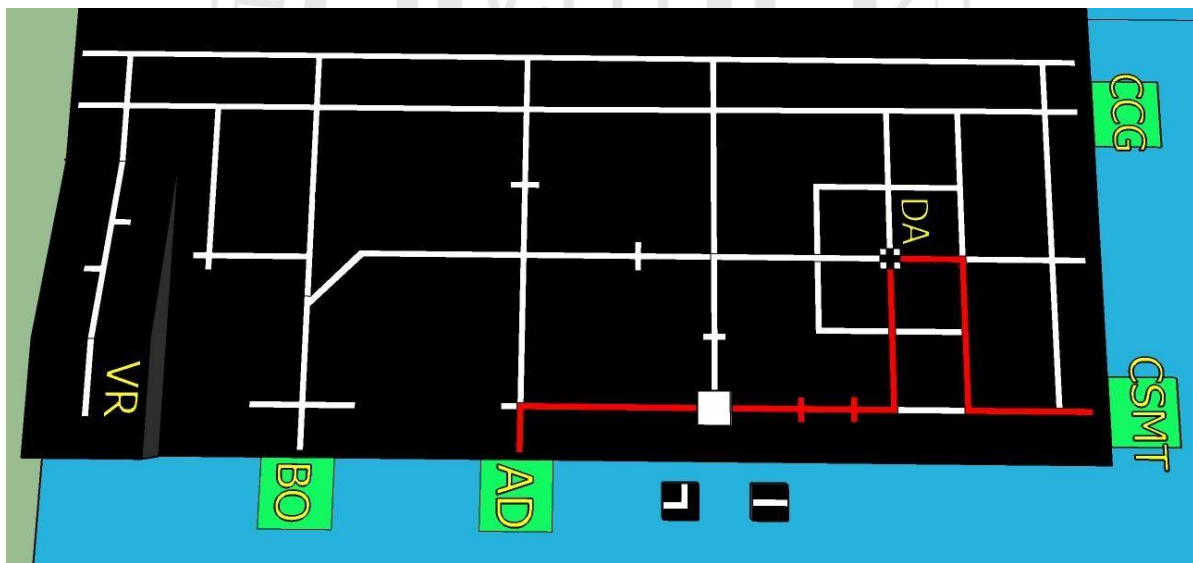


VIRAR STATION TO ANDHERI STATION (PATH 1)

ANDHERI STATION TO DESTINATION STATION



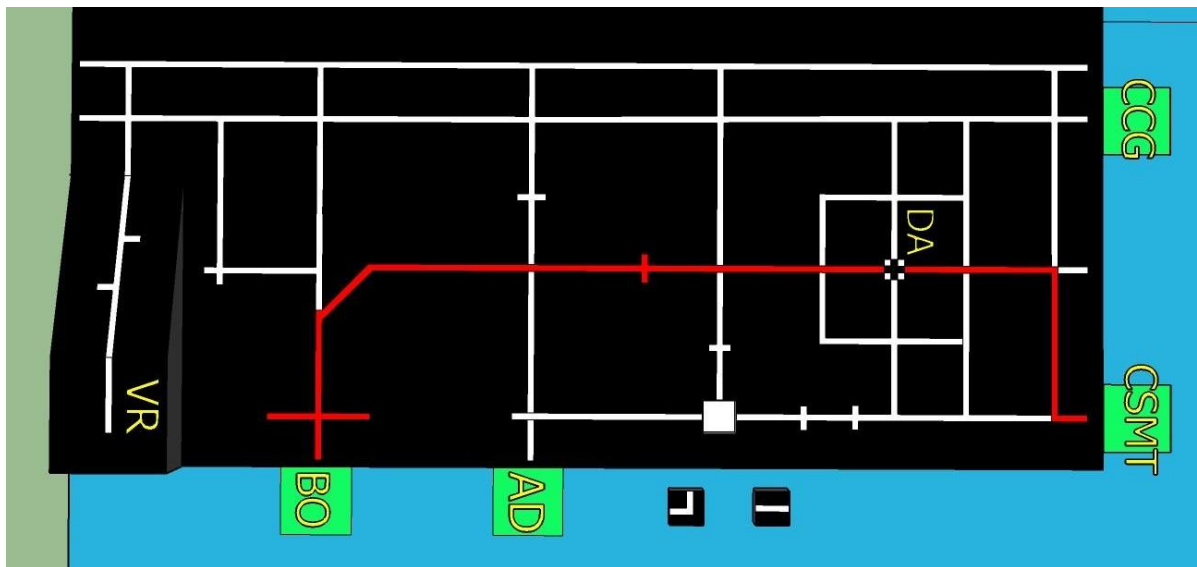
PATH 2A



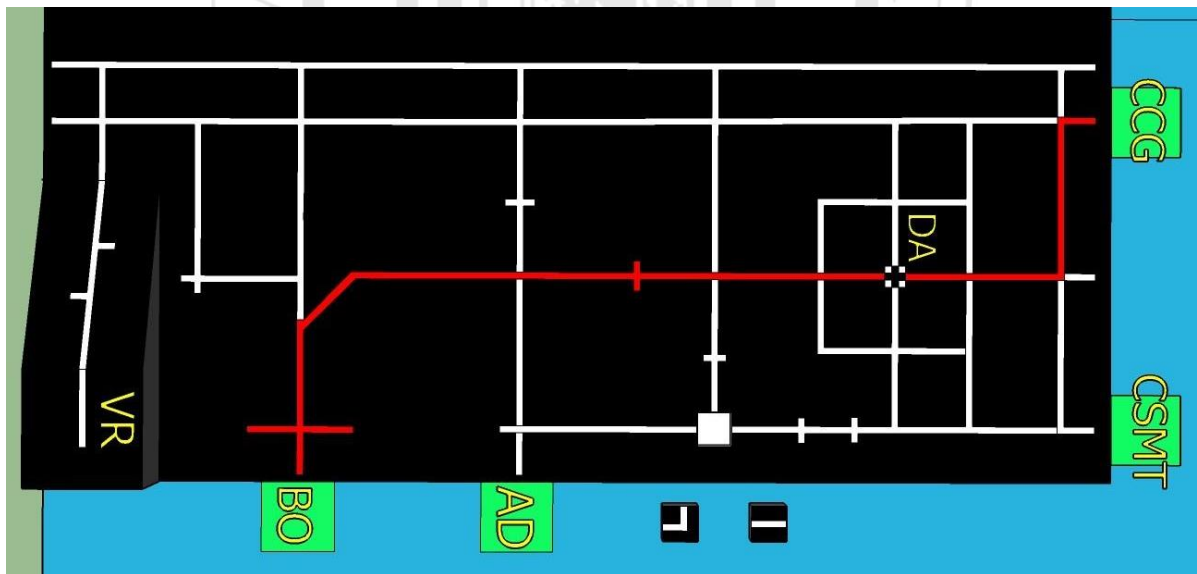
PATH 2B

NOTE: PARTICIPANTS CAN FOLLOW OTHER PATHS, BUT THEY SHOULD BE CHOSEN SUCH THAT, WHILE TRAVELLING FROM ANDHERI STATION(AD) TO DESTINATION STATION (CCG/CSMT), AUTO ROBOT MUST PASS THROUGH DADAR JUNCTION.

DESTINATION STATION TO BORIVALI STATION



PATH 3A



PATH 3B

GAMEPLAY:

Manual Robot- Sakharam

Auto Robot- Tukaram

1. Manual Robot starts his day by collecting dabbas from the house (coded dabba) and canteen (dabba without code) by sliding the door and hands over both the dabbas to Auto Robot at Virar Station (VR).
2. Auto Robot then starts his journey from Virar Station (VR) towards Andheri Station (AD). [Path1]
3. Meanwhile, Manual Robot reaches Andheri Station (AD) by road. There, he meets Auto Robot and hangs two dabbas (uncoded dabba carried by Auto Robot and another dabba which is already placed on the arena) onto the cycle carrier.
4. Manual Robot then helps Auto Robot in finding correct path according to the code on the dabba (coded) by filling in the auto track cavity in the path with the correct bun depending upon the code.
5. Manual Robot delivers the dabba which was initially hanging on the cycle carrier to its correct destination according to code on the dabba.
6. Then Manual Robot sorts the dabbas according to the railway lines (Western and Central).
Note- The sorting tray consists of 5 dabbas, each of which has a letter (W - Western / C- Central) written on it. Manual bot must sort the dabbas according to the railway line. Sorting can be done in a minimum of 3 moves.
7. Auto Robot reaches the destination station [Chhatrapati Shivaji Maharaj Terminus (CSMT) / Churchgate Station (CCG)] via Dadar Junction (**MUST**) [Path 2A/ Path2B] and hands over the dabba (coded) to Manual Robot. Manual Robot delivers the dabba to the correct destination depending on the code.
8. Manual Robot completes the 6-Sigma task and gives the “SHARE” sticker to Auto Robot. **6 - SIGMA TASK:** Manual Robot rotates the 6-sigma wheel to pull out the “SHARE” sticker. Subsequently, Manual Robot unhangs the “SHARE” sticker and gives it to Auto Robot.
9. Auto Robot then travels towards Borivali Station (BO) with “SHARE” sticker via Dadar Junction (**MUST**). [Path 3A / Path 3B]
10. Now, Manual Robot picks up the dabba with leftover food, which is to be shared with homeless and takes it to the Share My Dabba Zone (SMDZ).
11. Then, Manual Robot picks the “SHARE” sticker and places it over the dabba with leftover food which is kept in the Share My Dabba Zone (SMDZ).
12. **FINAL TASK:** Manual Robot places the “Gandhi Topi” on the statue in the Tribute Zone (TZ). (Final task can only be executed after **ALL** the other tasks are completed.)

END OF TASK

CODES:

- 1. PARTICIPANTS MUST PLACE THE CODED DABBAS ON THE CORRECT DESTINATION AS PER CODE GIVEN ON THE DABBAS. FOR THE DABBA CODING SYSTEM, REFER FIG.17**
- 2. PARTICIPANTS ARE NOT ALLOWED TO TOUCH ANY OF THE PROPS.**
- 3. PARTICIPANTS MUST BE READY WITH THE SUITABLE PROGRAM FOR THE AUTO ROBOT FOR ANY POSSIBLE COMBINATION OF PATH CODE AND SIDE OF ARENA.**
- 4. NO HAND TOUCH WILL BE ALLOWED AFTER PLACING THE TRACKBUN IN THE AUTO TRACK CAVITY FOR SELECTING PATH TO DESTINATION STATION. PARTICIPANTS CAN ASK ORGANIZERS TO SELECT THE CODE AT THIS POINT. THE SWITCH USED FOR THIS MUST BE EASILY ACCESSIBLE AND VISIBLE TO ORGANIZER.**
- 5. HAND TOUCH WILL BE PROVIDED AT FOLLOWING STATIONS:**
 - 1) VIRAR STATION (VR).**
 - 2) ANDHERI STATION (AD).**
 - 3) CHATRAPATI SHIVAJI MAHARAJ TERMINUS (CSMT) OR CHURCHGATE SATION (CCG).**

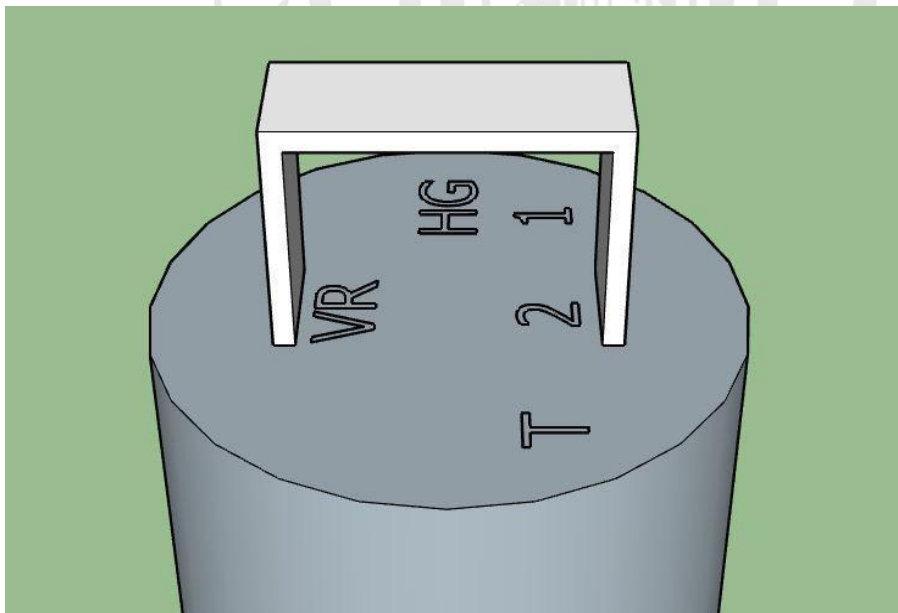


FIG 16: CODED DABBA

***ALL COLOURS ARE GIVEN FOR REFERENCE ONLY AND MAY BE SUBJECT TO CHANGE. ***

DABBAWALA'S CODING SYSTEM:

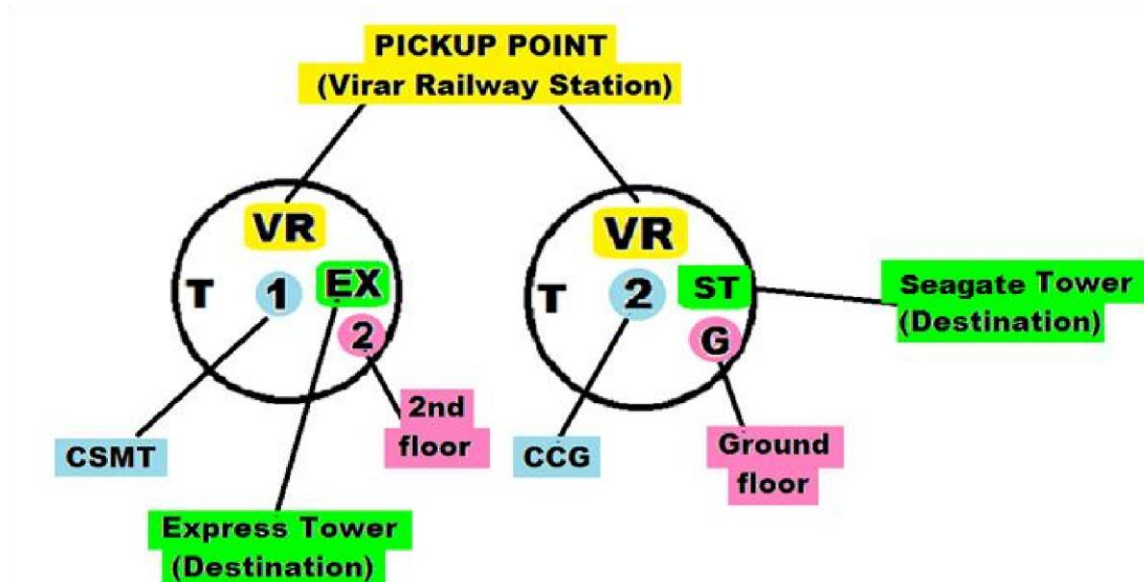


FIG 17

VR– Pick up point (Virar railway station)

EX2OR STG

EX- TOWER name (Express Tower)

ST- TOWER name (Seagate Tower)

2–Second Floor

1- First Floor

G- Ground Floor

(The number written below the initials of the building represents the floor.)

1–Destination railway station (1-CSMT/2-CCG)

T–Code for Dabbawala residential station (constant)

NOTE- THESE ARE SOME EXAMPLES OF THE POSSIBLE CODES IN THE GAME AND MAY VARY IN THE GAME. DIFFERENT CODED DABBAS WILL BE GIVEN FOR EVERY GAME. PARTICIPANTS MUST DECODE THE CODE ON THE DABBAS AND MUST PLACE THE DABBAS CORRECTLY ON THE APPROPRIATE TOWER ACCORDING TO THE CODE.



GAME RULES:

1. The maximum time given for completing the tasks is 5 minutes.
2. The operator of Sakharam (Manual robot) cannot be changed during the match.
3. Auto Robot is allowed to move in the auto zone only.
4. Manual Robot cannot drag the dabbas and must pick /place /hang them appropriately in their correct zones.
5. If suppose Manual bot drops any of dabba/sticker/Gandhi Topi, it must restart the current task.
6. In case of a wired robot, the wire must be slack at any point of time during the game. The total length of wire extending from the remote control to the manual robot must be of minimum 2 meters.
7. After starting the Auto robot, the team member who performs the starting action must leave the game arena immediately.
8. Both the robots cannot enter the arena of the opponent's team.
9. Laptops/personal computers are not allowed near the arena once the match starts. Other Wi-Fi, Bluetooth, etc. devices must be switched off. The organizers hold the rights to check for these devices and their usage and disqualify the team.
10. The organizers may stop any robot 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 inflammable, combustible, explosive or potentially dangerous process.
11. **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.**
12. **In case of any disputes/discrepancies, the organizer's decision will be final and binding. The organizer reserves the right 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 team.**



SAFETY FOR THE ROBOTS:

- 1) All robots must be designed and manufactured so as to pose no danger of any kind to any person at the venue.
- 2) All robots must be designed and manufactured so as to cause no damage to any robots of the opposing team or to the game field.
- 3) Combustible-fuel-driven engines, explosives, high-pressure pneumatics (e.g. 1 mega Pascal), power-generating chemicals, and undamped spring actuators (which make an action less than half a second) are all prohibited for motion propulsion or expansion of Robot's size.

If a laser emitting device is used, it must be of class 2 or less. In deploying the laser, full care must be taken to protect all people at the venue from harm during all procedures. In particular, the laser beams must be oriented such that the beam will not be aimed sloping upwards, or horizontally to hit the eyes of sitting spectators

RESTARTS:

- 1) If suppose the Auto robot drops dabba or sticker, it must restart from its previous destination.
- 2) If the Auto robot doesn't choose the correct path, then it must restart from the starting point of the previous task.
- 3) In case of a restart, the timer will not be set back to zero and time will not be paused.
- 4) During restarts for the Auto robot, a contestant cannot feed any information to it. However, participants are allowed to adjust sensor (gain, position etc.) and make minor repairs. A participant should not alter it in a manner that changes its weight (e.g. removal of a bulky sensor array or switching to lighter batteries to get better speed).

Any restart for Auto robot requires the approval of the organizers before it can be removed from the arena. If removed without approval, it will be considered as a violation.

ROBOT SPECIFICATIONS:

One- Manual robot (SAKHARAM BHAU)

One- Line follower robot (TUKARAM BHAU) are required for each team.

- **Tukaram Bhau (Auto Robot)-**

1. The Auto robot must be completely autonomous and it must run on principles of line following.
2. In VIRAR STATION (VR), the Auto robot should not exceed the dimensions of size **35cm×35cm×60cm** (l×b×h). Auto robot can expand, stretch or extend within a cylinder of length 60cm considered from the top view. No stretch up in height is allowed.
3. The starting procedure of Auto robot should be simple and should not involve giving it any manual force or impulse in any direction.
4. The Weight of the Auto robot should not exceed **8 Kg**.
5. Auto robot must be a single body and should not split into parts.
6. Only one Auto robot is allowed.

- **Sakharam Bhau (Manual Robot)**

1. Teams should use wired or wireless remote control for controlling the Sakharam (M) Bhau robot.
2. Only one team member is allowed to control the robot in the game field.
3. The robot should not exceed the dimensions of 50cm×50cm×60 cm(l×b×h). Manual robot can expand, stretch or extend without any limits after the start of the run.
4. Manual robot is not allowed to leave anything behind or make any marks while traversing or damage the arena in any way. If it is found damaging the arena, the team will be immediately disqualified.
5. The Manual robot cannot be constructed using readymade Lego kits or any readymade mechanism or readymade base/chassis. However, readymade gear assemblies can be used. Violating this clause will lead to disqualification of the team.
6. Only one manual robot is allowed.

POWER SUPPLY:

1. Both the Robots must use an on-board power supply. External power supply is not allowed and will not be given.
2. The potential difference between any two points should not be greater than 24V DC.

CONTROLS:

1. Manual robot (SAKHARAM BHAU (M)) should receive signal only from a single remote control. It can be wired or wireless.
2. Auto robot (TUKARAM BHAU (A)) cannot be controlled by wireless remote controller.

JUDGING CRITERIA:

1. 10 Points for sliding the house door.
2. 05+05 points for placing two dabbas on the Auto Robot at Virar Station(VR).
3. 10 points will be awarded to the Auto Robot for carrying dabbas to the Andheri station (AD).
4. 10 +10 for hanging dabbas on cycle carrier (one of the dabbas will be carried by Auto Robot and the other will be placed on the arena itself).
5. 10 points for placing the dabba (hung on the cycle carrier) on its appropriate place as per the code.
6. 15 points for sorting dabbas according to the code. Points will only be given for sorting **ALL** the dabbas correctly.
7. 10 points will be awarded to Manual bot for filling the auto track cavity on the auto path by appropriate bun according to the station code given on the dabba.
8. 15 points will be given to the Auto Robot for successfully taking the dabbas to the station as per code on dabba.
9. 20 points for delivery of dabba by Manual bot to destination tower and correct floor as per code on dabba brought by Auto Robot to the destination station.
10. 20 points for rotating the 6-sigma wheel and to pull and unhang the „SHARE“ sticker from the hook and placing on the Auto Robot.
11. 10 points for placing dabba to be shared in Share My Dabba Zone (SMDZ).
12. 10 points for taking “Share” sticker to Borivali Station (BO).
13. 10 points for placing “Share” sticker (carried by Auto Robot) on dabba with leftover food which is to be shared with homeless.
14. 10 points for placing "Gandhi Topi" on statue i.e. end of gameplay.

- **PARTICIPANTS CAN SKIP A TASK AT THE COST OF 10 POINTS. THE TASKS THAT CAN BE SKIPPED ARE:**
 - **Sliding of the house door.**
 - **6-σ task.**
 - **Auto track slot.**

VIOLATIONS:

1. The team with five violations in a match will be disqualified. Negative scores may appear in some cases.
2. When the Violations occur, 10 points will be deducted from the team. The team must bring the violating Robot back to the point where the referee indicates. The Violations are categorized as followed:
 - a. Any part of the Robot entering their respective restricted areas. The Auto robot cannot enter in Manual Robot and vice versa.
 - b. Other actions that infringe on the rules without mentioning in the Disqualification are considered as Violation.

DISQUALIFICATION:

1. A team will be disqualified if it commits any of the following actions during the match:
 - a) The team performs any acts that are not in the spirit of fair play.
 - b) The team fails to obey instructions or warnings issued by the referees.
 - c) Automatic Robots must not receive remote instructions from any human in the venue, sent via any form of RF or non-RF communication. Doing so will lead to disqualification.
 - d) The team has made five Violations in the same match.
2. Auto Robot is not allowed to leave anything behind or make any marks while traversing or damage the arena in the autonomous zone. Any Robot found damaging the arena will be disqualified immediately.

FINAL SCORE:

1. Team completing the tasks first will be considered as winners.
2. If both the teams could not complete the tasks then the team with maximum points will be the winner.
3. The rules and the regulations for the tie break would be told by the organizers before the event.



TECHNOVANZA

THIS IS THE BASIC GAMEPLAY, KEEP CHECKING FOR UPDATES OR MODIFICATIONS ON THE WEBSITE REGULARLY.

ANY INGENIOUS EXPLOITATION OF THE MENTIONED RULES/GAMEPLAY MUST BE NOTIFIED TO AND CLARIFIED WITH THE ORGANISERS BEFORE HAND.

IN CASE OF ANY AMBIGUITY, FEEL FREE TO CONTACT.

REPORTING TIME ON 26th December is 8:30AM to 9:30AM.

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