Hotel Guest Service

1. Introduction

Tourism plays a major role in the development of any nation. Hospitality industry entails providing efficient and proper services to its customers and it is the satisfied customers that bring more business. With many technologies available in hand, customers expect improved and quick services. It is in the interest of the hospitality industry to provide technology enabled guest services as this industry is a major source of revenue and development of a region.

Typically, in a hotel the guest calls the reception or housekeeping for various services. If the staff has many requests in hand, it will take time to process them and also there is a chance of incorrect service being provided, which will annoy the guest and hamper business. It is also required to provide immediate service to priority customers who pay premium rates.

If some of these services can be automated, it will help in minimizing errors in the service provided. With this objective, one of the themes presented in eYantra Robotics Competition (eYRC 2015) is "Hotel Guest Service".

A hotel wing has been abstracted as an arena for this theme. Guests indicate their service requests outside their doors. The Robot has to be programmed to traverse this hotel wing and look for service requests and provide them in the order of priority. One of the services that the robot has to provide is removal of trash from the guests' rooms.

The Robot that provides the requested services correctly in the minimum amount of time will be declared the WINNER.

2. Theme Description

a. A hotel has been abstracted on an arena for the competition.

*   **Hotel Wing**: There are four rooms in the hotel wing, referred to as **RoomA**, **RoomB**, **RoomC** and **RoomD.**

*   At the entrance of each room, two rectangular areas are marked on the arena on which thermocol **Indicators** of different colors will be placed which will indicate the service requested by a room.

    We use IA-1 to represent the left Indicator in RoomA and IA-2 to represent the right Indicator in RoomA (Refer to Figure 1). Similar notation is used for the other rooms.
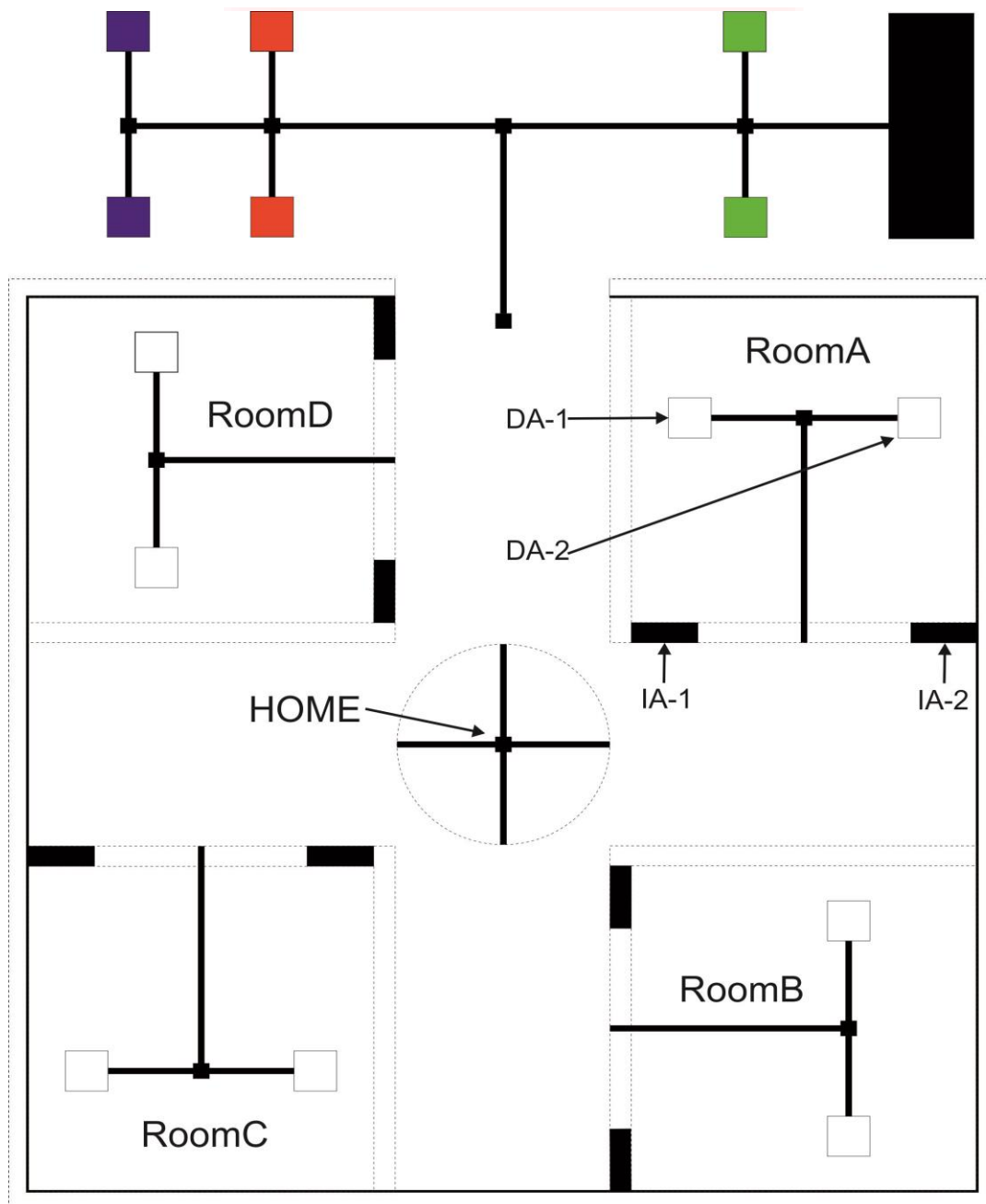

Figure 1: Arena

- Indicators are of four colors Red (R), Green (G), Blue (B), and Black (Bk).
  R, G and B represent the **Type of Service** requested by a room while Bk is used as a placeholder.
  For a room,
    i. If one of the Indicator is R, B or G and the other Indicator is Bk, it represents a **Regular Room** requesting that colored service.
    ii. If both Indicators are of same color (R, B or G), it represents a **VIP Room** requesting that colored service.
    iii. If both the Indicators are Bk, it represents **Do Not Disturb** Room: and robot should not enter that room.

- Thermocol blocks of three colors Red (R), Blue (B) and Green (G) are used to represent types of **Services**. These blocks are placed in the **Service Area** as shown in Figure 2.

- White colored thermocol block is used to represent the **Garbage**.

- Within each room there are two rectangular areas where service requested need to be placed; these are termed as **Deposition Zones.**
  Each room has two Deposition Zones. We use DA-1 to represent the left Deposition Zone and DA-2 to represent the right Deposition Zone in **RoomA** (Refer to Figure 1). Similar notation is used for the other rooms.

- At the time of competition Deposition Zone contains: (i) **No garbage** – when the Deposition Zone is empty or (ii) **Garbage** – when a white colored block is present at the Deposition Zone. Note that a maximum of ONE Garbage will be present in a room.

- Within the Service Area there is a **Garbage Dumping Section** marked in black (Refer to Figure 2) where all the collected Garbage should be dumped.
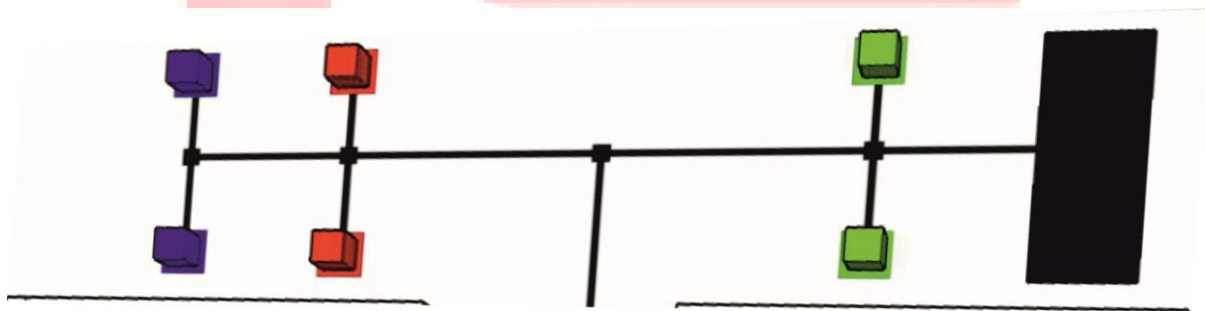

Figure 2: Service Area

- **RGB LED**: It is a three-colored Light Emitting Diode (LED) which is used for identification of the color of the Indicators -- RED, GREEN, or BLUE. Two RGB LEDs are provided in the robotic kit.

b. Make an autonomous robot which traverses the arena and does the following:

- The robot starts from the **HOME** position at the center of the arena and does the following:
  1. Identifies service requested by a room and glows corresponding color on **RGB LED** for 1 second by detecting the Indicators on either side of the entrance of the room.

     Example:
       a) For a Regular Room requesting Red colored service, glows Red color on RGB LED for 1 second when the R Indicator is detected and remains in off position at the Bk Indicator.
       b) For a VIP room requesting Red colored service, glows Red color on RGB LED for 1 second at each of the Indicators.
       c) For Do Not Disturb room LED should remain off at both the Indicators.

  2. Services a room by picking corresponding service from Service Area and depositing it in either of the Deposition Zones that is empty.

  3. Collects the Garbage if it is present in a room and dumps it into the Garbage Dumping Section.

  4. Returns to HOME position and beeps a continuous buzzer for 5 second, after servicing all the requests and dumping all the Garbage, indicating completion of the task.

  Important:
  - **Only one room will be designated as a VIP room in the competition. If it is identified correctly and serviced before all the other rooms, bonus points will be awarded to the team.**
  - **Steps 1-4 can be implemented in any order as desired by the team to maximize the points and minimize the time for completing the task. Teams are free to design the algorithm and mechanism for completing the task in the best possible manner.**

3. ARENA

The arena for this theme is a simplified abstraction of a hotel with dimensions as shown in Figure 3.
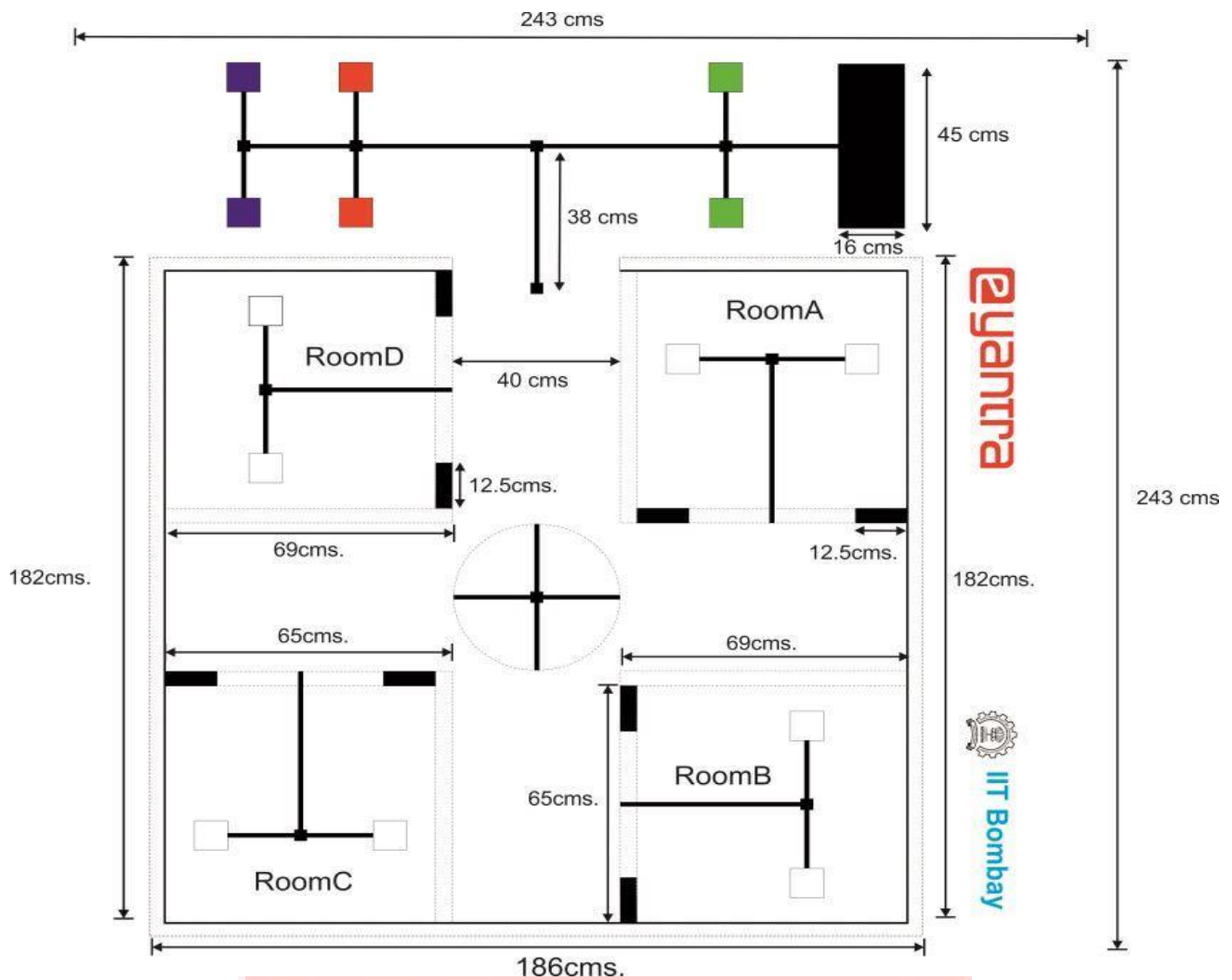

Figure 3: Arena with Dimensions

Preparing the arena:

Each team prepares the arena. Preparing the arena consists of five major steps:

1. Printing the arena design on flex sheet.
2. Preparing and placing the walls.
3. Preparing the Indicators, Garbage and Services.
4. Placing the Services.
5. Placing Indicators and Garbage.

NOTE: Teams are not allowed to make any changes in the arena design. Any team making unauthorized modifications will be disqualified from the competition.

3.1. Printing the arena design on flex sheet:

Arena design in shown in Figure 3. A Corel Draw (.cdr) file containing the flex design will be provided to the teams. Each team prints the flex design according to the direction given in the .cdr file.

WARNING: Please be careful while handling the flex sheet–avoid folding it like a bed-sheet since the resultant folds will cause problems while the robot moves. One way of "flattening" flex if it has been compromised is to hang it for a few hours in the sun -- it tends to straighten out. Never attempt ironing it or applying heat of any kind -- it may be a fire hazard.

Details of arena design:
- Dimension of the arena sheet is 186cm x 243cm.
- Dimension of the flex sheet is 243cm x 243 cm. A small margin is provided on all the sides to allow for sticking the flex sheet on the ground (Refer to Figure 3).
- All rooms have the same dimensions: 69cm x 69cm.
- Height of every wall is 20cm.
- The size of each Deposition Zone is 8cm x 8cm.
- Each room consists of a path of black lines of 1.2cm thickness as shown in the arena.
- Square nodes of 3cm x 3cm dimension have been provided along the black lines for localization.

3.2. Preparing and placing the walls:

Preparing the walls:

Materials required for preparing the walls:
- Thermocol sheets.

There are 2 types of **wall sections** used in the arena:
- **Outer Wall**: There are two types of Outer Walls required:
  Outer Wall 1: One wall of dimension 186cm x 4cm x 20cm.

  Outer Wall 2: Two walls of dimension 182cm x 4cm x 20cm.
  These three walls are placed on the periphery of the hotel wing. These are fixed permanently to the flex (Refer to Figure 4).

- **Inner Wall:** Six Inner Walls are used for the creation of rooms within the hotel wing each of dimension 69cm x 4cm x 20cm.

Note: If a single sheet of required length is not available, then two or more smaller pieces can be joined to form a single wall of required size. For example: Sheet 1 (100cm x 4cm x 20cm) + Sheet 2 (86cm x 4cm x 20cm) can work as an outer wall 1(186cm x 4cm x 20cm) when joined together.

Placing walls:

- Stick the Outer Walls and Inner Walls permanently to the arena using double sided tape or any other suitable adhesives. After this step the arena should look like Figure 4.
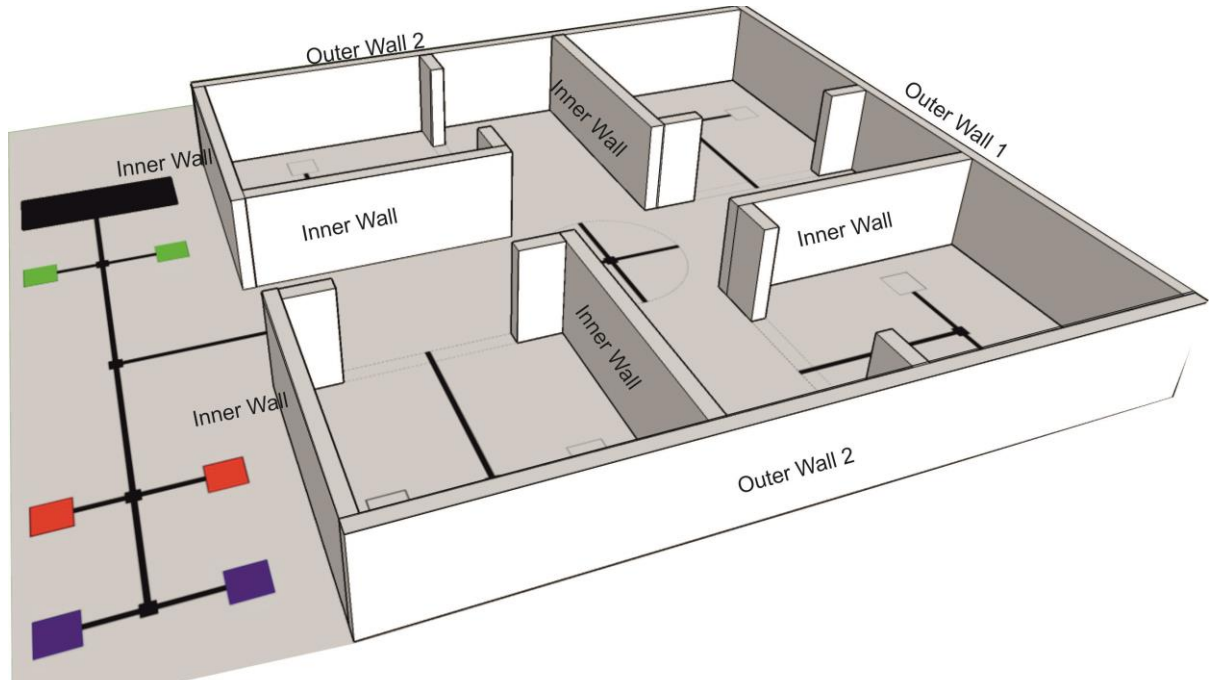

Figure 4: Wall Placement

3.3. Preparing the Indicator, Garbage and Service:

Preparing the Indicators:

Materials required for preparing the Indicators:
- Thermocol sheets.

- Red, Blue, Green and Black color chart paper.

- Sample chart paper of all these colors are provided in your kit. Teams may need to purchase additional chart paper for preparing the Indicators. If the exact same colored chart papers given as a sample in the kit could not be found, chart paper with minimal variation in the color is allowed to use. However, we recommend that you take the sample chart paper and exactly match these when you buy additional chart paper. All the colors given as samples have been tested for detection by the sensors provided with the robot. Note that the similar chart papers as in the sample will be used in the Finals of the competition.

- Team prepares three Indicators each of Red (R), Green (G), Blue (B) and Black (Bk) color of dimension 12.5cm x 4cm x 20cm (Refer to Figure 5) by covering the thermocol with respective chart papers.
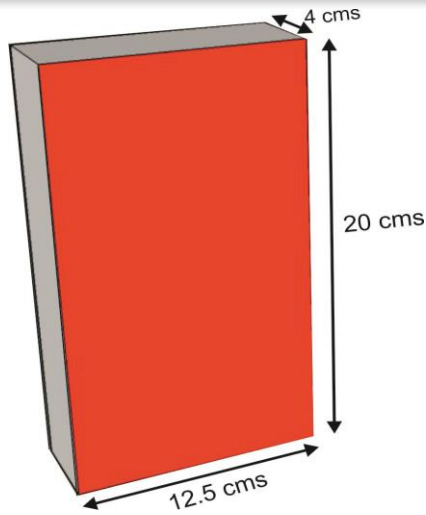
Figure 5: Red (R) Indicator

Preparing the Services and garbage:

- Dimension of each Service block is 6cm x 6cm x 6cm.
- Team prepares 2 Services each of Red (R), Green (G) and Blue (B) by covering the blocks with respective colored chart paper. A Red (R) Service is shown as an example in Figure 6.
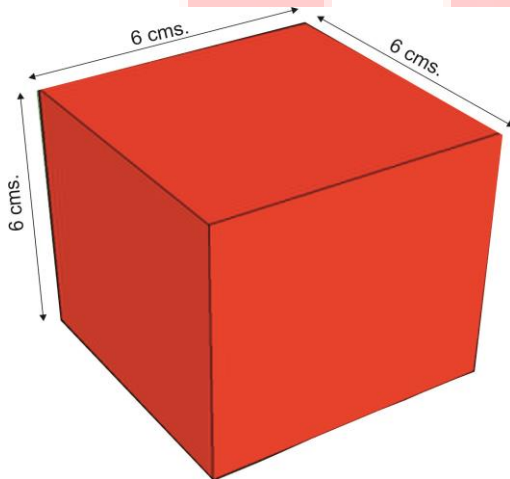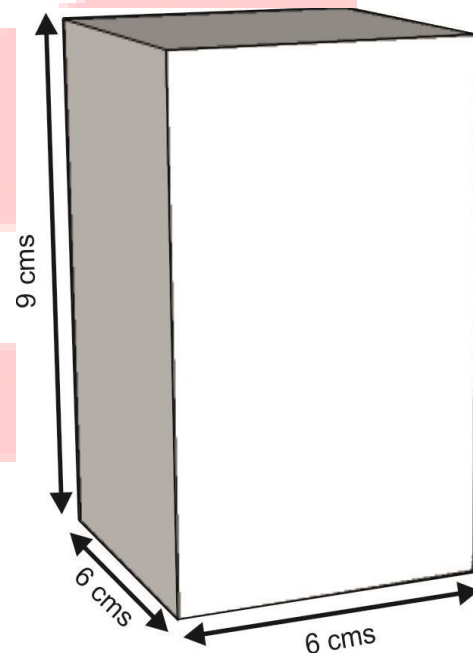

Figure 6: Red (R) Service

Figure 7: Garbage

- Team prepares garbage - 4 blocks of size 6cm x 6cm x 9cm with the thermocol sheets as shown in Figure 7.

3.4. Placing Services:

Prepared Services are to be placed in the Service Area in the middle of the respective 8cm x 8cm colored rectangular areas as shown in Figure 8.

Figure 8: Service Placement

3.5. Placing Indicators and Garbage:

Placement of Indicators and Garbage are defined in a **Configuration Table**. An example Configuration Table is given in Figure 9.

Configuration Table

Room(*)	I*-1	I*-2	D*-1	D*-2
A	Green	Black	Garbage	Empty
B	Red	Black	Empty	Empty
C	Blue	Blue	Empty	Empty
D	Red	Black	Empty	Garbage

Figure 9: Example Configuration Table

Important Note: * represents the respective rooms (A, B, C and D)

From the Configuration Table, for RoomA **IA-1** is a **Green Indicator** and **IA-2** is a **Black Indicator**. The **Garbage** is present at the left Deposition Zone in RoomA i.e. **DA-1**. RoomC is a VIP room requesting Red Service. Figure 10 shows the placement of Indicators for RoomC.
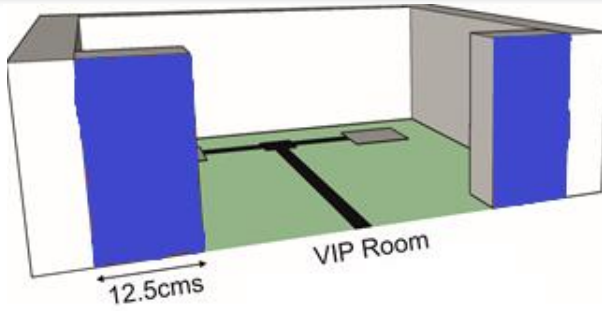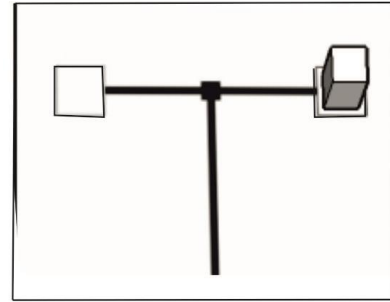
Figure 10: Placement of Indicators for RoomC

Figure 11: Garbage Placement

- Garbage is placed at the center of the specified Deposition Zone of dimension 8cm x 8cm as shown in Figure 11.

After placing Indicators and Garbage according to the Configuration Table, the arena will look as shown in Figure 12:
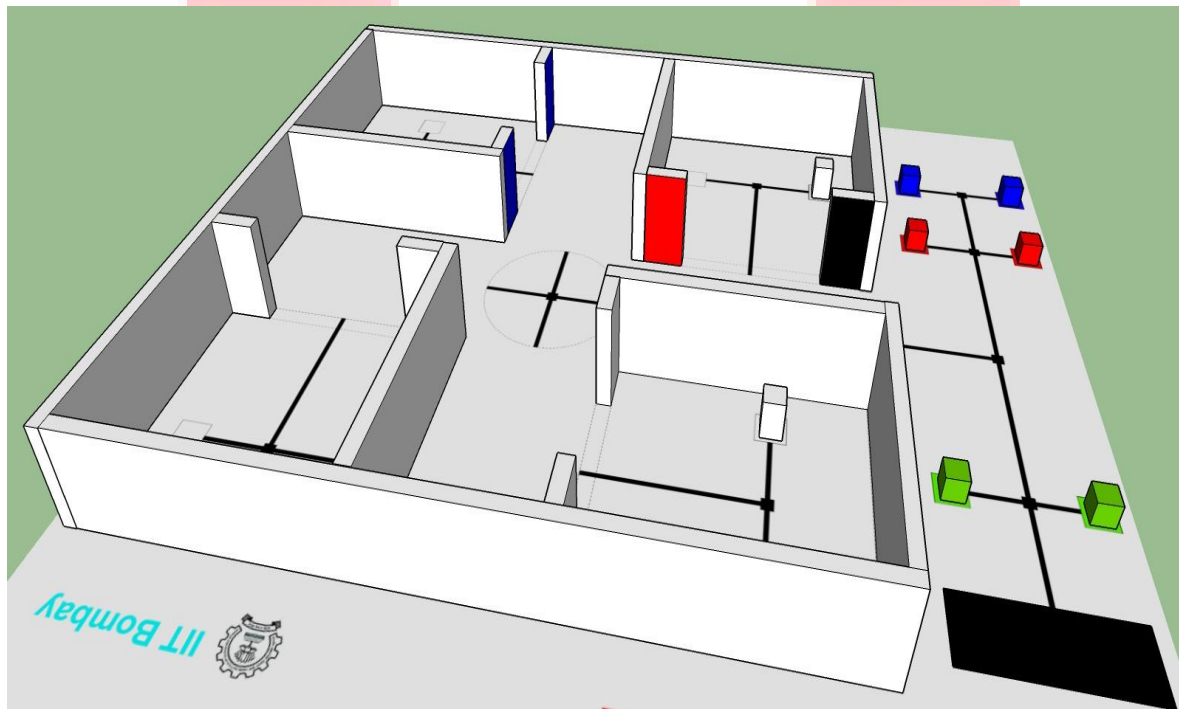

Figure 12: Final Arena

- This is an example used to illustrate the placement of Indicators and garbage. In the competition, they will be placed randomly. Thus, it is mandatory that you use the sensors to identify them.

NOTE: Accurate calibration of the sensors is key to successful implementation of a solution to this theme. You should make the sensing as robust as possible under different lighting conditions. Also take care in the fabrication of blocks since the proper sizing; positioning and positional stability of blocks might make the difference between failure and success.

WARNING: If the arena is found damaged or in a condition that makes evaluation difficult, e-Yantra has the right to disqualify a team. The final decision is at the discretion of the reviewer.

4. Hardware Specifications

4.1 Use of Firebird V:
- All participating teams must use **only** the Firebird V robot sent to them in the kit. **Only one** robot given in the kit is allowed per team.
- Team shall not dismantle the robot.
- The robot should be **completely autonomous**. The team is not allowed to use any wireless remote or any other communication protocol or devices such as a camera while the robot is performing the task.

4.2 Use of additional components not provided in the kit:
- No other microcontroller-based board shall be attached to the Firebird-V robot.
- Teams **may connect external actuators** along with their driver circuits to the Firebird V robot only on the condition that the actuators must be controlled through the Firebird V robot.
- The team is **not allowed** to use any other sensors apart from those provided in the kit.

4.3 Power Supply:
- The robot can be charged through battery or auxiliary power supply. These are shipped with the robot.
- The team cannot use any other power source for powering the robot.
- The team can use auxiliary power during practice but the final demonstration should only be made using only battery powered robot.

5. Software Specifications

- e-Yantra has provided all teams with ATMEL STUDIO 6, a free software for programming AVR microcontroller. Participating teams are free to use any other open source Integrated Development Environment (IDE) for programming AVR microcontroller.
- As per e-Yantra policy, all your code and documents are open-source and maybe published on the e-Yantra website.

6. Theme Rules

- The maximum time given for completing the task is 10 minutes. A maximum of **two runs** will be given to a team (the better score from the two runs will be considered as team's final score). A maximum of **two restarts** (explained below) are allowed in each run.
- Participants are not allowed to keep anything inside the arena other than the robot.
- The time measured by the reviewer will be final and will be used for scoring the teams. Time measured by any participant by any other means is not acceptable for scoring.
- The room naming conventions should never be changed under any circumstances. Refer to Figure 1 for the convention used in the competition.
- Robot should be kept at the HOME position with the castor wheel of the robot positioned on the node facing the gallery between RoomA and RoomB before the start of the run.
- Once the robot starts moving on the arena, participants are not allowed to touch the robot.
- The team should **Switch ON** the robot when asked by the reviewer. This is the start of a **run**. The timer will start at the same time.
- There will be a **maximum** of **four Service requests**, with no room requesting more than one service.
- Arena will have a **maximum of one VIP Room**.
- Once the robot is switched on, human intervention is NOT allowed.
- Robot should deposit the Service in the appropriate Deposition Zone inside the room.
- A room is considered as serviced even if the Service is partially placed within the boundary of an empty Deposition Zone (Refer to Figure 13).
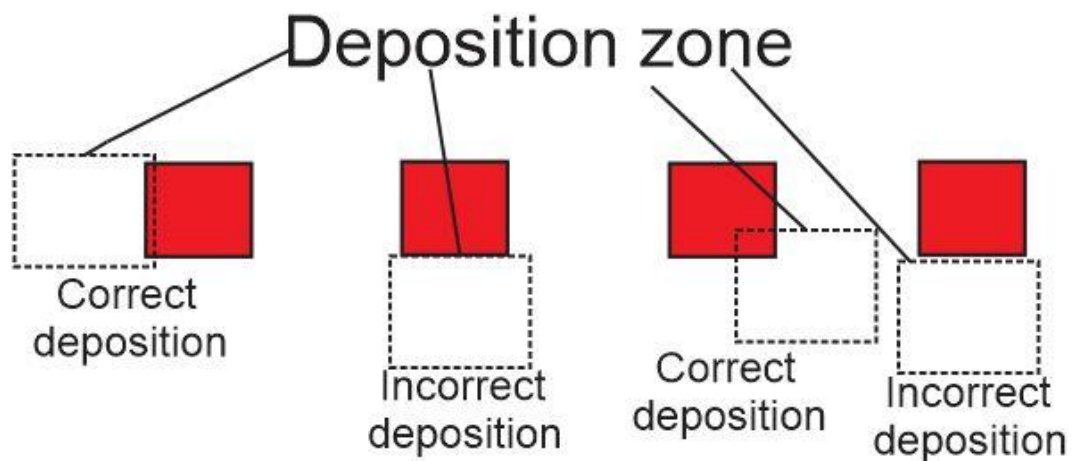

Figure 13: Correct Deposition of Services

- If a Do Not Disturb room is identified, robot should not enter this room.
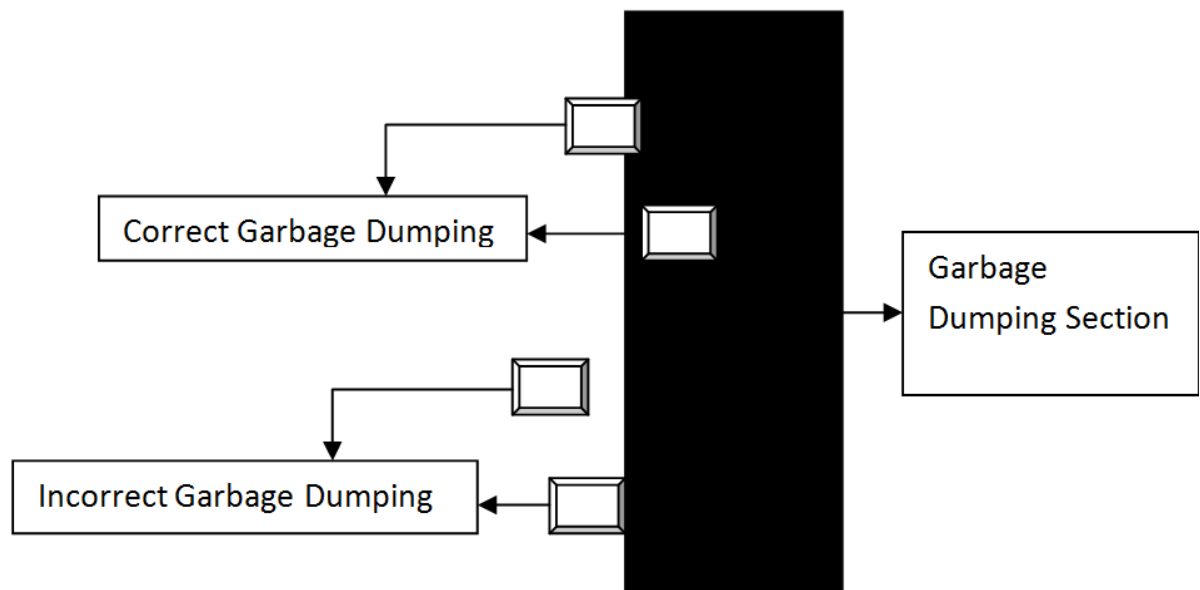- Garbage is dumped in the Garbage Dumping Section as shown in Figure 14.

Figure 14: Garbage Dumping

- A run ends and the timer is stopped when:
  ○ The robot stops and sounds continuous buzzer or
  ○ If the maximum time limit for completing the task is reached or
  ○ If the team needs repositioning but has used both reposition options for that run.
- Buzzer sound for more than **5 seconds** will be considered as continuous buzzer.

- The second run will start once again with resetting the score, timer and arena. The score of both runs will be recorded and best of two runs will be considered as the team's final score.

The robot is not allowed to make any marks while traversing the arena. Any robot found damaging the arena will be immediately stopped; repositioning will be allowed as per the rules. **The final decision is at the discretion of the e-Yantra team.**

Restart:

1. Restart is done under following circumstances:
- If robot is found to be displacing any block or damaging the arena then it will be kept at the HOME position.
- If the robot gets stuck in the arena or goes off the arena, teams can ask for a restart.

2. For a restart, the robot should be in Power Off mode, and turned on again at the HOME position, upon signal from the reviewer. During a restart, the timer will not be set back to zero.

3. Each team is allowed a maximum of two restarts in each run. Both restarts require the approval of the reviewer; the team will be disqualified if the robot is handled within the arena without approval.

4. During restarts, a participant must not feed any information to the robot. A participant may not alter a robot in a manner that alters its weight. The reviewer's decision is final.

5. After restart the robot has to complete the remaining task; the tasks completed previously will be counted in the score.

Note:

- You will be given a configuration table just before the submission of Task 3: Video submission along with instructions to complete this task.

- After completion of all tasks, teams will be selected as finalists based on their cumulative scores across all the tasks. Complete rules and instructions for the finals at IIT Bombay will be sent to those teams that qualify for the finals.

- In case of any disputes/discrepancies, e-Yantra's decision is final and binding. e-Yantra reserves the rights to change any or all of the rules as we deem fit. Any change in rules will be highlighted on the website and notified to the participating teams.

7. Judging and Scoring System

- The competition time for a team starts from the moment the robot is switched ON. The timer will stop as soon as the robot finishes the task.
- The better score of the two runs for a team will be considered as the final score of the team.

The team's total score is calculated by the following formula:

Total Score = (600 - T) + (CSRD*50) + (CD*100) + (GD*100) +OB + VIPB – (P*30)

Where:

✓ **Total time (T):**
T is the total time in seconds taken to complete the task.

✓ **Correct Service Request Detection (CSRD):**
CSRD is the total number of correctly detected **Service Requested**. It is considered correct if the robot glows the corresponding RGB LED color for 1 second after detecting a Service Requested**.**

✓ **Correct Deposition (CD):**
CD is the total number of correctly delivered Services. Note that a Service is considered delivered when an appropriate block is placed inside a Deposition Zone as described in Theme Rules.

✓ **Garbage Deposition (GD):**
GD is the total number of garbage blocks **picked and dumped** in the Garbage Dumping Section.

✓ **VIP Room Bonus (VIPB):**
VIPB is a bonus of 200 points awarded when a VIP room is serviced first with the requested service before servicing Regular Rooms.

✓ **Penalty (P):**
P is penalty where thirty points are deducted whenever:
1. The robot enters a Do Not Disturb Room.
2. The robot dashes against the walls or displaces any part of the arena during the run.

✓ **Overall Bonus Points (OB):**
100 Bonus points will be awarded, if the robot does **ALL** of the following:
- Detects all Indicators correctly.
- Services all rooms correctly.
- Dumps all the garbage blocks in the Garbage Dumping Section.

- Completes task before 10 minutes.
- Doesn't incur any penalties.
- Returns to HOME position and sounds a continuous buzzer of more than 5 seconds.

ALL THE BEST!!!!