Updated: 09 August 2016

1. Concept

The percentage of world aging population has been rapidly increasing due to the advancement in medical science. One of the main issues of the aging population is that their health problems require them to take more medicines than younger population.

As a result, elderly people with many diseases tend to end up with taking multiple medicines at the same time. However, there are many physical effects of aging such as changing eyesight and memory disorder which are at greatest risk for taking medicines correctly.

One way to help solving this problem is to use a pillbox to make it easier for them to manage their medication lists. However, it might be inconvenience for them to fill up a pillbox with many types of medications and consequently the caregiver is need.

The contest's objective is to support contestants' creativity and engineering knowledge to build robots taking care of elder people by maximally filling the correct pills into corresponding pillboxes within the time limit.

2. Objective

The main objective of this contest is to design and construct robots to support elderly people by dropping in pills into corresponding pillboxes.

3. The Field

3.1 The robot contest is played on a 6 m x 4.3 m square field, as shown in Figure 1. The field can be divided into 4 main parts, which include 1) medicine shelves (A1 - A5), 2) slopes (B1 - B5), dispensation area locating in the front (C1) and the two sides of the field (C2 - C3), and 4) pillboxes (D1 - D2).

3.2 Slopes which are B1 to B5 located on top of the 40 mm field height, as shown in Figure 2. The medicine shelves are located on the slopes which are 1 m width and 1.5 m depth. There are three different heights of the slopes, including 1.1, 1.5, and 2 m for B1 and B5, B2 and B4, and B3, respectively.

3.3 The medicine shelves with 300 mm width, 170 mm height, and 188.5 mm depth are shown in Figure 3.

3.4 The C1 area has 0.3 m height, 6 m width, and 2.44 m depth. The starting points for the first robots of the red team and the blue team are in the C1.2 and C1.3 areas, while the starting points for the second robots are in the C2.1 and C3.1 areas, respectively. Some of yellow pills are placed on the C2.2 and C3.2 areas. Slopes C4.1 and C4.2 which are 0.82 m x 0.3 m x 0.1 m are located in front of the C2 and C3 areas.

3.5 Pillboxes D1 and D2 are located at C1.2 and C1.3 areas. Each box in the pillboxes has 0.5 m width, 0.3 m length, and 0.45 m height. In Figure 4, there are partitions with 100 mm height separating C1.2 and C1.3 from pillboxes D1 and D2.

4. Marking

4.1 A black tape with 25.4 mm width and 700 mm long is laid on C1.1 area at the center of each medical shelf.

5. The Pills

5.1 There are 4 different pill shapes, which include tablets, oval pills, capsules, and herb balls.

5.2 Pill sizes are shown in Figure 5. A tablet is 80 mm diameter and 40 mm thick. An oval pill is 70 mm width, 140 mm length, and 40 mm thick. A capsule is 70 mm diameter and 170 mm length and 70 mm thick. An herb ball is 80 mm diameter.

5.3 There are 60 pills coming in different shapes and each of the first three shapes has 8 pills in red and another 8 pills in blue color. For the herb balls, the total number of the pills is 12 in which there are 3 pills located at zone C2.2, another 3 pills located in the C3.2 area, 2 pills are located on the medicine shelves and the other 4 pills are placed on C1.1 area. Detail of the location of pills on the medicine shelves A1 – A5 is shown in Table 1.

6. Required Materials and Robot Rules

6.1 Each team will have to design and construct 2 robots for completing the task. The robots can be remotely controlled, fully autonomous, or semi-autonomous.

6.2 Materials allowed for robot construction

6.2.1 Materials supplied from the host and given to each team

6.2.2 Materials provided in the workshop

6.2.3 Other materials requested by any teams. After being approved by the committee members, it is their team's responsibility to buy them within the budget provided.

6.3 Inappropriate and dangerous materials are prohibited in building the two robots.

6.4 There are many forms of energy resource that are allowed to be used, which include gravitational potential energy, elastic potential energy, and energy from provided battery and air tank.

6.5 Robots can be built without shape and weight limit.

6.6 Robots must have a starting size of no larger than 500 mm x 500 mm x 500 mm; however, they can expand to any sizes during the round.

6.7 Two sets of radio control receivers and transmitters and control units supplied by the technical staff are required to be used for the two robots.

6.8 Each team must provide some kinds of protection, especially from impact, to the given devices (radio control receivers and transmitters and control units) so that they remain functionality. The team is responsible for the damage of the devices.

6.9 Teams can choose any control algorithms to be bested suited for their robots.

6.10 Robots and other provided equipment cannot be moved out of the field without permission.

7. Competition Rules

7.1 Two members from each team will take control of the two robots. These members are not allowed to switch with other members in the team during a round.

7.2 Prior to the start of each round, each team will have 60 seconds to setup their robots in their starting zones. For the red and blue teams, the first robot from each team will be located on the C2.1 and C3.1 zones and the second robots will be located on the C1.2 and C1.3 areas, respectively. Every parts of the robots must be inside the starting zones.

7.3 Robots can be moved out of their starting zones right after the starting signal.

7.4 The two robots are responsible to pick up the pills and drop them off in their corresponding pillboxes. The red team will need to pick up red tablets, oval pills and capsules and also yellow herb balls and then drop them in pillboxes D1. On the other hand, the blue team will need to pick up blue tablets, oval pills and capsules and yellow herb balls and drop them in pillboxes D2.

7.5 Each round will be 120 seconds long.

7.6 Other competition rules

7.6.1 In case that any robots potentially damage the field and other robots, or pose a hazard to teams and other people within the competition area, the committee members

can request the robots to stop and maintain them in a safe condition. However, the competition is still ongoing.

7.6.2 Any teams that not strictly respect the rules, the teams will be disqualified from that round.

7.6.3 One representative from each team can inform to the committee members if the team is not satisfied with the results either during or after the competition. This is needed to be done before the next round is starting. The committee members will discuss and make the final decision together with representatives from the two teams. However, the request without any proper reasons can result in a penalty or a loss in that game.

7.6.4 The competition rules are subject to change by the committee members to be best suited for the contest and the changes made will be informed to all the contestants.

8. Scoring

8.1 The score will be counted at the end of each round.

8.2 Each of red and blue pills being dropped from medicine shelves will score 0.5 point to the red and blue team respectively.

8.3 The team will score 1 point for each pill with the right shape and color dropped into its corresponding pillbox.

8.4 If the pill with its color or shape is filled into the wrong pillbox, the team will suffer a -1 point penalty.

8.5 The team with higher score points will win the game each round.

9. Prohibition

9.1 Robots are not allowed to enter the robots' starting points (C1.2 or C1.3) of the opposing team.

9.2 Team members are only allowed to filled up the pills into their pillboxes.

9.3 Robots must be controlled without any physical contact.

9.4 Taking any items out of the field is not allowed for this contest.

9.5 Damaging the field, robots, objects, or human is strictly forbidden.

9.6 Team members are not allowed to attempt to interfere with the opposing team's robots.

10. Figures and Table (Sizes might be subjected to change due to construction process.)

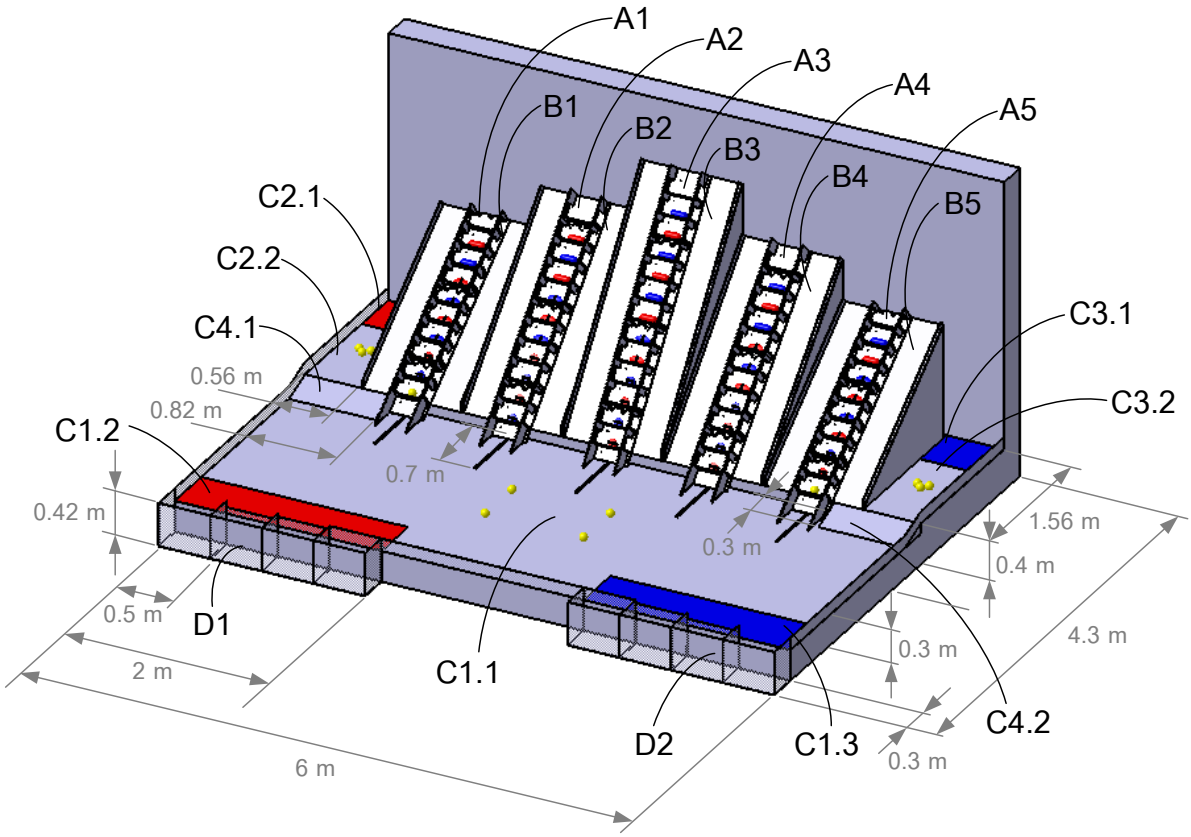


Figure 1: Field

A1 – A5	medicine shelves
B1 – B5	slopes
C1	dispensation area 1
C2 – C3	dispensation area 2 and 3
D1 – D2	pill boxes

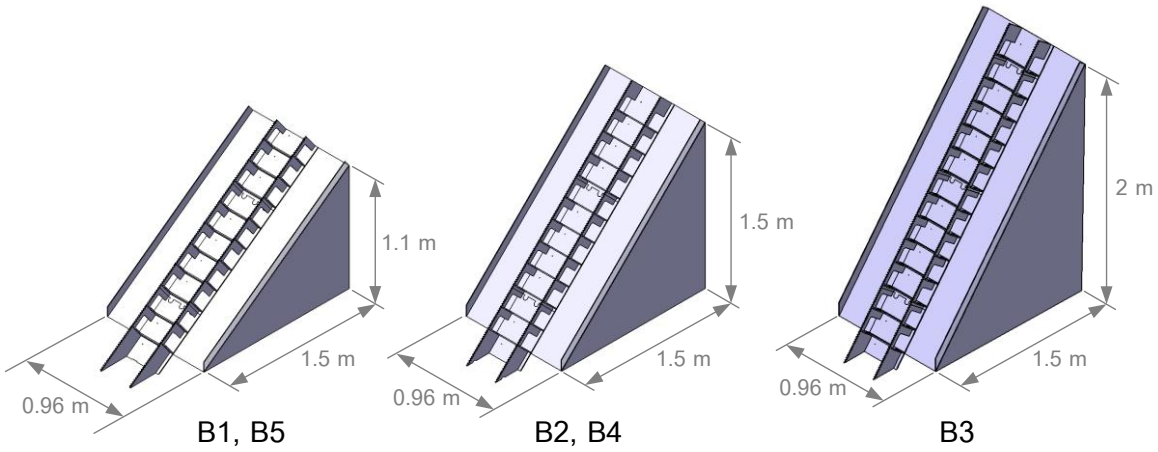


Figure 2: Slopes (B1 - B5)

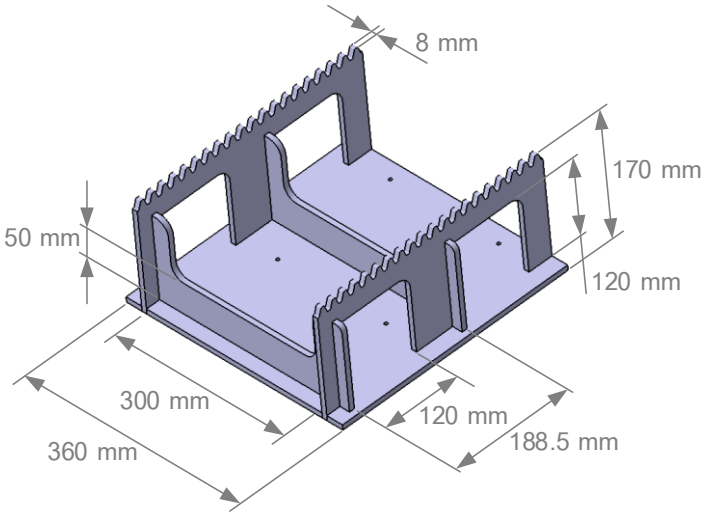


Figure 3: Example of medicine shelf

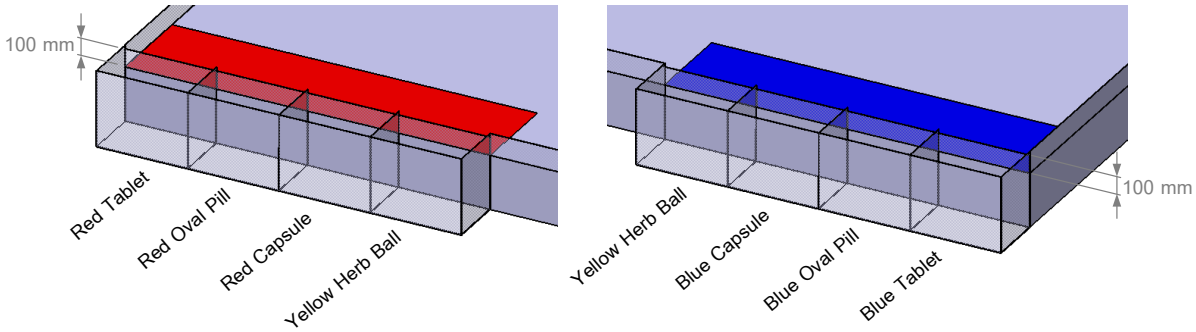


Figure 4: Pill boxes for the red team (D1) and the blue team (D2)

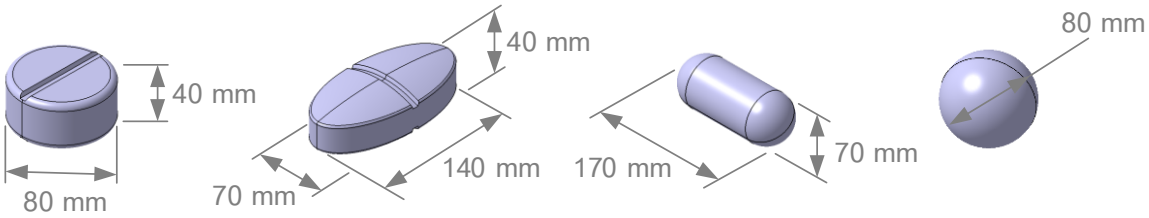
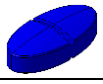
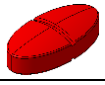
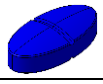
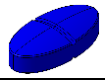
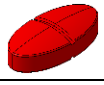
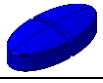
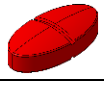


Figure 5: Different pill shapes including tablet, oval pill, capsule and herb ball

Table 1: Location of pills on the medicine shelves A1 – A5

	Shelf A1	Shelf A2	Shelf A3	Shelf A4	Shelf A5
12			Blue Capsule 		
11			Red Capsule 		
10		Red Capsule 	Blue Capsule 	Blue Capsule 	
9	Red Capsule 	Blue Capsule 	Red Capsule 	Red Capsule 	Blue Capsule 
8	Blue Capsule 	Red Capsule 	Blue Capsule 	Blue Capsule 	Red Capsule 
7	Red Oval Pill 	Blue Oval Pill 	Red Capsule 	Red Oval Pill 	Blue Oval Pill 
6	Blue Oval Pill 	Red Oval Pill 	Blue Oval Pill 	Blue Oval Pill 	Red Oval Pill 
5	Red Oval Pill 	Blue Oval Pill 	Red Oval Pill 	Red Oval Pill 	Blue Oval Pill 
4	Blue Oval Pill 	Red Tablet 	Blue Tablet 	Blue Tablet 	Red Oval Pill 
3	Red Tablet 	Blue Tablet 	Red Tablet 	Red Tablet 	Blue Tablet 
2	Blue Tablet	Red Tablet	Blue Tablet	Blue Tablet	Red Tablet
1	Yellow Herb Ball	Blue Tablet	Red Tablet	Red Tablet	Yellow Herb Ball