

Intelligent Service Competition -- Medical Delivery Robot

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1. Description

(1) Purpose

In recent years, the medical system has been overwhelmed due to the global pandemic, resulting in a significant increase in the demand for medical robots. To help students better understand the components and applications of medical robots, this competition aims to inspire students' creativity and understanding of the essence of medical robots. Competitors will design a mobile robot to identify the positions of objects displayed by a QR code, retrieve Contaminated Objects from the Contaminated Storage Shelf, place them in the designated area (Contaminated Waste Shelf), go disinfect itself in the Disinfection Zone, and then retrieve Clean Objects and put them in the designated area. Finally, the robot returns to the Starting Zone to complete the task.

(2) Rules

- a. Robots are required to move in Autonomous Control Mode.
- b. There will be no tape on the walls of the competition field.
- c. Only one controller (brand not limited) is allowed
- d. Team members cannot be changed after registration.
- e. Eligibility: students in high school or above.
- f. Registration: online registration without registration fee.
- g. Team composition: 2 students per team, one instructor, no repeat registration.
- h. The size of the robot body (length, width, height) is limited to 60 cm or less, and the weight is limited to 30 kg or less.
- i. The medical delivery robot body must be assembled with building blocks or 3D printing parts. Both can be used together, but commercially available products cannot be used for the competition.
- j. Load the competition program into your robot before the inspection. Once the inspection is done, competitors may not change or update the program. Please turn off the robot while placing it in the inspection area.
- k. The robot used during the competition must have the same body and cannot be replaced by a second robot.

(3) Indicator Lights and the Emergency Switch

The emergency switch and indicator lights must be installed at the highest position of the robot. The specifications of the robot indicator lights are as below:

Green	Power on
Yellow	Robot in Motion
Red	Emergency Button Pressed

(4) Match Period

Each match period is 4 minutes. Three minutes for a robot to operate and 1 minute for preparation before the robot starts moving. The competition order is based on the workstation number.

(5) Start and End of the match

- a. During match play, no competitor can enter the field (the competition area) or touch the robot. Otherwise, the game will end immediately, and the team will be scored based on the situation. Competitors can't enter the field until the end of the match.
- b. All scoring statuses are evaluated immediately after the match ends. Competitors should sign after confirming that the score is correct.
- c. No objections can be raised after the match.
- d. The match starts and ends according to the instructions or whistles of the timekeeper or referee.
- e. Before each match, the robot and the required equipment must pass the inspection. Teams that fail to complete the inspection will be disqualified from this match, and the game will be scored as zero points.
- f. If the robot experiences an uncontrollable situation, the referee or robot operator can enter the field and press the emergency button to stop the robot. The match will end, and the team will be scored according to the situation.

2. Field and Task

(1) Field

The playing field will be a 240cm×240cm square area surrounded by Cagobot pieces, as shown in Figure 1. The walls and partitions between each zone will be built using 7-cm-height / 1-cm-width Cagobot pieces. The bottom of the field is covered with a layer of a 5-mm-thick PP (polypropylene) plastic board. The Starting Zone and Disinfection Zone will be marked with electrical tape. The 3D diagram of the field is shown in Figure 2 (the dimensions in Figure 1 are for reference only, and the actual ones will be based on the playing field, with a 1-2 cm tolerance for each measurement.)

(2) Tasks

The robot starts its journey from the Starting Zone, either the A1 or A2 zone, as instructed by the on-site referee (the other zone is the Disinfection Zone). It walks toward the Task Zone (D zone) and scans a QR code on a Task Board (Figure 3). The Task Board near the Starting Zone indicates the position of the Contaminated Objects to be taken (Figure 5). In contrast, the Task Board near the Clean Zone indicates the position of the Clean Objects. The object for transportation is shown in Figure 6.



Figure 1: Field Layout (mm)

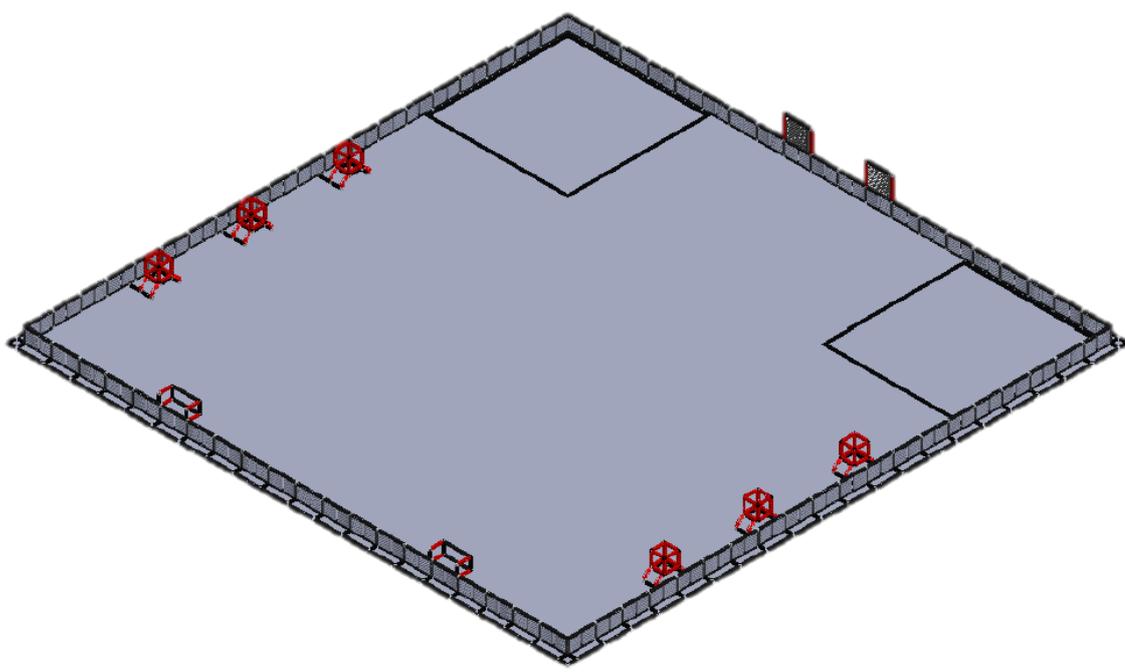


Figure 2: Three-dimensional Field Layout

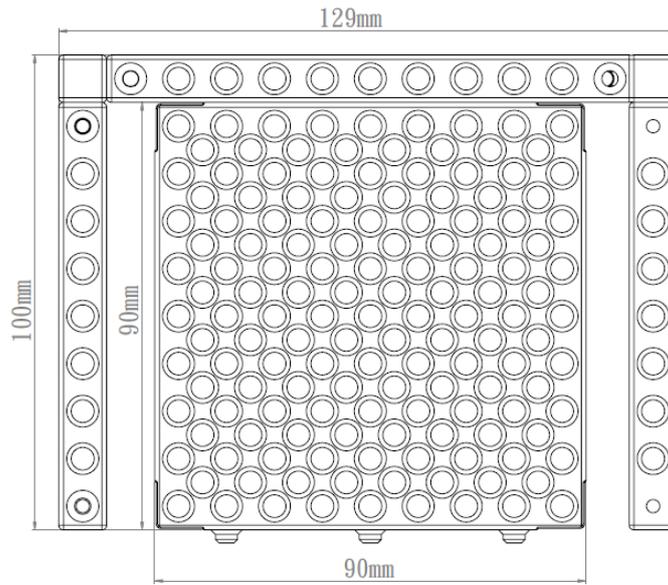


Figure 3 Task Board (mm)

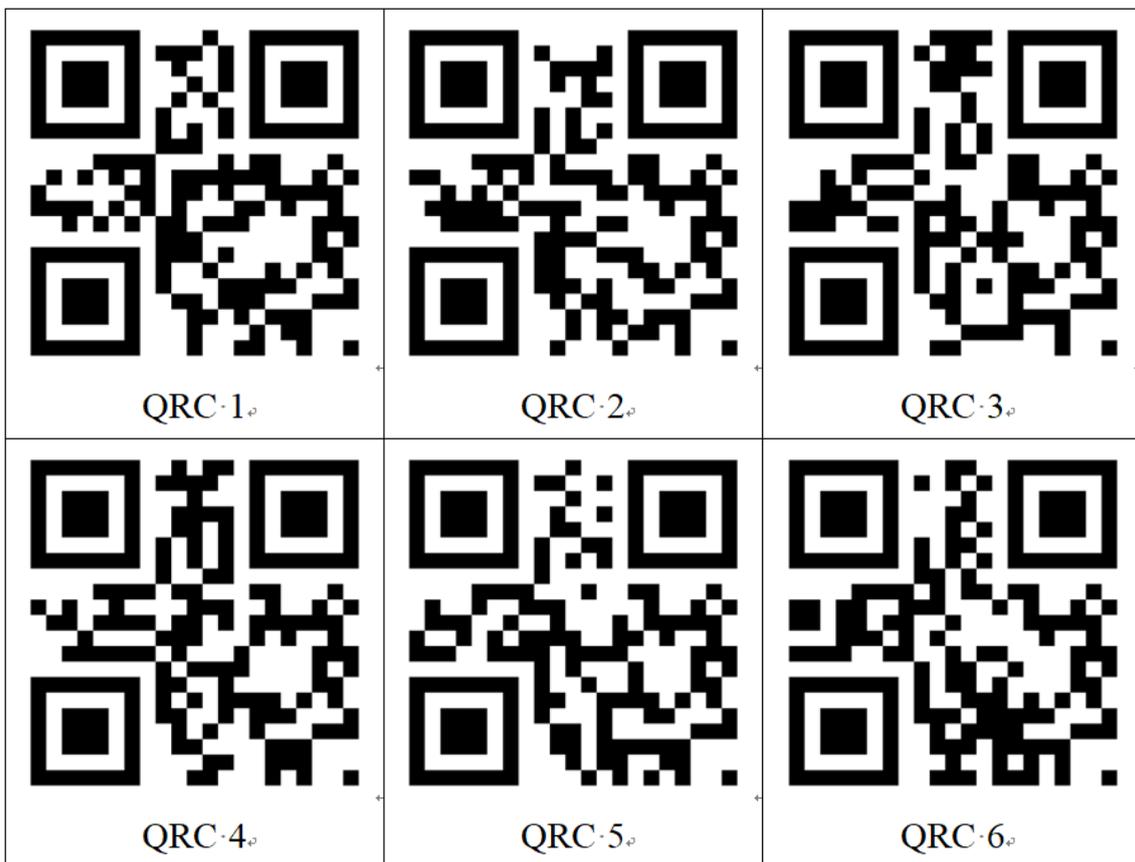


Figure 4 QR Code (9×9cm)

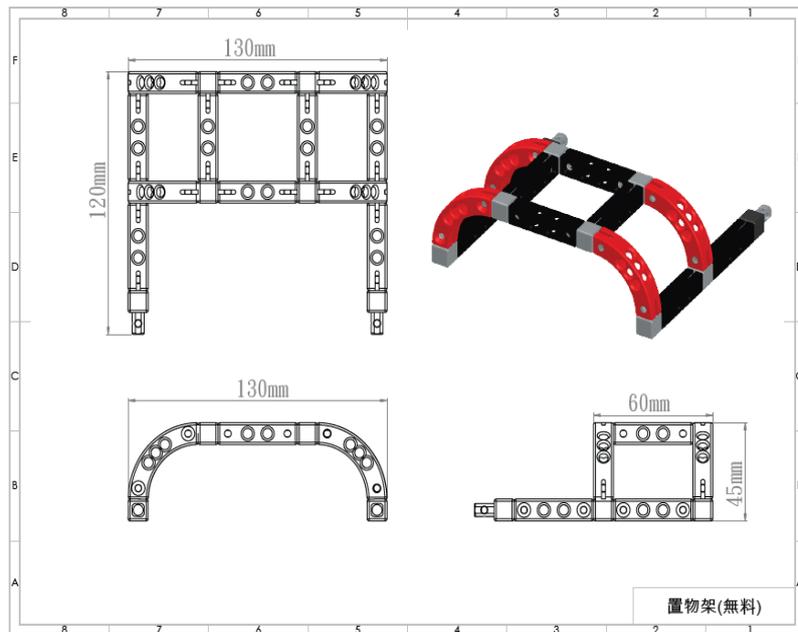


Figure 5 Storage Shelf where the robot takes objects from (mm)

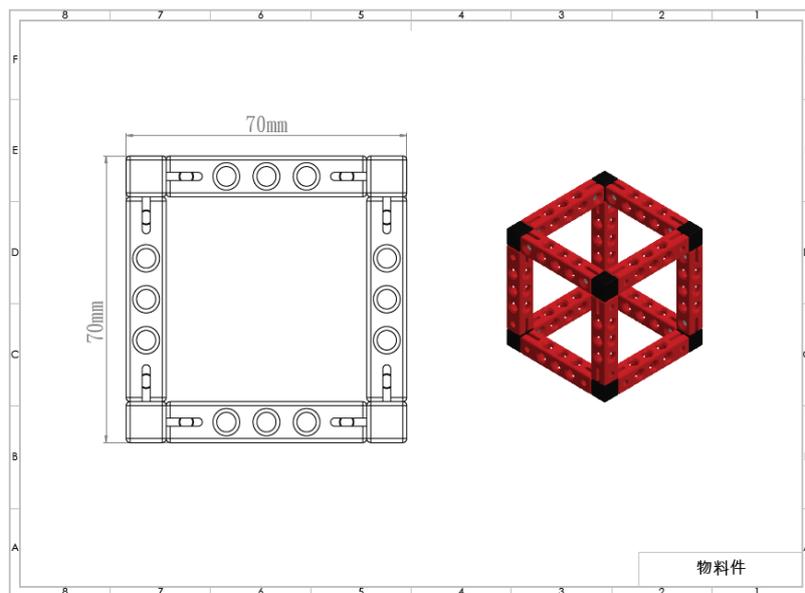


Figure 6 Object (mm)

The robot's first task is to place the Contaminated Objects in the designated Contaminated Waste Shelf (C1 or C2 deposit shelf, as the on-site referee directs, shown in Figure 7). Then, the robot must walk into the Disinfection Zone and rotate 360 degrees to perform the disinfection process. The robot can only handle the objects in the Clean Zone after the disinfection. Once the robot completes its task, it must return to the Starting Zone. (The dimensions in the figures are for reference only. The measurements will be based on the field, with a 1-2cm tolerance.)

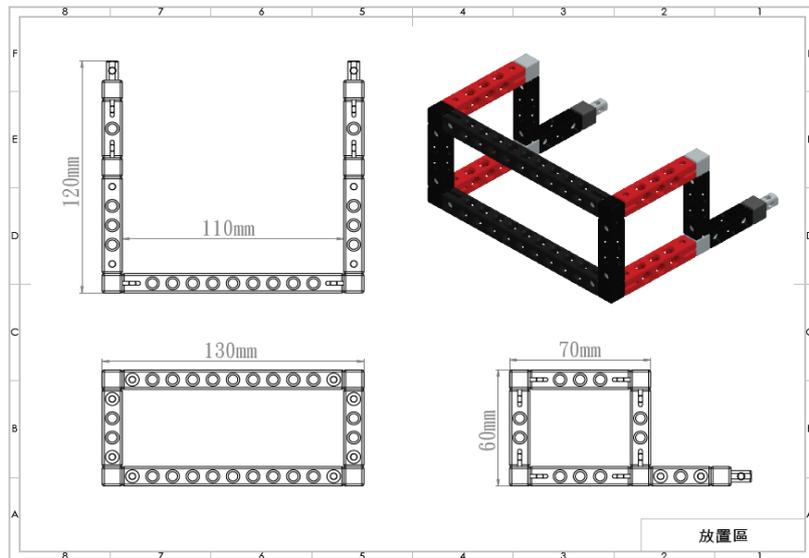


Figure 7 Deposit Shelf where the robot delivers objects to (mm)

3. Notes

- (1) The competition has two rounds; the highest score will be counted.
- (2) Competitors must dress nicely and look tidy; their shoes should cover the entire foot.
- (3) QR Codes 1 to 3 identify Clean Zones, while QR Codes 4 to 6 identify Contaminated Zones. They are arranged from top to bottom based on D Zone.
- (4) Before practice, the positions of the Starting Zone, Disinfection Zone, Contaminated Objects Storage Shelf, Clean Objects Storage Shelf, Contaminated Waste Deposit Shelf, and Clean Objects Deposit Shelf will be determined.
- (5) The objects are placed by the competitors. Please ensure that one side of each piece is parallel and aligned with the outer edge of the storage shelf.
- (6) Load the competition program into your robot before the inspection. Once the inspection is done, competitors may not change or update the program. Please turn off the robot while placing it in the inspection area.
- (7) Delivery of the Clean Objects cannot be done until the completion of the task for Contaminated Objects and the disinfection of the robot.
- (8) Only teams preparing for or competing can bring their robots to the competition or preparation area.
- (9) After the match, robots should be placed in the inspection area and wait for all other robots to finish. Only retrieve your robot with the permission of the referee.
- (10) Competitors and coaches must wear masks throughout the entire competition.
- (11) The practice is based on the number of players' workstations; each team's practice time is 8 minutes (tentative).
- (12) The winner of the robot competition is determined by the best score from the two rounds. If there is a tie, the completion time of the best score will be compared, and the shorter time wins. If the tie cannot be resolved, the second-best score and completion time will

be compared.

(13) The field may have a few variations on the competition day.

(14) If any situation arises that is not covered by the rules, the on-site referee will decide based on the circumstances.

4. Timetable

Time	Events
08:00-09:00	Check-in
09:00-12:00	First Practice Round
12:00-12:50	Lunch Break (Robot Adjustment and Maintenance)
12:50-13:00	Inspection
13:00-14:00	First Round of Competition
14:00-15:00	Second Practice Round (Registration Required)
15:00-15:10	Robot Adjustment and Maintenance (No Practice Round)
15:10-15:20	Inspection
15:20-16:20	Second Round of Competition
16:20-16:50	Score Tallying

17:00-17:30	Award Ceremony
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¶ The time may change depending on the circumstances of the competition day.

5. Scoring Table

Position	Weight	Leave the Starting Zone	Pick up Contaminated Objects	Correct placement of Contaminated Objects	Complete disinfection	Pick up Clean Objects	Correct placement of Clean Objects	Return to Starting Zone ¹	Indicator Lights and Emergency Switch	TIME	Total score	Signature
		5 points	20 points	20 points	5 points	20 points	20 points	5 points	5 points			
1												
2												
3												
4												
5												
6												
7												
8												

Note:

1. If the robot gets total points and parks itself fully in the Starting Zone within operation time, it can get the score of "Return to Starting Zone" (5 points).
2. If a robot causes damage to the field, it will be penalized based on the decision of the referee meeting, with a maximum deduction of 10% of the total score for that round.