NXT (Mindstorms, NXT & EV3)

Delivery 'bot in a hospital.

You are developing a service robot to be used in a hospital. The hospital administration has set the following specifications:

- It must have finesse and predictability in order to be safe for the people in the hospital.
- It must be able to hold and drop packages at designated locations. e.g. a 2" long piece of plastic pipe 1 ¼" diameter
- Bonus points will be given if the robot is running under a single program in which it can just be told which room to go to using the brick screen.
- The robot must stay in the 'halls' (white areas) and not hit the walls (coloured areas). Three hits on the wall and the robot will be deemed too destructive to continue any testing.
- To standardize the robots, all of them should be made using the motors and sensors from just one Lego kit. (3 servo motors, colour sensor, touch sensor, distance sensor)
- Using extra sensors or motors are permitted but under penalty.

The Ward:

The ward that will be used for testing the robots is laid out as per the diagram to the right. To help the robots navigate the hallways, a black line (17-19 mm electrical tape) is on the floor. Outside certain areas, coloured bars appear. Outside patients' rooms there are 17-19 mm x 22 mm bars in yellow (standard electrical tape). Outside the nursing station there is a red bar (standard electrical tape).

The Tasks:

The robot will be required to perform several tasks that include package delivery, obstacle avoidance and finding the correct rooms. Each task will increase in complexity. A score will be kept for each event and tallied for each competitor. The robot that scores the highest, overall points in the event will win the contract (and the game). Following are descriptions of each task.
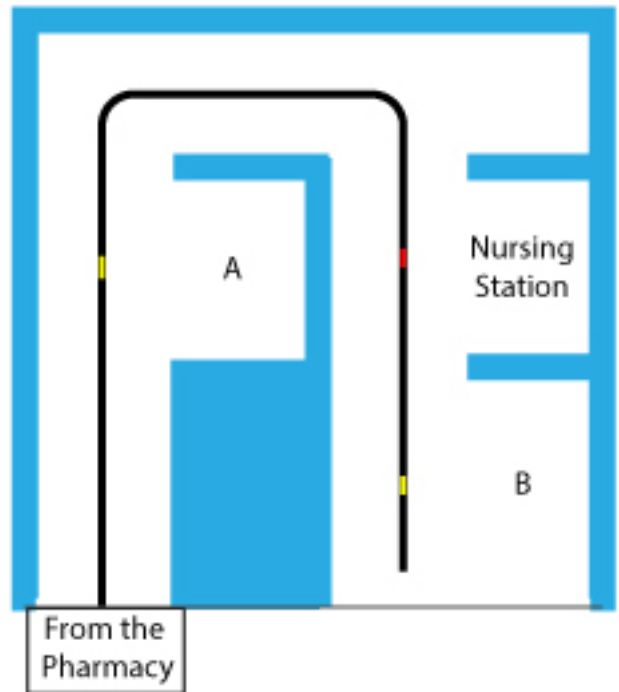
NXT (Mindstorms, NXT & EV3)

1) Make a delivery from the pharmacy to patient room A. The robot must demonstrate that it can follow a line, not just make it to the room, carry and drop a delivery.		
a. Follow a black line	5	
b. Stop at the room (detects yellow)	5	
c. Turn toward the room	5	
d. Signal that it has arrived.	2	
e. Drops the delivery	5	
f. Completed under 15 seconds	3	
g. Hits the walls	-3/hit	
h. Extra sensors or motors	-5/item	
2) The robot will report to the nursing station to wait for orders.		
a. Follow a black line	5	
b. Ignores yellow	5	
c. Stop at the room (detects red)	5	
d. Turn toward the room	3	
e. Signal that it has arrived.	2	
f. Time bonus: completed under 25 seconds	3	
g. Hits the walls	-3/ hit	
h. Extra sensors or motors	-5/item	
i. The robot has been preprogrammed so it can just be 'told' which room to find.	10	
3) Make a delivery to a designated room. The robot will be given a location (nursing station, room A or room B) by the judge and it will have to find the room following the line. Students will be able to reprogram the robot after getting the orders.		
a. Follow a black line	5	
b. Stop at the room (detects colour – ignores others)	10	
c. Turn toward the room	5	
d. Signal that it has arrived.	2	
e. Delivery is at the right location	5	
f. Time bonus (< 15s for A; < 25 s for Nursing station; < 30 s for B	5	
g. Hits the walls	-3/ hit	
h. Extra sensors or motors	-5/item	
i. Loses the package	-5	
j. The robot has been pre-programmed so it can just be 'told' which room to find.	10	

NXT (Mindstorms, NXT & EV3)

4) The robot must safely deliver a meal to room B. • The robot will not bump into anyone or any objects* in the hallways. • Three objects will be placed in the hallway at random locations. The robot must stop and make a pleasant signal at each object in its path. • When the object is removed the robot will continue to its destination.	
a. Follow a black line	5
b. Stop at the room (detects the yellow – ignores red and the first yellow)	15
c. Stops at all objects (5 points each)	15
d. Makes a pleasant warning signal	2
e. Turn toward the room	5
f. Signal that it has arrived.	2
g. Drops its delivery at the right location	5

h. Package is delivered: Upright
     Penalties: Tipped over!
                    Ends up outside the room.
	5
	 -2
	 -3

i. Time bonus <15s for A; <25 s for Nursing station; <30 s for B	3
j. Hits the wall	-3/ hit
k. Hits an object	-5/hit
l. Extra sensors or motors	-5/item
m. Loses the package	-5
5) Room to Room Delivery The robot is able to go from the nursing station and deliver medication to the patient in room A. The halls may be busy! The robot starts facing the nursing station and ends up driving into room A.	
a. Follow a black line	5
b. Stop at the room (detects colour – ignores others)	10
c. Turn toward the room	5
d. Signal that it has arrived.	2
e. Drives into room A	3
f. Drops its delivery at the right location	5
g. Time bonus: < 15 s	5
h. Loses the package	-5
i. Hits the walls	-3/ hit
j. Extra sensors or motors	-5/item