

5.1 Navigation and Follow Me

Description

The robot must navigate through a variety of waypoints and, at request, follow an operator from a safe distance avoiding hitting objects or any obstacles on the way. At the end of the test the robot must leave the arena.

Main goal: The main objective in this test is to evaluate whether the robot is able to navigate on the scenario and follow a person.

Focus

This task focuses on *mapping*, *navigation*, *path planning* and *person tracking* and *obstacle avoidance*.

Setup

- **Locations:**
 - This task takes place inside and outside the *Arena*.
 - The robot will start at front door.
 - The doors are open, except for the entry door.
- **People:**
 - There will be a operator who the robot must follow.
- **Furniture:**
 - All furniture are in their predefined locations.
- **Obstacles:**
 - There will be obstacles wich the robot must to avoid.
- **Objects:**
 - Avoidable objects will be placed on the way between rooms, the object has a minimum height of 10cm.

Procedure

1. The referee requests the team to move the robot to the start location.
2. The referee gives the start signal and starts the timer.
3. The team leaves the area after the start signal.
4. The referee follows the robot ready to press the emergency stop button.
5. **Entering the arena:** The robot starts outside the environment and must wait until the door opens.
6. **Waypoint 1 (door):** After entering the *Arena*, the robot must navigate to Waypoint 1, which may be any location and is reachable via several paths, all doors are open.
7. **Waypoint 2 (obstructed path):** After reaching Waypoint 1, the robot must navigate and reach Waypoint 2. The possible paths between Waypoint 1 and 2 are obstructed by

an avoidable obstacle, meaning there will be space for the robot to avoid the obstacle and follow its path.

8. **Waypoint 3 (following a human):** After reaching Waypoint 2, the robot must wait for an operator to show up for the follow me task. After the human arrives the robot must memorize and follow him.
 - **Memorizing the operator (training phase):** The robot has to memorize the operator. During this phase, the robot may instruct the operator to follow a certain setup procedure and instruct the operator on what to do when the robot needs to stop following.
 - **Following the operator (guiding phase):** When the robot signals that it is ready to start, the operator starts walking –in a natural way– through a designated path. The robot needs to follow the operator until the operator asks the robot to stop doing so (Waypoint 3).
9. **Waypoint 3 (going back):** Upon reaching Waypoint 3, the operator will command the robot to stop following him, using the instructions given by the robot in the training phase. Then, the robot must navigate back to Waypoint 2.
10. **Leaving the arena:** The robot must leave the arena through the indicated door.

Additional rules and remarks

- The teams can inform the operator of how to go through the start and stop following procedures before the task starts;
- The points for reaching a waypoint are only given if the robot had no collisions through its path. While following the robot may also keep a safe distance from the operator;
- If the selected waypoint 3 has two or more entries, the operator must follow the largest path.

Instructions:

To Referee

To OC

The OC needs to:

- **2 hours before the test:** Select and announce the robot start location.
- **2 hours before the test:** Define each of the waypoints for each trial of each team.
- **2 hours before the test:** Draw the waypoint 3 each round.

Score sheet

Maximum time:

5 minutes

Action	Score	1 st try	2 nd try	3 rd try
<i>Regular Rewards</i>				
Entering the arena	25	_____	_____	_____
Reaching waypoint 1	100	_____	_____	_____
Avoiding obstacle	100	_____	_____	_____
Reaching waypoint 2	200	_____	_____	_____
Following the operator	400	_____	_____	_____
Reaching waypoint 3	150	_____	_____	_____
Leaving the arena	25	_____	_____	_____
<i>Regular Penalties</i>				
Collision	-50	_____	_____	_____
Obstacle Collision	-100	_____	_____	_____
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<i>Score per try</i>	1000	_____	_____	_____
Total Score	1000	_____		