Mobile Robot Challenge: (Visual?) Odometry

Due April 29th 2024

The main goal of this Mobile Robot Challenge is to program the mobile robot such that it is capable to return to its home position after a manual drive, and secondly return home, after a manual drive and detecting and touching a small object of choice. This will be tested during two challenges:

1. A random drive is performed after which the robot autonomously returns to the home position.
2. A random drive is performed after which the robot autonomously finds and touches an object, and returns to the home position.

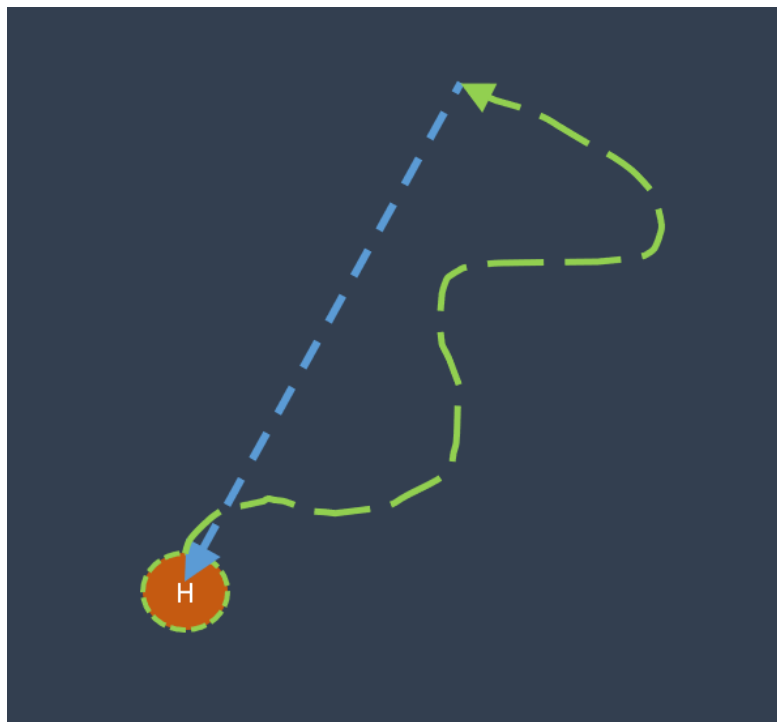## Challenge I Return home after a random manual drive.

Figure 1: Return home after a random manual drive. The green line depicts the trajectory of a manual drive, after which the robot should return to its home position (H).

This challenge is depicted in Figure 1.

1. Place your robot on the Home Position H such that the camera is facing forward.
2. Your robot should start in manual mode (i.e., 'wasd'-keyboard navigation).
3. The Teaching Assistant will manually perform a random drive of the robot using the wasd-keys, for example: 'w', "a", 'w', 'd', 's', 'a'.
4. Upon pressing the 'q'-key the robot should automatically navigate to the Home Position and stop.

NB Note, there is no visible marker on the home position (H). The robot is only allowed to use its RGB Camera sensor. After returning to the home position, the robot does not have to face forward.

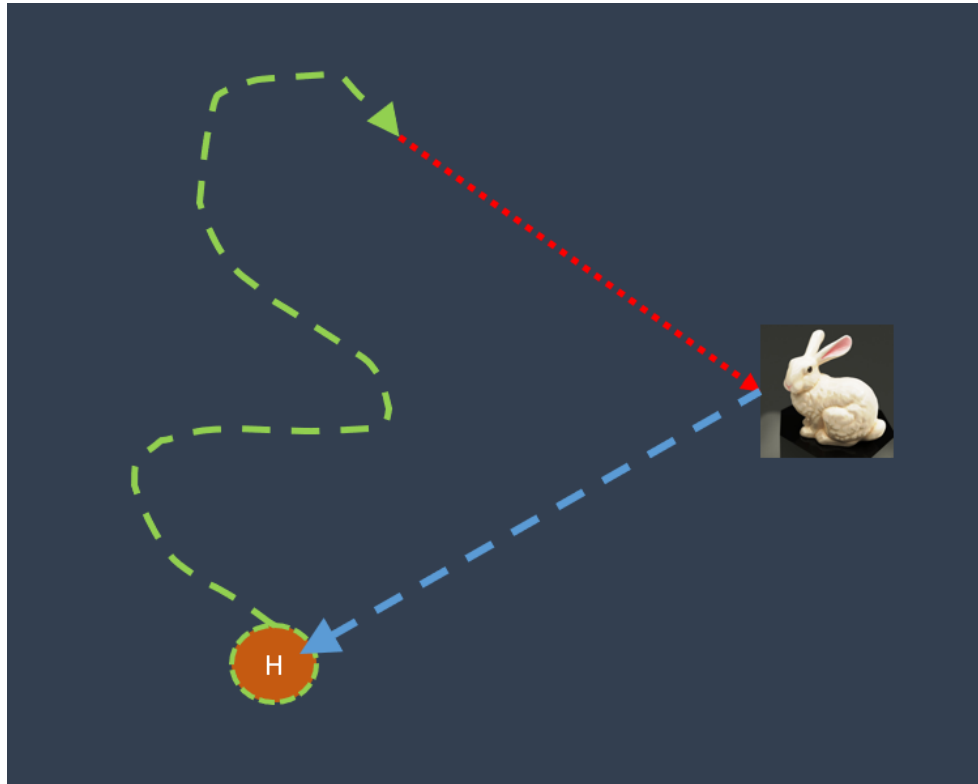# Challenge II Object finding and touching and return to home.

Figure 2: Return home after a random drive, followed by finding and touching the object.

This challenge is depicted in Figure 2.

1. Place your robot on the Home Position H such that the camera is facing forward.
2. An object of choice, with size less than 9cm x 9cm x 9cm will be placed within a 3 m distance from the robot's home position.
3. Your robot should start in manual mode (i.e., 'wasd'-keyboard navigation).
4. The Teaching Assistant will manually perform a random drive of the robot using the wasd-keys, for example: 'w', "d', 'w', a', 's', 'a'.
5. Upon pressing the 'q'-key the robot should automatically find the object, touch it and navigate to the Home Position. When it arrives at the Home Position it should stop. NB The robot does not have to face forward.

NB Note, there is no visible marker on the home position (H). The robot is only allowed to use its RGB Camera sensor. After returning to the home position, the robot does not have to face forward.

Notes:

- **Home Position:** there is no visible marker on the Home Position (H).
- NB The robot does not have to face forward after it returned to the Home Position (H).
- The only allowed sensor data used by the robot are the RGB camera data.
- You are not allowed to take your own floor with you.

Deliverables:

1. On April 29th and May 6th 2024 every team should show in a live demo that the robot is able to pass the two challenges.
2. Submit on Brightspace a zip-file containing your source-code, a link to a short movie of your robot executing the two challenges, and a pdf with a technical report (max 4 pages, font-size 12) containing a title, the name of the team, a list of all the team members a description and explanation of the methods used to solve the problems of the challenge and references to any libraries and papers used. Use a scientific writing style. Finally in an Appendix give the instructions of any dependencies of your code (i.e., extra libraries that need to be installed to get your code running) and how to execute your code to pass the two challenges.
3. The final grade will be based on the originality and robustness of your methods and solutions, the performance during the challenge, the quality of your code, the performance captured in your own movie, and the quality of the technical report.