Development of an agent for a robot that follows black/white transition

RMI - Robótica Móvel Inteligente

Assignment 1

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Introduction

- Development of an agent for a robot that
  - follows black/white transition
  - overcomes a number of different challenges by adding extra navigations skills

Project Development

List of the challenges:

- Simple navigation

- Navigation challenge 1 with sharp edge;

- Navigation challenge 2 with obstacle;

- Navigation in challenge 3 with controlled speed segment;

Project Development - Main Loop

In each cycle of the loop the robot has to make a decision based on the reading of the sensors. In every cycle the robot will:

- read the value of the sensors

- check for the start line

- check for the circles on the ground

- check for any obstacle

- make the decision of direction if there is no obstacle

- deal with the obstacle if it found an obstacle

Following black/white transitions
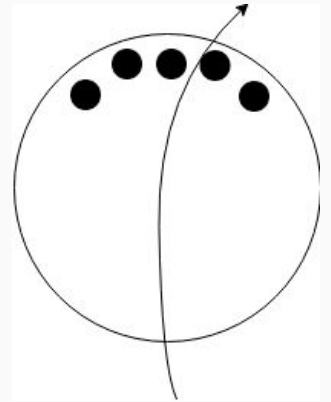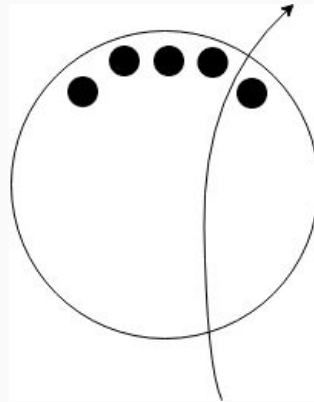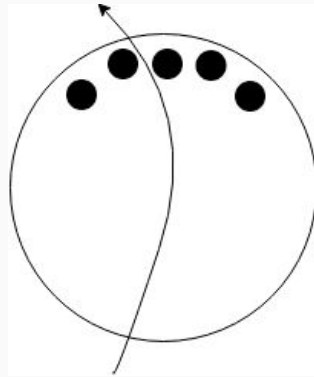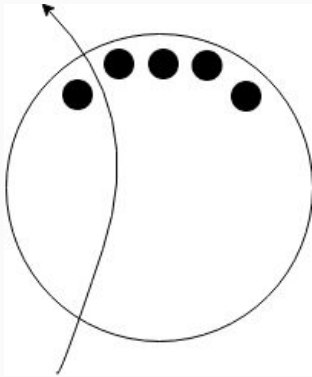
- Always enabled if no other challenge detected
- Turn (slightly) left or right based on ground sensor readings

# Lap progression / finding the start line

- Lap progression:

  2 regular rounds, 1 round in other direction

- Sources of information:

  - Odometry

  - Ground sensor

- Sensor fusion for more reliable detection

  - Boolean variables: Transition, Tolerance, Lock

- Reset beacon each round to avoid error
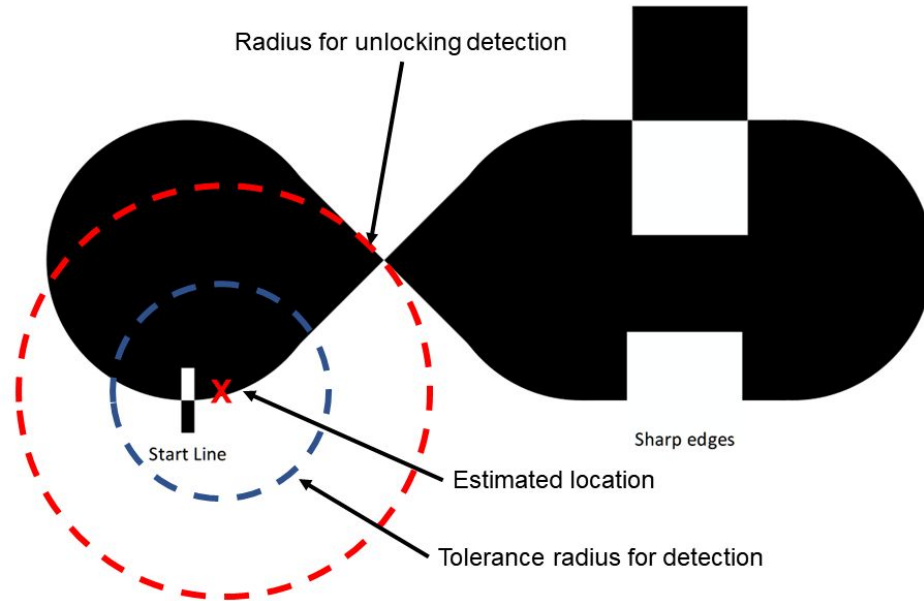
Navigation Challenge 1: Sharp transition

- Ground sensor 11111&&00000:

  lost black/white transition

- Stop and turn until back on track

- Direction of turning:

  Remember last valid sensor reading

Sharp transition
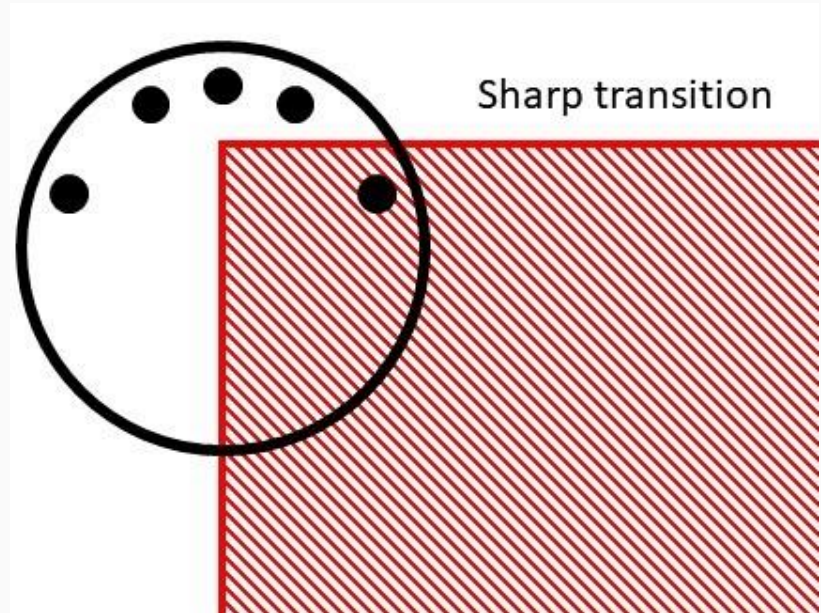
Navigation challenge 2: Avoiding an obstacle

1. Finds an object;
2. Turns approximately 90 degrees in direction to inside the circuit;
3. Move forward as long as the corresponding sensor detects an object at right or left;
4. Move forward an amount:
    a. equal to the radius of the robot in the first iteration ;
    b. Smaller than the radius in the next iterations;
5. Rotate again 90 degrees in the opposite direction;
6. Check if there is any additional obstacle in front;

Navigation challenge 2: Avoiding an obstacle

7.   Go forward an amount equal to the approximately the diameter of the robot;

8.   Move forward until the corresponding sensor that reads the side of the object no longer detects it;

9.   Turn 45 degrees in the direction of the white surface;

10. Go forward until it finds the white surface;

11.   Rotate in the direction that it must go.

Navigation challenge 3: Controlled speed

- Created function that will check the value of the ground sensor;

- If the value read corresponds to a circle will return true;

- Variable to save the value returned by the last call of the function;

- It is a circle if the current value is true and the old value is false;

  - Boolean variable that it is inverted every time a circle gets detected;

  - The LEDs will be turned on/off;

  - The correct speed is set;
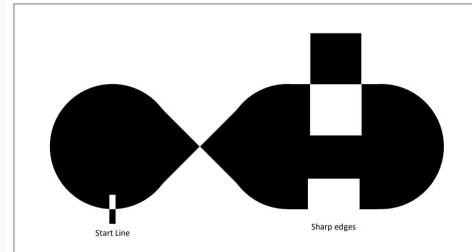
Results

- Most successful

  - Simple navigation

  - Navigation with sharp edges

  - Detection of the start line

Conclusion

- The robot was able to complete all challenges

- The code was developed to work in any track with the same challenges

- The environment plays an important role in the results of the challenges