# Finding a post

The task of the TurtleBot robot is to find the columns of a given color and knock them down. To knock the post down, the robot has to enter it bump (bump means that the position of the post is inside the robot's footprint). The robot must not collide when moving posts of a different color. The assignment is divided into three tasks according to the complexity of the solution:

1. Find a freestanding post of the color
2. Find a post in an environment with multiple posts of different colors
3. Find multiple columns of a given color in a multi-post environment

The current epidemiological situation does not allow us to meet over the solution of the task in the laboratory with robots. Therefore, this task was prepared for the simulator. If the rules for work in laboratories, we are ready to make robots available to you so that you can try everything in real life. However, solving the problem in the simulator will be suitable for granting the credit even in such a case.

# General rules

Basic rules for solving the task, which are common to all tasks of varying difficulty.

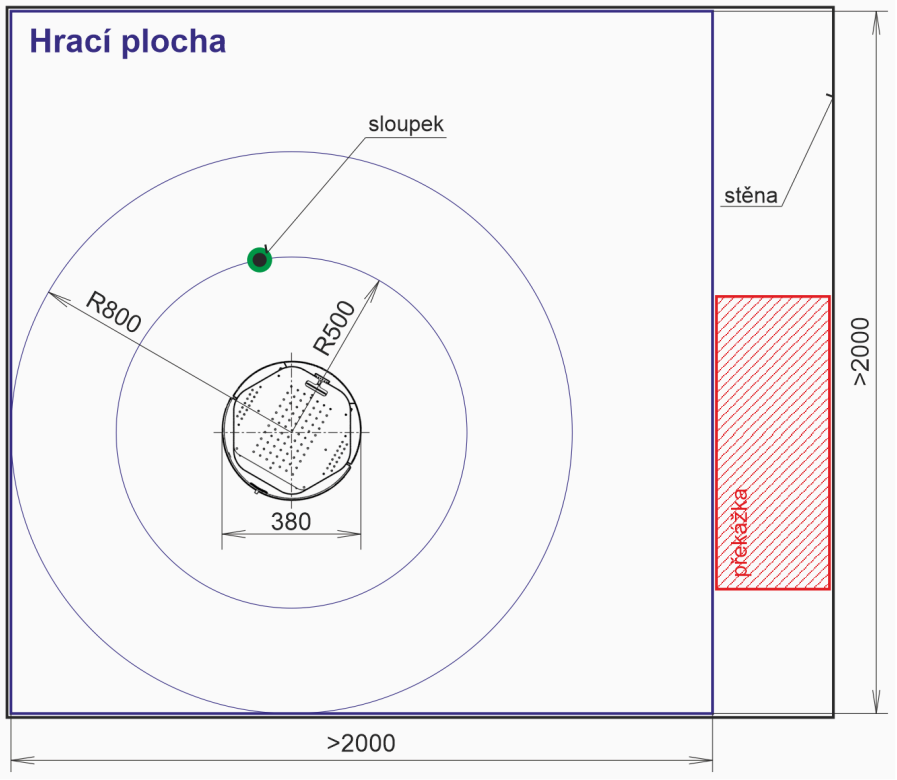


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Fig. 1: Playing area and starting position

## Playing area and posts

The TurtleBot robot moves on a flat playing surface (floor) with minimum dimensions of 2 x 2 m. The area can be bounded by vertical walls or other obstacles. Posts (one or more) are placed on the surface. There are no other obstacles on the rectangular playing area, where the posts are placed. Posts form in our In the case of a colored paper cylinder with a diameter of 50 mm and a height of about 350 mm. We have red, blue and green posts. Posts They are not attached to the floor in any way and the robot can easily knock them down if it touches them. The distance between the posts is defined as the distance between their nearest walls. The floor plan of the robot is approximately circular with a diameter of 380 mm.

## Driving process

The operator (student) places the TurtleBot robot at the starting position. The position and orientation are determined by the teacher. The starting position will be on the playing field and will not be closer to walls or obstacles than 0.8m. The nearest post will be no closer than 0.5 m. The starting position is shown in figure 1.

The color of the column you are looking for is determined by the teacher and entered into the program by the operator. After that, the operator starts the program and, on the teacher's instruction, starts the ride by pressing a button on the base of the robot or by touching the robot display. In the case of

implementation on the simulator, the ride will start with the start of the program. After the start, the robot will solve the task completely independently. During the journey, the robot must not be controlled from a computer other than the one on which the control algorithms are implemented.

During the ride, the robot must not touch or knock down any of the sticks of a color other than the one sought. The robot should stop and end the program after completing the task.

### Safety bumper

The robot's mechanical bumper must be active during the journey. Whenever the bumper is activated during the journey (collision with an obstacle), the robot must stop immediately and react to the detected obstacle (reverse, turn, ...). The bumper will not react when hitting the pillars. It is not necessary to implement the bumper function in the simulator, especially if the robot reacts to obstacles in a different way.

## Rules for individual tasks

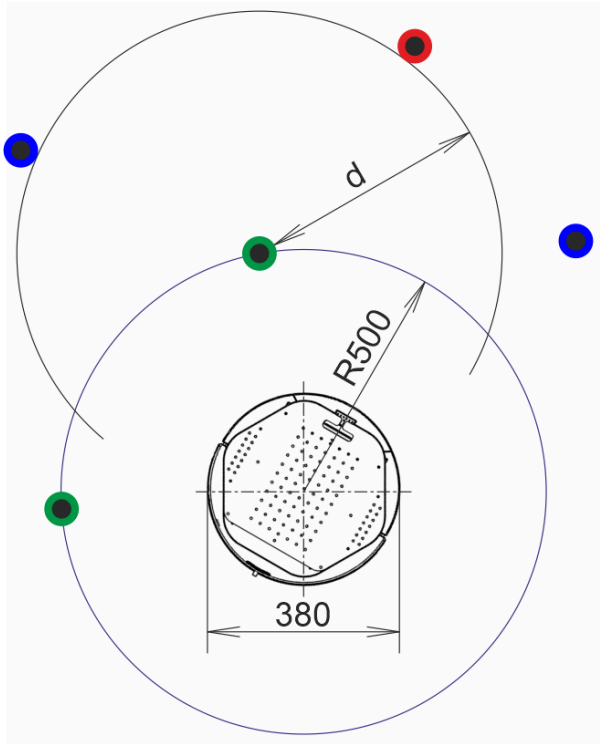
### 1. Finding a freestanding post

There is only one column of a predetermined color on the area. The pillar you are looking for is a maximum of 2 m away from the starting position, but it does not have to be in the field of view of any of the cameras on the robot. After placing it at the starting position and lowering it, the robot's task is to find the post, drive to it and knock it down. The robot should not hit walls or obstacles. A maximum of 30 points can be awarded for completing the task.

### 2. Finding a post among others

[/wiki/_detail/courses/b3b33lar/tasks/vykres_torpedo_distance.png?id=courses%3Ab3b33lar%3Atasks%3Atorpedo_cs] Fig. 2: Minimum post spacing

There are more posts on the board, but only one of the colors you are looking for. The pillar you are looking for will not be further than 2 meters from the designated starting position. The post will not be obscured by any other post or obstacle in the direction of view from the starting position. However, the placed columns can prevent the robot from moving directly from the starting position to the pillar being sought. Minimum distance between individual posts ***d = 500mm***. After placing it in the starting position and starting, the robot's task is to find a column of that color, drive to it and knock it down. It is considered an error if the robot touches or knocks down a post of a different color than the pillar you are looking for. If such an error occurs repeatedly or systematically, it will be taken into account in the point evaluation of the task. A maximum of 55 points can be awarded for completing the task.




## 3. Finding several posts

There are more posts on the playing field, including posts of the color you are looking for (pillars you are looking for). The nearest pillar to be searched will not be further than 2 m from the designated starting position. Minimum distance between individual posts ***d = 150mm***. However, there will always be at least one path from the starting position to each pillar that is searched for The distance from the searched posts to the nearest posts of another color will be at least 500mm. After placing it in the starting position and starting, the robot's task is to gradually find the columns of the color you are looking for, drive to them and knock them down. It is considered an error if the robot touches or knocks down a post of a different color than the pillar you are looking for. However, it is not a mistake if a falling or lying post of the desired color knocks down another post. If errors occur repeatedly or systematically, this will be taken into account in the scoring of the task. A maximum of 70 points can be awarded for completing the task.

# Points

The difficulty of the task corresponds to the maximum point rating. Each of the teams can solve one or more tasks during the semester. The team will receive a score corresponding to the point evaluation of the task with the greatest difficulty, which it has successfully solved. The maximum number of points corresponds to the flawless completion of the task. The number of points awarded may be lower depending on the functionality of the demonstrated solution.

All team members receive the same score (team score). If one of the team members does not work in this course, the other team members may suggest to the instructor that he or she be removed from the team or that his or her score be reduced. This is especially possible when demonstrating a solution to a

task where all team members should be present. The instructor assesses this request, discusses it with all team members and decides on the evaluation of the student in question.