Figure 1 is a diagram of the obstacle challenge for the mobile robot project. The objective is to program your robot to travel around an obstacle and return to a point behind the starting line. The obstacle is a cylindrical shape with diameter d_1 = 10.2 cm. The distance from the starting line to the far side of the obstacle is L_1 = 1 m. Behind the starting line are two square starting/stopping boxes of dimension, w = 25cm. In an ideal path, the robot would start in one (starting/stopping) box and end inside the other box. Closeness to the ideal stopping position is rewarded in the scoring.

The purpose of the challenge is to have fun and provide motivation for you to assemble, program and test your robot. Your grade on the project will be determined by a separate rubric.

Contest Procedure

Table 1 is the scoring rubric. Your score is the best result from three attempts. All teams rotate through the competition, making one attempt at a time. In other words, you have to wait until all teams complete their first attempt before you make your second attempt.

After placing the robot inside a starting position, you cannot touch the robot again until after the judge determines the final stopping position. The robot travels autonomously: no wired or wireless control from an operator is allowed. Your robot should come to a stop no more than 20 seconds after it started moving. If your robot is still moving after 20 seconds, the judge will declare the robot's position at 20 seconds to be the final position of the robot.

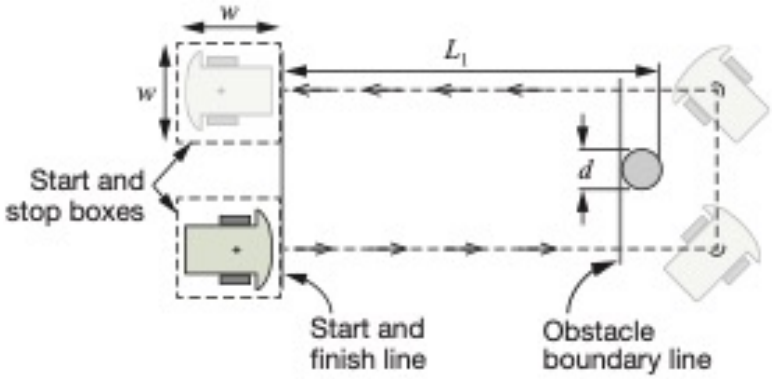

Figure 1 Features and dimensions of the obstacle challenge. The robot is depicted as taking left turns around the obstacle. A path with right turns is also allowed.

Distance Function

The distance function is a part of the scoring that rewards finishing close to the starting or stopping boxes. If s is the shortest distance (in cm) between the edge of the robot and the nearest starting or stopping box, the distance score is

$$f(s) = \frac{100}{\sqrt{(s)}+2} \tag{1}$$

Figure 2 is a plot of $f(s)$. Finishing close to the starting or stopping box (small s), results in a higher score.

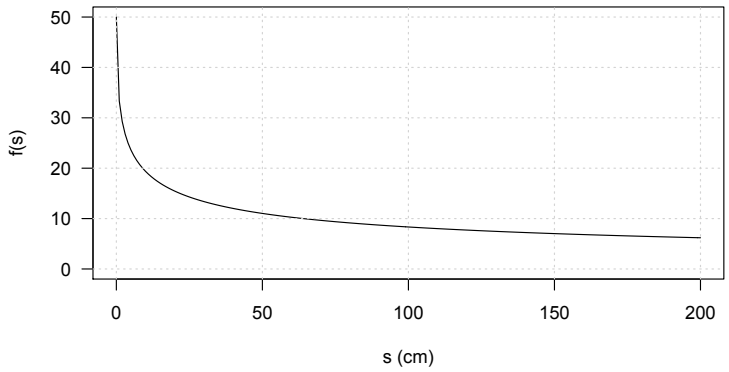

Figure 2 Distance function for scoring the final position of the robot.

Table 1 Scoring rubric for the robot challenge. The stopping position is defined as the location of the robot 20 seconds after it starts moving from the starting box.

Points	Description
5	Robot is fully assembled, and the Arduino program causes wheels to spin.
10	Robot travels from the starting line to the far side of the obstacle boundary line.
25	Robot travels around the obstacle and crosses the boundary.
50	Robot travels around the obstacle and completely crosses the starting line before stopping.
10	Robot comes to a complete stop (no wheels turning), and stays stopped, no more than 20 seconds after starting to move.
$f(s)$	$f(s)$ decreases with s, which is the shortest distance from the edge of the robot to the closest start/stop box. See Equation (1). $\max(f(s)) = 50$
$100 + f(s)$	Total score.

Deductions:

–15	Pieces fall off the robot.
–15	The robot displaces the obstacle without tipping it over.
–30	The robot tips over the obstacle.