Following Walls

Control of Mobile Robots: Programming & Simulation Week 6

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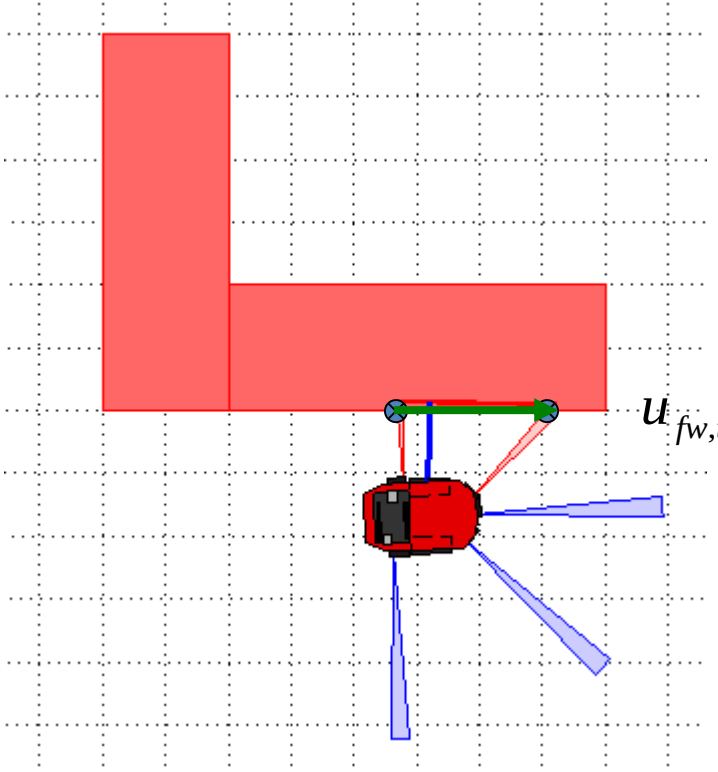
Overview

- This week we will add a new controller to follow walls.
  1. Estimate a section of a wall (obstacle) using the IR sensors.
  2. Compute a vector tangential to the wall and perpendicular to the wall.
  3. Combine the two vectors and steer in the direction of this new vector.

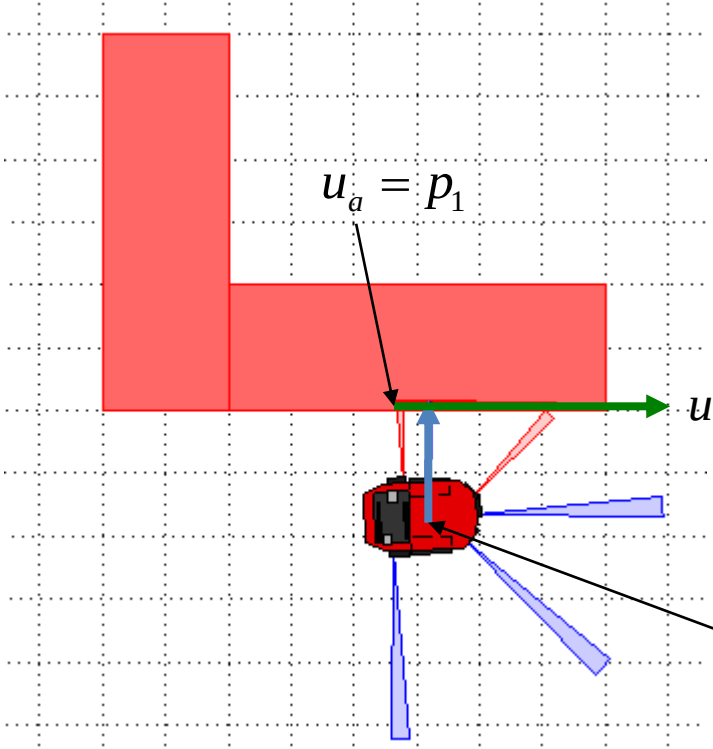
Estimating the Wall



- To follow wall on the *left*, use two (of three) left IR sensors with shortest distance measured.

$$u_{fw,t} = [p_2 - p_1]$$

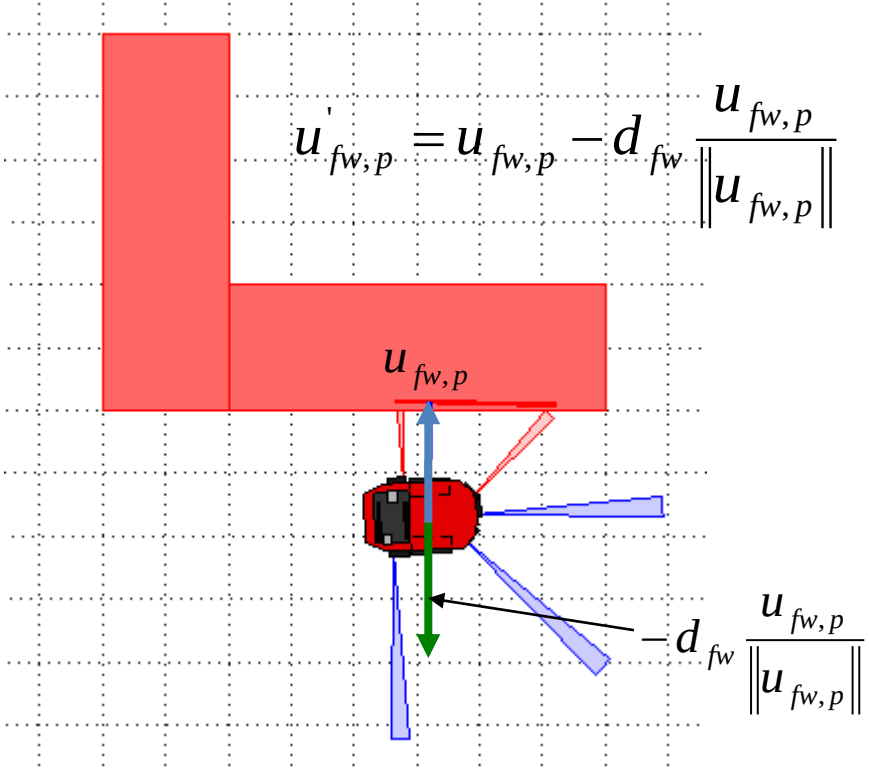
Maintaining Spacing from the Wall



$$u_{fw,p} = (u_a - u_p) - ((u_a - u_p) \cdot u'_{fw,t}) u'_{fw,t}$$

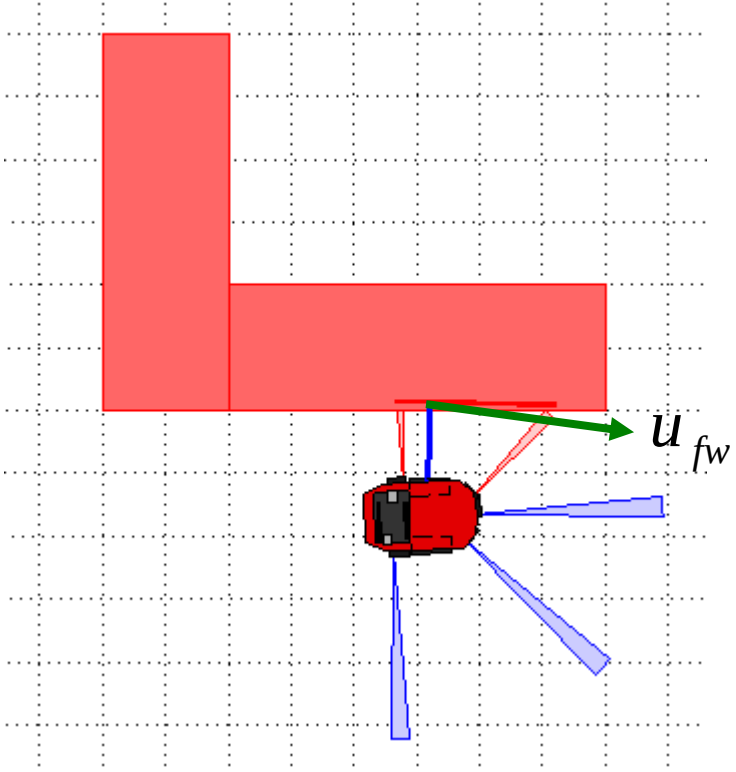
- We can find a vector from the robot to the closest point on `u_fw_tp`.

Maintaining Spacing from the Wall



- Find a vector that points in the opposite direction of `u_fw_p` and weighed by the distance we want to maintain from the wall.

Combining Vectors

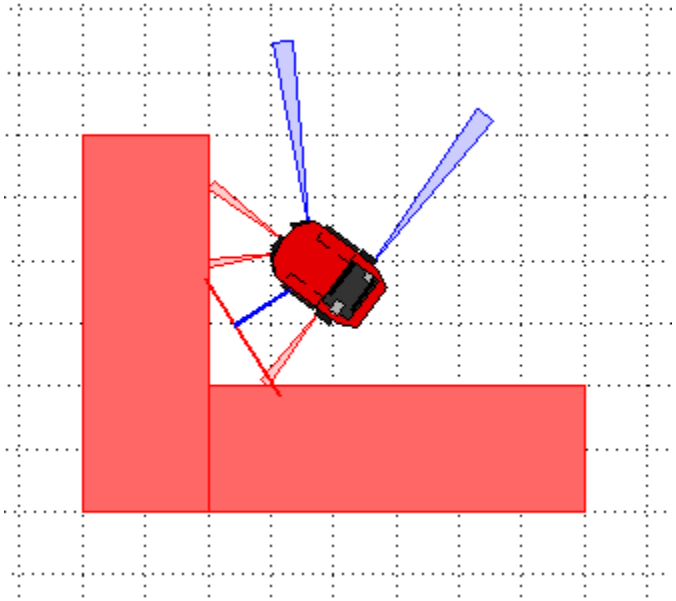


- Sum the two vectors into a single vector.

$$u_{fw} = \alpha u'_{fw,t} + \beta u'_{fw,p}$$

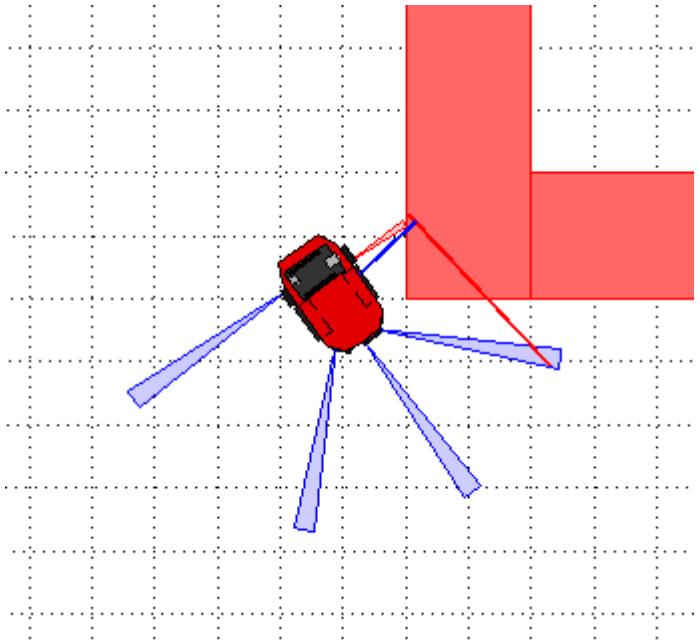
- Steer robot to orientation of `u_fw`.

How well does this work?



- Not the best estimate on inside corners, but OK.

How well does this work?



- Outside corners are more problematic. We need a good `d_fw`.

Implementation

- Implement the missing logic and math in the following file:

  `+simiam/+controller/FollowWall.m`

- Controller accepts `'left'` and `'right'` as input denoting the side of the robot on which to follow the wall.

Tips

- Refer to the section for Week 6 in the manual for more details!
- Experiment with different `d_fw` and combinations of the vectors `u_fw_t` and `u_fw_p`.