Universidad
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Mobile Robotics (II). Follow Line.

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Introduction.

This exercise will show how a race car completes a lap in a circuit, using artificial vision and reactive behaviours.

To do it, it will follow a red line captured with a camera, and depending on the position, it will command angular velocities controlled by a PD.

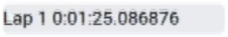

Fig 1. Lap time.

Filter

In the first stage, we need to capture only the red line, so we use openCV to get it.

First of all, I've decided to use HSV space because it's less sensitive to lightning changes, in other words, it's more robust to failures.

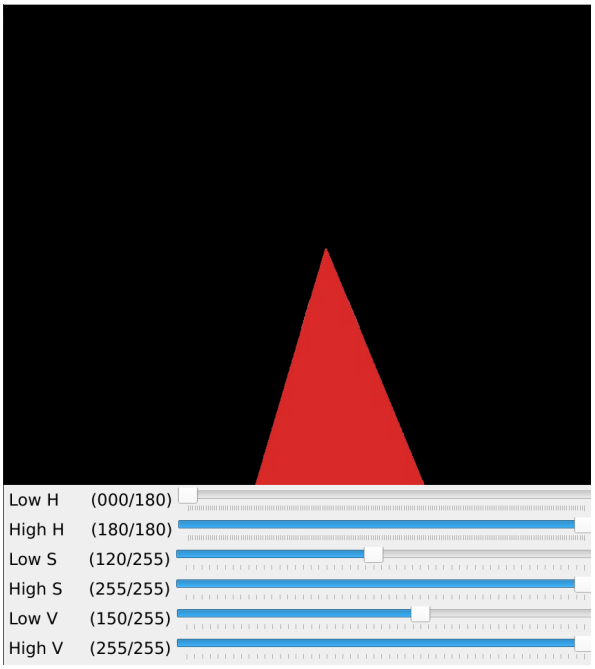

Fig 2. HSV tuning.

Centroids.

Next, we need to get our reference point, so I've used centroids. Notice that this point will be compared with the center of the image, so it's mandatory to also calculate the initial offset between the two, this is because the camera isn't centered.

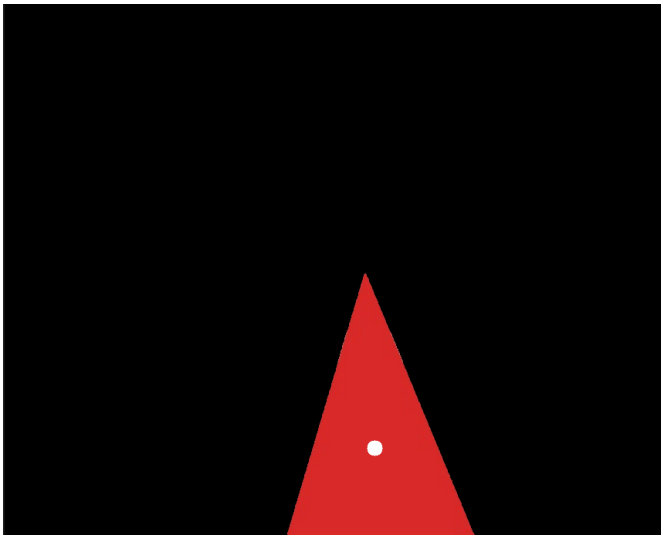

Fig 3. Centroid estimation.

Controller.

Finally, we add a PD controller.

Proportional part is to get into our reference, in this case is that the distance between centroid and center must be zero.

Derivative control increments the response when our reference moves away. This allows us to increase the linear velocity, avoiding huge oscillations.

Conclusions and comments.

This project is very extensible, we can add lots of features that improve the behaviour, but for time reasons, I couldn't add them.

For example, in artificial vision, we can divide the image into parts to make a curve detector. This could let us make a state machine with different types of control.

On the other hand, during tests, it's worth noting a worse performance (more oscillations), when the screen recorder was working in the background. Reducing linear velocity, significantly improves oscillations.