Key Detection and Positioning

Overall Process for Positioning on the Key

Camera

The image is acquired from a webcam.

→

BeagleBoard

The image is sent to a processor called the BeagleBoard, and the image is processed (see below) to get information about the key.

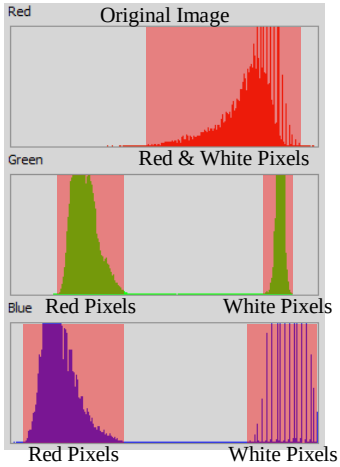
→

cRIO

The processed data is sent to the cRIO to control robot position to stop at the edge of the key.

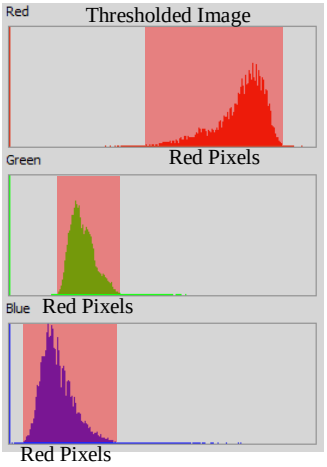
The entire process runs at 30 FPS.

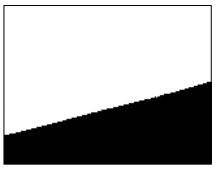
Detecting the Key



Input Image & Histogram

- The red channel peaks at the same value for both white and red pixels, so thresholding red values would not work.
- The values of the other channels are lower for red pixels (compared to the same for white pixels), so using a difference algorithm (thresholding differences between the red and the other channels) would only accept red pixels above a certain threshold.





Thresholded Image & Histogram

- The same process is also applied to the blue channel so that we can detect both keys.
- The red and blue pixels that pass the thresholds are added to a counter, which is converted to a percentage of the entire image.
- The percentage is used to determine whether the robot is on the edge of the key.

Lighting

Because the camera is mounted underneath our robot, bright lighting is needed to illuminate the surface of the carpet for the camera to be able to get a good quality image for processing.

We use a pair of white 7000mcd LEDs mounted next to the camera. They provide sufficient lighting for the camera to take well-illuminated images for accurate processing.