Lining Up to Goal Target

Overall Process for Lining Up to the Target

Camera

The image is acquired from a PS3 Eye camera with the IR filter removed (see below).

→

External Processor

The image is sent to a Foxconn computer, and the image is processed (see below) to find the location of the target.

→

cRIO

The location of the target is sent to the cRIO, which is used to position the robot until the location is correct.

Finding the Location of the Target (Phase Correlation)

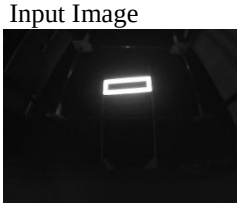
1. Input Image & Template

- An ideal image of the target is used as the template image.
- The template image is used to identify a match of itself (the target) in the input.
- The images are converted to grayscale for easier processing.

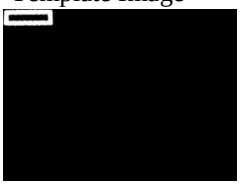
2. Fourier Transform of Input Image & Template

- The Fast Fourier Transform is applied to both images.
- The result is a set of complex numbers representing the frequency domain of the images.

Input Image



Template Image



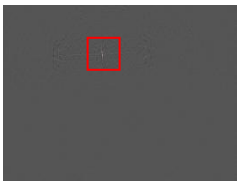
3. Result of Phase Correlation

- The phase correlation of the two images is calculated with the following formula (term by term):
R = AB*/|AB*|; R = resulting complex number, A = template, B* = complex conjugate of camera image, |AB*| = magnitude of complex number

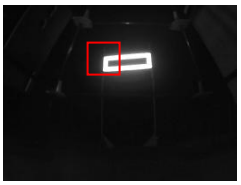
4. Inverse Fourier Transform of Phase Correlation

- The Inverse Fourier Transform is applied to the result to show the spatial domain of the result.
- The peak value (brightest point) is the location of the best match between the template and input, which is the location of the target.

Inverse Fourier Transform



Final Result



Camera Filtering & Lighting the Target

To filter out irrelevant data, we removed the infrared filter from the camera to limit the image to infrared light only. This allows the camera to only sense what we illuminate with infrared light.

To light up the reflective tape of the goal, we use a ring of bright infrared lights around the camera. The infrared light reflects back clearly from the reflective tape, making the target the only object visible to the infrared-only camera.