The University of Western Australia
School of Engineering
Prof. Thomas Bräunl

Embedded Systems
ELEC3020

Lab Assignment 9 – Image Processing **Points: 10**

TEAMS: This lab will be conducted in teams of 2 students

EQUIPMENT: Mobile Robot with Embedded Controller, sensors and motors
`https://roblab.org/eyebot/`

PREPARATION: Prepare this lab at home by using the *EyeSim* simulator:
`https://roblab.org/eyesim/`

EXPERIMENT 1 (2 points)

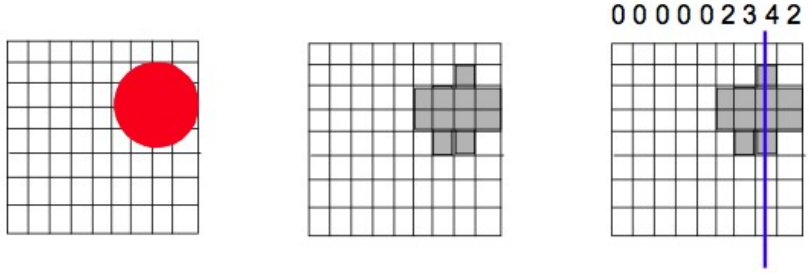
Write a program to "teach" an object color:

- Display current camera images on LCD, marking center with cross hairs
- When button is pushed, record average HUE value from 3x3 center area

EXPERIMENT 2 (6 points)

Search for largest object matching hue from previous experiment in live image sequence.

1. Convert the RGB image to a HSI image using the Robios functions
2. Convert the HSI image to a binary image (1 for match / 0 for no match).
   A match is achieved if a pixel's Hue value is within a range of the desired red hue [hue–x, hue+x] and the Intensity value is above a reasonable threshold.
   On the LCD, overlay matching pixels in red over the grayscale input image.
3. Create a histogram by adding all values of the match image
   a. Column histogram by adding values column by column
   b. Row histogram by adding values row by row
4. Find maximum value of the column histogram and the row histogram.
   If max. value is above threshold, plot the found position as cross hairs on LCD



EXPERIMENT 3 (2 points)

Rotate the camera by turning the Eyebot towards the detected object. Use a P-controller or On-Off-controller to rotate the robot in every time step, so it continuously centers the detected object.