

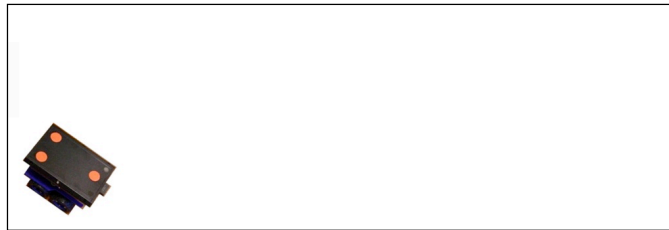
## HOMEWORK 1 – VISION-BASED ROBOT LOCALIZATION

Assigned: Sep. 7, 2011

Due: Sep. 28, 2011 – 3:05pm

You are tasked to construct a simple vision system to identify and localize a mobile robot using an overhead camera. A simple three-orange marker pattern on top of the robot is used to identify and track the robot. The steps for performing this task are as follows:

- A) Download the images “robotimg\*.jpg” from t-square. These images show the robot at three different locations. You can use these images as a training set to create your vision algorithm.



- B) Using any programming/scripting language, design an automated vision algorithm to identify the orange robot markers. Fit lines joining the robot markers and create an expression for the centroid of the intersecting space. If using Matlab, note that a color image is simply three monochrome (2-D) images, stacked on top of each other. The following code shows you how to extract the individual, 2-D monochrome images from a 3-D color image.

```
% Assume Matlab has a color image, img1, in memory

% Each value in img1 is an unsigned integer between 0 and 255
% Cast all values of color image as doubles, so you can do math
% operations on them, and scale values to the range of 0 to 1
img1 = double(img1)/255;

% Extract the red, green, and blue components from the 3-D color image
red_image = img1(:,:,1);
green_image = img1(:,:,2);
blue_image = img1(:,:,3);
```

- C) Assume that your robot starts at location (0,0) with a heading of 0 degrees, as shown in robotstart.jpg. For each subsequent image robotvalidate\*.jpg, calculate the relative distance traveled between frames (in pixel space) and the change in robot orientation. In addition, answer the following two questions – 1) How far has the robot physically traveled from start to goal (in pixel space) and 2) What is the shortest trajectory (i.e. minimum distance and rotation) to get the robot from the start to goal location?
- D) For homework credit, turn in your code, a README documenting how to run your code, and a summary of your results derived from step C.