

**GE 423 Mechatronics Homework Assignment #5**  
**Spring 2009, Due In Lecture April 22<sup>nd</sup>. The Microcontroller Demonstration Check-Off for Question 3 is due by 3PM**  
**Tuesday April 21<sup>st</sup>.**  
**Most answers should be typed. Graphs, etc. can be hand drawn if you wish.**

1. Read the computer vision chapter posted at the web site: <http://coecsl.ece.uiuc.edu/ge423/datasheets/vision.pdf>
2. For this homework you are going to explain most of the source code given to you in the file V:\c6713dsk\project\_creator\ge423\segmentation\user\_ColorVisionFuncs.c. For the five parts of this question the source code has been divided by line number. Perform the tasks specified for each section of code.
  - a. The function `void Init_Memory_for_Vision_Func(void)` lines 138 through 191. Explain what this code is doing and specifically detail the memory allocation of `HSV_Image` lines 174 to 188.
  - b. In `userProcessColorImageFunc_laser` explain what the code is performing in lines 223 to 288.
  - c. In `userProcessColorImageFunc_laser` lines 291 to 378, perform a “paper run” to understand what this code is doing. This paper run also includes the functions you will explain in part d below. Hand in your “paper run” crib sheet. The crib sheet is attached to this homework assignment. You can print out extra copies of the crib sheet at the web site. **Make sure to read the notes at the bottom of the crib sheet.**
  - d. Explain what the code is doing in the functions `int Check_Equivalency(int A, int B)`, `int Set_Equivalency(int A, int B)` and `int Fix_Equivalency(int num_equivalencies_used)`. Lines 567 to 680. The explanation should include the overall picture of what the segmentation algorithm in the function `userProcessColorImageFunc_laser` is accomplishing.
  - e. Briefly explain (but in different words than the existing comments) what each section of code is performing from lines 382 to 561.
3. This homework assignment is up to you. (same as question 6 of HW #4). Use your creativity to build something using the two RC servos that are in your microcontroller kit. Of course you will also need to use the F2012 microcontroller to control the RC servos. Make something that you will be proud of and put on your desk at home or something that will scare your friends when they try to raid your refrigerator. Anything goes but keep in mind that you also have a final project with the DSP/Robot to complete by the end of the semester. So in other words, I am not expecting it to be an elaborate and finely polished design.

Items that you **CAN** use that are in the Mechatronics Lab: *(This is not a complete list so ask if there is a part that you need).*

  - a. Any of the parts (resistors, capacitors, sensors, etc) used in previous homework assignments.
  - b. Anything (hardware, sensor, actuator or integrated circuit) that you purchase.
  - c. Your second microcontroller (F2013) that came with the kit you purchased. (This is an easy way to get points for your design).
  - d. The lab has a speaker that you can use/have.
  - e. The lab has a microphone you can use/have. It is a cheap microphone so don't expect too much from it. It can pick up loud noises.
  - f. Raw plastic and aluminum, “Super Velcro”, nuts and bolts. Cheap items that can be purchased from McMaster-Carr. I will be the judge of what is cheap.
  - g. You can turn your RC servos into continuous turn servos. Sadly this is an irreversible process for the RC servo. Ask your TA to be shown the procedure. With this modification, you could create a small mobile robot car.

Items that you **CANNOT** take from the lab.

- a. Pretty much any of the pre-made parts for the RC servos. Unfortunately these items are relatively expensive and I can't give them to you.
- b. Sensors used by the Robot.
- c. Gears, pulleys, belts.
- d. Other items? Ask before you plan on using them.

**What needs to be turned in for HW #5? (50 points).**

- a. Demonstrate your project working.
- b. All the source code you developed for this project. This source code must be commented well!
- c. Take a video or picture of your final design and email it to your TA. Each project will be displayed at the Mechatronics website.

