BIOE 421/521 Microcontroller Applications

Instructor: Jordan Miller, Office: BRC 415, Contact: jmil@rice.edu

Fall 2017
Lectures are on Tuesdays, 2:00–3:30 pm BRC 286
Labs are on Thursdays, 1:30–6:00 pm OEDK Computer Lab, Room 112

Overview

This class covers the usage and application of microcontrollers to solve discrete problems in a laboratory setting. We will utilize and build systems with widely-available low cost microcontrollers that have a rich community and online examples: namely, Arduino and Raspberry Pi. We begin by first learning command-line interaction and programming with the Linux operating system on Raspberry Pi. We then move on to using Linux and Raspberry Pi to program connected Arudino boards and their derivatives. We will also utilize the "Circuit Playground" board from Adafruit. Units in text processing, web scraping, thread looping, and working with sensors (light, temperature, sound) and signals (LEDs, buttons, speakers) provide a critical foundation toward building useful devices. Additional opportunities in motion control and actuation (pneumatics, gears, and motors) will provide students with additional functional knowledge. Ultimately, students will design and prototype their own experimental systems for laboratory-scale automation. **BIOE 521 students will be expected to complete a term paper.**

Register for OEDK Access

From OEDK Staff:
You **MUST register** for OEDK access by the first day of lab. It is very important for students go through the access process, so we are assured that they have watched the safety video and agreed to the terms of use of OEDK. Ringing the doorbell to gain access is unacceptable and strains the OEDK staff.

To register for OEDK access, students should go to: http://oedk.rice.edu/access, watch the video, take the quiz and pass it. We will then process their access request.

Keep in mind that it may take a few days for their access to be activated, especially during the beginning of each semester.

Office Hours

Contact Prof. Miller ahead of time if you would like to make use of office hours. Generally these will be the hour immediately before lectures, but I may be able to accommodate other times if you need.

Textbooks

A common theme with open source hardware is that by the time books are published they are already out of date. Instead, we will be making extensive use of installed documentation as well as web tutorials. So, no need to order books unless you want a lot more detailed background and perspective. O'Reilly has some decent ones on Arduino and Raspberry Pi. Our primary electronics for class are:

Raspberry Pi 3 - Model B - ARMv8 with 1G RAM:
https://www.adafruit.com/products/3055

Arduino Uno R3:
http://www.adafruit.com/products/50

RAMBo 1.3:
https://ultimachine.com/products/rambo-1-3

Grading

Regrade requests can be submitted to Prof. Miller within one week of receiving graded items, but keep in mind that the assignment/exam will be regraded in its entirety (so additional points may be taken off if initial grading is deemed too lenient).

Assignment	BIOE 421	BIOE 521
Homework	30%	20%
Exams	30%	30%
Labwork	30%	30%
Project Presentation	10%	10%
Term Paper	N/A	10%

Homework

Homework will be lab focused. You will generally be provided worksheets with instructions to follow, or tasks to achieve, during the lab component of the course. To receive credit, you may be asked to turn in worksheets or submit the code you have developed for grading.

Exams

Exams will be in-class and will help hone your skills with Microcontroller Applications and your ability to interpret written code, code management, work presented in class, and lessons learned from lab activities and assignments.

Final

There is no final examination during Rice Finals week.

Labwork

Labwork entails the effort you put into the lab component of the class and the results you achieve. With 24/7 access to OEDK, you should have ample time to achieve the weekly lab tasks and submit your homework. Your conduct in lab, and professionalism, will also affect the Labwork grade. Don't be afraid to ask questions, though. Questions are one of the best ways to 1) indicate to the instructor areas that need improvement and 2) get a deeper insight into the tasks at hand.

Lab Partner

The lab portion of class will be completed in pairs of 2 people. By the first day of class you must submit your **top 3 ranked** lab partner request to the Instructor. I will keep this confidential. Undergrads will be matched with undergrads, and grad students will be matched with grad students. This separation will help undergrads to overlap their final project with their Senior Design Project if they choose to do so, and may help grad students to focus their final project specific to their individual research projects (and because BIOE 521 students have an extra final project assignment).

Project Presentation

The final project for the class will be to design and develop your own use of the hardware and software we have in class. Your final project **MUST BE NON-DESTRUCTIVE** to lab hardware – we need to use this hardware in future years! The topic you have selected (title and abstract) must be approved by Prof. Miller **by October 19th**. Final presentations involving both teammates will be during the last week in front of the class and should be no more than 15-minutes including time for questions. You should adequately explain background and approach. Your peers in the class will assist in discussion as well as with evaluating your presentation with formalized constructive feedback. You will be graded on the quality of your presentation, the scope of your work, and your results. **More information will be given mid-semester.**

BIOE 521: Term Paper

The Term Paper, required for Bioe 521 students only, **(due November 27th)** will be detailed documentation of your final project sufficient for others to reproduce your work. Your written report should follow the paradigms: Define, Describe, and Develop; Quantify and Qualify; Document and Deploy.

Help Improve This Class!

Bioe 421/521 Microcontroller Applications is still a new class. There will be bugs, there will be typos, there will be areas that are unclear how to proceed. Please provide constructive feedback to your Instructor to make the class better for the future. Your class this semester is already better than in previous years **because** of constructive feedback from students like **you**.

Special Needs

Any student with a documented special need which may impact the above should speak to Prof. Miller within the first two weeks of class; discussions will remain confidential. Students should also contact Disability Support Services in the Ley Student Center.