CS 424 - Real-Time Systems

Instructors:

Professor Lui Sha, who has done significant research in the field and invented the Simplex architecture, teaches this class.

Prerequisites:

The listed prerequisite is CS 431 (Embedded Systems); however the course has since been redesigned to not depend on CS 431. But you do need a fair amount of coding experience since you're expected to do the labs rather independently. Just as for CS 431, you also need a basic understanding of how processors work. The labs are in Python; an introduction to the language is given in the first lab.

When to Take It:

You'll find a sizable number of graduate students in the course; most of the rest will be seniors. If you abide by the listed prerequisites, you probably won't get a chance to take the course until then.

Class Content:

This course offers a more conceptual approach to the same general topics covered in CS 431. Along with briefly revisiting things like feedback control and periodic scheduling, you'll study the difference between availability and reliability, dependency analysis, and other design principles for an embedded system reacting to real-time data from the surrounding world. Much time will be spent on the Simplex architecture principles that Prof. Sha invented, by which a complex but less-reliable program can be checked by a simple, more-reliable program. For instance, a complex routing program designed to find the ideal solution that sometimes fails can be checked by seeing that its path is less than that produced by a simple naive approach.

Work:

The class has a single midterm and a cumulative final, as well as about four homeworks and five labs. Just like in 431, the homeworks can be completed in a few hours each.

The labs (an extremely significant part of the grade!) build on one another to work up to programming the Roomba robot to move about the room following Android phone instructions while staying within safety limits (e.g. not bumping into things) per Simplex requirements. (After completing this, you can do an optional extension for a fourth credit hour.) You can probably do this in two or three hours per week, if you understand the concepts and can program well. The lab meets weekly, but you're only required to show up to demo the projects about every other week.

Life After:

Parts of this class are approaching the cutting-edge of research; you might be able to arrange a research project to follow up on topics learned. Also, this helps prepare you for various jobs in embedded systems.