

ENPM808X: Software Development for Robotics, Spring 2017

Instructor: David Pietrocola, dpiet@umd.edu

Office Hours: TBD

Prerequisite skills:

- Familiar with C or C++
- Comfortable with Linux OS and command-line
- Comfortable with version control (Git or subversion)

Objectives:

- Prepare students for the rising expectations of robotics software engineers in industry and government
- Strengthen students' portfolio of software projects

Textbook:

- Software Engineering: The Current Practice, Vaclav Rajlich. CRC Press
- Accelerated C++: Practical Programming by Example, Andrew Koenig, Barbara E. Moo
- A Gentle Introduction to ROS by Jason M. O'Kane (available for free as PDF, or in print on Amazon)
- Optional reference: C++ Primer (5th Edition), Stanley B. Lippman, Josée Lajoie, Barbara E. Moo, Addison-Wesley Professional. *Note: older editions do not cover C++11 features so go with 5th Ed. or alternative reference books.*

Week	Topic	Reading	Assignment
1	Course Overview Recent history of software development in robotics industry Tools of the trade and product example walk-through (OS, language, build systems, debugging, scripting, IDE, version control, simulation)	Articles covering robotics startups, commercial systems Introduction article on linux, command-line tools, bash scripting Accelerated C++: Ch. 0 Ch. 1: const, overloading Ch. 2 Ch. 3: vectors Ch. 4: try-catch	Set up programming environment (Eclipse IDE on Ubuntu). Programming exercises: Ch. 0, 1 (optional) DUE: Accelerated C++ Ch. 3, ex. 3-5 Ch. 4, ex 4-5, 4-7
	Review of C++, object-oriented programming, design patterns	Software Engineering: The Current Practice ch. 3-4 Accelerated C++: Ch.5: iterators, lists, sec. 5.3	Programming exercises: DUE: Software Engineering 3.10, 3.13, 3.14, 3.15

2		Ch. 6: review algorithm library Ch. 7: maps Ch. 9: classes	Accelerated C++ Ch. 6 ex 6-9
3	The robotics software development cycle Considerations when working on multidisciplinary team	Software Engineering: The Current Practice ch. 12-13 Accelerated C++: Ch. 8.1: templates Ch. 10.4 Ch. 13	Programming exercise
4	Version control, unit tests, debugging with Eclipse IDE and gdb, profiling with valgrind	Software Engineering: The Current Practice ch. 14-15	Programming exercise
5	Library dependencies, Build systems (cmake), continuous integration with build farms (Jenkins) Mid-term project discussion: focused on a small demo project that uses version control, documentation, OOP		Mid-term project proposal (due mid-week)
6	Overview of open-source software, licenses, how it affects robotics software development Mid-term project discussion		Mid-term project
7	Important libraries in robotics: Eigen, OpenCV, PCL, Boost Mid-term project discussion		Mid-term project
8	Mid-term project due Introduction to ROS	A Gentle Introduction to ROS ch. 1-3	ROS tutorials, installation

9	Spring Break, No Class		
10	Additional ROS overview	A Gentle Introduction to ROS ch. 4-7	ROS tutorials (intermediate) Programming assignment
11	ROS TF, parameters, logging and rosbag		Programming assignment
12	Review of other useful ROS packages, debugging tools available Final project discussion		Final project proposals
13	ROS for simulation and visualization (Gazebo and Rviz)		Programming assignment Final project
14	Additional simulation discussion and Gazebo work		Final project
15	Discussion of final projects		Final project
16	Project demos and presentations		