Tradeoffs, Constraints, and Opportunities for a single course on Robotics

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On the one hand, the robot **body** might be the focus of interest. This bring with it explorations of kinematics, dynamics, and design considerations with foci on ruggedness, modularity, maintenance, safety, and aesthetics. At the other end of spectrum, sensors and actuators (dubbed **appendages**) might of focal interest. The concerns will be electromechanical and rapid computational processing sophistication. A particular kind of appendage is a robot **manipulator**, i.e., robot arm. Concerns here are reachability in the work envelope, dexterity, payload, and precision. If the entire robot can move, common issues of interest are modes of locomotion, localization, navigation, and mapping.

On the one hand, a course can be largely hands on and applied. Primary concerns in this approach will be overcoming interfaces between the robot and the real world. One set of lessons are about lack of accounting for erroneous, sparse, and noisy sensory data. Another set of lessons revolve around lack of accounting for low fidelity and error proneness as well as inadequate capacity to act actuators, i.e., actuators do not accomplish what is mentally determined. On the other end of the spectrum, a course can be largely a collection of theories. Books that exemplify this approach are principled uncertainty management texts, e.g., (Choset, et. al, 2005) and (Thrun, 2005). Yet another approach is to rely entirely on simulation and focus on decision making, particularly planning (Lavalle, 2006). This approach makes the course a kind of an AI course (Murphy, 2000).

At SIUC, Dr. Martin Hoebel (at IST) leads robot building efforts with a team of engineering students. They successfully participate in competitions and workshops. In contrast to IST, the CS Dept. favors theory and algorithms.

My personal preferences are aligned with theoretical directions and simulations of multiple robotics as in UCAV and collective minds of a crowd.

References

Choset, H., 2005. Principles of Robot Motion: Theory, Algorithms, and Implementation, MIT Press.

LaValle, S., 2006. Planning Algorithms, Cambridge University Press.

Murphy, R., 2000. An Introduction to AI Robotics, The MIT Press.

Thrun, S., 2005. Probablistic Robotics, MIT Press.