Recognizing that robots are fun and engaging, Professors Fred Martin and Holly Yanco of UMass Lowell have designed an education program to stimulate an interest in science and technology for students from elementary school through college.

**Teacher Workshops**

Fred Martin and Holly Yanco host a variety of K-12 teacher workshops. Each fall, an introduction to classroom robotics workshop is run for teachers interested in bringing applied technology into their classrooms. The Botball and Botfest tutorial weekend occurs during the winter. In the spring, K-12 and university computer science educators gather to share their experiences during that school year.

In the classroom robotics workshop, teachers learn the Cricket Logo Blocks language to program the Handy Cricket robot processors. They work with a variety of sensors including touch, light, and infrared color detection sensors. In a three-hour workshop, teachers learn how to outfit a small mobile robot with sensors and program the robot to complete a task on its own.

Professional Development Points (PDPs) are offered to teachers for participation in our programs. We also offer scholarships for purchasing robotic materials.
Botball
Botball is a robot education program produced by the KISS Institute for Practical Robotics (KIPR) for middle and high school students. Participants in Botball receive a robot kit from which autonomous robots are built to solve a specified challenge in just seven weeks.

The Botball program teaches students more than how to build a robot. Students create and maintain a website for their team. They work collaboratively to design, program, and build their robot. They develop both offensive and defensive strategies. At the end of seven weeks, teams compete in a double elimination tournament. In addition, students present their development strategies, discuss the structure of their team, unexpected complications, and lessons learned.

In the fall of 2006, Arbotics continued with twelve high school students and five undergraduate mentors in an after school program. The combination of art and computer science themed with “light” yielded “Eclecticity.” This exhibit was shown at a gallery opening in November.

Arbotics is now a class offered to undergraduate students. The Arbotics project is funded by NSF (CNS-0540564).
More than 250 high school sophomores attended full day workshops last fall. In the fall of 2007, high school juniors and seniors will be able to take special semester-long college courses at the university. Topics will include assistive technology, environmental biotechnology, baseball bats, and robotics.

Cricket Science provides materials that can be readily adopted into inquiry-based work by teachers and students. Materials include the Handy Cricket, sensors, and corresponding labs. Cricket Science is funded by NSF (REC-0546513).

iCODE
The Internet Community of Design Engineers (iCODE) project encompasses an after-school program, weekend events, and a two-week summer immersion. Students complete a series of hands-on engineering projects, featuring the Handy Cricket. As the students develop their skills and knowledge, the projects become more open-ended. iCODE offers middle school and high school students from Boston and Lowell a year-long enrichment experience.

The iCODE project is a partnership between UMass Lowell and Machine Science, Inc., a non-profit organization based in Cambridge, MA. The UMass Lowell team consists of Fred Martin, Douglas Prime (Engineering), Michelle Scribner-MacLean (Graduate School of Education), and Phyllis Procter. The Machine Science team is Sam Christie, Ivan Rudnicki, and Emily Lin. iCODE is funded by NSF (ESI-0624669).

UML Robotics Classes
Fred Martin and Holly Yanco also teach undergraduate and graduate course pairs. Students learn about robot design, sensors, robot autonomy, and control paradigms.

In Robotics I, students build mobile robots from Lego and program the Handy Board robot controller. Students complete weekly labs (e.g. light seeking, obstacle avoidance, wall following), the “Egg Hunt” midterm competition, and a final project. The PowerWheels jeep robot is an example of a final project.

Cricket Science
With Cricket Science, Fred Martin combines the use of classroom robotics that has become prevalent across the K-12 grade levels with the characteristics of science experiments. Students become highly engaged as they frame problems, run tests, debug issues, and pursue solutions.
Enabling Technology: The Handy Cricket

The Handy Cricket is used in several of our interactive learning projects. It is an embedded controller developed by Fred Martin. The Handy Cricket is palm-sized, measuring 2.5" by 2.25" including its four AA battery pack. It is programmed using Cricket Logo Blocks, a custom, simplified version of Logo. The Handy Cricket combines processing, sensor data collection, and actuation. It can receive information from sensors in its analog sensor ports and control output to its motor ports. Also, a group of Handy Crickets can "talk" to each other by sending and receiving infrared messages.

Related Links

- UML Engaging Computing Lab
  http://www.cs.uml.edu/ecg
- UML Robotics Lab
  http://www.cs.uml.edu/robots
- Artbotics
  http://www.artbotics.org
- Botball
  http://www.botball.org
- Botfest
  http://www.botfest.org
- Cricket Science
  http://www.cs.uml.edu/ecg
- iCODE
  http://www.icodeproject.org
- TEAMS Academy
  http://gse.uml.edu/academy

Selected Publications


