Taking Away the Wires

In the past few years, technology has cut the wires that once tied us to our technology. Cellular phones, wireless Internet "hot spots," and palm-sized computers allow us to access a wealth of information from virtually anywhere in the world. At Cornell, a group of undergraduate research assistants is working to broaden the influence of wireless technology. Lin Zhu '03, Kenneth J. Ayres Jr. '04, Nicholas S. Gerner '05, and Joel P. Ossher '06 are working with Johannes E. Gehrke, Computer Science, on the Cougar Project to improve wireless devices that mine and monitor the material world. The Cougar System is a distributed database system for sensor networks and is part of the DARPA (Defense Advanced Research Projects Agency) SensIT program.

With its main components of motes and an electronic database, the Cougar Project aims to create an efficient data management system to monitor the physical environment. Motes are small, smart, wireless sensors that communicate with each other through radio waves. These mini-computers are shaped like cubes and can fit into the palm of a hand. They track changes in light, motion, and temperature in their immediate environment.

Using the power of two AA batteries, motes can run for several months at a time. Because of their sensory abilities and endurance, motes can be used for observation and tracking conducted by military or meteorological organizations. They have memories that permit them to store up to a month's worth of information. An electronic database controls the motes and helps them communicate efficiently with one another.

The Cougar Project's research team works to facilitate correspondence between motes, computers, and individuals. The ultimate goal of the Cougar Project is to perfect an electronic database and a set of high-endurance motes so that people can monitor and understand changes in nearby or far away environments. The project is supported by the Defense Advanced Research Projects Agency, the Cornell Information Assurance Institute, and a gift from Intel.

While all four students working on the Cougar Project are Computer Science majors, each one is at a different stage in his Cornell education. Gehrke taught Zhu in a computer science course and recruited him into the Cougar Project because of his exceptional performance. Gerner got involved through an independent research class in Computer Science. Ayres and Ossher latched onto the Cougar Project through the Cornell Presidential Research Scholars program. Ayres commends the program for getting him involved in the Cougar Project, calling it "a great program because few freshmen have the opportunity to do research."

Each student spends about eight hours a week in Cornell's computer labs working on the Cougar Project. Though they all have busy schedules as computer science majors, the students look forward to contributing to the project and spending time with Professor Gehrke. The research team enjoys the challenges of the Cougar Project—the work they do for the project is much more advanced than the assignments in their computer science courses. Ossher elaborates that, "From the beginning, the project looked like fun. I'm really enjoying it so far."

In the spring semester, the research team worked out the kinks in the wireless sensor network that enables communication between motes. They also developed a graphical user interface for conventional computer use. The interface aims to teach computer science novices how to use motes. Currently, the research team is writing code so that an individual can query the motes from a computer. The undergraduate researchers believe that the military can benefit significantly from a motes-and-database system similar to that of the Cougar Project. Ayres suggests that the military could deploy motes on battlefields to track the motion of humans, vehicles, and weaponry.

Gehrke commends the research team for their work on the Cougar Project and anticipates their continued success. He comments that the nature of the project allows him to learn from the undergraduate researchers: they become incredibly knowledgeable about those aspects of the project that they work to improve. Gehrke says that it is exciting for him to see the progress of his research assistants and watch them "learn lots of interesting programming techniques and to work with students of heterogeneous skills."

In the coming semesters, the research team plans to explore options in mote power storage. They want to look into ways to make motes more energy efficient because continual radio wave communication quickly drains their batteries. The research team also hopes to make mote sensor readings more accurate, increase the capability of their memories, and further facilitate communication between motes.

Participating in the Cougar Project has helped the students envision their futures. Ayres anticipates a career in software development, while Ossher would like to obtain a Ph.D. and go into the computer industry. For the time being, the research team concentrates on the Cougar Project, and works step-by-step to create a world that is networked to an unprecedented scale.

Sheila Yasmin Marikar '05

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