iCampus

Microsoft's $25 million iCampus alliance with MIT, which concluded in May 2007, was originally planned as a five-year project, but was extended for two additional years. iCampus was established in October 1999 to create and demonstrate technologies producing revolutionary IT-enabled teaching models and improved educational tools for higher education. This strategic initiative was a collaboration between Microsoft Research (MSR) University Relations, and MIT.

Over its seven-year run, iCampus provided $24 million to fund 28 faculty research projects and 27 student-run projects. As a measure of iCampus's impact at MIT, projects involved more than 150 courses with combined enrollment of over 7,200 students. About 400 MIT researchers, including 20 percent of all MIT engineering faculty and instructors, worked on iCampus research projects.

Beyond MIT, about 50 other universities and 13 companies were involved in collaborations resulting from iCampus projects, and MIT researchers interacted with a dozen Microsoft product groups. Approximately 90 articles about iCampus projects appeared in newspapers and magazines. Since the beginning of the alliance, Microsoft's hiring of MIT graduates tripled.

Project Conclusion

The project closed with a planned unexpended balance of about $1.2M. The funds will be administered by the dean for undergraduate education and be used to (a) provide a $400K annual student prize endowment for contributions to educational technology, and (b) fund an $800K three-year program supporting continued dissemination of iCampus technology.

iCampus's successful conclusion was marked with a two-day invitation-only symposium, "Learning without Barriers/Technology without Borders," in December 2006. The symposium brought together national leaders from industry, academia, and government, along with selected international guests, to reflect upon challenges affecting technical education in the US and globally, their effects on national competitiveness, and ways educational technology can help address these challenges.

iCampus also commissioned an extensive assessment study on factors affecting adoption of faculty-developed academic software. The study focused on five iCampus-supported projects:

- iLabs: students used web browsers to design experiments using distant laboratory equipment
- iMOAT: the web was used to manage the process of administering and grading written examinations for large numbers of students
- TEAL: two terms of introductory physics classes were redesigned to include discussion, experimentation, and visualization

- XMAS: students combined video clips and writing to create and share multimedia essays
- xTutor: a tool kit for creating online courses was developed

The study concluded that these projects improved important elements of an MIT education by making learning more authentic, active, collaborative, and rich in feedback. Nevertheless, wider adoption beyond MIT was extremely difficult to achieve, largely due to structural issues in universities that made it difficult for educational technology to spread beyond initial innovators, even to other departments within the same institution. The report, available at the iCampus web site (http://icampus.mit.edu/) included recommendations for universities, external sponsors, and for MIT in particular, regarding steps to achieve more effective dissemination. These recommendations are under review by the dean for undergraduate education and the MIT Council on Educational Technology.

Project Operation

Over its lifetime, iCampus was governed by a six-member joint steering committee (JSC): three members from Microsoft and three from MIT. The JSC members were Thomas Healy (MSR University Relations), Paul Oka (MSR University Relations), and Steve Drucker (MSR New Media Group) from Microsoft, and Thomas Magnanti (dean, School of Engineering), Vijay Kumar (assistant provost), and Hal Abelson (computer science faculty member) from MIT. Former Microsoft JSC members include Peter Pathe, Anoop Gupta, Doug Leland, David Salesin, Randy Hinrichs, and Sailesh Chutani. Executive sponsors for the alliance are Rick Rashid for Microsoft and Thomas Magnanti. The JSC set strategic directions, made funding decisions, and provided ongoing project supervision and shaping of the far-reaching impact of the research. MIT's iCampus management coordinated closely with the MIT Council on Educational Technology, the MIT central body formulating strategy for MIT's educational technology efforts.

Each iCampus project was under direction of a faculty member who served as principal investigator. Students worked on research projects for course credit or to fulfill advanced undergraduate or graduate thesis requirements. Projects were funded at levels between $100K and $800K per year for one to two years, while some projects continued for three to six years.

For the first five years of the program, iCampus focused internally at MIT in order to test innovations through significant use and integration into the MIT curriculum. Two major criteria for project selection were educational rationale rather than technology per se and expectation of commitment by schools and departments to adopt the technology; iCampus did not want to fund experiments that would disappear as soon as program funding terminated.

This approach proved remarkably successful in stimulating educational innovation. Virtually all MIT undergraduates have taken courses whose development was sponsored by iCampus. iCampus innovations were extensively integrated into the curriculum, and MIT continues to provide staffing and funding sustaining the impact of iCampus work.

In addition to faculty-led projects, iCampus also solicited and funded student projects, designed and managed entirely by student groups. Additionally, significant numbers of students participated as research assistants in faculty-led projects. Student projects each received one-year grants of $60K. To date, $1.7M was awarded for 27 wide-ranging student projects including designing wireless sensors, monitoring water quality, integrating computer games with exercise bicycles, implementing remote position sensing for MIT shuttles, and creating and installing screens mounted throughout the Institute, on which student groups advertise events. The availability of Microsoft funds directly to students, something unique among MIT's research alliances, generated enormous goodwill toward the program on campus and unleashed student creativity.

In March 2004, the JSC endorsed a new strategic thrust. After innovations were tested at MIT, iCampus moved beyond MIT as a demonstration site and actively promoted adoption of these innovations at other universities worldwide. This required a more active role for central iCampus staff, including hiring and managing staff to bring MIT work from its "alpha release" condition into states ready for dissemination, and creating relationships and support structure required to maintain a global network of affiliate institutions.

The resulting "iCampus Outreach" project was initiated during summer and fall of 2004 and accepted its first affiliates in December. Over the subsequent two years, iCampus concluded affiliate agreements involving over 60 campuses now deploying iCampus innovations. Following iCampus-sponsored workshops and conferences, many institutions have become involved.

Central Technical and Educational Themes

iCampus projects are selected from diverse MIT faculty responses to annually-issued requests for proposals. The JSC promoted projects in three broad areas, chosen for educational significance and for use of technologies poised for widespread diffusion among institutions of higher education. This section summarizes these themes, with iCampus initiatives below each theme viewed as having crucial impact on information technology in higher education.

Creating and Disseminating Educational Web Services

Just as with enterprise information technology, emergence of a robust web service infrastructure through .NET and other initiatives has enormous implications for educational IT infrastructure. iCampus pioneered development of a few global learning web services and initiated university consortia promoting shared infrastructure and services in higher education. These efforts included remote access to shared physical laboratory equipment (iLabs) and shared services for writing instruction and essay evaluation (iMOAT).

Reinventing the Higher Education Classroom

In reinventing the higher education classroom with pedagogically sound educational technology, iCampus initiated major transformations in MIT's largest courses, including freshman electromagnetism (MIT's highest enrollment subject), introductory computer science (taken by half of all undergraduates), architectural design, and Shakespearean drama. Impact has been felt in all MIT schools, and thus responds to needs of the entire curriculum—engineering and hard sciences as well as humanities and social sciences. Transformations included the following:

- Replacing large lecture classes with small group experiences supported by online multimedia instruction and embedded feedback
- Designing project-based learning with simulations and gaming
- Targeting location-based services that supported learning
- Using tablet PCs to support distributed, collaborative design

Educational Applications of Emerging Technologies

Although iCampus emphasized work that can be deployed for large-scale use in the short term, the program sponsored a few research investigations of significant emerging technologies. These included tablet computing, synthetic biology, and speech recognition and transcription.

iCampus also sponsored rigorous assessment studies of these innovations. Results of assessments were integrated into the projects. Initial analysis supported the conclusion that IT-based "active-learning" systems are superior to lecture methods in fostering student learning. These were high-stakes, high-profile efforts. Given MIT's history of worldwide impact in curriculum innovation, demonstrated success here may be expected to stimulate similar transformations elsewhere in higher education.

Educational Web Services

Web service architectures, which make it possible to modularize implementations, share infrastructure, create new services, and expose interfaces, have continued to have enormous impact on enterprise IT in almost every industry. The same is true in higher education, where scarce university resources, expensive laboratory equipment, for example, are increasingly connected to the web. Consequently, web services may support a new educational IT framework of software and services shared among universities and between universities and industry. The JSC recognized this at Microsoft's first announcement of the .NET initiative and put a plan in motion to build iCampus projects around web service opportunities. iCampus evolved to explore web services as agents of change for university collaborations around shared educational resources and to improve scholarship globally.

This section surveys two iCampus research projects that promoted web services and shared infrastructure: creating infrastructure for sharing laboratory equipment (iLabs) and writing instruction (iMOAT).

iLabs: Sharing Laboratory Equipment via Web Services

The most ambitious of these iCampus web services projects was iLabs, a .NET-based infrastructure for placing laboratory equipment online. The iLabs project developed an architecture and a set of foundational web services providing remote access to laboratory equipment, allowing labs to be shared across campus or across the world. As an example, students in Singapore and Sweden used MIT equipment—the same equipment used by MIT students—to perform transistor characterization experiments in their microelectronics course for the past three years.

iLabs presented the potential to drastically reduce universities' costs of providing laboratory courses. The iLabs team released a software development kit that universities may use to put lab equipment online for sharing, and iCampus affiliates in Mexico, Brazil, Germany, UK, Australia, China, Taiwan, Uganda, Tanzania, and Nigeria have implemented shared laboratories. The iLabs team also began work with schools in India. In March 2005, the Carnegie Corporation awarded an $800K grant to iLabs to further collaboration with universities in Africa.

Core services, such as status, identity, reservations, storage, events, and notifications, were defined and implemented with .NET. A core "Lab Server" service managed access to physical lab equipment, mediating access by users, administrators, and providers of enhanced services such as authentication of users and archiving of measurement results.

Under iCampus sponsorship and direction, MIT launched a program last year to encourage development of web-accessible laboratories across universities worldwide. Web-based shared laboratories developed at MIT support research in microelectronics, polymer crystallization, and vibrating structures, and equipment, including a chemical reactor, gas chromatograph, heat exchanger, and dynamic signal analyzer. In the long run, all university laboratory facilities could form the core of a global shared resource for science and engineering education. The iLabs team worked with MIT's OpenCourseWare initiative to make these services available to any university.

iMOAT: Shared Services for Writing Instruction

A second iCampus effort involving web services was the MIT Online Assessment Tool (iMOAT), a .NET-based web service that let universities collaborate in administering and grading essay exams. The tool permitted universities to set up web sites where students registered, viewed essay questions, and submitted responses. The system stored responses and provided workflow and tracking for administering and grading exams. MIT used this system for administering essay examinations to all entering students, and seven other universities currently administer exams via the MIT site. iCampus continues to work on release engineering of the system for easier distribution and replication.

Universities today operate largely as "IT islands," rarely sharing infrastructure around core educational or administrative activities. iMOAT illustrated how increasing reliability of web services changes the IT landscape and results in a major infusion of shared and outsourced IT services into higher education. iMOAT also established a large repository of essays (students opt in when submitting) that has potential to become a premier research database for writing analysis.

iMOAT was designed for large-population exams such as writing placement exams taken by all students entering most universities. Administering these exams via the web was a major convenience for both students and administrators, but few universities have been able to develop or maintain their own installations. It is highly attractive for universities to subscribe to a shared service, as presentations of iMOAT at national conferences of writing teachers have already confirmed.

iMOAT was first deployed in beta test during summer 2002 as a shared implementation used by MIT, the California Institute of Technology, the University of Cincinnati, DePaul University, and Louisiana State University. The system was used to grade over 4,000 essays, including writing placement essays for MIT's 2002, 2003, 2004, 2005, and 2006 entering fall classes. The iMOAT project launched a consortium to support and share this web service. Present consortium members are MIT, the University of Cincinnati, Stony Brook University, LSU, Albany College of Pharmacy, Rice University, Caltech, Drew University, DesMoines Area Community College, and the University of Massachusetts, Amherst. All together, these schools used the iMOAT system to assess almost 17,000 essays during the 2006-2007 academic year.

Reinventing the Classroom with Educational Technology

While iCampus's web services theme explored web services as agents of change for university collaboration around shared educational resources, the second major theme focused on pedagogy and classroom transformation. iCampus concentrated on major experiments aimed to reduce passivity in traditional lecture courses through active learning experiences supported by information technology.

Projects selected sparked fundamental reworking of MIT's largest courses to demonstrate effects technology could have on scaling education, improving learning outcomes, and demonstrating innovative uses of technology in a distributed, wireless environment using both Unix and Microsoft technologies.

These efforts required major institutional commitments from all MIT departments and deans, as evidenced by multiyear rollout plans. iCampus required intensive data collection and analysis aimed at assessing experiments to produce scientifically sound conclusions of these new techniques. The impact positioned both MIT and Microsoft as thought leaders in educational technology research.

In this section we review two large-scale course transformations: introductory computer science and freshman physics.

Computer Science

One major iCampus project in classroom transformation was development of online lectures and tutoring systems for two of MIT's largest computer science courses: 6.001 Structure and Interpretation of Computer Programs (which is MIT's core software course) and 6.034 Artificial Intelligence.

Like so many other large lecture classes, MIT's introductory computer science course was taught in the traditional mode of two large weekly lectures (300 students) and two weekly section meetings (30 students per section). The goal of the project was to study the effects of eliminating large lectures entirely and replacing them with interactive technologies enabling students to learn at their own paces.

Products of this work include complete sets of lectures—PowerPoint slides with audio narration—for each course. Faculty researchers also developed a platform for defining and administering a suite of online tutorial exercises, together with a complete semester's worth of online assignments for each course. These interactive materials are in use at MIT, and iCampus has begun to make them available on MIT OpenCourseWare, enabling worldwide access to two signature courses of the world's top-ranked computer science program.

As a result of this effort, a verifiable model for rebuilding online learning within engineering education was established. Students accessed web-based lectures designed with PowerPoint audio narration. Computer Science faculty members who developed the course contend that audio is superior to video for these purposes. Among other things, audio segments accompanying each slide can be updated easily from semester to semester, whereas updating video segments requires an expensive production process. Faculty researchers developed a platform for defining and administering a suite of online tutorial exercises. Students self-tested during instruction, writing short programs that automatically validated against a test suite and reported results. Related work in the computer architecture course included having students design circuits that the system ran through a verifier; and in the artificial intelligence course, students inputted formal language proofs that the system automatically ran through a proof checker.

Studies and models like these from MIT reinforced the overall goal for educational technology to boost comprehension of material by enabling students to learn at their own paces and schedules and to obtain immediate feedback on their progress. More notable was that instructors spent more time developing new content and interacting with students.

Comparison studies indicated that online material is *more educationally effective* than live lectures in conveying both broad conceptual ideas and detailed technical content. Based on an assessment study of 168 students, preliminary results compared student performance on material covered in live lectures versus material covered in the online system—both broad concepts and technical content. To a high confidence level, online experience surpassed live lectures in both categories.

Physics

iCampus's most ambitious project in this area was Technology Enabled Active Learning (TEAL), which replaced all lectures in freshman physics with "studio-mode" instruction, where students work in small groups using laptops that run simulations, administer short in-class quizzes, and control laboratory demonstration equipment. Freshman physics is MIT's largest course, required of all students, and while iCampus made TEAL possible, the scale of the experiment required significant additional investment by MIT, including construction of large multimedia classrooms dedicated to the experiment.

The goal of the iCampus physics project was to incorporate active learning methods into an introductory physics classroom. This work was modeled after the studio physics effort initiated at Rensselaer Polytechnic Institute in 1994. The studio format combined lecture, recitation, and hands-on laboratory experiments into a single classroom experience where students worked together in small groups, seated around a table, while instructors circulated about the class.

In addition to the new instructional format, TEAL created an extensive suite of physics simulations and visualizations, which MIT distributes via iCampus and OpenCourseWare. Along with visualizations, the TEAL group produced a toolkit enabling physics instructors around the world to create their own simulations and visualizations. In addition, TEAL conducted extensive professional evaluations demonstrating that MIT students perform better in studio learning instruction than in traditional lecture-style instruction.

Experimental sections were so encouraging that the Physics Department switched first-semester physics to studio mode as well. The department also began collaboration with Harvard on physics pedagogy. The final goal for freshman physics at MIT is to eliminate lectures completely and replace them with active, technology-enhanced learning.

TEAL's ambitious scope, together with the prominence of the MIT Physics Department, made TEAL one of the world's most noteworthy innovations in university physics instruction. The TEAL group received a $400K grant from the Davis Foundation of Massachusetts to disseminate work to other Massachusetts colleges and universities, and an iCampus affiliate in Taiwan received a grant from its government to build a new classroom dedicated to TEAL-style instruction. TEAL continued to expand at MIT after its three-year iCampus funding period elapsed, an endorsement of iCampus's decision to focus on sustainable innovations with institutional commitment.

One major educational hypothesis behind this transformation of freshman physics was that work with desktop experiments and simulations leads to increased conceptual understanding with no decrease in technical facility when compared to standard lecture methods. Assessment results continue to be analyzed but seem to support this hypothesis.

The assessment team administered pretests and posttests to students in both the experimental (studio) group and a control (lecture) group. Tests were designed to measure conceptual understanding of the material. Impact on conceptual understanding was measured by comparing average amounts students improve from pretest to posttest. Results showed that for students at all academic levels, improvement in the experimental group was higher than that in the control group.

Emerging Technologies

One emerging technology is tablet computing. iCampus's Natural Interaction tool let students sketch scenarios involving simple machines, such as a cart with a spring bumper at the top of a hill, with a wall at the bottom of the hill. It then used sketch understanding and simulation to animate the scenario according to the laws of physics: The cart rolls down the hill and bounces off the wall. Originally known as Magic Paper, Natural Interaction was transferred to Microsoft for release engineering, and Microsoft now distributes it under the name "Microsoft Physics Illustrator."

iCampus also examined educational implications of synthetic biology, the engineering of biological organisms at the cellular level using organizational principles of computer science. iCampus sponsored the Intercollegiate Genetically Engineered Machine Competition (iGEM), where students from over a dozen universities competed during 10 weeks in the summer to design and build biological devices implemented as genetically engineered *E. coli*. In 2006, 32 teams participated in the iGEM competition, including teams from Canada, Europe, South and Central America, India, Japan, and the US. The 2007 competition increased to 54 teams with new teams from China, Australia, Italy, and Turkey and increased numbers of teams from most regions.

A third area, which seemed exceptionally promising, was use of speech recognition technology in automatic transcription, summarization, and indexing of audio lectures. Researchers at MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) are creating an annotated corpus of lectures from OpenCourseWare and *MIT World* for use by the speech research community in developing transcription tools. They also created a web service to which anyone can submit an audio recording of a lecture and obtain an automatically generated transcript synchronized to the recording. Such a service could dramatically reduce the cost of preparing materials for distance education and could play a major role in advancing education in the developing world, both at university and precollege levels.

Overview of Other Faculty Research

The bulk of this report has described four projects illustrating how work funded at MIT supports coherent themes strategic to both MIT and Microsoft. Below is a brief synopsis of some remaining iCampus faculty projects.

- *iDAT: Web-based wireless sensors for education.* The Department of Mechanical Engineering created a comprehensive package (iDAT) for teaching instrumentation and measurement to engineering and science students, including a suite of web-based wireless sensors specifically designed as educational tools.
- *International genetically engineered machine competitions.* CSAIL researchers developed course materials for the MIT Synthetic Biology Working Group's engineered biological systems based on interchangeable, standardized biological parts and hosted international genetically engineered machine competitions for teams of students from many universities.
- *Classroom learning partner.* CSAIL researchers promoted student feedback during lectures by creating software to capture, classify, and aggregate student questions and responses and integrated this into the Classroom Presenter system (University of Washington) running on tablet PCs.
- *Visualizing cultures.* The Foreign Languages and Literatures Department deployed curriculum and software enabling university and high school students to create multimedia presentations dealing with comparing cultures, drawing upon image repositories at MIT, the Boston Museum of Fine Arts, and the Smithsonian Institution's Sackler Museum.

- *CWSpace.* MIT Libraries extended the DSpace digital repository platform to be a long-term repository for OpenCourseWare materials and implemented standards, protocols, and web service interfaces to enable DSpace to support archiving and retrieval of OpenCourseWare content.
- *Simulations in engineering education.* The Department of Aeronautics and Astronautics initiated major curriculum transformation to support active learning and simulation. Microsoft Flight Simulator was integrated into nearly every course in the department. Faculty created modeling and analysis tools closely coupled to Flight Simulator so students could simulate flying aircraft of their own designs.
- *Simulations in mechanical engineering.* Creation of "active paper" as a medium for mechanical engineering design with tablet PCs was explored as a result of our emphasis on simulations, shape recognition, and immersive feedback systems to generate human inquiry while engaged in active sketching. An early prototype of this work was demonstrated when Bill Gates reviewed Microsoft's academic programs. Similar curriculum efforts were undertaken by the departments of Mechanical Engineering, Civil and Environmental Engineering, and Health Sciences and Technology. Once more, emphasis was to incorporate active learning into lectures using both physical models and simulations. Telepresence and remote white-board technologies were evaluated for MIT's Internet 2-based collaborative courses with universities in Singapore.
- *Simulations and distributed collaborative discussions in the humanities.* The Literature section in the School of Humanities, Arts, and Social Sciences has been teaching Shakespeare with the aid of XMAS, a multimedia annotation system. Students combine video clips and writing to create and share multimedia essays. It is believed that multimedia composition will become a fundamental communication skill and that learning to create effective multimedia compositions will be a regular part of higher education, just as learning to write is today.
- *Improving collaborative design with tablet PCs.* MIT's internationally famous robot design course incorporated a .NET-based framework for teaching engineering design. The system was piloted by the International Design Contest held at MIT during summer 2002. In addition to the .NET software, students used tablet PCs and tablet-enabled applications specially developed for the course. Microsoft showcased this work in a case study and has featured it at tablet PC launches.
- *Location-based tracking in architecture.* MIT's master of architecture program created a virtual community and location-based tracking software to identify location and access to professional architects across the world. This program was carried out in collaboration with MSR's Social Computing Group.

Combined, these projects produced over 60 published papers, 32 theses, and approximately 300 public talks. Taken as a whole, these projects helped to promote a shift toward technology-based environments providing new forms of motivation, increasing student time on tasks, and providing rich feedback mechanisms for long-term scholastic development.

Student Projects

In addition to funding faculty projects, iCampus solicited and funded projects designed and managed entirely by MIT student groups. These projects have targeted creating web services to enhance campus life. Student projects each received one-year grants of $60K, with over $1.7M awarded. Student awards generated good publicity for iCampus and Microsoft on the MIT campus, but, more importantly, students often demonstrated creative ideas for web services to improve campus life. The following table describes the life cycle of student projects.

November–December	Student requests for proposals published and widely advertised. Web-based proposal system open to the MIT student community. Groups with most promising proposals interviewed and proposals refined. Final selection completed by the end of the fall semester.
February–May	Chosen students helped with project management (using MSF best practices) and presentation skills. Weekly milestone deliverables ensured projects stayed on track.
June–August	Students could elect to pay themselves or hire others to work on projects over summer. Some students offered MSR internships in areas complementary to project.
September–December	Project work continued as students returned to school. About one-third of student projects deployed work in a fall-semester course.

iCampus has funded 27 student projects. Here are snapshots of nine.

Shuttle Track

The Shuttle Track project enhanced MIT's SafeRide shuttle van service by providing spatial location and estimated arrival times, viewable on a website. The team, comprised of graduate students from diverse backgrounds, integrated three key technology components in a cost-effective, sustainable manner: GPS hardware, communication devices, and display technologies. GPS position information was transmitted over radio to a network server, where data was processed and stored in a SQLServer database. Data collected was also used with forecasting algorithms to estimate arrival times of vans at various stops along their routes. The Shuttle Track website displayed updated-to-the-minute shuttle and route information and also hosted several web services providing the same information via simple object access protocol (SOAP) over hypertext transfer protocol (HTTP). The team continued to explore different methods of displaying information to users, such as schematic route maps, telephone interfaces, and public displays.

iQuarium

iQuarium gave people a hands-on introduction to ocean engineering by placing an aquarium display screen in an easily viewed setting—in this case, the Hart Nautical Gallery. iQuarium was a colorful, interactive aquarium display screen featuring swimming fish and a visible flow field in their wakes. The student team created an animated fish screensaver with 3D modeling and rendering software, based on libraries of empirical data on fluid flow phenomena, such as complex vortices that form around live swimming fish.

Researchers usually collect this data in tow tanks and water tunnels. Tools to visualize this data are inaccessible to anyone other than researchers in the field; it takes weeks or months to transform sets of empirical data into visualizations using the latest software. For iQuarium, vertical flow field visualizations were broken down into a library and brought together into a pseudo real-time sequence that a user can control. Anyone passing the display will be able to see vortices shedding almost instantly as fish swim. The iQuarium project brought hydrodynamics out of the lab into the hallway for better understanding of principles behind ocean engineering and fluid dynamics.

Software Tools for Environmental Study

Software Tools for Environmental Study developed a mobile software application for environmental field studies streamlining data collection and improving data accuracy. The project created an electronic field notebook wireless PDA application integrating tasks of collecting data from environmental and GPS sensors, storing data, making field computations based on data, and displaying data to the field-worker and others on an internet site. The technical project objective was to create mobile field data collection software for environmental professionals.

The project also had a strong educational component focused on providing hands-on product development experience to undergraduate environmental engineering majors. Through a six-unit undergraduate seminar, students were exposed to programming for Windows CE, technologies for field studies, and entrepreneurship in the software industry. Students in the seminar built a system prototype that was field tested during an IAP trip to New Zealand and Australia, offered under the auspices of the department of Civil and Environmental Engineering. The team has been in discussion recently with representatives from the government of India, which is interested in deploying this technology.

CycleScore

The aim of the CycleScore project was to determine what motivational experiences are most effective for aerobic exercise machines and to increase a person’s desire to exercise by providing an entertaining, motivational, and fun exercise experience. CycleScore installed a working prototype of a stationary bicycle in MIT’s Zesiger sports facility connecting an exercise bike to a PC and monitor. By pedaling the bike, riders controlled the flight of a hot-air balloon floating above a mountain range on the attached computer screen. The harder they pedaled, the higher the balloon soared and the higher was the cyclist’s motivation to continue. The student project leaders hope to make this technology available to gymnasiums throughout the campus and to the greater Boston/Cambridge area in the future.

Placemap

Researchers from the Media Lab have been creating a web-based service to display an interactive campus map including information about current campus events automatically centered on the user's location.

Topobo

Researchers have been using a 3D constructive assembly system with kinetic memory in a series of educational workshops at the Boston Museum of Science to help children understand relationships between natural forms and dynamic structures.

The Huggable

This project has been designing and creating the Huggable, a sociable robot, designed with touch, responsiveness, and affect in mind, with the ultimate goal to distribute this robot to children in hospitals. Its sensate skin allows the Huggable to know where and how it is being touched, and it will be able to move and turn toward the child.

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More information about iCampus can be found at http://icampus.mit.edu/.