iCampus

Microsoft's $25-million iCampus alliance with MIT, originally planned for five years but extended for two additional years, was established in October 1999 to create and demonstrate technologies that produce revolutionary IT–enabled teaching models and improved educational tools for higher education. This strategic initiative is managed by Microsoft Research (MSR) University Relations, whose mission is to build world-class partnerships with key universities and establish Microsoft as a leading technology partner for higher education. iCampus is one of a small number of strategic alliances that MIT maintains with major corporations. The other alliances are with Amgen, Merck, Ford, NTT, Merrill Lynch, DuPont, and Hewlett-Packard.

Now completing its sixth year, iCampus has provided $21 million to fund 26 faculty research projects and 26 student-run projects. As a measure of iCampus's impact at MIT, the iCampus projects have involved more than 100 courses with a combined enrollment of over 5,200 students. Over 330 MIT researchers, including 20 percent of all MIT engineering faculty and instructors, have worked on iCampus research projects.

Beyond MIT, about 50 other universities and 13 companies have been involved in collaborations resulting from iCampus projects, and MIT researchers have interacted with a dozen Microsoft product groups. Approximately 85 articles about iCampus projects have appeared in newspapers and magazines.

Since the beginning of the alliance, Microsoft's hiring of MIT graduates has tripled while overall Microsoft hiring of college graduates has remained flat.

iCampus is governed by a six-member Joint Steering Committee (JSC), three members from Microsoft and three from MIT. The current JSC members are Thomas Healy (MSR University Relations), Paul Oka (MSR University Relations), and Steve Drucker (MSR New Media Group) from Microsoft and Tom 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 Tom Magnanti, MIT dean of engineering. The Joint Steering Committee sets strategic directions, makes funding decisions, and provides ongoing project supervision and shaping of the far-reaching impact of the research. MIT's iCampus management coordinates closely with the MIT Council on Educational Technology, the MIT central body that formulates strategy for MIT's educational technology efforts.

Each iCampus project is under the direction of a faculty member who serves as principal investigator. Students work on research projects for course credit or to fulfill advanced undergraduate or graduate thesis requirements. Projects have been funded at levels between $100K and $800K per year for one to two years, with some projects continuing for three to five years.

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

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

In addition to faculty-led projects, iCampus also solicits and funds student projects, which are designed and run entirely by MIT student groups. This is in addition to the significant numbers of students who participate as research assistants in faculty-led projects. Student projects each receive one-year grants of $60K, and the participants are led through a course in project management based on the Microsoft Solutions Framework method. To date, $1.6M has been awarded for 26 student projects ranging from designing wireless sensors to monitor water quality to integrating computer games with exercise bicycles, to implementing remote position sensing for MIT sailboats, to deploying patient tracking systems to community health workers who treat HIV+ children in Lusaka, Zambia. The availability of Microsoft funds directly to students—something unique among MIT's research alliances—has generated enormous goodwill toward the program on campus.

In March 2004, the iCampus Joint Steering Committee endorsed a major new strategic thrust for the program. With innovations having been proved at MIT, iCampus would move beyond just using MIT as a demonstration site and actively promote the adoption of these innovations at other universities worldwide. This has required a much more active role for the central iCampus staff, including hiring and managing staff that would bring the MIT work from its "alpha release" condition into a state ready for dissemination and creating the 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 was ready to accept its first affiliates in December. Over the following six months, iCampus concluded affiliate agreements involving over 40 campuses that plan to deploy iCampus innovations during the coming year. All signs indicate that many more institutions will want to participate.

Central Technical and Educational Themes

iCampus projects are diverse and selected from MIT faculty responses to requests for proposals that are issued annually. The Joint Steering Committee has promoted projects in three broad areas, chosen both for educational significance and for use of technologies that are poised for widespread diffusion among institutions of higher education. This section summarizes these themes and the most important iCampus initiatives under each theme, which we view as crucial to the impact of information technology in higher education.

Creating and Disseminating Educational Web Services

Just as with enterprise information technology, the emergence of a robust web service infrastructure through .NET and other initiatives has enormous implications for educational IT infrastructure. iCampus is pioneering the development of a few global learning web services and initiating university consortia to promote shared infrastructure and shared services in higher education. These efforts include 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 has initiated major transformations in MIT's largest courses. Among the courses changed are freshman electromagnetism (MIT's highest enrollment subject), the introductory computer science subject (taken by half of all undergraduates), architectural design, and Shakespearean drama. The impact has been felt in all of MIT's schools, and thus responds to the needs of the entire curriculum—engineering and hard sciences as well as humanities and social sciences. Transformations include the following:

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

Educational Applications of Emerging Technologies

Although iCampus emphasizes work that can be deployed for large-scale use in the short term, the program does sponsor a few research investigations of significant emerging technologies. Some of these are tablet computing, synthetic biology, and speech recognition and transcription.

iCampus has also sponsored rigorous assessment studies of these innovations. The results of these assessments are being integrated into the projects. Initial analysis supports the conclusion that IT–based "active-learning" systems are superior to lecture methods in fostering student learning. These are high-stakes, high-profile efforts. Given MIT's history of worldwide impact in curriculum innovation, demonstrated success here can 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—are beginning to have an enormous impact on enterprise IT in almost every industry. The same is true in higher education, where scarce university resources such as expensive laboratory equipment are increasingly being connected to the web. Web services can consequently be the basis for a major new educational IT framework of software and services shared among universities and between universities and industry. The iCampus Joint Steering Committee recognized this at Microsoft's first announcement of the .NET initiative and put into motion a plan to build major iCampus projects around web service opportunities. iCampus is evolving to explore web services as agents of change for how universities collaborate around shared educational resources and improve scholarship globally.

This section surveys two iCampus research projects that promote web services and shared infrastructure. This includes 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 is iLabs, a .NET-based infrastructure for placing laboratory equipment online. The iLabs project has developed an architecture and a set of foundational web services that provide remote accessing laboratory equipment, allowing labs to be shared across campus or across the world. As an example, students in Singapore and Sweden have been using MIT equipment—the same equipment used by MIT students—to perform transistor characterization experiments in their microelectronics course for the past three years.

iLabs has the potential to revolutionize engineering education by drastically reducing the cost to universities of providing laboratory courses. The iLabs team has just released a software development kit that universities can use to put lab equipment online for sharing, and iCampus affiliates in Mexico, Brazil, Germany, UK, Australia, China, Taiwan, Uganda, Tanzania, and Nigeria are planning to implement shared laboratories this year. 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, are being defined and implemented with .NET. A core "Lab Server" service manages access to the 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 the development of web-accessible laboratories across universities worldwide. Web-based shared laboratories being developed at MIT include microelectronics, polymer crystallization, chemical reactor and gas chromatograph, heat exchanger, and vibrating structures. In the long run, all university laboratory facilities could form the core of a global shared resource for science and engineering education. We are working 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 is the MIT Online Assessment Tool (iMOAT), a .NET-based web service that lets universities collaborate in administering and grading essay exams. It permits universities to set up web sites where students register, view essay questions, and submit their responses. The system stores the responses and provides workflow and tracking for administering and grading the exams. MIT has used this system for administering essay examinations to all entering students, and seven other universities are currently administering exams via the MIT site. iCampus is currently doing release engineering on the system so that it can be distributed and replicated.

Universities today operate largely as "IT islands," rarely sharing infrastructure around core educational or administrative activities. iMOAT illustrates how the 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 has also established a large repository of essays (students opt in when submitting) that has the potential to become one of the premier research databases for writing analysis.

iMOAT is designed for large-population exams such as the writing placement exams taken by all entering students at most universities. Administering these exams via the web is a major convenience for both students and administrators, but few universities are able to develop or maintain their own installation. It is highly attractive for universities to subscribe to such 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, Caltech, the University of Cincinnati, DePaul University, and Louisiana State. The system was used to grade over 4,000 essays, including the writing placement essays for much of MIT's fall 2002, 2003, and 2004 entering classes. The iMOAT project has continued to expand, launching a major university consortium for supporting and sharing this web service.

Reinventing the Classroom with Educational Technology

While iCampus's web services theme explores web services as agents of change for how universities collaborate around shared educational resources, the second major theme focuses on pedagogy and classroom transformation. Here iCampus has chosen to concentrate on major experiments that aim at reducing the passivity of traditional lecture courses through active learning experiences supported by information technology.

The projects selected sparked fundamental reworkings of MIT's largest courses to demonstrate the effect technology could have on scaling education, improving learning outcomes, and demonstrating innovative uses of technology in a distributed, wireless environment that uses both Unix and Microsoft technologies.

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

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

Computer Science

A second major iCampus project in classroom transformation has been the 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 the large lectures entirely and replacing them with interactive technologies that enable students to learn at their own pace.

Products of this work include complete sets of lectures—PowerPoint slides with audio narration—for each course. The 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 just begun to make them available on MIT OpenCourseWare, thus 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 has been established. Students access web-based lectures designed with PowerPoint audio narration. The Computer Science faculty members developing the course contend that audio is superior to video for these purposes. Among other things, the audio segments accompanying each slide can be easily updated from semester to semester, whereas updating video segments would require an expensive production process. The faculty researchers developed a platform for defining and administering a suite of online tutorial exercises. Students self-test during instruction, writing short programs that automatically validate against a test suite and report the results. Related work by the same group of faculty include, in the computer architecture course, having students design circuits and having the system run these through a verifier; and in the artificial intelligence course, having student input proofs in a formal language and having the system automatically run these through a proof checker.

Studies and models like these from MIT reinforce the overall goal that educational technology can boost comprehension of material by enabling students to learn at their own pace and schedule and obtain immediate feedback on their progress. More notable is that instructors can now spend more time developing new content and interacting with students.

Comparison studies indicate that the online material is *more educationally effective* than the live lectures in conveying both broad conceptual ideas and detailed technical content. Based on an assessment study of 168 students, preliminary results compare 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 surpasses live lectures in both categories.

Physics

iCampus's most ambitious project in this area is Technology Enabled Active Learning (TEAL), which has 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 the construction of large multimedia classrooms dedicated to the experiment.

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

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

The experimental sections were so encouraging that the Physics Department is switching first-semester physics to studio mode as well. They are also beginning to work with Harvard on integrating the model. If all goes as planned, freshman physics lectures at MIT will have been completely eliminated by the end of 2005 and replaced by active, technology-enhanced learning.

TEAL's ambitious scope, together with the prominence of the MIT Physics Department, makes TEAL one of the world's most noteworthy innovations in university physics instruction. The TEAL group has recently received a $400K grant from the Davis Foundation of Massachusetts to disseminate this work to other Massachusetts colleges and universities, and one of the iCampus affiliates in Taiwan has received a grant from its government to build a new classroom to be dedicated to TEAL–style instruction.

TEAL has continued to expand at MIT even after its three-year iCampus funding period elapsed, which is an endorsement of iCampus's decision to focus on sustainable innovations that have institutional commitment.

One major educational hypothesis behind this transformation of freshman physics is that the 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 are still being 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. These tests were designed to measure conceptual understanding of the material. The impact a course has on conceptual understanding can be measured by comparing the average amount students improve from the pretest to the posttest. Results show that for students at all academic levels, the improvement in the experimental group was higher than that in the control group.

Emerging Technologies

One of these technologies is tablet computing. iCampus' Magic Paper tool lets students sketch scenarios involving simple machines, such as a cart with a spring bumper at the top of the hill with a wall at the bottom of the hill. It then uses 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. Magic Paper was transferred to Microsoft for release engineering, and Microsoft is now distributing it under the name "Microsoft Physics Illustrator."

iCampus is also looking at the educational implications of synthetic biology—the engineering of biological organisms at the cellular level using the organizational principles of computer science. iCampus sponsors the Intercollegiate Genetically Engineered Machine Competition, where students from a dozen universities compete over 10 weeks in the summer to design and build biological devices implemented as genetically engineered E. coli. This summer's competition will include teams from MIT, Harvard, Toronto, University of Texas–Austin, Cornell, Princeton, and others.

A third area, which seems exceptionally promising, is the use of speech recognition technology in the automatic transcription, summarization, and indexing of audio lectures. Researchers at MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) are currently creating an annotated corpus of lectures from OpenCourseWare and *MIT World* for use by the speech research community in developing transcription tools. They also plan to create 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 would 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 the university and precollege levels.

Overview of Other Faculty Research

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

- *iDAT: Web-based wireless sensors for education.* The Department of Mechanical Engineering is creating 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.* Researchers in CSAIL are developing course materials for the MIT Synthetic Biology Working Group's engineered biological systems based on interchangeable, standardized biological parts and hosting international genetically engineered machine competitions for teams of students from several universities.

- *Classroom learning partner.* Researchers in CSAIL are promoting student feedback during lectures by creating software to capture, classify, and aggregate student questions and responses and integrate this into the Classroom Presenter system (University of Washington) running on tablet PCs.

- *Visualizing cultures.* The Foreign Languages and Literatures Department is deploying curriculum and software to enable 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.* The MIT Libraries are extending the DSpace digital repository platform so that it can be a long-term repository for OpenCourseWare materials and implementing the 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 a major curriculum transformation to support active learning and simulation. Microsoft Flight Simulator is integrated into nearly every course in the department. The faculty created modeling and analysis tools closely coupled to Flight Simulator so that students could simulate flying aircraft of their own design. *Result: Game-based simulation software can be used to engage students in rich experiential learning and improve their "real world" knowledge, if the simulation software imitates "real world" experience.*

- *Simulations in mechanical engineering.* The creation of "active paper" as a medium for mechanical engineering design with Tablet PCs will be explored further 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 at a Bill Gates review of Microsoft's academic programs. *Result: Software is designed to simulate physics and mechanical engineering education around simulation software to improve learning.*

- Similar curriculum efforts have been undertaken by the departments of Mechanical Engineering, Civil Engineering, and Health Science and Technology. Once more, the emphasis has been to incorporate active learning into lectures using both physical models and simulations. Telepresence and remote whiteboard technologies have been evaluated for MIT's Internet 2–based collaborative courses with universities in Singapore. A cross-departmental effort within MIT's School of Engineering developed simulations and online curriculum for teaching fluid mechanics. *Result: A need was demonstrated for improving telepresence (n-way video conferencing) with a rich set of collaborative tools to enhance learning.*

- *Simulations and distributed collaborative discussions in the humanities.* The Literature Section in the School of Humanities, Arts, and Social Sciences is teaching Shakespeare with the aid of XMAS, a multimedia annotation system. Students combine video clips and writing to create and share multimedia essays. This project arises from the belief 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. *Result: Multimedia software is developed to discuss different productions of Shakespeare's plays, with accompanying text and discussion.*

- *Improving collaborative design with TabletPCs.* MIT's internationally famous robot design course is incorporating 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 PC's and tablet-enabled applications specially developed for the course. Microsoft has showcased this work in a case study and has featured it at Tablet PC launches. *Result: Software integrating collaborative design using Tablet PCs improves student design.*

- *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 is being carried out in collaboration with MSR's Social Computing Group. *Result: Location-based services with web interfaces improve architecture education.*

- *Basic research in gaming for learning.* We have inquired why gaming hasn't taken off in education. What are the reasons education and entertainment haven't historically mixed? Given the next generation of multiplayer, object-event–driven technologies that enable students to manage objects in rich, visual environments, we are exploring how to develop environments that use storytelling, strategy, object manipulation, consequential behaviors, and increased time on task to examine another platform for learning. Development and study of a collection of immersive simulation games as prototypes for a next generation of educational games promises another breakthrough in learning.

- *Photologs by children around the world.* We awarded seed funding for a program that involved MIT undergraduates in collaborations with children in countries around the world in order to produce extensive photographic libraries and books that document what it's like to be a child in those countries. The Expeditions

Project successfully created and marketed "the largest book in the world" and is using the proceeds form the sale of the book to build a school in Bhutan.

Combined, these projects have produced over 50 published papers, 28 theses, and approximately 220 public talks. Taken as a whole, these projects are helping to promote a shift toward technology-based environments that provide new forms of motivation, increase student time on task, and provide a rich feedback mechanism for long-term scholastic development.

Student Projects

In addition to funding faculty projects, iCampus solicits and funds projects designed and run entirely by MIT student groups. These projects are targeted toward creating web services that will enhance campus life. Student projects each receive one-year grants of $50K, and to date over $900K has been awarded. These student awards have generated good publicity for iCampus and for Microsoft on the MIT campus, but more importantly, students have often demonstrated creative ideas for web services to improve campus life. The table below describes the life cycle of student projects.

November	Student RFP published and widely advertised. Web-based proposal system opens to MIT student community.
December	Groups with most promising proposals are interviewed and proposals are refined. Final selection is completed by the end of the fall semester.
February–May	As a condition of funding, all students receiving an iCampus grant must enroll in a for-credit spring semester course taught by an MS FTE. The course focuses on project management (using MSF best practices) and presentation skills. Weekly milestone deliverables ensure the projects stay on track.
June–August	Students can elect to pay themselves or hire others to work on the project over the summer. Some students have been offered MSR internships in areas complementary to the project.
September–December	Project work continues as students return to school. About one-third of the student projects deploy their work in a fall-semester course.

iCampus has funded 26 student projects to date. Here are snapshots of nine.

Shuttle Track

The Shuttle Track project has enhanced MIT's SafeRide shuttle van service by providing spatial location and estimated arrival times, viewable on a website. The team, comprised of MIT graduate students from diverse backgrounds, has integrated three key technology components—GPS hardware, communication devices, and display technologies—in a cost-effective, sustainable manner.

GPS position information is transmitted over radio to a network server, where the data is processed and stored in a SQLServer database. The data collected is also used with forecasting algorithms for estimating the arrival times of the vans at various stops along their routes. The Shuttle Track website displays updated-to-the-minute shuttle and route information and also hosts several web services that provide the same information via simple object access protocol (SOAP) over hypertext transfer protocol (HTTP). The team is also exploring different methods to display the information to users, such as schematic route maps, telephone interfaces, and public displays. An additional goal is to author how-to and best-practice guides and make them available to other universities.

DevHood

Devhood (http://www.devhood.com/) is an online student community that lets college students all over the world come together to learn about Microsoft and .NET technologies. Created by six MIT students on the .NET platform in early 2001, DevHood has grown into a community with over 10,000 users from 400 colleges. DevHood incorporates a revolutionary user experience and rating system that integrates elements of a traditional role-playing game with an online community, providing user contribution metrics as well as an incentive for users to continue to take part in the community.

The Student Developer Community project is a .NET developer's community/website for college students worldwide. The focus is on students interested in learning about the latest in Microsoft technology and discussing software development. Students will revamp software user interfaces and add features, including college-specific themes, intercollegiate competitions, personal calendars, administration features, messaging and chat capabilities, class specific discussion boards, and mobile accessibility.

iQuarium

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

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

Software Tools for Environmental Study

Software Tools for Environmental Studyhas developed a mobile software application for environmental field studies that streamlines data collection and improves data accuracy. The project has created an electronic field notebook wireless PDA application that integrates the tasks of collecting data from environmental and GPS sensors, stores the data, makes computations in the field based on the data, and displays the data to the field-worker and to others through an internet site. The technical project objective was to create mobile field data collection software for the environmental professional.

The project also has 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 recently been in talks with representatives from the government of India, who are interested in deploying this technology.

CycleScore

Aerobic exercise is not often engaging or motivating and would be more effective if it were as much fun as playing sports. The aim of the CycleScore project is to determine what kinds of motivational experiences are most effective for the use of aerobic exercise machines and to increase a person's desire to exercise by providing an exercise experience that is entertaining, motivational, and fun.

CycleScore has installed a working prototype of a stationary bicycle in MIT's Zesiger sports facility that connects an exercise bike to a PC and monitor. By pedaling the bike, riders control the flight of a hot-air balloon that floats above a mountain range on the attached computer screen. The harder they pedal, the higher the balloon soars and the higher is the cyclist's motivation to continue. The student project leaders hope to make this technology available to gymnasiums throughout the MIT campus and to the greater Boston/Cambridge area in the future.

PlaceMap

Researchers from the Media Lab are creating a web-based service to display an interactive campus map that includes information about current campus events and is automatically centered on the user's location.

Open Health

This project is designing a locally maintainable, web-based system to track home-based health care for pediatric HIV patients in Zambia, in response to the high rate of HIV infection and lack of sufficient traditional health care options.

Topobo

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

The Huggable

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

Hal Abelson
Director
Class of 1922 Professor of Computer Science and Engineering

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