Design Laboratory

Established in 2006 under the leadership of William J. Mitchell, the Design Laboratory (DL) is located within the School of Architecture and Planning. Its work focuses on the theories, techniques, and practices of innovative design as it pursues research, executes practical design and art projects, and engages in scholarship and criticism.

The Design Laboratory is organized as a collection of multidisciplinary research and project teams unconstrained by the traditional boundaries among design, planning, and engineering professions and disciplines. The laboratory's projects engage new technologies to find fresh and highly effective solutions to problems of substantial social, economic, and cultural importance. They are concerned not only with the design of individual products, buildings, and urban areas but also with the roles that these elements play in larger urban, regional, and global systems and their long-term sustainability. The laboratory is committed to the highest standards of design quality, and it pursues its projects within a context of vigorous debate about related issues of values, ethics, and social justice.

In 2008–2009, the Design Laboratory was host to five projects, programs, and groups:

- ArchNet
- Digital Design and Fabrication Group
- House_n
- Mobile Experience Lab
- Smart Customization

In addition, the Design Laboratory is affiliated with the Legatum Center for Development and Entrepreneurship, the SENSEable City Laboratory, and Smart Cities.

All five DL projects were recipients of larger budgets and/or new sponsors in 2008–2009.

ArchNet

ArchNet is an online international community of scholars, students, and professionals concerned with architecture, planning, and landscape design, with a special focus on the Islamic world. The ArchNet site is located at http://www.archnet.org/. Its goal is to build bridges, particularly between the Islamic world and the West; share resources; encourage collaboration and communication; nurture local expertise; and become an indispensable tool for the teaching of architecture.

ArchNet currently has more than 63,000 members from 190 countries, with more than 5,000 visitors a day. The "top 10" member countries are the United States, India, Egypt, the United Kingdom, Turkey, Canada, Iran, Pakistan, Serbia, and the United Arab Emirates. The Digital Library continues to grow, with 65,000 images, 4,500 publications and files, and 8 GB transferred per day. The group workspaces continue to be used extensively, especially for educational purposes. During the past year, the project supported six student research assistant positions at MIT.

The site is in the process of being completely reconceptualized and redesigned to move from a largely "top-down," centralized mode of collection and dissemination to one that is "bottom-up" and decentralized. In response to this initiative, project funding increased by 30% in 2009, which permitted us to hire new graduate research assistants and several consultants.

Digital Design and Fabrication Group

The Digital Design and Fabrication Group is a center for education and research in rapid prototyping and CAD/CAM operations for architects and designers. The group engages faculty and students in research focused on the relationship between design computing and the physical output of information using rapid prototyping and CAD/CAM machines for design representation and reflection.

The Digital Design and Fabrication Group offers a number of graduate and undergraduate courses that focus on the relationship between design and digital fabrication. Using state-of-the-art CAD/CAM machines including 3D printers, milling machines, and cutters, students, faculty, and researchers have undertaken a number of projects. Materializing Design investigates the theory of materializing a design beyond prototyping and computing. Design with Wood Substrates addresses ways to materialize designs with plywood products such as houses and furniture. Computable Composite Components is a novel evolutionary system used for the production of tiles and blocks. Finally, Historical Reconstructions studies ways to materialize historical structures designed by past architects yet still unbuilt.

One of the major accomplishments of the group over the past year was yourHOUSE, a research and design project that is breaking new ground as a pioneer in prefabricated home construction. Displayed at the Museum of Modern Art in New York, the design of the house was a reinterpretation of historical New Orleans–style "Shotgun" housing utilizing recycled plywood as the main structural material. The house was fabricated and assembled on site entirely of friction-fit components, completely eliminating the need for mechanical fasteners such as nails and screws. This fabrication technique was made possible through the extensive use of computer numerical control milling machines. The work led to the establishment of Physical Design Co, an MIT start-up company that is bringing this exciting technology to market.

House_n

House_n is a research group that focuses on how the design of the home and its related technologies, products, and services should evolve to better meet the opportunities and challenges of the future and the needs of people as they live in their homes. This broad research approach is leading to innovative product ideas not likely to be uncovered in more narrowly focused industries or research endeavors. Major House_n initiatives include the PlaceLab and the Open Source Building Alliance.

The PlaceLab, a joint MIT and TIAX LLC initiative, is a residential condominium located in Cambridge, MA, that is designed to be a highly flexible and multidisciplinary observational research facility for the scientific study of people and their interaction patterns with new technologies and home environments. More information about the

Place Lab is available at http://architecture.mit.edu/house_n/placelab.html. The Open Source Building Alliance's goal is to develop key components of a more responsive model for creating places of living where (1) developers become integrators and alliance builders to offer tailored solutions to individuals, (2) architects construct design engines to efficiently create thousands of unique environments, (3) manufacturers agree on interface standards and become tier-one suppliers of components, (4) builders become installers and assemblers, and (5) customers (home buyers) become "designers" at the center of the process by receiving personalized information about design, products, and services at the point of decision. More information about the Open Source Building Alliance is available at http://architecture.mit.edu/house_n/projects.html#osba.

In 2009 House_n sponsored two consortium events: Low-Energy Buildings and Energy Behavior Change and (Re)Mix: Living and Working. Two courses, Kalasatama Architectural Design Studio and Responsive Cities Seminar, were offered in the spring semester. The group was awarded several grants: a National Institutes of Heath grant for "Enabling Population-Scale Physical Activity Measurement on Common Mobile Phones"; a grant from TEKES, the Finnish National Funding Agency, for the "Mobile Health Project" and the "Situated Innovation Project"; and a grant from the MIT Energy Initiative for the "Siemens Lighting Project." In addition, House_n gained Allstate Insurance, Daikin, and Procter and Gamble as sponsors.

Mobile Experience Lab

The Mobile Experience Lab (MEL) focuses on radically reinventing and creatively designing connections between people, information, and places using cutting-edge information technology to improve people's lives through meaningful experiences. With a multidisciplinary team, we research and design new technologies along with their impact on societies, spaces, and communities.

The lab has been working on a number of projects over the past year. Connected Sustainable Homes is an alliance between MEL and the Fondazione Bruno Kessler. The goal of the alliance is to advance research in sustainable connected homes, including subtopics of renewable energy systems, sustainable architecture, social sustainability, and connected information systems, to optimize home behavior and people's lives. Ride. link, a ride-sharing system for young people who utilize wearable media, promotes social sustainability. Its goal is to strengthen communication among communities and with institutions. NFC@ MIT envisions use of Near-Field Communication (NFC) in the specific context of the MIT campus. Current NFC usages include mobile ticketing on public transportation systems, mobile payment, smart postering, and Bluetooth pairing. Locast is an innovative platform for discovering and sharing location-based user-generated videos and production-quality multimedia content provided by RAI TV. It consists of a combination of mobile and wearable computing elements supported by a distributed web application. This project was deployed in Venice, Italy, on July 3, 2009. Finally, in collaboration with the Smart Cities group, we are proceeding with a project in Brescia, Italy, involving the GreenWheel Bicycle. We are seeking to design the road map for technology and user experiences, and we will deploy the project in Brescia, Italy,in the upcoming year.

Smart Customization

The Mass Customization Interest Group is an MIT-industry collaboration devoted to improving the ability of companies in various industries to efficiently customize products and services for diverse customer groups. This industry interest group brings together the key players in the area of mass customization and strives to become a vital community of practice in this field. The Smart Customization group focuses on advancing research in the key areas of customized manufacturing, smart supply chain networks, custom product design, product architecture, and sustainable customization.

The objectives of the group are to increase knowledge of effective and efficient ways to provide custom products and services, to advance "smart customization" as a field of research, and to establish a productive group of executives and researchers who are aware of the latest research and its applications in industry.

Affiliates

Legatum Center

The Legatum Center for Development and Entrepreneurship was founded on the belief that economic progress and good governance in low-income countries emerge from entrepreneurship and innovations that empower ordinary citizens. The center was established at MIT in 2007 through a structured gift of $50 million from Legatum, a global investment firm.

The center administers programs and convenes events that promote and shape discourse on bottom-up development. Led by Iqbal Z. Quadir, founder of GrameenPhone and Emergence BioEnergy, the center runs a highly competitive fellowship program for MIT graduate students who intend to launch enterprises in low-income countries. In addition, the center convenes an annual conference, hosts lectures, and supports teams of enterprising men and women at MIT who are passionate about starting viable businesses in the developing world.

SENSEable City Laboratory

The increasing deployment of sensors and hand-held electronics in recent years allows a new approach to the study of the built environment. The way we describe and understand cities is being radically transformed as well as the tools we use to design them. Studying these changes from a critical point of view and anticipating them are the goals of the SENSEable City Laboratory.

The lab is involved in a number of projects, including Real Time Copenhagen Eye Stop, GeoBlog, Spacebook, TrashTrack, the Copenhagen Wheel, Pink, and SmartSign.

Smart Cities

Research of the Smart Cities group focuses on intelligent, sustainable buildings, mobility systems, and cities. It explores application of new technologies to urban energy efficiency and sustainability, enhanced opportunity and equity, and cultural creativity. Buildings and cities can usefully be compared to living bodies. They have skeleton and

skin systems that provide shelter and protection to inhabitants, metabolic systems that process inputs of materials and energy to support daily life, and now artificial nervous systems consisting of sensors, networks, and ubiquitously embedded computational capacity. Smart Cities is particularly concerned with the emerging roles of networked intelligence in fabrication and construction, urban mobility, building design and intelligently responsive operation, and public space. It takes a broadly multidisciplinary approach and is not constrained by traditional professional boundaries.

Projects include Mobility-on-Demand Systems, CityCar with General Motors, Wheel Robots, RoboScooter with the Industrial Technology Research Institute and Sanyang Motors, GreenWheel Bicycle, Liberated Pixels, and Protopia.

Administrative Initiatives

In the summer of 2008, the Design Laboratory moved to new offices at 1 Cambridge Center, which permitted, for the first time, four of the DL projects (ArchNet, House_n, the Legatum Center, and the Mobile Experience Lab) to share common space and have all of their staff located together under one roof. Additional space was made available to Digital Design and Fabrication Group research assistants. The move has had a positive impact on the laboratory's work. Not only has it improved coordination and effectiveness within groups, but it has opened up possibilities for collaboration between groups.

William J. Mitchell
Director

More information about the Design Laboratory can be found at http://design.mit.edu/.