

MIT House_n Research Consortium/Open Source Building Alliance (OSBA)

Autumn 2005 Newsletter

1. Upcoming Meeting

Our next sponsor-only meeting will be held on Wednesday, November 2nd, 2005 at MIT. This meeting will focus solely on the development of an interior partition system for the OSBA OPEN Prototype House Initiative.

This design meeting is open only to House_n/OSBA sponsors and companies seriously considering sponsorship who have not attended a previous meeting.

2. OPEN Prototype House Initiative Update

At the June, 2005 sponsor meeting, we presented the master plan for the Crotched Mountain site, the program for the OPEN_1 prototype, opportunities for sponsor collaboration and participation, and preliminary designs for the OPEN Prototype House Initiative. Work on the design is continuing, with an anticipated construction completion date of June, 2006.

For more information, please visit,

http://architecture.mit.edu/house_n/documents/OPEN_Prototype.pdf

3. Galileo Lofts @ MIT – a Non-profit Multifamily Housing Prototype

The Cambridge Redevelopment Authority has approved a prototype multifamily housing project to be built adjacent to MIT. A non-profit group under the direction of Kent Larson is now being formed to work with the MIT House_n Open Source Building Alliance to test a new model for creating housing. It will allow industrial partners to collaborate in the deployment of new design and construction methods, as well as develop strategies for highly personalized interiors and furnishings. Specifically, the goals of the projects are:

- Test and evaluate a new model for housing design, construction, and financing.
- Create a larger percentage of affordable housing units than would typically be possible with a for-profit development company.
- Help coordinate efforts with CRA for the funding, design, and construction of a public park.
- Create a structure that encourages manufacturers to contribute time and products in the interest of developing a new model for highly responsive housing.
- Secure grants to subsidize emerging systems related to sustainable buildings.
- Fund three prototypical, highly instrumented research apartments.
- Fund MIT students to work on real-world projects that create a rich educational experience related to design, technology, energy production/conservation, proactive health, responsive housing, affordable housing, etc.

An update of this project was presented at the June 2005 sponsor meeting.

4. PlaceLab Update/Activities:

The PlaceLab was featured in a three-page spread in the autumn edition of the Media Lab Frames publication. The highly instrumented infrastructure and four ongoing projects that utilize the PlaceLab were described.

Over the summer the PlaceLab was used to collect data for two thesis projects and to further development of the House_n Portable Sensor Toolkit. Pallavi Kaushik used the PlaceLab in an exploratory study testing a new type of context-sensitive medication reminder system. Jason Nawyn used the PlaceLab for an exploratory study to test a novel device designed to encourage physical activity by discouraging television viewing. In addition, Randy Rockinson and several undergraduate students used the PlaceLab to stress-test the object motion MITes – sensors in the House_n Portable Sensor Toolkit designed to be easily and quickly “installed” in existing homes. Results from these experiments are currently being written up for publication.

The PlaceLab has also been used in new grant applications with partner, TIAX, LLC. Two Small Business Innovative Research Grants (SBIRs) were submitted, one to the NIH and one to DARPA. Both SBIRs proposed using the PlaceLab’s unique capabilities to develop and test new home health monitoring systems.

We have released a preliminary test dataset from the PlaceLab, to encourage sponsor companies and academic collaborators to use the dataset in their own work. That sample dataset, to be updated soon, can be found here:

http://architecture.mit.edu/house_n/data/PlaceLab/PlaceLab.htm

We continue to document the capabilities of our sensor systems to encourage sponsor involvement.

5. MITes update:

MITes (MIT Environmental Sensors) are portable wireless sensing devices created by House_n for real-time data collection of human activities in natural settings. MITes come in several forms. Mobile MITes are wearable accelerometers that are now being used extensively in House_n research, as well as by our collaborators. To date, MITes are being used as follows:

- Dr. Sandy Pentland (MIT Media Laboratory) is using MITes for research on activity recognition for a large multi-institutional DARPA project.
- Dr. Pattie Maes (MIT Media Laboratory) is using MITes in an RFID-reading glove being used to demonstrate new ideas in ubiquitous computing
- Dr. Bill Haskell (Stanford Medical School) is using MITes as part of a joint House_n/Boston Medical School research project on measuring everyday physical activity. Dr. Haskell is validating the MITes compared to other wired and bulky

accelerometers used in the medical field and finding excellent performance qualities.

- Dr. Chris Wren (Mitsubishi Electric Research Laboratory) is using a new version of the MITes designed by House_n student Emmanuel Munguia Tapia in a project on automatic detection of activity in office spaces.
- Dr. Robert Friedman (Boston University Medical School) is using MITes in a joint House_n/BU study to develop a new physical activity measurement system.

The House_n team began a new phase in MITes testing this summer, for the first time asking participants in experiments to “install” the sensors on their own in their own homes. Our goal is to create a system that can be easily deployed by a layperson without any computer experience in their own homes in just a few hours. The sensors could then be used to drive innovative applications, such a preventive healthcare monitoring.

House_n researchers are working with SteelCase, a new House_n sponsor, to design an office-scale experiment that will use the MITes as well.

6. PlaceLab Participant Recruiting

We need your help developing a community of potential PlaceLab volunteers. Please forward the note below to anyone you know who lives near Boston who might consider participation:

Help Create Technologies for Healthy Living

We are seeking individual volunteers to live in a state-of-the-art, comfortable apartment in Cambridge, MA. Researchers from MIT's Department of Architecture in collaboration with TIAX LLC seek volunteers to participate in experiments related to the home, such as those investigating how to promote healthy living. Volunteers must be over 18, have a permanent residence in the Boston area, spend most of their time at home, and not be employed by MIT. For more information and to learn how you may participate in PlaceLab and other House_n research studies, please contact homestudy@mit.edu or call Jennifer at 617-452-5679.

7. Current Project Updates:

Media Lab student Jason Nawyn has completed his SM thesis: *A Persuasive Television Remote Control for the Promotion of Health and Well-Being*.

Abstract: New forms of media technology that enter the home often fundamentally transform the way that people spend their time. In the present day, daily "screen time" with televisions and other entertainment systems continues to rise. Within this climate of escalating media consumption, experts in the medical community have repeatedly voiced concerns about the public health crisis that looms over a largely sedentary U.S. population. Principal among these concerns is the continuing upward trend in lifestyle-related disorders such as obesity and Type 2 diabetes. Within the last two decades, substantial epidemiological research has linked excessive television viewing with both obesity and Type 2 diabetes. This

work describes the design, implementation, and evaluation of a ubiquitous computing system intended to simultaneously decrease a user's television viewing while increasing his or her frequency and quantity of non-sedentary activities. This system, known as ViTo, employs a residential sensing infrastructure to recognize an individual's television viewing and uses wearable accelerometers to detect physical movement. The primary user interface consists of a handheld computing device that serves as a wireless remote control for a television and home theatre system, as well as an interface for planning and reviewing daily activity. This device tracks daily activity patterns and uses theories of behavior modification to non-intrusively persuade users to decrease their daily television use while increasing physical activity. Results from a 14-day case study evaluation revealed examples of how persuasive interface design elements might influence user behavior without inducing a burden of annoyance.

Media Lab student Pallavi Kaushik has also completed her SM thesis project: *The Design and Evaluation of a Mobile Handheld Intervention for Providing Context-Sensitive Medication Reminders*.

Abstract: This work introduces the design and exploratory evaluation of a home reminder system for medication and healthcare that situates the timing and location of reminders based on contextual information about the user. The system consists of three major components: 1) a handheld computing interface for providing reminders, 2) a sensor subsystem integrated into the home environment, and 3) a central server that manages medical tasks and reasons over sensor data in real time. A volunteer participant adhering to a complex regimen of simulated medical tasks is closely observed in a residential research facility. The participant is presented with both context-sensitive reminders and reminders that are scheduled at fixed times during the day. The degree of adherence to the regimen, and the participant's own assessment of the usefulness of each reminder (while blinded to the reminder strategy being used), are evaluated over the course of a 10-day study. Quantitative and qualitative results are provided, comparing the efficacy of context-sensitive reminders over fixed-time reminders with respect to adherence and perceived value.

Louis Lopez completed his M.Eng. thesis: *A Sensor Toolkit to Facilitate Context-Awareness for Just-In-Time Questioning*.

Abstract: Studying human behavior is a task that researchers in many diverse fields from medicine to ubiquitous computing perform to identify potential health risks or to better understand how computers can assist people. One effective means of acquiring data on human behavior is through just-in-time (JIT) questioning whereby researchers ask a person context-sensitive questions concerning their current activities or well being at appropriate times. Automatic JIT questioning is now possible, and it involves mobile or in-home computing devices that use sensors to determine when to ask real-time contextually specific questions about a person's state. Unfortunately, there is a lack of dedicated, inexpensive, and easy-to-use sensors that are tailored to operate in a JIT questioning framework. This work describes the construction of a toolkit of sensors dedicated to providing the necessary, real-time contextual data that is needed to facilitate JIT questioning. Among the sensors in the toolkit are a heart rate monitor, an electrical current sensor, a UV radiation exposure sensor, a proximity and location sensor, and a multiple switch input sensor. The data returned by the sensors of the JITQ toolkit can be used to create context-sensitive computing devices that can determine appropriate times to ask JIT questions. The sensor toolkit can provide researchers with an affordable and robust option for carrying out behavioral studies using the JIT questioning paradigm.

Jennifer Beaudin has begun deploying KinQuery to family and co-worker user groups. KinQuery is a software application for mobile phones and desktop personal computers designed to help people preserve and share group history and knowledge. It is a prototype for novel, in-home applications that provide opportunities for social connectedness, longitudinal health tracking, and mental stimulation without being time intensive. If you are interested in trying out KinQuery, contact Jennifer (kinquery@mit.edu). We are looking for organizations where a group of 20-50 co-workers might be willing to test the software using their desktop computers.

Emmanuel Munguia Tapia spent the summer at the Mitsubishi Electric Research Laboratory (MERL) where he developed an extension to the MITes sensor kit for measuring movement throughout an office environment. He also worked on the development of pattern recognition algorithms to detect office behaviors, such as impromptu meetings.

Randy Rockinson has been helping with PlaceLab development, MITes testing, and preparing for future studies on automatic activity detection using home sensors.

Stephen Intille is working with Boston Medical, Stanford Medical, and UNC School of Public Health on experiments using MITes for preventive healthcare research and novel interventions.

Kent Larson has been leading the design process for the OPEN Prototype House Initiative and a component-based loft development project in Cambridge using House_n building strategies. He is also working with SteelCase and Gunter Henn to develop ideas for future workplace studies.

8. New Grants

Stephen Intille's grant from Intel Corporation was renewed for a third year. This grant has funded the development of KinQuery, research on personal health tracking tools, and some of the work in the PlaceLab.

Grant proposals have recently been submitted with researchers from TIAX LLC, the Harvard School of Public Health and the University of Rhode Island.

9. Transitions

House_n alum, TJ McLeish, who acted as detailing and construction manager for the PlaceLab, has moved to Chicago. He is currently teaching at the Illinois Institute of Technology as an Adjunct Professor and working in residential design.

Pallavi Kaushik has graduated and is now working at Motorola Research Labs in Chicago. Jason Nawyn has graduated and will be working as an interaction designer in the New York area.

Kenneth Cheung, a 1st Year Masters student in the Department of Architecture joined House_n in June. Kenneth graduated in 2005 with a B.A. in Architecture from Cornell

University. He will be working on the use of MITes for architectural design and analysis, particularly of office environments.

Two new Media Lab 1st year S.M. students have joined House_n as of September: Steve Pliam and Jeff Goldenson. Steve Pliam received his Masters in Architecture from Virginia Tech and has worked with architect Frank Gehry. His also part of the Media Lab group Opera of the Future. Jeff Goldenson received his BA in architecture from Princeton and has professional experience in architecture. They will be working on OSBA related activities.

10. Sponsors and Partners

We'd like to thank the following organizations for their support and collaboration:

Sponsors:

International Paper
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Samsung Housing
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TIAX, LLC
University of North Carolina School of Public Health

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Thank you for helping to make our research possible!

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Documents describing the House_n Research Consortium, benefits to sponsors, and major initiatives can be downloaded from:

http://architecture.mit.edu/house_n/publications.html