Project Summary

In 2001 an original vision of deeply-embedded computing was captured by the term "smart dust". While a decade ago this seemed a bold and visionary goal, in the years that have passed dust has grown smarter and smarter. Today these "smart" embedded sensors and actuators are aiding attempts to construct smarter structures, a smarter electrical grid, and smarter cities.

Since 2003 the ACM Conference on Embedded Sensor Systems (SenSys) has served as a nexus of exciting, original research in the fast-moving field of sensor networks. An annual, highly-selective, single-track venue, SenSys has established itself as the preëminent conference in this area. SenSys focuses on results highlighting experiences with real systems obtained by experimentation with actual embedded sensors, as opposed to simulations. SenSys'09 [1] presented multiple applications of embedded sensing technology to problems such as health care, building energy efficiency, and environmental monitoring.

Making the most of limited resources drives sensor network research to incorporate and extend work done in many other of computer science, and SenSys has maintained a broad purview to ensure that these advances reach the sensor networking community. Recent conferences have included sessions on programming languages, security and fault-tolerance, data collection and processing, architectural challenges, and power management. While the breadth of sensor networking concerns helps create an exciting research environment, it also challenges the cohesion of a field where new ideas are emerging from so many different directions. SenSys serves both as a place that practitioners count on to help highlight the most exciting and relevant new discoveries, and as a gathering place for a diverse community.

Maintaining this diversity requires facilitating access for new participants, particularly students. We are seeking travel funding for SenSys'10 to sponsor 15 attendees. Selected applicants will receive monies intended to cover travel and lodging.

Intellectual Merit: Providing students with access to the research presentations and general intellectual environment of SenSys'10 is the primary source of intellectual merit for this support request. Research results will be presented from many projects receiving NSF funding, and travel grants will be directed to applicants bringing their own unique energy and diversity to share at the conference.

Broader Impact: Bringing students together with experienced practitioners enriches existing research projects and creates new collaborations. With SenSys'10 being held in Zurich, Switzerland, this creates an even greater opportunity for US participants, who may not always be aware of research happening in Europe. A continued expansion of interest in this area will bring new minds to bear on its hard problems and help speed the development of effective and innovative solutions.

Year	Location	% Papers Accepted
2003	Los Angeles, CA, USA	17.5
2004	Baltimore, MD, USA	14.5
2005	San Diego, CA, USA	17.8
2006	Boulder, CO, USA	19.7
2007	Sydney, Australia	16.8
2008	Raleigh, NC, USA	16.3
2009	Berkeley, CA, USA	17.6
2010	Zurich, Switzerland	N/A

Table 1: SenSys history including locations and paper acceptance rates.

Background and History

SenSys'10 is the eighth annual flagship conference for sensor networking researchers. April 8th, 2010, was the submission deadline, and at present notifications have gone out to authors and the program is being finalized. The 2010 edition also features two co-located workshops — the 2nd ACM Workshop on Embedded Sensing for Energy-Efficiency in Buildings (BuildSys 2010) and an International Workshop on Sensing for App Phones (PhoneSense) — as well as a doctoral colloquium. SenSys'10 continues the tradition of including both poster and demo sessions which provide excellent forums for new researchers to receive early feedback on ongoing projects. Combining the poster and demo sessions with a carefully-selected set of paper submissions produces an exciting summary of the state of the art in embedded sensing systems.

Attendance at SenSys has fluctuated between 200 and 250 participants, with numbers evenly-divided between students and professionals. Examining attendance trends shows that SenSys'07, held in Sydney, Australia, was a low-water mark, likely due to the barriers the distance created for potential attendees. The organizers of SenSys'10 are trying to lower barriers for participants in two ways. First, SenSys'09 revenues exceeded costs, allowing student registration fees to be lowered for 2010. Second, funding received from the NSF will be disbursed through a competitive application process and offset the costs for a select group of applicants.

The NSF has consistently funded SenSys travel grants since the conference's inception in 2003.

Applicant Selection Process

Undergraduate students, graduate students and post-docs will be invited to apply for funding to support their attendance at SenSys'10. Applicants will be asked to submit the following materials:

1. An up-to-date curriculum vitae.
2. A budget detailing the applicant's funding request including estimated prices for airfare, accommodations, and other expenses.
3. A five-minute video in which they discuss their research, describe their interest in SenSys'10 and indicate how they will help contribute to a vibrant and exciting intellectual exchange. Applicants lacking access to suitable equipment may substitute a written essay addressing the same topics. Submitted videos may be used during SenSys'10 with the applicants permission.
4. A letter from the students academic advisor or supervisor addressing both the applicant's potential contributions to SenSys'10 as well as the lack of available travel funding from other sources.

Dr. Challen will coödinate the review of submitted applications. Preferences will be given to:

- Applicants who are *not* presenting papers at SenSys'10. Paper presenters are expected to be supported by their home institution. We are interested, however, in supporting students that present posters or demos, participate in the doctoral colloquium, or express interest in attending a co-located workshop.
- Applicants who, through their application materials, express a sincere and genuine interest in embedded sensor systems and seem ready to participate actively in SenSys'10. While paper presenters are usually focused on their conference presentations, attendees that do not present papers should have time to read accepted papers and help create constructive dialog surrounding the conference themes.
- Applicants underrepresented in embedded sensor systems, including women, minorities, and applicants from schools without a history of previous research in this area.
- Finally, consideration will be given to other applicants falling outside of the previous categories with a well-justified financial need.

The call for travel funding applications will highlight the NSF's consistent multi-year support of SenSys with the NSF logo appearing prominently on application materials.

Project Schedule

We expect the call for travel grant submissions to go out as soon as funding can be guaranteed, and no later than mid-September. Submitted requests will be reviewed in late September and award decisions made before advance registration closes on October 6, 2010. SenSys'10 takes place from November 3–5, 2010. A report detailing the selection process, award recipients, and conference feedback will be submitted to the NSF by the end of the year.

	Airfare	**Lodging**	**Total**
1 Attendee	$750	$250	$1,000
15 Attendees	$11,250	$3,750	$15,000

Table 1: Budget summary. Items are explained below.

Year	**Location**	**NSF Travel Support**	**Students Supported**
2003	Los Angeles, CA, USA	$15,000	20
2004	Baltimore, MD, USA	$15,000	20
2005	San Diego, CA, USA	$15,000	20
2006	Boulder, CO, USA	$15,000	20
2007	Sydney, Australia	$26,400	14
2008	Raleigh, NC, USA	$15,000	20
2009	Berkeley, CA, USA	$15,000	20
2010	Zurich, Switzerland	$15,000 (Requested)	15 (Estimated)

Table 2: History of NSF travel support for SenSys.

Budget Justification

We are requesting $15,000 to support SenSys'10 travel grants which, given the higher costs of attendance in Zurich, will support 15 applicants. Table 1 details the costs involved. Airfare is estimated based on round-trip travel from the East and West Coasts. Lodging is based on numbers for hotels near ETH Zurich campus — the SenSys'10 conference site — assuming double occupancy; applicants will be expected to arrange to share rooms.

Note that it is expected that the amounts awarded will not completely offset the total cost of attendance, as airport transportation, incidental meals and other miscellaneous expenses are not included. This is intentional. Selected applicants will be expected to contribute a reasonable amount of their own financial resources towards the intellectual growth and professional advancement SenSys'10 will facilitate.

Geoffrey Challen

né Werner-Allen

Department of Computer Science and Engineering
University at Buffalo
201 Bell Hall
Buffalo, NY 14260-2000
challen@buffalo.edu
http://www.cse.buffalo.edu/~challen/

Professional Preparation

Harvard University, Physics, A.B. 2003
Harvard University, Computer Science, Ph.D. 2010
Massachusetts Institute of Technology, Post-Doctoral Researcher, 2010-2011

Appointments

Starting Fall 2011, Assistant Professor, SUNY Buffalo

Related Publications

- **Mercury: A Wearable Sensor Network Platform for High-Fidelity Motion Analysis**
  Konrad Lorincz, Bor-rong Chen, Geoffrey Werner Challen, Atanu Roy Chowdhury, Shyamal Patel, Paolo Bonato and Matt Welsh. In Proceedings of the 7th ACM Conference on Embedded Networked Sensor Systems (SenSys'09).

- **Lance: Optimizing High-Resolution Data Collection in Wireless Sensor Networks**
  Geoffrey Werner-Allen, Stephen Dawson-Haggerty and Matt Welsh. In Proceedings of the 6th ACM Conference on Embedded Networked Sensor Systems (SenSys'08).

- **Resource Aware Programming in the Pixie OS**
  Konrad Lorincz, Bor-rong Chen, Jason Waterman, Geoffrey Werner-Allen and Matt Welsh. In Proceedings of the 6th ACM Conference on Embedded Networked Sensor Systems (SenSys'08).

- **Firefly-Inspired Sensor Network Synchronicity with Realistic Radio Effects**
  Geoffrey Werner-Allen, Geetika Tewari, Ankit Patel, Radhika Nagpal and Matt Welsh. In Proceedings of the 3rd ACM Conference on Embedded Networked Sensor Systems (Sensys'05).

- **Simulating the Power Consumption of Large-Scale Sensor Network Applications**
  Victor Shnayder, Mark Hempstead, Bor-rong Chen, Geoffrey Werner-Allen, and Matt Welsh. In Proceedings of the 2nd ACM Conference on Embedded Networked Sensor Systems (SenSys'04).

Other Significant Publications

- **IDEA: Integrated Distributed Energy Awareness for Wireless Sensor Networks**
  Geoffrey Werner Challen, Jason Waterman and Matt Welsh. In Proceedings of the 8th Annual International Conference on Mobile Systems, Applications and Services (MobiSys'10).
- **Peloton: Coordinated Resource Management for Sensor Networks**
  Jason Waterman, Geoffrey Werner Challen, and Matt Welsh. In Proceedings of the 12th Workshop on Hot Topics in Operating Systems (HotOS'09).
- **Fidelity and Yield in a Volcano Monitoring Sensor Network**
  Geoffrey Werner-Allen, Konrad Lorincz, Jeff Johnson, Jonathan Lees and Matt Welsh. In Proceedings of the Seventh USENIX Symposium on Operating Systems Design and Implementation (OSDI'06).
- **MoteLab: A Wireless Sensor Network Testbed** Geoffrey Werner-Allen, Pat Swieskowski, and Matt Welsh. In Proceedings of the Fourth International Conference on Information Processing in Sensor Networks (IPSN'05), Special Track on Platform Tools and Design Methods for Network Embedded Sensors (SPOTS).

Synergistic Activities

- Program Committee Member, 31st IEEE Real-Time Systems Symposium (RTSS 2011) (Wireless Network Systems Track), Ninth Annual IEEE International Conference on Pervasive Computing and Communications (PerCom 2011) (Work-in-Progress Session).
- 2009-2010 Siebel Scholar.
- Recipient of the 2005 Harvard Division of Engineering and Applied Sciences Teaching Fellow Award.

Ph.D. Thesis Advisor: Matt Welsh (Harvard University)

Post-Doctoral Supervisor: Hari Balakrishnan (Massachusetts Institute of Technology)

Collaborators: Mike Allen (Coventry University), Paolo Bonato (Spaulding Rehabilitation Hospital), James Brusey (Coventry University), Bor-rong Chen (Harvard University), Stephen Dawson-Haggerty (UC Berkeley), Elena Gaura (Coventry University), Lewis Girod (Massachusetts Institute of Technology), Atanu Roy Chowdhury (Blue Highway), Konrad Lorincz (BBN Technologies), Shyamal Patel (Spaulding Rehabilitation Hospital), Jason Waterman (Harvard University).

Former Ph.D. Students: None.

References

[1] Sensys '09: Proceedings of the 7th acm conference on embedded networked sensor systems, 2009. General Chair-Culler, David and Program Chair-Liu, Jie and Program Chair-Welsh, Matt.