

Samuel Madden

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Research Interests

Systems-oriented database research, with a specific focus on adaptive database systems and data processing in the context of sensor networks.

Education

Ph.D., Electrical Engineering and Computer Science Expected, 2003
Advisor: Michael Franklin
Thesis Topic: An Architecture for Query Processing in Distributed Sensor Networks
University of California, Berkeley, Berkeley, CA.

M.Eng., Electrical Engineering and Computer Science May, 1999
B.S., Computer Science Engineering
Massachusetts Institute of Technology, Cambridge, MA.

Professional Experience

UC Berkeley Computer Science Department, Berkeley, CA August 1999 - Present
Graduate Research Assistant, with Professors Michael Franklin and Joseph Hellerstein.

TinyDB Project: Designed a declarative query processing system for battery-powered, radio-equipped sensor networks. Explored the issues involved in algorithms, languages, and structure of systems to extract and process data on the devices within such networks, as well as the augmentation of conventional database systems with adaptive facilities to process continuous streams of data produced by sensors. Developed TinyDB, a freely available query processor for TinyOS based sensors which reduces the task of programming sensor networks for various monitoring and data-collection tasks to writing a few lines in a simple, SQL-like query language. TinyDB is being incorporated into sensor network solutions produced by Intel Corporation.

Telegraph and TelegraphCQ Projects: The goal of these projects was to apply adaptive query processing techniques to distributed, wide-area data sources, such as the Web, router logs, peer-to-peer systems, and sensor networks. The Telegraph project pioneered the idea that routing decisions in a DBMS could be made on a per-tuple basis, rather than being fixed into a query plan at query-initiation time. In the TelegraphCQ project, this idea was extended to cover long-running, continuous queries that apply to data which arrives after a query is posed. The design of TelegraphCQ is based on my work on Continuously Adaptive Continuous Queries. Telegraph and TelegraphCQ are freely available software systems, implemented in Java and C, respectively.

Federated Facts and Figures Demo: Worked with 3 other Ph.D. students to develop a system built on the Telegraph code base for running database-style queries over form-based web sites. The FFF demo provided statistics about campaign contributions in the 2000 presidential election. Publicized in the local news media and as an exhibit at the ACM1 exposition.

TinyOS Project: Worked with the TinyOS group, under Professor David Culler, to deliver and maintain several releases of the TinyOS operating system for embedded sensor devices produced by UC Berkeley and the Crossbow Corporation. In addition to TinyDB, contributed a handle-based memory manager and a metadata management system to TinyOS and also assisted in the development of code for network reprogramming and simulation.

Intel Corporation, Berkeley, CA
Graduate Intern, Intel-Research Berkeley

Summer 2001 and 2002

Developed software systems for wireless sensor networks. Participated in a demonstration of a self-organizing wireless sensor network consisting of over 800 tiny low-power sensor nodes. The demonstration was live, involving most of the audience attending the kickoff keynote of the Intel Developers Forum. Represented Intel Research with a demonstration of TinyDB to the Intel Board of Directors at the Intel Corporate Strategy Meeting. Participated in the design of the Generic Sensor Kit, a TinyDB-based toolkit designed to eliminate the need for programming for many users of sensor networks.

Software Consulting, El Cerrito, CA

May 1999 - Present

Summer 2000 - Present: Assisted in the design and deployment of a prototype web service for online testing for Children's Progress. Primary tasks: PHP programming, database design, and Linux system administration.

Summer 1999: Macintosh Printer Drivers. Developed Macintosh printer drivers for Palomar Software and ALPS Electronics.

Massachusetts Institute of Technology, Cambridge, MA

September 1995 – May 1999

Research Assistant, MIT Research Laboratory of Electronics

September 1998 – May 1999

Principal research: automated system for the generation of 3D virtual environments from 2D blueprint files in DXF format. Designed software and PC-to-hardware interfaces for a variety of sensory-related devices. Maintained code for 3D VE simulations on SGI and Windows NT workstations running Inventor and DIVE.

Undergraduate Researcher, MIT Research Laboratory of Electronics

Fall 1997 – September 1998

Designed and implemented a prototype texture acquisition engine for a small, computer controlled robot. The system used a robot-mounted CCD camera to capture photographs which were used to automatically generate texture files for 3D virtual environments.

Undergraduate Researcher, MIT Media Laboratory

September 1996 – May 1997

Implemented a real time system to download articles from the Usenet and group them into clusters of related articles via eigenvector analysis of term frequencies. Designed and implemented a DB2 database and C interface to store such articles and their relationships.

Undergraduate Researcher, MIT Research Laboratory of Electronics

January 1995 – May 1996

Designed and implemented a situational awareness assessment experiment in C++ for a submarine navigation simulator at MIT on the SGI Onyx platform. Participated in the development of a user interface for experimenters using the virtual environment testbed developed by the lab.

Software Consultant, W³ Consortium

Fall 1995

Designed a prototype Macintosh user interface for the PICS system to allow parents to restrict their child's access to unsuitable material on the Internet based on a parent-selectable rating system.

Palomar Software, Oceanside, CA

May 1992 – June 1994, Summer 1995 and 1996

Programmer

May 1992 – June 1994, Summer 1995 and 1996

Designed and implemented a Macintosh printer driver for a color desktop printer. Wrote approximately 20,000 lines of C code and integrated it into a substantial framework of existing code. Significant experience with PowerPC and 68k assembler, asynchronous SCSI and serial I/O, and Macintosh user interface design. Worked closely with Japanese clients to design driver software and correct problems with hardware and software. Maintained and updated several other Palomar drivers and internal utilities with up to four other engineers.

Project Manager

Summer 1995 and 1996

Managed a staff of three software testers. Oversaw day to day work, performed periodic evaluations, and participated in pay and hiring decisions. Managed quality control database for two printer-driver projects. Oversaw the creation of a bug database and a test suite for those products.

Teaching Experience

TA, Software Engineering (UCB CS169)

Fall, 1999 and Spring, 2000

Sole TA for two semesters. Taught approximately 50 students each semester the core concepts of software engineering in weekly discussion sections. Supervised group projects of 5-7 students each and assisted in the writing and grading of assignments and projects.

Publications

Conferences and Workshops

- [1] Sirish Chandrasekaran, Owen Cooper, Amol Deshpande, Michael J. Franklin, Joseph M. Hellerstein, Wei Hong, Sailesh Krishnamurthy, Samuel R. Madden, Vijayshankar Raman, Fred Reiss, and Mehul A. Shah. "TelegraphCQ: Continuous Dataflow Processing for an Uncertain World." To appear in *Proceedings of the 1st Biennial Conference on Innovative Data Systems Research (CIDR 2003)*, January 2003, Asilomar, CA.
- [2] Samuel R. Madden, Michael J. Franklin, Joseph M. Hellerstein, and Wei Hong. "TAG: A Tiny AGgregation Service for Ad-hoc Sensor Networks." *Proceedings of the 5th Symposium on Operating Systems Design and Implementation (OSDI)*, Boston, MA, December 2002 .
- [3] Samuel R. Madden, Robert Szewczyk, Michael J. Franklin, and David Culler. "Supporting Aggregate Queries Over Ad-hoc Sensor Networks." In *Proceedings of the 4th IEEE Workshop on Mobile Computing Systems and Applications (WMCSA)*, Callicoon, NY, June 2002.
- [4] Samuel R. Madden, Mehul A. Shah, Joseph M. Hellerstein, and Vijayshankar Raman. "Continuously Adaptive Continuous Queries over Streams." In *Proceedings of the 2002 ACM SIGMOD Conference on Management of Data*, pages 49-60, Madison, WI, June 2002.
- [5] Samuel R. Madden and Michael J. Franklin. "Fjording the Stream: An Architecture for Queries over Streaming Sensor Data." In *Eighth International Conference on Data Engineering (ICDE)*, pages 555-566, San Jose, CA, February, 2002.

Journals

- [6] Samuel R. Madden and Thomas Wiegand. "TOADS: A Two-Dimensional, Open-Ended Architectural Database System." *Presence: Teleoperators and Virtual Environments* 10(2): 175-192. (2001). MIT Press.

Demos and Posters

- [7] Samuel R. Madden, Wei Hong, and Joseph M. Hellerstein. "Queries over Ad-Hoc Sensor Networks." Demo. In *Proceedings of the 2002 ACM SIGMOD Conference on Management of Data*, page 622, Madison, WI, June 2002.
- [8] Samuel R. Madden, David Culler, Michael J. Franklin, Joseph M. Hellerstein, Robert Szewczyk, and Wei Hong. "Database-Style Aggregation in Sensor Networks." Demo. In *4th IEEE Workshop on Mobile Computing Systems and Applications (WMCSA)*, Callicoon, NY, 2002.

In Submission

- [9] Joseph M. Hellerstein, Wei Hong, Samuel R. Madden, and Kyle Stanek. "Beyond Average: Toward Sophisticated Sensing with Queries." Submitted for Publication, December, 2003.
- [10] Samuel R. Madden, Michael J. Franklin, Joseph M. Hellerstein, and Wei Hong. "The Design of An Acquisitional Query Processor for Sensor Networks." Submitted for Publication, November, 2003.

[11] Sirish Chandrasekaran, Sailesh Krishnamurthy, Samuel R. Madden, Amol Deshpande, Michael J. Franklin, Joseph M. Hellerstein, and Mehul Shah. “Windows Explained, Windows Expressed.” Submitted for Publication, November, 2003.

[12] Philip Levis, Nelson Lee, Alec Woo, Samuel R. Madden, and David Culler. “TOSSIM: Simulating Large Networks of TinyOS Motes.” Submitted for Publication, November, 2003.

Non-Refereed Work

[13] Mehul A. Shah, Samuel R. Madden, Michael J. Franklin, Joseph M. Hellerstein. “Java Support for Data-intensive Systems: Experiences Building the Telegraph Dataflow System.” *SIGMOD Record* 30(4): 103-114 (2001).

[14] Joseph M. Hellerstein, Michael J. Franklin, Sirish Chandrasekaran, Amol Deshpande, Kris Hildrum, Samuel R. Madden, Vijayshankar Raman, Mehul Shah. “Adaptive Query Processing: Technology in Evolution.” *IEEE Data Engineering Bulletin* 23(2): 7-18 (2000).

Invited Talks

“TinyDB: A Database Engine for Sensor Networks.”

- Systems Seminar, UCLA, October 2, 2002.
- Database Seminar, University of Wisconsin, Madison, November 18, 2002.
- New England Database Seminar (NEDS), December 13, 2002.

”TinyDB Demonstration.” Intel Corporate Strategy Meeting. July 25, 2002.

“Database Implementation Experiences with Java.” RightOrder Corporation. April, 2001.

Software

TinyDB (<http://telegraph.cs.berkeley.edu/tinydb>): A query processing engine for TinyOS-based battery-powered, radio-equipped sensors.

Telegraph (<http://telegraph.cs.berkeley.edu/>): An adaptive query processor for long-running queries over streaming data sources.

TinyOS (<http://webs.cs.berkeley.edu/tos>): An operating system for wireless sensors.

Service Activity

UC Berkeley

President, UC Berkeley Computer Science Graduate Student Association (CSGSA), 2001-2002.

Member, New Student Committee, UC Berkeley CSGSA, 1999-Present.

Member, Graduate Admissions Committee, UC Berkeley Computer Science Department, 2000-2001.

Community

External conference reviewer: ASPLOS

External journal reviewer: TKDE, Concurrency and Computation: Practice and Experience, PRESENCE

Miscellaneous

Citizenship: US

Please see: <http://www.cs.berkeley.edu/~madden/apply.html> for additional information and selected publications.

References

Michael J. Franklin

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David E. Culler

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