Jim Reich

Computing Sciences Laboratory
Embedded Collaborative Computing Area
Palo Alto Research Center (PARC)
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Education

Carnegie-Mellon University *1994-1996*
M.S., Electrical and Computer Engineering.

Thesis: "Symbolic Simulation Based Debugging of Discrete Event Control Systems." Internship at Allen-Bradley Corp's Advanced Technology Labs, developing techniques for program analysis of Programmable Logic Controller (PLC) programs.

Massachusetts Institute of Technology *1985-1989*
B.S., Aeronautical and Astronautical Engineering (Avionics option)

Employment History

Palo Alto Research Center (PARC) 1998-Present
Area Manager, *Embedded Collaborative Computing* Computing Sciences Laboratory

Researcher and manager of research group in sensing and sensor networks. Areas of focus include collaborative signal processing using video and acoustic sensors, tracking of people and vehicles and programming approaches for sensor network development. Project manager for multiple projects, functional manager for group of 5, and Principal Investigator for government and commercial sponsored research totaling approximately $10M. This included deep involvement in business development and proposal-writing process and customer interaction at all levels with US and Japanese partners.

A sampling of my projects at PARC:

- A mobile infrastructure-based system allowing survey-free, high-accuracy indoor localization of devices to ease installation and commissioning of sensor systems
- An acoustic sensing system for automatic realtime facilitation of meetings.
- Several Automotive sensor networks projects
    - Utility-based protocols for citywide automotive information dissemination which increased bandwidth efficiency by 6x in congested city environments while tripling the useful information delivered in sparse traffic situations.
    - A system enabling early collision warning through a combination of coarse geometric search algorithms and detailed dynamic models for the highest-risk scenarios
- Distributed attention architectures allowing sensor networks to operate in very cluttered environments by decomposing estimation and detection into multiple tasks which explicitly compete for resources in a decentralized optimization.
- Middleware allowing automatic adaptation of abstract programs to specific hardware configurations. The system also supported mobile agents and mobile code via a spatiotemporal publish-subscribe mechanism.

- Acoustic multi-target tracking in a completely decentralized mobile agent framework; local tracking used microphone arrays and intensity measurements from individual microphones to locally track vehicles, while identity management permitted delayed matching of vehicles to identities until sufficient evidence was available.
- Airjet paper mover which controlled paper position to 20 micron accuracy using a batch fabricated array of 1200 airjets built on a printed circuit board substrate.

My role in these projects included team leadership, project management and being primary customer contact. In addition, I have designed and implemented significant components of most of these systems and have had the role of selecting tools, hardware, designing demonstration scenarios. This has involved coding in C for embedded systems, C++, Java, and Matlab, and designing control systems and signal processing and information dissemination algorithms.

Lockheed Martin Advanced Technology Center *1996-1998*
Research Specialist Dynamics and Control Laboratory
Prototyped control system and simulation for segmented space telescope; played major role in successful bid for Next Generation Space Telescope (Hubble follow-on)

Control Systems Lead, AIT Active Mirror Image Stabilizer
Primary responsibility for novel cascaded nonlinear controller design, system models and simulations, electromagnetic actuator design for radian accuracy, kHz-bandwidth optical system. Designed nonlinear analog controller, wrote multi-processor DSP code.

Orbital Sciences Corporation *1992-1994*
Engineer Guidance and Control Department

Developed analytical models, test procedures, and simulations for various hydraulic and electromechanical actuators and gas-jet attitude control systems. Devised new system architectures for low-cost liquid and hybrid-fueled space launch vehicles.

General Dynamics, Space Systems Division *1989-1992*
Engineer Fluid Systems Development Group

Created automated built-in test methods for cryogenic and pneumatic systems, including solenoid valve current signature, leak detection and purge flow sensing methods, built pneumatic test bed. Originated catalytic heated fuel tank pressurization concept.

Awards

Technical/Team Excellence Award, PARC, 1999, 2002, 2004, 2005, 2006
Technical Excellence Award, Lockheed Martin Advanced Technology Center, 1997, 1998

Society Memberships: IEEE, ACM

Publications

Journals

Tarek Abdelzaher, Yaw Anokwa, Peter Boda, Jeff Burke, Deborah Estrin, Leonidas Guibas, Aman Kansal, Samuel Madden, Jim Reich, “Mobiscopes for Human Spaces,” IEEE Pervasive Computing, April-June 2007

J. J. Liu, M. Chu, J. Reich, “Multitarget Tracking in Distributed Sensor Networks,” IEEE Signal Processing Magazine, Volume 24, Issue 3, 2007, p. 36 – 46

J. J. Liu, J. Liu, J. Reich, P. Cheung, and F. Zhao, "Distributed Group Management for Track Initiation and Maintenance in Target Localization Applications," in Telecommunication Systems Journal, Kluwer Academic Publishers, 2004.

J. Liu, M. Chu, J. J. Liu, J. Reich, F. Zhao, “State-centric programming for sensor and actuator network systems.” IEEE Pervasive Computing. 2003 October/December; 2 (4): 50-62

F. Zhao, J. Liu, J. J. Liu, L. Guibas, J. Reich, “Collaborative signal and information processing: an information directed approach.” Proceedings of the IEEE. 2003; 91 (8): 1199-1209.

J. Liu, J. Reich, F. Zhao, "Collaborative In-Network Processing for Target Tracking." J. on Applied Signal Processing (EURASIP), vol. 23, no. 4, March 2003, pp378-391.

F. Zhao, J. Shin, J. Reich, "Information-Driven Dynamic Sensor Collaboration for Tracking Applications." IEEE Signal Processing Magazine, 19(2):61-72, March 2002.

F. Zhao, X. Koutsoukos, H. Haussecker, J. Reich, P. Cheung, “Distributed monitoring and fault detection of hybrid systems.” IEEE Transactions on Systems, Man, and Cybernetics, Part B.

F. Zhao, X. Koutsoukos, H. Haussecker, J. Reich, P. Cheung, C. Picardi, “Distributed monitoring of hybrid systems: a model-directed approach.” 17th International Joint Conference on Artificial Intelligence (IJCAI); 2001 August 4-10; Seattle, WA. San Francisco: Morgan Kaufmann; 2001; 1: 557-564.

D. Biegelsen, A. Berlin, P. Cheung, M. Fromherz, D. Goldberg, W. Jackson, B. Preas, J. Reich, L. Swartz, “Air-jet paper mover: an example of mesoscale MEMS.” SPIE Proceedings, Micromachined Devices and Components VI; 2000 September; Santa Clara, CA. Bellingham, WA: SPIE; 2000; 4176: 122-129.

Conferences

D. Greene, J. J. Liu, M. Mosko, J. Reich, Y. Hirokawa, T. Mikami, T. Takebayashi, “Utility-Driven Information Dissemination in Vehicle Ad-Hoc Networks,” ITS World Congress, Beijing, China, October 2007 (to be presented)

Zhang, Y.; Partridge, K.; Reich, J. E. “Localizing tags using mobile infrastructure.” Location and Context-Awareness Workshop (LoCA), Munich Germany, September 2007 (to be presented)

J. Reich, “Position Paper: Resource Management for Distributed Attention in Sensor Networks,” SPIE Defense and Security Symposium, Orlando, FL, March 2006

A. Bakshi, V. Prasanna, J. Reich, D. Larner, “The abstract task graph: A methodology for architecture-independent programming of networked sensor systems.” Workshop on End-to-End, Sense-and-Respond Systems, Applications, and Services; 2005 June 5; Seattle; WA; US.

D. Larner, J. Reich, A. Bakshi, “A toolkit for architecture-independent programming and synthesis of networked sensing applications.” Information Processing in Sensor Networks (IPSN) - Special track on Platform Tools and Design Methods for Network Embedded Sensors (SPOTS); 2005 April 25-27; Los Angeles; CA; US.

J. J. Liu, J. Liu, M. Chu, J. Reich, F. Zhao, “Distributed state representation for tracking problems in sensor networks.” Information Processing in Sensor Networks (IPSN); 2004 April 26-27; Berkeley; CA. NY: ACM; 2004; 234-242.

M. Chu, J. Reich, F. Zhao, ”Distributed Attention for Large Video Sensor Networks.” IEE Intelligent Distributed Surveillance Systems; February 2004; London; UK.

F. Zhao, J. Liu; J. Reich, M. Chu, J. J. Liu, “Programming embedded networked sensor systems,” Hardware/Software Codesign and System Synthesis, 2003, 1-3 Oct. 2003

J. J. Liu, X. Koutsoukos, J. Reich, F. Zhao, “Sensing field coverage characterization in distributed sensor networks,” IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 2003 Page 173-6 vol 5

J. J. Liu, J. Liu, J. Reich, P. Cheung, F. Zhao, “Distributed group management for track initiation and maintenance in target localization applications.” Information Processing in Sensor Networks (IPSN); 2003 April 22-23; Palo Alto, CA. Berlin: Springer; 2003; Lecture Notes in Computer Science 2634: 113-128.

J. Reich, Collaborative sensing and in-network processing of sensor network data. IEEE CAS Wireless Networking Workshop; 2002 September 6; Pasadena; CA; USA

W. Jackson, M. Fromherz, D. Biegelsen, J. Reich, D. Goldberg, “Constrained optimization based control of real time large-scale systems: airjet object movement system.” Conference on Decision and Control, 4-7 Dec. 2001 p. 4717 - 4720 vol. 5

X. Koutsoukos, F. Zhao, H. Haussecker, J. Reich, P. Cheung, “Fault modeling for monitoring and diagnosis of sensor-rich hybrid systems.” Proceedings of the 40th IEEE Conference on Decision and Control; 2001 December 4-7; Orlando; FL. Piscataway, NJ: IEEE; 2001; 1: 793-801.

F. Zhao, X. Koutsoukos, H. Haussecker, J. Reich, P. Cheung, C. Picardi, “Distributed monitoring of hybrid systems: a model-directed approach.” International Joint Conference on Artificial Intelligence (IJCAI); 2001 August 4-10; Seattle, WA. San Francisco: Morgan Kaufmann; 2001; 1: 557-564.

P. Cheung, H. Haussecker, X. Koutsoukos, S. Narasimhan, C. Picardi, J. Reich, F. Zhao, "Efficient fault diagnosis of real-time distributed embedded systems using model-based and signal processing techniques." DX01; March 7-9 2001.

J. Reich, "Integrated Smart Stuff: A 3-axis Airjet Paper Mover using Hierarchical Closed-loop Control," Xerox Directions in Machine Control 2000, Rochester, NY.

A. Berlin, D. Biegelsen, J. Reich, W. Jackson, P. Cheung, M. Fromherz, B. Preas, L. Swartz, D. Goldberg, "Motion control of macro-scale objects using large-area arrays of MEMS-like distributed manipulators." Mechatronics Forum International Conference; 2000 September 6-8; Atlanta, GA.

J. Reich, "Smart Matter and its Relevance to SenSkin", Sensitive Skin Workshop, Arlington, VA, October 14-15, 1999.

A. Berlin, D. Biegelsen, P. Cheung, M. Fromherz, D. Goldberg, W. Jackson, E. Panides, B. Preas, J. Reich, and L. Swartz, "AirJet paper mover: An example of meso-scale MEMS" in Proceedings of SPIE: Micromachined Devices and Components VI, October 2000

A. Berlin, D. Biegelsen, P. Cheung, M. Fromherz, D. Goldberg, W. Jackson, E. Panides, B. Preas, J. Reich, and L. Swartz, "Paper Transport using Modulated Airjet Arrays" in Proceedings of the IS&T NIP15 Int. Conf. on Digital Printing Tech.

Reich, J., Krogh, B., Baxter, I., "Symbolic Simulation Based Techniques for Debugging Discrete Control Programs," IFAC 13th World Conference, San Francisco, CA. 1996

Book Chapters

F. Zhao, J. Reich, "Information Directed Sensor Query", in *Distributed Sensor Networks*, Edited by S. Iyengar and R. Brooks, CRC Press, to be published in 2004

M. Yim, J. Reich, and A. Berlin, "Two Approaches to Distributed Manipulation," book chapter in *Distributed Manipulation*, ed. Bohringer, K. and Choset, H, Kluwer Publishing, 2000, pp. 237-261

Patents

Issued

US7133168	Portable coilable electronic apparatus and method
US6743982	Stretchable interconnects using stress gradient films
US6922681	Problem Partitioning Method and System
US7228634	Using Viewing-Angle-Sensitive Visual Tags to Determine Angular Orientation And/Or Location

Pending

Total of 23 patent applications filed on the following topics:

- Middleware and Algorithms for Distributed Sensor Information Processing (3 patents)
- Vehicle Collision Warning algorithms and system designs (6 patents)
- Peer-to-peer information propagation in Mobile Ad-Hoc Networks (9 patents)
- Indoor Localization algorithms, hardware designs and location-based browsing techniques using RF, Ultrasound and Visual tags (3 patents)
- Solid State Lighting and Lighting-Based Sensing and Communication (2 patents)

Academic Service

Local chair, IPSN '03; Demo chair IPSN '05; Poster Chair DCOSS '06; Workshop Chair, DCOSS '07

Editorial board member for *Ambient Intelligence and Smart Environments*

TPC member for Information Processing and Systems and Platforms (SPOTS) tracks of Information Processing in Sensor Networks (IPSN), Distributed Computing on Sensor Systems (DCOSS), SenSys, Int'l Conf. on Distributed Computing Systems (ICDCS), Int'l Conf. on Distributed Smart Cameras (ICDSC), Real Time Sensor Systems (RTSS), Wireless Sensor Networks and Applications (WSNA), and Mobiquitous

Reviewer for ACM Transactions on Sensor Networks, IEEE Transactions on Aerospace and Electronic Systems and the European Journal for Signal Processing (EURASIP)

Interns supervised

Lei Chen, Vijay Vishwanathan (MBA intern), Amol Bakshi, Arpita Ghosh, Krishnan Eswaran, Manu Chhabra, Soham Mazumdar, Jaewon Shin, Nirupama Bulusu, Maurice Chu, Nitin Gupta, Pragyan Mishra