

# Jacob Sorber

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## Research Interests

I make **embedded systems, mobile sensors, wearables**, and other **computational things** smaller, more efficient, lower cost, longer-lasting, and easier to deploy. My students and I develop and deploy new hardware and software technologies, tools, and abstractions that help embedded devices adapt to changing conditions, recover from frequent power failures, and operate maintenance-free for decades.

## Education

<b>University of Massachusetts Amherst</b> Ph.D., M.S. in Computer Science	2010
<b>Brigham Young University</b> B.S. in Computer Science	2002

## Academic Positions

<b>School of Computing, Clemson University</b> Associate Professor, 2017– Assistant Professor, 2012–2017	Clemson, SC
<b>Computer Science, Dartmouth College</b> Research Associate/Instructor, 2010–2012	Hanover, NH

## Honors and Awards

**NSF CAREER Award**  
The Faculty Early Career Development (CAREER) Program. 2015

**ACM SenSys Best Paper Award**  
“Ekho: Realistic and Repeatable Experimentation for Tiny Energy-Harvesting Sensors,” J. Hester, T. Scott, J. Sorber November 2014

**Dean’s Professor of Computer Science**  
College of Engineering and Science 2016

### **ACM SenSys Best Poster Award**

“Towards Robust Reprogrammability for Wireless Sensors,” N. Tobias, C. Bolton, J. Hester, L. Sitanayah, J. Sorber. November 2015

### **MobiSys Ph.D. Forum Best Presentation Award**

June 2008

## Publications

### Refereed Journal Publications

#### **Realistic and Repeatable Emulation of Energy Harvesting Environments**

J. Hester, L. Sitanayah, T. Scott, J. Sorber

*ACM Transactions on Sensor Networks*, Volume 9, Number 4, Article 39, March 2017.

#### **Shoulder Angel: An Open Platform for Reprogramming Wayward Wireless Sensors**

N. Tobias, C. Bolton, J. Hester, L. Sitanayah, J. Sorber

*IEEE Embedded Systems Letters*, Volume 8, Issue 4, December 2016.

#### **Persistent Clocks for Intermittently Powered Devices**

J. Hester, N. Tobias, A. Rahmati, D. Holcomb, L. Sitanayah, K. Fu, J. Sorber

*ACM Transactions on Embedded Computing Systems*, Volume 15 Issue 4, August 2016.

#### **Hide-n-Sense: Preserving Privacy Efficiently in Wireless mHealth**

S. Mare, J. Sorber, M. Shin, C. Cornelius, D. Kotz

*Mobile Networks and Applications (MONET)*, Volume 19, Issue 3, pp 331–344, June, 2014. Special issue of Wireless Technology for Pervasive Healthcare, Copyright © 2014 Springer-Verlag.

#### **Tula: Balancing Energy for Sensing and Communication in a Perpetual Mobile System**

J. Sorber, A. Balasubramanian, M. D. Corner, J. Ennen, C. Qualls

*IEEE Transactions on Mobile Computing*, Volume 12, Issue 4, April 2013 <sup>1</sup>.

#### **Parallel Search for LTL Violations**

M. D. Jones, J. Sorber

*International Journal on Software Tools for Technology Transfer*, Volume 7, Issue 1, Feb 2005.

### Refereed Conference and Workshop Papers<sup>2</sup>

#### **Flicker: Rapid Prototyping for the Batteryless Internet-of-Things**

J. Hester, J. Sorber

*Proceedings of the 15th ACM Conference on Embedded Networked Sensor Systems (SenSys'17)*, November 2017. [17.2% acceptance rate].

#### **Timely Execution on Intermittently Powered Batteryless Sensors**

J. Hester, K. Storer, J. Sorber

*Proceedings of the 15th ACM Conference on Embedded Networked Sensor Systems (SenSys'17)*, November 2017. [17.2% acceptance rate].

<sup>1</sup>Previously published as University of Massachusetts Technical Report #UM-CS-2009-058, December 2009.

<sup>2</sup>Acceptance rates are provided when available, based on conference websites and personal communications with conference organizers. All acceptance rate percentages reflect the rates of full papers, accepted based on full paper reviews.

### **The Future of Sensing is Batteryless, Intermittent, and Awesome**

J. Hester, J. Sorber

*Proceedings of the 15th ACM Conference on Embedded Networked Sensor Systems (SenSys'17)*, November 2017. [23.5% acceptance rate (New Directions Paper)].

### **Sustainable Leakage Monitoring Systems for Water Distribution Pipeline Networks**

S. Yazdekhosti, K. R. Piratla, J. Sorber

*2017 ASCE Pipelines Conferences*, Phoenix, AZ.

### **Amulet: An Energy-Efficient, Multi-Application Wearable Platform**

J. Hester, T. Peters, T. Yun, R. Peterson, J. Skinner, B. Golla, S. Hearndon, K. Storer, K. Freeman, S. Lord, R. Halter, D. Kotz, J. Sorber

*Proceedings of the 14th ACM Conference on Embedded Networked Sensor Systems (SenSys)*, November 2016. [15.9% acceptance rate].

### **Realistic Simulation for Tiny Batteryless Sensors**

M. Furlong, J. Hester, K. Storer, J. Sorber

*Proceedings of the 4th Workshop on Energy Harvesting and Energy-Neutral Sensing Systems (EN-Ssys)*, November 2016..

### **Towards A Language and Runtime for Intermittently Powered Devices**

J. Hester, K. Storer, L. Sitanayah, J. Sorber

*Proceedings of the Workshop on Hilariously Low-Power Computing (HLPC)*, April 2016.

### **Tragedy of the Coulombs: Federating Energy Storage for Tiny, Intermittently-Powered Sensors**

J. Hester, L. Sitanayah, J. Sorber

*Proceedings of the 13th ACM Conference on Embedded Networked Sensor Systems (SenSys)*, November 2015. [19.8% acceptance rate].

### **Ekho: Realistic and Repeatable Experimentation for Tiny Energy-Harvesting Sensors**

J. Hester, T. Scott, J. Sorber

*Proceedings of the 12th ACM Conference on Embedded Networked Sensor Systems (SenSys)*, November 2014. [17.9% acceptance rate, **Best Paper Award**].

### **Current Events: Identifying Webpages by Tapping the Electrical Outlet**

S. Clark, H. Mustafa, B. Ransford, J. Sorber, K. Fu, W. Xu

*Proceedings of the 18th European Symposium on Research in Computer Security (ESORICS)*, September 2013. [18% acceptance rate].

### **WattsUpDoc: Power Side Channels to Nonintrusively Discover Untargeted Malware on Embedded Medical Devices**

S. Clark, B. Ransford, A. Rahmati, S. Guineau, J. Sorber, W. Xu, K. Fu

*USENIX Workshop on Health Information Technologies*, August 2013.

### **Provenance framework for mHealth**

A. Prasad, R. Peterson, S. Mare, J. Sorber, K. Paul, D. Kotz

*Proceedings of the Workshop on Networked Healthcare Systems (NetHealth)*, Bangalore, India. January, 2013.

### **Understanding Sharing Preferences and Behavior for mHealth Devices**

A. Prasad, J. Sorber, T. Stablein, D. Anthony, D. Kotz

*Proceedings of the Workshop on Privacy in the Electronic Society (WPES)*, Raleigh, NC. November 15, 2012. [28% acceptance rate].

**TARDIS: Time and Remanence Decay in SRAM to Implement Secure Protocols on Embedded Devices without Clocks**

A. Rahmati, M. Salajegheh, D. Holcomb, J. Sorber, W. Burlison, K. Fu  
*Proceedings of the 21st USENIX Security Symposium*, Bellevue, WA. August 2012. [19% acceptance rate].

**Who wears me? Bioimpedance as a passive biometric**

C. Cornelius, J. Sorber, R. Peterson, J. Skinner, R. Halter, D. Kotz  
*Proceedings of the USENIX Workshop on Health Security and Privacy (HealthSec)*, Bellevue, WA. August, 2012.

**Plug-n-Trust: Practical trusted sensing for mHealth**

J. Sorber, M. Shin, R. Peterson, D. Kotz  
*Proceedings of the International Conference on Mobile Systems, Applications, and Services (MobiSys)*, pages 309-322, Low Wood Bay, UK. June, 2012. [18% acceptance rate].

**An Amulet for Trustworthy Wearable mHealth**

J. Sorber, M. Shin, R. Peterson, C. Cornelius, S. Mare, A. Prasad, Z. Marois, E. Smithayer, D. Kotz  
*Proceedings of the Twelfth Workshop on Mobile Computing Systems and Applications (HotMobile)*, San Diego, California. February 2012. [20% acceptance rate].

**Ekho: Bridging the Gap Between Simulation and Reality in Tiny Energy-Harvesting Sensors**

H. Zhang, M. Salajegheh, K. Fu, and J. Sorber  
*Proceedings of the 4th Workshop on Power-Aware Computing and Systems (HotPower)*, Cascais, Portugal. October 2011. [26% acceptance rate].

**Adapt-lite: Privacy-aware, Secure, and Efficient mHealth Sensing**

S. Mare, J. Sorber, M. Shin, C. Cornelius, D. Kotz  
*Proceedings of the 10th annual ACM Workshop on Privacy in the Electronic Society (WPES)*, Chicago, Illinois. October 2011.

**Mementos: System Support for Long-Running Computation on RFID-Scale Devices**

B. Ransford, J. Sorber, K. Fu  
*Proceedings of the 16th Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, Newport Beach, California. March 2011 [21% acceptance rate].

**Eon: A Language and Runtime System for Perpetual Systems**

J. Sorber, A. Kostadinov, M. Garber, M. Brennan, M. D. Corner, E. D. Berger  
*Proceedings of the 5th International Conference on Embedded Networked Sensor Systems (SenSys)*, Sydney, Australia. 2007. [16.8% acceptance rate].

**Triage: Balancing Energy Consumption and Quality of Service in Tiered Microservers**

N. Banerjee, J. Sorber, M. D. Corner, S. Rollins, and D. Ganesan  
*Proceedings of the 5th International Conference on Mobile Systems, Applications and Services (MobiSys)*, San Juan, Puerto Rico. June 2007, [20% acceptance rate].

**Turducken: Hierarchical Power Management for Mobile Devices**

J. Sorber, N. Banerjee, M. D. Corner, and S. Rollins  
*Proceedings of the 3rd International Conference on Mobile Systems, Applications and Services (MobiSys)*, Seattle, WA. June 2005. [24% acceptance rate].

## Book Chapters

### **Understanding User Privacy Preferences for mHealth Data Sharing**

A. Prasad, J. Sorber, T. Stablein, D. Anthony and D. Kotz

*Mobile Health (mHealth): Multidisciplinary Verticals*, chapter 50, Taylor & Francis (CRC Press), 2014. Accepted for publication. ©2014 by authors.

## Invited / Unrefereed Publications

### **Vocal resonance as a passive biometric**

C. Cornelius, Z. Marois, J. Sorber, R. Peterson, S. Mare, D. Kotz

*Technical Report TR2014-747*, Dartmouth College, Hanover, NH, February, 2014.

### **Current events: Compromising web privacy by tapping the electrical outlet**

S. Clark, B. Ransford, J. Sorber, W. Xu, E. Learned-Miller, K. Fu

*Technical Report UM-CS-2011-030*, University of Massachusetts, Amherst, MA, July 2012.

### **Tula: Balancing Energy for Sensing and Communication in a Perpetual Mobile System**

J. Sorber, A. Balasubramanian, M. D. Corner, J. Ennen, C. Qualls

*Technical Report UM-CS-2009-058*. University of Massachusetts, Amherst, MA. December 2009.

## Presentations

### **A Batteryless Revolution in the Internet of Things**

J. Sorber

*Invited speaker at the RCID Research Seminar (Clemson University)*, Clemson, SC, March 2017.

### **Computing on Unreliable Power**

J. Sorber

*Invited seminar at Stonybrook University*, Stonybrook, NY, October 2016.

### **Tragedy of the Coulombs: Federating Energy Storage for Tiny, Intermittently-Powered Sensors**

J. Hester (presenter), L. Sitanayah, J. Sorber

*ACM Conference on Embedded Networked Sensor Systems (SenSys 2015)*, Seoul, South Korea, November 2015.

### **Batteries Not Included: Moving Toward Long-Term Sustainable Sensing**

J. Sorber

*Keynote Speech, 3rd International Workshop on Energy Harvesting & Energy Neutral Sensing Systems*, Seoul, South Korea, November 2015.

### **Demo: A Hardware Platform for Separating Energy Concerns in Tiny, Intermittently-Powered Sensors**

J. Hester (presenter), L. Sitanayah, J. Sorber

*ACM Conference on Embedded Networked Sensor Systems (SenSys 2015)*, Seoul, South Korea, November 2015.

### **Poster: Towards Robust Reprogrammability for Wireless Sensors**

N. Tobias (presenter), C. Bolton, J. Hester, L. Sitanayah, J. Sorber

*ACM Conference on Embedded Networked Sensor Systems (SenSys 2015)*, Seoul, South Korea, November 2015.

**Enabling Long-Term Sensing Without Batteries**

Jacob Sorber

*Invited seminar at Brigham Young University, Provo, UT, May 2015.*

**Enabling Long-Term Sensing Without Batteries**

Jacob Sorber

*Invited seminar at Florida Atlantic University, Boca Raton, FL, April 2015.*

**CAREER Proposal Writing Advice**

Jacob Sorber

*NSF CISE CAREER Proposal Writing Workshop (presenter/panelist, Washington D.C., March 2015.*

**Ekho: Realistic and Repeatable Experimentation for Tiny Energy-Harvesting Sensors**

J. Hester (*presenter*), T. Scott, J. Sorber

*ACM Conference on Embedded Networked Sensor Systems (SenSys 2014), Memphis, TN, November 2014.*

**Demo: Ekho: Realistic And Repeatable Experimentation For Tiny Energy-harvesting Sensors**

J. Hester (*presenter*), T. Scott, J. Sorber

*ACM Conference on Embedded Networked Sensor Systems (SenSys 2014), Memphis, TN, November 2014.*

**Enabling computational jewelry for mHealth applications (Poster)**

A. Molina-Markham (*presenter*), R. Peterson, J. Skinner, R. J. Halter, J. Sorber, D. Kotz

*ACM International Conference on Mobile Systems, Applications, and Services (MobiSys), Bretton Woods, NH, June 2014.*

**Enabling Sustainable Sensing in Adverse Environments (Poster)**

J. Hester (*presenter*), T. King, A. Probst, K. Piratla, J. Sorber

*IEEE International Conference on Sensing, Communication, and Networking, New Orleans, LA, June 2013 (Best Poster Award).*

**Challenges in Securing mHealth Infrastructure**

J. Sorber

*Securing IT in Healthcare, Part III (workshop), Dartmouth College, Hanover, NH, USA, May 17, 2013.*

**Bridging the Gap Between Simulation and Reality in Tiny Energy-Harvesting Sensors**

J. Sorber

*MIT CSAIL, Invited Seminar, Cambridge, MA, USA. October, 17, 2011.*

**Practical Trusted Computing for mHealth Sensing (Poster)**

J. Sorber (*presenter*), M. Shin, R. Peterson, and D. Kotz

*The 9th International Conference on Mobile Systems, Applications, and Services (MobiSys), Bethesda, MD, USA. June 29, 2011.*

**Enabling Ubiquitous Sensing in Uncertain Energy Environments**

J. Sorber

*Dartmouth College, Computer Science Department Colloquium, Hanover, NH, USA. May 18, 2011.*

**Perpetual Systems: Building Embedded Systems to Survive in the Wild**

J. Sorber

*UMass Lowell, Computer Science Department Colloquium, Lowell, MA, USA. November 17, 2010.*

**Balancing Sensing and Communication Energy in Perpetual Mobile Networks (Poster)**

J. Sorber (*presenter*), A. Balasubramanian, M.D. Corner, J. Ennen, C. Qualls  
*The 11th International Workshop on Mobile Computing Systems and Applications (HotMobile)*,  
 Annapolis, MD, USA. February, 22, 2010.

**Into the Wild: Taming Uncertainty in Perpetual Systems**

J. Sorber  
*ACM MobiHoc S3 Workshop, invited speaker*, New Orleans, Louisiana, USA. May 18, 2009.

**TurtleNet: System Support for In-Situ Wildlife Tracking**

J. Sorber  
*Coastal Environmental Sensing Networks (CESN) conference*, University of Massachusetts Boston.  
 Boston, MA, USA. April 12, 2007

**eFlux: Simple Automatic Adaptation for Environmentally Powered Devices (Poster/Demo)**

J. Sorber (*presenter*), A. Kostadinov, M. Brennan, M. D. Corner, and E. D. Berger  
*The Seventh IEEE Workshop on Mobile Computing Systems & Applications (WMCSA)*, Semiah-  
 moo Resort, Washington, USA. April 6, 2006.

## Sponsored Research

Role	Title/Organization	Total (\$)	Clemson (\$)	Dates
PI	<i>Computational Jewelry for Mobile Health (ABR)</i> <b>NSF (CNS-1619950)</b> <i>with Dartmouth College (Clemson PI)</i>	\$1,175,419	\$396,420	10/2016– 9/2018
PI	<i>Smart earpiece for supporting healthy eating behaviors</i> <b>NSF (Recommended)</b> <i>with Dartmouth College (Clemson PI)</i>	\$1,400,000	\$700,711	10/2016– 9/2018
PI	<i>CAREER: Enabling Low-Cost, Maintenance-Free, Long-Term Embedded Sensing Without Batteries</i> <b>NSF (CNS-1453607)</b>	\$496,661	\$496,661	9/2015– 8/2020
PI	<i>Game Changer: Solar Powered Peer-toPeer Tracking Network for Oiled and Rehabilitated Sea Otters</i> <b>Oiled Wildlife Conservation Network</b>	\$50,000	\$50,000	7/2014– 9/2016
PI	<i>Computational Jewelry for Mobile Health</i> <b>NSF (1314342)</b> <i>with Dartmouth College (Clemson PI)</i>	\$1,500,026	\$524,680	10/2013– 9/2016
PI	<i>Conservation Corridors for Desert Tortoises</i> <b>U.S. Geological Survey</b>	\$49,995	\$49,995	1/2013– 7/2016
PI	<i>Architectural Support for Transiently-Powered Computing</i> <b>University Research Grant Committee (URGC)</b>	\$10,000	\$10,000	1/2013– 6/2013

PI	<i>Conservation Corridors for Desert Tortoises</i> <b>U.S. Geological Survey</b>	\$8,130	\$8,130	5/2012– 8/2012
Co-PI	<i>CyberSEES: Type 1: Enabling Sustainable Water Supplies Through Self-Powered Sensor-Based Monitoring</i> <b>NSF (1539536)</b>	\$396,011	\$396,011	9/2015– 8/2017
Co-PI	<i>Machinability Modeling and Data Use for Manufacturing: Cost Reduction for Manufacturing of Superalloy Components through Information</i> <b>General Electric</b>	\$235,488	\$235,488	4/2015– 12/2015

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## Patents

### **Wearable computing device for secure control of physiological sensors and medical devices, with secure storage of medical records, and bioimpedance biometric.**

U.S.A. patent no. 9,595,187 with D. Kotz, R. Halter, C. Cornelius, J. Sorber, M. Shin, R. Peterson, S. Mare, A. Prasad, J. Skinner, A. Molina-Markham

### **Methods and systems for improving security in zero-power devices**

U.S.A. patent no. 9,158,361 with K. Fu and M. Salajegheh

## Graduate Student Advising

### Ph.D. Graduates

**Josiah Hester** (PhD) — May 2017

Topic: Sophisticated Sensing on Transient Power

<http://josiahhester.com/>

### Masters Graduates

**Ravi Mandliya** (MS) — May 2014

**Bhargav Golla** (MS) — December 2015

**Steven Hearndon** (MS) — December 2016

Topic: Secure and Efficient Logging and Software Updates for mHealth Wearables

**Kevin Storer** (MS) — August 2017

Topic: Nuanced Views of Pedagogical Evaluation

## Current Graduate Advising

**Nicole Tobias** (PhD)

**Arwa Alsubhi** (PhD)

**Harsh Desai** (MS)

**Ryan Scott** (PhD)



## Post Doctoral Research Advisees

**Lanny Sitanayah** (2014–2017)

Low-Cost Monitoring of Advanced Manufacturing Systems

## Undergraduate Research

Nicholas Reed (CS, 2017), Joseph McKulka (ECE, 2017), Jesse Leopold (CS, 2017), Micah Johnson (CS, 2017), Nandita Viswanath (visiting student, 2016), Calvin Moody (CS, 2016), Charles Stahl (REU, 2016), Pranav Yerabati Venkata (REU, 2016), Jeremy Wilder (CS, 2016), Robert Underwood (CS, 2015–2016), Connor Bolton (ECE, 2015–2016), Caroline Bryant (CS, 2014–2015), Michael Smith (CS, 2015–2016), Taylor Hardin (CS, 2015–2016), Matthew Furlong (CS, 2014–2016), Austin Anderson (CS, 2015–2016), Brendan Fletcher (CS, 2014–2015), Harrison Donellan (CS, 2015), Timothy Scott (CS, 2014), Diana Zhang (REU, 2014), Drew Nederhoff (REU, 2014), Siara Fabbri (REU, 2014), Tamara Ortega (REU, 2014), Kyle McGuigan (CS, 2012–2013), Ryan Archer (CS, 2012–2013)

## Outreach

**Embedded electronics and programming mini-course.**

2014–

R. C. Edwards Middle School

## Teaching

### Courses Taught

Embedded Systems Prototyping (CPSC 4820/6820) — Fall 2016.

Operating Systems (CPSC/ECE 3220) — Fall 2014–Spring 2017.

Networks and Networked Programming (CPSC 3600) — Spring 2014.

Software Development Foundations (CPSC 2150) — Spring 2013.

Mobile Computing Systems (CPSC 8810) — Fall 2012.

Computer Architecture (Dartmouth College) (CS37) — Summer 2011.

### Course Development

Embedded Systems Prototyping (CPSC 4820/6820) — Fall 2016.

Mobile Computing Systems (CPSC 8810) — Fall 2012.

## Consulting Experience

SpotterRF LLC, 2010, advised on the design and evaluation of mobile radar systems.

Intel Research, 2007, Research Intern, Ubiquity Group

## Memberships

Member, Association for Computing Machinery, ACM (2008–)

Member, ACM Special Interest Group on Mobile Computing (SIGMOBILE) (2008–)

## Professional Activities

The ACM Conference on Embedded Networked Sensor Systems (SenSys 2017), TPC Member, 2017

ACM/IEEE International Symposium on Low Power Electronics and Design (ISLPED 2017), TPC Member, 2017

International Workshop on Energy Harvesting & Energy Neutral Sensing Systems, Technical Program Committee Chair, 2016

GetMobile (the SIGMobile magazine), Column Editor, 2015–2016

ACM Conference on Mobile Systems, Applications, and Services (MobiSys), Treasurer 2014

USENIX Workshop on Power-Aware Computing and Systems (HotPower), Technical Program Committee Member, 2014

ACM SIGCOMM Workshop on Medical Device Communication Systems, Technical Program Committee member, 2012

USENIX Workshop on Health Security and Privacy, Technical Program Committee member, 2012

Workshop on Secure Data Management on Smartphones and Mobiles, Technical Program Committee member, 2012

International Conference on Mobile Systems, Applications, and Services, PhD Forum Chair, 2009