JEREMY GUMMESON

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151 Holdsworth Way
Amherst, MA 01003

EDUCATION

PhD University of Massachusetts Amherst, Computer System Engineering Jan 2014
Dissertation: "Exploiting Energy Harvesting for Passive Embedded Computing Systems"
Committee: Tilman Wolf and Deepak Ganesan (co-chairs), Lixin Gao, Bodhi Priyantha, Michael Zink

MS University of Massachusetts Amherst, Computer System Engineering May 2010
Thesis: "Leveraging Multi-Radio Communication for Mobile Wireless Sensor Networks"
Committee: Tilman Wolf (chair), Aura Ganz, Prashant Shenoy

BS University of Massachusetts Amherst, Computer System Engineering Aug 2006

HONORS AND AWARDS

NSF CSR: Medium: Collaborative Research: CNS Medium: Systems Foundations for Battery-free Body Area Intelligence and Sensing 2021

Principle Investigator on a 3-year NSF grant that explores the use of human skin tissue as a medium for power and communication in body area networks

NSF CSR: Medium: Systems Abstractions for Self-Powered Smart Textiles 2018
Received three-year NSF grant to explore the system designs of self-powered textile sensing and computing systems

IMWUT Volume 1 Distinguished Paper Award 2018
Awarded for paper "RFID Light bulb: Enabling Ubiquitous Deployment of Interactive RFID Systems"

NASA AES Innovation Award 2017
Awarded for work on REALM RFID inventory management system currently deployed on the International Space Station

Hewlett-Packard Leading the Way Award 2014
Outstanding Undergraduate Teaching Assistant 2006
IEEE Outstanding Senior Award 2006
Betterment of the ECE Department Award 2006

PUBLICATIONS

Journal Publications

Noor Mohammed, Rui Wang, Robert W. Jackson, Yeonsik Noh, Jeremy Gummeson, and Sunghoon Ivan Lee. *ShaZam: Charge-Free Wearable Devices via Intra-Body Power Transfer from Everyday Objects*, Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies 5, no. 2, 2021 (**IMWUT**)

Ali Kiaghadi, Pan Hu, Jeremy Gummeson, Soha Rostaminia, Deepak Ganesan, Continuous Measurement of Interactions with the Physical World with a Wrist-Worn Backscatter Reader, *ACM Transactions on Internet of Things*, 2020. (**TIOT)**

Ali Kiaghadi, Seyedh Zohreh Homayounfar, Jeremy Gummeson, Trisha Andrew, Deepak Ganesan, Phyjama: Physiological Sensing via Fiber-enhanced Pyjamas, *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, 2019. **(IMWUT)**

Jeremy Gummeson, James McCann, Jack Yang, Damith Ranasinghe, Scott Hudson, and Alanson Sample, RFID Light Bulb: Enabling Ubiquitous Deployment of Interactive RFID Systems, *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, 2017. (**IMWUT**)

Soha Rostaminia, Addison Mayberry, Deepak Ganesan, Benjamin Marlin, and Jeremy Gummeson, iLid: Low-power Sensing of Fatigue and Drowsiness Measures on a Computational Eyeglass, *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies,* 2017. (**IMWUT**)

Navin Sharma, Jeremy Gummeson, David Irwin, and Prashant Shenoy, Leveraging weather forecasts in renewable energy systems, *Sustainable Computing: Informatics and Systems*, Issue 4, 2014. (**SUSCOM**)

Jeremy Gummeson, Deepak Ganesan, Mark D. Corner, and Prashant Shenoy, An Adaptive Link Layer for Heterogeneous Multi-radio Mobile Sensor Networks, *IEEE Journal on Selected Areas in Communications*, Special Issue on Simple Wireless Sensor Network Solutions, September 2010. (**JSAC**)

Conference Papers

R. Ivan Zelaya, William Sussman, Jeremy Gummeson, Kyle Jamieson, and Wenjun Hu. *LAVA: fine-grained 3D indoor wireless coverage for small IoT devices,* In Proceedings of the 2021 ACM SIGCOMM 2021 Conference, pp. 123-136, 2021 (**SigComm**)

Lili Chen, Wenjun Hu, Kyle Jamieson, Xiaojiang Chen, Dingyi Fang, Jeremy Gummeson, Pushing the Physical Limits of IoT Devices with Programmable Metasurfaces, *USENIX Symposium on Networked Systems Design and Implementation*, 2021. (**NSDI**)

Rishi Shukla, Neev Kiran, Rui Wang, Jeremy Gummeson, Sunghoon Ivan Lee, SkinnyPower: Enabling Batteryless Wearable Sensors via Intra-body Power Transfer, *ACM Conference on Embedded Networked Sensor Systems*, 2019. **(ACM SenSys)**

Zhuqi Li, Yaxiong Xie, Longfei Shangguan, Rotman Ivan Zelaya, Jeremy Gummeson, Wenjun Hu, and Kyle Jamieson, Towards Programming the Radio Environment with Large Arrays of Inexpensive Antennas, *USENIX Symposium on Networked Systems Design and Implementation*, 2019. (**NSDI**)

Ali Kiaghadi, Morgan Baima, Jeremy Gummeson, Trisha Andrew, and Deepak Ganesan, Fabric as a Sensor: Towards Unobtrusive Sensing of Human Behavior with Triboelectric Textiles, *ACM Conference on Embedded Networked Sensor Systems*, 2018. **(ACM SenSys, Presented)**

Mohammad Rostami, Jeremy Gummeson, Ali Kiaghadi, and Deepak Ganesan, Polymorphic radios: A New Design Paradigm for Ultra-low Power Communication, *ACM Special Interest Group on Data Communications*, 2018. (**SIGCOMM**)

Jack Yang, Jeremy Gummeson, and Alanson Sample, Riding the airways: Ultra-wideband Ambient Backscatter Via Commercial Broadcast systems, *IEEE International Conference on Computer Communications*, 2017. (**INFOCOM**)

Amee Trivedi, Jeremy Gummeson, David Irwin, Deepak Ganesan, and Prashant Shenoy, iSchedule: Campus-scale HVAC scheduling via mobile WiFi monitoring, *ACM International Conference on Future Energy Systems*, 2017. (**e-Energy**)

Patrick W Fink, Timothy F Kennedy, Lazaro Rodriguez, James L Broyan, Phong H Ngo, Andrew Chu, Ami Yang, Donald M Schmalholz, Robert W Stonestreet, Robert C Adams, Jesse Berger, Adam K Merta, Frank J Graffagnino, Prashant Shenoy, Emmanuel Cecchet, and Jeremy Gummeson, Autonomous Logistics Management Systems for Exploration Missions, *The American Institute of Aeronautics and Astronautics*, 2017. (**AIAA**)

Shrirang Mare, Mary Baker, and Jeremy Gummeson, A Study of Authentication in Daily Life, *In proceedings of the International Symposium of Usable Privacy and Security*, 2016. (**SOUPS**)

Shahriar Nirjon, Jeremy Gummeson, Dan Gelb, and Kyu-Han Kim, TypingRing: A Wearable Ring Platform for Text Input, *In proceedings of the International Conference on Mobile Systems, Applications, and Service*, 2015. (**MobiSys**)

Jeremy Gummeson, Bodhi Priyantha, and Jie Liu, An Energy Harvesting Wearable Ring Platform for Gesture Input on Surfaces, *In proceedings of the International Conference on Mobile Systems, Applications, and Service*, 2014. (MobiSys, Presented)

Artem Dementyev, Jeremy Gummeson, Derek Thrasher, Aaron Parks, Deepak Ganesan, and Joshua R Smith, Wirelessly Powered Bistable Display Tags, *In proceedings of the International Conference on Pervasive and Ubiquitous Computing*, 2013. (**UbiComp**)

Jeremy Gummeson, Bodhi Priyantha, Deepak Ganesan, Derek Thrasher, and Pengyu Zhang, EnGarde: Protecting the Mobile Phone from Malicious NFC Interactions, *In proceedings of the International Conference on Mobile Systems, Applications, and Services*, 2013. (**MobiSys**)

Jeremy Gummeson, Pengyu Zhang, and Deepak Ganesan, Flit: A Bulk Transmission Protocol for RFID-Scale Sensors, *In proceedings of the International Conference on Mobile Systems, Applications, and Services*, 2012. (**MobiSys**)

Pengyu Zhang, Jeremy Gummeson, and Deepak Ganesan, BLINK: A High Throughput Link Layer for Backscatter Communication, *In proceedings of the International Conference on Mobile Systems, Applications, and Services*, 2012. (**MobiSys**)

Jeremy Gummeson, Shane S. Clark, Kevin Fu, and Deepak Ganesan, On the Limits of Hybrid Energy Harvesting on Mobile CRFID Sensors, *In proceedings of the International Conference on Mobile Systems, Applications, and Services*, 2010. (**MobiSys**)

Navin Sharma, Jeremy Gummeson, David Irwin, and Prashant Shenoy, Cloudy Computing: Leveraging Weather Forecasts in Energy Harvesting Sensor Systems, *In proceedings of the International Conference on Sensor, Mesh and Ad Hoc Communications and Networks*, 2010 (**SECON**)

Jeremy Gummeson, Deepak Ganesan, Mark D. Corner, and Prashant Shenoy, An Adaptive Link Layer for Range Diversity in Multi-Radio Mobile Sensor Networks, *IEEE International Conference on Computer Communications*, 2009. (**INFOCOM**)

Navin Sharma, Jeremy Gummeson, David Irwin, and Prashant Shenoy, SRCP: Simple Remote Control for Perpetual High-power Sensor Networks, *In the proceedings of the European Conference on Wireless Sensor Networks*, 2009. (**EWSN**)

Invited Papers

Jeremy Gummeson, *A body area power network*, Nature Electronics 4, no. 7, 2021

Workshop Papers

Kun Woo Cho, Mohammad H. Mazaheri, Jeremy Gummeson, Omid Abari, and Kyle Jamieson. *mmWall: A Reconfigurable Metamaterial Surface for mmWave Networks*, In

Proceedings of the 22nd International Workshop on Mobile Computing Systems and Applications, pp. 119-125, 2021 (**HotMobile**)

Jean Bosco Nkurunziza, Michael Busa, Jeremy Gummeson, and Erik Risinger, *Psycho-physiological impedance matching through holistic closed-loop cyber-physical systems*, In Proceedings of the 2021 Workshop on Future of Digital Biomarkers (pp. 51-54), 2021. (**DigiBiom**)

Sougata Sen, Sunghoon Ivan Lee, Robert Jackson, Rui Wang, Nabil Alshurafa, Josiah Hester, Jeremy Gummeson, Towards Battery-Free Body Sensor Networks, *Proceedings of the 8th International Workshop on Energy Harvesting and Energy-Neutral Sensing Systems*, 2020. (**EnSys)**

Allen Welkie, Longfei Shangguan, Jeremy Gummeson, Wenjun Hu, and Kyle Jamieson, Programmable Radio Environments for Smart Spaces, *ACM Workshop on Hot Topics in Networks*, 2017. (**HotNets**)

Animesh Srivastava, Jeremy Gummeson, Mary Baker, and Kyu-Han Kim, Step-by-step Detection of Personally Collocated Devices, *In proceedings of the International Workshop on Mobile Computing Systems and Applications*, 2015. (**HotMobile**)

Shane Clark, Jeremy Gummeson, Kevin Fu, and Deepak Ganesan, Towards Autonomously-Powered CRFIDs, *Workshop on Power Aware Computing and Systems*, 2009. (**HotPower**)

Technical Reports

Hong Zhang, Jeremy Gummeson, Benjamin Ransford, and Kevin Fu, Moo: A Batteryless Computational RFID and Sensing Platform, Tech report UM-CS-2011-020, Department of Computer Science, University of Massachusetts Amherst. Amherst, MA, June 2011

PATENTS

Shahriar Nirjon, Kyu Han Kim, Jeremy Gummeson, and Dan Gelb,
"Detecting finger movements", Patent Pending, Filed 12.17.2017

Jeremy Gummeson, Mary G Baker, and Animesh Srivastava,
User Authentication Device, Patent Pending, Filed 11.30.2017

Souvik Sen, Jeremy Gummeson, David Lee, Martin R Fink, and Kyu Han Kim,
"Supplying Power to a Computer Accessory From a Captured Wifi Signal",
Patent Pending, Filed 10.19.2017

Bodhi Priyantha, Jie Liu, and Jeremy Gummeson,
"Hand-worn Device for Surface Gesture Input",
US Patents 9,232,331 and 9,360,946

RESEARCH EXPERIENCE

University of Massachusetts Amherst, Amherst, MA 2019 to Present
Assistant Professor, Department of Electrical and Computer Engineering

- Led the technical development of multiple applied mobile health projects with the Institute of Applied Life Sciences
- Formed a lab to look at novel hardware/software systems in the domains of wireless networking, internet of things, and mobile health applications
- Supervising undergraduate students in research activities including independent studies, honors theses, and senior design projects
- Initiating collaborative research activities with Stockbridge School of Agriculture, the Department of Psychological and Brain Sciences, and the College of Information and Computer Sciences

University of Massachusetts Amherst, Amherst, MA 2016 to 2019
Senior Research Fellow, College of Information and Computer Sciences

- Lead several funded research efforts including smart pill intake monitoring, textile sensing, and water quality monitoring
- Lead and assist grant proposal writing with faculty that spans multiple departments and colleges, which has resulted in several awards for sensing and communication research projects
- Collaborating with Yale and Princeton universities on a large RF communication research initiative; contributed several hardware prototypes and core research ideas that have resulted in two top-tier research publications
- Advise and consult with PhD students and faculty across several labs and research areas including RF communications, circuit design, energy harvesting, sensing and mobile computing
- Responsible for administrative and management tasks for the IALS mobile health sensing core that include industry outreach, consultation, and maintaining a hardware lab for device prototyping and mobile heath research studies using consumer wearable devices

The Walt Disney Company, Pittsburgh, PA 2015 to 2016
Associate Research Scientist, Wireless Lab

- Led and supported several wireless research efforts including RFID sensing using networks of RFID-enhanced lightbulbs, imaging through walls using the channel impulse response of commodity ultra-wideband radios, ambient backscatter that combines signals from FM, TV, and WiFi broadcasts, and a thermal energy harvesting study that looked at how much energy can be practically harvested from wrist-worn mobile devices

Hewlett-Packard, Palo Alto, CA 2014 to 2015
Research Scientist, Networking and Mobility Lab

- Engaged in several research efforts that spanned several dimensions of mobile networked systems including co-location detection, energy harvesting for battery free operation using Wi-Fi and NFC technologies, wearable authentication devices, and wearable input devices that allow text entry without a keyboard
- Developed several demo research systems that were showcased at company-wide technical conference including authentication devices and a battery-free keyboard prototype

Microsoft Research, Seattle, WA 2011 to 2013
Research Intern, Sensing and Energy Research Group

- Architected software with hardware-enabled reliability primitives for large-scale multi-hop sensor networks
- Designed an energy harvesting ring platform that enabled seamless gesture recognition on surfaces

Dissertation, Sensors Lab, University of Massachusetts Amherst 2010 to 2014
Advisor: Deepak Ganesan

- Designed and evaluated a broad set of battery-free embedded systems that use energy harvested from RFID, NFC, and solar power to enable maintenance-free operation
- Designed data collection and measurement systems that enabled green energy research that focused on solar and wind energy

Masters Thesis, University of Massachusetts Amherst 2007 to 2010
Advisors: Tilman Wolf and Deepak Ganesan

- Designed and Implemented a hardware/software multi-radio system that optimized power by using reinforcement learning to dynamically switch between two heterogeneous radios

TEACHING EXPERIENCE

University of Massachusetts Amherst, Amherst, MA Fall 2019 - Present
Assistant Professor, Department of Electrical and Computer Engineering

- Taught ECE 331 “Hardware Organization & Design” and ECE 597LP “Design Principles for Low Power Embedded Computing Systems”

University of Massachusetts Amherst, Amherst, MA Fall 2018
Lecturer, College of Information and Computer Sciences

- Co-taught Mobile Health Sensing and Analytics (CS 328), an undergraduate course with 60 students, covering the following topics: signal processing, machine learning, and Android and Python programming

- Developed quizzes, exams, and course projects, delivered lectures on advanced research topics and Android programming fundamentals, and coordinated grading and labs with a team of 3 teaching assistants

University of Massachusetts Amherst, Amherst, MA Fall 2005 to Spring 2006
Teaching Assistant, Department of Electrical and Computer Engineering

- Re-designed embedded systems course projects to teach closed loop embedded control applications; developed new lab sequence that used Altera's DE2 FPGA development board

INVITED LECTURES

Invited Talk, "Pushing the Limits of the Internet of Things,"
Northwest University, Xi'an, China, Nov 9, 2018

Invited Talk, "Realizing a Ubiquitous and Interactive Internet of Things,"
University of Massachusetts Amherst, Amherst, MA, Oct 26, 2018

PROFESSIONAL TRAINING

Altium Schematic and Board Layout Fundamentals
Altium Corporation, Pittsburgh, PA, July 2015
Description: Learned design fundamentals for Altium Designer software suite.

PROFESSIONAL AFFILIATIONS

Association for Computing Machinery, 2014-Present
Institute of Electrical and Electronic Engineers, 2014-Present

PROFESSIONAL SERVICE

Peer-Reviewed Articles for:

- TPC Member, EnSys 2019-2021
- TPC Member, MobiCom, 2021
- TPC Member, ACM MobiSys 2016-2019,2021
- External TPC Member, ACM MobiSys 2015
- TPC Member ACM IPSN 2019 - 2022
- TPC Member, IEEE SECON 2018
- TPC Member, IEEE RFID 2016-2018
- TPC Member, IMWUT Doctoral Colloquium 2018
- Invited Reviewer, ACM CHI
- Invited Reviewer, ACM UIST

- Invited Reviewer, ACM UbiComp
- Invited Reviewer, ACM IMWUT
- Invited Reviewer, ACM Transactions on Networks
- Invited Reviewer, ACM Transactions on Sensor Networks

Workshop and Tutorial Co-Chair, EWSN, 2021
Publicity Chair, IPSN, 2020
Publicity Chair, Sensys, 2020
Web Chair, HotMobile, 2015

LANGUAGES

English: Native Language

Spanish: Intermediate Listener, Novice Speaker, Intermediate Reading and Writing

PROFESSIONAL SKILLS

Programming: C, C++, Java, Python, MATLAB, Kotlin

Applications: MATLAB, Altium, SciKitLearn, Android Studio, IAR Studio

Platforms: Android, TI MSP430, Arm Cortex Series Microntrollers, Unix, Windows

REFERENCES

Deepak Ganesan
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413-545-2450
Email: dganesan@cs.umass.edu
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Princeton, NJ 08540
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