

PAT PANNUTO

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Computer Science and Engineering
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RESEARCH OVERVIEW AND INTERESTS

My research focuses on solving the “last inch” problem and solving the challenges that stand between the burgeoning Internet of Things and inevitable Internet of Everything. My interests span from low-level details—developing new technology to meet the energy and area demands of millimeter systems—to large-scale global considerations—understanding how our network and infrastructure must scale to support the trillions of impending devices.

EDUCATION

University of Michigan, Ann Arbor, MI (2012–present)
Ph.D. Student in Computer Science (degree expected roughly summer 2017)
Advisor: Prabal Dutta

University of Michigan, Ann Arbor, MI (2007–2012)
B.S.Eng in Computer Engineering

AWARDS AND GRANTS

University of Michigan College of Engineering Featured Graduate Student (Fall 2014)

Qualcomm Innovation Fellowship Honorable Mention, Team Fellowship with Brad Campbell, \$50,000 (2013–2014)

National Defense Science & Engineering Graduate Fellowship, \$95,000 plus tuition (2013–present)

National Science Foundation Graduate Research Fellowship, \$90,000 plus tuition (2013, declined)

University of Michigan Department of Computer Science First-Year Fellowship (2012–2103)

TEACHING AND HONORS

University of Michigan College of Engineering Featured Graduate Student, ('14–'15)

Best Undergraduate Instructor, University of Michigan, EECS ('11–'12)

Undergraduate Teaching Assistant, EECS 470: Computer Architecture (W'12)

Undergraduate Teaching Assistant, EECS 482: Introduction to Operating Systems (W'12, F'11, W'11, F'10)

Undergraduate Teaching Assistant, EECS 373: Design of Microprocessor Based Systems (F'11, W'11)

PROFESSIONAL SERVICE

2014 ACM Workshop on Visible Light Communication Systems – Demo Co-Chair

Recurring reviewer for IEEE Transactions on Circuits and Systems II (TCAS-II) *2013–present*

Recurring reviewer for USAID Development Innovation Ventures (DIV) *2015–present*

JOURNAL PUBLICATIONS

- [J1] Yoonmyung Lee, Suyoung Bang, Inhee Lee, Yejoong Kim, Gyouho Kim, Mohammad Hassan Ghaed, **Pat Pannuto**, Prabal Dutta, Dennis Sylvester, and David Blaauw. “A Modular 1 mm³ Die-Stacked Sensing Platform with Low Power I²C Inter-die Communication and Multi-Modal Energy Harvesting”. In: *IEEE Journal of Solid-State Circuits*. Vol. 48. 2013.

CONFERENCE PUBLICATIONS

- [C1] **Pat Pannuto**, Yoonmyung Lee, Ye-Sheng Kuo, ZhiYoong Foo, Benjamin Kempke, Gyouho Kim, Ronald G Dreslinski, David Blaauw, and Prabal Dutta. “MBus: An Ultra-Low Power Interconnect Bus for Next Generation Nanopower Systems”. In: *Proceedings of the 42nd International Symposium on Computer Architecture*. ISCA '15. Portland, Oregon, USA: ACM, June 2015. Acceptance: 58 / 305 (19%).
- [C2] William Huang, Ye-Sheng Kuo, **Pat Pannuto**, and Prabal Dutta. “Opo: A Wearable Sensor for Capturing High-Fidelity Face-to-Face Interactions”. In: *Proceedings of the 12th ACM Conference on Embedded Networked Sensor Systems*. SenSys '14. Memphis, Tennessee, USA: ACM, 2014. ISBN: 978-1-4503-3143-2. Acceptance: 21 / 117 (18%).
- [C3] Ye-Sheng Kuo, **Pat Pannuto**, Gyouho Kim, Zhi Yoong Foo, Inhee Lee, Benjamin Kempke, Prabal Dutta, David Blaauw, and Yoonmyung Lee. “MBus: A 17.5 pJ/bit Portable Interconnect Bus for Millimeter-Scale Sensor Systems with 8 nW Standby Power”. In: *CICC '14: IEEE Custom Integrated Circuits Conference*. San Jose, California, USA, Sept. 2014. Acceptance: 94 / 266 (35%).
- [C4] Ye-Sheng Kuo, **Pat Pannuto**, Ko-Jen Hsiao, and Prabal Dutta. “Luxapose: Indoor Positioning with Mobile Phones and Visible Light”. In: *The 20th Annual International Conference on Mobile Computing and Networking*. MobiCom '14. Maui, Hawaii, USA, Sept. 2014. Acceptance: 36 / 220 (16%).
- [C5] David Blaauw, Dennis Sylvester, Prabal Dutta, Yoonmyung Lee, Inhee Lee, Sechang Bang, Yejoong Kim, Gyouho Kim, **Pat Pannuto**, Ye-Sheng Kuo, Dongmin Yoon, Wanyeong Jung, Zhi Yoong Foo, Yen-Po Chen, Jeong Seok-Hyeon, and Myungjoon Choi. “IoT Design Space Challenges: Circuits and Systems”. In: *Proceedings of the 2014 IEEE Symposium on VLSI Technology (VLSI'14)*. Honolulu, Hawaii, USA, June 2014. **Invited Paper**.
- [C6] Gyouho Kim, Zhi Yoong Foo, **Pat Pannuto**, Ye-Sheng Kuo, Benjamin Kempke, Mohammad Hassan Ghaed, Suyoung Bang, Inhee Lee, Yejoong Kim, Seokhyeon Jeong, Prabal Dutta, Dennis Sylvester, and David Blaauw. “A Millimeter-Scale Wireless Imaging System with Continuous Motion Detection and Energy Harvesting”. In: *VLSI Circuits (VLSIC), 2014 Symposium on*. Honolulu, Hawaii, USA, June 2014. Acceptance: 96 / 420 (23%).
- [C7] Ye-Sheng Kuo, **Pat Pannuto**, Thomas Schmid, and Prabal Dutta. “Reconfiguring the Software Radio to Improve Power, Price, and Portability”. In: *Proceedings of the 10th ACM Conference on Embedded Networked Sensor Systems*. SenSys '12. Toronto, Canada: ACM, 2012. Acceptance: 23 / 123 (19%).

WORKSHOP PUBLICATIONS

- [W1] Benjamin Kempke, **Pat Pannuto**, and Prabal Dutta. “PolyPoint: Guiding Indoor Quadrotors with Ultra-Wideband Localization”. In: *2015 ACM Workshop on Hot Topics in Wireless*. HotWireless ’15. Paris, France, Sept. 2015.
- [W2] **Pat Pannuto**, Yoonmyung Lee, ZhiYoong Foo, Gyouho Kim, David Blaauw, and Prabal Dutta. “Lessons from Five Years of Making Michigan Micro Motes”. In: *6th Workshop of Architectural Research Prototyping*. WARP ’15. Portland, Oregon, USA, 2015. Acceptance: 11 / 20 (55%).
- [W3] Bradford Campbell, **Pat Pannuto**, and Prabal Dutta. “Interfacing the Internet of a Trillion Things”. In: *The Second International Workshop on the Swarm at the Edge of the Cloud*. SEC ’15. Seattle, Washington, USA, 2015.
- [W4] Benjamin Kempke, **Pat Pannuto**, and Prabal Dutta. “Harmonia: Wideband Spreading for Accurate Indoor RF Localization”. In: *2014 ACM Workshop on Hot Topics in Wireless*. HotWireless ’14. Maui, Hawaii, USA, Sept. 2014.
- [W5] Ye-Sheng Kuo, **Pat Pannuto**, and Prabal Dutta. “System Architecture Directions for a Software-Defined Lighting Infrastructure”. In: *1st ACM Workshop on Visible Light Communication Systems*. VLCS ’14. Maui, Hawaii, USA, Sept. 2014.
- [W6] Noah Klugman, Javier Rosa, **Pat Pannuto**, Matthew Podolsky, William Huang, and Prabal Dutta. “Grid Watch: Mapping Blackouts with Smart Phones”. In: *Proceedings of the 15th Workshop on Mobile Computing Systems and Applications*. HotMobile ’14. Santa Barbara, California: ACM, Feb. 2014.
- [W7] **Pat Pannuto** and Prabal Dutta. “Exploring Powerline Networking for the Smart Building”. In: *Extending the Internet to Low power and Lossy Networks*. IP+SN ’11. Chicago, Illinois, USA, Apr. 2011.

POSTERS AND DEMOS

- [PD1] **Pat Pannuto**, Michael P Andersen, Tom Bauer, Bradford Campbell, Amit Levy, David Culler, Philip Levis, and Prabal Dutta. “Poster Abstract: A Networked Embedded System Platform for the Post-Mote Era”. In: *Proceedings of the 12th ACM Conference on Embedded Networked Sensor Systems*. SenSys ’14. Memphis, Tennessee, USA: ACM, 2014.
- [PD2] Ye-Sheng Kuo, **Pat Pannuto**, and Prabal Dutta. “Demo — Luxapose: Indoor Positioning with Mobile Phones and Visible Light”. In: *The 20th Annual International Conference on Mobile Computing and Networking*. MobiCom ’14. Maui, Hawaii, USA, Sept. 2014.
- [PD3] Ye-Sheng Kuo, **Pat Pannuto**, and Prabal Dutta. “Demo — Luxapose: Indoor Positioning with Mobile Phones and Visible Light”. In: *1st ACM Workshop on Visible Light Communication Systems*. VLCS ’14. Maui, Hawaii, USA, Sept. 2014.
- [PD4] **Pat Pannuto**, Yoonmyung Lee, Zhiyoong Foo, David Blaauw, and Prabal Dutta. “Demo: M3: A Mm-scale Wireless Energy Harvesting Sensor Platform”. In: *Proceedings of the 1st International Workshop on Energy Neutral Sensing Systems*. ENSys ’13. Rome, Italy: ACM, Nov. 2013, 17:1–17:2. ISBN: 978-1-4503-2432-8. DOI: [10.1145/2534208.2534225](https://doi.org/10.1145/2534208.2534225).
- [PD5] **Pat Pannuto**, Bradford Campbell, and Prabal Dutta. “GATD: A Robust, Extensible, Versatile Swarm Dataplane”. In: *The First International Workshop on the Swarm at the Edge of the Cloud*. SEC ’13. Montreal, Quebec, Canada, 29, 2013.
- [PD6] Ye-Sheng Kuo, **Pat Pannuto**, and Prabal Dutta. “Demo: Floodcasting, a Data Dissemination Service Supporting Real-time Actuation and Control”. In: *Proceeding of the 11th Annual International Conference on Mobile Systems, Applications, and Services*. MobiSys ’13. Taipei, Taiwan: ACM, June 2013, pp. 489–490. ISBN: 978-1-4503-1672-9. DOI: [10.1145/2462456.2465697](https://doi.org/10.1145/2462456.2465697).
- [PD7] **Pat Pannuto**, Prabal Dutta, Bradford Campbell, Samuel DeBruin, Trey Grunnagle, William Huang, Ben Kempke, Ye-Sheng Kuo, Andrew Robinson, Aaron Schulman, Maya Spivak, and Lohit Yerva. “Platforms and Protocols for Emerging Wireless Systems”. In: *Future of Mobile Computing Workshop*. Mountain View, California: Google, 2012.

- [PD8] **Pat Pannuto**, Yoonmyung Lee, Ben Kempke, Dennis Sylvester, David Blaauw, and Prabal Dutta. “Demo: Ultra-constrained sensor platform interfacing”. In: *Proceedings of the 11th international conference on Information Processing in Sensor Networks*. IPSN '12. Beijing, China: ACM, Apr. 2012, pp. 147–148. ISBN: 978-1-4503-1227-1. DOI: [10.1145/2185677.2185721](https://doi.org/10.1145/2185677.2185721).