Anh Luong

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Education

University of Utah   *Salt Lake City, Utah, USA*

PHD IN ENGINEERING: COMPUTER ENGINEERING   *August 2013 - August 2017*

Dissertation: Radio Frequency Sensing Networks for Localization, Synchronization, and Health Monitoring,

Advisor: Professor Neal Patwari

University of Utah   *Salt Lake City, Utah, USA*

B.S./M.S. IN ENGINEERING: COMPUTER ENGINEERING   *August 2008 - May 2013*

Focus: VLSI & Wireless Embedded Sensing Systems, **Advisor:** Professor Thomas Schmid

Research Interests

Wireless	Systems	Networks
Wireless Communications	Embedded Systems	Wireless Sensor Network
Radio Frequency Sensing	Localization	Time Synchronization

Professional/Research Experience

Wireless, Sensing, and Embedded Systems Laboratory, PI: Prof. Anthony Rowe   *Carnegie Mellon University*

CYLAB POSTDOCTORAL RESEARCHER   *August '17 - PRESENT*

- NIST: Firefighters localization
- Low-power wide area networking
- ARPA-E: Occupancy detection through breathing estimation
- Gridballast: Smart water heater for demand response
- CONIX: Lead students on main application drivers (smart and connected communities, situational awareness, and mixed reality

Sixth Sensing (Start-up)   *Salt Lake City, Utah*

TECH. CONSULTANT   *May '18 - PRESENT*

- Non-invasive breathing monitoring

Sensing and Processing Across Networks Laboratory, PI: Prof. Neal Patwari   *University of Utah*

POSTDOCTORAL FELLOW   *May '17 - August '17*

- Breathing and localization for search and rescue operations
- Football player localization

Plusone Technologies LLC (Start-up)   *Salt Lake City, Utah*

TECH. CONSULTANT   *January '17 - February '17*

- Non-invasive breathing monitoring

XANDEM (Start-up)   *Salt Lake City, Utah*

TECH. CONSULTANT   *December '14 - PRESENT*

- Detection and localization for in-home security

Sensing and Processing Across Networks Laboratory, PI: Prof. Neal Patwari *University of Utah*
RESEARCH ASSISTANT *Summer '14 - Spring '17*
- Bandwidth efficient and highly accurate wireless time synchronization protocol
- Research platform for wireless time synchronization (Beaglebone Black Cape based on Cortex-M4, FPGA, Zigbee, BLE, & UWB radios)
- Created system to generate high-res RSS with low-cost COTS Radio (TI CC1200) for non-invasive breathing monitoring, gesture recognition, etc…
- Designed & Implemented non-invasive breathing and localization algorithms
- Designed & Implemented a breathing and localization hardware platform for Search and Rescue operations
- Designed & Implemented hardware for spatial diversity to enhance accuracy and reduce deployment density
- Designed & Implemented Wireless Communication Protocol to accommodate large scale deployments for Radio Tomographic Imaging

SmartStream, EmbeddedHQ LLC (Start-up) *Salt Lake City, Utah*
CTO / CO-FOUNDER *July '15 - April '16*
- Smart audio mixer for live stream performance

Wireless Embedded Sensing Systems Laboratory, PI: Prof. Thomas Schmid *University of Utah*
RESEARCH ASSISTANT *Summer '12 - Spring '14*
- Scalable programming interface for wireless ranging enabled node
- Study of population movement patterns for tracking influenza
- System to create printable circuits with the Makerbot Thing-O-Matic

Honors & Awards

2018	**Charm: Exploiting Geographical Diversity Through Coherent Combining in Low-Power Wide-Area Networks**, *Best Paper Award*	*ACM IPSN*
2018	**Welcome to My World: Demystifying Multi-user AR with the Cloud**, *Best Demo Award*	*ACM IPSN*
2018	**Microsoft Indoor Localization Competition**, *1st Place*	*ACM IPSN*
2016	**Sandia National Laboratories Clinic 2016 - DAQ for EIT (Mentor)**, *Best Clinic Award*	*University of Utah*
2014	**Student Travel Grant**,	*ACM Sensys*
2012	**Rapid Deployable System for Human Contact Network Research**, *Best Demo Award*	*ACM Sensys*
Fall '10	**Dean's List**,	*University of Utah*
Spring '09	**Dean's List**,	*University of Utah*
	Electrical and Computer Engineering Undergraduate Scholarship,	*University of Utah*
	Clegg Memorial Scholarship,	*University of Utah*

Technical Skills

HARDWARE

CAD	Altium, Eagle, SolidWorks, Synopsys EDA
FPGA	Microsemi IGLOO, Microsemi SmartFusion, Xilinx Spartan-6, Xilinx Spartan-3E
μController	ARM-based, Texas Instruments MSP430, Beaglebone series (Texas Instruments AM335x), Raspberry Pi series, Intel 8051, CR16
Radio	Zigbee/IEEE802.15.4 (Texas Instruments CC2420, CC2520, CC253x, CC1200, Atmel RF233), WiFi (Texas Instruments CC3000, CC3200), Digi XBEE, Semtech SX125x, Semtech SX1276

FIRMWARE

Language	C, C++, Verilog, NesC, Assembly (CR16, ARM, x86, MSP430, TI PRU), Gcode
IDE	gcc-based, Eclipse-based, IAR, Microsemi Libero, Xilinx ISE

SOFTWARE

Language	C, C++, Python, C#, Objective-C, Java, Rascal
OS	Mac, Windows, Debian-based

Teaching Experience

18-349 Embedded System Design *Carnegie Mellon University*
GUEST LECTURER *Fall '17, Fall '18*

ECE/CS 5780/6780 Embedded Systems Design *University of Utah*
LAB INSTRUCTOR/TEACHING ASSISTANT *Spring '13, Spring '14*
- Guide students through the process of implementing their own embedded systems
- Instructed students on exercises and projects using various embedded platforms

Robotics and Engineering Matters *University of Utah*
INSTRUCTOR *Summer '12*
- Lead discussions on the importance of engineering
- Introduced students to embedded systems with Arduino-based exercises

Mentoring Experience

Master Project *University of Utah*
CAPSTONE PROJECT ON DEVELOPING A MOBILE SDR SYSTEM *2016 - 2017*
- Goverdhan Reddy (now @ Apple)

Sandia Clinic *University of Utah*
UNDERGRAD CAPSTONE PROJECT ON DEVELOPING A MEASUREMENT SYSTEM FOR IMPEDANCE TOMOGRAPHY *2015 - 2016*
- Mark Stacey (now @ Raytheon)
- Drew Janibagian (now @ Vaporsens)
- Steven Brown (now @ Sandia National Laboratories)
- Travis Grey (now @ Raytheon)
- Michael Empey (now @ Sandia National Laboratories)

Master Project *University of Utah*
CAPSTONE PROJECT ON DEVELOPING A HEALTHCARE MONITORING SYSTEM *2014*
- Kellen Madsen (now @ Sandia National Laboratories)
- Spencer Clegg (now @ GE Healthcare)

Publications

CONFERENCE

[1] A. S. Abrar, A. Luong, P. Hillyard, and N. Patwari, "Save our spectrum: contact-free human sensing using single carrier radio," ArXiv e-prints, arXiv:1811.10129, arXiv:1811.10129, Nov. 2018. arXiv: 1811.10129 [eess.SP].

[2] A. Dongare, R. Narayanan, A. Gadre, A. Luong, A. Balanuta, S. Kumar, B. Iannucci, and A. Rowe, "Charm: Exploiting geographical diversity through coherent combining in low-power wide-area networks," in Proceedings of the 17th ACM/IEEE International Conference on Information Processing in Sensor Networks, ser. IPSN '18, Porto, Portugal: IEEE Press, 2018, pp. 60–71, ISBN: 978-1-5386-5298-5. DOI: 10.1109/IPSN.2018.00013. [Online]. Available: https://doi.org/10.1109/IPSN.2018.00013.

[3] P. Hillyard, A. Luong, A. S. Abrar, N. Patwari, K. Sundar, R. Farney, J. Burch, C. A. Porucznik, and S. H. Pollard, "Comparing respiratory monitoring performance of commercial wireless devices," ArXiv preprint arXiv:1807.06767, 2018.

[4] ——, "Experience: Cross-technology radio respiratory monitoring performance study," Proceedings of the 24th Annual International Conference on Mobile Computing and Networking, 2018.

[5] A. Luong, P. Hillyard, A. S. Abrar, C. Che, A. Rowe, T. Schmid, and N. Patwari, "A stitch in time and frequency synchronization saves bandwidth," in Proceedings of the 17th ACM/IEEE International Conference on Information Processing in Sensor Networks, ser. IPSN '18, Porto, Portugal: IEEE Press, 2018, pp. 96–107, ISBN: 978-1-5386-5298-5. DOI: 10.1109/IPSN.2018.00016. [Online]. Available: https://doi.org/10.1109/IPSN.2018.00016.

[6] P. Hillyard, A. Luong, and N. Patwari, "Highly reliable signal strength-based boundary crossing localization in outdoor time-varying environments," in Information Processing in Sensor Networks (IPSN), 2016 15th ACM/IEEE International Conference on, IEEE, 2016, pp. 1–12.

[7] M. Bocca, A. Luong, N. Patwari, and T. Schmid, "Dial it in: Rotating rf sensors to enhance radio tomography," in Sensing, Communication, and Networking (SECON), 2014 Eleventh Annual IEEE International Conference on, IEEE, 2014, pp. 600–608.

WORKSHOP

[1] A. Luong, A. S. Abrar, T. Schmid, and N. Patwari, "Rss step size: 1 db is not enough!" In Proceedings of the 3rd Workshop on Hot Topics in Wireless, ser. HotWireless '16, New York City, New York: ACM, 2016, pp. 17–21, ISBN: 978-1-4503-4251-3. DOI: 10.1145/2980115.2980128. [Online]. Available: http://doi.acm.org/10.1145/2980115.2980128.

[2] K. T. Min, A. Forys, A. Luong, E. Lee, J. Davies, and T. Schmid, "Wrensys: Large-scale, rapid deployable mobile sensing system," in 2014 IEEE 39th Conference on Local Computer Networks Workshops (LCN Workshops), IEEE, 2014, pp. 557–565.

DEMO/POSTER/PRESENTATION

[1] A. Dongare, A. Luong, A. Balanuta, C. Hesling, K. Bhatia, B. Iannucci, S. Kumar, and A. Rowe, "The openchirp low-power wide-area network and ecosystem: Demo abstract," in Proceedings of the 17th ACM/IEEE International Conference on Information Processing in Sensor Networks, ser. IPSN '18, Porto, Portugal: IEEE Press, 2018, pp. 138–139, ISBN: 978-1-5386-5298-5. DOI: 10.1109/IPSN.2018.00032. [Online]. Available: https://doi.org/10.1109/IPSN.2018.00032.

[2] J. Miller, N. Rajagopal, K. Kumar, A. Luong, and A. Rowe, "Realty and reality: Where location matters," Microsoft, 2018. [Online]. Available: https://www.microsoft.com/en-us/research/uploads/prod/2017/12/John_Miller_2018.pdf.

[3] N. Rajagopal, J. Miller, K. K. R. Kumar, A. Luong, and A. Rowe, "Welcome to my world: Demystifying multi-user ar with the cloud: Demo abstract," in Proceedings of the 17th ACM/IEEE International Conference on Information Processing in Sensor Networks, ser. IPSN '18, Porto, Portugal: IEEE Press, 2018, pp. 146–147, ISBN: 978-1-5386-5298-5. DOI: 10.1109/IPSN.2018.00036. [Online]. Available: https://doi.org/10.1109/IPSN.2018.00036.

[4] A. S. Abrar, A. Luong, P. Hillyard, and N. Patwari, "Poster: Link line crossing speed estimation with narrowband signal strength," in Proceedings of the 23rd Annual International Conference on Mobile Computing and Networking, ACM, 2017, pp. 528–530.

[5] A. Luong, T. Schmid, and N. Patwari, "Demo abstract: A platform enabling local oscillator frequency synchronization," in 14th ACM Conference on Embedded Networked Sensor Systems, SenSys 2016, Association for Computing Machinery, Inc, 2016.

[6] A. Luong, S. Madsen, M. Empey, and N. Patwari, "Rubreathing: Non-contact real time respiratory rate monitoring system," in Proceedings of the 14th International Conference on Information Processing in Sensor Networks, ser. IPSN '15, Seattle, Washington: ACM, 2015, pp. 412–413, ISBN: 978-1-4503-3475-4. DOI: 10.1145/2737095.2737133. [Online]. Available: http://doi.acm.org/10.1145/2737095.2737133.

[7] A. Forys, J. Davies, A. Luong, K. Min, E. Lee, and T. Schmid, "Rapid deployable system for human contact network research," in Proceedings of the 10th ACM Conference on Embedded Network Sensor Systems, ACM, 2012, pp. 383–384.

COMPETITION

DARPA 2018 - Current	**Subterranean Challenge (CMU Team)**	
ACM IPSN 2018	**Microsoft Indoor Localization Competition** *1st Place*	*Porto, Portugal*
RASC-AL 2012-2013	**Robo-Ops Competition (University of Utah Team)**	*Houston*

Committee Work

2019	**ACM IoTDI**, TPC	*Montreal, Canada*
2018	**ACM TOSN**, Reviewer	*Journal*
2018	**ISJ**, Reviewer	*Journal*
2015	**ACM IPSN**, Shadow Program Committee	*Seattle, Washington*
2017	**IEEE WCNC**, Reviewer	*San Francisco, CA*

Outreach

2012 - 2013	**RoboUtes**, Lead Computer Engineer	*University of Utah*
2012	**Teton Science Schools Lab Tour**, Presenter	*University of Utah*
2012	**Salt Lake City Mini-Maker Faire**, Presenter	*Salt Lake City, Utah*
2010 - 2012	**Computer Engineering Student Advisory Committees**, Member	*Unversity of Utah*
2010 - 2012	**UofU CoE Engineering Day & Highschool Recruit Day**, Recruiter	*University of Utah*

Language

English	Fluent
Vietnamese	Native
Spanish	Basic

Professional Society Memberships

ACM Professional	2018 - Present
ACM Student	2014 - 2017
IEEE Student	2012 - 2013

References

Prof. Anthony Rowe *Carnegie Mellon University*

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DIRECTOR OF CONIX RESEARCH CENTER

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Prof. Neal Patwari *Washington University in St. Louis*

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