

Patrick Chwalek

patrickchwalek.com

chwalek@mit.edu

SUMMARY

- Background in electronic hardware, embedded firmware, data processing, and mechanical design
- Interests in environment monitoring, empathetic systems, and automated interventions

EDUCATION

Massachusetts Institute of Technology <i>PhD Media Arts and Sciences, Responsive Environments Group</i>	September 2020 – Present
Massachusetts Institute of Technology <i>M.S. Media Arts and Sciences, Responsive Environments Group</i> <i>Focus: Electrical/Mechanical Design, Embedded Systems, Pervasive Computing, Human-Computer Interaction</i>	September 2020
Georgia Institute of Technology <i>M.S. Computer Science</i> <i>Focus: Machine Learning, Computational Perception, and Robotics</i>	May 2018
University of Illinois at Urbana-Champaign <i>B.S. Mechanical Engineering</i>	December 2015

ACADEMIC RESEARCH AND DESIGN EXPERIENCE

MIT Media Lab Spotlight	November 2019 – Present
<ul style="list-style-type: none">▪ Designed an actuated luminaire system to characterize environments for optimal illumination of objects within a space	
Project Captivate	May 2019 – Present
<ul style="list-style-type: none">▪ Designed a wearable smart-eyeglass platform for measuring attention and cognitive load through sensor fusion of minimally invasive sensing technologies on a real-time embedded operating system▪ Spent one month in Shenzhen, China, working with factories on pushing the capabilities of existing mechanical and electrical manufacturing processes	
Space Terroir: Measuring Fermentation in Space	January 2019 – Present
<ul style="list-style-type: none">▪ Designed and constructed an embedded system that periodically samples sensors that monitor miso fermentation and streams that sensor data to Earth from the International Space Station	
Koosh: Indoor Temperature Monitoring and Target Localization	April 2019 – June 2019
<ul style="list-style-type: none">▪ Designed and built a wireless sensing system consisting of several ceiling-mounted embedded nodes that sensed radiated and conducted heat, ambient sound, and visible light	
CD-Synthesizer: A Rotating, Untethered, Digital Synthesizer	September 2018 – February 2019
<ul style="list-style-type: none">▪ Designed an untethered digital synthesizer platform that can be held and manipulated while broadcasting audio data to a receiving off-the-shelf Bluetooth receiver	

INDUSTRY RESEARCH AND DESIGN EXPERIENCE

Gridware, Inc. <i>Research Intern</i>	May 2021 – August 2021
<ul style="list-style-type: none">▪ Architected and tested a low-cost, distributed, wildfire detection system▪ Interfaced with design firm on overall design of product and integration of electrical subsystems▪ Conducted photovoltaic panel analysis and studied placement across variably distributed outdoor nodes	
MIT Lincoln Laboratory Ambulatory Voice Monitors – <i>Bioengineering Systems and Technologies</i>	January 2016 – July 2018
<ul style="list-style-type: none">▪ Designed a wireless, electroglottography (EGG) system for noise-robust vocal fold performance monitoring▪ Lead the electrical engineering team on integrating an EGG system into an existing, wearable circuit▪ Devised a flexible, wearable, ambulatory, wireless system with acoustic and vibration sensors for physiological monitoring and behavioral analysis▪ Assisted in several data collection events in aircraft, sound rooms, research labs, and natural environments	

Low-Power, Wireless Detection System – *Homeland Protection Systems*

June 2016 – July 2018

- Developed a low-power multi-sensor system architecture for noise-robust detections in unpredictable environments
- Experimented with thermopile sensors and designed a dynamic algorithm for presence and movement detection based on only infrared sensor data
- Characterized signals of passive infrared sensors to target movement in various environments
- Built a visible and infrared spectrum sensor data logger for variable condition environments which allowed for the characterization of multiple infrared sensing technologies, correlation with control events, and environmental mapping

Remote, Self-Sustaining, Image Tracking System – *Project Lead – Homeland Protection Systems* January 2017 – July 2018

- Led technical meetings with sponsors and supporting industry partners
- Constructed and deployed multiple wireless imaging systems for off-grid surveillance and real-time image tracking
- Analyzed and improved custom tailored target detection and tracking software for visible and infrared imagery
- Designed high-frequency vibration sensor circuit to analyze stochastic wind load impact onto image tracking system
- Built a user interface for remote communication with the system and its sub-components

Project MiRaTA (CubeSat) – *Systems Engineering*

June 2015 – August 2015

- Designed a CAD model of experimental 3U CubeSat for structural analysis and component layout
- Conducted radiometer aperture analysis of thermal vacuum test fixture
- Researched and defined environmental test requirements for the laboratory’s CubeSat Program

UTC Aerospace Systems

Electronics Packaging Co-op

May 2013 – August 2014

- Performed analysis on failing flight PCBs for the Boeing 787 airliner
- Researched conformal coating deposition and removal methods
- Investigated nonconforming components and assemblies for commercial airliners and military aircraft

PUBLICATIONS

- **Chwalek, P.C.,** Ramsay, D.B., & Paradiso, J.A. (2021). Captivates: A Smart Eyeglass Platform for Across-Context Physiological Measurements. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, 5, 1 - 32.
- Berke, A., Lee, N., & **Chwalek, P.C.** (2021). Private Delivery Networks - Extended Abstract. *ArXiv, abs/2108.07354*.
- **Chwalek, P.C.,** & Paradiso, J.A. (2019). CD-Synth: a Rotating, Untethered, Digital Synthesizer. *NIME*.
- **Chwalek, P.C.,** Mehta, D.D., Welsh, B., Wooten, C., Byrd, K., Froehlich, E., Maurer, D., Lacirignola, J., Quatieri, T.F., & Brattain, L.J. (2018). Lightweight, on-body, wireless system for ambulatory voice and ambient noise monitoring. *2018 IEEE 15th International Conference on Wearable and Implantable Body Sensor Networks (BSN)*, 205-209.
- Mehta, D.D., **Chwalek, P.C.,** Quatieri, T.F., & Brattain, L.J. (2017). Wireless Neck-Surface Accelerometer and Microphone on Flex Circuit with Application to Noise-Robust Monitoring of Lombard Speech. *INTERSPEECH*.
- Brattain, L.J., Landman, R., Johnson, K.A., **Chwalek, P.C.,** Hyman, J., Sharma, J., Jennings, C., Desimone, R., Feng, G., & Quatieri, T.F. (2016). A multimodal sensor system for automated marmoset behavioral analysis. *2016 IEEE 13th International Conference on Wearable and Implantable Body Sensor Networks (BSN)*, 254-259.

AWARDS

- 2019: Best Poster (New Interfaces for Musical Expression)
- 2015: Senior Design Outstanding Achievement Award
- 2015: Undergraduate Project Innovation Trophy Winner: Myoelectric Prosthetic Hand
- 2011-2015: James Scholar
- 2011-2015: Dean’s List

TECHNICAL SKILLS

- **Programming languages and related:** C, C++, Python, React Native, MongoDB, MATLAB, Simulink, LabVIEW, PyTorch, Keras
- **Computer aided design/engineering:** Altium Designer, SolidWorks, PTC Creo, Mentor Graphics, EAGLE, Rhino, Grasshopper

LEADERSHIP AND ACTIVITIES

MIT Media Lab

Organizing Committee – MIT IoT Seminar Series

December 2020 – Present

Electronics Teaching Assistant – Zero Gravity Flight Course

September 2020 – Present

Head Teaching Assistant – Adventures in Sensing

February 2021 – May 2021

Head Teaching Assistant – Sensors for Interactive Environments

January 2019 – May 2019