

Patrick Chwalek

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SUMMARY

- Interests in product and system design, scalable technologies, and semi-automated interventions
- Expertise in electronic hardware, embedded firmware, mechanical design, and deployable systems

EDUCATION

Massachusetts Institute of Technology <i>PhD Media Arts and Sciences, Responsive Environments Group (5.0/5.0)</i>	September 2020 – Present
Massachusetts Institute of Technology <i>M.S. Media Arts and Sciences, Responsive Environments Group (5.0/5.0)</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 (4.0/4.0)</i> <i>Focus: Machine Learning, Computational Perception, and Robotics</i>	May 2018
University of Illinois at Urbana-Champaign <i>B.S. Mechanical Engineering (3.90/4.00)</i>	December 2015

ACADEMIC RESEARCH AND DESIGN EXPERIENCE

MIT Media Lab

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|---|--------------------------------|
| National Geographic Projects | April 2022 – Present |
| <ul style="list-style-type: none">▪ Designing deployable hardware (e.g., microphone arrays, multi-imager systems, low-power particulate measurement) for three National Geographic Explorers to monitor African Wild Dogs in Botswana, Guardian Frogs in Borneo, and various species of bees in Patagonia and the U.S. Rocky Mountain Area | |
| AirSpecs | May 2022 – Present |
| <ul style="list-style-type: none">▪ Designing an environment-focused, research and development smart glasses platform with accompanying software toolkits that allow users to probe the quality of their environments across contexts and to perform remote data collection in naturalistic settings | |
| MicroPET | May 2022 – January 2023 |
| <ul style="list-style-type: none">▪ Designed firmware and electronics for a system to study the biological upcycling of polymer polyethylene terephthalate (PET) over 30-days within the International Space Station | |
| Project Captivate | May 2019 – December 2022 |
| <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 | |
| Spotlight | November 2019 – May 2020 |
| <ul style="list-style-type: none">▪ Designed an actuated luminaire system to characterize environments for optimal illumination of objects within a space | |
| Space Terroir: Measuring Fermentation in Space | January 2019 – December 2020 |
| <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

National Geographic Society

- | | |
|--|-------------------------|
| <i>Exploration Technology Lab Intern</i> | June 2022 – August 2022 |
| <ul style="list-style-type: none">▪ Added a dissolved oxygen sensor to the existing Deep Ocean Dropcam system▪ Designed, prototyped, and tested the wireless communication and camera controls for a remote mobile camera system used to capture up-close photos and videos of wild lions and hyenas▪ Created a low-power, React-based, web server running on an ESP32 for in-the-wild camera trap configuration▪ Assisted with technology planning for the Exploration Technology Lab's future project portfolio | |

Gridware, Inc.

Research Intern

May 2021 – August 2021

- 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 – *Bioengineering Systems and Technologies*

January 2016 – July 2018

- 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
- 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
- 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
- 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

- Analyzed and reported on failing flight PCBs for the Boeing 787 airliner
- Researched conformal coating deposition and removal methods
- Investigated component and assembly for commercial airliners and military aircraft

FEATURED PUBLICATIONS

- **Chwalek, P.C.** et al. (2023). AirSpec: A Smart Glasses Platform, Tailored for Research in the Built Environment. *Adjunct Proceedings of the 2023 ACM International Joint Conference on Pervasive and Ubiquitous Computing & the 2023 ACM International Symposium on Wearable Computing*, 18–22.
- **Chwalek, P.C.**, et al. (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.
- **Chwalek, P.C.**, et al. (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.

FEATURED AWARDS

- 2023: TIME Bests Inventions of 2023 (MicroPet: Breaking Down Plastics in Space)
- 2021: Distinguished Paper Award (Interactive, Mobile, Wearable and Ubiquitous Technologies Journal)
- 2019: Best Poster (New Interfaces for Musical Expression)
- 2015: Senior Design Outstanding Achievement Award
- 2015: Undergraduate Project Innovation Trophy Winner: Myoelectric Prosthetic Hand

TECHNICAL SKILLS

- **Programming languages and related:** C, C++, Python, Swift, 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

Program Chair and Speaker – Workshop in Environmental Sensing, University of Fribourg, Switzerland

January 2024

Speaker – Workshop in Extreme Sensing

October 2023

Organizing Committee – MIT IoT Seminar Series

December 2020 – December 2021

Electronics Teaching Assistant – Zero Gravity Flight Course

September 2020 – May 2021

Head Teaching Assistant – Adventures in Sensing

February 2021 – May 2021

Head Teaching Assistant – Sensors for Interactive Environments

January 2019 – May 2019