

# Levi Burner | Curriculum Vitae

University of Pittsburgh, Pittsburgh, PA

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Strong interest in aggressive control of autonomous systems constrained by onboard sensing and future application of this research to space systems.

## Education

### University of Pittsburgh

Electrical Engineering, GPA: 3.80/4.0

Dean's List: Fall 2015–Present

Pittsburgh

Fall 2014–December 2018

### Important Coursework

Linear System Theory, Linear Control Systems, Image Processing, Analysis of Stochastic Processes (audit), Digital Communications, Analog Communications, Algorithm Implementation, Intro to Theoretical Math

## Honors and Awards

- **IARC Mission 7 2018:** Most Points, Best System Design, Best Technical Paper at the American Venue
- **Swanson School of Engineering Design Expo Spring 2018:** 3rd place in Electrical and Computer Engineering
- **IARC Mission 7 2017:** Most Points, Best System Design at the American Venue
- **Tartan Hacks 2017:** STEM Education Award for self-driving car educational webapp
- **IEEE Student Activities Conference 2016:** 4th Place, Minisumo
- **Steel Hacks 2016:** 1st Place for cross-platform, blender based robotics simulator (RoboSim)

## Research Experience

### NSF Center for Space, High-performance, and Resilient Computing

Simulation of CubeSat Flight Control

Pittsburgh, PA

August 2018–Present

Working with Christopher Manderino, under Dr. Alan George, to research robust development techniques for CubeSats. Adding closed loop controls simulation to the NASA Operations Simulator for Small Sats. Developing a gimbal mounted, desktop test bed containing reaction wheels. Will demonstrate HITL simulation incorporating attitude control based on input from a neuromorphic camera.

Gallium Nitrate (GaN) FET DC Circuit Breakers for Space

May 2017–November 2017

Worked under Dr. Ansel Barchowsky to consider methods to replace fuses in low-earth orbit missions with GaN FET based circuit breakers. Designed prototype through simulation and identified potential points of failure.

### Sharma Lab: Neuromuscular Control and Robotics

Wearable Sensing System to Estimate Lower Limb State

Pittsburgh, PA

May 2017–August 2017

Worked under Dr. Nitin Sharma to develop a wearable, IMU based, limb angle estimation system for foot drop correction using functional electrical stimulation. System interfaced with ROS and Simulink.

## Papers

Miller, A., Burner, L., Becker, E., Misra, R., Saba, A., and Berti, L. (2018). **A Novel UAV for Interaction with Moving Targets in an Indoor Environment.** *IARC Symposium on Indoor Flight Issues.* [Link](#) (Not peer-reviewed; Best Technical Paper award)

Burner, L., and Sharma, N. (2018). **A Wearable Sensing System to Estimate Lower Limb State for Drop Foot Correction.** *Ingenium: Undergraduate Research Undergraduate Research at the Swanson School of Engineering*, 16-20. [Link](#)

Miller, A., and Burner, L. (2017). **Aerial Robot Design for Ground Robot Interaction and Navigation without Landmarks.** *IARC Symposium on Indoor Flight Issues.* [Link](#) (Not peer-reviewed)

## Presentations

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<b>A Novel UAV for Interaction with Moving Targets in an Indoor Environment</b> <i>International Aerial Robotics Competition Symposium Presentation</i> Aaron Miller, Levi Burner, Liam Berti, Evan Becker, and Ritesh Misra (equal contribution)	<b>Atlanta, Georgia</b> July 2018 <a href="#">Slides</a>
<b>6 Degree of Freedom Autonomous UAV</b> <i>Swanson School of Engineering's Design Exposition, Poster Session</i> Levi Burner, Liam Berti, Long Vo, Ritesh Misra (equal contribution)	<b>Pittsburgh, PA</b> April 2018 <a href="#">Poster</a>
<b>Navigation and Control for an Autonomous Multirotor in an Indoor Environment</b> <i>Pennsylvania Automated Vehicle Summit 2018, Student Poster</i> Aaron Miller, Levi Burner, Liam Berti (equal contribution)	<b>Pittsburgh, PA</b> April 2018 <a href="#">Poster</a>
<b>Functional Electrical Stimulation Control and IMU-Based Limb Angle Estimation</b> <i>Science 2017 Undergraduate Research Poster Reception</i> Levi Burner, Dr. Nitin Sharma	<b>Pittsburgh, PA</b> October 2017 <a href="#">Poster</a>
<b>Aerial Robot Design for Ground Robot Interaction and Navigation without Landmarks</b> <i>International Aerial Robotics Competition Symposium Presentation</i> Aaron Miller, Levi Burner (equal contribution)	<b>Atlanta, Georgia</b> July 2017 <a href="#">Slides</a>

## Industry Experience

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<b>Carnegie Robotics LLC</b> <i>Software Engineering Intern, converting to full-time in January 2018</i> Created custom Linux distribution for single board computer. Main author and maintainer of a complex STM32 based project. Design electronics using Altium Designer. Working with the latest in robotics camera technology.	<b>Pittsburgh, PA</b> June 2018–Present
<b>KLC Electronics</b> <i>Embedded Software Developer, part-time</i> Programming PIC based embedded systems for utility grade wind turbines ranging in size from 60 to 750 kW.	<b>Lake Havasu City, AZ</b> June 2012–Present
<b>Rockwell Automation</b> <i>Embedded Software Engineering Co-op</i> Used C++, C, and assembly to develop firmware for a functional safety certified industrial controller. Created run-time diagnostics to test CPU features. Created specialized firmware to support memory bus signal integrity testing. Co-led a team that developed an interactive checker playing robot used for recruiting events.	<b>Mayfield Heights, OH</b> May 2016–December 2016

## Notable Projects

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<b>International Aerial Robotics Competition (IARC) Mission 7</b> <i>Team Co-Founder, System Designer, Electronics and Controls Team Lead</i> Co-founded Pitt's IARC team with Aaron Miller, which combined contributions from over 30 students. Designed and demonstrated a custom multirotor that avoided obstacles and interacted with moving targets using only onboard sensing and computation. Combined 6 cameras, Intel and NVIDIA computers, and a novel flight control system. In 2017, received 2 of 6 awards at the American Venue for most points and Best System Design. In 2018, received these awards again, along with Best Technical Paper.	<i>July 2016–August 2018</i>
<b>Media:</b> <a href="#">Technical Postmortem</a> (Videos), <a href="#">Project Page</a> , <a href="#">2018 Technical Paper</a>	
<b>News and Press Releases:</b> <a href="#">Swanson School of Engineering News 2018</a> , <a href="#">Pittwire</a> , <a href="#">SSOE Annual Report 2017: Page 15</a> , <a href="#">Pittsburgh Tribune</a> , <a href="#">Swanson School of Engineering News 2017</a> , <a href="#">Unmanned Systems Technology</a>	

<b>Technical Contributions to the IARC</b> .....	
o <b>Texture Classifier to Identify Arena Boundaries</b> Used a 41 element filter bank and SVM to classified image regions as within or outside of an arena. Demonstrated 99% classification accuracy at competition. Evaluated at 100 fps on a NVIDIA Jetson using TensorFlow.	<i>July 2018</i>
o <b>Time Variant, Non-linear Rotor Thrust Modeling</b> Designed rotor modeling system suited for 1-7 kg UAVs. Used data from over 100 step-responses to estimate performance across all operating points. Decreased lag from 85 to 50 ms and allowed four times higher slew rates.	<i>January 2017–July 2018</i>

- **ROS and Cleanflight based UAV Flight Controller** *August 2016–July 2018*  
Designed motion-profile generators and a linear controller to achieve responsive, accurate flight sufficient for interaction with moving targets. Demonstrated on 2-5 kg UAVs and a CrazyFlie.
- **Optical Flow for UAV State Estimation** *July 2017–June 2018*  
Worked with Aaron Miller to create a UAV velocity estimator using OpenCV's implementation of Lucas-Kanade optical flow with pyramids. Designed statistical filter to estimate health and detect bad flow vectors.
- **30A, 30V, Eight Channel DC Circuit Breaker with Current Sensing and Isolation** *March 2018*  
Used for emergency power removal for a 7 kg UAV. MOSFET based design provided eight 30A channels. Control interface and high current features were electrically isolated. Included per-channel current sensing.

### **UAV with 6 Controllable Degrees of Freedom**

*Team Member*

### **Senior Capstone Project**

*January 2018–May 2018*

Member of a team of four that designed, built, and demonstrated an eight rotor autonomous UAV with 6 controllable degrees of freedom. Won 3rd place in ECE at Pitt's senior design exposition. [Video](#)

### **High-speed Line Follower**

*Co-Project Lead*

*August 2015–April 2016*

With Aaron Miller, led a team of approximately 15 students to create a line follower capable of 1 m/s translation while navigating 90 degree corners. [Video](#)

### **Wi-Fi Controlled Rover**

*Co-Project Lead*

*August 2015–April 2016*

With Aaron Miller, led a team of approximately 10 students to create a rover with gimbaled cameras. [Photo](#)

## **Interests and extra-curricular activity**

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- Working with Dr. Zachary Horton to recreate the 1972 Magnavox Odyssey using only analog circuit components
- "Director of Technology" for Pitt's Robotics and Automation society from early 2016 to mid 2018. Provided technical guidance to leaders of 8 project teams; guided growth from 40 to 80 active members; and spearheaded increase in funding from 4 to 15 thousand dollars per year.
- Member of Tau Beta Pi; volunteered in the Lambda chapter's Mindset program (STEM outreach)
- Robotics demonstrations at Carnegie Science Centers Sci-Tech days and other STEM outreach events
- Cooking, sharing recipes, sailing, 3D printing technology, vintage electronics, history and philosophy of science

## **Technical and Personal skills**

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- **Programming Languages:** *Experienced:* Python, C++, C, Matlab *Capable:* LaTeX, ARM assembly, Go
- **Software Libraries:** *Experienced:* OpenCV, ROS, SciPy, NumPy, ChibiOS *Capable:* TensorFlow, Buildroot
- **CAD:** *Experienced:* KiCad, LTSpice, SolidWorks *Capable:* Altium Designer, Eagle
- **Embedded Platforms:** *Experienced:* NVIDIA Jetson, PIC, STM32 *Capable:* ARM Cortex-A bare metal
- **Soft Skills:** Team organization, obtaining sponsorship, writing reports, identifying development pathways
- **Other:** *Experienced:* Soldering/PCB Rework, 3D printing, multirotor construction *Capable:* laser cutting

## **References**

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- Prof. Dr. Samuel Dickerson, University of Pittsburgh, "[dickerson@pitt.edu](mailto:dickerson@pitt.edu)"
- Prof. Dr. Alan George, University of Pittsburgh, "[alan.george@pitt.edu](mailto:alan.george@pitt.edu)"
- Prof. Dr. Ahmed Dallal, University of Pittsburgh, "[ahd12@pitt.edu](mailto:ahd12@pitt.edu)"
- Prof. Dr. Zhi-Hong Mao, University of Pittsburgh, "[zhm4@pitt.edu](mailto:zhm4@pitt.edu)"