Levi Burner | Curriculum Vitae

University of Maryland, College Park, MD

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Strong interest in robust control of autonomous systems constrained by onboard sensing.

Education

University of Maryland   **College Park, MD**
Ph.D. in Electrical and Computer Engineering   *2019–Present*
Controls Track

Coursework
Convex Optimization, Linear System Theory, Random Processes

University of Pittsburgh   **Pittsburgh, PA**
BS in Electrical Engineering, GPA: 3.82/4.0   *2014–2018*
Concentration in Communications and Signal Processing

Selected Coursework
Linear Control Systems, Image Processing, Digital Communications, Analog Communications
Algorithm Implementation, Intro to Theoretical Math

Honors and Awards

- **Outstanding Graduate in Electrical Engineering**   *University of Pittsburgh, Fall 2018*
- **Swanson School of Engineering Dean's List**   *University of Pittsburgh, Fall 2015–Fall 2018*
- **Most Points, Best System Design, Best Technical Paper**   *IARC American Venue, Georgia Tech, 2018*
- **3rd place in ECE Senior Design**   *Swanson School of Engineering Design Expo, Spring 2018*
- **Most Points, Best System Design**   *IARC American Venue, Georgia Tech, 2017*
- **STEM Education Award for self-driving educational webapp**   *Tartan Hacks, Carnegie Mellon University, 2017*
- **4th place in Minisumo robotics competition**   *IEEE Student Activities Conference, 2016*
- **1st place for Blender based robotics simulator**   *Steel Hacks, University of Pittsburgh, 2016*

Research Experience

NSF Center for Space, High-performance, and Resilient Computing   **Pittsburgh, PA**
Simulation of CubeSat Flight Control   *August 2018–March 2019*

Worked with Christopher Manderino, under Dr. Alan George, to explore robust development practices for CubeSat missions.
Designed gimbal mounted test model for hybrid physical and software based mission simulation.   Project Page

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   **Pittsburgh, PA**
Wearable Sensing System to Estimate Lower Limb State   *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.   Project Page

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; Awarded Best

Technical Paper)

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

A Novel UAV for Interaction with Moving Targets in an Indoor Environment   **Atlanta, Georgia**
International Aerial Robotics Competition Symposium Presentation   *July 2018*
Aaron Miller, Levi Burner, Liam Berti, Evan Becker, and Ritesh Misra (equal contribution)   Slides

6 Degree of Freedom Autonomous UAV   **Pittsburgh, PA**
Swanson School of Engineering's Design Exposition, Poster Session   *April 2018*
Levi Burner, Liam Berti, Long Vo, Ritesh Misra (equal contribution)   Poster

Navigation and Control for an Autonomous Multirotor in an Indoor Environment   **Pittsburgh, PA**
Pennsylvania Automated Vehicle Summit 2018, Student Poster   *April 2018*
Aaron Miller, Levi Burner, Liam Berti (equal contribution)   Poster

Functional Electrical Stimulation Control and IMU-Based Limb Angle Estimation   **Pittsburgh, PA**
Science 2017 Undergraduate Research Poster Reception   *October 2017*
Levi Burner, Dr. Nitin Sharma   Poster

Aerial Robot Design for Ground Robot Interaction and Navigation without Landmarks   **Atlanta, Georgia**
International Aerial Robotics Competition Symposium Presentation   *July 2017*
Aaron Miller, Levi Burner (equal contribution)   Slides

Industry Experience

Carnegie Robotics LLC   **Pittsburgh, PA**
Software Engineer I   *January 2019–July 2019*
Software Engineering Intern   *June 2018–December 2018*

Designed electronics and software for a robust robotic vision system with six HD cameras and a real-time video transmission. Created custom Linux root file system for NVIDIA Jetson using Buildroot that preserved support for advanced hardware features. Developed ChibiOS based STM32 firmware with USB connectivity for sensor aggregation and real-time processing. Designed microphone system with high-fidelity over wide dynamic range (50-100 dBA). Debugged non-trivial issues with Android WebRTC SDK. Optimized H264 parameters for poor networking. Designed initial integration and release tests.

KLC Electronics   **Lake Havasu City, AZ**
Embedded Software Developer, part-time   *June 2012–January 2019*

Programmed Microchip PIC based embedded systems for utility grade wind turbines ranging in size from 60 to 750 kW.

Rockwell Automation   **Mayfield Heights, OH**
Embedded Software Engineering Co-Op   *May 2016–December 2016*

Used C++, C, and assembly to develop firmware for a functional safety certified industrial controller. Created run-time diagnostics to functionally 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.

Notable Projects

International Aerial Robotics Competition (IARC) Mission 7
Team Co-Founder, System Designer, Electronics and Controls Team Lead   *July 2016–August 2018*

Co-founded Pitt's IARC team with Aaron Miller, which combined contributions from over 30 students. Designed and demonstrated a 5 kg 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.

Media: Personal Project Page, Technical Postmortem, Overall Project Page, 2018 Technical Paper

News and Press Releases: Swanson School of Engineering News 2018, Pittwire, SSOE Annual Report 2017: Page 15, Pittsburgh Tribune, Swanson School of Engineering News 2017, Unmanned Systems Technology

Technical Contributions to the IARC

- **Texture Classifier to Identify Arena Boundaries**   *July 2018*
  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.

- **Time Variant, Non-linear Rotor Thrust Modeling**   *January 2017–July 2018*
  Designed rotor modeling system suited for 1-7 kg UAVs. Used data from over 100 step-responses to estimate response at all operating points. Decreased profile lag from 85 to 50 ms and enabled four times higher slew rate.

- **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 two dimensional 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   **Senior Capstone Project**
Team Member   *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.   Project Page

High-speed Line Follower
Co-Project Lead   *August 2015–April 2016*

With Aaron Miller, led ~15 students to create a line follower capable of 1 m/s translation while navigating 90 degree corners using cascaded PID control loops.   Project Page

Wi-Fi Controlled Rover
Co-Project Lead   *August 2015–April 2016*

With Aaron Miller, led ~10 students to create wheeled rover with two cameras streamed over WebRTC using gstreamer and hardware H264 encoding.   Project Page

Interests and extra-curricular activity

- Worked with Dr. Zachary Horton from early 2018 and on to recreate the first home video game console (1972 Magnavox Odyssey) using only analog circuit components. In 2019, attempted resurrection and operation of an early prototype (c. 1967) through a unique collaboration with the Smithsonian National Museum of American History.
- "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, sailing, 3D printing technology, vintage electronics, history and philosophy of science

Technical and Personal skills

- **Programming Languages:** *Experienced:* Python, C++, C, Matlab *Capable:* LaTeX, ARM assembly, Go
- **Software:** *Experienced:* OpenCV, ROS, SciPy, NumPy, ChibiOS *Capable:* TensorFlow, Buildroot
- **CAD:** *Experienced:* KiCad, SolidWorks *Capable:* Altium Designer, Eagle, LTSpice
- **Platforms:** *Experienced:* NVIDIA Jetson, PIC, STM32
- **Soft Skills:** Team organization, obtaining sponsorship, detailed documentation, robust design practices
- **Other:** *Capable:* Electronics design, PCB rework, multirotor design, rapid prototyping

References

- Dr. Samuel Dickerson, course instructor and club advisor — *Assistant Professor, University of Pittsburgh*
- Dr. Ahmed Dallal, course instructor — *Assistant Professor, University of Pittsburgh*
- Dr. Zhi-Hong Mao, course instructor and capstone advisor — *Professor, University of Pittsburgh*
- Dr. Alan George, former research supervisor — *ECE Department Chair and Professor, University of Pittsburgh*
- Woody Douglass, former industry supervisor — *Senior Software Engineer, Carnegie Robotics LLC*