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# Matthew Song

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## EDUCATION

**Electrical Engineering and Computer Science B.S.,** *University of California, Berkeley*

Expected graduation: 2025

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## RELEVANT COURSEWORK

Digital Design and ICs, Machine Learning, Signals and Systems, User Interfaces, Prototyping and Fabrication, Operating Systems, Machine Structures, Artificial Intelligence, Algorithms, Physics for Scientists and Engineers, Information Devices and Systems

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## WORK EXPERIENCE

### SLAC National Accelerator Laboratory

August 2024 — Present

*Electrical Engineering and Programming Intern*

- Performed extensive fault analysis of SSI-protocol absolute encoders interfaced with a Galil motion controller
- Developed a test fixture and custom cable adapter to analyze control and data signals directly with an oscilloscope both in-system (mounted on robot) and in isolation (removed from robot).
- Advised SSRL staff on the next steps to take regarding the encoder and motion controllers
- Initiated extensive conversations with the manufacturers of the components tested to gain insight
- Analyzed schematics of existing PCBs with Altium to determine their capability to drive a detector trigger
- Designed and programmed an FPGA-based waveform generator to perform diagnostics and test edge conditions for the encoder

### UAVs@Berkeley

Summer 2024 - Present

*President - previous Lead Electrical Engineer*

- Leveraged over a decade of drone design knowledge, and electromechanical system design skills to lead the club
- Designed and completed bringup of a PCB for a delayed release payload controller
- Wrote custom firmware, debugged, reworked, and performed extensive testing on the payload controller before deployment
- Collaborated with other subteams to refine connector placement, harnessing options, and mounting
- Wired and debugged CAN, I2C, and UART busses to communicate with on-board and off-board components

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## PROJECTS

### FPGA Computer Vision Accelerator

March — April 2024

- Designed a Zynq-7000 SoC PCB to run a hardware implementation of the ORB computer vision algorithm
- Integrated and routed DDR3, gigabit ethernet, USB 2.0, QSPI, and SDIO
- Optimized traces for the best possible signal integrity with simulation
- Worked with mechanical constraints for mounting on the UAVs@Berkeley competition hexacopter

### GPS-Denied UAV Navigation

November — December 2024

- Worked with a team to build a computer-vision based geolocation system for UAV navigation in GPS-denied environments
- Set up and performed troubleshooting for an RTSP stream from our camera system to our onboard computer
- Researched and tested various image processing pipelines to achieve the most accurate geolocation results
- Performed full system test flights and in-field debugging
- Designed and 3D printed mounts for critical hardware

### Fully Custom 3D Printer

June 2024

- Self-sourced and built a modified Voron 2.4 3D printer
- Endstop switches for homing and hard mechanical endstops for failsafe
- Designed and programmed an autonomous, reliable, dockable bed probe
- Custom configured and compiled firmware on Raspberry Pi and STM32 architecture
- Tuned resonance and backlash compensation for accurate high speed prints

### FPGA RISC-V CPU

November — December 2024

- Used Verilog to design a 3-stage pipelined RISC-V CPU on a Xilinx PYNQ-Z1 board
- Implemented synchronization, signal smoothing, and button parsing modules to allow interfacing with the real world
- Designed a UART communication module to allow easier communication between the CPU and a separate computer

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## SKILLS

Altium, Xilinx Vivado, Python, Java, C/C++, Drones, Ardupilot, oscilloscope and multimeter usage, RISC-V, Git, Solidworks, 3D printing, SMD soldering