

# Timothy Jacques

☎ (858) 774-8078 | ✉ tjacques@stanford.edu | 🏠 timjacques.com | 🌐 TJ178 | in timothyjacques | US Citizen

## Education

### Stanford University

M.S. Electrical Engineering, September 2024 – June 2026

Palo Alto, CA

**In Progress Courses** Intro to VLSI Systems, Smartphone Sensors

### University of California, Los Angeles (UCLA)

B.S. Computer Engineering, August 2020 – March 2024

Los Angeles, CA

GPA: **3.83**

#### Courses

Digital Electronic Circuits, Adv. Computer Arch., Digital Signal Processing, Speech/Image Processing, Algorithms, Communications Systems, Secure Computing Systems, Operating Systems, Software Const., Data Science

## Experience

### Stanford Smart Sensing Systems Lab

Graduate Researcher under Professor Zerina Kapetanovic, PhD

Palo Alto, CA  
September 2024 – Present

- Developing ultra-low-power, low-cost wireless sensing devices to enable more accessible oceanography research
- Integrating novel sensor design and Texas Instruments MCU to optimize for cost, power while surviving 1km ocean depth

### Qualcomm Inc.

Hardware Platforms Intern

San Diego, CA  
May 2024 – August 2024

- Designed hardware daughter-cards for next-generation compute platforms through schematic capture, PCB routing, and tape-out
- Simulated insertion loss, DC resistance to evaluate PCB stackup feasibility and USB4 SoC to connector signal integrity
- Evaluated and presented potential solutions for laptop reference design, executed and finalized USB sub-board design

### UCLA Communications Systems Lab

Undergraduate Researcher under Professor Richard Wesel, PhD

Los Angeles, CA  
May 2023 – June 2024

- Designed an end-to-end hardware testbench on a Xilinx MPSoC FPGA to benchmark an LDPC decoder implementation
- Utilized Vivado, Vitis IDE to design encoder and noise generator modules, integrate embedded CPU and FPGA using AXI-Stream
- Performed simulations in MATLAB and Python to verify hardware results and optimize RTL, improving performance by 15%
- Led team of four students to change LDPC code from AR4JA to 5GNR, and add multi-coderate support

### UCLA Secure Systems and Architectures Lab

Undergraduate Researcher under Professor Nader Sehatbakhsh, PhD

Los Angeles, CA  
October 2021 – September 2022

- Developed covert data transmission methods that utilize side-channel RF emissions from tranceiverless embedded devices
- Tested microcontrollers using spectrum analyzers, software-defined radios to find and study controllable CPU-based RF emissions
- Designed MATLAB DSP and ML pipeline for side-channel based device identification that achieved 92% accuracy
- Contributed to a conference publication and a journal publication, see list below

### IEEE at UCLA

FPGA Digital Design Project Lead

Los Angeles, CA  
May 2022 – June 2023

- Led FPGA intro project to expose >60 students to Verilog, digital design fundamentals, RTL simulation, and hardware DSP
- Redesigned project curriculum to include FPGA design lectures on FSMs, I<sup>2</sup>C drivers, pipelining, Fast Fourier Transforms, VGA

Micromouse Project Lead

May 2021 – June 2022

- Led year-long autonomous maze-solving robot project involving PCB Design, PID controllers, and maze-solving algorithms
- Developed custom STM32 microcontroller-based robot with infrared sensors, motors, and power electronics for >75 students

### Fluid Components International

Electrical Engineering Intern

San Marcos, CA  
Summer 2020, 2021

- Wrote calibration program for industrial flowmeters, increasing production speed by 200% and tightening tolerances by 15%
- Diagnosed and repaired >50 malfunctioning motherboards at the SMD component level, patched firmware root issue
- Operated industrial assembly equipment including pick and place machines and reflow ovens, produced hundreds of assemblies

## Skills

#### Languages

SystemVerilog, Embedded C, Python, MATLAB, C++

#### Software

Xilinx Vivado, Vitis, Intel Quartus, ModelSim, Linux, Git, Bash, Arduino

#### CAD Software

SIEMENS Xpedition, Cadence Allegro, Cadence OrCAD, Autodesk EAGLE, Fusion 360, SOLIDWORKS, Figma

#### Tools

SMD Soldering, Logic Analyzer, Oscilloscope, Software-Defined Radio, Signal Analyzer, 3D Printing

## Publications

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- **[IPSN'23]** "Everything has its Bad Side and Good Side: Turning Processors to Low Overhead Radios Using Side-Channels."  
Justin Feng, **Timothy Jacques**, Omid Abari, and Nader Sehatbakhsh.  
The 22nd International Conference on Information Processing in Sensor Networks (IPSN '23).
- **[IMWUT/UbiComp'23]** "Fingerprinting IoT Devices Using Latent Physical Side-Channels."  
Justin Feng, Tianyi Zhao, Shamik Sarkar, Dominic Konrad, **Timothy Jacques**, Danijela Cabric, and Nader Sehatbakhsh.  
Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT '23).

## Projects

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### **FPGA-based Spoken Keyword Spotter** | Capstone Project

February 2024 - March 2024

- Researched and designed spoken-keyword speech detection processing pipeline and model for FPGA implementation.
- Utilized MATLAB to design, verify, and train model, then implemented preprocessing and inference model in SystemVerilog.

### **IoT Bus Tracker** | Hobby IoT Project

November 2023

- Used Los Angeles Metro API to design fridge-mounted, ESP-32 based IoT device that tracks next bus arrival times
- Designed custom Flask and Python server backend to minimize API requests and transmitted packet size

### **Mini Starship Micromouse** | Hobby Robotics Project

January 2023 – May 2023

- Created custom micromouse robot shaped as a miniature Starship food delivery robot using custom 3D-printed shell and PCB
- Adapted micromouse robotics design into new form factor, retaining original functionality despite 30% less PCB space available

### **Packed-SIMD Extension to RISC-V CPU** | Graduate Computer Architecture

February 2023 - March 2023

- Implemented packed-SIMD (single instruction, multiple data) instructions to gem5, a simulator of a RISC-V CPU.
- Performed performance analysis using a C implementation of a deep neural network, with and without the SIMD instructions.
- Patched gcc compiler to compile test programs with SIMD instructions.

### **Transistor-Level Design of 8-bit Adder** | Digital Electronic Circuits

February 2023 - March 2023

- Designed a CMOS carry-save adder in Cadence Virtuoso, utilizing Cadence ADE for simulation.
- Optimized design for power and speed given certain constraints.

### **Simulated RISC-V Processor** | Honors Advanced Computer Architecture

November 2022 - December 2022

- Implemented 2-issue, 7-stage pipelined, out-of-order RISC-V processor in SystemVerilog to handle R, S, I-type instructions
- Utilized ModelSim to write, simulate, and debug logic modules using batch scripts and waveform analysis

### **IEEE Digital Audio Visualizer** | Terasic DE-10 Lite FPGA-based Project

October 2021 – June 2022

- Created real-time audio frequency spectrum visualizer using a microphone, FPGA, and VGA monitor
- Wrote FFT, VGA, and all other modules from scratch in Quartus and verified functionality through testbenches in ModelSim, QuestaSim

### **FPGA Brickbreaker Game** | Hobby Project

April 2022

- Recreated classic arcade game on Intel Altera FPGA using custom hardware VGA display and I<sup>2</sup>C controllers
- Reverse-engineered Wii Nunchuck I<sup>2</sup>C protocol using genuine Wii hardware and logic analyzer to control player in game
- Used Intel Quartus, ModelSim to implement collision FSMs, I<sup>2</sup>C nunchuck driver, and to debug, testbench modules

### **IoT Fire Detection Device** | 3rd Place IDEAHacks Hackathon Project

January 2022

- Collaborated with team of 5 for 36 hours to create a mesh-networked IoT device with 7 environmental sensors to detect forest fires
- Designed and 3D printed custom enclosures using Fusion 360 to create compact final assembly, debugged device firmware

### **IEEE Micromouse** | STM32-based Autonomous Maze-Solving Robot

October 2020 – June 2021

- Designed and programmed an autonomous, maze-solving robot to compete against other micromice using STM32 microprocessors
- Used STM32CubeIDE to write C programs that included PID control, sensor fusion, and floodfill algorithms to guide the robot
- Created and assembled 3 custom PCBs to construct the final robot through Autodesk EAGLE, Fusion 360
- Won second place in final competition against 50+ other students in the project based on lowest time to 6x6 maze completion

### **IoT Pool Controller** | Hobby Project

July 2020

- Reverse-engineered pool controller to retrofit with Arduino-based transceiver and Raspberry Pi bridge
- Designed Node.js webserver backend, wireless protocol, and HTML/CSS frontend
- Used to remotely control spa and pool features, as well as provide live temperature readouts

### **Marching Band LED Dome Props** | Volunteer Prop Design

September 2019 – November 2019

- Designed, constructed, and programmed 12-foot tall remote-controlled LED domes for high school marching band field show
- Utilized LoRA and Arduino to provide reliable wireless control of hundreds of meters of LED strips from across an entire football field
- Worked with a large team to solder thousands of power and data connections for dome wire harnesses