Minghui (Scott) Zhao

(858) 405-3316 ▪ linkedin.com/in/scott-zhao ▪ mz2866@columbia.edu ▪ scottz.net

Education

Doctor of Philosophy (Ph.D.) in Electrical Engineering, Columbia University — *Expected May 2026*
Master of Science (M.S.) in Computer Engineering, Columbia University — *Jan 2021 – May 2022*
Bachelor of Science (B.S.) in Electrical Engineering, UC San Diego — *Aug 2016 – Dec 2020*
Relevant Courses: C, C++, Python, Rapid HW&SW Prototyping, IoT and Cloud Computing, FPGA / SystemVerilog, Computer Architecture, Embedded Systems, Operating Systems, Computer Networking, Robotics, Software as a Service

Professional Experience

Columbia Intelligent and Connected Systems Lab — *New York, NY*
Research Assistant (advisor: Prof. Xiaofan (Fred) Jiang) — Sep 2021 – Present

- ***Sensor-less Autonomous 3D Airflow Mapping Using Palm-sized Off-the-Shelf Drones***: Developed a low-cost off-the-shelf microdrone platform, based off the open-source Crazyflie drone platform, to autonomously measure 3D airflow fields in indoor environments leveraging only motor control signals, no hardware modifications, and no onboard or external sensors. Performed drone STM32 C firmware modifications to extract and stream motor control data. Created Python pipelines and benchmarking systems to collect motor control data, predict airflow, and control the drone. (**demo** at ACM MobiSys '22, **first author publication** at ACM MobiCom '23).

- ***Zero-Code Easy-to-Deploy Modular IoT Sensing Platform***: Proposed and developed a plug-and-play sensing platform for hassle-free data acquisition, allowing users to easily mix and match different sensors depending on application needs. Designed the software middleware and drivers in C and Python; designed and assembled 9 different PCBs with KiCad, including an adapter board and 16 plug-and-play sensors. Refined system architecture for ease-of-use, flexibility, and scalability by enabling support for popular open-source hardware/software platforms (e.g., Raspberry Pi) and protocols (e.g., I2C, UART, SPI). Deployed the platform on cars and drones, in subway, and in homes while conducting user tests/surveys with 10+ subjects over a 2-week period to demonstrate increased productivity and utility over existing configurable sensing solutions. Used the platform in two STEM outreach events with middle school and high school students (**demo** at ACM MobiSys '22, **first author publication** at ACM/IEEE IoTDI '23).

- ***High-Speed Optical Communication using Diffused Infrared Laser***: Built a wireless transmitter and receiver system using an infrared laser, diffuser, collimator, and avalanche photodiode to perform optical communication at 100 MHz, leveraging ambient diffused reflections from the laser. Analyzed the receiver signal and developed data processing code in SystemVerilog, C, and Python. Designed hardware to power and interface the components (**best demo** at ACM/IEEE IPSN'23).

- ***Automated Daily Activities Screening using Smart Home Infrastructure***: Built a system that interfaces with existing low-cost smart home sensors to predict and classify human activities. Developed hardware and C firmware code to interface with 7 different types of sensors acting as wireless nodes streaming data to activity prediction models; developed algorithms for detecting daily activities (e.g., showering, cooking, sleeping) and achieved 88% accuracy. Deployed and conducted user studies in 5 subject homes throughout a 14-day period (**best demo runner-up** at ACM SenSys '22, **publication** at ACM IASA '22).

Tencent Pixel Lab — *New York, NY*
Embedded Systems Intern — Jun 2023 – Sep 2023

- Proposed and built a light stage with 800+ addressable and wirelessly controlled high-power light-emitting diodes (LEDs) with polarizers to provide fine-grained structural lights to relight objects for 3D reconstruction. Designed modular PCBs for LED lights, the power system, and wireless controllers. Developed C firmware with ESP32 to support scalable wireless brightness adjustments for each of the 800 LEDs with millisecond-level latency.
- Built automation software in Python and C++ to interface light systems with industrial cameras; built hardware systems to synchronize industrial cameras with video frames.

UCSD Wireless Communications Sensing and Networking Lab *La Jolla, CA*
Research Assistant (advisor: Prof. Dinesh Bharadia) Apr 2019 – Oct 2021

- ***Centimeter-accurate Scalable 3D UWB Tag Localization***: Designed an indoor 3D positioning system employing an array of ultra-wideband (UWB) radio frequency (RF) transceivers and achieved state-of-art accuracy, latency, scalability, and power consumption. Developed embedded firmware and hardware systems for the UWB transceivers and the PCBs for an eight-transceiver array. Processed the RF signal data and analyzed the performance and limits of the system. Evaluated and optimized various methods and algorithms in angle of arrival estimation and location solving to reduce the median 3-D localization error to 3.6 cm (**first author publication** in IMWUT / UbiComp '21).

Talke Lab UCSD *La Jolla, CA*
Research Assistant (advisor: Prof. Frank E. Talke) Apr 2017 – Jun 2019

- ***Wireless Wearables for Ergonomic Motion Tracking***: *Developed* an embedded, wireless hand and ergonomic self-contained motion tracking system to improve the surgical operation training and ergonomic health monitoring of medical students and doctors. Designed 3 PCBs and 3D printed enclosures for sensor and microncontroller boards; assembled a working demo, and successfully performed trials in hospitals (**publication** in ISPS '19).

Honors and Awards

- Best Demo Award: ACM/IEEE IPSN 2023
- Best Demo Runner-Up: ACM SenSys 2022
- Columbia University Presidential Fellowship
- 2020-2021 Henry G. Booker Memorial Honors Award
- 2020 ECE Best Tutor Award
- First Award. SD Hacks 2019: Best Use of AWS AI/ML Services
- Honorable Mention. LA Hacks 2019: Site 1001 Big Data Award

Professional Skills and Languages

- **Programming:** Python, MATLAB, C, C++, LabVIEW, Flutter, Java, Ruby, SystemVerilog
- **Software:** PCB (KiCad, Autodesk EAGLE, EasyEDA), 3D Modeling (Solidworks)
- **Prototyping:** Soldering, 3D Printing, Laser Cutting
- **Other:** Internet of Things, Embedded Systems, Cloud Computing Systems, Unix, Git
- **Certification:** Certified LabVIEW Associate Developer (CLAD)

Selected Publications

- **Zhao, M.**, Xia, S., Adhivarahan, C., Hou K., Chen, Y., Nie J., Wu E., Dantu K., & Jiang X. (2023, October). Anemoi: A Low-cost Sensorless Indoor Drone System for Autonomous Mapping of 3D Airflow Fields. In *Proceedings of the 29th Annual International Conference on Mobile Computing And Networking* (***MobiCom***). ACM. https://doi.org/10.1145/3570361.3613292
- **Zhao, M.**, Xia, S., Nie, J., Hou, K., Dhupar A., & Jiang, X. (2023, May). LegoSENSE: An Open and Modular Sensing Platform for Rapidly-Deployable IoT Applications. In *2023 IEEE/ACM Eighth International Conference on Internet-of-Things Design and Implementation (**IoTDI**)*. IEEE. https://doi.org/10.1145/3576842.3582369
- **Zhao, M.**, Chang, T., Arun, A., Ayyalasomayajula, R., Zhang, C., & Bharadia, D. (2021, September). ULoc: Low-Power, Scalable and cm-Accurate UWB-Tag Localization and Tracking for Indoor Applications. In *Proceedings of the ACM on Interactive, Mobile, Wearable, and Ubiquitous Technologies. 5, 3, Article 140 September 2021 (**IMWUT**)*. https://doi.org/10.1145/3478124
- Morris, K., **Zhao, M.**, Lam, J., Jacobsen, G., Horgan, S., & Talke, F. E. (2019, June). A Wearable Neck Measurement Device and Monitoring System to Improve Ergonomic Performance of Surgeons. In *Information Storage and Processing Systems (vol. 59124, p. V001T09A002)*. American Society of Mechanical Engineers. https://doi.org/10.1115/ISPS2019-7513