Taiting (Jackson) Lu

Education

Pennsylvania State University — **State College, PA**
Ph.D. *in Computer Science* — Aug. 2021 - Present

University of California, Irvine — **Irvine, CA**
B.Sc. *in Computer Science* — Jun. 2016 – Jun. 2021
B.Sc. *in Electrical Engineering*

Research Field **Human Computer Interface, Wearable Computing, Machine Learning Application, Internet of Things**

Selected Publication

- FuSenseRing: An Open-Source Platform for Robust Cuffless Blood Pressure Monitoring via Multimodal Sensor Fusion and Temperature-Adaptive Attention
  Zhenghao Li*, **Taiting Lu***, Runze Liu, Jigar Gosalia, Christine Bowlus, David Nathan Proctor, James A. Pawelczyk, Yincheng Jin, Mahanth Gowda
  ACM IMWUT/UbiComp, 2025
- VisRing: A Display-Extended Smartring for Nano Visualizations
  Taiting Lu*, Christian Krauter*, Alexander Achberger, Tanja Blascheck, Michael Sedlmair, Mahanth Gowda
  ACM UIST, 2025
- SignGlass: First-Person View Comprehensive ASL Translation Using Wearable Glass
  Yongxiang Cai *, **Taiting Lu***, Zhenghao Li, Hao Zhou, Kenneth DeHaan, Mahanth Gowda, Yincheng Jin
  ACM UIST, 2025, Special Recognition for Belonging & Inclusion Award
- MmBack: Clock-free Multi-Sensor Backscatter with Synchronous Acquisition and Multiplexing
  Yijie Li, Weichong Ling, **Taiting Lu**, Yi-Chao Chen, Vaishnavi Ranganathan, Lili Qiu, Jingxian Wang
  arXiv, preprint, arXiv:2507.01360 (2025) Under Review
- A Large Language Model Powered Integrated Circuit Footprint Geometry Understanding
  Yida Wang*, **Taiting Lu***, Runze Liu, Lanqing Yang, Zhe Chen, Yuehai Wang, Yixin Liu, Kaiyuan Lin, Xiaomeng Chen, Dian Ding, Yijie Li, Yifan Yang, Yi-Chao Chen, yincheng jin, Mahanth Gowda
  arXiv, preprint, arXiv:2508.03725 (2025) Under Review
- iRing: Rich Interaction on Smart Ring with Multi-point Capacitive Touch Screen
  Runze Liu*, **Taiting Lu***, Zhenghao Li, Yixi Wang, Shengming Yuan, Mahanth Gowda
  Under Review
- SoberRing: Continuous Passive Monitoring of Blood Alcohol Concentration Using a PPG-Based Smart Ring
  Taiting Lu, Zhenghao Li, Runze Liu, Suryoday Basak, Yi-Chao Chen, Yincheng Jin, Mahanth Gowda
  Under Review
- SmartDampener: An Open Source Platform for Sport Analytics in Tennis
  Runze Liu*, **Taiting Lu***, Shengming Yuan, Hao Zhou, Mahanth Gowda
  ACM IMWUT/UbiComp, 2024
- ASLRing: American Sign Language Recognition with Meta-Learning on Wearables
  Hao Zhou*, **Taiting Lu***, Kenneth DeHaan, Mahanth Gowda
  ACM / IEEE IoTDI, 2024
- I am an Earphone and I can Hear my Users Face: 3D Facial Reconstruction using Smart Earphones
  Shijia Zhang*, **Taiting Lu***, Hao Zhou, Yilin Liu, Runze Liu, Mahanth Gowda
  ACM Transactions on Internet of Thing, 2023
- SignQuery: A Natural User Interface and Search Engine for Sign Language with Wearable Sensors
  Hao Zhou**, Taiting Lu**, Kristina McKinnie, Joseph Palagano, Kenneth DeHaan, Mahanth Gowda
  ACM MobiCom, 2023
- One Ring to Rule Them All: An Open Source Smartring Platform for Finger Motion Analytics and Healthcare Applications
  Hao Zhou*, **Taiting Lu***, Yilin Liu, Shijia Zhang, Runze Liu, Mahanth Gowda
  ACM / IEEE IoTDI, 2023, Best Paper Award for IoT Edge AI
- Learning on the Rings: Self-Supervised 3D Finger Motion Tracking using Wearable Sensors
  Hao Zhou*, **Taiting Lu***, Yilin Liu, Shijia Zhang, Mahanth Gowda
  ACM IMWUT/UbiComp, 2022
- Storage codes with flexible number of nodes
  Weiqi Li, Zhiying Wang, **Taiting Lu**, and Hamid Jafarkhani
  IEEE Transactions on Information Theory, 2022
- Flexible Partial MDS codes
  Weiqi Li, **Taiting Lu**, Zhiying Wang, and Hamid Jafarkhani
  Non-Volatile Memories Workshop/NVMW, 2021

Research & Projects **PSU IoT Research Group,** Penn State Department of Computer Science and Engineering **State College, PA**

Research Assistant; Advisor: Dr. Mahanth Gowda

Multi-Modal Smart Ring for Motion Tracking, Health, and Interactive Visualization Sept. 2021 – Present

- Designed ***OmniRing***, the first open-source smart ring for 3D finger motion tracking and heart rate monitoring, leveraging synthetic training data extracted from public videos; developed a two-layer FPCB in EAGLE integrating an NRF52832-QFAA microcontroller, ICM20948 IMU, MAX30101 PPG sensor, and MIC5370 voltage regulator, achieving 12 mA power consumption, 100 Hz sampling rate, $24.18 cost, 2.5 g weight, and up to one week of battery life in low-power mode; additionally built a two-layer MCP73831-based charger enabling 1-hour full recharge with a scalable PLA–TPU housing adaptable to various ring sizes.
- Designed ***FuSenseRing***, the first open-source smart ring for blood pressure monitoring robust across diverse temperature conditions; developed a two-layer PCB in Altium integrating ECG, PPG, temperature, IMU, and force sensors to enable accurate, non-invasive blood pressure estimation under varying thermal environments.
- Developed ***iRing***, the first smart ring integrating a multi-touch capacitive touchscreen and flexible OLED display; proposed one-handed and two-handed interaction techniques (tap, double tap, long press, slide, pinch, spread); and evaluated its comfort, usability, and social acceptance across applications such as messaging, media control, healthcare, and gaming.
- Developed ***SoberRing***, a smart ring that passively and continuously monitors blood alcohol content (BAC) using PPG signals to detect alcohol-induced changes in arterial blood flow; designed a custom algorithm achieving 0.0055 g/dL (±0.0021) mean absolute error in a user study with 18 participants, demonstrating strong user adoption potential.
- Developed ***LLM4-IC8K***, a framework for automated PCB footprint geometry reasoning from IC mechanical drawings using large multimodal models (LMMs). Built an **8,608-sample multi-modal dataset** through a four-stage pipeline integrating datasheet–EDA collection, LLM-assisted diagram extraction, image–label alignment, and expert validation. Designed a **two-stage LMM training framework** that mimics human geometric reasoning for accurate IC footprint interpretation.
- The relevant papers are named ***OmniRing*** **(ACM/IEEE IoTDI, 2023)**, ***FuSenseRing*** **(ACM IMWUT, 2025)**, ***LLM4-IC8K*** **(under review)**, ***iRing*** **(under review)** and ***SoberRing*** **(under review)**.

Multi-Cameras Smart Glass for Sign Language Translation Nov. 2023 – Oct. 2025

- Initiated a research collaboration with Prof. Yincheng Jin at the **Binghamton University** to research sign language recognition via smart glasses platform.
- Designed and implemented ***SignGlass*** a multi-camera wearable prototype integrating three miniature RGB cameras (160° FOV) with Raspberry Pi Zero modules for real-time facial and hand motion capture. Developed the hardware architecture, wireless data transmission, and custom PLA housing, achieving a compact 40 g platform.
- The relevant published paper named ***SignGlass*** **(ACM UIST, 2025)**.

Flexible Display-Extended Smart Ring for Nano Visualization Sept. 2023 – Oct. 2025

- Initiated a research collaboration with the **VISUS Group** at the **University of Stuttgart**, Germany, to explore next-generation human-computer interaction wearables through a smart ring platform.
- Developed ***VisRing***, the first open-source smart ring featuring a bendable 160×32 4-bit grayscale OLED display with a system-on-chip architecture integrating IMU, PPG, temperature, Bluetooth, and microcontroller modules; enabled nano visualizations on a compact 6.6 g, low-cost ($35) platform; supported nano visualizations on a compact 6.6 g, low-cost ($35) platform; and evaluated its feasibilty across applications such as messaging, time display and health monitoring.
- The relevant published paper is named ***VisRing*** **(ACM UIST, 2025)**.

Intelligent Dampener for Sport Analytics Aug. 2022 – July 2024

- Designed ***SmartDampener***, a lightweight, practical and easy to use dampener platform that can be mounted on tennis racket as common-used dampener while being embedded with electronics and IMU sensor to classify player's stroke type and estimate other vital ball's characteristics via vibration sensed by the dampener and stream the data wirelessly for analytics.
- Designed a flexible printed circuit board (FPCB) using NRF52832-QFAA microcontroller, ICM20948 IMU, achieving low cost of $9.42, weight of 6.1 g and up to 5.8 hours of continuous data streaming.
- The relevant published paper is named ***SmartDampener*** **(ACM IMWUT, 2024)**.

Intelligent Earphone for Facial landmark Estimation Feb. 2022 – Oct. 2022

- Designed ***EARFace,*** an earable platform to track facial landmarks for 3D facial reconstruction using in-ear acoustic sensors embedded within smart earphone.
- Designed a sensor module using two-layer PCB via EAGLE embedded with OPA344 amplifier to amplify audio signal from the acoustic sensor and MEMS acoustic microphone (Sonion P11AC03) to gather acoustic sensor data. The PCB incorporated with Teensy Audio SGTL5000 to play ultrasonic speaker (Sonion EST65D801).
- Designed a two-processors data acquisition module using Teensy 4.0 to collect acoustic data, ESP32 as co-processor to transmit data via WIFI, achieving 12-bit resolution ADC at a sampling rate of 80 kHz.
- The relevant published paper is named ***EARFace*** **(ACM TIOT, 2023)**.

Smart Glove For Sign Language Recognition Nov. 2021 – May 2024

- Designed a wearable ring-shaped platform using a two-layer PCB via Altium to recognize American Sign Language (ASL) using ring-shaped sensing platform, embedded with multiple ICM20948 IMU sensors and NRF52832 MDBT42Q-512KV2 microcontroller, achieving power consumption of 32mA, sampling rate of 100 Hz, weight of 21.2g and up to 16 hours of continuously data streaming.
- The relevant published papers are named ***ASLRing*** **(ACM/IEEE IoTDI, 2024)** and ***SignQuery*** (**ACM MobiCom, 2023)**.

Industrial Experience

Microsoft Research Asia **Shanghai, China**

Research Intern; Mentor: Dr. Lili Qiu (ACM/IEEE/NAI Fellow, MSRA Assistant Managing Director) May. 2024 – Aug. 2024

- Developed a fully integrated multimodal earphone platform combining PPG, EEG, IMU, air, EDA/GSR, and pressure sensors for comprehensive environmental and physiological data acquisition supporting taste and activity analysis.
- The relevant paper is filed a patent named EARPHONE EXG SENSING.

Karpos Cultivation LLC **Irvine, CA**

Operation Lead; CEO: Frank Lee Oct. 2020 – Aug. 2023

- Served as an operation lead to manage a group of several teams including software team, hardware team, machine learning team and supply chain team to design, develop and manufacture a smart planting machine.
- Collaborated with hardware team to design and develop a smart indoor planting machine to plant mushroom, lettuce and herbs within a control loop system including sensing module like temperature sensor, humidity sensor and water sensor, controller module like light and pump and microcontroller module enabling WiFi communication.
- Collaborated with software team to design and develop a mobile APP to communicate and control smart planting machine to control lightness of light, temperature, and humidity inside the machine, developed a supply chain management website to manage flow of goods and planting machine.
- Led a team to manage supply chain in China to manufacture and exporting planting machine internationally.

Patents

- PLATFORM FOR FINGER MOTION ANALYTICS AND HEALTHCARE APPLICATIONS **(WO2024233526)**
- APPARATUS, PROCESS AND PLATFORM FOR ACTIVITY ANALYSIS **(63/688,633)**
- A DISPLAY-EXTENDED SMART RING **(63/880,639)**
- IN SITU BLOOD PRESSURE MONITORING ON A SMART RING WITH ROBUSTNESS TO AMBIENT CONDITIONS **(63/880,639)**
- EARPHONE EXG SENSING (Pending)

Honors

- HARRY G. MILLER Fellowship in Engineering **(May 2024)**
- Entrepreneurial Lead, NSF National I-Corps Program **(Oct. 2023)**
- Entrepreneurial Lead, NSF Regional I-Corps Program **(Mar. 2023)**
- 2020 Chancellor's Award for Excellence in Undergraduate Research (One student per school per year) **(2021)**
- UCI UROP Fellow **(2019-2021)**
- UCI SURP Fellow **(Summer 2020)**
- UCI Honorary SURP Fellowship **(Summer 2019)**

Invited Talk

- Tsinghua University (estimated Oct. 2025)
- Montana State University (Oct. 2025)
- Microsoft Research Asian, Shanghai (Sept. 2024)
- Shanghai Jiao Tong University (May 2024)
- Binghamton University (Dec. 2023)
- University of South Carolina (Nov. 2023)

Skills

Hardware: Keil MDK, nRFgo Studio, Arduino, Raspberry Pi, ESP32, RFID, Eagle, P Spice, OrCAD, SolidWorks, MATLAB, Altium, Autodesk EAGLE, NRF52832, Teensy 4.0, Teensy Audio, sensors (ECG, PPG, IMU, acoustic sensors, EDA/GSR and pressure sensor), actuator (vibrator and bone conduction speaker.)
Software: Microsoft Word, Excel, PowerPoint, Java, Python, C++, C, Swift, basic HTML, SQL, Firebase