Jiaqing (Allen) Liu

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Research Interests

Wearable & Ubiquitous Computing, Human-Computer Interaction

Education

University of Notre Dame   Notre Dame, IN
PhD in Computer Science & Engineering   *2025 – Present*
Advisor: Dr. Tingyu Cheng

University of Washington   Seattle, WA
MS in Electrical & Computer Engineering   *2023 – 2025*
Advisor: Dr. Shwetak Patel

Southwest Jiaotong University   Chengdu, China
BEng in Biomedical Engineering   *2019 – 2023*
Advisor: Dr. Weili Deng

Publications

[2] **ECG Necklace: Low-power Wireless Necklace for Continuous ECG Monitoring**
Qiuyue (Shirley) Xue, Eric Martin, Jiaqing Liu, Ruiqing Wang, Antonio Glenn, Richard Li, Vikram Iyer, and Shwetak Patel
Proceedings of the ACM CHI Conference on Human Factors in Computing Systems (CHI '25)

[1] **Recent Progress in Flexible Piezoelectric Devices toward Human-machine Interactions**
Jiaqing Liu, Guo Tian, Weiqing Yang, and Weili Deng
Soft Science, 2(4), 22. (2022)
🏅 Highlight Article

Research Experience

Ubiquitous Computing Lab, University of Washington   Apr. 2024 – Apr. 2025
Graduate Researcher   *Advisor: Dr. Shwetak Patel*

- Continuous Blood Pressure (BP) Monitoring via Smart Jewelry Network
- Developing a compact wearable photoplethysmogram (PPG) sensing network embedded in earrings and rings for passive, longitudinal BP monitoring using pulse transit time (PTT).
- Creating firmware to achieve precise wireless time synchronization across multiple Nordic nRF52 devices, achieving an accuracy within 20 μs.
- Designing algorithms to compute PTT from synchronized PPG data and model BP fluctuations.

- Low-power Wireless Necklace for Continuous ECG Monitoring
- Contributed to the development of a light-weight, low-power necklace for continuous ECG monitoring.
- Designed signal processing algorithms to filter motion artifacts, extract seismocardiography (SCG) and respiratory patterns from IMU signals, and compute key ECG intervals.
- Evaluated signal validity by calculating peak-SNR and timing errors against FDA-approved wearables.

Wearable Electronics Lab, SWJTU Sept. 2021 – June 2023
Research Assistant *Advisor: Dr. Weili Deng*

- PiezoTouch: Self-powered Tactile Sensing with Stretchable Piezo-ionic Hydrogels
- Developed a self-powered, flexible hydrogel sensor capable of generating 25.74 mV upon touch and stretching to 378% of its original length.
- Fabricated 15+ device groups and holistically analyzed their material, mechanical and electrical properties.
- Evaluated dynamic response and spatial localization during finger-press tests for potential wearable use.

- DiaperSense: Incontinence Detection with Paper-based Humidity Sensors
- Developed a smart diaper system with novel, sustainable paper-based humidity sensors, custom PCB, and ESP32 for wireless incontinence monitoring in Alzheimer's patients.
- Trained and compressed a neural network model, achieving 93.82% accuracy in detecting incontinence events.
- Designed an app to display real-time sensor data and notify caregivers, helping prevent skin issues for wearers.

- On-Skin Motion Sensing Interface using Soft Materials
- Designed wearable piezoelectric nanosensors for gait analysis and gesture recognition.
- Researched applications of flexible piezoelectric devices in physiological monitoring and interactive systems.

Engineering Projects

Sickle Cell Disease (SCD) Physician Chatbot (Sponsored by **Novo Nordisk**) June 2024
- Developed a mobile chatbot to provide ER physicians with quick access to SCD clinical treatment guidelines.
- Utilized GPT-3.5 Turbo API, LangChain, and AWS to build a fast, scalable model for medical data embedding and retrieval.
- Collaborated with physicians and Novo Nordisk teams to enhance chatbot accuracy and usability.

CheerUp: Emotion-driven Music Recommendation System for Mental Well-being Mar. 2024
- Designed a Raspberry Pi system with a camera to enhance users' mental well-being by capturing real-time facial expressions and automatically playing adaptive music.
- Deployed a pre-trained CNN with OpenCV for emotion recognition, optimized for embedded systems.

OxyBand: SpO_2 Monitoring Wristband Jan. 2021
- Developed a wearable PPG-based oximeter wristband using MSP430 and MAX30102 sensor for real-time SpO_2 monitoring, enabling hypoxemia detection and alerts.

Technical Skills

Languages: Python, C/C++, MATLAB, Java, SystemVerilog, LabVIEW

Software: Digital Signal Processing, Mobile Development, ROS, Linux, Machine Learning

Hardware/Prototyping: PCB Design, FPGA Design, SolidWorks, Soldering, Laser Cutting, 3D Printing, Flexible Electronic Materials and Devices (Design, Fabrication and Testing)

Embedded Systems: Arduino, Nordic nRF52, I2C, SPI, UART, BLE

Honors & Services

SWJTU K-12 Outreach Program, Volunteer 2021
SWJTU Academic Excellence Scholarship 2020, 2021