KAIYUAN HOU

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RESEARCH INTEREST

My research specializes in embedded AI and machine learning with a focus on healthcare applications. My work aims to create intelligent systems for home assistance and health monitoring, leveraging edge computing to bring real-time, privacy-preserving solutions to medical wearables and devices, aiming to alleviate human workload and improve quality of life. Currently, I am expanding my expertise into the realm of spatial computing. I am particularly interested in harnessing AR/XR technologies for visualizing and interacting with digital twins that encompass both visible and invisible elements.

EDUCATION

Columbia University   New York, NY, USA
Ph.D. Electrial Engineering **4.07/4.00**   **09/2021 - Present**
Research Advisor: Dr. Xiaofan (Fred) Jiang
Course: Computer Network, Cloud Computing, Big Data, Reinforcement Learning, Embedded AI, Blockchain, Database, Random Signals, Math in Deep Learning, Digital Signal Processing, Sparse Model, SaaS, Mobile Computing

University of Colorado Boulder   Boulder, CO, USA
B.S. Electrical Engineering **3.98/4.00**   **09/2017 - 05/2021**
Summa Cum Laude; Member of Tau Beta Pi; Dean's list from 2017 fall to 2021 fall; Merit Scholarship
Course: Computer Architecture, Control Theory, Microelectronics, Linear Systems, Embedded System, Algorithm, Data Structure, Complex Variables, Ordinary Differential Equations, Probability, Quantum Computing, Quantum Physics

RESEARCH EXPERIENCE

Intelligent and Connected Systems Lab, Columbia University   **09/2021 - Present**
Graduate Research Assistant

Continuous multi-person fever screening system: Developed a low-cost RGB-thermal camera system for continuous multi-person fever screening. Implemented real-time algorithms for tracking and reconstructing personalized 3D head model for each head detected. The system achieved a measurement error rate of within 0.4°F at 2 meters and 0.6°F at 3.5 meters without introducing bias on different skin colors. Deployed multiple systems at the entrance of clinics and medical center for more than two years. (IPSN 2022)

Modular sensing platform: Developed a plug-and-play platform based on Raspberry Pi, designed for no-code data acquisition, which enabling users to custom mix-and-match various sensors. Contributed to the system architecture design and conducted evaluations focusing on ease-of-use, flexibility, and scalability. (Mobisys 2022, IoTDI 2023)

AR assisted intelligent stethoscope platform: Developed an Augmented Reality (AR)-assisted intelligent stethoscope platform that guides user self-auscultate at home. Implemented an integrated system that leverages pose estimation, computer graphics, acoustic intelligence, human-computer interaction, and signal processing algorithms. Conducted comprehensive evaluations that demonstrate the effectiveness and accuracy of the AR guidance in the system. (Sensys 2022, IPSN 2023)

Airflow measurement with UAV: Worked on a low-cost drone system for 3D airflow mapping in indoor environments by leveraging the motor information. Engineered various flight control loops to explore the impact of different PID configurations on airflow estimation accuracy. (MobiCom 2023)

Dynamic Task Automation for Smart Homes: Worked on a smart home system that automates task execution without user programming. The system employs IoT sensors and actuators, which are assessed on power, accuracy, coverage and privacy. A proprietary algorithm generates dynamic execution pipelines based on user preferences and device spatial layout, all controlled by voice commands.

LASP, University of Colorado Boulder   **09/2020 - 05/2021**
Undergraduate Research Assistant

Medium Energy Electron Telescope in the Van Allen radiation belt: Designed a 1U CubeSat-compatible PCB from scratch for a ground detector simulator and implemented its FPGA logic and firmware using Verilog and C. Also contributed to the design of the charge-sensitive amplifier (CSA) for the detector.

PUBLICATIONS

S. Xia, M. Zhao, C. Adhivarahan, **K. Hou**, Y. Chen, J. Nie, E. Wu, K. Dantu, X. Jiang, (2023).**Anemoi: A Low-cost Sensorless Indoor Drone System for Automatic Mapping of 3D Airflow Fields**, *The 29th Annual International Conference On Mobile Computing And Networking (MobiCom) 2023* (to appear).

K. Hou, S. Xia, E. Bejerano, J. Wu & X. Jiang, (2023). **ARSteth: Enabling Home Self-Screening with AR-Assisted Intelligent Stethoscopes**, *The 22nd ACM/IEEE Conference on Information Processing in Sensor Networks (IPSN) 2023* pp. 205-218.

M. Zhao, S. Xia, J. Nie, **K. Hou**, A. Dhupar & X. Jiang, (2023). **LegoSENSE: An Open and Modular Sensing Platform for Rapidly-Deployable IoT Applications**, *8th ACM/IEEE Conference on Internet of Things Design and Implementation (IoTDI) 2023* pp. 367-380.

K. Hou, S. Xia, J. Wu, M. Zhao, E. Bejerano, X. Jiang, (2022). **AI Stethoscope for Home Self-Diagnosis with AR Guidance**, *The 20th ACM Conference on Embedded Networked Sensor Systems (Sensys) 2022*

K. Hou, S. Xia, & X. Jiang, (2022). **BuMA: Non-Intrusive Breathing Detection using Microphone Array**, *ACM International Workshop on Intelligent Acoustic Systems and Applications (IASA) 2022* pp. 1–6.

M. Zhao, Y. Liu, A. Dhupar, **K. Hou**, S. Xia, X. Jiang, (2022). **A modular and reconfigurable sensing and actuation platform for smarter environments and drones: demo abstract**, *20th Annual International Conference on Mobile Systems, Applications and Services (Mobisys) 2022*.

K. Hou, Y. Liu, P. Wei, C. Yang, H. Kang, S. Xia, T. Spada, A. Rundle, & X. Jiang, (2022).**A Low-Cost In- situ System for Continuous Multi-Person Fever Screening**, *Information Processing in Sensor Networks (IPSN) 2022* pp. 15-27.

WORK EXPERIENCE

Columbia University   **09/2021 - 05/2023**
Teaching Assistant
EECS E4764 Internet of Things - Intelligent and Connected Systems: Mentored students with hands-on projects on smart watch and various personal course projects, prepared lab section presentations, developed and graded the exam.
EECS E6892 Reinforcement Learning in Information Systems: Prepared homework starting code, helped students on course projects' proposal and implementations, graded homework and projects.
ELEN E6883 An Introduction to Blockchain Technology(two semesters): Help students on course projects on building personal smart contracts, graded homework and exam.

University of Colorado Boulder   **09/2019 - 05/2021**
Course Assistant
ECEN 2260 Circuits as Systems(two semesters): Prepared 2-hour long review sessions before every exam, gave lectures when instructor is not available, graded homework and exams.
ECEN/CSCI 4593 Computer Organization(two semesters): Helped students implement a 5-stage pipeline RISC-V processor and optimizations (bypassing and memory hierarchy). Graded homework and exams, answered students questions during class.

SKILLS

Programming	Python, C, C++, RISC-V, MATLAB, Verilog, Ruby, R, Spark
Software & Tools	Linux, EAGLE, 3D Printing, AIGC(Stable Diffusion), Git
Machine Learning	Scikit-learn, Deep learning(TensorFlow, PyTorch), NCNN framework, TVM
Certificate	Ham Radio License

PROFESSIONAL SERVICE

Volunteer, SIGCOMM 2023, New York, NY, USA

Proxy Presenter, ACM/IEEE IPSN 2023

Web Chair, ACM Mobisys 2022 Workshop IASA