# KAIYUAN HOU

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## RESEARCH INTEREST

My research lies at the intersection of Mobile Computing and Human-Computer Interaction, focusing on accessible health platforms and AR systems. Passionate about generative AI, I am working on enabling Large Language Models to better understand and interact with the physical world.

## EDUCATION

**Columbia University** — New York, NY, USA
Ph.D. Electrial Engineering **4.06/4.00** — **09/2021 - Expected 2027**
Research Advisor: Dr. Xiaofan (Fred) Jiang
*Course: Generative AI, RL, Deep Learning, Computer Network, Cloud Computing, Big Data, Embedded AI, Blockchain, Database, Random Signal Processing, DSP, 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 with Highest Honor;
*Course: Computer Architecture, Control Theory, Microelectronics, Linear Systems, Embedded System, Algorithm, Data Structure, Complex Variables, ODE, Probability, Quantum Computing, Quantum Physics*

## RESEARCH EXPERIENCE

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

**Smart Health**: (1)*Fever Screening System*: Developed a real-time fever detection system using RGB-thermal cameras, enabling high-accuracy mass screening at distances of up to 3.5 meters. Deployed continuously for over three years, it successfully screened over 40,000 individuals and identified more than 3,000 fever cases. (2) *Infant Breathing Detection*: Designed a non-intrusive breathing detection system using microphone arrays, leveraging both content-based and spatial filtering methods to achieve reliable monitoring.

**HCI&AR Systems**: (1)*AR-Assisted Auscultation*: Developed an AR-guided platform for non-expert users to conduct 4-point cardiac auscultation at home using digital stethoscopes, achieving significant improvements in accuracy for cardiac monitoring. (2)*Visualizing the Invisible*: Converted smart building sensor data into immersive 3D visualizations using AR and 3D Gaussian Splatting (3DGS), enabling users to better perceive and interact with their environment.

**GenAI in IoT**: *Automated Smart Home Assistant*: Developed an autonomous indoor drone for item localization, monitoring, and delivery, using an LLM agent for task comprehension and scene understanding. Designed a modular swapping mechanism to load or unload sensing and actuating modules based on task requirements.

**Smart Home**: (1)*Airflow measurement with UAV*: Developed a low-cost drone system for 3D airflow mapping in indoor environments based on the fact that motor controllers adaptively adjust their behavior to compensate for wind-induced turbulence. (2) *Modular sensing platform*: Developed a plug-and-play platform based on Raspberry Pi, designed for no-code data acquisition, enabling users to easily mix and match various sensors.

**AIoT Lab, The Chinese University of Hong Kong** — **01/2024 - 06/2024**
*Visiting Student & Research Assistant*

*Stable Sensor Representation*: Developed an embedding blending approach to improve sensor data visualization by mitigating biases where changes in sensor values were not accurately reflected, resulting in abrupt and inconsistent visualizations. This approach ensures continuous and smooth transitions, providing a more accurate reflection of sensor input changes.

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

*Medium Energy Electron Telescope (MEET)*: Developed an on-ground detector simulator circuit for a 1U CubeSat, including PCB design and charge-sensitive amplifier (CSA). Implemented simulator firmware using FPGA.

**Medtronic**                                                   **08/2020 - 06/2021**
*Project Leader*

*Intelligent Surgery Device*: Led a student research group to develop an ultrasonic dissector for minimally invasive surgery, enhancing connectivity and intelligence, in collaboration with Medtronic engineers and researchers.

## SKILLS

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|---|---|
| **Programming** | Python, RISC-V, MATLAB, SQL, Verilog, Ruby on Rails |
| **Tools & Framework** | PyTorch, LangChain, Android, EAGLE, Solidworks, ROS |

## AWARDS

· Third Place - ECE Capstone Project 2021, University of Colorado Boulder
· Tau Beta Pi Engineering Honor Society, 2019, University of Colorado Boulder
· J. Ranald Fox Memorial Scholarship, 2019, University of Colorado Boulder
· James H. Cole Scholarship, 2019, University of Colorado Boulder
· Dean's List (2017-2021), All Semesters at University of Colorado Boulder
· Best ECE Undergraduate Freshman Project 2017, University of Colorado Boulder

## NEWS AND MEDIA

EurekAlert! 2022 - [Cheaper, faster, safer way to screen temperatures](#)

## TEACHING AND OUTREACH

**Columbia University**                                             **09/2021 - 12/2023**
**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.

**Outreach and Other Activities**

· High School Science and Innovation Seminar, Alma Mater                             2024
Delivered a presentation on the background and applications of sensing technology in smart health, autonomous driving, and unmanned aerial vehicles (UAVs), as well as current research trends in these areas.

· Society of Women Engineers Workshop                                        2023
Assisted in hosting a workshop focused on teaching female high school students about sensor networks, encouraging their interest and participation in STEM fields.

· Mentors for Undergraduate Researches
*Columbia University Undergraduate Research Symposium*                             2023
- *Thilina Balasooriya* on studying the effect of skin color for temperature estimation with thermal cameras. *Summer Undergraduate Research Experience (SURE) Program*                   2022
- *Alfonso Rivas* on the development of a scalable, low-cost fever screening system.
- *Nia Cole* on creating a digital stethoscope for diagnoses with augmented reality (Best Presentation Award).

# PUBLICATIONS

Y Liu, M Zhao, **K Hou**, J Xia, C Carver, S Xia, X Zhou, X Jiang, (2024) **AIRA: A Low-cost IR-based Approach Towards Autonomous Precision Drone Landing and NLOS Indoor Navigation**, *arXiv preprint arXiv:2407.05619*

Y. Guo, **K. Hou**, Z.Yan, H. Chen, G. Xing, and X. Jiang, (2024). **Sensor2Scene: Foundation Model-driven Interactive Realities**, *International Workshop on Foundation Models for Cyber-Physical Systems & Internet of Things (FMSys) 2024* pp. 13-19

M. Zhao, J. Xia, **K. Hou**, Y. Liu, S. Xia, X. Jiang, (2024). **RASP: A Drone-based Reconfigurable Actuation and Sensing Platform Towards Ambient Intelligent Systems**, *arXiv preprint arXiv:2403.12853*

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* pp. 1-16.

**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.