Kailai Cui

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RESEARCH INTEREST

Mobile & Wearable Systems, **Foundation Models for Mobile Systems**

Currently, I investigate VLM frameworks for human memory augmentation, focusing on extracting structured context and persistent object states from daily interactions. I also design novel sensing systems for UWB localization and IoT security.

EDUCATION

University of Michigan **August 2023 – Present**
PhD Candidate, Computer Science and Engineering Ann Arbor, MI

- Advisors: Professor Kang G. Shin, Professor Ke Sun

College of William & Mary **August 2019 – May 2023**
Bachelor of Science, Computer Science; Bachelor of Science, Mathematics Williamsburg, VA

PUBLICATIONS

- **Kailai Cui**, Ke Sun, Kang G. Shin "UWB-based Localization of Smartphones Inside a Vehicle to Prevent Distracted Driving," ACM/IEEE International Conference on Embedded Artificial Intelligence and Sensing Systems (SenSys) 2026
- Woosub Jung, **Kailai Cui**, Kenneth Koltermann, Junjie Wang, Chunsheng Xin, Gang Zhou, "Light Auditor: Power Measurement can tell Private Data Leakage through IoT Covert Channels," ACM Conference on Embedded Networked Sensor Systems (SenSys) 2022

RESEARCH EXPERIENCE

Memory Augmentation with Smart Glasses **July 2025 – Present**
University of Michigan Advisors: Professor Kang G. Shin, Professor Ke Sun

- Developed a egocentric perception system that augments human memory by automatically tracking the semantic state evolution of household food.
- Addressed VLM context limits by introducing a "working memory" retrieval mechanism that grounds current queries to relevant past object states without re-processing the full history.
- Created the first Food State Benchmark on the egocentric video datasets, introducing a context-aware adaptive state taxonomy to evaluate memory consistency beyond traditional action-centric metrics.

UWB-based Phone Localization Inside Vehicles **August 2023 – July 2025**
University of Michigan Advisors: Professor Kang G. Shin, Professor Ke Sun

- Developed a system to prevent distracted driving by localizing smartphones inside the car and disabling usage on the driver's seat.
- Repurposed modern vehicles' UWB-based keyless entry systems to localize smartphones using a single UWB anchor leveraging UWB CIR information.
- Proposed two ways to resolved CIR ambiguity: (1) identifying optimized anchor placements at design-time and (2) designing a lightweight directional RF shield for retrofit scenarios.
- Proposed and evaluated a CIR processing pipeline and a seat-level classifier that is robust to vehicle motion, body occlusion, and different car interior layouts

Power Auditing IoT Devices **March 2021 – May 2023**
College of William and Mary Advisor: Professor Gang Zhou

- A novel covert channel attack leaks user's private data by transmitting them through smart bulb's infrared emission.
- Proposed to detect the attack by monitoring the power consumption pattern of the smart bulb.
- Designed, developed and evaluated a data processing pipeline and a CNN model that identifies the data leakage attack, showing robustness to unseen attack pattern.

RELEVANT COURSEWORKS

- Advanced Operating Systems, Real-Time Systems, Human-Computer Interaction, Interactive Systems, Machine Learning, Performance of Systems, Computer & Network Security, Mobile Application Security, Computer Networks

SKILLS

- **Languages & AI:** Python, C/C++, PyTorch, Hugging Face, OpenCV, NumPy, Pandas.
- **Systems & Tools:** Docker, Git, ROS 2, Android SDK, UWB (Ultra-wideband).