

Curriculum Vitae

Xue Sun

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🏛 Northwest University, Xi'an, Shaangxi, China



RESEARCH INTERESTS

My research interests are centered around Artificial Intelligence (AI), Wireless Communication/Sensing Systems, Bioelectronics, Wearable Sensor, Flexible Electronics.

I am interested in interdisciplinary innovation, by borrowing techniques from diverse areas, including deep learning, hardware design (RF circuits, antenna design), energy harvesting, signal processing, physics, materials science and chemistry, to explore and develop new wireless sensing applications, including wireless health sensing, E-skin and soft robots.

EDUCATION

Ph.D., Northwest University, Xi'an, China

2017 – 2023

Majoring in Software Engineering

Advisor: Xiaojiang Chen

Thesis title: *Research on Key Technologies of Low-cost Portable Wireless Sensing System.*

M.S., Yunnan University, Kunming, China

2014 – 2017

Majoring in System Analysis and Integration

Advisor: Wei Wang

RESEARCH EXPERIENCE

1) Principal Investigator

Advisor: Xiaojiang Chen, Jie Xiong (Associate Professor, University of Massachusetts Amherst)

Gas Sensing Paradigm using Graphene-based Tags: We innovative combine *material science* and *wireless sensing* to achieve a *battery-free, long distance, and fine-grained gas sensing* system using cheap RFID tags. By jointly optimizing gas-sensitive material and RFID antenna structure, we can accurately recognize multiple gases, e.g., CH_4 , CO_2 , and CO , which outperform diverse commodity gas sensors. In addition, our work can simultaneously support multi-point gas monitoring, whose working range is more than 8 m. **(To appear in Mobicom 2024, TOP-A conference in the computer network.)**

2) Principal Investigator

Advisor: Xiaojiang Chen, Jie Xiong (Associate Professor, University of Massachusetts Amherst)

In-ear Vital sign Sensing Using Commodity Earphones: We present a *low-cost heartbeat sensing* and *user identification* system based on cheap commercial earphones. By leveraging the fact that each person's ear canal varies in size and shape, we therefore can extract the unique features from the ear

canal-reflected signals to depict the personalized differences in ear canal geometry. The proposed system achieves *heartbeat sensing* even during *user movement (i.e., walking, running)*, marking the *first time* this has been achieved in wireless sensing. (**Published in Ubicomp 2023, TOP-A conference in the human-computer interaction.**)

3)Principal Investigator

Advisor: Xiaojiang Chen, Jie Xiong (Associate Professor, University of Massachusetts Amherst)

Silent Speech Recognition via Earphones: We present an earphone-based *silent speech recognition* system to enable interaction without a need for vocalization. The key insight is that when people are speaking, their ear canals exhibit unique deformation patterns and the corresponding deformation patterns are related to words/letters even without any vocalization. We jointly design a *AI neural network* and a *signal processing scheme* to achieve fine-grained letter/word recognition, i.e., 82% for *single alphabetic* letter recognition, and 93% for *word recognition*. (**Published in TMC 2024, TOP-A journal in the computer network.**)

4)Principal Investigator

Advisor: Xiaojiang Chen, Baochun Li (Professor, University of Toronto)

AI-enabled Liquid Identification Using Smartphones: We propose a contactless *liquid identification* system based on *commercial smartphone*. We observe that different liquids exhibit varying intrinsic impedance, resulting in distinct reflected acoustic signals. Then, we combine deep learning and signal features to distinguish different liquids, which can realize the functions that can only be achieved by *high-end instruments* such as mass spectrometers. Interestingly, our work also can identify *food additives* and measure *protein concentration* in the artificial urine with a 92.3% accuracy under 1 *mg/100 ml* as well. (**Published in TOSN 2023, TOP-B journal in the computer network.**)

PUBLICATIONS

- [1] **Xue Sun**, Jie Xiong, Chao Feng, Xiaohui Li, Jiayi Zhang, Binghao Li, Dingyi Fang, Xiaojiang Chen. Gastag: A Gas Sensing Paradigm using Graphene-based Tags[C]// Proceedings of the 30th Annual International Conference on Mobile Computing and Networking (**Mobicom'24, TOP-A international conference in the field of Computer Network**).
- [2] **Xue Sun**, Jie Xiong, Chao Feng, Wenwen Deng, Xudong Wei, Dingyi Fang, Xiaojiang Chen. Ear-monitor: In-ear Motion-resilient Acoustic Sensing Using Commodity Earphones[C]// Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (**Ubicomp'23, TOP-A international conference in the field of Computer Network**), 2023, 6(4): 1-22.
- [3] **Xue Sun**, Jie Xiong, Chao Feng, Haoyu Li, Yuli Wu, Dingyi Fang, Xiaojiang Chen. EarSSR: Silent Speech Recognition via Earphones[J]. IEEE Transactions on Mobile Computing (**TMC, TOP-A international journal in the field of Computer Network**, 2024,).
- [4] **Xue Sun**, Wenwen Deng, Xudong Wei, Dingyi Fang, Baochun Li, Xiaojiang Chen. Akte-liquid: Acoustic-based liquid identification with smartphones[J]. ACM Transactions on Sensor Networks (**TOSN, TOP-B international journal in the field of Computer Network**), 2023, 19(1): 1-24.

PATENTS

- [1] Xiaojiang Chen, **Xue Sun**, Xudong Wei, Wenwen Deng, Xiaohui Li, Anwen Wang, Dingyi Fang, Dan Xu. Neural network-based acoustic user recognition and heartbeat monitoring headset system and method (CN202211534010.4[P], China).
- [2] Dingyi Fang, Xin Meng, Meng Jin, **Xue Sun**, Dan Xu, Xiaojiang Chen, Feng Chen, Anwen Wang,

Wei Wang, Zhanrong Tang. A parallel decoding method and system of multi-label signals in backscatter protocol (CN201710962064.3[P], China).

- [3] Xiaojiang Chen, Zhuang Yin, Fang Liu, Dingyi Fang, Feng Chen, Baoying Liu, **Xue Sun**. A target imaging method and system based on RFID(CN201910469425.X[P], China).
- [4] Dan Xu, Wangqian Hu, Zhongyuan Ren, **Xue Sun**, Shaojie Chen, Wei Wang, Dingyi Fang, Xiaojiang Chen. A LoRa splicing communication method and system based on segmented neural network decoding (CN202110590420.X[P], China).
- [5] Dingyi Fang, Wenwen Deng, Xudong Wei, **Xue Sun**, Xiaojiang Chen, Pengfei Xu, Siying Niu. Liquid recognition system and method based on deep learning and sound signal (CN202111149838.3, China).
- [6] Baoying Liu, Haoyu Li, Miao Cui, **Xue Sun**, Dingyi Fang, Xiaojiang Chen. An ECG signal reconstruction method based on Bi-LSTM network (CN202211347908.0[P], China).

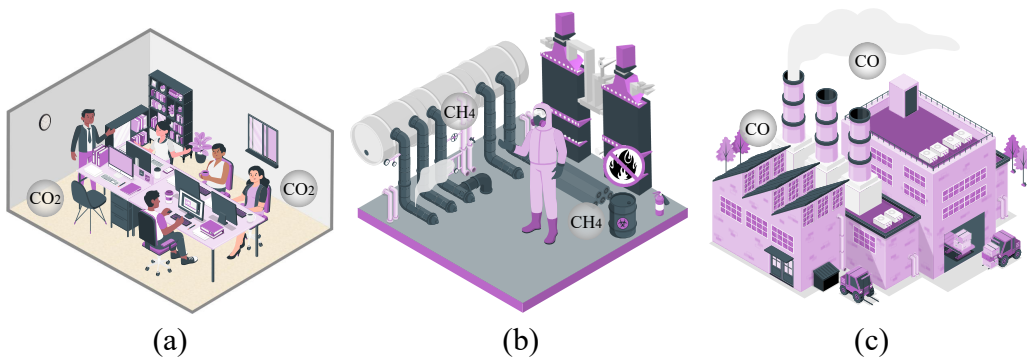
SKILLS

Languages	Strong reading, writing and speaking competencies for English.
Coding	HFSS; COMSOL; Java; C/C++; C#; Python; Matlab.
Domain knowledge	Signal Process; Wireless Networking; Antenna/Circuit Design; Machine/Deep Learning; Material Design; 3D/4D Manufacture; Mechanical Design Manufacturing.

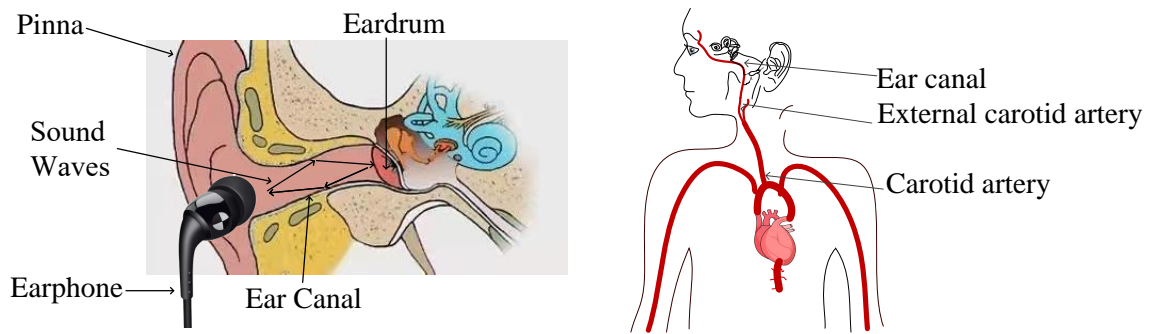
PRESENTATION

Invited Talks: Network Committee of China Computer Federation (CCF), global live broadcast, 04/2024

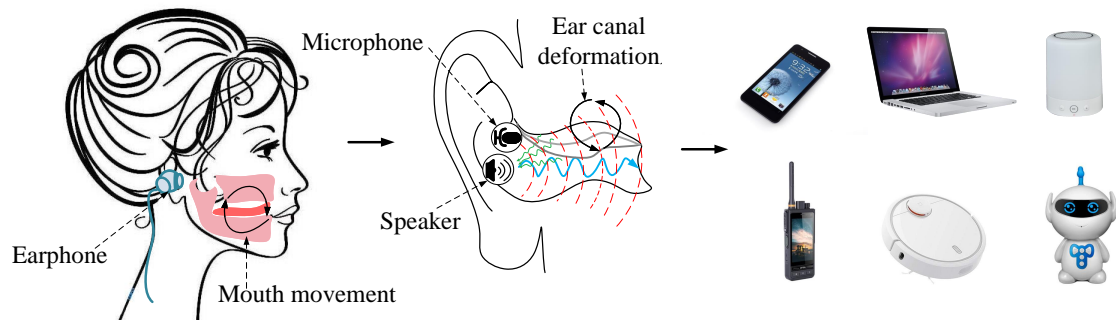
PROJECT SUMMARY



Publication 1: Gastag: A Gas Sensing Paradigm using Graphene-based Tags



Publication 2: Earmonitor: In-ear Motion-resilient Acoustic Sensing Using Commodity Earphones



Publication 3: EarSSR: Silent Speech Recognition via Earphones



Publication 4: Akte-liquid: Acoustic-based liquid identification with smartphones