

Renjie Zhao | Curriculum Vitae

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RESEARCH INTEREST

- **Wireless Systems and Networking:** Designing and implementing next-generation wireless network architectures (based on millimeter-wave, 5G NR, vehicle networks, 6 GHz wide band); hardware and software design (SDR, ultra wide band and ultra low power communication system)
- **Mobile and Ubiquitous Computing:** Designing and implementing ubiquitous sensing systems for Internet-of-Things applications (virtual/augmented reality, smart homes/buildings, localization, smart supply chain and 3D human-mobile interaction)

EDUCATION

University of California San Diego (UCSD)

Ph.D. Student, Electrical and Computer Engineering
Advisor: Professor Xinyu Zhang

San Diego, CA, US

Sept. 2018 - now

Shanghai Jiao Tong University (SJTU)

B.E. in Electric Power Engineering and Automation

Shanghai, China

Sept. 2014 - June 2018

EMPLOYMENT

Microsoft Research

Research Intern. Host: Krishna Chintalapudi

Research and develop wireless communication protocol for Xbox.

Remote, US

June 2021 - Dec. 2021

Alibaba Group

Research Intern. Host: Pengyu Zhang, Yunfei Ma

Research and develop accurate and reliable RFID based localization and sensing system.

Remote, US

June 2020 - Sept. 2020

Alibaba Group

Research Intern. Host: Pengyu Zhang, Yunfei Ma

Research and build long range, high accuracy object identification system based on NFC.

Bellevue, WA, US

Sept. 2019 - Jan. 2020

PUBLICATIONS

Note: '*' marks co-primary authors.

Conference Papers:

[C4] "RF-Chord: Towards Deployable RFID Localization System for Logistic Networks"

Bo Liang, Purui Wang, **Renjie Zhao**, Pengyu Zhang, Xinyu Zhang, Hongqiang Harry Liu and Chenren Xu

20th USENIX Symposium on Networked Systems Design and Implementation (NSDI), 2023

(50 out of 272 submissions, acceptance ratio: 18.4%)

[C3] "NFC+: Breaking NFC Networking Limits through Resonance Engineering"

Renjie Zhao*, Purui Wang*, Yunfei Ma, Pengyu Zhang, Hongqiang Harry Liu, Xianshang Lin, Xinyu Zhang, Chenren Xu and Ming Zhang

Annual conference of the ACM Special Interest Group on Data Communication on the applications, technologies, architectures, and protocols for computer communication (SIGCOMM), 2020
(54 out of 250 submissions, acceptance ratio: 22%)

[C2] “M-Cube: A Millimeter-Wave Massive MIMO Software Radio” (Best Paper Award, Highlighted by GetMobile)

Renjie Zhao, Timothy Woodford, Teng Wei, Kun Qian and Xinyu Zhang
ACM International Conference on Mobile Computing and Networking (MobiCom), 2020
(62 out of 384 submissions, acceptance ratio: 16%)

[C1] “OFDMA-Enabled Wi-Fi Backscatter”

Renjie Zhao, Fengyuan Zhu, Siyuan Peng, Yuda Feng, Xiaohua Tian, Hui Yu and Xinbing Wang
ACM International Conference on Mobile Computing and Networking (MobiCom), 2019
(55 out of 290 submissions, acceptance ratio: 19%)

Journal:

[J1] “M-CUBE: A Millimeter-Wave Massive MIMO Software Radio” (invited)

Renjie Zhao, Timothy Woodford, Teng Wei, Kun Qian and Xinyu Zhang
GetMobile: Mobile Computing and Communications, Volume 25, Issue 1, March 2021, pp 30–33

Notes: Photoelectric related works hided, please refer to *google profile*

Demo:

[D2] “Demo: M-Cube: An Open-Source Millimeter-Wave MIMO Software Radio for Wireless Communication and Sensing”

Renjie Zhao, Timothy Woodford, Teng Wei, Kun Qian and Xinyu Zhang
The 20th ACM International Conference on Mobile Systems, Applications, and Services (Mobisys), 2022

[D1] “Demo: M-Cube: An Open-Source Millimeter-Wave MIMO Software Radio for Wireless Communication and Sensing Applications”

Renjie Zhao, Timothy Woodford, Teng Wei, Kun Qian and Xinyu Zhang
ACM International Conference on Mobile Computing and Networking (MobiCom), 2020

Poster:

[P1] “Poster Abstract: Ultra-Wideband Backscatter Towards General Passive IoT Localization”

Renjie Zhao, Penyu Zhang, Yunfei Ma and Xinyu Zhang
The 20th ACM Conference on Embedded Networked Sensor Systems (SenSys), 2022

RESEARCH EXPERIENCE

“Slim” radio design for passive wearables

UCSD

Supervised by Prof. Xinyu Zhang

Jan. 2020 - now

- Design simplified active radio architecture which consumes μW power
- Design asymmetric modulation scheme which enables commercial Wi-Fi devices to decode the waveform from “Slim” radio
- Working on Wi-Fi device firmware and driver to implement with commercial Wi-Fi device

RF-Chord: multi-tone high reliability, high throughput, long range RFID localization (NSDI '23)

Alibaba Group

Supervised by Pengyu Zhang, Yunfei Ma and Prof. Xinyu Zhang

Dec. 2019 - May 2022

- Design multi-tone sniffer hardware
- Design localization algorithm based on the information collected by multi-tone signal

- Working on Wi-Fi device firmware and driver to implement CTC with commercial Wi-Fi device

Ultra-Wideband Backscatter for Passive IoT Localization

Alibaba Group

Supervised by Pengyu Zhang, Yunfei Ma and Prof. Xinyu Zhang

June 2020 - Apr. 2021

- Address passive IoT localization challenges on: tail error, one-shot localization, tag cost, etc.
- Design FMCW radar working in 6 GHz band with 1.2 GHz bandwidth
- Design localization algorithm based on the dual band ultra-wideband signal

NFC+: long range high accuracy magnetic RFID (SIGCOMM '20)

Alibaba Group

Supervised by Pengyu Zhang, Yunfei Ma and Prof. Xinyu Zhang

Sept. 2019 - Jan. 2020

- Solve RFID object identification accuracy issue with magnetic wave
- Utilize resonance engineering for range boosting
- Design beamforming algorithm for arbitrary orientation coverage

Millimeter wave (mmWave) on V2X

UCSD

Supervised by Prof. Xinyu Zhang

Sept. 2018 - Sept. 2019

- Reality check for 5G Millimeter Wave V2X (outdoor experiment with 802.11ad platform)
- Hack firmware and revise controller for wireless card and phased array antenna
- Design and validate beam tracking and switching algorithm
- Implementing open source cellular network system (OAI)

Low cost mmWave massive MIMO (M-Cube) SDR (MobiCom '20)

UCSD

Supervised by Prof. Xinyu Zhang

Sept. 2018 - now

- Bridging commercialized phased array antenna and network card with SDR design
- Design cooperation mechanism between antenna control and data processing
- Design and validate bridging circuit

OFDMA enabled backscatter system (MobiCom '19)

IIoT, SJTU

Supervised by Prof. Xinbing Wang and Prof. Xiaohua Tian

Dec. 2016 - Mar. 2018

- Demonstrated for the first time how to enable OFDMA in the backscatter system
- Implemented the non-real time and real time system design with WARP
- Implemented transmission line on PCB to achieve RF phase delay
- Designed analog OFDM tag for OFDM implementation
- Solved asynchronization problem and phase offset problems of the system

HONORS AND AWARDS

- ACM MobiCom Best Paper Award (2 out of 384 submission) 2020
- Academic Records Scholarship (first-class) (**Top 1 out of 158**), SJTU 2016 - 2017
- National Scholarship (**Top 3 out of 158**), SJTU 2016 - 2017
- Academic Records Scholarship (second-class), SJTU 2015 - 2016
- UHV Scholarship (**Top 5 out of 160**), UHV Scholarship Fund 2015 - 2016
- Academic Records Scholarship (third class), SJTU 2014 - 2015

TECHNICAL SKILLS

Programming Languages:

- C/C++, Python, MATLAB, LabVIEW, Assembly, Verilog, \LaTeX

Platforms (Development Environment):

- Software-Defined Radio: WARP (MATLAB, Python, ISE), USRP (UHD-based, GNURadio);
- Wi-Fi driver and firmware (nexmon toolsets, wil6210 for 802.11ad, Atheros HAL);

- Cellular network system (OAI, srsLTE);
- Embedded system development ARM Cortex-M3 (Keil);
- FPGA Nexys3, Basys2, Cmod A7, ZYNQ (ISE, Vivado, petalinux);

SERVICE

- SenSys 2022 Shadow PC;
- External reviewer of MobiCom 2019-2022;
- Reviewer of IEEE Transactions on Networking;
- Reviewer of IEEE Transactions on Wireless Communications
- Reviewer of IEEE Transactions on Sensor Networks