

TENG WEI

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1415 Engineering Dr. EH3556 ◊ Madison, WI 53706

EDUCATION

University of Wisconsin – Madison

Sep. 2013 – Apr. 2018 (EXPECTED)

PhD. Dissertator, Electrical and Computer Engineering

Research Area: Wireless Networking, Millimeter-wave Networks, Wireless Sensing/Tracking and Human-mobile Interaction.

Advisor: Professor Xinyu Zhang

Graduate Courses: Real-time Computing System, Machine Learning, Mobile and Wireless Networking, Wireless Communications, Probability Theory and Stochastic Processes, etc.

Shanghai Jiao Tong University, China

Sep. 2009 – Jun. 2013

B.S., Electrical Engineering

Overall GPA: 90.40/100, Ranking: 4/230

Undergraduate Courses: Communication Principles, Signals and Systems, Data Structure, EM Fields and Waves, Digital Signal Processing, Computer Network, etc.

EMPLOYMENT

Google

Seattle, WA, USA

Software Engineering Intern. Host: David Chu, Zengbin Zhang

May 2017 – Aug. 2017

Develop toolsets and conduct in-field experiments to evaluate, understand, and diagnose the performance of VR streaming over the wireless network.

Microsoft Research

Redmond, WA, USA

Research Intern. Host: Krishna Chintalapudi, Yongguang Zhang

May 2016 – Aug. 2016

Researched and built prototypes for 60 GHz wireless communication application.

PUBLICATIONS

Conference Papers:

- [C10] **Teng Wei** and Xinyu Zhang, “*Pose Information Assisted 60 GHz Networks: Towards Seamless Coverage and Mobility Support*,” To appear in ACM International Conference on Mobile Computing and Networking (**MobiCom**), Snowbird, Utah, USA, Oct. 2017
(35 out of 186 submissions, acceptance ratio: 19%)
- [C9] **Teng Wei** and Xinyu Zhang, “*Facilitating Robust 60 GHz Network Deployment By Sensing Ambient Reflectors*,” USENIX Symposium on Networked Systems Design and Implementation (**NSDI**), Boston, MA, USA, Mar. 2017
(46 out of 253 submissions, acceptance ratio: 18%)
- [C8] **Teng Wei** and Xinyu Zhang, “*Gyro in the Air: Tracking 3D Orientation of Batteryless Internet-of-Things*,” ACM International Conference on Mobile Computing and Networking (**MobiCom**), New York, NY, USA, Oct. 2016
(32 out of 226 submissions, acceptance ratio: 14%)

- [C7] **Teng Wei** and Xinyu Zhang, “*Random Access Signaling for Network MIMO Uplink*,” IEEE Conference on Computer Communications (**INFOCOM**), San Francisco, CA, USA, Apr. 2016 (300 out of 1644 submissions, acceptance ratio: 18%)
- [C6] **Teng Wei**, Shu Wang, Anfu Zhou and Xinyu Zhang, “*Acoustic Eavesdropping through Wireless Vibrometry*,” ACM International Conference on Mobile Computing and Networking (**MobiCom**), Paris, France, Sep. 2015 (38 out of 207 submissions, acceptance ratio: 18%)
- [C5] **Teng Wei**, and Xinyu Zhang, “*mTrack: High-Precision Passive Tracking Using Millimeter Wave Radios*,” ACM International Conference on Mobile Computing and Networking (**MobiCom**), Paris, France, Sep. 2015 (38 out of 207 submissions, acceptance ratio: 18%)
- [C4] Anfu Zhou, **Teng Wei**, Xinyu Zhang, Min Liu and Zhongcheng Li, “*Signpost: Scalable MU-MIMO Signaling with Zero CSI Feedback*,” ACM International Symposium on Mobile Ad Hoc Networking and Computing (**MobiHoc**), Hangzhou, China, Jun. 2015 (37 out of 250 submissions, acceptance ratio: 14.8%)
- [C3] **Teng Wei**, Sanjib Sur, and Xinyu Zhang, “*Bringing Multi-Antenna Gain to Energy-Constrained Wireless Devices*,” ACM/IEEE Conference on Information Processing in Sensor Networks (**IPSN**), Seattle, WA, USA, Apr. 2015 (316 out of 1640 submissions, acceptance ratio: 19.2%)
- [C2] **Teng Wei**, Sanjib Sur, and Xinyu Zhang, “*Autodirective Audio Capturing Through a Synchronized Smartphone Array*,” ACM International Conference on Mobile Systems, Applications, and Services (**MobiSys**), Bretton Woods, NH, USA, Jun. 2014 (25 out of 185 submissions, acceptance ratio: 13.5%)
- [C1] **Teng Wei**, Gaofei Sun, Xinbing Wang and Mohsen Guizani, “*Opportunistic Access for Cooperative Cognitive Radio Networks with Requirement Constraint*,” IEEE International Conference on Communications (**ICC**), Budapest, Hungary, Jun. 2013 (948 out of 2422 submissions, acceptance rate 39.1%)

Invited Paper:

- [I1] **Teng Wei**, and Xinyu Zhang, “*Gyro in the Air: Tracking 3D Orientation of Batteryless Internet of Things*,” GetMobile: Mobile Comp. and Comm., May 2017

Demo:

- [D1] **Teng Wei**, and Xinyu Zhang, “*Tracking Orientation of Batteryless Internet-of-Things Using RFID Tags: Demo*,” ACM International Conference on Mobile Computing and Networking (**MobiCom**), New York, NY, USA, Oct. 2016

Poster:

- [R3] **Teng Wei**, and Xinyu Zhang, “*Enabling Seamless Coverage and Mobility Support for 60 GHz Networks*,” Western Electrical and Computer Engineering Department Heads Association, San Diego, CA, USA, Nov. 2017
- [R2] **Teng Wei**, and Xinyu Zhang, “*Pose Information Assisted 60 GHz Networks: Towards Seamless Coverage and Mobility Support*,” CWC Research Review and Planning Meeting, San Diego, CA, USA, Nov. 2017
- [R1] **Teng Wei**, and Sanjib Sur, “*Dia: AutoDirective Audio Capturing Through a Synchronized Smartphone Array*,” Qualcomm Innovation Competition, Madison, WI, USA, Apr. 2014

Patents:

- **[P3]** Xinyu Zhang, Sanjib Sur, and **Teng Wei**, “*Radio Frequency Communication with Antenna Index Coding*,” U.S. Utility Patent No. 14/921346, filed on Oct. 2015
- **[P2]** Xinping Guan, Yanxi Wang, Cailian Chen, **Teng Wei**, and Suyan Wang, “*Three Dimensional Localization and Remote Query System Based on Wireless Sensor Networks*,” China Patent No. 201210054563.X, filed on 2011
- **[P1]** Gaofei Sun, **Teng Wei** and XinXin Feng, “*Global Sensing Information Aided Opportunistic Spectrum Access in Cognitive Radio Networks*,” China Patent No. 201210166476.3, filed on 2012

RESEARCH PROJECTS AND EXPERIENCE

Research Assistant

2013 – PRESENT

WixNet Group, University of Wisconsin - Madison

- **2017, Pose Information Assisted Robust 60 GHz Networks:** The directional transmission of phased arrays makes the 60 GHz networks sensitive to the user mobility. In this work, we find the pose information from portable devices can significantly facilitate many 60 GHz network operations (AP switching, beam selection, and interference avoidance). It improves the network robustness and will accommodate many emerging mobile applications (*e.g.*, wireless VR). We evaluate the system design using COTS 60 GHz radios (Qualcomm Wil6210) with many-antenna phased arrays and tap into the Linux driver to distill useful information such as active beam index, MCS, and signal quality.
- **2016, Environment Sensing Using the 60 GHz Radio [C9]:** We leverage the highly directional and steerable phased array 60 GHz radio to resolve the angle/length of major multipaths. The estimated spatial channel profile enables us to reconstruct a coarse structure of the environment and thus facilitate network deployment and protocol optimization. We develop a prototype using the custom 60 GHz front-end and programmable software-defined baseband radios. We also implement a software-based AGC in C# and other processing algorithms in MATLAB.
- **2016, Tracking Orientation of RFID Tags [C8]:** Passive orientation sensing can enable a new variety of Internet-of-things applications (*e.g.*, detecting a cargo’s orientation during transportation). We approach this goal by forming an array using multiple passive RFID tags and designing algorithms that can learn its geometry and track the orientation. We first build a validating prototype using the USRP and then a complete running system using the commercial RFID tags/antennas/reader (Impinj R420). A real-time orientation display and a user-control interface are implemented using C and C#.
- **2015, Fast Neighbor Discovery for 60 GHz Networks:** 60 GHz link discovery and quality are substantially affected by the environmental characteristics and client mobility. We leverage the sparsity of 60 GHz spatial channel profile and apply the compressive sensing technique to accelerate the neighbor discovery procedure. We collect spatial channel profiles using our custom 60 GHz testbed and perform trace-driven emulation to evaluate the design.
- **2015, Audio Capturing Using WiFi Signals [C6]:** Playing loudspeakers/smartphones will cause vibration on their surfaces. Though the vibration is invisible by human eyes, it can be sensed and captured by the sensitive wireless signal. We demonstrate the original sound wave can be recovered from the reflected signal by applying novel processing algorithms. We implement a system prototype using the WARP software-defined radio at 2.4 GHz with 8 MIMO antennas and an 802.11g-compliant library for packet decoding. We also modify the FPGA image and WARPLab to extend the sampling duration and fasten packet collection speed.
- **2015, Fine-grained Passive Tracking Using mmWave Radios [C5]:** This system tracks a passive object, *e.g.*, pen, at millimeter-level accuracy. We approach this goal by leveraging the highly

directional/steerable 60 GHz radio and designing novel processing algorithms to deal with background reflections that will disturb the passive tracking. A prototype is developed using the custom 60 GHz testbed with mechanical-steerable directional antennas. Major processing algorithms are implemented in MATLAB and then exported to C language for acceleration.

- **2014, Random Access Signaling for Uplink MU-MIMO Network [C7]:** WiFi uplink traffics are randomly initiated by clients. The overhead of a centralized client selection mechanism will hurt the efficiency of media access for the MU-MIMO network. To this end, we propose a light-weight signaling protocol enabling random channel access using a request-permit based scheme. We construct a large-scale netMIMO network using two carrier-synchronized WARP boards with 8 extended distributive antennas and evaluate the performance by measuring the trace data over 50 user spots.
- **2014, Scalable MU-MIMO Signaling for Concurrent Uplink Contention [C4]:** User selection mechanism increases capacity for the MU-MIMO network, but the CSI-feedback overhead may neutralize such benefit. We propose a zero CSI-feedback overhead protocol that enables each user to speculate its channel to others and prioritize their contentions for media access. We implement the software protocol and perform trace-driven emulation using the wireless channel measured from the WARP SDR platform.
- **2014, Antenna Hopping to Improve WiFi/Zigbee Energy Efficiency [C3]:** We propose an antenna hopping technique to improve the bitrate of single RF-chain/multi-antenna radios. It modulates additional bits by alternating the active antenna index during transmission. An adaptive algorithm is designed to adapt the antenna-switching frequency according to the channel state. We implement the antenna hopping encoding/decoding schemes in MATLAB and evaluate the performance in a real field study using two WARP boards with up to eight antennas.
- **2013, Audio-recording Beamforming of Smartphones [C2]:** The project aims to cooperate multiple spatially distributed smartphones so that their microphones can function coherently and boost the audio recording quality. It leverages the ubiquitous WiFi beacon signals to synchronize smartphones at ms-level. The tight synchronization allows us to apply the state-of-the-art audio beamforming algorithms. We build a system prototype using 8 Samsung Galaxy V smartphones (tapping into the android kernel to extract the beacon timestamp) and implement the beamforming algorithms in Java.

Member, External Reviewer

2011 – 2013

Institute of Wireless Communication and Technology, Shanghai Jiao Tong University

- **2013, Session Initiation Protocol (SIP) over Internet Protocol v6 (IPv6) (Foxconn funded project):** Investigate the specifications of SIP protocol and its existing architecture over the IPv4 networks. Extend and implement a SIP module that can work over both the IPv4 and IPv6 networks.
- **2012, Resource Allocation in the Cognitive Radio Networks [C1]:** We propose a resource allocation model for the cooperative cognitive radio networks, which takes the resource requirement of secondary users into account. The model is solved by applying the backward induction analysis.

TEACHING EXPERIENCE

Fall 2016	Title: Tracking 3D Orientation of Batteryless Internet-of-Things Guest Lecturer, Mobile and Wireless Networking, CS/ECE 707
Fall 2015	Title: High-Precision Passive Tracking Using Millimeter Wave Radios Guest Lecturer, Mobile Computing Laboratory, ECE 454
2010–2012	Study Representative of Administrative Class Electrical Engineering, Shanghai Jiao Tong University

HONORS AND AWARDS

2017	Student Travel Grant Award – NSDI 2017
2016	Student Travel Grant Award – INFOCOM 2016
2015	Student Travel Grant Award – MobiCom 2015
2014	Finalist in Qualcomm Innovation Competition
2013–2014	Chancellor’s Opportunity Fellowship, University of Wisconsin - Madison
2010–2012	Model Student of Academic Records Scholarship in SJTU, Level B (Top 5%)
2010–2011	Toshiba Scholarship (Top 2%)
2010–2011	Contemporary Undergraduate Mathematical Contest in Modeling (3rd Place)
2009–2010	National Scholarship (Top 1%)
2009–2010	Model Student of Academic Records Scholarship in SJTU, Level A (Top 1%)
2009–2010	27th National Undergraduate Physics Competition (2nd Place)

ADVISING & MENTORING

Fall 2017	Sungen Chiu Sequential Search for mmWave Initial Access with Single RF-chain and 1-bit ADC
Fall 2017	Arunkumar Ravichandran Scalable Millimeter Wave Communication
Fall 2017	Chuhan Gao Multipath Content Delivery Framework for Legacy WiFi and WiGig Networks
Fall 2016	Jialiang Zhang 60 GHz Software Radio Platform With a Reconfigurable Phased-Array Antenna
Fall 2016	Burak Varici Tracking 3D Orientation of Batteryless Internet-of-Things [C8]
Fall 2015	Shu Wang Autodirective Audio Capturing Through a Synchronized Smartphone Array [C6]

PROFESSIONAL SERVICE

2017	ACM S3 Workshop Chair
2017	MobiSys PhD Forum TPC member
2014–2017	External Reviewer of conferences and journals IEEE SECON 2014-2016 ACM CHI 2017 ACM CoNext 2015 and 2017 ACM HotWireless 2014-2016 IEEE ICNP 2015-2017 IEEE INFOCOM 2016-2018 ACM MobiCom 2015-2017 ACM SIGCOMM 2017 IEEE Transactions on Networking IEEE Transactions on Wireless Communications
2016–2017	Reviewer of IEEE Sensors 2017 and IEEE Transactions of Signal Processing 2016

INVITED TALKS

- Oct. 2017** Title: Towards Seamless Coverage and Mobility Support for 60 GHz Millimeter-wave Networks
1st ACM Workshop on Millimeter-Wave Networks and Sensing Systems, Snowbird
- Sep. 2017** Title: Towards Untethered VR Streaming
Google, Seattle
- Sep. 2016** Title: Tracking 3D Orientation of Batteryless Internet-of-Things
Computer Engineering Seminar, ECE Department, Madison
- Oct. 2015** Title: Acoustic Eavesdropping through Wireless Vibrometry
Computer Engineering Seminar, ECE Department, Madison
- Apr. 2014** Title: Autodirective Audio Capturing Through a Synchronized Smartphone Array
Computer Engineering Seminar, ECE Department, Madison

TECHNICAL STRENGTHS

Computer Languages	C/C++, Python, C#, Matlab, Shell, Java, Latex, HTML, PHP
Software Skills and Platforms	WARPLab software-defined radio, USRP and GNUradio Linux wireless driver and networking stacks Impinj RFID system Socket networking programming in Linux Embedded system development on ARM platform NS-3 network simulation

REFEREES

Xinyu Zhang <i>Associate Professor</i>	Email: xyzhang@eng.ucsd.edu <i>University of California San Diego</i>
Parameswaran Ramanathan <i>Professor, Vice Chair of Infrastructure</i>	Email: parmesh.ramanathan@wisc.edu <i>University of Wisconsin - Madison</i>
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Krishna Chintalapudi <i>Researcher</i>	Email: krchinta@microsoft.com <i>Microsoft Research</i>
David Chu <i>Manager, Software Engineer</i>	Email: chudavid@google.com <i>Google</i>
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