
RESEARCH INTERESTS

- **Security and Privacy in IoT:** Fingerprinting and human biometric privacy with a special focus on embedded sensors in the IoT devices.
- **Mobile Computing/Sensing Systems:** sensing with ubiquitous modalities, such as WiFi, camera, IMU, and sound in smart transportation and smart homes.
- **Human Computer Interaction:** Context-aware IoT systems relating to bridging Cyber-Physical Systems and ML.

EDUCATION

- North Carolina State University (NCSU)**, Raleigh, NC 7/2023
- Ph.D. Computer Science
 - Dissertation: *Enhancing the Security and Privacy of Voice Assistants*.
 - Adviser: Dr. Anupam Das
- South Dakota State University (SDSU)**, Brookings, SD 2017
- MS. Computer Science (non-degree)
 - MS. Civil Engineering
 - Thesis: *Identification, Calculation, and Warning of Horizontal Curves for Low-volume Two-lane Roadways Using Smartphone Sensors*.
 - Advisor: Dr. Jonathan Wood
- Shanghai Maritime University (SMU)**, Shanghai, China 2012
- M.S. Supply Chain Management
- Zhejiang Ocean University (ZJOU)**, Zhoushan, China 2010
- B.A. Marine Fishery

UNDER SUBMISSION

1. VoicePM: A Robust Privacy Measurement on Voice Anonymity. **PopETs'23** (Under Review).
2. IPPV: Instance-level Privacy-Preserving Video Transformation for Vehicular Camera Videos. **PerCom'23** (Under Review)
3. Speaker Orientation-Aware Security and Privacy Control for Voice Assistants. **DSN'23** (Under Review).

PEER-REVIEWED CONFERENCE PUBLICATIONS

1. **Shaohu Zhang**, Anupam Das. Enabling 2-FA for Smart Home Voice Assistants using Inaudible Acoustic Signal, *In 24th International Symposium on Research in Attacks, Intrusions and Defenses*, pp. 251-265. 2021. **(RAID'21)**, acceptance rate: 33/138=23.9% .
2. **Shaohu Zhang**, Raghav Venkatnarayan, Muhammad Shahzad. A WiFi-based Home Security System. *In 2020 IEEE 17th International Conference on Mobile Ad Hoc and Sensor Systems (MASS)*, pp. 129-137. **IEEE MASS'20**, acceptance rate:28%.
3. Muhammad Shahzad, **Shaohu Zhang**. Augmenting User Identification with WiFi Based Gesture Recognition. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, 2(3), pp.1-27, 2018. **IMWUT/Ubi-comp'18**, acceptance rate:18%
4. **Shaohu Zhang**, Myounggyu Won, Sang H. Son. Low-cost and Non-intrusive Traffic Monitoring System Using WiFi. *In 2017 26th International Conference on Computer Communication and Networks (ICCCN)*, pp. 1-9. **IEEE, 2017. ICCCN'17**, acceptance rate:28.6%.

5. Myounggyu Won, **Shaohu Zhang**, Appala Chekuri, Sang H. Son. Enabling Energy-Efficient Driving Route Detection Using a Built-in Smartphone Barometer Sensor, *In 2016 IEEE 19th International Conference on Intelligent Transportation Systems (ITSC)*, pp. 2378-2385. IEEE, 2016.
6. **Shaohu Zhang**, Myounggyu Won, Sang H. Son. Low-cost Realtime Horizontal Curve Detection Using Inertial Sensors of a Smartphone. *In 2016 IEEE 84th Vehicular Technology Conference (VTC-Fall)*, pp. 1-5. IEEE, 2016.
7. Xiao Qin, **Shaohu Zhang**, Wei Wang. Advanced Curve-speed Warning System Using an In-Vehicle Head-Up Display. *Proceedings of 94th Transportation Research Board Meeting, Washington, D.C, 2015.*

JOURNAL PUBLICATIONS

1. Jonathan Wood, **Shaohu Zhang**. Evaluating Relationships Between Perception-Reaction Times, Emergency Deceleration Rates, and Crash Outcomes using Naturalistic Driving Data. *Transportation research record* 2675, no. 1 (2021): 213-223. **TRR'21, acceptance rate: 20%** .
2. Jonathan Wood, **Shaohu Zhang**. Identification and Calculation of Horizontal Curves for Low-Volume Roadways using Smartphone Sensors. *Journal of Transportation Research Record, Transportation research record*, 2672(39), 1-10. 2018. **TRR'18, acceptance rate: 20%** .

POSTER ABSTRACT

1. **Shaohu Zhang**, Anupam Das. A 2-FA for home voice assistants using inaudible acoustic signal. *In Proceedings of the 27th Annual International Conference on Mobile Computing and Networking*, pp. 834-836. 2021. **MobiCom'21**.
2. **Shaohu Zhang**, Myounggyu Won, Sang H. Son. WiTraffic: Non-intrusive Vehicle Classification Using WiFi. *In Proceedings of the 14th ACM Conference on Embedded Network Sensor Systems CD-ROM*, pp. 358-359. 2016. **SenSys'16**
3. Xiao Qin, **Shaohu Zhang**, Wei Wang. Advanced Curve-speed Warning System Using an In-Vehicle Head-Up Display. *Proceedings of 94th Transportation Research Board Meeting, Washington, D.C, 2015.*

TECHNICAL REPORT

1. Jonathan Wood, **Shaohu Zhang**. Evaluating Relationships Between Perception-Reaction Times, Emergency Deceleration Rates, and Crash Outcomes Using Naturalistic Driving Data. *MPC-17-338, North Dakota State University - Upper Great Plains Transportation Institute, Fargo: Mountain-Plains Consortium, 2017.*

THESIS

1. Enhancing the Security and Privacy of Voice Assistant. *Committee members: Dr. Anupam Das (Chair), Dr. William Enck, Dr. Muhammad Shahzad, Dr. Chau-Wai Wong. North Carolina State University, 2023.*
2. Identification, Calculation and Warning of Horizontal Curves for Low-volume Two-lane Roadways Using Smartphone Sensors. *Committee members: Dr. Jonathan Wood (Chair), Dr. Suzette Burckhard, Dr. Rouzbeh Ghabchi. South Dakota State University, 2017.*

TALKS & PRESENTATION

1. Enabling 2-FA for Smart Home Voice Assistants using Inaudible Acoustic Signal. *The 24th International Symposium on Research in Attacks, Intrusions and Defenses. (RAID'21 virtual).*
2. 2-FA for Smart Home Voice Assistants using Inaudible Acoustic Signal. *In Proceedings of the 27th Annual International Conference on Mobile Computing and Networking. (Mobicom'21 virtual).*
3. Security on Android Devices. *NCSU Data Privacy Month 2021.*

4. A WiFi-based Home Security System. *The 17th IEEE International Conference on Mobile Ad Hoc and Sensor Systems*. (MASS'20 virtual).
5. Identification and Calculation of Horizontal Curves for Low-Volume Roadways using Smartphone Sensors. *In the 97th Transportation Research Board Annual Meeting (TRB'18), Washington D.C.*
6. WiTraffic: Non-intrusive Vehicle Classification Using WiFi. *In the 14th ACM Conference on Embedded Networked Sensor Systems (SenSys'16), Stanford University*.
7. Horizontal Curve Detection Using Inertial Sensors of a Smartphone. *Sigma Xi Chapter, South Dakota State University, 2016*
8. Avoiding Roadway Departure Crashes with an In-Vehicle Head-Up Display. *In the TRB 94th Transportation Research Board Annual Meeting (TRB'15) Washington D.C.*

TEACHING EXPERIENCE

Instructor, North Carolina State University, Raleigh, NC

- CSC773 Advanced Internet Protocol, Spring 2023, co-instructor with Dr. Khaled Harfoush

Teaching Assistant/Lab Instructor, North Carolina State University, Raleigh, NC

- CSC573/591 Internet Protocol, Fall 2022, Instructor: Dr. Khaled Harfoush
- CSC433 Privacy in the Digital Age, Spring 2021, Instructor: Dr. Anupam Das
- CSC533 Privacy in the Digital Age, Fall 2020, Instructor: Dr. Anupam Das
- CSC591/791, ECE591/791 Internet of Things, Spring 2020, Instructor: Dr. Muhammad Shahzad
- CSC573/591 Internet Protocol, Spring 2020, Instructor: Dr. Muhammad Shahzad
- CSC456 Internet of Things, Spring 2019, Instructor: Dr. Muhammad Shahzad

Instructor, Shanghai Maritime University, Institute of Advanced Technology, Shanghai, China

- International Multimodal Transport, Spring 2012 (72 undergraduate students).
- Customs Declaration, Fall 2011 (48 undergraduate students).

STUDENTS/MENTORING

North Carolina State University, Raleigh, NC

- **Current PhD student:** Zhouyu Li
- **Past PhD students (IoT course research project):** Haoze Du, Xiao Ling, Kewen Peng
- **Past Master Student (independent study):** Lee Shyu (Fall 2021)

HONORS & AWARDS

- **2022 Summer Graduate Fellowship**, College of Engineering, North Carolina State University, 2022.
- **COE Enhancement Fee Travel Award**, College of Engineering, North Carolina State University, 2020.
- **COE Graduate Research Award, College of Engineering**, North Carolina State University, 2018.

- **Student Travel Grant:** RAID'21, MASS'21, CCS'21, MobiCom'21, MobiCom'17, and SenSys'16.
- **Sigma Xi Graduate Research Award**, South Dakota State University, 2016.
- **Outstanding Undergraduate Thesis Award**, Zhejiang Ocean University, China, 2010.

PROFESSIONAL ACTIVITIES

I have reviewed more than ten journal manuscripts and >30 conference papers in top-tier conferences/journals.

Artifact Review Committees:

- Privacy Enhancing Technologies Symposium (PoPETs): 2023
- ACM ASIA Conference on Computer and Communications Security (AsiaCCS): 2023
- Annual Computer Security Applications Conference (ACSAC): 2023
- ACM Conference on Security and Privacy in Wireless and Mobile Networks (ACM WiSec): 2022

Workshop

- Co-chair, Privacy Check-up Sessions, NCSU Data Privacy Month 2021. North Carolina State University. Feb 2021.

Conference Review/sub-review

- ACM Conference on Computer and Communications Security (CCS): 2021, 2022.
- Symposium on Security and Privacy (IEEE S&P): 2021.
- ISOC Networked and Distributed System Security Symposium (NDSS): 2021
- Security and Privacy in Wireless and Mobile Networks (WiSec): 2021.
- Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT): 2019, 2021.
- ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (BuildSys): 2019.

Journal Review:

- Journal of Transportation Research Record: 2023.
- ACM Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT): 2019, 2022.
- IEEE Internet of Things Journal: 2021, 2022.
- ACM Transactions on Interactive Intelligent Systems: 2021.
- IEEE Transactions on Mobile Computing: 2021, 2022.

PROPOSALS

I am the main student contributor, together with my advisor, to the design, experiments, and writing of the following grant proposals.

- Title: **Physical Context-aware Voice Assistant for Smart Homes.**
Lead PI: Dr. Anupam Das, North Carolina State University
Total Award: \$75,000
Sponsor: Proposals for 2022 Towards Trustworthy Products in AR, VR, and Smart Devices, Meta Company
- Title: **Preventing Misactivation of Voice Assistant Using Head Orientation**
PI: Dr. Anupam Das, North Carolina State University
Finalist of 2021 Towards Trustworthy Products in AR, VR, and Smart Devices, Meta Company.
- Title: **A Roadway Departure Warning System with an In-Vehicle Head-Up Display**
PI: Dr. Qin Xiao, South Dakota State University
National Cooperative Highway Research Program (NCHRP IDEA 2016) (unfunded)

PROJECTS

During the past 8 years of master's and Ph.D. study, I have been grateful for the support from the following funded projects, other resources from SDSU and NCSU, and travel grants from NSF.

- Title: **CRII: SaTC: Analyzing Information Leak in Smart Homes**
Sponsor: National Science Foundation (NSF)
PI: Dr. Anupam Das North Carolina State University
Total Award: \$174,995 Duration: 3 years (June 01, 2019 – May 31, 2022)
Responsibility: main investigator on the security and privacy of voice assistant.

- Title: **WiFi based Indoor Mapping and Human Discovery**
PI: Muhammad Shahzad North Carolina State University
Total Award: \$384,583 Duration: 2018-2021
Sponsor: Army Research Office, USA
Responsibility: WiFi sensing projects.
- Title: **CRII: CSR: Pervasive Gesture Recognition Using Ambient Light.**
Sponsor: National Science Foundation (NSF)
PI: Dr. Muhammad Shahzad North Carolina State University
Total Award: \$174,878 Duration: 3 years (2016 – 2020)
Responsibility: investigated non-LOS VLC.
- Title: **Evaluating Relationships between Perception-Reaction Times, Emergency Deceleration Rates, and Crash Outcomes using Naturalistic Driving Data.**
Sponsor: North Dakota State University - Upper Great Plains Transportation Institute
PI: Dr. Jonathon Wood South Dakota State University
Total Award: \$180,258 Duration: 2016 – 2017
Responsibility: main investigator to the data analysis and report writing.
- Title: **Developing a Pavement Management System for Small Communities.**
Sponsor: jointly funded by the city of Madison, SD and Mountain Plain Consortium
PI: Dr. Qin Xiao South Dakota State University
Total Award: \$91,040 Duration: 01/2014-12/2016
Responsibility: Data collection and mapping

WORK EXPERIENCE

- Wolfpack Security and Privacy Research (WSPR) Lab**, NCSU, Raleigh, NC 1/2020–present
- Graduate Research Assistant
 - Advisor: Dr. Anupam Das
 - **VoicePM**: Developed a robust Voice Privacy Measurement framework to study the feasibility of applying different state-of-the-art voice anonymization solutions to achieve the optimum tradeoff between privacy and utility.
 - **HeadTalk**: Collected speaker's orientation data from VA and used it to develop a speaker orientation-aware privacy control for voice assistants.
 - **HandLock**: Proposed and developed the concept of a gesture-based 2-FA system for VAs.
- Wolfpack Interactive, Sensing and Networking Lab (WiSN) Lab**, NCSU, Raleigh, NC 8/2017–12/2019
- Graduate Research Assistant
 - Advisor: Dr. Muhammad Shahzad
 - Mobile Computing/Sensing Systems: collected data and designed the system for WiFi sensing on gesture recognition, authentication, and home human events.
- Civil Lab for Operations and Safety Engineering in Transportation**, SDSU, Brookings, SD 1/2017–7/2017
- Graduate Research Assistant
 - Advisor: Dr. Jonathan Wood
 - Main investigator to evaluate causal relationships between perception-reaction times, emergency deceleration rates, and crash outcomes by mining the Naturalistic Driving Data.
- Wireless Embedded and Networked Systems (WENS) Lab**, SDSU, Brookings, SD 8/2015–12/2016
- Graduate Research Assistant
 - Advisor: Dr. Myounggyu Won
 - designed and implemented a WiFi-based traffic monitoring system to classify vehicles, measure vehicle speed and perform vehicle lane detection using WiFi signals.
- Logistics Engineer, China Railway Materials Commercial Corp**, Shanghai, China 6/2012 – 8/2013
- Instructor, Shanghai Maritime University**, Shanghai, China 9/2011 – 7/2012

REFERENCE

- **Dr. Anupam Das**, Assistant Professor
Department of Computer Science, North Carolina State University, Raleigh, NC, USA.
Email: anupam.das@ncsu.edu

- **Dr. Jonathan Wood**, Assistant Professor
Department of Civil, Construction, and Environmental Engineering, Iowa State University, Ames, IA, USA.
Email: jwood2@iastate.edu
- **Dr. Muhammad Shahzad**, Associate Professor
Department of Computer Science, North Carolina State University, Raleigh, NC, USA.
Email: mshahza@ncsu.edu