Proposal Defense

Doctor of Philosophy in Information Science (Telecommunications)

“Wireless Solutions for Improving Healthcare: Contact Tracing and Hand Hygiene” by Akshay Madan

Date: December 6, 2023
Time: 10:30 a.m. – 12:30 p.m.
Place: Room 502, Information Sciences Building, 135 N Bellefield Ave, Pittsburgh PA 15260

Committee:
- Dr. David Tipper, Professor and Advisor, Department of Informatics and Networked Systems, School of Computing and Information
- Dr. Mai Abdelhakim, Assistant Professor, Department of Electrical and Computer Engineering, Swanson School of Engineering
- Dr. Balaji Palanisamy, Associate Professor, Department of Informatics and Networked Systems, School of Computing and Information
- Dr. Pengfei Zhou, Assistant Professor, Department of Informatics and Networked Systems, School of Computing and Information

Abstract:
Disruption in healthcare highlights the need for advanced strategies, robust systems, and innovative solutions to address the evolving challenges. One such disruption is COVID-19, which had a great impact on the nations worldwide having claimed over 6.9 million lives. The high rate of spread and frequent emergence of new variants can be addressed by preventive and screening measures such as contact tracing. Contact tracing can help identify individuals who have been in touch with infected users and timely prompt the use of appropriate measures such as isolation and testing. The most common approach for the same is to broadcast packets using the already prevalent technology, Bluetooth, to register close contacts. However, due to a lack of control over the Bluetooth range, these approaches suffer from lower accuracy. Additionally, most work is focused on tracking direct contact (touching, talking, etc.), but ignores contacts where the infected are not present (contaminated surface, contaminated aerial respiratory particles). Another such disruption in healthcare is healthcare-associated infection (HAI) which, according to WHO, is the leading cause of morbidity and mortality among patients in healthcare facilities. Lack of following the hand hygiene protocols by healthcare workers (doctors, nurses, etc.) is a leading cause of inter-patient infections (including COVID-19) in hospitals. Proper hand hygiene compliance (HHC) can reduce HAs to a great extent.

We work on both the above-mentioned problems. One is to improve the accuracy of digital contact tracing while maintaining the privacy of users. This is done with the help of Bluetooth-based IoT devices installed in public infrastructure such as restaurants, hospitals, etc. With the help of this infrastructure, the proposed technique can also detect indirect contacts. Further, we extend our work and apply it to the specific context of backward contact tracing which is detecting the additional contacts due to asymptomatic users. For the second problem mentioned above, we aim to use WiFi channel state information (CSI) data to recognize the activity performed in that environment, viz. the hand washing or hand rubbing motion. This will help ensure compliance with the required hand hygiene protocols.