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Invited Talk, Center for Energy-Efficient Computing and Applications

SMART HOME CYBERSECURITY: THREAT AND DEFENSE IN A CYBERPHYSICAL SYSTEM

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ABSTRACT: The massive deployment of advanced metering infrastructure and home energy management system has mandated a transformative shift of the classical grid into a more reliable and secure grid. A smart home system is critical in this infrastructure as it controls all the end use components of a grid. Despite its importance, such a system is vulnerable to various cyberattacks such as energy theft and pricing hack. In this talk, I will describe several of our recent works on smart home cyberthreat analysis and defense technology development. I will first show that due to the interdependence between utility pricing and customer energy load, a cyber attacker could tamper smart meters for electricity bill increase and energy load unbalancing, which could result in a larger area blackout through cascading effects. Similarly, energy theft could also potentially disturb the power system and generate cascading effects. I will then discuss some advanced control theoretic and algorithmic techniques developed in my group to protect from those cyberattacks, including partially observable Markov decision process (POMDP) based detection and cross entropy optimization based Feeder Remote Terminal Unit (FRTU) deployment optimization. I will conclude the talk with some of the ongoing research conducted in my group as well as our international collaborators.

BIOGRAPHY: Shiyan Hu received his Ph.D. in Computer Engineering from Texas A&M University in 2008. He is currently an Associate Professor in the Department of Electrical and Computer Engineering at Michigan Tech., where he is the Founding Director of Michigan Tech Cyberphysical System Research Group and the Director of Michigan Tech VLSI CAD Research Lab. He has been a Visiting Professor at IBM Research (Austin) during Summer 2010. His research interests are in the area of Computer-Aided Design of VLSI Circuits and Smart Home Cybersecurity, and he has published over 80 technical papers in the refereed journals and conferences. He is a recipient of ACM SIGDA Richard Newton DAC Scholarship (as the faculty advisor), a recipient of Faculty Invitation Fellowship from Japan Society for the Promotion of Science (JSPS), and a recipient of the National Science Foundation (NSF) CAREER award. His papers have been nominated for IEEE/ACM William J. McCalla Best Paper Award in 2009 and IBM Pat Goldberg Best Paper Award in 2008 and 2010. His microfluidic biochip physical synthesis research was featured in the front cover of IEEE Transactions on Nanobiosciences in March 2014, which has been highlighted in IEEE Spectrum, Communications of ACM, Science Daily, Daily News and various other media. He is among 62 researchers invited from the European Union and the United States to attend the Frontiers of Engineering Symposium of National Academy of Engineering in 2014.

He is an Associate Editor for IEEE Transactions on Circuits and Systems II, and Guest Editor for IEEE Transactions on Computers, IEEE Transactions on Industrial Informatics and ACM Transactions on Embedded Computing Systems. He has served as TPC Subcommittee Chairs for the premier conferences DAC 2014, 2015 and ICCAD 2011, and as TPC members for various conferences for more than 50 times. He is a Senior Member of IEEE.