THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING PRESENTS:

PROFESSOR MOHAMMAD AL FARUQUE

CROSS-DOMAIN SECURITY ISSUES OF EMBEDDED AND CYBER-PHYSICAL SYSTEMS

ABSTRACT

A Cyber-Physical System (CPS) is a cross-domain system integrating sub-systems from multiple domains connected through communication networks. Today, CPSs can be found in security-sensitive areas such as aerospace, automotive, energy, healthcare, manufacturing transportation, entertainment, and consumer appliances. Compared to the traditional information and embedded systems, due to the tight interactions between cyber and physical domains in CPSs, new vulnerabilities emerge from the boundary between cyber and physical domains. This enables new types of "cross-domain attacks" which include the following two concepts. First, observable energy flows from physical domain such as the analog emissions from acoustics, power flow, electromagnetic (EM), thermal, etc. provide the attackers new ways to access the critical information in the cyber domain. We call these types of attack as "Side Channel Attacks." Second, the classic cyber domain attacks on CPS may cause direct physical damage on them. The second types of attack in the scope of this talk will be called "Kinetic Cyber Attack." In my talk I will be presenting our recent work on additive manufacturing systems (3D-printers), where we have demonstrated the vulnerability of a 3D-printer to confidentiality attacks. An additive manufacturing system is attacked through observable acoustic analog emissions in this work. See recent articles at Science (http://science.sciencemag.org/content/352/6282/132) and at ACM Communications (http://cacm.acm.org/news/199406-bad-vibrations-uci-researchers-find-security-breach-in-3d-printing-process/fulltext) about our work. Moreover, in this talk, I will also cover few research topics in the area of automotive and transportation systems security. Finally, before concluding the talk, I will discuss the challenges of Hardware security (Hardware Trojan detection and localization) from a cross-domain security point of view.

BIOGRAPHY

Mohammad Al Faruque is currently with the University of California Irvine (UCI), where he is an associate professor (with tenure) and director of the Cyber-Physical Systems Lab. Professor Al Faruque is the recipient of the IEEE Technical Committee on Cyber-Physical Systems Early-Career Award 2018 and the IEEE CEDA Ernest S. Kuh Early Career Award 2016. He is also the recipient of the UCI Academic Senate Distinguished Early-Career Faculty Award for Research 2017, and the School of Engineering Early-Career Faculty Award for Research 2017. He served as an Emulex Career Development Chair during October 2012 till July 2015. Before this, he was with Siemens Corporate Research and Technology in Princeton, NJ. His current research is focused on system-level design of Internet-of-Things (IoT), Embedded Systems, and Cyber-Physical-Systems (CPS) with special interests on design automation methodologies, data-driven modeling techniques including machine learning for design, CPS security, etc. His work involves novel hardware and software design for various CPS application areas, including Industry 4.0 (manufacturing), smartgrid, and autonomous vehicles. Professor Al Faruque received his B.Sc. degree in Computer Science and Engineering (CSE) from Bangladesh University of Engineering and Technology (BUET) in 2002, and M.Sc. and Ph.D. degrees in Computer Science from Aachen Technical University and Karlsruhe Institute of Technology, Germany in 2004 and 2009, respectively. Professor Al Faruque received the Thomas Alva Edison Patent Award 2016 from the Edison foundation, the 2016 DATE Best Paper Award, the 2015 DAC Best Paper Award, the 2009 IEEE/ACM William J. McCalla ICCAD Best Paper Award, the 2016 NDSS Distinguished Poster Award, the 2008 HiPEAC Paper Award, the 2015 Hellman Fellow Award, the EECS Professor of the year 2015-16 Award, and the 2015 UCI Chancellor's Award for Excellence in Fostering Undergraduate Research. Besides 80+ IEEE/ACM publications in the premier journals and conferences. Professor Al Faruque holds 6 US patents. He is currently serving as the associate editor of the ACM Transactions on Design Automation on Electronics and Systems and publication editor of the IEEE Design & Test. He is also a IEEE senior member and a ACM senior member.

OCTOBER 22, 2018

BOURNS HALL A265

11:10 A.M. - 12:00 P.M.

FOR MORE INFORMATION VISIT US AT WWW.ECE.UCR.EDU