Deepak Krishnankutty

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Objective

Seeking a full time position in the area of hardware and software co-design. With passionate effort, I hope to tackle the challenges in this field. I am a team member who can quickly adapt to and learn new systems, develop expertise and produce significant contributions.

Education

University of Maryland Baltimore County — *Maryland, USA*

Ph.D. candidate in Computer Engineering — *Aug. 2013 - Present*

- Advisers: Dr. Chintan Patel and Dr.Ryan Robucci
- Research areas: Side Channel Leakage Analysis, Hardware Security, Power Analysis.

National Institute of Technology, Rourkela — *Orissa, India*

Master of Technology (M.Tech.) in Computer Science & Engineering — *Jun. 2007 - Jul. 2009*

- Thesis: Implementation of a generic modular RSA on FPGA

University of Calicut — *Kerala, India*

Bachelor of Technology (B.Tech.) in Computer Science & Engineering — *Aug. 2002 - Aug. 2006*

Technical Skills

- **Embedded and IoT Systems Design:**

  Hardware/Software co-design, System debugging, Sensor calibration and data acquisition.

  Languages UML, HTML, Java, JavaScript, PHP, VHDL, Verilog, MATLAB, C, C++, Python, Assembly.

  Tools/Platforms Rational Rose, Xilinx (ISE, EDK with MicroBlaze), ModelSim, AVR Studio, Code Composer Studio (TI MSP430, Mbed ARM), PSoC Creator, MPLAB.

- **Hardware Architecture and System Layout:**

  PCB design, Peripheral interfacing, Standard cell based ASIC layout design, SPICE models and simulation.

  Tools/Platforms Cadence (Encounter, Virtuoso, Spectre, Capture CIS, Allegro), Autodesk Eagle, KiCad.

Research Experience

ECLIPSE Research Lab, UMBC — *Maryland, USA*

Research Assistant — *Aug. 2013 - Present*

Investigations on side channel leakage analysis of Xilinx based FPGAs and discrete TI MSP430 chips.

- Designed and developed a custom board for obtaining power analysis measurements.
- Analyzed on-board measurements using a 12-bit 4-channel ADC Via SERDES and SPI protocols.
- Analyzed off-board measurements using high speed oscilloscopes.
- Utilized GPIB protocol for oscilloscope communications.
- Utilized FTDI based serial communications for the custom board.
- Post-processing and signal analysis implemented using SVMs on MATLAB and Python.
- Optimized current board configuration for remote data collection via Python based socket protocols.

Implemented a 64-bit DES block cipher using the .180 μm CMOS IBM PDK.

- Comprised design RTL synthesis & custom layout.
- Implemented an SoC testbed by integrating a 128-bit AES block cipher and an open implementation of the TI MSP430.

Selected Projects

Hardware Demonstration at Hardware Oriented Security and Trust 2016 — *Virginia, USA*

Hardware designer and Presenter — *May. 2016*

- Firmware Instruction Identification Using Side-Channel Analysis (3rd Position)

Three-axis accelerometer data processing on FPGA — *Maryland, USA*

Hardware designer — *Aug. 2014 - Nov. 2014*

- Processed three-axis acceleration data from the MPU6050 IC module and generated impulse response using a 201 tap band-pass FIR filter.
- Implemented a 1024 FFT processor core via a Hamming window having a sample window size of 1024 samples.
- Implemented custom FIFO units to stream data between FPGA and a communicating PC.

Multi Functional Industrial Timer — *Kerala, India*

Hardware and Firmware Engineer — *May. 2011 - Dec. 2011*

- A menu driven timer setup developed for managing the startup and end times of 10 external units.
- Implemented using a PIC18 series micro-controller.

Implementation of a generic modular RSA on FPGA — *Orissa, India*

Hardware Designer — *May. 2008 - May. 2009*

- Implemented a high throughput 256 bit version of the RSA on a Xilinx Virtex 2 Pro.
- Utilized a recursive parallel version of the Karatsuba multiplier, and a modified Extended Euclid's inversion algorithm.

Work Experience

Mobile, Pervasive, and Sensor Systems Lab *Maryland, USA*

PCB Design Engineer *Feb. 2020 - Present*

- Designed PCBs for health kits equipped with bio-sensors.
- Developed firmware for health kit boards for TI MSP430 and PSoC 6.

University of Maryland Baltimore County *Maryland, USA*

Visiting Lecturer *Aug. 2018 - Dec. 2019*

- Taught CMSC 313 - Introduction to Assembly And Computer Organization.
- Taught CMPE 310 - Systems Design and Programming.

MultiDyne *Happauge, Long Island, USA*

Engineering Intern *May. 2018 - Aug. 2018*

- Successfully designed PCBs for high-speed Audio/Video transmission over fiber-optic network.
- Familiarization with AES and SDI standards for audio/video communications.
- Familiarization with CircuitWorks for PCB modelling.

University of Maryland Baltimore County *Maryland, USA*

Graduate Teaching Assistant *Aug. 2013 - May. 2018*

Assisted courses:

- CMPE 311 - C Programming and Embedded Systems.
  - Provided guidance to students in various projects involving the Atmel AVR Butterfly board.
- CMPE 306 - Basic Circuit Theory
  - Assisted students in getting accustomed to lab equipments.
  - Analysis of basic RLC circuits using high speed oscilloscopes.
  - Data capture via GPIB and post-processing of signals using MATLAB.
- CMPE 310 - Systems Design and Programming
  - Guided students in the design of a minimum mode 8086 Intel microprocessor board.
  - Familiarization with Allegro PCB Designer for board design.
  - Familiarization with Cadence Capture CIS for schematics design.

National Institute of Technology Calicut *Kerala, India*

Adhoc Lecturer *Dec. 2012 - May. 2013*

- Courses Taught : Graph Theory and Combinatorics, Programming in C

Jyothi Engineering College *Kerala, India*

Lecturer *Jan. 2010 - Jun. 2012*

Courses Taught:

- Embedded Systems, Design and Analysis of Algorithms, Operating Systems.
- Computer Programming in C, Computer Graphics.

Publications

Peer-reviewed

Deepak Krishnankutty, Zheng Li, Ryan Robucci, Nilanjan Banerjee, Chintan Patel,“Instruction Sequence Identification and Disassembly Using Power Supply Side-Channel Analysis” in IEEE Transactions on Computers, Nov. 2020

Tracie Severson, Erick J. Rodríguez-Seda, Brien Croteau, Deepak Krishnankutty, KiriakosKiriakidis, Chintan Patel, Nilanjan Banerjee, Ryan Robucci, “Trust-Based Framework for Resilience to Sensor-Targeted Attacks in Cyber-Physical Systems” in 2018 IEEE American Control Conference, Jun 2018.

Brien Croteau, Deepak Krishnankutty, Kiriakos Kiriakidis, Tracie Severson, Chintan Patel, Ryan Robucci, Erick Rodriguez-Seda, Nilanjan Banerjee, “Cross-level Detection Framework for Attacks on Cyber-Physical System” in Journal of Hardware and Systems Security, Springer International Publishing, Nov 2017.

Brien Croteau, Deepak Krishnankutty, Ryan Robucci, Chintan Patel, Nilanjan Banerjee, Kiriakos Kiriakidis, Tracie Severson, Erick Rodriguez-Seda, “Cross-level detection of sensor-based deception attacks on cyber-physical system” in CYBER, Jul 2017.

Deepak Krishnankutty, Ryan Robucci, Nilanjan Banerjee, and Chintan Patel, “FISCAL: Firmware Identification Using Side-Channel Power Analysis” in Hardware Oriented Security and Trust (HOST), pp 1–6.997, May 2017.

Sushmita Kadiyala Rao, Deepak Krishnankutty, Ryan Robucci, Nilanjan Banerjee, and Chintan Patel, “Post-Layout Estimation of Side-Channel Power Supply Signature” in Hardware Oriented Security and Trust (HOST), McLean, VA, USA, May 2015.

Non-peer-reviewed

Brien Croteau, Deepak Krishnankutty,“Cyber-Physical Security Research at Umbc’s Eclipse Lab” in ASME. Mechanical Engineering. March 2017; 139(03): S18–S23.