Feature Member

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Saraju P. Mohanty is a Professor at the University of North Texas. Prof. Mohanty's research is in "Smart Electronic Systems" which has been funded by National Science Foundations (NSF), Semiconductor Research Corporation (SRC), US Air Force, Indo-USA Science and Technology Forum (IUSSTF), and Mission Innovation Global Alliance. He has authored 300 research articles, 4 books, and invented 4 US patents. His Google Scholar h-index is 29 and i10-index is 97. He has received 4 best paper awards and has delivered multiple keynote talks at various International Conferences. He received IEEE-CS-TCVLSI Distinguished Leadership Award in 2018 for services to the IEEE, and to the VLSI research community. He has been recognized as a IEEE Distinguished Lecturer by the Consumer Electronics Society (CESoc) since 2017. He was conferred the Glorious India Award in 2017 for his exemplary contributions to the discipline. He received Society for Technical Communication (STC) 2017 Award of Merit for his outstanding contributions to IEEE Consumer Electronics Magazine. He was the recipient of 2016 PROSE Award for best Textbook in Physical Sciences & Mathematics from the Association of American Publishers for his Mixed-Signal System Design book published by McGraw-Hill in 2015. He was conferred 2016-17 UNT Toulouse Scholars Award for sustained excellent scholarship and teaching achievements. He is the Editor-in-Chief (EiC) of the IEEE Consumer Electronics Magazine (CEM). He served as the Chair of Technical Committee on VLSI, IEEE Computer Society during 2014-2018, and was responsible to oversee a dozen of IEEE meetings including ASAP, ASYNC, ISVLSI, and iSES. More about his biography, research, education, and outreach activities can be obtained from his website: http://www.smohanty.org.

Q1. Tell us a little about your research area and what motivated you to get into it?

My current research is on Smart Electronic Systems. The research can be classified into the following inter-related thrusts: (1) Security and Energy Aware Internet-of-Things (IoT), (2) IoT-enabled Solutions for Smart Healthcare, and (3) Consumer Electronics for Smart Cities. The key aspects of the smart electronics are Energy-Smart, Security-Smart, and Response-Smart. Energy-Smart ensures that energy consumption of consumer electronics is minimal for longer battery life. Security-Smart deals with the security/protection of electronics systems as well as that of the information/media that these systems capture, process, or store. Response-Smart refers to accurate sensing, intelligent processing, and fast decision/actuation/response. Smart Electronics in the framework of IoT can provide 3Is (Instrumentation, Interconnection, and Intelligence) to the Smart Cities. Optimal combinations of hardware and software modules are explored for ESR-smartness and design/operation cost trade-offs of electronic systems. I have been engaged low-power hardware design for more than a decade. I have also worked on algorithms and hardware designs for security and copyright protection for a long time. My current research motivation is to work more close to applications domain and have stronger and fast impact on society. Thus, smart healthcare, smart cities application domains are of interests to me.

Q2. What are some of your proudest accomplishments?

There are many things that come to mind. In 1997, joining Indian Institute of Science (IISc) Bangalore that admits only top less than 1% students from India was one proud moment. In fact, during MS research, the articles that I had published later helped me to get USA Permanent Residency in EB1 category in a matter of a month since when I applied in 2004. It was a very good feeling when I built the proof of concept of Secure Digital Camera (SDC) in 2004. SDC with integrated security and protection capabilities and energy-efficient design is a demonstration of energy and security trade-offs which is essential for the current edge computing which is post-cloud-based-IoT computing paradigm. The architecture-level approaches for power transience/fluctuation minimization during deign exploration that I did around 2003 to 2005 has made me feel good. It was one of its kind during high-level synthesis to capture power, power-fluctuation, process variation unified fashion at early design flow. Moreover, reducing power fluctuation to make uniform power profile can essentially be a tool for power trace obfuscation to reduce the side channel attack through power analysis to make security aware DSP design. Another work that I am proud is iVAMS (Intelligent-Metamodel Integrated Verilog-AMS) which can be used for ultra-fast and yet accurate simulation, design exploration, optimization, and verification of analog/mixed-signal components. The key idea was to build intelligent metamodels (which is essentially machine learning models) from the silicon data of the integrated circuit and integrate them in Verilog-AMS to make simulations of large designs feasible with silicon accuracy. Thus, the use of machine learning models (ML) for silicon bigdata was done in this work way before current data-science community talked about bigdata with of course a variety of datasets. I was proud when USCIS approved my self-petition in 2005 for USA permanent residency in EB1 outstanding researcher category in 3 weeks time. Receiving the 2016 PROSE Award for best Textbook in Physical Sciences & Mathematics category from the Association of American Publishers (AAP) for his book titled "Nanoelectronic Mixed-Signal System Design" published by McGraw-Hill in 2015 was a proud moment. To be listed 42 distinguished Non-resident Indians (NRI) and Indian origin who have excelled in their careers to receive the Glorious India Awards in 2017 was a proud moment. It was done during May 2017, the Glorious India Expo took place at the New Jersey Convention & Exposition Center, Edison, USA by carious India and USA based organizations including Innovative Council of Indian Tourism, Make in India, Incredible India, and US-India Business Council were sponsoring entities. I am proud to Chair of IEEE-CS TCVLSI as well as to serve that the Editor-in-Chief (EiC) Consumer Electronics magazine to serve our research community.

Q3. How do you see your research field shaping up and what are the major directions?

I am currently interested in smart electronics research in the smart cities applications domain. Automated monitoring of various city parameters for decision making. In smart healthcare, automatically monitoring food intake to determine calories and automatically suggest future diet for healthy living is one area that I have been researching. In smart healthcare, monitoring physiological activities for stress level detection and management. Another interesting work is early detection (or even prediction) of seizure and then onsite drug delivery in a IoT framework. I consider security, privacy, energy-efficiency, response-time, intelligence, design-cost, and operational-cost are important for but mutually conflicting requirements in smart electronics. For example, a security solution in an implantable electronics can cause energy issues. A security mechanism for a smart car or an UAV can have impact on their battery life (energy), payload, range, and response time. Research in anyone of these objectives and/or their combined forms are directions. Specifically, system design flow accounting one and more of these requirements as objective and/or constraints is an important research direction. Hardware-assisted security in which hardware protects itself, protects the system, and also protects the information being processed by the system is an

important research direction. Appropriate PUF design, PUF based security protocols, and integration of PUF in the IoT platform is important research. Blockchain technology integration in electronics for security and other applications is an involving trend. Blockchain inherently need not be an efficient solution. It can be effective when completely untrusted entities are working together. However, the blockchain technology is extreme energy hungry. For example, mining of 1 bitcoin (that uses blockchain with proof-of-work as the consensus algorithm) needs energy equivalent to 2 years' consumption of a typical US household. The proof-of-work (PoW) even in high-performance servers can take significant time to run. Blockchain technology that can run using a very minimal resource and energy is a research direction. Edge computing instead of classic cloud-based IoT computing for energy efficient and fast response is a research direction.

Q4. What advice would you give to junior researchers and graduate students?

The best advice that I can think of for researchers is that time is crucial and spend is wisely. For the graduate students, I advise to work hard and be productive as soon as possible. It is crucial to discuss research with your mentor and complete your degrees on time. It is good to spend time on hard and challenging problems than easy and incremental problems. Understanding the research problem is critical before trying to solve it. If you understand the problem, then your research is half done. For junior researchers (faculty), I advise to maintain balance between professional and personal aspects is important. I think maintaining a balance between different aspects of research such as funding, publishing, and student graduation is key for long-term sustainability. Similarly, teaching both undergraduate and graduate classes is important for a faculty as it is a medium for research dissemination. Professional services are helpful for networking as well as for leadership skills.

Q5. What profession would you be in if you weren't in this field?

I always wanted to be in academia. Right from the first day of my undergraduate studies I planned to be a faculty in an Engineering Institute. The other option that I was thinking is a research scientist in a National lab. However, it reminds me that my father always wanted me to join Indian Administrative Services (IAS). It is through a National level selection process and appointment is done by the President of India. The position seemed to have lots of power. However, I always used to tell him that I will be an Engineering Professor: I like Engineering and to train others on the same.

Q6. Any final thoughts?

There is no substitute to working hard and smart.