

# Nurani Saoda

151 Engineer's Way, University of Virginia, Charlottesville, VA 22904

☎ +1-434-249-4853    🌐 [nsaoda.github.io](https://github.com/nsaoda)    ✉ [saoda@virginia.edu](mailto:saoda@virginia.edu)    📌 [saodacynthia](#)    🗣 [SaodaCynthia](#)    📄 [Google Scholar](#)

## EDUCATION

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- **University of Virginia** Charlottesville, VA  
*PhD Candidate in Computer Engineering* Aug 2017 – Dec 2022 (expected)
- **University of Virginia** Charlottesville, VA  
*M.S. in Computer Engineering* Aug 2017 – Aug 2020
- **Bangladesh University of Engineering and Technology (BUET)** Dhaka, Bangladesh  
*B.S. in Electrical and Electronic Engineering* Feb 2011 – Mar 2016

## PROFESSIONAL EXPERIENCE

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- **Graduate Research Assistant** Charlottesville, VA  
*University of Virginia* Aug 2017 – Present  
Research interest: Energy-harvesting and battery-less sensors, Low power sensor networks, Machine learning in IoT
- **Graduate Teaching Assistant** Charlottesville, VA  
*University of Virginia* Jan 2019 – May 2020  
Courses: Computer Networks (Spring 2019), Discrete Mathematics (Spring 2020)
- **Lecturer, EEE** Dhaka, Bangladesh  
*Uttara University* May 2016 – Jun 2017  
Courses: Electrical Properties of Materials, Energy Conversion I and II, Microprocessor and Interfacing Lab, Control Systems Lab, Wireless Communication Lab.

## TECHNICAL SKILLS

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- **Programming Language:** Python, C/C++/C#, Embedded C, MATLAB, Verilog, Java, Javascript (Node.js), Make, ARM Assembly Language
- **Hardware Platforms:** nRF51 and nRF52 SoCs, STM32, MSP430, Arduino, Raspberry PI
- **Machine Learning tools:** TensorFlow, Scikit-learn
- **Real-time OS:** Zephyr RTOS
- **Embedded Development:** EAGLE, Proteus, Keil uVision, STM32CubeIDE, SEGGER Embedded Studio, TI Code Composer Studio, Cadence, PSpice, Xilinx Vivado, Orcad, Quartus II
- **Communication Protocols:** UART, SPI, I2C, JTAG, DMA, USB, Bluetooth Low Energy (BLE), LoRa, UWB
- **Prototyping and Equipment:** Board bring-up, Board debug and validation, Oscilloscope, Source/Load Measure Units, Power Profiler, Spectrum Analyzer, Logic Analyzer

## SELECTED RESEARCH PROJECTS

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### Altair: An energy supervisor architecture for energy-harvesting applications

- Proposed and designed a new energy-harvesting power management architecture, ALTAIR, that offloads all energy-management operations to the power supply itself, while making the power supply programmable. The proposed design achieves modularity, flexibility, and better energy optimization for battery-less designs.
- Proposed and developed an on-device duty cycle adaptation technique using reinforcement learning to ensure optimal energy utilization and device performance in post-deployment conditions.
- Microcontrollers: STM32L010R8, nRF52840, Tools: EAGLE CAD, GNU ARM Embedded toolchain, Language: Embedded C, Node.js

### RetroIoT: Retrofitting existing IoT devices with new functionality

- Proposed and demonstrated a technique that uses the reported battery voltage channel of an IoT sensor to inject additional data such as an advanced sensor, metadata or tag and retrofit the device with advanced functionality.
- Implemented a digital data encoding technique by replacing the device's battery with a programmable energy-harvesting power supply.

- Development platforms used: STM32L0 LoraWan kit, Tools: EAGLE CAD, Language: Embedded C, Python

### SolarWalk: Occupant identification using small photovoltaic harvesters

- Proposed a new non-invasive, unobtrusive, and infrastructure-free method to identify occupants in smart home from their distinguished solar cell output voltage traces using machine learning techniques.
- Development platforms used: Nordic nRF52840 DK, Language: Embedded C, Python

### Herald: Investigating the performance of intermittently-powered solar beacons

- Analyzed the performance of intermittently-powered solar energy-harvesting Bluetooth Low Energy (BLE) beacons in different indoor lighting conditions by designing an intermittent solar beacon.
- Evaluated the viability of solar-powered beacons in low indoor light conditions and identified crucial design-level and system-level factors while using intermittently powered beacons.
- Microcontroller: nRF51822, Tools: EAGLE CAD, Language: Embedded C, Python

### SELECTED PUBLICATIONS (Google Scholar)

1. RetroIoT: Retrofitting Internet of Things Deployments by Hiding Data in Underused Data Channels. **Nurani Saoda**, Victor Ariel Leal Sobral, Ruchir Shah, Wenpeng Wang, Bradford Campbell. **ACM MobiCom'22**
2. SolarWalk: Smart Home Occupant Identification using Unobtrusive Indoor Photovoltaic Harvesters. **Nurani Saoda**, Md Fazlay Rabbi Masum Billah, Victor Ariel Leal Sobral, Tushar Routh, Wenpeng Wang, Bradford Campbell. **ACM BuildSys'2022**
3. An Energy Supervisor Architecture for Energy-Harvesting Applications. **Nurani Saoda**, Wenpeng Wang, Md Fazlay Rabbi Masum Billah, Bradford Campbell. **ACM IPSN'22**
4. Low Cost Light Source Identification in Real World Settings. Tushar Routh, **Nurani Saoda**, Md Fazlay Rabbi Masum Billah, Brad Campbell. **IEEE SECON'22**
5. BLE Can See: A Reinforcement Learning Approach for Radio Frequency based Occupancy Detection. Md Fazlay Rabbi Mashum Billah, **Nurani Saoda**, Jiechao Gao, Bradford Campbell. **ACM IPSN'21**
6. UbiTrack: Enabling Scalable & Low-Cost Device Localization with Onboard WiFi. Wenpeng Wang, Zetian Liu, Jiechao Gao, **Nurani Saoda**, Bradford Campbell. **ACM BuildSys'21**
7. SolarWalk Dataset: Occupant Identification using Indoor Photovoltaic Harvester Output Voltage **Nurani Saoda**, Md Fazlay Rabbi Masum Billah, Victor Ariel Leal Sobral, Bradford Campbell. **ACM DATA Workshop with SenSys'22**
8. Developing a General Purpose Development Platform for Energy-harvesting Applications. **Nurani Saoda**, Md Fazlay Rabbi Masum Billah, Bradford Campbell. **ACM ENSsys Workshop with SenSys'21**
9. No Batteries Needed: Providing Physical Context with Energy-Harvesting Beacons. **Nurani Saoda**, Bradford Campbell. **ACM ENSsys Workshop with SenSys'19**

### INVITED TALKS

- *Designing Energy-Harvesting Devices for Sustainable Internet-of-Things*  
**Research for Industry Talk, Networking Research Group, Microsoft** Mar 2023
- *Sustainable Internet-of-Things with Batteryless Energy-harvesting Sensors*  
**Earth Systems Predictability & Resiliency Group, Pacific Northwest National Laboratory** Jan 2023
- Presented my research on *Broadening the Capabilities of Self-Powered Energy-Harvesting Systems*  
**UVA Link Lab Student Seminar Award Series** Nov 2022
- *Making IoT Batteryless: Challenges and Opportunities*  
**Embedded Systems Seminar, University of California San Diego** Jan 2021

### AWARDS AND SCHOLARSHIPS

- UVA Link Lab Student Seminar Award 2022
- ACM SIGBED SRC Winner, Second Runner-up 2022
- ACM MobiCom'22 Travel Grant Scholarship 2022
- Finalist of NCWIT Collegiate Award 2022
- Grace Hopper Student Scholar, GHC 2019, 2021
- CRA-WP Grad Cohort for Women Workshop 2020
- N2Women Young Researcher Fellowship, SenSys'19 2019
- CRA-E Funding for CRA-E workshop on Academic Careers, FCRC'19 2019
- University of Virginia Graduate Engineering Travel Grant Award, Society of Women Engineers (SWE)'18 2018
- **Best paper award**, ICCIT'16 2016