Bashima Islam

bislam@wpi.edu

https://users.wpi.edu/~bislam/

L +1 919 338 9160

Research Description

My research interests include mobile and pervasive computing, machine learning for Internet-of-Things, cyber-physical systems, and mobile health. I am especially interested in intermittent computing. The goal of my research is to understand and enhance the processing capabilities of tiny energy-constrained computing devices. I aim to introduce a new set of time-aware, intelligent, and personalized edge computers and provide sustainable and scalable sensing solutions in various application domains ranging from health monitoring to smart agriculture. I work on the control and processing layers of resource-constrained embedded systems and use both commercial-of-the-shelf and custom-designed hardware to achieve this goal. As a recognition of my work, I have been named the Finalist for the Gaetano Borriello Outstanding Student Award of UbiComp 2020.

Education

2021 Rh.D. in Computer Science, University of North Carolina at Chapel Hill

Advisor: Dr. Shahriar Nirjon

Dissertation Title: Scheduling Tasks on Intermittently-Powered Real-Time Systems.

Dissertation Committee: Dr. Kevin Jeffay, Dr. Donald E. Porter, Dr. Xiaofan (Fred) Jiang, Dr. Parasara Sridhar Duggirala, and Dr. Shahriar Nirjon

B.Sc. in Computer Science & Engineering, Bangladesh University of Engineering & Technology

Thesis Title: High Performance Approximate Computing by Adaptive Relaxed Synchronization.

Thesis Advisor: Dr. Rifat Shahriar

Awards: Dean's List Award, University Merit, and Technical Board Scholarship.

Awards and Achievements

2020 Rising Stars in EECS 2020 at University of California, Berkeley.

Finalist, Gaetano Borriello Outstanding Student Award, UbiComp 2020.

■ Best Presentation Judge's Award, UbiComp 2020.

■ CRA-WP Career Mentoring Workshop, 2020.

2018 Rest Presentation Award, Vehicular Networking Conference 2018.

■ Best App Runner-Up Award, Vehicular Networking Conference 2018.

■ Grace Hopper Conference Scholarship, UNC CS.

2018-19 Computing Research Association (CRA) grants for CRA-W grad cohort.

N2Women Young Researcher Fellowship Award, MobiSys 2017.

■ Best Summer Intern Presentation Award, Nokia Bell Labs.

2016 Rest Demo Runner-Up Award, SenSys 2016.

Dean's List Award & University Scholarship: Academic Honor by Bangladesh University of Engineering & Technology (BUET), Bangladesh.

2014 Popular Poster Award, Workshop on Women Empowerment through ICT 2014.

2013 World Finalist and National Champion, Microsoft Imagine Cup, Russia.

■ Best Demo Award, WDIECS 2013.

Technical Board Scholarship, by BUET, Bangladesh.

Professional Experience

August '22 Assistant Professor, Department of Electrical and Computer Engineering, Worcester Polytechnic Institute.

June '21 – July '22 Affiliated Assistant Professor, Department of Electrical and Computer Engineering, Worcester Polytechnic Institute.

Professional Experience (continued)

June '21 - May '22

■ Visiting Postdoctoral Research Associate, Beckman Institute, University of Illinois at Urbana-Champaign.

- Advisor: Dr. Romit Roy Chowdhury and Dr. Nancy McElwain

Aug '16 - May '21

■ Graduate Research Assistant, Department of Computer Science, University of North Carolina at Chapel Hill.

- Advisor: Dr. Shahriar Nirjon

May '20 - Aug '20

■ Summer Research Intern, Samsung Research America, CA.

- Mentors: Dr. Md Mahbubur Rahman, Dr. Tousif Ahmed, and Dr. Jilong Kuang

Jun '17 – Aug '17

Summer Research Intern, Nokia Bell Labs, NJ.

– Mentors: Dr. Mostafa Uddin, Dr. Sarit Mukherjee, and Dr. TV Lakshman

Feb '15 – Jun '16 Quantitative Software Developer, Stochastic Logic Ltd, Bangladesh. – Supervisor: Dr. Arif Dowla

Research Publications

Main Peer-Reviewed Journals and Conference Publications

- Bashima Islam, Md Mahbubur Rahman, Tousif Ahmed, Mohsin Yusuf Ahmed, Ebrahim Nemati, Korosh Vatanparvar, Viswam Nathan, Daniel McCaffrey, Jilong Kuang and Jun Alex Gao: *BreathTrack: Tracking Breathing Biomarkers Using Smartphone Acoustic Sensor.* In: ACM Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT/UBICOMP '21), 2021.
- Bashima Islam and Shahriar Nirjon: Zygarde: Time-Sensitive On-Device Deep Inference and Adaptation on Intermittently-Powered Systems. In: ACM Proceedings on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT/UBICOMP '20), Volume 4, Issue 3, 2020.
- Bashima Islam and Shahriar Nirjon: Scheduling Computational and Energy Harvesting Tasks in Deadline-Aware Intermittent Systems. In: IEEE International Conference on Real-Time and Embedded Technology and Applications Symposium (RTAS '20), 2020.
- 4 Alma Probstl, **Bashima Islam**, Shahriar Nirjon, Naehuck R Chang and Samarjit Chakraborty: *Intelligent Chargers will Make Mobile Devices Live Longer*. In: IEEE Design and Test Journal, 2020.
- Seulki Lee, **Bashima Islam**, Yubo Luo and Shahriar Nirjon: *Intermittent Learning: On-Device Machine Learning on Intermittently Powered System.* In: ACM Proceedings on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT '19/UBICOMP '20), Volume 3, Issue 4, *Best Presentation Judge's Award*, 2019.
- 6 Bashima Islam, Md Tamzeed Islam and Shahriar Nirjon: Glimpse.3D: A Motion-Triggered Stereo Body Camera for 3D Experience Capture and Preview. In: ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN '18), 2018.
- Bashima Islam, Mostafa Uddin, Sarit Mukherjee and Shahriar Nirjon: Rethinking Ranging of Unmodified BLE Peripherals in Smart City Infrastructure. In: ACM Multimedia Systems Conference (MMSys '18), 2018.
- Md Tamzeed Islam, **Bashima Islam** and Shahriar Nirjon: *Duty-Cycle-Aware Real-Time Scheduling of Wireless Links in Low Power WANs.* In: IEEE International Conference on Distributed Computing in Sensor Systems (DCOSS '18), 2018.
- Daniel de Godoy, **Bashima Islam**, Stephen Xia, Md Tamzeed Islam, Rishikanth Chandrasekaran, Yen-Chun Chen, Shahriar Nirjon, Peter R Kinget and Xiaofan Jiang: *Paws: A Wearable Acoustic System for Pedestrian Safety*. In: IEEE/ACM International Conference on Internet-of-Things Design and Implementation (IoTDI '18), 2018.
- Chong Shao, **Bashima Islam** and Shahriar Nirjon: *Marble: Mobile Augmented Reality using a Distributed BLE Beacon Infrastructure*. In: IEEE/ACM International Conference on Internet-of-Things Design and Implementation (IoTDI '18), 2018.
- Md Tamzeed Islam, **Bashima Islam** and Shahriar Nirjon: *SoundSifter: Mitigating Overhearing of Continuous Listening Devices.* In: ACM Proceedings Conference on Mobile Systems, Applications, and Services (**MobiSys '17**), 2017.

Bashima Islam, Faysal Hossain and Rifat Shahriyar: High Performance Approximate Computing by Adaptive Relaxed Synchronization. In: IEEE International Conference on High Performance Computing and Communication (HPCC '16), 2016.

Publications Under Review or Preparation

Bashima Islam and Shahriar Nirjon: Falinks: Emulating a Persistent System with Distributed Intermittent Systems, In Preperation.

Other Peer-Reviewed Journals and Conference Publications

- Md Mahbubur Rahman, Mohsin Yusuf Ahmed, Tousif Ahmed, **Bashima Islam**, Viswam Nathan, Korosh Vatanparvar, Ebrahim Nemati, Daniel McCaffrey, Jilong Kuang and Jun Alex Gao: *BreathEasy: Assessing Respiratory Diseases Using Mobile Multimodal Sensors.* In: ACM International Conference on Multimodal Interaction (ICMI '20), 2020.
- Tousif Ahmed, Mohsin Yusuf Ahmed, Md Mahbubur Rahman, Ebrahim Nemati, **Bashima Islam**, Korosh Vatanparvar, Viswam Nathan, Daniel McCaffrey, Jilong Kuang and Jun Alex Gao: *Automated Time Synchronization of Multimodal Cough Events from Mobile Devices*. In: ACM International Conference on Multimodal Interaction (ICMI '20), 2020.
- 3 Stephen Xia, Daniel de Godoy, **Bashima Islam**, Md Tamzeed Islam, Rishikanth Chandrasekaran, Yen-Chun Chen, Shahriar Nirjon, Peter R Kinget, Xiaofan Jiang: *Improving Pedestrian Safety in Cities using Intelligent Wearable Systems*. In: IEEE Internet of Things Journal (IoTJ '19), 2019.
- Ravi Srinivasan, Md Tamzeed Islam, **Bashima Islam**, Zeyu Wang, Tamim Sookoor, Omprakash Gnawali and Shahriar Nirjon: *Preventive Maintenance of Centralized HVAC Systems: Use of Acoustic Sensors, Feature Extraction, and Unsupervised Learning*. In: Proceedings of Building Simulation, 2017.
- Md Shihabul Islam, Mohammad Ali, Kazi Hasan Zubaer, Saiyma Sarmin, Md Tamzeed Islam, **Bashima** Islam, A.B.M. Alim Al Islam and Asif Mohaisin Sadri: *Trusted Worrier: A Low-Cost and High-Accuracy User Authentication System for Firearm Exploiting Dynamic Hand Pressure Biometrics*. In: IEEE International Conference on Networking, Systems and Security (NSyss '17), 2017.

Peer-Reviewed Workshop

- Bashima Islam: PhD Forum Abstract: Scheduling Tasks on Intermittently Powered Systems. In: PhD Forum in ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN '20), 2020.
- **Bashima Islam**, Yubo Luo, Seulki Lee and Shahriar Nirjon: *Time-Aware Deep Intelligence on Batteryless Systems*. Work in Progress Paper. In: Proceedings of IEEE Real-Time and Embedded Technology and Application Symposium (**RTAS '19**), 2019.
- Bashima Islam, Md Tamzeed Islam and Shahriar Nirjon: LoRaIn: Making a Case for LoRa in Indoor Localization. Work in Progress Paper. In: IEEE International Conference on Pervasive Computing and Communications, (PerCom '19), 2019.
- Md Tamzeed Islam, **Bashima Islam** and Mohammed Eunus Ali: A System for Identifying and Visualizing Influential Communities. In: Workshop on Social Data Analytics and Management, (VLDB '16), 2016.

Peer-Reviewed Posters and Demos

- **Bashima Islam**, Yubo Luo and Shahriar Nirjon: Poster Abstract: On-Device Training from Sensor Data on Batteryless Platforms. In: ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN '19) 2019.
- Bashima Islam, Md Tamzeed Islam and Shahriar Nirjon: A Motion-Triggered Stereo Camera for 3D Experience Capture. In: ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN '18), Porto, Portugal 2018.
- Stephen Xia, Daniel de Godoy, **Bashima Islam**, Md Tamzeed Islam, Shahriar Nirjon, Peter R. Kinget and Xiaofan Jiang: A Smartphone-Based System for Improving Pedestrian Safety. In: IEEE Vehicular Networking Conference (VNC '18) 2018, Runner-Up Best App Award and Best Presentation Award.

- Rishikanth Chandrasekaran, Daniel de Godoy, Stephen Xia, **Bashima Islam**, Md Tamzeed Islam, Shahriar Nirjon, Peter R. Kinget and Xiaofan Jiang: *Demo Abstract: SEUS: A Wearable Multi-Channel Acoustic Headset Platform to Improve Pedestrian Safety*. In: ACM Conference on Embedded Network Sensor Systems (Sensys '16). 2016, *Best Demo Runner Up*.
- Tanzila Choudhury, **Bashima Islam** and A. B. M. Alim Al Islam: *Poster Abstract: Super-savior: A System to Aid Combating Harassment and Violence Against Women*. In: Proceedings of Workshop on Women Empowerment through ICT: Higher Studies, Research and Career (WE-ICT '14). 2014, *Popular Poster Award*.
- **Bashima Islam**, Md Tamzeed Islam, Zaheen Mustakin, MM Haque and Hasan Shahid Ferdous: *Demo Abstract: Happy Watch: A Portable Health Monitoring System*. In: Workshop on Design and Implementation of Emerging & Computing Systems (WDIECS '13). 2013, *Best Demonstration Award*.

Selected Research Experience

University of Illinois at Urbana-Champaign

Mentor: Dr. Romit Roy Chowdhury and Dr. Nancy McElwain

■ Topic: Monitoring Development of Infant and their Interaction with Parents [2021–2022]

- Understanding the relating between mental development and the interaction with parents from infant's acoustic and motion activities and heart-rate variability.

Dept of Computer Science, UNC Chapel Hill

Mentor: Dr. Shahriar Nirjon

- Topic: Time-Aware On-Device Computing and Deep Inference in Intermittently-Powered Systems. [2018–2020]
 - Proposed scheduling algorithms for *intermittent* systems by integrating *real-time* systems with characteristics intermittent energy.
 - Proposed an imprecise DNN structure for on-line on-device learning in batteryless system.
 - Implemented real-time scheduler with multiple tasks including imprecise deep neural network in a small embedded system (e.g., MSP430FR5994).
 - Studied energy harvesting patterns of different sources and proposed a metric to characterize them.
 - Provided scheduling analysis and necessary conditions for proposed scheduling algorithms.
- Topic: Complex Assessment of Military Performance (CAMP). [2019–2020] Funding Source: U.S. Department of Defense.
 - Worked on the Response Time Analysis system which indicates the presence of concussion.
 - Developed the complete system which is currently in pilot test at Fort Bragg, North Carolina, which is a military installation of the United States Army in North Carolina. This system will be deployed in two other military installation in future.
 - Faculty Collaborators: Karen McCulloch (Department of Allied Health Sciences, UNC), Oleg Favorov (Department of Biomedical Engineering, UNC), Robert Hubal (School of Pharmacy, UNC) and Amy Cecchini (Womack Army Medical Center).
- Topic: 3D Reconstruction in Low-Resource Systems. [2017–2018]
 - Proposed an optimized 3D reconstruction framework for resource-constrained body-camera systems that utilizes human movement to minimize computational and energy cost.
 - Defined a quality metric for 3D point clouds using their structural similarity index.
 - Formulated an *optimization problem* that finds an *optimal trigger-point* for the body camera to prolong its battery life while maximizing the quality of the captured 3D environment.
 - Implemented structure from motion on Raspberry Pi using OpenCV.
- Topic: Pedestrian Safety by Audio Sensing. [2016–2018]
 - Funding Source: NSF CSR: CHS: Medium: Improving Pedestrian Safety in Urban Cities using Intelligent Wearable Systems. Award #1704469.
 - Created a *custom wearable system* and smartphone application for car detection and localization.
 - Implemented machine learning pipeline to detect and localize cars using acoustic features from multichannel audio recordings.
 - Faculty Collaborators: Xiaofan Jiang and Peter R Kinget (University of Columbia).

Digital Health Lab, Samsung Reseach America

Mentors: Dr. Md Mahbubur Rahman and Dr. Tousif Ahmed

Selected Research Experience (continued)

■ Topic: Breathing Phase Detection and Biomarker Estimation using Audio. [2020]

- Redesigned the *teacher-student network* architecture by fusing signal processing technique with a deep learning model and transferring knowledge from inertial sensing modality to acoustic sensing modality to eliminate the need of breathing sound annotations.

Nokia Bell Labs

Mentors: Dr. Mostafa Uddin and Dr. Sarit Mukherjee

- Topic: Passive Localization of Bluetooth Low Energy (BLE) devices. [2017]
 - Exploited reflection and multipath profiling to passively determine range of BLE peripheral devices.
 - Modified source code of Ubertooth One and implemented BLE protocol in software defined radio (HackRF).
 - Part of my work has been deployed as a demo in the *Future X Lab* to showcase localization of visitors in real-time.

Teaching Experience

Department of Computer Science, University of North Carolina at Chapel Hill

- Topic: Motion-Triggered Stereo Body Camera for 3D Experience Capture and Preview.

Spring 2019 **Teaching Assistant**, Mobile Computing Systems (COMP 433).

- Course Description: An undergraduate course that covers the basics of Mobile Applications development using Android APIs, and selected topics on Mobile Systems.

- Number of Students: 37

- Responsibilities: Held weekly office hours and assisted students with programming assignments to understand object-oriented programming and Android APIs. Graded programming assignments and classworks including programming tasks and application design.

Fall 2019 **Teaching Assistant**, Embedded Intelligent Systems (COMP 790).

- Course Description: A graduate course that teaches the advancement of intelligent mobile and embedded systems. Along with research paper presentation and discussion it has lab sessions for learning embedded programming and PCB development.

- Responsibility: Assisted in lab sessions by providing hands-on instructions to the students about the fundamental of PCB designing, printing, and assembly.

Mentorship Experience

Undergraduate Students

- Sultan Mahmud Sajal, Dept. of Computer Science & Engineering, Bangladesh University of Engineering and Technology.
 - Current: Ph.D. Student, Department of Computer Science and Engineering at Pennsylvania State University.
- Rubaba Hasan, Dept. of Computer Science & Engineering, Bangladesh University of Engineering and Technology.
 - Current: Ph.D. Student, Department of Computer Science and Engineering at Pennsylvania State University.
- Saad Manzur, Dept. of Computer Science & Engineering, Bangladesh University of Engineering and Technology.
 - Current: Ph.D. Student, Donald Bren School of Information and Computer Sciences at University of California, Irvine.
- Marjan Ferdousi Orthy, Dept. of Computer Science & Engineering, Bangladesh University of Engineering and Technology.
 - Current: Chief Technology Officer (CTO) at Insight Labs-MetSys.

High School Student

Mentorship Experience (continued)

- Nithya Sampath, North Carolina School of Science and Mathematics.
 - Current: Undergraduate Student, Department of Electrical and Computer Engineering, Carnegie Mellon University.
 - Mentored Nithya during the summer before her senior year of high school and introduce her to the research in computer science.
 - Her research under my supervision resulted in a publication at Journal of Emerging Investigators.

Grant Activity - neither PI or Co-PI

- Designed figures, performed preliminary experiments, and wrote part of technical contributions. (NSF 1816213) Overheard at Home - Mitigating Overhearing of Continuous Listening Devices. Awarded: \$252,000. 2018.
- Designed figures and performed preliminary experiments. (NSF 1704469) Collaborative Research: Improving Pedestrian Safety in Urban Cities using Intelligent Wearable Systems. Awarded:\$320,782. 2017.

Professional Services and Leadership Experience

2019-2022 TPC.
- ENSsys, 2021, 2022
- LPIoT, 2021

- ACM SenSys (Poster and Demo), 2019

2020 Session Chair.

– BuildSys, 2020

- ENSsys, 2020.

- CHI, 2022

- IEEE PerCom, 2021

- IEEE Access, 2021

- IMWUT, 2020

- IEEE Internet of Things Journal, 2020, 2021

- CHASE, 2020

- Transactions on Network Science & Engineering, 2018

- MobiSys Women's Workshop, 2017

■ Secondary Reviewer.

- RTAS, 2020

- IPSN, 2017, 2020

- MMSys, 2018

2019 **Mentor**

- MobiSys 2021 Mentoring Program

- North Carolina School of Science and Mathematics - Mentoring Program

2018–2019 President, Computer Science Student Association (CSSA) at UNC.

■ Organizer and Instructor, TARHEEL Hackathon (for Middle School and High School Girls).

– Held hands-on embedded system development sessions for Middle School and High School female students (age range: 11 – 16).

2017 Organizer, The 2nd MobiSys Women's Workshop.

2017–Present Career Event Officer & General Secretary (2018-2019), Graduate Women in Computer Science at UNC.

2013–2014 Microsoft Student Partner, Microsoft Student Partners Bangladesh.

2011–2012 Reneral Secretary, Viqarunnisa Noon Science Club.

Selected Talks

Invited University Talks

October 2021 Mobile and Ubiquitous Computing, Guest Speaker, Syracuse University.

September 2021 📕 Sustainable Intelligent Everyday Objects, Guest Speaker, Worchester Polytechnic Institute.

March 2021 Computing on the Extreme Edge Devices, University of Utah (CS).

■ Computing on the Extreme Edge Devices, University of Texas Austin (ECE).

Computing on the Extreme Edge Devices, Worchester Polytechnic Institute (ECE).

Computing on the Extreme Edge Devices, Vanderbilt University (EECS).

Computing on the Extreme Edge Devices, New Jersey Institute of Technology (CS).

■ Computing on the Extreme Edge Devices, Auburn University (CSSE).

February 2021 Computing on the Extreme Edge Devices, Northwestern University (CS).

■ Computing on the Extreme Edge Devices, Syracuse University (EECS).

January 2021 Computing on the Extreme Edge Devices, Carnegie Mellon University (ECE).

Feb 2020 Introduction to Embedded Intelligence, Chancellor's Science Scholars Program, University of North Carolina at Chapel Hill.

Invited Industry Talks

Aug 2020 Tracking Breathing Biomarkers Using Smartphone Acoustic Sensor, Digital Health Lab, Samsung Research America.

Aug 2017 Rassive Ranging of Unmodified BLE Peripherals, Nokia Bell Labs. Best Presentation Award.

Conference Talks

Sep 2020 Zygarde: Time-Sensitive On-Device Deep Inference and Adaptation on Intermittently-Powered Systems, the ACM international joint conference on pervasive and ubiquitous computing (UBICOMP) 2020.

Apr 2020 Scheduling Computational and Energy Harvesting Tasks in Deadline-Aware Intermittent Systems, IEEE Real-Time and Embedded Technology and Application Symposium (RTAS), CPS-IoT Week 2020.

Scheduling Tasks on Intermittently Powered Systems, PhD Forum in ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN), CPS-IoT Week 2020.

Apr 2019 Time-Aware Deep Intelligence on Batteryless Systems, IEEE Real-Time and Embedded Technology and Application Symposium (RTAS), CPS-IoT Week 2019.

Jun 2018 Rethinking Ranging of Unmodified BLE Peripherals in Smart City Infrastructure, ACM Multimedia Systems Conference (MMSyS) 2018.

References

Available on Request