Faculty Member Contact Information

Name	Mousam Hossain
Contact Info	
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Department	Electrical and Computer Engineering

1 Funded, Unfunded URCA Assistant

	This position is **ONLY** open to students who have declared a major in this discipline.	
	This project deals with social justice issues.	
X	This project deals with sustainability (green) issues.	
X	This project deals with human health and wellness issues.	
	This project deals with community outreach.	
	This mentor's project is interdisciplinary in nature.	

Are you willing to work with students from outside of your discipline? If yes, which other disciplines?

No

How many hours per week will your student(s) be required to work in this position?
(Minimum is 6 hours per week; typical is 9)

9

Will it be possible for your student(s) to earn course credit?

Location of research/creative activities:

Engineering Building EB2020

Brief description of the nature of the research/creative activity?

The main effort I pursue in my lab is designing evolvable computing architectures for embedded machine learning (ML) and edge-IoT applications, including reconfigurable hardware, high performance and low-power designs, and emerging technology-based next-generation computing.

The research can be categorized in two levels. URCA students can be engaged in numerous aspects of these projects, and enhance their skill set in the process.

At the architecture level, we have a distributed framework that utilizes the emerging spintronic-based devices for energy-efficient and reliable in-memory processing with run-time configurability of neuronal activation function, as per the target application requirements. We have developed an energy-efficient processing-in-memory architecture for pattern recognition ML applications with adaptable neural activations. We are working to expand the deep learning models to include other datasets, for evaluation accuracy of the platform.

At the application-level, we have explored optimization of ML and object detection algorithms on hardware. The project aims at investigating novel, energy, and resource optimized neural network frameworks for efficient video prediction on FPGAs.

Brief description of student responsibilities?

The URCA Assistant will be exploring circuit level implementations of these spintronic devices for different applications. They will also participate in incorporating new datasets into our existing in-memory computing platform, which is built for data inferencing and handwritten digit recognition. The URCA student will be responsible for conducting necessary developmental changes to our framework (MATLAB, Python and HSPICE-based platform), and validating it in terms of achieving acceptable image recognition accuracy. Students should have a basic idea of Digital Electronics (CMOS design fundamentals) and Computer Organization & Architecture

URCA Assistant positions are designed to provide students with *research or creative activities* experience. As such, there should be measurable, appropriate outcome goals. What exactly should your student(s) have learned by the end of this experience?

By the end of the experience, the student will be able to:

1) Implementing hybrid spin-CMOS circuit designs in HSPICE software

2) Develop skills in MATLAB and python for software development

3) Acquire hands-on skills and knowledge in machine learning and neural networks, memory systems architecture, ML hardware and post-CMOS emerging device applications, which are an active area of research and employment

4) Learn about formatting and drafting technical research papers, presenting research data in a professional manner, and communicating ideas in a research environment

Requirements of Students

If the position(s) require students to be available at certain times each week (as opposed to them being able to set their own hours) please indicate all required days and times:

There are no set times necessary, and the schedule can accommodate the student, as long as the work effort is totaling the said number of weekly hours.

If the location of the research/creative activities involves off campus work, must students provide their own transportation?

No off-campus work

Must students have taken any prerequisite classes? Please list classes and preferred grades:

CS 140

Other requirements or notes to applicants:

The ideal applicant must have experience with Python and MATLAB. Some knowledge on CMOS designs is an added skillset