Department of Electrical Engineering and Computer Science

HOWARD UNIVERSITY

6th Annual Capstone Design Day
Friday, April 12, 2024
Sponsored by the ATT Corporation

At
Howard University
INNOVATION CENTER
Mackey Building, 2336 Sixth Street, Northwest
Washington, DC 20059

Keynote Speaker

Kelvin D. Sims
Senior Vice President of Bechtel Corporation

Kelvin Sims is a Senior Vice President of Bechtel Corporation. Since joining Bechtel as a college hire in San Francisco, Kelvin has held various positions of increasing responsibility on environmental, petrochemicals, mining, and energy projects across the globe. He's a proven leader, helping customers transition to meet clean energy demand and expand multi-modal transportation options around the world.

He has led the U.S. region responsible for its portfolio of power, communications, aviation, rail, and civil infrastructure projects. His team successfully developed and completed the Cricket Valley Energy Center in New York, as well as the Southfield Energy Center in Ohio, by implementing the most advanced and sophisticated technologies to convert natural gas to electricity. Also under his leadership, Bechtel completed the 695-megawatt Keeyask Hydropower Generation Station, advanced Edmonton's Valley Line – Light Rail Project, and secured the Metrolinx' Delivery Partner contract for the new 15.6-km Ontario Line.

Kelvin has worked on projects in seven countries and in the corporate office. He also had the distinct honor of working alongside Bechtel's chief executive officer and chief operating officer as their executive assistant from 2014 to 2016. His Bechtel experience covers assignments in every Bechtel business unit; this has provided him the global experience in project execution and management to deliver the most complex projects of our generation. Kelvin holds a bachelor's degree in marketing with a minor in international business from California's San Jose State University. He also serves on the advisory board for Howard University's School of Business and College of Engineering and Architecture.

Schedule of Activities

8:30 am – 9:00 am **Registration and Breakfast**

9:00 am – 9:15 am **Welcome and Overview**
Dr. John Anderson, Dean
College of Engineering and Architecture

9:15 am – 3:00 pm **Capstone Design Presentations**

Session 1: Innovation Center – Electrical & Computer Engineering Projects (Parallel session)

9:15 am – 9:30 am

- **Team 1:** D2
- **Project Title:** Deliveroid Enhancement
- **Mentor/Advisor**: Charles Kim
- **Team Member(s):** Mohammed Akinbayo (CPE), LaDelwyn Mealey (EE), Anthony Berry (EE)
- **Project Goal:** To add on further enhancements to the deliveroid bot, including automated driving capabilities and computer vision.
- **Problem Statement:** The current robot is not able to drive automatically or detect/avoid obstacles which could lead to damage to the robot. The approach to this problem is to equip the robot with cameras and program in obstacle avoidance algorithms. This will allow the robot to drive on its own smoothly and avoid obstacles. The competitor to this approach would be to use motion sensors instead.

9:30 am – 9:45 am

- **Team 2:** PCC
- **Project Title:** Photonic MicroCavities with High-Q Resonances in PIC waveguides
- **Mentor/Advisor:** Eric Seabron
- **Team Member(s):** Reanna Jones (CpE), Dequane Nealy (EE), Johan Milele (EE), Brandon Sierra (CpE)
- **Project Goal:** Develop several unique microcavity PIC devices, and catalog strong modes to optimize NMC waveguide designs.
- **Problem Statement:** Inside photonic integrated circuits, microcavities, also known as waveguides, have a very simple design but constitute one of the largest components. Our approach involves developing several unique microcavity PIC devices designs, and cataloging strong modes to optimize. The benefit of this design is an increase in figures of merit including enhancement of light propagation and a clearer signal (1 or 0) for computing. An increase in these figures of merit for our design would make PICs more useful in devices that are sensitive to signals like sensors.

9:45 am – 10:00 am

- **Team 3:** Photon2
- **Project Title:** Phase Change Photonic Circuit

- **Mentor/Advisor:** Eric Seabron
- **Team Member(s):** Juwon Wharwood (CpE), Sabien Sykes (EE), Goodness Atanda (CpE), Victor Iyke-Osuji (CpE)
- **Project Goal:** To design a working phase change photonic system
- **Problem Statement:** Phase change systems are large with unpredictable delay issues. Therefore we propose the design of a smaller system while accounting for the longest possible delay during the design process. This device will maintain the benefits of a regular phase change system, such as high system responsiveness and power. While smaller systems sacrifice some power, cost of the overall system are reduced making it more appealing for consumer use in new avenues.

10:00 am – 10:15 am
- **Team 4:** UAV
- **Project Title:** Drone Competition
- **Mentor/Advisor:** Danda Rawat
- **Team Member(s):** Adebola Babatunde-Lawal (CpE), Emmanuel Igban (EE), Philips Akinbami (EE), Lauren Dewberry (EE)
- **Project Goal:** To build/design a drone that conforms to competition guidelines
- **Problem Statement:** People need to access moving ground objects with the use of an autonomous flying drone. We have come to a few conclusive ideas that would allow the drone to make autonomous decisions in determining who is an ally or an enemy on the ground level. Customers will use drones to perform tasks in dangerous environments for military use in targeting enemies from afar. Our project will allow people to access environments that could pose threats to them, which will allow them to avoid injuries/harm.

10:15 am – 10:30 am
- **Team 5:** UGV
- **Project Title:** Unmanned Ground Vehicle (Drone Challenge)
- **Mentor/Advisor:** Danda Rawat
- **Team Member(s):** Ernest Olopoenia (EE), Teminijesu Oyedele (CpE), Chidi Onyekwelu (EE), Oghosa Osaghae (CpE)
- **Project Goal:** To build/design an unmanned ground vehicle that conforms ro competition guidelines
- **Problem Statement:** The ground vehicle should be able to autonomously navigate through a predefined course, recognize and avoid obstacles in its path can communicate with a drone. We looked into adding features such as a GPS module, obstacle detecting sensors on each side of the vehicle, and Wi-Fi or Bluetooth modules. These features can help ensure a vehicle that always takes optimized routes, prioritizes a safe and smooth operation all while communicating and working with a drone. The vehicle uses the selected optimized routes, data from the sensors and drone to ensure it reaches its destination using the quickest available route, while avoiding any obstacles on the way.

10:30 am – 10:45 am
- **Team 6:** SLAM
- **Project Title:** Simultaneous Localization and Mapping (SLAM)
- **Mentor/Advisor:** Eric Seabron

- **Team Member(s):** Ahmad Abdur-Rahman (CpE), Karci Gibson (EE), Ayron Fears (CpE), Alayen Pratt (CpE), Robert Jones (CpE)
- **Project Goal:** Implementation of SLAM algorithm on an autonomous vehicle
- **Problem Statement**: We aim to introduce a new standardization of autonomous vehicular design using the ORB SLAM-2 algorithm on a Raspberry Pi and FPGA. Our implementation will drastically improve processing and executable timing in addition to SWAP-C-related trade-offs and overall human safety. It will further address the need for a hardware-centric design to optimize the precision, efficiency, and navigation that is constrained by software-based designs. Our approach will be able to map its environment at the necessary speed for commercial driving because of its hardware-driven design that utilizes principles such as pipelining in its operation.

10:45 am – 11:00 am

- **Team 7:** Power
- **Project Title:** Power Integrity Evaluation System
- **Mentor/Advisor:** Su Yan
- **Team Member(s):** Anu Upadhyaya (CpE), Joanne Ukawuilulu (EE), Hridweek Karki (CpE), Kemar Jordan (CpE)
- **Project Goal:** Design a system to measure power voltage fluctuation and power distribution network noise.
- **Problem Statement:** Mitigating Power Delivery Network (PDN) noise is essential for efficient power distribution and to ensure proper functioning of electrical systems present in modern electronic devices. Our approach is to design a power delivery network for a common circuit found in modern electronic devices and a power integrity tester for that circuit, then test, simulate, and fabricate PCBs for it. Our design ensures proper identification and evaluation of different noises in the power delivery network of the specific circuit thereby resulting in optimal power integrity for the system. It's a better evaluated study of the specific circuit with a precise validation system for debugging that will be beneficial to other engineers while incorporating that specific circuit to other complex systems.

11:15 pm – 12:00 pm	PROJECT DEMONSTRATION
12:00 pm – 1:00 pm	**LUNCH**
1:10pm – 2:00pm	**Award Ceremony**
2:00pm	**End of the event**