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Bluetooth Location Mapping of Data Center Assets

Two Sentence Elevator Pitch:
Dell EMC data centers around the world have thousands of servers, storage products, and networking devices. Students on the Dell project team will use available Bluetooth technology to reliably map the location of these assets, helping data centers with hardware audits, deployment planning, power delivery planning, and environmental balancing.

Abstract:
Dell EMC is one of the largest Enterprise Hardware and Solution providers in the world. Data centers may have thousands of servers, storage products, and networking devices. Maintaining, controlling, and tracking all of these assets are daunting tasks for information technology professionals.
A method is needed to track and locate the physical location of these assets. Solving this problem is a key foundational component to enabling portions of Dell EMC's long-term data center vision. Many asset-tracking methods exist, but most are relatively manual and require data entry or the scanning of every device in a data center. Other solutions require proprietary data center infrastructure that make the solutions expensive or work only on a single provider's hardware.

Students on this team can leverage the background research from the 2019 Dell project and developing an asset tracking system based on new Bluetooth 5.1 angle of arrival technology.

Impact:
The final prototype will map location of the assets and help data center planners with hardware audits, deployment planning, power delivery planning, and environmental balancing.

Scope:

Minimum Viable Product Deliverable (Minimum level of success)

- Develop a method of identifying an asset's relative location in a rack leveraging solution strength and elevation data available in new Bluetooth 5.1.
- Prove the method is feasible in a laboratory environment.

Expected Final Deliverable (Expected level of success)

- Incorporate a centralized position engine and user interface (UI) to map the asset in the data center.
- Create a functional proof of concept that is validated in a production / near production environment.

Stretch Goal Opportunities (High level of success - May include one or more of the following)

- Associate the asset location information to a real server in a rack/data center
- Assigned the asset location information to the final server using asset tag and IP information.
- Develop a wayfinding mobile solution with the location data.

Student Skills:

MDP Sponsored Projects are both a professional and academic learning experience for students. By participating in this program, students are actively preparing for graduate school and a professional career. As part of the experience, MDP expects professional behavior. To best prepare you for future professional opportunities, your experiences on this MDP team will be very broad. In addition to key technical skills that you will bring to the team, you will engage deeply in the self-directed learning of new and important concepts, demonstrate flexibility, collaboration, and cooperation, and develop strong professional communication skills. This also means that you will need to be able to work outside of your traditional area of study in the true multidisciplinary nature of our projects. You won't always be able to anticipate how your skills and expertise will be used, so the MDP Sponsored Project will challenge you to grow and develop as a professional.

Project Area	**Specific Skills**	**Likely Majors**
General Programming (2 students)	General Programming skills, good software engineering practice and design	CS (All) EE (BSE) CE (BSE) DATA (MS/MSE) Any
Signal processing + Bluetooth (2 students)	Familiarity with Bluetooth functionality, signal processing and general programming	EE (BSE) CS (All) DATA (MS/MSE) Any
Embedded Programming (1 student)	Practical Experience with embedded programming; real time OS or embedded Linux	CE (BSE) CS (All) EE (BSE)
User Interface Design (1 student)	UI/UX Design, usability studies, graphic design experience/interest desirable and general programming	SI (MS) ARTDES (ALL)

Additional Desired Skills/Knowledge/Experience

Any of the following Skills, Knowledge, Experience, Interest or Outlook, would be valuable to the 2020 team. We don't expect students to be familiar all or even most of the technical items, but strong candidates will have familiarity or experience with *some* of them and a positive attitude to learn what is necessary as the project gets underway. Please highlight your experience with any of the items on this list in your personal statement on the application.

- C, C++, JAVA and Restful Web services
- DMTF Redfish standards

Location:

All work will take place on North Campus. Some testing/validation may be performed at a local Dell location (MDP will provide transportation).

Sponsor Mentor:

Arulnambi Raju

Arulnambi is a Distinguished Member of Technical Staff in the Dell Server and Infrastructure Systems organization (Firmware Engineering). He has been working at Dell for the past 9 years. Arul has extensive experience in the design and development of Remote server management and At the box wireless (Bluetooth, WiFi) management solutions. He has experience in mentoring college graduates and junior engineers. Arul holds 8 US patents and 6 pending patents.

Executive Mentor:

Choudary Maddukuri

Choudary is a Distinguished Engineer in the Dell Server and Infrastructure Systems organization (firmware engineering). Choudary has been working at Dell for the past 20 years and has extensive experience in Embedded Systems Management and Systems Management Protocols. He has delivered multiple generations of Embedded Systems Management solutions starting from ESM (Dell proprietary) to BMC (IPMI) and the current iDRAC. Over this period Choudary was instrumental in maturing the product from a Dell proprietary management solution to the current industry leading and most advanced management controller (iDRAC). Choudary holds 11 US patent and 14 pending patents.

Faculty Mentor:

Shai Revzen
Assistant Professor, Electrical and Computer Engineering

Shai's research interests include the study of bio-inspired robotics and new methods and mechanisms for control. He has also been involved with the scientific study of animal and human locomotion based on nonlinear dynamical systems, and application to design of legged robotic vehicles and other devices.

Legal Requirements:
Citizenship Requirements.

- This project is open to all students on campus.

Intellectual Property Agreements / Non-Disclosure Agreement

- Students will sign IP/NDA document(s) that are unique to Dell.

Summer Project Activities

- Dell, as a company, offers summer internships every year. Interested students are invited to apply online for any intern positions – internships/interviews are not guaranteed for students on this project team.

Company Information:
As a powerhouse of seven technology leaders, Dell Technologies is committed to transforming businesses, shaping the future of innovation and developing technologies to drive human progress.

At Dell Technologies, our purpose is to drive human progress, through greater access to better technology, for people with big ideas around the world.

It's a journey that began over a generation ago, in our founder Michael Dell's Texas University dorm room. He believed he could provide customers with more powerful technology at a better value by rethinking how computers were manufactured and delivered.

Around the same time, Richard Egan and Roger Marino started EMC; first delivering compatible memory boards with higher reliability, then delivering data storage solutions scalable to enterprise level.

These journeys completely changed the way the world sources, builds and sells technology.

For Dell, it was selling technology directly to people, rather than through retail outlets. For EMC, it was Symmetrix, a data storage solution that transformed the way data centers operated in large enterprises. By the new millennium, both Dell and EMC were market leaders.

https://www.delltechnologies.com/en-us/index.htm