BIN

Bucket Indicator Network

ELECOMP Capstone Design Project 2026-2027

Sponsoring Company:

VoltServer Inc.
42 Ladd St, Suite 227
East Greenwich, RI 02818
http://www.voltserver.com

Company Overview:

VoltServer's founder and CEO, Stephen Eaves, knew the energy sector needed smarter, transformation-friendly solutions. His goal was simple: to make electricity inherently safe. With his 15 patents and patents pending for energy storage and power conversion, Eaves set out to make his mission a reality. Thanks to great leadership, partners, and venture capital backing, VoltServer® began shipping products in early 2014. Its patented Digital Electricity® solution revolutionizes how power is distributed across buildings, campuses, and even cities. From its headquarters in East Greenwich, Rhode Island, VoltServer continues to develop and deliver innovative power distribution platforms. Today, the company's Digital Electricity powers over 1,000 large sports stadiums, office towers, hotels, condominiums, medical buildings, and more. It enables 5G mobile communications, intelligent building optimization, and high-yield indoor agriculture with the power of safe, high-voltage energy.

Technical Director(s):

Jordan Garces, CSC, RIT '20
Software Engineer II, Sustaining & Test Engineering Team
jordan.garces@voltserver.com
https://www.linkedin.com/in/jordan-garces

Camilo Giraldo, ELE, URI '17
Team Manager, Sustaining & Test Engineering Team
camilo.giraldo@voltserver.com
https://www.linkedin.com/in/camilo-giraldo-b41a73b6

Project Motivation:

Similar to many other lab settings where experimentation and design take place, VoltServer has an entire wall in our lab at headquarters dedicated to storing useful materials, cable assemblies, testing components, and equipment. The wall is loosely organized using storage bins which are each dedicated to a single type of item. Ultimately, anyone who is trying to handle any type of test, design, or validation task at VoltServer headquarters will come to this wall at one point or another to retrieve an item required for their task. Since there is no actual structure to the wall, which is a level of freedom we would like to maintain, it can become cumbersome to find items quickly; ***normally the storage bins are never placed back in their original location.***

Someone looking for an item at the wall may spend between 3-5 minutes looking for the correct bin where the item is stored. This seems like a small amount but compounding this by the number of employees that use the wall, as well as the number of times they each require an item from the wall, ***it adds up to a significant quantity of lost time***.

Anticipated Best Outcome:

The Anticipated Best Outcome consists of the development of a proof-of-concept system that can point out a specific bin that a user is looking for on the wall. The system needs to be able to take input from a user that came up to the wall looking for a specific item. Ideally, this will be in the form of a GUI but other ways to implement this are possible. The system must then perform some processing to determine the bin that the user is attempting to find. On the specified storage bin, a separate piece of hardware will be instructed to signal its location to the user. This will ideally be a blinking LED, but alternate ways to implement this are possible. The team will be expected to deliver the following:

- A complete bill of materials for the UI hardware
- A complete bill of materials for the storage bin receivers
- Well commented firmware and UI source code and compiled binaries, if applicable
- A system user manual describing the hardware, firmware, and application, as well as any necessary descriptions or justifications, where applicable
- Schematics, layout, fabrication, and assembly files for PCBs
- At least one working prototype of the headend UI peripheral
- At least one working prototype of a storage bin receiver

Project Details:

"The Wall":

Requirements for UI peripheral:

- User input: This can be in the form of a graphical interface but other ways to implement this are possible.
- Straightforward bin registration/item modification
- Bin/item search algorithm
- Wireless transmission of indication signal to storage bin receiver
- Power supply circuit for UI

Stretch Goals:

- User interface uses voice commands for search and bin identification tasks
- GUI displays approximate location of bin on the shelves
- Web access to the interface, to be accessible via network
- Bin receiver low battery notifications

Requirements for bin receiver peripheral:

- System output: The storage bin receiver has the sole task of receiving the indication signal from the UI and signaling to the user.
- Power supply circuit for bin receiver - Battery life: > one year prior to maintenance
- Wireless reception of indication signal from UI
- Active bin indicators are easy to identify among the others
- User input to let system know bin has been found
- Ability to easily charge or swap battery

Stretch Goals:

- Secondary indicator mode for especially bright conditions or low power modes
- Battery/power level monitoring

Hardware and Electrical Tasks:

- Identify potential major system components: LEDs, embedded processor, DC/DC converters, sensors, wireless communication, etc.
- Develop schematics for at least one related PCB, identifying how all system requirements are being met.
- Layout design of at least one related PCB
- Build and validate at least one related PCB
- Document all aspects of the hardware development and subsequent testing

Software/Firmware Tasks:

- Implement GUI operation:
  - GUI must be able to easily add or edit existing storage bins
  - GUI must have accurate searching abilities
  - GUI must be intuitive and accurate
  - GUI must be able to detect proper storage bin
  - GUI must send indication signal to the proper storage bin receiver
- Implement storage bin receiver operation:
  - Receivers must identify themselves to GUI
  - Receivers must activate based on GUI wireless indication signal
  - Receivers must clearly physically identify themselves to user
  - Receivers must deactivate based on user input

Composition of Team:

2 Electrical Engineers & 2 Computer Engineers

Skills Required:

Electrical Engineering Skills Required:

- Low power embedded circuit design
- Power supply circuit design
- Microprocessor circuit development
- Wireless communication circuit design
- Schematic capture
- PCB layout

Computer Engineering Skills Required:

- GUI design
- Microprocessor/microcontroller initialization/configuration
- Microprocessor/microcontroller programming
- Wireless data protocols
- Signal processing

Anticipated Best Outcome's Impact on Company's Business, and Economic Impact

The impact a system like this would have on the engineering team's productivity would be significant. In an ideal world, the amount of time spent in front of the wall looking for an item is less than thirty seconds per item. Being able to install this system would mean less time spent in front of the wall and more time that can be dedicated to getting tasks completed. This should translate into tasks being finished with quicker effect, which should in turn result in launching more projects in a shorter amount of time.

Broader Implications of the Best Outcome on the Company's Industry:

Realistically, having this system installed would generate an instant productivity boost for everyone in VoltServer headquarters that visits the wall for an item. Looking forward, a potential application for this type of system could be for a warehouse organization network. Currently the warehouse staff is expected to memorize the locations by their warehouse code which can be confusing and easy to forget. Having a physical cue that indicates where an item lives within the warehouse relieves the necessity of memorizing all of the location codes for the warehouse.

Appendix A: AI Use Policy – Bucket Indicator Network

Allowed

- Students may use AI tools for

  ☒ brainstorming support

  ☒ concept development

  ☒ literature and publicly available documentation review

  ☒ software development

  ☒ debugging

  ☒ data analysis

  ☒ test development

  ☒ non-proprietary paragraph editing

  ☒ non-proprietary single-slide formatting

  ☒ preparation of project deliverables

  ☒ note taking or transcription of meetings

  ☒ Others: Any within URI guidelines

Not Allowed

- Using AI in violation of university policies, applicable laws, or course-specific rules identified by capstone instruction team and project-specific rules identified by the technical directors.
- Entering proprietary, confidential, personally identifiable, security-sensitive, or otherwise restricted information into an AI system without authorization.
- Submitting AI-assisted work without understanding, reviewing, verifying, and appropriately disclosing its use.

- Submitting entire documents or presentations to an AI system for editing or formatting.
- Any unchecked items from the allowed list above.

Requirements

- If any use is allowed, AI tools may only be used to enhance, but not replace, students' technical reasoning, engineering judgment, and understanding. Students must be able to explain, justify, and defend all submitted designs, code, analyses, test results, documentation, and conclusions.
- During the first two weeks of the project, the student team shall work with the Technical Directors to: identify any proprietary or confidential information that may be involved in the project; determine what information may or may not be shared with AI systems; identify the AI tools, models, accounts, and configurations approved for project use; and document any project-specific restrictions or approval requirements.
- Students shall transparently document the uses of AI using the URI CYPHER AI Usage Marking guidelines (https://web.uri.edu/cypher/ai-marking/). A workshop is planned for September to familiarize students with these guidelines.
- Students retain full professional responsibility for all design decisions, analyses, implementations, testing, documentation, presentations, and final deliverables, regardless of whether AI tools contributed to the work.