Barco CTRL Internships

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About Barco CTRL:
Barco is a global technology company specializing in visualization and collaboration solutions. Their control room division is particularly renowned for providing advanced solutions for critical decision-making environments.

Barco has been developing control room solutions since 1994, focusing on enhancing situational awareness and decision-making capabilities. Their offerings include:

- **Visualization Solutions:** Barco provides high-quality video walls, including the Barco UniSee II LCD video wall and TruePix LED platform, designed for seamless and clear visualization in control rooms.
- **Control Room Software:** Barco CTRL is a software platform that manages information flow efficiently, ensuring that critical data is accessible at the right time and place.
- **Applications:** Their solutions cater to various industries, including power production, transportation, manufacturing, security operations, and healthcare. These applications help monitor and control critical assets, ensuring optimal performance and safety.

Barco's control room solutions are designed to support digital transformation and provide comprehensive situational overviews, making them a preferred choice for professionals in mission-critical environments.

Our internships offer

- Hands-on experience with real-world projects and innovative technologies.
- Mentorship from experienced professionals in the field.
- Opportunity to work on impactful projects and make a real difference.
- A collaborative and inclusive work environment.
- Potential for future employment opportunities based on performance.

Practically

The following pages will describe the available topics for internships. All topics are guidelines and can be finetuned based on the student's interests. The minimum duration for internships is one month, but duration is negotiable, depending on the topic.

If interested, apply to the link in the internship details or reach out to the contacts listed at the top of this document.

Component testing – C, Docker & Automation

Input manager validation in Barco CTRL decoder

One of the key features of CTRL is that large desks (up to 16 monitors) can show different video streams, applications and remote desktops while being controlled from a single keyboard, mouse, and optionally a multi-touch touch screen. Although the video rendering is distributed, the input events are processed on and distributed by a single node of the desk. The distribution of those events between different rendering nodes needs to be validated for all types of events and gestures.

The component responsible for this distribution is called *Input Manager*. It is written in C, packaged into a Debian package and runs as a systemd service on all nodes.

Request:

Validate the Input Manager. This includes developing a comprehensive validation plan, writing tests, executing them from within a Docker container, and automating validation.

Technologies: C, Docker, Debian Linux, test frameworks, Jenkins, git, VS Code, Copilot

Key Responsibilities:

- **Determine the method of validation:** Analyze the Input Manager to identify the best approach for validation. This includes understanding the program's functionality and identifying key areas for testing.
- **Validate:** Create a detailed plan outlining the validation process, including the scope of testing, test cases, and expected outcomes.
- **Implement:** Write and implement unit tests for the Input Manager. These tests will be performed inside a Docker container.
- **Automate:** Integrate the validation into our current release process to avoid regressions in future releases.
- **Document:** Prepare detailed reports on the validation process, including test cases, results, and recommendations for improvements.

Qualifications:

- Enrolled in a bachelor's or master's program in Computer Science, Informatics, Electronics, or a related field.
- Strong knowledge of C programming language.
- Experience with writing and executing unit tests.
- Familiarity with Docker and containerized environments.
- Excellent analytical and problem-solving skills.
- Effective communication and teamwork abilities.

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Python Data Processing – JSON to Dataclasses

Robust configuration handling in Barco CTRL decoder

During installation of a Barco CTRL desk or wall the devices communicate over a configuration system called Spider. This system shares JSON configuration data with all devices in the desk or wall. The *Spider server* is responsible for distributing the configuration while a *Spider agent* is present on all devices to parse, store and apply them. Additionally, each agent reports their device's status of the device back to the server. The Spider network uses JSON data structures to transfer data.

On the Barco CTRL decoder, the Spider agent is written in Python and (for the most part) currently parses, handles, and stores the raw JSON data. Part of the data is parsed and stored as Python dataclass objects. The purpose of dataclasses is to represent, validate, and store data efficiently.

Request:

Improve the data structure used to parse and store device configurations in the Spider agent. All JSON data should be parsed, validated, and reported using dataclasses.

Technologies: Python, dataclasses, JSON, pytest, Jenkins, git, VS Code, Copilot

Key Responsibilities:

- **Analyze current implementation:** Review the existing codebase to understand how Python dataclasses are currently used in processing parts of the configuration.
- **Implement**
  - **Extend functionality:** Adapt the entire configuration handling to fully parse and store the configuration using Python dataclasses.
  - **Status reporting:** Implement the use of Python dataclasses to report the current device status to the configuration server.
- **Validate:** Develop and execute tests to ensure the new data structure works correctly and efficiently.
- **Document:** Document the changes made, including the new data structure and any modifications to the existing code.

Qualifications:

- Enrolled in a bachelor's or master's program in Computer Science, Informatics, Electronics, or a related field.
- Strong knowledge of Python programming language.
- Bonus: Experience with Python dataclasses and handling JSON structures.
- Excellent analytical and problem-solving skills.
- Effective communication and teamwork abilities.

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HDMI Video encoding – FPGA, Linux & C++

Interlaced HDMI support on Barco CTRL video encoder

The NGS-D440 video encoder is a Xilinx Ultrascale SOC based h.264/265 encoder running Linux and multiple custom business logic C/C++ applications. It has 2 HDMI inputs, two analog audio inputs, one HDMI output and one analog audio output. This encoder is the main source of video streams in Barco CTRL setups. There is a business request for proof of concept for HDMI interlaced support on the NGS-D440, which could give the competitive edge to win projects and drive extra sales.

Request:

Implement HDMI interlaced support end to end: from analyzing datasheets, over FPGA development, Linux driver, C++ application, to Python automated testing. There is an existing study which resulted in a set of refined tasks to start with.

Technologies: HDMI, electronics, VHDL, FPGA, Linux, C, C++, Python, Pytest, GIT

Key Responsibilities:

- **Refine:** Investigate solutions, refine, and plan tasks to make an implementation plan.
- **Implement:** support interlaced HDMI sources based on the implementation plan.
- **Validate:** Develop tests to ensure functionality and robustness, integrate those tests in the component validation test suite.
- **Document:** Document the changes, including how to try the feature.

Qualifications:

- Enrolled in a bachelor's or master's program in Computer Science, Informatics, Electronics, or a related field.
- Knowledge of C++: understanding of fundamental C++ concepts and syntax
- Knowledge of Python: basic experience
- Hardware affinity: able to interpret datasheets and board schematics
- Hands on mentality: basic proficiency using oscilloscopes and other measurement tools for debugging hardware issues
- Excellent analytical and problem-solving skills
- Effective communication and teamwork abilities
- Bonus: basic knowledge or interest for FPGA development and VHDL programming
- Bonus: basic embedded Linux development
- Bonus: basic understanding of Linux kernel architecture and driver development
- Bonus: knowledge of C

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Diagnostics UI redesign – Svelte to Angular

Design and implement Barco CTRL's updated diagnostics UI

One of the main ways our service team or developers can debug an issue is using a small component within our application called the Observe UI. This component pulls in all the logging from all the components across the different devices within a control room and displays this.

Request:

This UI is written in JavaScript using the Svelte framework. It reports useful information but is still basic. We would like a new and improved version of this component using Angular with JavaScript. The new diagnostics UI can have more features this way (such as improved filtering) while having it in Angular also allows it to be closer tied to other front-end components in the application. It can then replace the old component and be released inside production. Helping our service team debug issues for customers.

Technologies: JavaScript, TypeScript, Angular, Svelte, frontend, Jenkins, unit tests, VS Code, git

Key Responsibilities:

- **Refine:** Refine and plan the work with the team, making sure you understand all tasks.
- **Implement**
  - **Initial deployment:** Create a new service within Barco CTRL
  - **Feature parity:** Strive to match the features of the current implementation
  - **Improvements:** Implement new features for the diagnostics backend
- **Validate:** Ensure service quality with automated tests
- **Document:** Document the new service thoroughly

Qualifications:

- Enrolled in a bachelor's or master's program in Computer Science, Informatics, Electronics, or a related field.
- Proficient knowledge with JavaScript/TypeScript
- Effective communication and teamwork abilities
- Bonus: knowledge about either Svelte or Angular

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Middleware migration – Study, evaluate & implement

Redesign the CTRL configuration backend WAMP middleware

The Barco CTRL backend uses a Web Application Messaging Protocol (WAMP) middleware called crossbar.io. It is written in Python, and its purpose is to collect and distribute the configuration and settings of all devices in a control room.

Request:

The crossbar.io middleware is being deprecated, and we want to replace it. Investigate alternatives, present them, and find the best candidate for replacement. Create a proof of concept that demonstrates how a Barco CTRL backend would work with the new middleware.

Technologies: WAMP, Python, data models, JSON, pytest, Jenkins, git, VS Code

Key responsibilities:

- **Investigate:** Analyze alternatives to crossbar.io
- **Analyze:** Pick a viable candidate for a proof of concept (POC)
- **Implement:** Make the POC, demonstrating its pros and cons

Qualifications:

- Enrolled in a bachelor's or master's program in Computer Science, Informatics, Electronics, or a related field.
- Proficient knowledge with Python
- Effective communication and teamwork abilities
- Bonus: Experience with web backends in Python
- Bonus: experience with WAMP
- Bonus: knowledge about crossbar.io

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Frontend Quality – Refactor, Test, and Elevate the CTRL UI

Improving the Barco CTRL configuration UI

Control room administrators set up and manage their Barco CTRL control room. They do so through an extensive web application. This application is continuously evolving, and components need to be continuously refactored and/or improved.

Request:

Improve the configuration front end of Barco CTRL. First, review the current implementation, documenting potential improvements. Then, prioritize them together with the team. Finally, implement the improvements, making sure that all modifications are fully and automatically tested.

Technologies: JavaScript, TypeScript, Angular, unit tests, component tests, Jenkins, git, VS Code

Key responsibilities:

- **Refine:** Refine, Prioritize, and plan improvements according to impact
- **Implement:** Implement them based on priority
- **Validate:** Ensure the quality of your code with automated tests

Qualification:

- Enrolled in a bachelor's or master's program in Computer Science, Informatics, Electronics, or a related field.
- Proficient knowledge with JavaScript/TypeScript
- Bonus: knowledge about Angular
- Bonus: proficient in writing unit tests and/or component tests

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