BRENO CUNHA QUEIROZ

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EXPERIENCE

Nuwa Pen ▶ 🔗 *Groningen, NL*
Sensor Fusion Engineer   Nov 2023 – Present
- Designed real-time **sensor fusion** pipeline to estimate pen motion from **IMU**, **3 cameras**, and **force sensor**
- Derived and implemented nonlinear **Kalman filters (EKF/UKF)**, improving orientation accuracy **3x** and reducing velocity error **4x**
- Developed offline and online algorithms for **IMU calibration**, reducing inclination error by **over 2x** and heading error by **over 3x**
- Built tool to collect, annotate, and **calibrate camera intrinsics/extrinsics**, reducing reprojection error **over 7x** *(implemented overnight)*
- Built **simulation**, playback, and evaluation tools with **OptiTrack** integration, integral to the team's workflow

Software Engineer   Mar 2022 – Nov 2023
- Designed and implemented the **firmware architecture** for a **Cortex-M4**-based embedded system
- Developed **camera and IMU drivers** (SPI/I^{2}C) for real-time sensor data streaming
- Integrated and programmed **FPGA** in Verilog, achieving a **15x increase** in image capture rate
- Built desktop tool in **C++/OpenGL/ImGui** for playback, inspection, and debugging, actively used by the team

U-Get (Coca-Cola) ▶ *São Carlos, BR*
Software Engineer   Dec 2019 – Sep 2022
- Built backend and admin console for **Coca-Cola smart vending machines** across Brazil
- Developed **Android** software to interface with **ESP32 cameras** and stream sensor data to the backend
- Built a **photo-realistic synthetic dataset generator**, increasing product detection accuracy by **10%**
- Deployed the tool **headlessly on servers** for continuous dataset generation using dynamic product configs

EDUCATION

University of Groningen – *AI/CS Exchange Program*   Feb 2022 – Feb 2023
Exchange Scholarship Recipient   *Groningen, NL*

University of São Paulo – *BSc in Computer Science*   Feb 2019 – Feb 2024
Specialization in Robotics. GPA 3.8/4.0. Awarded *Academic Excellence* (Top 3%)   *São Carlos, BR*

PROJECTS

ImPlot3D – **Interactive 3D Plotting** ⬡
A high-performance C++/Python 3D plotting library for visualizing 3D data interactively (★**850+** GitHub stars)
- Real-time **GPU-accelerated** rendering of 3D lines, surfaces, meshes, and point clouds
- Intuitive controls for **camera rotation, pan, zoom**, and interactive legends
- Supports custom **markers**, **colormaps**, and **visual styling**
- **Live WebGL demo:** 🔗

Atta – **Multi-Robot Simulator** 🔗 ⬡
A fast and modular C++ simulator for large-scale multi-robot systems (**40k+ LOC**)
- Built **cross-platform** simulation engine with modular **physics**, **rendering**, and **sensor** stacks
- Enabled real-time GPU/CPU simulation with dynamic switching and **CUDA** acceleration
- Designed **custom scripting engine** with hot-reload and shared library support
- Developed high-fidelity **sensor simulation** and physically based rendering for realistic environments
- Added **web support** via Emscripten; **see live demos at** 🔗

PATENTS

Handwriting detecting pen *(WO2024072219A1)*   Mar 2023 🔗
A ballpoint pen equipped with a wide-angle camera system and IMU to capture handwriting in real time and transmit it digitally; patented as part of the Nuwa Pen product.

PUBLICATIONS

B.C. Queiroz, D. MacRae, "Occlusion-based object transportation around obstacles with a swarm of miniature robots," *Swarm Intelligence*, 2024. 🔗

B.C. Queiroz, F. Ferreira, "Soccer Robots Modeling Project Based on RoboCupJunior: Simulation Environment for Physical Robot Improvement," *RoboCup 2021: Robot World Cup XXIV*, 2022. 🔗

TECHNICAL SKILLS

Programming: C/C++, Python, CMake, Verilog, GLSL, CUDA, TypeScript, JavaScript, SQL
Robotics: Kalman Filter, EKF/UKF, Visual Odometry, SLAM, Nonlinear Optimization, Sensor Fusion, Monte Carlo Simulation, ROS
Embedded Systems: Embedded C++, STM32, ESP32, FPGA, SPI/I^{2}C, UART, USB, BLE, RTOS, J-Link
Hardware & Prototyping: PCB Design (Altium Designer), CAD (SolidWorks, Onshape), Oscilloscope, Logic Analyzer, OptiTrack, Soldering, 3D Printing
Tools & Frameworks: Git, GitHub Actions, GDB, Docker, Wireshark, RenderDoc, Blender, ImGui