

# TAN KAI CONG

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Aspiring robotics engineer with extensive interdisciplinary experience across all levels of hardware and software, currently specializing in embedded systems and physical AI.

## Work Experience

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**Apicoo Robotics** | *PyTorch, ROS2, OpenCV, Isaac Lab*

May 2025 – Aug 2025

*Robotics and Machine Learning Intern*

*Hanoi, Vietnam*

- Prototyped a turnkey solution for general object sorting with an integrated eye-in-hand gripper system. Using an RGB-D camera, the system could segment, classify, and perform pick-and-place tasks, from a user-provided text prompt with minimal training overhead.
- Developed end-to-end reinforcement learning policies for a humanoid robot to walk across various terrains in Isaac Lab by using only proprioceptive data, with successful sim2sim deployment in MuJoCo.
- Collaborated with the BizDev team to create 3 promotional videos showcasing key aspects of the SuSGrip product.

**BeeX Autonomous Systems** | *Altium, C/C++, PlatformIO*

Jan 2024 – Jun 2024

*Electrical Intern*

*Singapore*

- Designed the thruster interfacing PCB to simultaneously control the 7 thrusters of the 1st-generation BETTA Autonomous Underwater Vehicle (AUV) over the Modbus RTU protocol with over-current and over-temperature protection.
- Created a stepper driver board to extend and retract the BETTA AUV's antenna by providing closed-loop control of the motor's velocity based on its load, maximizing its speed while preventing stalls and step loss.
- Developed the power architecture for Topside Lite, a miniaturized version of the Topside surface communication box for use in untethered operations, achieving a 90% weight reduction from the original.
- Revamped the hull monitoring PCB by optimizing parts placement and routing, reducing its overall size by 20%.

## Projects

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**Object Tracking System with FPGA** | *Verilog, Fusion*

Aug 2025 – Nov 2025

- Developed a real-time, colour-based object tracking system running at 30 FPS, where frame capture, image filters, blob detection and closed-loop control of a pan-tilt mechanism were all performed on a single Basys3 FPGA board.
- Integrated the system with a drag-and-drop GUI that streamed the live camera feed to a display over VGA, and allowed users to fully customise the filters used as well as the blob detection settings of the computer vision pipeline.

**RISC-V CPU on FPGA** | *Verilog, RISC-V Assembly*

Aug 2025 – Nov 2025

- Designed a 5-stage pipeline RISC-V CPU supporting the RV32IM instruction set, implemented on a Nexys4 FPGA.
- Enhanced performance with hazard detection & forwarding, 2-bit branch prediction, and vectored interrupt handling.

**STM32L4 Smart Watch** | *C, ARMv7E-M Assembly, STM32CubeIDE*

Jan 2025 – Apr 2025

- Interfaced an STM32 with 5 sensors over I2C to emulate various smart watch functionalities, most notably implementing attitude estimation using an Extended Kalman Filter, with real-time 3D orientation visualization on an OLED screen.
- Implemented Wi-Fi connectivity to a central computer with a GUI to monitor multiple STM32s from one dashboard.

**Autonomous Underwater Vehicle (AUV)** | *Altium, LTspice, C/C++, MATLAB*

Sep 2024 – Mar 2025

- Served as Electrical Lead for a 17-member team spread across 5 subdomains to design the electrical architecture of an AUV from scratch, overseeing the creation of 5 separate PCBs with a focus on ease of maintenance and integration.
- Developed the entire software stack for an underwater acoustic positioning system, which used a triangular hydrophone array with a custom algorithm to calculate the azimuth and elevation of an underwater pinger, accurate to 1 degree.
- Designed the full hardware stack of the acoustic positioning system, comprising analog filters and motherboard PCBs.

## Education

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**National University of Singapore**

Aug 2024 – Present

*Bachelor of Engineering in Electrical Engineering, GPA: 4.92/5.00*

*Singapore*

*Recipient of NUS Global Merit Scholarship*

*Member of the Electrical Team in NUS Bumblebee Autonomous Systems*

## Skills

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**Mechanical:** AutoCAD, Autodesk Fusion, SolidWorks

**Electrical:** Altium Designer, EAGLE, KiCAD, Vivado, LTspice

**Programming:** C/C++, Python, ARM/RISC-V Assembly, Verilog, MATLAB

**Robotics/ML Frameworks:** ROS2, OpenCV, PyTorch, Isaac Lab