Darren Liu

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Technical Skills

Software: Python, Java, C, C++, HTML/CSS, JS, Git, VSCode, Linux
Hardware: Arduino, ESP32, STM32, Raspberry Pi, Soldering, Circuit Design, Altium, CAN, SPI, RTOS

Experience

Midnight Sun Solar Car Team **Sep 2024 – Present**
Firmware Developer *Waterloo, ON*

- Developing an IMU **Driver** on a **Linux** virtual machine to control an **STM32** in **C**. Used datasheets and **schematics** to send and fetch sensor values from correct registers using **SPI** protocol. Used **freeRTOS** to schedule high level tasks
- Developed a self-calibration function to correct sensor gain and offset, improving data precision and reliability.

First Robotics Competition Team 7902 **Oct 2022 – May 2024**
Programming Lead *Markham, ON*

- Utilized and taught **object-oriented programming** based approach to robotics coding in **Java**
- Applied **control systems** concepts such as PID feedback loop, feedforward, and command groups to control 12+ motors through **CAN** and **PWM** to create complex **autonomous** commands.
- Implemented a **Raspberry Pi** based vision processing client and data analysis to triangulate the robot's distance from the target and automatically adjust the arm angle accordingly using object detection.
- Led a team of 6, delegated members to subsystems, conducted **rapid prototyping**, managed and merged projects from multiple branches using **Git** and **Github**. Worked on **integrating hardware and software**
- Operated robot & won finalist and judges awards at Centennial & Durham events out of **30** teams & **1000** participants

University of Toronto **Jan 2024 – May 2024**
Pure Math Research Mentee *Toronto, ON*

- Presented a research project alongside another student regarding our research findings on the composition of covering maps on topological spaces, touched on fields of math such as group theory, abstract algebra, and combinatorics

Mathnasium **Aug 2022 – Aug 2024**
Math Instructor *Markham, ON*

- Improved confidence and achievement in **60+** students per shift from a K to grade 12 level through Socratic questioning and strategic intervention, ensuring deep understanding of concepts.

Projects

Differential Swerve Drive | *C++, ESP32, Control Systems* **Jun 2024**

- Wrote low-level **firmware** in **C++** on a motor & encoder, creating a motor controller on a **ESP32 Microcontroller** with a PID feedback loop to allow precise control of speed and position and wrote higher-level code to allow full control of the 3d-printed module in two axes of rotation

Smart Trash Bin | *C++, ESP32, OpenCV, Python* **Jul 2024**

- Incorporated ultrasonic and motion sensors along with a servo motor controlled by an **ESP32** with **C++** to auto sort waste based on results from a camera running **Python** with an OpenCV (computer vision system) **machine learning model** utilizing the serial library
- Collaborated with a team to make a garbage bin gamifying the recycling process, rewarding points to users on a Flask server based on correct guesses. Points were routed to a leaderboard stored on a database

Smart Plant Pot | *C++, Arduino, OpenCV, Python* **Oct 2023**

- Used **Arduino** and **C++** with sensors to track humidity, light, and other stats, using an **LLM** to communicate its needs with TTS, to make owning a plant more engaging
- Coordinated the sensors with an LED matrix and LCD with **I2C** communication protocol & **C++** to display stats

Education

University of Waterloo **2024 – 2029**
Candidate for BASc in Electrical Engineering *Waterloo, ON*

- Academic Class Representative for Electrical Engineering 2029 Cohort