Gavin Tranquilino Mechatronics Engineering Student

Education

University of Waterloo

Candidate for BASc in Mechatronics Engineering

June 2028

Waterloo, ON • Coursework: Data Structures, Algorithms, Linear Algebra, Circuits, OOP, Microprocessors, Digital Logic (FPGA, PLC), Mechanics of Deformable Solids, Structure and Properties of Materials, Statistics, Ordinary Differential Equations

Experience

Humanoid Robotics Engineering Co-op	May 2025 – Present
WATonomous	Waterloo, ON
• Building robotic arms (6DoF) with tendon driven anthropomorphic hands (20DoF each), aiming for VR teleoperation.	
• Developing software interface to bridge high-level ROS2 control and low-level embedded systems over a CAN bus .	
• Containerizing ROS2 system in Docker , mounting CAN transceivers to enable communication between subsystems.	
• Developing URDF models to define kinematic chains and hardware specifications for humanoid robot sim and control.	
• Implementing embedded $C++$ firmware on $STM32$ microcontrollers for sensor data acquisition and feedback control loops.	
• Designing PID controllers and Kalman filters for control and state estimation of robotic arm joints.	
Undergraduate Research Assistant September	r 2024 – December 2024
University of Waterloo - Engineering IDEAs Clinic	Waterloo, ON
• Instrumented a wearable knee crutch, allowing force readings for gait analysis and material selection via FEA .	
• Built swarm robots in Gazebo using ROS2 and TurtleBot4, showcasing LiDAR integration and odometry in Python.	
• Implemented adaptive cruise control on physical robots using PID controllers in $C++$ and Python packages.	
Mechanical Engineering Associate Ja	nuary 2024 – April 2024
Sheartak Tools Ltd.	Waterloo. ON

- Designed 15 third party woodworking machinery upgrades with DFMA in SolidWorks to meet OEM specifications.
- Applied **GD&T** principles to guarantee manufacturing accuracy for custom machine parts.
- Created 25 detailed installation manuals, including parts lists and assembly instructions, ensuring ease of use for customers.
- Built a **Python/Selenium** web scraper to automate competitive analysis and product uploads, processing 2000+ products.

Projects

Autonomous LiDAR Navigation for Mobile Robot

- Developed C++ ROS2 nodes to convert LiDAR data into a 2D costmap for obstacle detection and perception.
- Generated a world model from costmap and odometry data to represent the current environment.
- Implemented **A* algorithm** to compute obstacle-aware paths through the mapped environment.
- Applied Pure Pursuit to follow planned paths for smooth differential drive navigation.
- Dockerized the system and integrated with Gazebo and Foxglove for simulation, debugging, and real-time visualization.

Instrumented Knee Crutch

- Designed a digital CAD twin of an existing knee crutch in SolidWorks.
- Developed a data aquisition system using I2C and Arduino, converting a bathroom scale for real-time load measurements.
- Prototyped **3D-printed** mounts and knee platforms for strain gauges, ensuring user comfort.
- Built **Python** scripts for force distribution visualization in **Matplotlib**, with data logging for **gait analysis**.

Self-Balancing Unicycle

- Built a simulator from scratch using C++ and CMake, integrating OpenGL to create a custom physics environment.
- Implemented cascading PID controllers to control: balancing and achieving precise position tracking.

Technical Skills

Mechanical: SolidWorks, Fusion360, AutoCAD, GD&T, CAD, FEA, DFMA, 3D Printing, Machine Tools, Onshape Electrical: I2C, SPI, UART, CAN Bus, Arduino, ESP-IDF, Soldering, Oscilloscope, LiDAR, PLC, LAD, VHDL, FPGA Software: Python, C, C++, CMake, SSH, Bash, TypeScript, JS, HTML, CSS, SQL, LaTeX, Gazebo, Foxglove Libraries/Frameworks: ROS2, Docker, OpenCV, Linux, Ubuntu, Git, MediaPipe, Flask, Selenium, NumPy, OpenGL