Armaan Sengupta

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Relevant Skills

Software: Python, C, C++, VHDL, Verilog, Git, CMake, Bash, GBD | FreeRTOS, Pytest, NumPy, Pandas
Technologies/Protocols: STM32, NXP, Ambiq, ESP32, AVR | I2C, SPI, CAN, PWM, UART, JTAG, BLE, MIPI DSI
Tools: KiCad, Altium, EasyEDA, MATLAB/Simulink | Oscilloscope, Signal Generator, Digital Logic Analyzer

Work Experiences

Incoming - Implant Firmware & Embedded Systems Intern — California, USA
Neuralink — Jan 2026 – April 2026

Vehicle Firmware Body Controls Intern — California, USA
Tesla — May 2025 – August 2025

- Brought up 20 exterior lights & related ADCs on Semitruck from hardware to app layer (Altium & C)
- Fixed Cybertruck (CT) bug causing left/right headlamp stepper motors to calibrate out of sync (C)
- Refined auto high-beam latching logic to engage only at night, improving user experience (C)
- Developed current-sense self-tests for Cybercab lights, preventing faulty units passing production (C)
- Fixed error in fault logging impacting Model 3/Y & CT, improving retroactive failure analysis (C)
- Identified issue with short ADC sample time causing self-tests to false pass on Cybercab (Altium & C)
- Wrote SIL tests verifying lighting functionality across models preventing regressions (Python: Pytest)

Embedded Systems & Firmware Engineering Intern — Indianna, USA
Ixana — August 2024 – December 2024

- Designed firmware to implement video transmission from smart glasses to smart watch improving frame rate from 4 fps to 13 fps and reducing power consumption by 8% (C++)
- Developed amoled display driver using MIPI DSI protocol enabling reliable video rendering (C++)
- Implemented automatic gain control for custom RF chip improving packet reception rates by 45%
- Developed library for Rigol Arb signal generator to facilitate HIL testing of custom silicon (Python)
- Debugged SPI & I2C signal timing and encoding issues between FPGA & MCU with logic analyzer

Data Science & Controls R&D Engineering Intern — Ontario, Canada
Magna — January 2024 – April 2024

- Designed an anomaly detection algorithm using strain gauge data from a hydraulic press to identify cracked parts from the production line with a 100% accuracy during 150 part burst run (Python)

Robotics and Embedded Systems Intern — Ontario, Canada
Fyelabs — May 2023 – September 2023

- Implemented checksums in custom RF protocol reducing data corruption by 15%
- Designed a LiDAR dust filtering algorithm, enhancing object localization in harsh environments (C++)
- Developed PCB board for a custom HMI panel enabling driver-system communication (EasyEDA)
- Developed UART driver for LiDAR module to enable data logging and live HIL debugging (Python) & (C)

Engineering Design Teams

Waterloo Rocketry
Controls - Firmware and PCB board design — September 2023– December 2024

- Developed C code for an STM32 using FreeRTOS to manipulate aerodynamic control surfaces
- Implemented a PID controller based on predicted trajectory to command servo motor over PWM; during flight this allowed our Air Brakes to bring the rocket 1500 ft closer to its target apogee (C)
- Designed 4 layer central processing board PCB in KiCad improving power efficiency from 66% to 95% and incorporated an onboard IMU over I2C, as well as an external AHRS through UART (KiCad)

Education

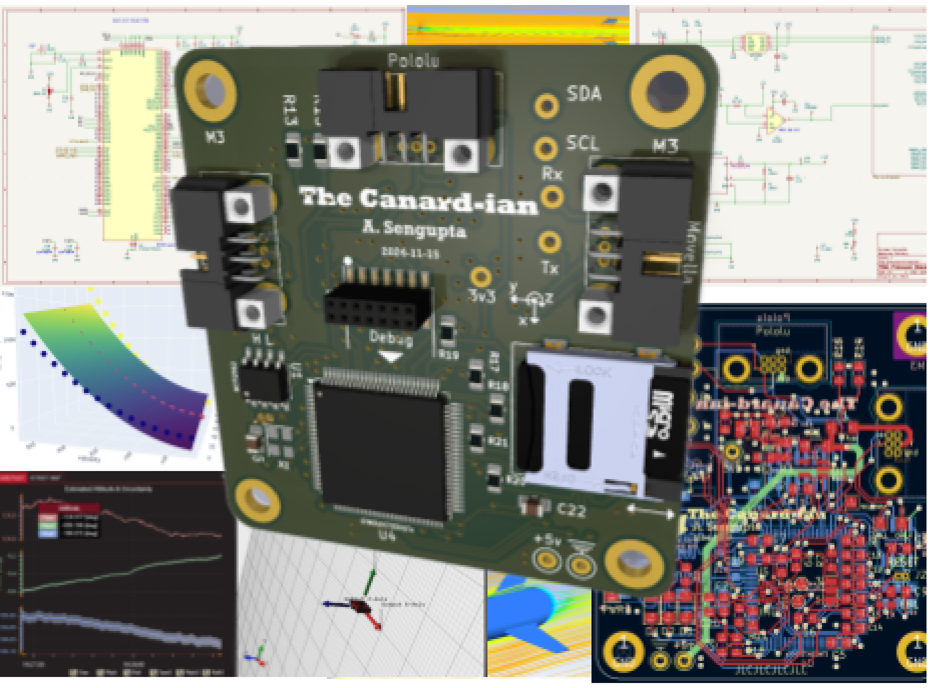
University of Waterloo
Bachelors of Mechatronics Engineering | GPA: 90% (Dean's Honors List) — September 2022 - April 2027

Highlighted Projects

More projects on my website: https://www.armaansengupta.ca

Rocket Air Brakes & Canards

Waterloo Rocketry (Student Design Team)



- Developed embedded C code on an STM32 microcontroller within a FreeRTOS environment
  - Serial communication with IMU (VN-300)
  - Board to board communication over CAN
  - 4th order Runge-Kutta methods for trajectory prediction
  - PID controller for closed loop control of the fin extension during flight
- Designed schematic and PCB layout for central computing board in KiCad
  - Improved power efficiency of board from 66% to 95% by using buck converter
  - I2C communication to two IMUs and UART to external AHRS sensor

Autonomous Truck Back Up Safety System

FYELABS

- Communicated between 6 microcontrollers using wireless and serial communication (C++)
  - Defined custom serial communication byte standard including checksums, and error codes
- Developed LiDAR array subsystem firmware (C++)
  - Custom dust/noise filters based on experimental data
  - Zone mapping to compute what grid an object is in
  - Autonomous alley mode detection feature
- Used Python to visualize live LiDAR data over UART, representing it as a 2D top view of the environment

View project's [Electronics]() or [Software]()

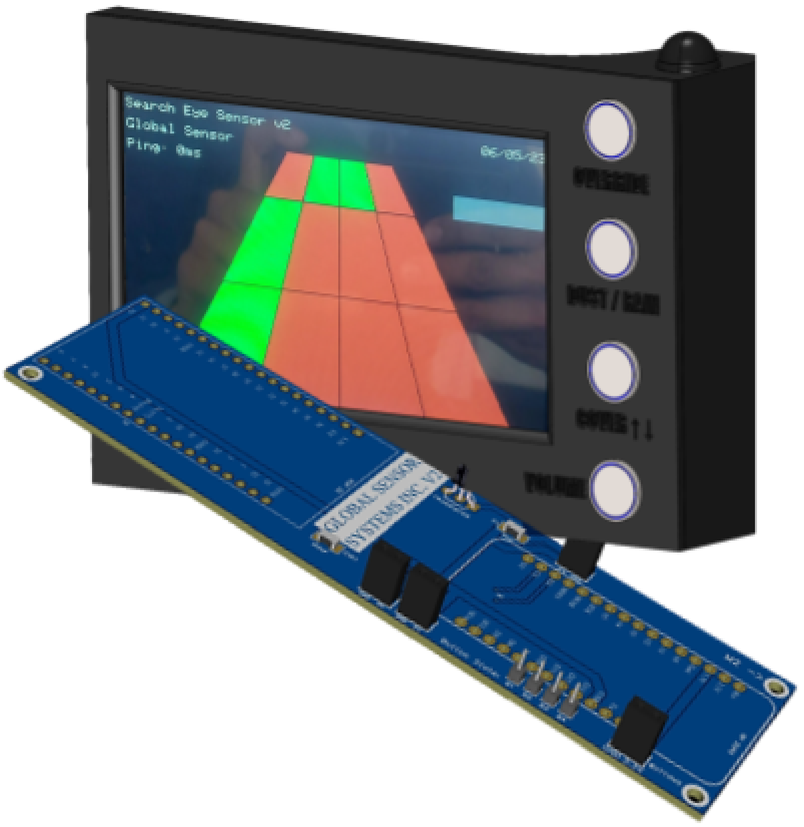
Confidential Project.
For Illustration Purposes Only

Smart Glass To Smart Watch Video Streaming

Ixana

- Designed power efficient low level core OS on bare metal chips using C++ to facilitate wireless video transmission from smart glasses to smart watch
- Developed Verilog code for FPGA to interface over MIPI DSI to Amoled display
- Orchestrated data flow between camera, to encoding FPGA, to transmitter microcontroller, then wirelessly transmitted between 2 "[Wi-R]()" chips, to receiver microcontroller, to decoder FPGA, and finally displayed on AMOLED screen
- Debugged extensive data encoding, timing, and signal integrity issues in all parts of system

[Last Year's CES Demo]() or [Some Early Prototypes]()

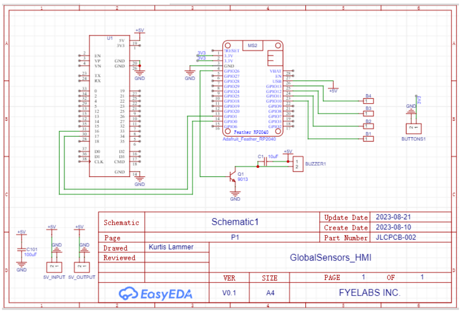


Human Machine Interface (HMI)

FYELABS

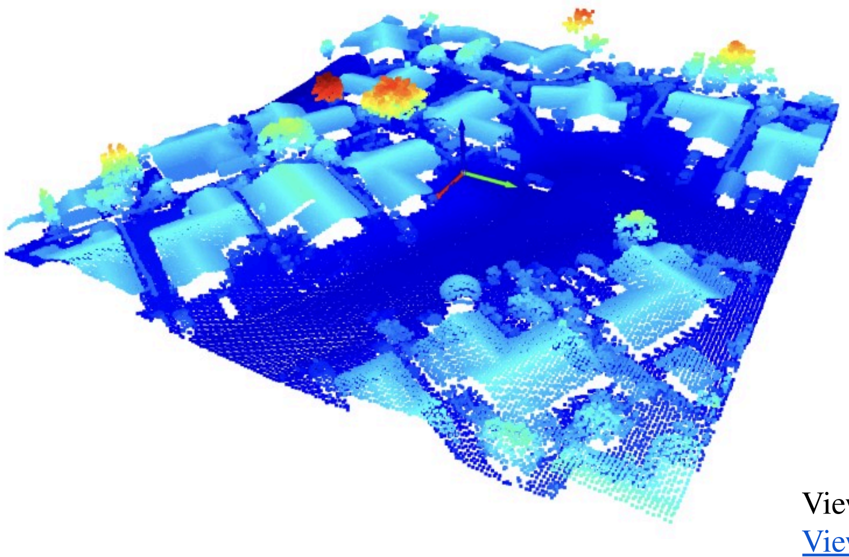
- Created a graphics library in C++ to display incoming data from the lidar board.
- Designed PCB to support 2 microcontrollers and various other peripherals within the HMI (EasyEDA)
- Created a zone mapping algorithm to project a detected object to one of 12 zones so it could be visually displayed on the HMI (C++)
- Outcome of the project is driver can successfully interpret current system behavior and change system settings wirelessly

View More



LiDAR Data Processing

Personal Project



- Used Python with laspy, open3D, and numpy
  - laspy: tool for LiDAR data handling and analysis
  - open3D: 3D data processing and visualization
- Manipulation, cleansing, filtering, and analysis of LiDAR point cloud data
- Applied voxel grouping to downsize the data
- Removed artifacts such as dust using a nearest neighbour outlier algorithm
- Found the furthest point within a region to any other point in the data set using a custom algorithm to vastly decrease time complexity (essential for 1M+ points)

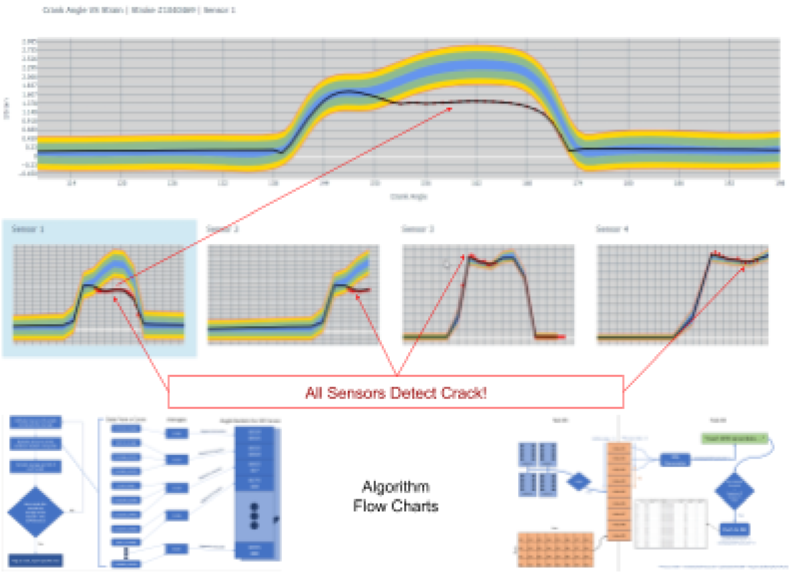
View project details or view the 3D point cloud online

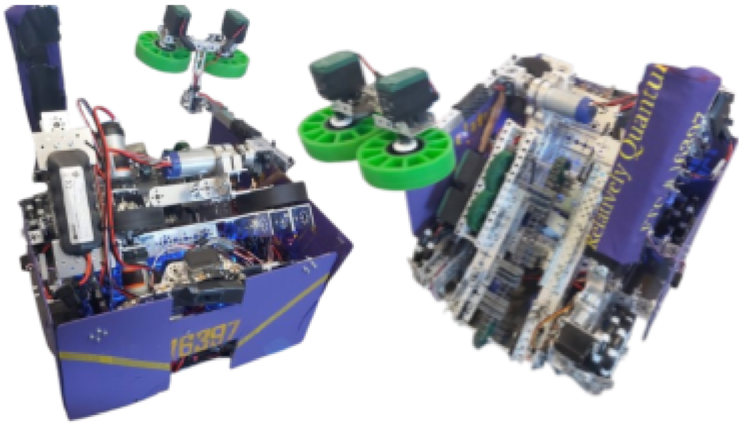
View LiDAR implementation on physical hardware

In Die Crack Detection + Die Condition Monitoring

Magna

- Read strain gauge data from press (MQTT), re-factored it, stored it in PostgreSQL database, and developed anomaly detection algorithm to detect when a part cracked based on this data (Python)
  - Algorithm correctly detected cracked parts 100% of the time during a production run (350 strokes)
- Created web-app to visualize/interact with the data (Python)
- Developed data aggregation algorithm for a PLC using multithreading with custom semaphores and data queues to circumvent limited hardware performance
  - Data collection rate improved from 142 Hz to 500 Hz





Autonomous Mobile Robots (AMRs)

Competitive Robotics Team (FTC 16397)

- Independently wrote all software (Java)
- Implemented PIDF control structure to ensure motors held their position (arm) or velocity (flywheel) under load
- Used TensorFlow to implement computer vision that detected objects to influence robot behavior
- Utilized distance sensors and gyros for localization
- Won the control award in the Asia Pacific Open Championship for the best software reliability

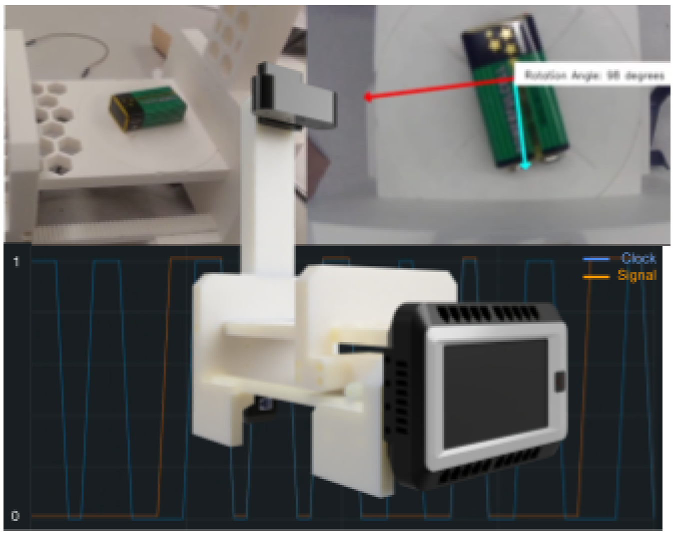
View demo video, 2 page technical report, or top match

Automated Multi-Dimensional Tolerance Verification System

Team Project (3 People)

- Wrote C code to control both motors (clamp + turntable), derive object dimensions from encoder values, and user GUI
- Designed and implemented a custom 2 wire communication protocol (C++ & C) (similar to I2C)
- Determined object orientation in OpenCV (Python)
- Accurately rotated objects 100% of the time during testing as well as measured results within 0.3mm of true value

View demo video or technical report

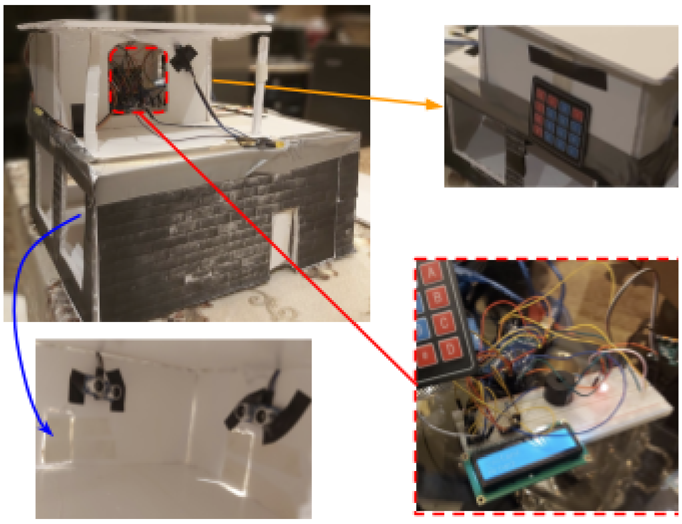


Home intrusion detection system

Personal Project

- Programmed in C++ using Arduino as the MCU
- Components include lights, buzzers, motion sensors, distance sensors, a key pad and an LCD screen
- Loitering detection with automatic warning lights achieve through Passive Infrared Sensor (PIR) sensor
- Intrusion detection performed using a matrix of distance sensors to determine where the intruder is in the house
    - Matrix of ultrasound sensors detect change in reading from calibrated baseline
    - System needs to be disarmed by entering the password into the keypad following instructions on the LCD

View Demo Video or view full presentation

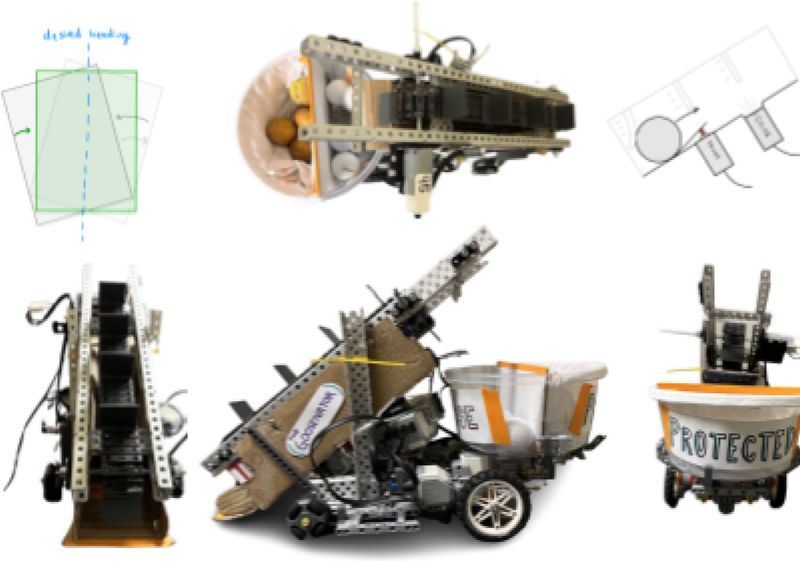


Autonomous egg collecting + sorting robot

Team Project (4 people)

- Wrote code to sweep an area to collect and sort endangered and invasive species of bird eggs (C++)
- Used proportional feedback control system (PIDF)
    - Uses a gyro sensor to accurately turn
    - Correct for drift in angle when driving straight
- Used a touch and color sensor to detect and categorize the type of egg collected
- Encoder-based intelligent anti-jam code
- Developed an algorithm based on the percentage of time a color was detected to detect eggs with a 100% accuracy (over 40 trials).

View Demo Video or view full engineering design report



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