

# Jaavin Mohanakumar

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Canadian Citizen (TN Eligible)

## Education

**McMaster University** – BAsC, Computer Engineering

April 2027

Relevant Coursework: Digital Systems Design, Data Structures and Algorithms, Signals and Systems, Electronic Devices

## Experience

**Software Engineering Intern** – [IPEX Management Inc.](#) – Oakville, ON

May 2024 – Aug 2024

- Designed and implemented monitoring system in C# with alerts for machine failures, cutting response time by 30%
- Architected network configuration server with automated DHCP management supporting 200+ corporate users

**Software Engineering Intern** – [IPEX Management Inc.](#) – Oakville, ON

May 2023 – Aug 2023

- Implemented file transfer service in C# using .NET for business-critical process, reducing downtime from 14% to 2%
- Improved API Gateway item-vendor mapping accuracy by 183 basis points and planned MongoDB migration

## Selected Projects

**Hardware Image Decompressor** – ([Technical Report](#))

Oct 2025 – Dec 2025

- Designed and implemented RTL image decompressor achieving 88.89% multiplier utilization at 50 MHz
- Developed end-to-end decoder with IDCT, 10-tap FIR upsampling, and YUV-to-RGB conversion for 192×144 image

**Real-Time 3D LiDAR Mapping System** – ([Technical Report](#))

Feb 2025 – April 2025

- Created LiDAR system with MSP432 microcontroller, ToF sensor, and stepper motor achieving 360° spatial scanning
- Developed Python control panel with Open3D visualization for real-time 3D point cloud rendering

**What's in Front of Me (WIFOM?)** – ([Youtube Demo](#))

Jan 2023 – April 2023

- Designed wearable ML-powered object detection system with dual ESP32-CAM providing real-time audio and haptics
- Developed end-to-end pipeline integrating image capture, cloud-based ML processing, and haptics for under \$40 CAD

**MeGPT** – ([Website](#))

Sept 2023 – Dec 2023

- Launched AI SaaS platform reaching 2.2K visitors in 24 hours; featured on McMaster news and startup accelerator

## Student Design Teams

**Controls Project Manager** – [McMaster Rocketry Team](#) – Hamilton, ON

Nov 2022 – Dec 2023

- Led controls sub-team of 15 members to design avionics and control systems for Spaceport America in New Mexico
- Coordinated across 6 sub-teams and 70+ members to integrate flight control, telemetry, and data acquisition

**Software Development Co-Lead** – [FIRST Robotics Team 1325](#) – Mississauga, ON

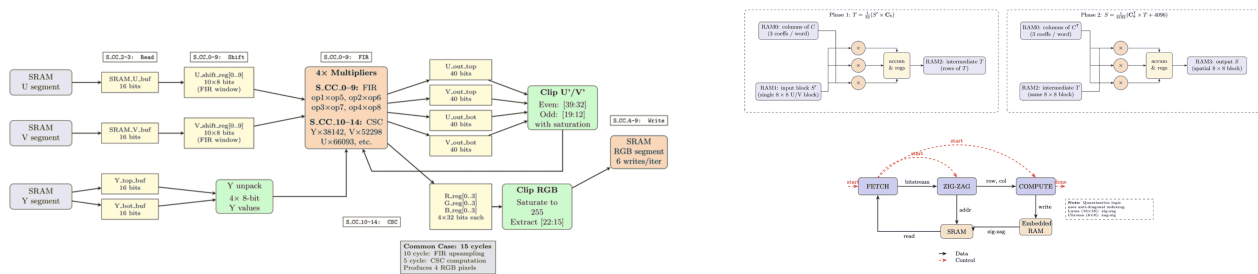
Sept 2021 – June 2022

- Designed autonomous control systems in Java implementing path following, encoder/gyro feedback, and computer vision based targeting with trigonometric interpolation for 120lb competition robot
- Developed state machine control architecture with PID loops, feedforward gravity compensation, and sensor fusion enabling Excellence in Engineering Award at FIRST Robotics World Championship in Houston

## Skills

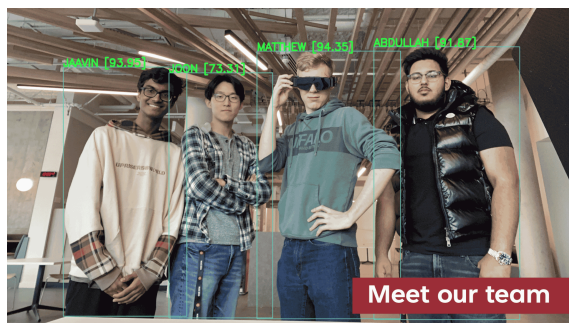
- **Hardware:** RTL Design & Verification (Verilog/SystemVerilog), FPGA/ASIC Development, Digital Signal Process, Timing
- **Tools:** Quartus, C, C++, Java, Modelsim, ARMv7, Python, Git, Oscilloscope, OrCAD, MATLAB, Linux, Logic Analyzer
- **Protocols:** I2C, SPI, CAN, UART, USB (2.0), VGA, TCP/IP, UDP, DHCP, AXI, FIFO, PCIe

## Hardware Implementation of an Image Decompressor, based on JPEG



- Architected RTL image decompressor for JPEG-like format achieving 88.89% hardware constrained multiplier utilization at 50 MHz, implementing 10-tap FIR upsampling and YUV-to-RGB colour space conversion with minimal stalls across the 192×144 image.
- Designed 4-stage pipelined IDCT processor (FETCH → COMPUTE\_T → COMPUTE\_S → WRITE) with time-shared hardware multipliers across 325 blocks; implemented column grouping to maximize parallel computation throughput.
- Optimized datapath architecture by deriving row/column indices combinatorially from address counters and streaming final S-phase samples, eliminating redundant embedded RAM usage and reducing register overhead by 30%.
- Implemented circular buffer architecture with dual-port embedded RAMs for concurrent multiply-accumulate operations; achieving timing closure with 3.282 ns slack while utilizing only 4% of FPGA logic elements.
- Validated RTL against Python reference model using unit-isolated testbenches with golden SRAM comparisons and no-write-region assertions covering boundary conditions (row-edge chroma filter, clipping). Debugged VGA through mismatch-address and ModelSim waveform tracing.
- Technical documentation available [here](#)

## What's in Front of Me (WIFOM?) / Assistive Device for Visually Impaired



### Testing Plan: Hardware

Component Placement	Comfortability	Practicality
Tested the general placement of the electronic components as per the CAD design	Tested the comfortability at points of contact with face and added extra padding where needed	Tested the practicality of the glasses by wearing them for an extended period of time

- Architected end-to-end computer vision pipeline for assistive wearable device with dual ESP32-CAM modules, web application middleware, and cloud-based ML inference backend, enabling real-time object detection and hazard identification for visually impaired users for under \$40 CAD.
- Developed a prioritized alert system with text-to-speech auditory feedback and haptic motor actuation based on threat classification (dangers, warnings, objects), enabling multimodal sensory substitution with <2s latency from image capture to user notification.
- Implemented RESTful API integration layer connecting embedded ESP32 image capture to cloud ML service.
- Validated system robustness through field testing in high-density environments (crowds), occlusion scenarios (direct sunlight) demonstrating reliable multi-object detection.
- Technical slides available [here](#) and video demonstration available [here](#)

# Portfolio

hi@jaavin.ca  
github.com/UnloadingGnat

## McMaster Rocketry Team, Controls Executive Management

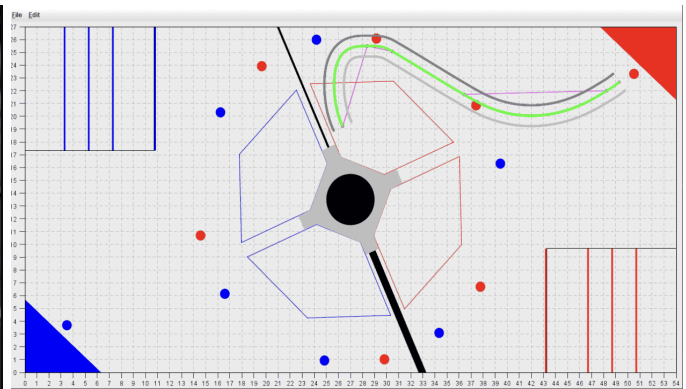
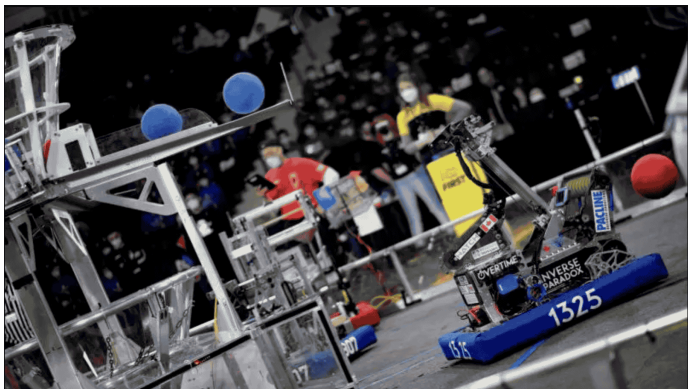
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- Led controls sub-team coordinating integration across 6 engineering sub-teams to develop SRAD avionics suite (VLF3 telemetry/DAQ + VL8 power/pyro/camera controller) with STM32 microcontrollers, barometer, and LoRa telemetry.
- Developed visualizer displaying telemetry data with plots(battery voltage, acceleration, altitude), navball orientation display, and view showing rocket location and speed relative to launchpad.
- Co-authored IREC Spaceport America Cup 2023 Project Technical Report documenting avionics architecture, sensor integration, and assembly/preflight/recovery checklists for competition submission.
- Contributed to avionics design supporting future active control extensions through sensor fusion with Kalman filter implementation for powered flight state estimation.
- Technical documentation available [here](#) and video of launch available [here](#)

## FIRST Robotics Team 1325 – Inverse Paradox, Software

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- Architected autonomous navigation with path following and encoder/gyro feedback enabling shooting while moving, implemented Limelight vision processing with trigonometric calculations and cached position tracking maintaining target lock during sensor dropout.
- Designed state machine for 11-second automated climb with pitch based transitions and soft stops, implemented trigonometric feedforward gravity compensation.
- Developed vision-guided turret with interpolated RPM speed map and OpenCV colour detection enabling automatic cargo rejection, and manual clear.
- Technical documentation available [here](#) and video of a match available [here](#)