Alireza Beigi

Embedded Software Engineer

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Education

Mechatronic Systems Engineering, MASc, *Simon Fraser University* — Jan 2022 - Aug 2024, Surrey, Canada
- Supervisor: Dr. Krishna Vijayaragahavan

Mechanical Engineering, BASc, *University of Tehran* — Sep 2015 - Sep 2019, Tehran, Iran

Skills

- **Software**: C#, C, C++, Android, Python, PLC, Arm Microcontroller, TMS570, STM32, MQTT, TCP/IP, ESP32, Communication interfaces (SPI, I2C, I2S, ADC, UART, RTOS), Linux operating system, Kotlin, Jira, Confluence, Git
- **Mechatronic**: Oscilloscope, multimeter, Feedback control, Nonlinear control, Neural network, Reinforcement learning, Optimization algorithm, Matlab, Simulink

Work Experience

Firmware Engineer, *Envo Drive Systems* — Apr - Oct 2024, Burnaby, Canada
- Developed diagnostic tools and software using a RISC-V microprocessor with RTOS, integrating CAN communication to monitor and display controller and sensor data with minimal hardware modifications.
- Created firmware solutions incorporating ADC, I2C, SPI, and UART peripherals, enhancing system communication, diagnostics, and interoperability.
- Implemented and calibrated a feedback loop controller, improving system accuracy and reliability by fine-tuning temperature and current sensors.
- Conducted root cause analysis and led performance testing, including controller heat tests and closed-loop loaded tests, to optimize system reliability and functionality.
- Enhanced product scalability by developing specifications for mass production of PMSM motor controllers, improving vehicle connector and harness designs, and reviewing battery configurations for compliance and efficiency.

Embedded Engineer, *Embodix* — Apr - Oct 2024, Burnaby, Canada
- Developed advanced control firmware utilizing RTOS, PWM, and micro linear servo actuators for a dexterous hand, integrating force sensors on fingertips, achieving a notable improvement in delicate task handling.
- Advanced ROS integration for a dexterous robotic hand, developing custom services and nodes to optimize data flow between sensors, actuators, and VR systems. This setup reduced response times and enhanced system modularity, facilitating improved VR interaction and maintenance efficiency.
- Designed and optimized the embedded system architecture using RTOS to balance performance and power efficiency, resulting in a 30% enhancing system responsiveness

Firmware Engineer, *Damon* — Jan - Aug 2023, Burnaby, Canada
- Designed and implemented a custom bootloader to support OTA (Over-The-Air) firmware updates, ensuring high system availability and minimal downtime during update processes, resulting in a 10% reduction in system downtime and ensuring continuous system availability.
- Conducted extensive testing of selected hardware modules using ARM microcontrollers to validate their performance and reliability, leading to a 7% increase in system robustness.
- Implemented MQTT protocol using Mosquitto and LAN modules for establishing a reliable communication link with the AWS server, facilitating efficient data handling and telemetry, achieving a 5% improvement in data handling efficiency and establishing a reliable communication link with AWS servers

Teaching Assistant, *Simon Fraser University* — June - Sep 2023, Surrey, Canada
- Assisted Dr. Marzouk in delivering lectures, designing course materials, and conducting laboratory sessions focused on STM32F4 Discovery kit
- Guided and mentored students in understanding core concepts, programming techniques, and debugging strategies in embedded systems design, specifically in the practical implementation of timers, interrupts, GPIO, UART, ADC, DAC, SPI and RTOS.

Research Assistant, *Simon Fraser University*
Jan 2022 - Dec 2023
Surrey, Canada

- Designed and developed a nonlinear control algorithm for precise power regulation in a fuel cell system, leveraging a lumped model and implemented in Matlab Simulink, achieving 20% improvement in robustness under varying load conditions.
- Implemented an Extended Kalman Filter (EKF) for real-time state estimation, improving the accuracy of fuel cell state variable predictions by 12%, leading to more effective control strategies.
- Engineered an optimized power control algorithm that integrates state estimates and system inputs, resulting in 5% enhancement in fuel cell efficiency through dynamic load regulation and the application of MPPT (Maximum Power Point Tracking).

Hardware Intern Specialist, *Iranian Space Research Center*
June - Sep 2021
Tehran, Iran

- Participated in the development and testing of hardware modules for the Attitude Determination and Control System (ADCS), contributing to critical aspects of spacecraft orientation and maneuvering capabilities.
- Engaged in hands-on work with a variety of sensors and actuators, gaining valuable experience in hardware integration and performance optimization within space applications.
- Collaborated with a multidisciplinary team to analyze and resolve hardware performance issues, enhancing system reliability and operational efficiency in simulated space conditions.
- Contributed to the creation and management of comprehensive Bills of Materials (BOM) for ADCS projects, ensuring accurate tracking of components, cost estimation, and procurement planning.
- Acquired in-depth knowledge of space-grade hardware specifications and compliance standards, facilitating the selection of components that meet the rigorous demands of space environments.

Software Intern Developer, *Advanced Instrumentation Laboratory*
June - Sep 2020
Tehran, Iran

- Developed an autonomous robot navigation and object tracking system using ROS Noetic, .NET Framework 4.8, and OpenCV 4.5, with efficient camera integration via ROS image_transport and coordinate transformations using ROS tf2.
- Implemented object detection and tracking algorithms in C# with Emgu.CV 4.5.5, and custom ROS nodes with ROS# 1.7, achieving real-time tracking at 30 fps on 720p video streams.
- Engineered navigation algorithms with the ROS navigation stack, including a custom local planner that improved performance by 40% in cluttered environments, and optimized real-time operations using multi-threading in C#.
- Created a WPF user interface for system control and monitoring, featuring real-time robot status and sensor data visualization, with enhanced ROS-C# integration and GPU-accelerated vision processing using OpenCL.

Systems Integration Engineer, *Human Robot Interaction Laboratory*
Jan - Jun 2020
Tehran, Iran

- Designed and integrated a custom torque sensor with optical enhancements within a jaw coupling, ensuring high measurement accuracy and straightforward system compatibility.
- Implemented an ESP32 microcontroller running a Real-Time Operating System (RTOS) to guarantee precise operation and efficient task management, enhancing system reliability.
- Developed firmware for optimized sensor response and data management using RTOS, handling multiple inputs and operations.
- Constructed a durable, compact sensor package that combines mechanical and electronic elements, engineered to withstand harsh industrial conditions and deliver precise real-time torque feedback.

Embedded Projects

ADCS Co-Lead, *SFU Satellite Design Team*
July 2022 - Dec 2023
Surrey, Canada

- Led a team of five members as the ADCS co-leader in the design and implementation of an Attitude Determination and Control System for a CubeSat mission.
- Designed and integrated a novel AHRS algorithm that combined data from sun sensors, IMUs, and gyros to determine the attitude and heading of the CubeSat.
- Utilized the TMS570 microcontroller to process sensor data, implement the AHRS algorithm, and execute control commands for attitude control.
- Collaborated with other sub-teams from various disciplines to ensure seamless integration of the ADCS with OBC.

References

References Available Upon Request