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PROFESSIONAL SUMMARY

Mechatronics engineer with 5+ years building **multi-domain physical products**. Track record of owning electronic, firmware, and electro-mechanical subsystems in custom hardware deployed with SME clients, complemented by MSc-level research in additive construction and hardware functional validation experience in server processors at Intel. Seeking product development roles in companies building **intelligent physical systems**, including robotics, integrated devices & advanced hardware.

TECHNICAL SKILLS

Electronics & Hardware: Mixed-signal PCB design (EAGLE, transferable to KiCad) · Analog circuit design, signal conditioning, ADCs · Power management (DC-DC, reverse polarity & overvoltage protection, isolation, fusing) · Circuit simulation (Multisim, LTSpice) · Bench validation (oscilloscopes, signal generators).

Embedded Systems: C/C++ firmware development · ESP32, Arduino Duet, exposed to STM32 · Communication protocols (UART, SPI, I2C) · IoT connectivity (HTTP/REST, JSON over WiFi/Ethernet/GPRS via ESP32) · Custom library development · Sensor and actuator integration · PID control implementation.

Electro-Mechanical Integration: CAD design and DfMA/DfD (SolidWorks, CSWA certified) · Actuators selection and integration · Prototype bring-up and functional testing · Hardware troubleshooting and root-cause analysis · G-code-based motion systems.

Software & Tools: Python · Linux environments · Test automation · Git / GitLab / SVN · Technical documentation

PROFESSIONAL EXPERIENCE

Graduate Research Assistant · Mechanical Engineering

May 2023 – May 2026

University of Alberta · Edmonton, AB

- Designed, fabricated, and integrated a **reconfigurable auger-based extrusion subsystem** for an existing mid-scale additive construction printer, targeting cementitious materials with fine aggregates.
- Owned development across **mechanical design** (SolidWorks), drive train selection (400W DC servo + 50:1 gearbox, up to 59 Nm), custom PCB design for servo DIDO signal handling, and firmware integration into existing Duet 3 control architecture.
- Derived 9 formal design requirements from prior system bottlenecks and literature, and validated prototype against each through dry and material tests, achieving **65–74% reduction in cleaning time** and **17–38% reduction in assembly time** vs. baseline piston extruder.
- Demonstrated **successful extrusion in 6/7 material runs** across cement-based premixes with up to 2 mm aggregates and measured drive train torque (12–21 Nm nominal, 36 Nm peak) corroborating preliminary analytical estimates (drag-pressure adapted model for preliminary sizing).
- Published project progress and results in 3 peer-reviewed venues (see Publications).
- Coordinated up to 3 collaborators per experimental cycle; partnered with Lafarge Canada and external 3D printing construction specialists; led organization of the 1st edition and supported the 2nd edition of an internal additive construction conference.

Functional Validation · Server Processors

Aug 2020 – Apr 2023

Intel Corporation · Guadalajara, MX

Validation Engineering Associate (Jan 2023 – Apr 2023) · Functional Validation Intern (Aug 2020 – Dec 2022)

- Validated hardware-level IP functionality (Resource Director Technology, Network Acceleration Complex, Security) in Snow Ridge and Grand Ridge server processors across pre-silicon (FPGA emulation) and post-silicon (volume testing) stages.
- Designed and executed **structured test plans** in **Python** and **Bash**; collaborated with design engineers in Santa Clara and India on **issue root-cause analysis**.
- Progressed from intern to junior engineer with growing test ownership in the Security IP team; built strong habits in **systematic troubleshooting**, technical documentation, and cross-geographic collaboration in **formal engineering environments**.

TRIHTON · Guadalajara, MX

- Co-built a small hardware engineering team delivering **custom technology products for SME clients**, with personal **ownership of electronics design**, embedded firmware, basic computerized control, and design-for-manufacturing operations.
- Designed **mixed-signal PCBs** in EAGLE integrating analog, digital, and power domains across multiple voltage levels; implemented power management (DC-DC, protection, isolation), signal conditioning for sensors, and communication buses (UART, SPI, I2C).
- Developed **embedded firmware** in C/C++ for ESP32-based systems, including custom libraries and PID-based temperature and motion control.
- **Translated client needs** into hardware/firmware architectures through direct consultation; supported **prototype bring-up**, functional testing, technical documentation, versioning, iterative design improvements, and technical support.

SELECTED PRODUCTS

- **EDAPI · Bee venom collection device** (2019–2020, 3-person team). Master-slave architecture with 1 central unit + 15–20 slave units; H-bridge generating square-wave bipolar signals with variable frequency, amplitude, and duty cycle. **Delivered 2 systems**, client placed additional order in 2024.
- **CAHD · Unbreakable IoT biometric attendance system** (2019–2020, 5-person team). Dual-ESP32 PCB with multi-source power (120VAC + UPS battery backup), fingerprint sensor, Ethernet/WiFi/GPRS/SD storage, Nextion HMI. Resolved severe EMC and form-factor constraints inside metal enclosure. **Reached 4th functional prototype** with cloud connectivity before project pause.
- **Furnace for steel heat treatment** (2019–2020, 2-person team). Redesigned PCB around existing mechanical system; integrating Kanthal heating elements driven from AC source (dual 120V/220V capability, up to ~1200°C), thermocouple feedback, PID control, Nextion HMI, and IoT alerts via ESP32. Ability to heat-treat D2, O1 & H13 steel parts (quenching, tempering, annealing, and normalizing profiles). **Conducted 6 functional tests** in D2 steel parts for quenching + tempering before project pause.
- **Semi-automatic honey packer** (2020–2021, 3-person team). Designed agitator mechanism & control PCB managing AC pump, solenoid valve, eccentric mixer, load cell, and footswitch input. **Delivered and still in active use; ±15 g accuracy on 1 kg jars**.
- **Electric marquesita griddle** (2020–2022, 3-person team). PCB and firmware for AC-driven nichrome heating with temperature control and timing indicator. **Delivered 5 units during the first 2 design iterations**.

EDUCATION

MSc, Mechanical Engineering · University of Alberta · Edmonton, AB

May 2026

Thesis: "A System-Centered Approach to Mid-Scale Additive Construction: 3D Printing System Design and Development"

BS, Mechatronics Engineering · Tecnológico de Monterrey · Guadalajara, MX

June 2022

Líderes del Mañana 100% scholarship recipient.

Integration project (NXP collaboration): designed and built a scale-model car door integrating STM32 microcontroller firmware, sliding door mechanism, linear actuators, custom-designed steel and aluminium parts, and PCB for sensing acquisition and components activation. FPGA programming with Verilog.

PUBLICATIONS

Ramirez Rodriguez, F., Ahmad, R. (2025). *Sustainable technology advances for additive construction: a state-of-the-art review*. Construction Robotics, 9, 22. doi.org/10.1007/s41693-025-00167-9

F. Ramirez-Rodriguez, P. Pancho, F. Ramirez-Rodriguez, P. Pancho, D. Sanchez, S. Poudel, D. Bhavsar, and R. Ahmad, "Design and Development of a Lean Robotic Cell for Concrete 3D Printing," Procedia Comput Sci, vol. 253, pp. 475–484, Jan. 2025, doi: 10.1016/J.PROCS.2025.01.109

Ramirez-Rodriguez, F. M., Alghamdy, M., Ahmad, R. (Under review). *Performance Assessment of a Piston-based Gantry Printer for Mid-Scale Additive Construction*. Construction Robotics.

Ramirez-Rodriguez, F. M., Alghamdy, M., Khan, A. N., Ahmad, R. (Accepted, 2026). *Design and Prototyping of a Modular Auger Extruder for Mid-Scale Additive Construction*. International Mechanical Engineering Congress & Exposition (IMECE) 2026, ASME, Vancouver, Canada.

Certifications · Certified SolidWorks Associate (CSWA), Dassault Systèmes

Languages: Spanish (native) · English (advanced, professional working proficiency)