Paul E.C. Cairns

857-250-5737 | paulcair@gmail.com | Boston, MA, 02134
Portfolio: www.paul-cairns.com

Experienced Mechanical Engineer with Expertise in Electro-Mechanical Design, Robotics, and Prototyping for Innovative Product Development

PROFESSIONAL SUMMARY

Results-oriented Senior Mechanical Engineer - Robotics, with a proven track record in electro-mechanical design, rapid prototyping, and product development. Proficient in CAD/CAM, PCB design, and electronics programming, with experience in stress analysis, mechanism design, and the selection and testing of motors and sensors. Adept in utilizing a range of prototyping tools and experienced in guiding successful projects from conception to completion. Passion for collaboration and rapid development in a fast-paced environment. Well-organized and excellent communication skills, to both technical and non-technical audiences. Thrives in a startup environment. I have a bias for action and a strong history of delivering results. Seeking a challenging role as a Mechanical and Product Development Engineer to continue adding to your growth and success.

RELEVANT SKILLS

- **Programming:** Proficient in JavaScript, C++, Python, HTML, CSS. Experienced with Arduino, Mongo, Express, React, Redux, Node.js.
- **CAD/CAM:** Proficient in a range of 2D and 3D CAD tools (Solidworks, Fusion360, OnShape, FreeCAD) for 3D modeling and drafting
- **PCB Design:** Proficient in PCB design (KiCad, Eagle)
- **Electronics Programming:** Proficient in electronics programming. Proficient in using Arduino IDE (C++) to program and flash programs to microcontrollers
- **Prototyping Tools:** Proficient in 3D scanning, 3D printing, laser cutting, CNC milling, soldering, machine assembly, shop tools, PCB soldering, and electronics fabrication.
- **I/O:** Proficient in programming input and output sensors
- **GUI:** Proficient in programming Graphical User Interfaces (GUI)
- **Rapid prototyping:** Proficient in rapid-prototyping from conception, design, and construction of physical and digital based prototypes
- **Product design:** Expertise in full-cycle physical product design, spanning CAD/CAM, 3D modeling, 3D printing, CNC machining, molding, PCB design, programming, laser-cutting, assembly, and integration
- **Product Lifecycle Management (PLM):** Familiar with Product Lifecycle Management (PLM) software and Engineering Change Orders (ECO's) as well as design for production processes and automation
- **Stress analysis and FEA:** Familiar with Thermal and Stress Analysis using SolidWork and FEA simulation
- **GD&T:** Familiar with ASME Y14.5 Geometric Dimensioning and Tolerancing (GD&T) standard for mechanical engineering drawings, design, and quality control
- **Mechanism Design:** Proven Experience in Mechanism design including linear actuators, gear boxes, belt-drives and lead screws.
- **Motors and Sensors:** Adept in the selection, programming, and testing of motors and sensors including brushless DC (BLDC) motors, stepper motors, optical sensors, time of flight sensors, ultrasonic sensors, and more.

RELEVANT EXPERIENCE

Technical Director **Nov. 2019 - Present**
Energy Generation - Entrepreneurial and Prototyping Center, Lome, Togo

- **Electro-mechanical and Robotics Design:** Extensively utilized CAD (Computer-Aided Design) for creating detailed designs and accurate drawings of numerous prototypes and electro-mechanical systems to support local entrepreneurs in launching numerous successful startups in the region.
- **Hands-on Prototyping Experience:** Extensively utilized 3D-printing, CNC-milling, and laser-cutting for various prototypes and applications, resulting in the efficient production of over 50 cost-effective prototypes.
- **Machine Building Expertise:** Designed and constructed a range of complex multi-axis machines and 3D printers/components, including a belt-driven 3D printer, wire-cutter, and a 3-axis CNC machine. These creations facilitated innovative product development and provided practical solutions to entrepreneurs within our incubator.
- **3D Printing Advancements:** Spearheaded the design and construction of a belt-driven 3D printer using Merlin firmware with RAMPs shield. This custom 3D printer enabled the production of components too long for conventional linear axis 3D printers, significantly enhancing manufacturing capabilities.
- **Technical Documentation:** Produced comprehensive technical documentation, including Bill of Materials, product wireframes, and product specifications. These documents ensure clear and accurate communication of project details and requirements, streamlining project management and facilitating efficient procurement processes.
- **Mechanism Design:** Designed a multitude of robotic mechanisms using various BLDC, stepper motors, and sensors, such as belt drives, linear actuators, rack and pinion, linkages, and gear boxes, etc. to develop innovative prototypes for clients.

Executive Director **Jan. 2017 - Nov. 2018**
SmartNet Alliance - Business Incubator, Ottawa, ON

- Provided technical input and guidance into the development of various products for companies incubated under our incubation program, ensuring the integration of cutting-edge green energy technology to enhance product quality and innovation.

Mechanical Engineer **Jan. 2009 - Dec. 2016**
Natural Resources Canada - Research Center, Ottawa, ON

- **Cross-functional Teams:** Collaborated with a cross-disciplinary team to design, procure, and construct a High Pressure Oxy-fired Combustion (HiPrOx) pilot test facility, enabling cutting-edge research and development in the field
- **Mechanical Engineering:** Designed pressure vessels for various research applications including HiPrOx reactors, scrubbers, and pressurized TGAs , ensuring safety and performance compliance
- **Stress Analysis and FEA:** Collaborated on thermal and stress analysis reviews and design changes led by the FEA team to validate the HiPrOx pintle burner, pressure vessel, combustion cooling wall, and other parts subjected to the high temperature environment.
- **GD&T:** Designed and made drawings of parts that included Geometric Dimensioning and Tolerancing (GD&T) for vendors to make highly precise parts, ensuring machining and fabrication was within desired tolerances.
- **Material Selection:**Performed numerous mechanical and chemical analyses for material selection of materials operating in highly corrosive, high temperature, and high pressure environments ensuring the reliability and safety of various mechanical systems.

- **Communication:** Effectively communicated with vendors and suppliers to design, procure, and manufacture components suitable for a harsh environment, ensuring all components met standards and regulations suitable for the HiPrOx conditions.

EDUCATION

Master's Degree (M.A.Sc.) Chemical Engineering **Graduated Jun. 2013**

University of Ottawa

Bachelor's Degree (B.A.Sc.) Mechanical Engineering **Graduated Dec. 2010**

University of Ottawa

RELEVANT PUBLICATIONS

High Pressure Oxy-firing (HiPrOx) of Fuels with Water for the Purpose of Direct Contact Steam Generation (DCSG); Cairns, P.E.C., Clements, B.R., Hughes, R., Herage, T., Zheng, L., Macchi, A., Anthony, E.J.; **Energy & Fuels**; 2015, 29, p.4522-4533

RELEVANT CERTIFICATIONS

- **Principles and Applications of Digital Fabrication**, Fab Academy - 2021
- **Basic Corrosion**, National Association of Corrosion Engineers (NACE) International - 2014