Edward Rhys Faultless

Staff Robotics System Engineer at Clearpath Robotics

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PRIMARY SKILLS

- Mechanical design and drafting including ASME Y14.5 GD&T *(SolidWorks, Siemens NX)*.
- Design of machined parts, sheet metal, weldments, custom rubber bellows, aluminum castings, injection moulded ABS parts, and cable harnesses.
- Built many robots, including drivetrains, electronics assemblies, brackets, and structures.
- Configuration management, BOM structuring, revision control, and data organization.
- System engineering V-model process, with requirements definition, and testing execution.
- System design and implementation including data budgets, power budgets, mass and CofG analysis.

AUXILIARY SKILLS

- Electrical PCB design (*Altium)*.
- Firmware development with C and C++ (*Atmel and STM32)*.
- Linux and ROS 2 programming with C++ and Python.
- Website development with JavaScript, Node.js, React, and other JavaScript libraries.
- Use of Git with GitHub and GitLab, including branches, rebasing, and merge requests.

EXPERIENCE

Clearpath Robotics—*Mechanical And Systems Engineering Roles*   April 2018 - Present

- Mechanical
  - Used Solidworks 2020 and Arena PLM.
  - Designed an IP67 drivetrain for a differential drive robot, with rocker-bogie suspension. The mobility unit included a BLDC 200 W gearmotor, shaft coupler, shaft seals, nickel plated wear surfaces, bearings, belleville washers, wave springs, retaining rings, o-rings, and machined MTS components. Systems calculations were performed to determine the motor's size and planetary gearhead's ratio.
  - Built a robot that included two KUKA iiwa 14 arms, with BarrettHand end effectors.
  - Designed IP54 enclosures, with forced convection. These designs included fans, replaceable air filters, and cable routing paths to optimize air flow through the enclosures. Thermal calculations were used to determine required flow rates. Testing with air speed sensors allowed for cable routing changes to optimize airflow.
  - FEA of aluminum weldments, including consideration of temper's yield stress reduction due to the heat affected zone near welds.
  - Busbar designs between contactors, fuses, circuit breakers, and cables.
  - Sealing enclosures with bulb seals and o-rings.
- Electrical
  - Designed and commissioned a circuit board with an Atmel microcontroller and H-bridge motor controllers that interfaced with a computer over a RS-232 serial.
  - GPIO circuits to connect NPN and PNP sensors to microcontrollers.
  - Created wiring diagrams and cable drawings, including networks like CAN.

- Systems, Program, Product, and Documentation
  - I have led the ISO 12100 process for multiple robot designs. These designs have also included safeguards per ISO 13849.
  - Created assembly work instructions for multiple products.
  - Set up Clearpath's documentation website: docs.clearpathrobotics.com
  - Extensive internal documentation and guides for best practices (*Confluence*).
  - Drafted proposals, quotes, and similar application engineering tasks.
- Software
  - Networking of Ethernet, CAN, and Serial devices to Linux computers and PLCs.
  - Choosing and commissioning sensors such as: 3D lidar, 2D lidar, 1D time-of-flight, depth cameras, network IP cameras, and IMUs.
  - Have selected PLC components for Safe IO, motion, and networking gateways.
  - Have developed several ROS 2 drivers in Python, converting a sensor's data for use in ROS. Sensors have used RS-232, I^2C, and CAN.
  - Have set up live analytics and graphing for multiple projects using Docker, Prometheus, and Grafana.
- Example robots that I designed and built (*with public facing stories*):

  - [Husky A300](#)
  - [RFID scanning facility robot](#)
  - [Outdoor facility inspection robot](#)
  - [Road vehicle converted to be a robot](#)
  - [Moose, 8 wheeled outdoor robot](#)

General Dynamics—*Physical Architect*   February 2015 - April 2018
- Used Siemens NX and Siemens Teamcenter for mCAD and PLM.
- I was the lead mCAD designer of 3 vehicle variants for the [LAV 700 program](#), and coordinated work for multiple design teams.
- Maintained commonality of subsystems between vehicle variants. This effort reduced the required inventory at maintenance facilities, as well as reducing technician training due to reuse of designs.
- Developed vehicle architecture and estimated the design engineering hours. This includes separating the vehicle's components into different Installation Items (*Drivetrain, Suspension, Engine, Seating, etc*).
- Led the investigation of manufacturing issues, to assess whether issues should be resolved with changes to the design or assembly processes. This also included cost studies of how changes would affect the active assembly line.
- Designed vehicle side mirrors to withstand acceleration due to a tank gun firing. This was a systems problem where I balanced; the mirror size, view angles, design factor of safety, and cost.

Toronto and Region Conservation Authority—*Support Staff*   2008 - 2014
- Maintained machinery including diesel tractors and 2-stroke equipment.

EDUCATION

McMaster University—*Bachelor of Engineering, Mechanical*   2010 - 2014