Clearpath Robotics June 18, 2015
1425 Strasburg Rd. Suite 2A
Kitchener, ON N2R 1H2

Dear Hiring Manager,

I am an engineer interested in working at Clearpath Robotics. I'm excited about the possibilities for using autonomous robots to replace humans in dangerous or dull workplaces and I believe that Clearpath will be an important part of that revolution. Reading about your commitment to open source projects and knowing first-hand about your cooperation with academic projects, I believe that Clearpath is taking the right approach to revolutionizing robotics. Along with my admiration for your strategy, I have the technical skills to excel in a role as an Autonomy Engineer.

For the past two years, I've been a graduate student at the University of Waterloo building 3-D simulations of the golf swing for use in designing golf clubs. By building a model of the golfer and club using MapleSim and MATLAB on Linux, I was able to evaluate golf club design decisions without building or experimenting with physical golf clubs. To control the model, I took courses in multi-variate, adaptive, and optimal control to find a way to optimize the swing for different parameter sets. The final model was delivered along with concise documentation to an outside partner to be used as part of their evaluation process for new golf clubs.

As my fourth-year design project, I used ROS and Gazebo to create a simulation of an autonomous robot for the NASA Sample Return Robot Challenge. My group's responsibility was to develop a Simultaneous Location and Mapping algorithm for a 6 degree of freedom environment without using GPS sensors. By combining wheel odometry, IMU measurements, and laser scan point clouds in a novel way, we were able to improve on existing techniques for locating the robot in its environment. The final algorithm incorporated a Kalman Filter, the Iterative Closest Point algorithm for aligning point clouds, and GraphSLAM for redistributing error in the estimated positions. A Clearpath Husky robot was used as our platform for this competition and since that time, I've always thought of Clearpath as a place I would like to work.

I had many opportunities as part of the coop program at the University of Waterloo to demonstrate my skills in development. At Apple Inc. I designed and developed an internal application for testing location algorithms that included iOS, OS X, and server-side components using Objective-C, C++, and Python. This application was used to help develop a new Kalman Filter based algorithm for determining device locations. In the Vision and Image Processing Lab at uWaterloo I worked on MAGIC, a computer vision program written in C++ used for segmenting satellite images of sea-ice. I developed a new algorithm for this product that used a multi-level segmentation to classify large images. On my own, I've built a few smaller projects which can be found on my website at `http://ddajohnson.com/projects`.

I'm excited by the chance to work at Clearpath in a dynamic environment solving interesting problems with autonomous robots. I hope to hear from you soon.

Sincerely yours,

Daniel Johnson

Daniel Johnson
142 Wood St. Apt. B – Kitchener, ON N2G2H8
(226) 989 0511 • *dan@ddajohnson.com* • *ddajohnson.com*

Daniel Johnson

M.A.Sc., B.A.Sc.
142 Wood St. Apt B Kitchener, ON

June 17, 2015
dan@ddajohnson.com
(226)-989-0511
http://ddajohnson.com

Goal: To work with a team solving interesting problems in mechatronics and robotics. My fourth year design project was to develop 3-D 6 degree of freedom SLAM algorithm for the NASA Sample Return Challenge and I'd be excited to return to that area of work at Clearpath.

Skills

- **Modeling:** 2-D and 3-D Dynamics and simulation of multibody systems.
- **Control Systems:** Practical experience with optimal control of biomechanical models using Pontryagin's Minimum Principle. Theoretical training in multi-variate, adaptive, and optimal control and state estimation techniques
- **Development:** C/C++, Python, MATLAB, Git, Objective-C, ROS, Linux
- **Experimentation:** Designed and executed experiments involving human subjects and processed the resulting data to estimate parameters for system modelling and control
- **Autonomous Systems:** Designed and developed a 3D 6DoF SLAM algorithm for the NASA Sample Return Challenge using ROS, Gazebo, Python, and C++.
- **Communication:** Excels at writing clear and concise documents and explaining ideas
- **Learning:** Love to learn new things and explore new ideas. Quick to pick up new skills and technologies as required

Education

University of Waterloo Waterloo, ON
Masters of Applied Science - Systems Design Engineering *2012-2015*

- Created a comprehensive, 3-D, forward dynamic, golfer swing model using MapleSim and Matlab on Linux. The model is optimally controlled to allow for evaluation of golf club designs.
- Delivered the completed model to an industry partner along with complete documentation.
- Excelled in courses in multivariate, adaptive, and optimal control systems.
- Managed Linux server for the lab including web sites, file shares, and wiki pages.

University of Waterloo Waterloo, ON
B.A.Sc. - Systems Design Engineering, Dean's Honour List, Co-operative Program *2007 - 2012*

- *4th Year Design Project* - SLAM for NASA Sample Return Challenge
  - Combined Kalman Filters, Iterative Closest Point (ICP), and GraphSLAM algorithms to develop a novel approach for 6 degree of freedom simultaneous location and mapping without the use of GPS
  - Improved on the performance of these methods individually by performing GraphSLAM in the background and updating the pose information after its completion.

Work Experience

University of Waterloo (Vision and Image Processing Lab) Waterloo, ON
Research Assistant - `vip.uwaterloo.ca/website-package` *May-Aug 2011*

- Developed algorithms for processing SAR imagery of sea-ice in the Canadian North
- Implemented algorithms within existing image processing software in Visual C++.
- Supervised and assisted a co-op student building a website for the lab using Drupal resulting in a package for building research group websites that was released as open-source
- Administered linux web server for hosting the lab website

Apple Inc. Cupertino, CA
Software Engineering Intern - iOS Location Software *Jan-Apr 2010 and Sep-Dec 2010*

- Designed and implemented a testing framework for location algorithms on iPhones and iPads in the form of an iOS application, Mac application, and accompanying server-side code. This application was used by the iOS Location team to develop and test indoor positioning systems.
- Developed an improved location algorithm using Kalman Filters for determining an iOS device's location during indoor positioning.

Trimble Navigation Christchurch, NZ
GPS Software Tester *May-Aug 2009*

- Developed and performed experiments on software keyboards for mobile devices using C#.
- Developed embedded micro-controller code for RF chamber test rig for handheld GPS devices.
- Tested hand held GPS devices for accuracy and interface usability.

CREZ Basketball Waterloo, ON
Software developer *Jan-Apr 2007 and Sep-Dec 2007*

- Developed statistics software for basketball coaches in Visual Basic .NET and C#
- Implemented client-side code for livestreaming basketball statistics to a web service.
- Packaged and released software to clients using InstallShield.
- Provided technical support through direct interaction with customers and written documentation

Personal Projects

Bearded Baritones Website nodeJS, Javascript, HTML & CSS
`github.com/proverbialsunrise/baritonesWebsite` *2015*

pySTL Python
`github.com/proverbialsunrise/pySTL` *2014*

Hymnal Mobile Application Objective-C, C++, Java
`github.com/proverbialsunrise/hymnalapp` *2010*

Personal

Crash Ultimate - KW Guelph Competitive Ultimate `crashultimate.ca`
Captain *2013-*

- Elected captain of National Championship winning team in 2014

Hobbies: Singing (A Cappella and Barbershop in particular), Ultimate Frisbee, Soccer, Basketball