

Avinash Singh

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Summary

- Experience with Python, C++, ROS, MATLAB/Simulink in Ubuntu Linux & Windows environments
- Hands-on experience with sensors like depth cameras, LiDAR, IMU, wheel odometry, UWB sensors
- Demonstrated experience with lab test equipment, rapid prototyping (3D printing and laser cutting), building and debugging complex electro-mechanical hardware systems
- Highly adaptable, work well autonomously as well as with diverse and cross-functional teams
- Relevant Coursework: Dynamics, Multivariate Control, Biology Inspired Robot Control, Robot Manipulation ([CSMM.103x](#)), Robotics Software Engineer ([Udacity NanoDegree](#)), Machine Learning ([CognitiveAI](#)), Intro to Deep Learning, Computer Vision

Technologies

- **Programming & Scripting:** Proficient with Robot Operating System (ROS), Python, C++. Working knowledge of LabVIEW, MATLAB/Simulink Real-Time, TensorFlow, Keras, OpenCV, Git, Bash
- **Modeling & Analysis:** Experience with modeling in Gazebo-ROS & Simulink
- **Hardware:** Micro Controllers (Arduino, Raspberry Pi), NI CRIO, cDAQ, Jetson Xavier, Nano, TX2, Motion Capture Systems (OptiTrack, Vicon)
- **CAD Software:** Working knowledge of SolidWorks and Pro-Engineer/Creo

Education

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|---|------------------|------------|
| • M.S. , Mechanical Engineering, University of Washington, Seattle | 3.7/4 | March 2018 |
| • B.E. , Mechanical Engineering, Nagpur University, India | 77.45/100 | May 2013 |

Experience

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|--------------------------------|---------------------------------------|--------------------------|
| Robotics Engineer | Fresh Consulting, Bellevue, WA | September 2019 – Present |
| ↳ Mechatronics Engineer | Fresh Consulting, Bellevue, WA | July 2018 – August 2019 |
- Autonomous Rover Robot - SLAM, Navigation, Localization:
 - Researched various sensors for use in autonomous robot navigation and integrated GPS, IMU, LIDAR, stereo camera, and Ultra-Wide Band (UWB) to enable advanced robot behaviors
 - Successfully trained a deep learning model based on VGG-16 to read gauges and deployed it on a robot
 - Integrated Extended Kalman Filter EKF into the robot's navigation stack to localize a robot in a GPS denied, indoor space using UWB sensors only and integrated that into the existing robotic navigation framework
 - Currently working on developing and integrating existing state-of-the-art control algorithms for a differential drive robot using C++, Python and ROS
 - Python App For Ventilator Burn-in:
 - Lead a team of 2 software engineers to deliver a GUI based burn-in app, that runs prolonged idling test phases on medical-grade ventilators, collects and logs data, and performs timed oxygen concentration tests
 - Developed Python-Serial interfaces for various sensors to facilitate communication with the app
 - Developed data analysis code with NumPy & SciPy to analyze oxygen data for pass-fail outcome of the test.
 - Ball Balancing AI Platform:
 - Verified nonlinear dynamics of a ball-on-plate system through first principles
 - Developed a Python & OpenCV program to track the ball
 - Successfully designed and integrated a PID controller (Python) that stabilizes a ball at a set point on the plate
 - Developed servo operation code and successfully integrated it with the PID controller
 - Mechanical Design for an Autonomous Club Car ATV:
 - Developed detailed mechanical designs of the fixtures for hardware and robotics sensors in SolidWorks
 - Created a bill of materials (BOM) and contributed to the design-build book.
 - Collaborated with internal engineering and design teams along with external suppliers to get parts manufactured and worked closely with technicians to get the robotic systems assembled.

Mechatronics Intern**Robodub, Seattle, WA**

January 2018 - June 2018

- Fabricated complete sliding rotor arm assembly for a proof of concept prototype of the drone using commercial & off-the-shelf components and rapid prototyping techniques (3D printing, laser cutting) and CNC machining
- Developed Arduino (C++) program to interface and control carriage motors according to the tilt angles and command position of the drone
- Developed a Python program to generate way-points from a 2D CAD drawing of a given closed structure

Research Assistant**AirLab, UW, Seattle, WA**

January 2017 – March 2018

Thesis: Planar Aerial Reorientation of an Insect Scale Robot (~140mg) Using Piezo Actuated Tail Like Appendage

- Implemented feedforward controller using XPC target and MATLAB/Simulink to minimize oscillations after reorientation and absence of onboard sensing
- Performed dynamical analysis and system identification to create a model in MATLAB for robot reorientation
- Designed experiments to characterize piezoelectric actuator displacement against applied input voltage

Mechanical Engineer**Shapoorji Pallonji and Co. Ltd., India**

August 2013 – July 2014

- Partnered with teams across Business Planning, Clients, Real Estate, Finance and Contract team to define the requirements of the project, develop Scope of Work analysis and provide detailed technical Letter of Estimate
- Worked closely with the contracts team to convert project requirements and engineering drawings into cost estimates, milestones and deliverables expected from the sub-contractors and into material requirements and Bill of Materials (BOM) for vendors and suppliers
- Assisted planning engineer with planning for manpower, scheduling resource availability and budgeting against upcoming projects and tracked the progress of different activities on MS Project
- Acted as engineering point of contact, maintaining liaison between reporting project management firms and sub-contractors to resolve ambiguities related to the Scope of Work

Relevant Academic Projects

- **Kinematics of a 6 DOF robot (robotics)** Solved a model of a 6 degree-of-freedom robot including DH parameters, forward and inverse kinematics using TF2 library of Robot Operating System (ROS), performed velocity and acceleration analysis in Python (Numpy, Scipy) and simulated the robot motion in Gazebo
- **Control of inverted pendulum (dynamics and control)** Performed dynamical analysis, linearization, stabilization and control of an inverted pendulum mounted on a cart and applied LQR, Kalman Filter and Linear Quadratic Gaussian Estimation to both discretized systems using MATLAB

Select Publications

- **A. Singh**, "Planar Aerial Reorientation of an Insect Scale Robot Using Piezo-Actuated Tail Like Appendage," Master's thesis, University of Washington, Seattle, 2018 [[PDF](#)]
- Chukewad, Y.M., **Singh, A.T.**, James, J.M. and Fuller, S.B., 2018, October. "A new robot fly design that is easier to fabricate and capable of flight and ground locomotion" in 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) [[PDF](#)]
- **A. Singh**, T. Libby, and S. B. Fuller, "Rapid Inertial Reorientation of an Aerial Insect-sized Robot Using a Piezo-actuated Tail," in International Conference on Robotics and Automation (ICRA), 2019 IEEE/RSJ [[PDF](#)]
- RoboFly: An insect-sized robot with simplified fabrication that is capable of flight, ground, and water surface locomotion, Chukewad, Y., James, J., **Singh A.**, and Fuller S. B., arXiv preprint arXiv:2001.02320, 2020.

Extra-Curricular

- Volunteer, Mechanical Engineering Graduate Association (MEGA), University of Washington
- Volunteer, National Service Scheme 2011-13
- Events Manager, Students Representative Council 2012