

Education

Stony Brook University

Ph.D., Mechanical (Concentration: Design and Robotics, Minor: Applied Mathematics), GPA 3.95

Stony Brook, NY

Aug 2015 – Present

- **Relevant Courses:** Robotics, Advanced Dynamics, Vibration and Control, Kinematic Analysis and Synthesis, Applied Stress Analysis, Product Design Optimization, Geometric Modeling, Analysis of Algorithms

Udacity, School of Autonomous Systems

Self Driving Car Engineer Nanodegree

Mountain View, CA

Mar 2019 – Mar 2020

- **Relevant Areas:** Computer Vision, Deep Learning, Sensor Fusion, Localization, Planning, Control, System Integration

Experience

Stony Brook University

Research Assistant

Stony Brook, NY

May 2017 – Present

- Developing a Computational Framework for Data-Driven Mechanism Design Innovation supported by a \$450K NSF grant.
- Creating **MotionGen** a web-based mechanism design framework. Uses MEAN (MongoDB, Express.js, Angular.js, Node.js) stack to create a RESTful web service based on MVC architecture. iOS and Android apps created using Apache Cordova framework.
- Designing algorithms for simulation and synthesis of Planar, Spherical and Spatial single-degree-of-freedom Robotic systems resulting in publications in journals by the American Society of Mechanical Engineers.
- In-charge of Computer-Aided Design and Innovation Lab and collaborating with a research group of 10+ graduate students.

Teaching Assistant

Aug 2016 – Apr 2017

- Developed **SnappyXO**, a laser-cut design-driven robotics platform that enables designing mechanisms, structures, and robots. It has successfully raised \$16K+ on **Indiegogo** for a crowdfunding campaign.
- Advised 250+ students in MEC101-Freshman Design Innovation, MEC 102-Engineering Computing, and Vertically Integrated Projects(VIP) Program. The Robot Design projects gained recognition from the Office of President at university.

Indian Institute of Information Technology

Junior Research Fellow

Jabalpur, India

May 2014 – May 2015

- Led a \$70k+ research project funded by the Science and Engineering Research Board titled “Development of Additive-Subtractive Integrated Rapid Prototyping System for Improved Part Quality”.
- Spearheaded design and manufacturing teams to create a new hybrid 3D printing process using Pellet based Screw Extruder with CNC machines. Created Toolpath Planning strategies to manufacture CAD models using Hybrid Manufacturing techniques.

Relevant Projects

Self Driving Car

Python, Jupyter, OpenCV, TensorFlow, Keras, C++, ROS

Udacity

May 2019 – Aug 2019

- Perception: A robust image processing pipeline is created to detect highway lanes in dashcam live-feed.
- Localization: Car's position within lane and lane curvature is calculated using perspective transform and polynomial fitting.
- Perception: LeNet inspired convolution neural network is developed to detect and classify 40+ kinds of traffic signs.
- Motion Planning: Cloned human behavior using an end-to-end neural network to autonomously steer a car using camera input.
- Sensor Fusion: Car location is estimated using an extended Kalman filter which acts on LIDAR and RADAR sensors data.
- Path Planning: A Finite State Machine based planner is created to achieve autonomous highway driving with other cars.
- Control: A PID controller is implemented to maneuver a vehicle around a virtual track using steering, throttle and brake.
- Localization: A 2D particle filter for sparse localization is designed and uses GPS and sensor data with a landmark map.
- System Integration: Robot Operation System (ROS) is used to combine Perception, Localization, Planning, and Control.

Two Armed Robotic Manipulator

Matlab

MEC529 Robotics

Mar 2016 – May 2016

- Optimal motion planning in Dual Quaternion space to pick and place objects considering manipulator reachability.

Interactive Manipulation of NURBS Surfaces

C++, OpenGL, Qt5

MEC572 Geometric Modelling

Mar 2016 – May 2016

- OpenGL based implementation in C++ for interactive manipulation of Non Uniform Rational B-Spline Surfaces.

Technical Proficiency

- **Languages :** Python, Javascript, C++, MATLAB, Mathematica
- **CAD softwares :** Solidworks, Autodesk Inventor, PTC Creo, CATIA, Ansys (CFD and Mechanical), Autodesk AutoCAD, Autodesk Moldflow, FeatureCAM, MSC-Adams, ZWCAD, Altair HyperMesh, Altair OptiStruct, Materialize Magics, Materialize Mimics, CNC G-M Code
- **Tools & Technologies :** Keras, Tensorflow, OpenCV, HTML, CSS, Canvas, Node.js, Express.js, Redis, Apache Cordova, OpenGL, Jupyter, Anaconda, Git, npm, MongoDB, Docker, ROS

Selected Publications

- Sharma S., Purwar A., Ge Q.J.; **A Motion Synthesis Approach to Solving Alt-Burmester Problem by Exploiting Fourier Descriptor Relationship Between Path and Orientation.**, ASME J. Mechanisms Robotics; doi:10.1115/1.4042054
- Sharma S., Purwar A., Ge Q.J.; **An Optimal Parametrization Scheme for Path Generation Using Fourier Descriptors for Four-Bar Mechanism Synthesis.**, ASME J. Computing and Information Science in Engineering; doi:10.1115/1.4041566