

## Experience

### **Dematic, Kion Mobile Automation**

*Machine Learning Engineer*

Holland, MI  
Sept 2020 – Present

- Creating a robust SLAM algorithm testing pipeline using ROS, Gazebo and Rviz.
- Evaluating Gmapping, Octomap and Cartographer based mapping approaches using 2D and 3D Lidar sensors.
- Evaluating the use of Visual Inertial Odometry and GraphSLAM to improve AGV navigation in warehouse environments.

### **Stony Brook University**

*Research Assistant*

Stony Brook, NY  
May 2017 – Aug 2020

- Developed a Computational Framework for Data-Driven Mechanism Design Innovation supported by a \$450K [NSF grant](#).
- Designed algorithms for simulation and synthesis of Planar, Spherical, and Spatial single-degree-of-freedom Robotic systems resulting in multiple publications in journals by the American Society of Mechanical Engineers.
- Created [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.
- 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.

### **Vivonics, Inc.**

*Product Design Intern*

Stony Brook, NY  
Feb 2016 – Aug 2016

- Coordinated with the design team on developing PMT Monitor, a portable medical headset that detects head trauma.
- Generated concepts for an interpupillary distance adjusting mechanism focusing on manufacturability and robustness.

### **Leviathan Energy**

*Strategic Partnership for Industrial Resurgence (SPIR) Intern*

Stony Brook, NY  
Feb 2016 – May 2016

- Designed and manufactured Hydro-kinetic turbines with improved airfoil design which produces 50% more power in collaboration with Leviathan Energy.
- Created engineering models using Solidworks and Autodesk Inventor and fabricated parts by FDM based 3D printing.

### **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.

### **Sara Sae Private Limited**

*Design Intern*

Dehradun, India  
May 2013 – Aug 2013

- Involved with product development of Hydraulic Tongs used in the oil and gas industry.
- Carried out Kinematic and Dynamic analysis to find the most probable failure regions.

### **Altair**

*Engineering Intern*

Jabalpur, India  
Sept 2012 – Dec 2012

- Solved practical engineering problems by Topology, Topography, Size and Shape Optimization using OptiStruct.
- Achieved 44th rank in Altair All India Optimization Contest 2012.

### **Vehicle Factory Jabalpur**

*Manufacturing Intern*

Jabalpur, India  
July 2011 – July 2011

- Worked with the Production Line and Maintenance Teams for Mine Protected Vehicle and Stallion Mark-I trucks.

### **Central Institute of Hand Tools**

*Computer Aided Design Intern*

Jalandhar, India  
June 2010 – June 2010

- Carried out Computer-aided Design using Pro/ENGINEER, Mold Modelling and Mold-flow analysis.

## Education

### **Stony Brook University**

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

Stony Brook, NY  
Aug 2015 – Aug 2020

- **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

## Relevant Projects

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### Self Driving Car subsystem design and integration

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

Udacity  
May 2019 – Aug 2019

- Detection: A robust image processing pipeline is created to detect highway lanes in dashcam live-feed.
- Perception: Car's position within lane and lane curvature is calculated using perspective transform and polynomial fitting.
- Classification: LeNet inspired convolution neural network is developed to detect and classify 40+ kinds of traffic signs.
- Deep Learning: 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.
- Localization: A 2D particle filter for sparse localization is designed and uses GPS and sensor data with a landmark map.
- Trajectory 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.
- System Integration: Robot Operation System (ROS) is used to robustly combine Perception, Planning, and Control.

### Motion Planning for a Robot with Two Anthropomorphic 6-DOF Arms

*Matlab*

MEC529 Robotics  
Mar 2016 – May 2016

- Inverse Kinematics and Dual Quaternion interpolation based optimal trajectory planning to pick and place objects considering individual arm's workspace and dexterity.

### 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.

### Fracture test analysis for compact tension specimen

Feb 2017 – May 2017

- Finite element analysis of a fracture specimen to predict and validate deformations at the crack tip using Abacus.

### Conceptual Design

Aug 2015 – May 2016

- Formulation of design specification/criteria and conceptual design generation of an Ergonomic Nutcracker and Stone Crusher.

### Quality Improvement of Aircraft Wing Assembly

Aug 2015 – Nov 2015

- Identifying and correcting the root cause for high rejection rate of final assembly using Pareto Charts, Cause and Effect Diagrams, Control Charts and Histograms.

### Mold Design and Manufacturing

May 2012 – Nov 2012

- Designed and manufactured molds for irrigation industry products for Injection Molding Process.
- Flow Analysis results were used to optimize design and a Pricing Strategy was developed for industry.

## Technical Proficiency

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- **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

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- Sharma S., Purwar A.; **Path Synthesis of Defect-Free Spatial 5-SS Mechanisms Using Machine Learning.**, ASME IDETC-CIE2020; doi:10.1115/DETC2020-22731
- Sharma S., Purwar A.; **Unified Motion Synthesis of Spatial Seven-Bar Platform Mechanisms and Planar-Four Bar Mechanisms.**, ASME IDETC-CIE2020; doi:10.1115/DETC2020-22718
- Sharma S., Purwar A.; **Using a Point-Line-Plane Representation for Unified Simulation of Planar and Spherical Mechanisms**, ASME J. Computing and Information Science in Engineering; doi:10.1115/1.4046817
- 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