VARUN WALIMBE

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EDUCATION

Worcester Polytechnic Institute   **Aug 2021 – May2023**
Master of Science in Robotics Engineering   *Worcester, MA*

Mumbai University, Maharashtra   **July 2016 - Oct 2020**
Bachelor Of Electronics Engineering   *Mumbai, India*

SKILLS

- **Programming Languages**: Python, C++, KUKA KRL, Fanuc Karel, DRL, SPEL+.
- **Experience With Robots**: Fanuc, KUKA, Epson, Mitsubishi, Denso, Doosan, Universal.
- **Robot Software:** ROS2, Roboguide, Epson RC+, WorkVisual, RT Toolbox 3, RoboDK, Dart Studio, WincapsIII.
- **Robot Simulation Tools**: Gazebo, Rviz, KUKA Sim, Roboguide, RoboDK, Webots.
- **PLC and Vision Software**: OpenCV, Cognex Insight Explorer, Studio 5000, Codesys.
- **Continuous Integration Tools**: Git.

EXPERIENCE

Robotics Field Engineer| Website   **Jul 2024 - Present**
AES Corporation – Arlington, VA
- **Troubleshoot and Debugging:** Troubleshoot and debug the solar panel installation KUKA Robots on field.
- **Motion Optimization:** Optimize Robot motions by analyzing trajectories using plot juggler, ROS 2 and reduced the cycle time by 10 seconds. Made motion smoother by reducing jerk during trajectory.
- **Robot Programming:** Develop test scripts in C++, Python and KRL to tackle issues on field and deploy new optimized solutions on the Robot.
- **Robot Operation:** Operate Robots on field to identify issues with Robot motions, production, sensors and actuators. Develop software using ROS2 to test and resolve those issues.
- **Robot Simulation:** Analyze Robot simulation using Rviz2 with ROS2 to identify new features and solutions that could be added to increase the operational efficiency and minimize downtime.
- **Robot Engineering:** Perform Robot mastering, Hardware and file backups on KUKA, Intrinsic-Extrinsic Vision Calibration and Lidar Calibration. Closely monitor sensors – Proximity, Force-Torque every day.
- **Additional Takeaways:** Gained skills in understanding Behavior Trees, Robot-Vision Calibration, Hardware-Lidar, Proximity Sensors, Camera, PLC and Force-Torque Sensor.

Robotics Engineer| Website   **Jun 2023 –May 2024**
Calvary Robotics – Webster, NY
- **Automation:** Design, program, test, configure and debug automated robotic systems.
- **Integration:** Program industrial robots in their native format including development of interface to other systems such as Allen Bradley PLC, ROS2, and Vision through Ethernet IP/Modbus Protocols
- **Troubleshoot and Debugging:** Troubleshooted Industrial Robots like Epson, Fanuc, KUKA and Denso.
- **Robot programming:** Teach Robot points and optimized motion paths of various Industrial Robots.
- **Training:** Trained customers in motion programming of KUKA Robots and equipment use.
- **Service:** Remotely troubleshooted robot issues with customers and resolved them onsite.
- **Robot Lab Manager:** Debugged, Maintained and Optimized demo applications in Calvary Robotics Lab.
- **Robot Simulation Validation and Analysis:** Perform robot simulation to estimate cycle times, conducted feasibility study, and virtual validation of EOAT design.
- **Team Collaboration:** Collaborate with team members during system design, build and debug.
- **Developing Agenda:** Worked with a multidisciplinary team to prioritize tasks and develop weekly agendas.
- **Additional Takeaways:** Gained familiarity with programming Allen Bradley PLC and HMI.

Robot Testing and Computer Vision Intern| Website   **Jun 2022 - Sep 2022**
Harvest CROO Robotics – Tampa, FL
- **Feature Analysis:** Performed feature analysis of berries using **ORB feature descriptor** for segmenting and distinguishing two berries touching each other.
- **Vibration Characterization:** Developed a statistical model to **characterize vibration** using intel real sense IMU and investigated various approaches to remove cross-coupling in the sensor data.
- **Robot Alignment and Control:** Developed script for **pose estimation** and **alignment** using Charuco Board.
- **Additional Takeaways:** Got an opportunity to work on PLC and testing **industrial sensors**.

Manipulation and Environmental Robotics Lab | [Website](#), [PPT]   **Aug 2021 - Dec 2021**
Research under Dr. Berk Calli - Worcester, MA
- **Non-Prehensile Manipulation Algorithm Implementation:** Proposed a way of using non-prehensile manipulation algorithm in cluttered environment for sorting waste pile using robotic arm.
- **Robot Design:** Developed scara robot **URDF** from scratch, deployed and controlled it in gazebo.
- **Topography Mapping:** Developed a topography mapping algorithm for environment using **ROS**, **Gazebo**, **Rviz**, **Moveit** and **Microsoft Kinect.**

PROJECTS

Autonomous Chess Playing Robotic Arm |[Project Link](#)
- **Kinematics of serial Manipulator:** Calculated forward kinematics using **DH-convention** and inverse kinematics using geometrical approach for a 3-DOF robotic arm and computer vision.
- **Singularity computation:** Analyzed the singularity and evaluated the **manipulability** in Matlab.
- **Trajectory Generation:** Calculated equations of motions and implemented trajectory planning algorithm.

Autonomous Warehouse Management System Using ROS |[Project Link](#)
- **ROS Simulation:** Utilized simulation of real-time amazon warehouse ur5 robots and ordering mechanism using ROS and Gazebo.
- **Warehouse Automation:** Implemented path planning using MoveIt! and used computer vision framework to detect QR codes on customer's orders and package location on conveyor belt.

Feasibility and Simulation Study of KUKA KR 10 Robot Using KUKA Sim
- **Modeling:** Modeled EOAT of the robot and Linear rail for the robot in KUKA Sim
- **Reach Study:** Conducted comprehensive reach studies to evaluate the robot's ability to access all necessary points within its workspace, accounting for the dimensions of the EOAT and the extended range provided by the 7th axis.
- **Singularity Analysis**: Performed singularity analysis to identify positions where the robot's movements might become unpredictable or uncontrollable, implementing strategies to avoid these singularities and ensure smooth operation. Recorded the data and collaborated with mechanical engineers to perform final testing.
- **Testing and Validation**: Tested the final program by transferring simulation program to actual robot and ensured that robot reaches all the necessary points.

Motion Study with Pick and Place Using KUKA Robot
- **ROS Simulation:** Made a simple program for picking and placing blocks on a table using KUKA Smart Pad.
- **Motion Study:** Used various kinds of motions during programming like PTP, Linear, Spline Linear, relative motions and compared and evaluated the results during robot motion.
- **Optimization:** Optimized the motion as per the results obtained during motion study.

Vision Based Pick and Place with Fanuc Robot
- **IR Vision:** Setup IR Vision on Fanuc M200 iD/6 to detect the parts and get the pose of the object.
- **TCP Teaching**: Used pointer to teach the TCP of the Robot using 4-point method. Repeated with different methods such 3-Point, 6-point method and compared the results.
- **TP Program Setup:** Made a TP Program to get the pose of the pallet block with vision data from the camera.

Robot Commissioning of Doosan Robot M0609
- **Programming:** Programmed the M0609 robot in its native format and tested the program using Task Maker.
- **Configuration:** Set up TCP, Inertia data and configured base and user frames on the robot application.
- **Communication Setup:** Established communication between PLC, Robot Controller and Dart Studio using Ethernet IP Protocol.
- **Robot Control through PLC:** Setup Ethernet IP on controller and controlled the Robot through PLC commands.
- **Operation:** Operated Robot in manual, auto mode and optimized motions

PUBLICATIONS

- Smart Phone Accidents Prevention System ([IJSRET_V5I3 - 366](#))
- Detection and Correction of Potholes using ML ([IEEE-Springer-ICCCMLA-2020](#)

ACHIEVEMENTS

- **Best Hardware Project** - Worcester Polytechnic Institute, USA| [Website](#), [Video](#)
- **Best MQP** - University of Mumbai, India| [MQP Report](#), [Certificate](#)
- **Winner in smart India internal hackathon** - University of Mumbai |[Poster](#)