VARUN WALIMBE

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EDUCATION

Worcester Polytechnic Institute — **Aug 2021 - Present**
Master of Science in Robotics Engineering — *Worcester,MA*

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

EXPERIENCE

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 eachother.
- **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.
- **UI Optimization:** Optimized the algorithmic scripts for robot UI and software for controlling the robot
- **Robot Alignment and Control:** Developed script for **pose estimation** and **alignment** of robot using charuco board.
- **Additional Takeaways:** Got an opportunity to work on PLC, mounting and testing **industrial accelerometers** and cameras on the robot, experience with linux commands, camera calibration techniques, **Robot live testing**, Implementation of **Kalman Filter**, visit the field where robots are deployed, understanding about various industrial equipments like metal cutters, 3D Printing, Laser cutters and PCB fabrication.

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 novel way of using non-prehensile manipulation algorithm in cluttered environment for sorting waste pile using robotic arm.
- **Robot Design:** Developed the scara manipulator **URDF** from scratch, deployed and controlled it in gazebo simulator.
- **Topography Mapping:** Developed a topography mapping algorithm of environment using **ROS**, **Gazebo**, **Rviz**, **Moveit** and **Microsoft Kinect**
- Investigated and impelemented various **non-prehensile manipulation** techniques to flatten pile of waste and separating it from non desired waste.

Computer Vision Intern | Certificate, Report — **Apr 2021 - Aug 2021**
Solar Industries Limited - Mumbai, India

- **Automation:** Automated the process of counting package content by developing python scripts using computer vision.
- **Database Management:** Developed python script and integrated it with **AWS, HTML** and **PostgreSQL**.
- **Optimization:** Devised machine learning model using tensor-flow achieving **90%** accuracy.
- **Web-app Deployement:** Created web-app using HTML, Flask and eliminated **60%** of the manual work.

Robotics Engineering Intern | Website, Video — **Aug 2020 - Nov 2020**
Ocean Energy - Mumbai, India

- **PCB Design:** Designed and fabricated PCB for a mobile robot using **Eagle** software and soldered the components and interfaced with Servo Motor, Raspberry PI and Arduino.
- **Software Implementation:** Implemented face tracking algorithm in python using **haar cascades** and **OpenCV** library. Additionally used winsound library to output endearing sounds upon human face detection.
- **Integration:**Integrated the **Arduino**,**Rapsberry PI**,and electronics with the software to get it working and investigated various approaches to power management for efficient working.
- **Team Collaboration:** Collaborated in group of 5 to create physical hardware for robotic application.

Electrical Engineering Intern | Website — **Jun 2019 - Jul 2019**
Crompton Greaves - Mumbai, India

- Implemented simple programmable logic controller programming concepts on **Festo PLC** hardware.
- Experienced familiarity with transformers, electronic circuits, product transformation and development.
- Assisted in the development of project management tools and development.
- Developed ability to design electronic circuits and read **component data sheets**.

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 Pothole Detecting and Repairing Robot |Project Link, PPT

- **Team Collaboration:** Collaborated with 3 team members to design pothole repairing robot using Fusion360.
- **Algorithm Implementation:** Implemented **occupancy grid mapping** algorithm for robot localization and environmental mapping framework.
- **Machine Learning:** Implemented Support Vector Machine model for detecting potholes achieving an accuracy of 85%.

Maze Solver Bot Using LSRB and Shortest Path Algorithm |Website

- **Robot Assembly:** Assembled a mobile robot using Arduino which solves line maze.
- **Algorithm Implementation:** Formulated **LSRB** algorithm to solve the maze from any starting point.
- Implemented shortest path algorithm which was 2 times faster than the implemented LSRB 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.

Quadruped Robot Motion on Hardware with Voice Control |Project Link, Video

- **Robot Assembly:** Assembled Quadruped Robot to demonstrate Robot dynamics, Stability and Control.
- Implemented **creep gait** algorithm and Inverse Kinematics to incorporate stability while walking and used C++ to program the robot.
- **Dynamic Control:** Simulated dynamic control of the robot using **matlab** and **ROS**.

Self-Learning Robot Using Reinforcement Learning |Project Link, Video

- **Q-learning Implementation:** Implemented Q-Learning algorithm to make it learn avoid obstacles on its own
- **Software Development:** Developed programming logic in C++ and used Arduino as the framework.
- **AI Training:** Trained the robot in different states and achieved convergence in 100 epochs.

PUBLICATIONS

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

SKILLS

- **Programming Languages**: Python, C++, Embedded C,PLC
- **Tools**:ROS, Gazebo, Rviz, Matlab, Visual Studio, SolidWorks, Git, Anaconda
- **PCB Design Software**: Eagle, Proteus, Fritzing.
- **Operating Systems**: Ubuntu(18.04,20.04), Windows, Debian, Raspbian.
- **Hardware**: Arduino, Raspberry Pi, Nvidia Jetson Nano, Qtpy, Raspberry Pi Pico, ESP8266
- **Frameworks/Packages:**Tensorflow, Keras, Numpy, Matplotlib, Pandas,Scikit-Learn, NLTK.
- **AI Algorithms:** Regression, Classification, Clustering, SVM, Q-Learning, SARSA, Artificial Neural Network, Convolutional Neural Network
- **Contributing Writer,Hackster.io:https://www.hackster.io/Varun2905**

RELEVANT COURSEWORK

- **Foundation of Robotics|Course Content**
- **Computer Vision|Course Content**
- **Robot Dynamics|Course Content**
- **Robot Control|Course Content**

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**