CHARMIN PRITESH DESAI

+1(716)-614-2519 | desaicharmin@gmail.com| LinkedIn | GitHub | Buffalo, NY, USA

EDUCATION

The State University of New York at Buffalo (UB) **Buffalo, New York, USA**
- Master of Science in Robotics (Robotics & Artificial Intelligence) Aug 2021 – May 2023
- CGPA : 3.22/4

Sardar Vallabhbhai Patel Institute of Technology (SVIT) **Vasad, Gujarat, India**
- Bachelor of Engineering in Instrumentation & Control (Industrial Automation) Aug 2016 – Aug 2020
- CGPA : 8.15/10

SKILLS

Programming Languages: C , Embedded C, Python, MATLAB & Simulink, Ladder Logic
Hardware: PLC, PID Control, Electrical, Electronics, Embedded Systems
Software: Machine Learning, Computer Vision, Image Processing, Robot Algorithms, ROS, Gazebo
Libraries: NumPy, Pandas, Matplotlib, OpenCV, TensorFlow, Sklearn, Keras

ACADEMIC PROJECTS

Autonomous Plant Watering Robot (View) **Sept 2022 – May 2023**
- **Objective :-** Developed an autonomous robot for watering plants in an unknown environment, facilitated by SLAM Gmapping for creating occupancy grid. Further used A* path planning and generated a shortest path. Moreover, utilized AprilTags and robot's own velocity to localize the robot which was then used for plant searching and its pose estimation. Finally navigating to reach and water the plants effectively.

1. **SLAM :-** Used Gmapping on a TurtleBot3 robot in ROS gazebo to generate an image of size 384x384 pixels.
2. **Occupancy Grid :-** Performed image processing to generate an occupancy grid matrix of 400x400 pixels.
3. **Path Planning :-** Used homogenous transformation method to formulate two opposite coordinate frame transformations from Gazebo world frame to occupancy grid frame and vice-versa.
   Optimized A* algorithm from scratch and planned a 95% improved shortest path for the robot.
4. **Perception :-** Deployed AprilTags in gazebo. Executed AprilTag continuous detection node to derive the transform from any AprilTag's frame to robot's camera frame and world frame.
5. **Localization :-** Calculated the pose of the robot in the world frame with almost 100% accuracy.
   a) Updated robot's pose from AprilTag detection by a ROS Server-TF Broadcaster & Client-TF Listener node.
   b) Updated robot's pose using its own linear and angular velocity through trigonometric calculation.
6. **Recognition :-** Programmed a mathematical algorithm which estimates the true position of a plant from continuously updated robot's pose and robot to plant transform.
7. **Exploration :-** Robot explores the environment parallelly searching for plants to save their position in its memory.
   - Programmatically came up with random points in the occupancy grid for robot exploration.
   - Implemented K-Means Clustering algorithm with A* planning as a distance metric to cluster the points.
8. **Navigation & Control :-** Executed a controller node, driving the robot 80% faster from start to goal/plant location.
9. **Plant Watering :-** Enabled the robot navigating a shortest path for watering all the plants in least time.

Neural Network and CNN on Income & Fashion-MNIST Dataset **Apr 2022 - May 2022**
- A Neural Network was built on Income dataset of size 32500 to predict a person's income. An accuracy of 85.60 % was achieved though Hyperparameter Tuning for NN model optimization.
- CNN was built on Fashion-MNIST dataset of size of 70000 images to predict the item type. Accuracy of 92.05 % was achieved through Hyperparameter Tuning for CNN model optimization.

Analysis of Fanuc LR Mate 200-iD Robot Arm **Sept 2021 – Nov 2021**
- Standardized position of 6-DOF robot manipulator's end-effector in base frame and world frame.
- Formulated calculations by Denavit-Hartenberg methodology and Forward Kinematics.
- Derived 6x6 Jacobian Matrix to generalize linear and angular velocities of end-effector using DH Table.
- Chose Euler-Lagrange method to derive a mathematical model of 6-DOF unit.

Controlled Silo Process using PLC **May 2021**
- Empty bottles run on a conveyor by a 1-phase motor belt until identified by a photo-switch sensor.
- This halts the motor and starts a LFM (liquid filling apparatus) for 3 seconds. Finally, level sensor ends LFM.
- Conveyor is commenced again to fill new bottles; this repeated each cycle for 6 seconds.

INTERNSHIP AND WORK EXPERIENCE

Teaching Assistant at University at Buffalo **Feb 2023 – May 2023**
- Teaching assistant of professor Dr. Vojislav Kalanovic (Program Director) in the course MAE594 Robotics 2.
  a) Conducted lectures on mathematical modelling of robot mechanisms and LABs on 6-DOF Jetmax Robot Arm.
  b) Simulated the robot on ROS-Gazebo and ran robot hardware via ROS-1 commands and programs.
  c) Calibrated 3 unalike end-effectors (electromagnetic suction cup, grippers, pen) with 1 AprilTag.
  d) Interfaced 5 different sensors like ultrasonic scan, display, dot matrix, touch, fan tracking, etc.

Internship at Tara Mechons Pvt. Ltd. **Apr 2020**
- Devised an Automatic Turn-Off Electrical Cutting System for operator safety in a team of 4 members.
  a) Interfaced 4-pole relay contactor to 3-phase induction motor that energized it.
  b) Lever when released, NC switch opened and disconnected the circuit that powered machine off.
  c) When lever was pulled, NC switch closed that completed this circuit, which turned mechanism on.

Internship at Larsen and Toubro Power Training **Jun 2019**
- Engaged in Training on Industrial Instrumentation and Control Systems.
  a) Learned about PLC, Ladder Logic programing, DCS, SCADA, industrial valves, and transmitters.
  b) Studied various motor starters. e.g., 2-3-4 point, VFD's, Soft starter and DOL starter.