CHARMIN PRITESH DESAI

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EDUCATION & SKILLS

The State University of New York at Buffalo (UB), NY, USA **Aug 2021 – May 2023**

- Master of Science in Robotics (Robotics & Artificial Intelligence)
- ✓ Python programming, Robot Algorithms, ROS, Gazebo, AI/ML, OpenCV, Computer Vision, Engineering Mathematics

Sardar Vallabhbhai Patel Institute of Technology (SVIT), Gujarat, India **Aug 2016 – Aug 2020**

- Bachelor of Engineering in Instrumentation & Control (Industrial Automation)
- ✓ C programming, Arduino, MATLAB & Simulink, PLC, PID Control, Electrical/Electronics, Embedded Systems

ACADEMIC PROJECTS

Autonomous Plant Watering Robot (ROS) **Sept 2022-May 2023**

1. **Watch :-** **Autonomous Robot (ROS and Gazebo)**
2. **Objective :-** Development of a mobile robot to water household plants autonomously. It explores an unknown environment, builds a map, while also searching for plants. The robot localizes itself and navigates autonomously.
3. **SLAM :-** Used Gmapping on a TurtleBot3 robot in ROS gazebo to generate an image of size 384x384 pixels.
4. **Occupancy Grid :-** Performed image processing to generate an occupancy grid matrix of 400x400 pixels.
5. **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.
6. **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.
7. **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.
8. **Recognition :-** Programmed a mathematical algorithm which estimates the true position of a plant from continuously updated robot's pose and robot to plant transform.
9. **Exploration :-** Robot explores the environment parallelly searching for plants to save their position in its memory.
   a) Programmatically came up with random points in the occupancy grid for robot exploration.
   b) Implemented K-Means Clustering algorithm with A* planning as a distance metric to cluster the points.
10. **Navigation & Control :-** Executed a controller node, driving the robot 80% faster from start to goal/plant location.
11. **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**

1. Introduced a Neural Network for income prediction from an Income dataset of size 32500 and achieved accuracy of 85.6% by Hyperparameter Tuning for optimization.
2. Built Object Recognition implementing CNN utilizing Fashion-MNIST dataset of 70000 sample images and obtained 92% accuracy.

Analysis of Fanuc LR Mate 200-iD Robot Arm Manipulator **Sept 2021 - Nov 2021**

1. Standardized position of 6-DOF robot manipulator's end-effector in base frame and world frame.
2. Used Denavit-Hartenberg methodology and Forward Kinematics for calculations.
3. Derived 6x6 Jacobian Matrix to generalize the linear and angular velocities of the end-effector using DH Table.
4. Used Euler-Lagrange method to derive the mathematical model of the 6-DOF robot manipulator.

PLC Process Automation (Ladder Logic) **Aug 2019 - Dec 2019**

1. Automated Bottle Filling System (Silo Process)
   a) A conveyor belt run by 1-phase motor running empty bottles until detected by a photo-switch sensor.
   b) Sensor stops motor from starting LFM (liquid filling machine) for 3 seconds. Level sensor stops the LFM.
   c) The conveyor begins running again to fill new empty bottles repeating each cycle for 6 seconds.
2. Batch Mixer Process Control
   a) Two pumps pouring different fluids into 1 container until detected by a level switch sensor.
   b) The fluid mixture is heated and processed by heater and spinning motor for a set timer of 30 seconds.
   c) Finally, an output valve opens and a third pump supplying the resultant fluid out in 10 seconds.

Electrical/Electronics and Automation **2019 – 2021**

1. Miniature adapter to set timer to any device/machine from 1-99 minutes with automatic turn-off functionality.
2. Reconstructed Indoor automatic lighting system controlled in 3 ways (PIR/IR Remote/Phone/Ambient Light).
3. Built an automatic system that detects & prevents water wastage and measures water consumption.

INTERNSHIP AND WORK EXPERIENCE

Teaching Assistantship, University at Buffalo **Feb 2023 – May 2023**

- Teaching assistant for professor Dr. Vojislav Kalanovic (Program Director) in the course MAE594 Robotics 2.
- Conducted lectures on mathematical modelling of robot mechanisms and LABs on 6-DOF Jetmax Robot Arm.
  a) Simulated and controlled the robot on Gazebo and controlled it via ROS nodes and commands.
  b) Calibrated robot's different end-effectors (electromagnetic suction cup, grippers, pen) with AprilTag.
  c) Performed operations like color & waste sorting, block stacking, gesture recognition, numeric calculation.
  d) Interfaced different sensors like ultrasonic scan and display, dot matrix, touch control, fan tracking, etc.
  e) Programmed a ROS node to move the robot's end-effector in X-Y-Z-axis, home position and localization.

Grader Assistantship, University at Buffalo **Sept 2022 – Dec 2022**

- Grader assistant for professor Dr. Minghui Zheng in the course MAE340 Dynamic Systems.

Internship at Tara Mechons Pvt. Ltd. **Apr 2020**

- Devised an Automatic Turn-Off Electrical Cutting Machine for operator safety in a team of 4 members.

a) Used a 4-pole relay contactor to interface 3-phase induction motor that powers the machine.
b) NC contact switch breaks the circuit when the lever arm of the machine is released, turning it off.
c) When the level arm is pulled, the NC switch closes completing the circuit, powering the machine.

Internship at Larsen and Toubro Power Training **Jun 2019**

- Engaged in Training on Industrial Instrumentation & 3 popular Automatic Control Systems (PLC, DCS, SCADA).

a) Learnt about PLC and Ladder Logic programing. Recognized various control valves and industrial sensors.
b) Learned about 6 motor starters: 2-3-4 point, VFD's, Soft starter and DOL starter.

Internship at Niyantras Automation **Dec 2018**

- Prototyped an Indoor Air Quality Monitoring System operating on Arduino, MQ135, and MQ5 sensor modules for detecting particulate matter, N2O, SO2, H2, LPG, CH4, CO, and alcohol.