

CHARMIN PRITESH DESAI

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EDUCATION

The State University of New York at Buffalo (UB), NY, USA

Aug 2021 – May 2023

- Master of Science in Robotics (Robotics & Artificial Intelligence)

Sardar Vallabhbhai Patel Institute of Technology (SVIT), Gujarat, India

Aug 2016 – Aug 2020

- Bachelor of Engineering in Instrumentation & Control (Industrial Automation)

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 (ROS)

Sept 2022-May 2023

- **Objective :-** Developed an [autonomous robot](#) for watering plants in an unknown environment, facilitating SLAM Gmapping for creating occupancy grid. Further using A* path planning for generating a shortest path. Moreover, utilized AprilTags and robot's own velocity to localize the robot which is 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.
 - 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.
- 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.

Analysis of Fanuc LR Mate 200-iD Robot Arm Manipulator

Sept 2021 - Nov 2021

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

Silo Process using PLC

Feb 2018 – May 2018

- Empty bottles run on a conveyor by a 1-phase motor belt until detected by a photo-switch sensor. The sensor stops the motor and starts a LFM (liquid filling machine) for 3 seconds. Then the level sensor stops LFM and starts conveyor belt to run again to fill new bottles repeating each cycle for 6 seconds.

Batch Mixer Process Control using PLC

Feb 2018 – May 2018

- Two pumps pour different fluids into 1 container until detected by a high limit level sensor. The fluid mixture is heated and processed by heater and spinning motor for a set timer of 30 seconds. Finally, an output valve opens and a third pump supplying the resultant fluid out in 10 seconds. Level of fluid in the container drops that is detected by low limit level sensor, that turns on the two pumps again repeating the cycle.

Embedded and Automation

2019 – 2021

1. Invented miniature adapter to time 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 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 Gazebo and controlled the robot hardware via ROS-1 commands and programs.
 - c) Calibrated 3 different end-effectors (electromagnetic suction cup, grippers, pen) with 1 AprilTag.
 - d) Interfaced 5 different sensors like ultrasonic scan, display, dot matrix, touch control, fan tracking, etc.

Grader Assistant at University at Buffalo

Sept 2022 – Dec 2022

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

Internship at Tara Mechcons Pvt. Ltd.

Apr 2020

- Devised an Automatic Turn-Off Electrical Cutting Machine for operator safety in a team of 4 members.
 - Utilized a 4-pole relay contactor to interface 3-phase induction motor that powers the machine.
 - NC contact switch breaks the circuit when lever arm of the machine is released, which turns it off.
 - When lever arm is pulled, NC switch closes that completes the circuit, powering the machine on.

Internship at Larsen and Toubro Power Training

Jun 2019

- Engaged in Training on Industrial Instrumentation & 3 popular Automatic Control Systems (PLC, DCS, SCADA).
 - Learnt about PLC and Ladder Logic programming. Recognized various control valves and industrial sensors.
 - Learned about 6 motor starters: 2-3-4 point, VFD's, Soft starter and DOL starter.

Internship at Niyanttras 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.