Dev Soni

devsoni44.pp@gmail.com | LinkedIn | GitHub | Website | +91-6353686534

INTERESTS

Control System, Intelligent System, Optimization, Artificial Intelligence, Robotics (Industrial, Mobile, and Rehabilitation)

EXPERIENCE

Undergraduate Researcher — Indian Institute of Science Education and Research, Bhopal **July 2021 – Present**

Guide: Dr. P. B. Sujit

Learning-based NMPC Framework (Deep Q Network + Nonlinear Model Predictive Controller) **Jun 2022 – Present**

- Working on development of Learning—NMPC framework with the use of Deep Reinforcement Learning for learning weights of NMPC cost components in order to reduce iterative tracking error
- Using open source frameworks like CasADi, OpenAI Gym, and PyTorch

Learning-based NMPC Framework (Q-Learning + Nonlinear Model Predictive Controller) **Jan 2022 – May 2022**

- Designed Learning Nonlinear Model Predictive Controller (L-NMPC) for filming racing car with the use of fixed-wing AAV, Q-learning—Reinforcement learning algorithm was used for learning purposes
- Custom RL environment created through OpenAI Gym, CasADi library used for NMPC optimization, and proposed algorithm validate through simulation
- Achieved ~70% error reduction by using this approach (Paper)(GitHub)

Nonlinear Model Predictive Controller for Target Tracking **July 2021 – Dec 2021**

- Implemented NMPC for target tracking problem, NMPC controller is able to avoid static and dynamic obstacles and persistently tracks the ground target with gimbaled fixed-wing UAV (GitHub)

Team Lead — Mechatronics Forum @ ITM Vocational University

Powered Lower Limb Exoskeleton Robot **Jan 2021 – Mar 2022**

Guide: Dr. Pujita Bhatt **| Funded:** Gujarat Council on Science and Technology (GUJCOST), Government of Gujarat **| Aggregate Funding: 750,000 ₹**

- Human walking gait trajectory analysed through kinovea software, torque trajectory plotted through inverse dynamics of musculoskeletal model ran on OpenSim software
- According to wearer's parameters geared motors selected and body, spur gears designed in SolidWorks software and fabricated with aluminium
- Six PID controllers implemented on Arduino microcontroller in a way that follows input reference gait trajectory and feedback provided by motor encoders (Web-Page)

Plastic Extrusion and Compression Moulding Machines **Apr 2021 – Dec 2021**

Guide: Prof. Jaimin Bhatt **| Funded:** Student Startup & Innovation Policy (SSIP), Government of Gujarat **| Aggregate Funding: 83,499 ₹**

- Modified design of the community extrusion & compression moulding machine according to Indian design standard, source design was designed by precious plastic community (Community Page)
- Selected VFD, heating coils, PID temperature controller, thermocouple sensor, gearbox, motor and other components in a synchronized way and build the robust machines (Web-Page)

Embedded and IoT System Intern — UniConverge Technologies Pvt. Ltd, Noida **Jun 2020 – Aug 2020**

HVAC and Remote Energy Monitoring System

Guide: Kaushlendra Singh Sisodia

- Designed User-Interface and simulation of HAVC & Remote energy monitoring system on Node-RED software where plant's data (current, voltage, etc.) transfer via Pub-Sub mechanism and MQTT broker with the use of Internet of Things (IoT)

EDUCATION

B. Tech – Mechatronics Engineering	ITM Vocational University, Gujarat	CGPA - 9.8/10 (Dept. Rank 2)	**Aug 2018 – July 2022**
Class 12	Aditi Science School, Gujarat	PR - 80.8/100	**April 2017 – July 2018**
Class 10	Aditi Science School, Gujarat	PR - 98.11/100	**April 2015 – July 2016**

PUBLICATIONS

Learning-based NMPC Framework for Car Racing Cinematography Using Fixed-Wing UAV (Paper)

Dev Soni, Amith Manoharan, Prakrit Tyagi, PB Sujit

IEEE International Conference on Unmanned Aircraft System, 2022

PROJECTS

Dynamics and Controls of Quadrotor in MATLAB simulated environment **Jul 2021 – Sep 2021**

- Analyze how thrust to weight ratio and initial speed affects the Quadrotor
- Coded PID Controller for controlling Quadrotor in 1-D and 2-D plane for moving in predefined trajectories
- Coded trajectory generator for Quadrotor to pass from the way-points in 3-D plane (GitHub) (Web-Page)

Factory Automation Using ROS (Robot Operating System) in Gazebo and RViz simulated environment **Oct 2020 – Dec 2020**

- Coded Pub-Sub ROS nodes to establish communication, Modified custom Unified Robot Description Format (URDF) file for factory environment
- Created Map with GMapping ROS package and implemented autonomous navigation through navigation stack
- Implemented pick and place pipeline with ROS MoveIt package (GitHub) (Web-Page)
- Designed state machine for production line with two UR-5 robotic arms and a turtlebot mobile robot with the use of FlexBe behavior engine

Motion Planning Algorithms for Mobile Robots **Sep 2020 – Oct 2020**

- Implemented different kind of motion planning algorithms for mobile robots through Computational Motion Planning Course
- Such as Dijkstra's Algorithm, A* Algorithm, Collusion detection and free space sampling method in C-Space

COURSES

Relevant University Courses

Control System, Robotics and Machine Vision, Design of Mechatronics System, Artificial Intelligent System

Online Courses

Modern Robotics, Course 1: Foundations of Robot Motion **(Verify)**

Robotics: Aerial Robotics **(Verify)**

Robotics: Computational Motion Planning **(Verify)**

ACHIVEMENTS

- Won the ROBOFEST2.0 competition under the Powered Lower-Limb Exoskeleton Robot, teams from the Tier-1 universities was participated in this competition (SVNIT, Nirma, BVM, etc.), in aggregate 250,000 ₹ funding received for building robot and 500,000 ₹ as a winning cash prize, currently robot is situated at India's first ever Robotics Gallery at Ahmadabad, Gujarat (Winners List) (Robotics Gallery) (Web-Page)
- Avail the funding of 83,899 ₹ from SSIP (Student Start-up and Investment Policy – Gujarat Government) for building plastic extrusion and compression molding machines (Web-Page)

SKILLS

- **Languages:** Python, Matlab, C, C++
- **Frame-Work & Libraries:** CasADi, OpenAI Gym, PyTorch, ROS (Robot Operating System)
- **Simulators:** Gazebo, RVIz, V-REP
- **CAD Modeling Software:** SolidWorks, Fusion 360, AutoCAD