Dev Soni

: devsoni44.pp@gmail.com

: +91-6353686534

EDUCATION

ITM VOCATIONAL UNIVERSITY Gujarat, India

*Bachelor of Technology in **Mechatronics Engineering** | CGPA: **9.63/10** (till 6th semester)* *Aug. 2018 – Pursuing*

INTERESTS

Control System, Intelligent Systems, Optimization, Aerial Robotics and Rehabilitation Robotics.

PUBLICATIONS

- **Dev Soni**, Amith Manoharan, Prakrit Tyagi, and P. B. Sujit. "Learning-based NMPC Framework for Car Racing Cinematography Using Fixed-Wing UAV". 2022 International conference on Unmanned Aircraft Systems (ICUAS). IEEE, 2022.

WORK EXPERIENCE

● **Indian Institute of Science Education and Research, Bhopal** May. 2021 – Present

*Research Intern, **M**ulti-**R**obot Aut**on**omy (MOON Lab)* *Dr. P. B. Sujit*

* **Learning-based NMPC Framework (Deep Q Network + Nonlinear Model Predictive Controller)**
  - Working on Learning-NMPC framework with the use of Deep Q Network for learning weights of NMPC cost components in order to reduce tracking error.
  - Using open-source frameworks like CasADi, OpenAI Gym and PyTorch.
* **Learning-based NMPC Framework (Q-Learning + Nonlinear Model Predictive Controller)**
  - Propose a Learning-NMPC framework with the use of Q-Learning for learning weights of NMPC cost components in order to reduce tracking error.
  - 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.
* **Nonlinear Model Predictive Controller For Target Tracking**
  - Implemented NMPC for target tracking problem, NMPC controller is able to avoid static and dynamic obstacles and persistently tracks the ground target with gimballed fixed-wing UAV.

● **Mechatronics Forum**

Team Lead, ITM Vocational University

* **Powered Lower Limb Exoskeleton Robot** Jan. 2021 – Mar. 2022
  - Analysed gait trajectories of wearer through kinovea software.
  - Torque trajectories plotted through inverse dynamics of musculoskeletal model ran on OpenSim software.
  - According to torque requirements, body and gears of exoskeleton designed and fabricated with aluminium.
  - Implemented PID controllers on Arduino for controlling angles of the motors with encoders as feedback, and gait trajectories are feed as PID input.
* **Plastic Extrusion and Compression Moulding Machines**
  - Modified design of the community extrusion and compression moulding machine according to Indian standard, main design designed by precious plastic community.
  - Selected VFD, heating coils, PID controllers, thermocouple sensors, gearbox, motor and other components in systematic way in order to finish project under budget without compromising on robustness.

● **UniConverge Technologies Pvt. Ltd., Uttar Pradesh** Jun. 2020 - Aug. 2020

Embedded and IoT System Intern

- worked on a project HVAC & Remote Energy Monitoring System by IoT.

- Plants data (Current, Voltage, etc.) transfer via Pub-Sub mechanism and MQTT broker.
- Made User-Interface & Simulation on Node-RED software, Set email alert for threshold condition.

PROJECTS

- **Dynamics & Control System Analysis of Quadrotor in MATLAB Simulated Environment**
  - Analyse how thrust to weight ratio and initial speed affect on Quadrotor.
  - Built PID Controller for controlling Quadrotor in 1-D and 2-D plane for moving in predefined trajectories.
  - Built trajectory for Quadrotor to pass from the way-points in 3-D plane.
- **Factory Automation Using ROS (Robot Operating System) in RViz and Gazebo**
  - Box from conveyor taken by UR5 robotic arm by pick-place pipeline made in ROS MoveIt setup assistance & Turtlebot navigates box to another UR5 robotic arm by ROS navigation stack.
  - Implement sequential states in FlexBe app for whole simulation.
  - Achieved communication between UR5-Turtlebot-UR5 using ROS.
- **Motion Planning Algorithms for Aerial & Mobile Robots in MATLAB**
  - Learnt different kind of motion planning algorithms for robot in Computational Motion Planning Course
  - Dijkstra's Algorithm ● A* Algorithm ● Collusion detection and free space sampling method in C-Space.

CERTIFICATION COURSES

- Modern Robotics, Course 1: Foundations of Robot Motion
- Robotics: Aerial Robotics
- Robotics: Computational Motion Planning

ACHIEVEMENT

- Won ROBFEST2.0 (state-level) competition under the Powered Lower Limb Exoskeleton category, teams from the tier-1 universities like SVNIT, Nirma University was participated; our exoskeleton robot is showcasing at India's first Robotics gallery at Ahmadabad, Gujarat. Moreover, won 5lakh rupees as winning prize.
- Avail funding of 83,899₹ from SSIP (Student Start-up and Investment Policy – Gujarat Government) for building plastic Extruder and Compressor machine for recycling of plastic waste and making useful products.
- Won 7000₹ cash price for being at 6^{th} rank in Sci-Math (district level) exam among 2200 students.

VOLUNTEERING

- **Mentor at UniConverge Technologies Pvt. Ltd. & IoT Academy | Collaboration: IIT, Guwahati**
  - Throughout this mentorship I mentor 4 groups of students having 5 students in each, In short, I handled 20 students from **Assam Science and Technology University (ASTU)**, solved their doubts related to their projects, and helped them to complete their industrial internship with great knowledge.
  - This mentorship also helped me to work on another 5 projects of Embedded & IoT.

SKILLS

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