Ritesh Gole

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Education

Indian Institute of Technology Guwahati, India Nov. 2020 - Present
Bachelors of Technology in Mechanical Engineering, Previous Year Performance Index: 9.43/10. GPA: 8.38/10.0

Experience

Stochastic Robotics Lab, Robert Bosch Centre for Cyber-Physical Systems, IISc Bangalore Apr. 2023 - Jul. 2023
Research Intern Bengaluru, India

- Developed a dynamic model and LQR controller for balancing of wheeled biped, validated via Gazebo simulation.
- Contributed to innovative research, optimizing control inputs to minimize cost functions in wheeled bipedal locomotion.
- Initiated study in "Optimization Techniques in Engineering," enhancing control input strategies for robotics.
- Supported doctoral candidates by fine-tuning RL policies for bipedal robot stability in the face of external perturbations.

IITD-AIA's Foundation for Smart Manufacturing Jun. 2023 - Aug. 2023
Robotics Intern Delhi, India

- Developed a Aruco marker pose-estimation package using RGB-camera and integrated the module with ROS.
- Designed a PID based visual servoing system for tracking and following Aruco marker with UR5 Robot arm in Gazebo.
- Performed trajectory planning using MoveIt API and motion prediction using Kalman Filtering.

Projects

Cosmo Logistic Bot Sep. 2023 - Present
e-Yantra Robotics Competition (eYRC) 2023-24, IIT Bombay Website

- Executed Aruco Marker pose estimation with Intel Realsense Camera and published transform data using TF2 package.
- Orchestrated trajectory planning and collision avoidance for UR5 robot arm using MoveIt for pick and place operations.
- Conducted SLAM with AMCL and EKF-based localization and implemented navigation using Nav2.

Autonomous Navigation of Underwater ROV for welding purposes Aug. 2022 - Present
Bachelor's Thesis Project under Dr. Satish Kumar Panda and Dr. Biranchi Panda, IIT Guwahati Website

- Developed YOLOv8-based pipeline tracking system and PCA-based vectorization for pose estimation.
- Simulated ROV in UUV Simulator via Gazebo and tested PID controller for alignment of ROV with the pipeline.
- Engaged in the integration of software and hardware through physical testing on the BlueROV2.

Yuvaan IITG Mars Rover Jul. 2021 - Jul. 2023
Robotics Club, IIT Guwahati Website

- Designed and manufactured a 5-DOF robotic manipulator with a bevel-gear differential-based end-effector.
- Performed structural analysis, achieved 30% weight reduction and optimized workspace for constraints.
- Deployed encoder feedback-based PID controller interfaced with ROS for hardware subsystems of the rover.
- Developed YOLOv8-based arrow detection system and RRT-based path planner for autonomous navigation task.

Delivery Bike Sept. 2022 - Feb. 2023
e-Yantra Robotics Challenge (eYRC) 2022-23, IIT Bombay Website

- Designed a self-balancing flywheel based delivery bike with LQR based controller for balancing.
- Developed algorithms for driving, steering, road-following and color detection and simulated it in CoppeliaSim.
- Mathematically modeled it using the Euler-lagrangian method, calculated its controllability, observability and stability.
- Used pole placement method to get required baseline PD controller input parameters.

Implementation of Supervisory Control System Mar. 2022 - Jun. 2022
Formula Bharat PiEV 2022, IITG Racing Website

- Led a team of 6 members to design the supervisory control system of the first two iterations of the EV powertrain.
- Implemented automatic sensor data plausibility checks on-board and sensor data flow through Simulink.
- Performed Failure Mode Analysis and Safety Analysis, and designed software architecture.

DRDO's UAV-guided UGV navigation challenge Mar. 2022
Inter IIT Tech Meet 10.0, IIT Guwahati contingent Website

- Guided sensor-less UGV using UAV through a complex static environment in Gazebo using ROS.
- Used Laplacian and Otsu methods for car edge detection and masking, and wrote controller for car cruising.
- Applied Principal Component Analysis for vectorizing the direction in which the car is facing.

Achievements

INSPIRE scholarship 2020: By HSC Board, for being within the top 1 % of the Board in Class XII examinations.
JEE Advanced 2020: Secured an All India Rank of 3925 amongst a total of 0.15 million candidates.
International Rover Challenge, 2021-22 and 2022-23: Among top 20 onsite finalist teams.
International Rover Design Challenge, 2021-22 and 2022-23: Ranked 11th and 7th respectively worldwide.
Techevince 8.0, 2022, IITG: Secured Best Project Award in Jury and Overall Categories for Yuvaan Rover project.
Pi-EV, 2022: Secured 3rd Place in Overall and Engineering Design categories as Supervisory Control Systems Head.

Technical Skills

Programming languages: Python, C/C++, MATLAB
CAD and Analysis: SolidWorks, Fusion 360, ANSYS
Robotics Technologies: ROS/ROS2, CoppeliaSim, Mujoco
AI and CV: Keras, OpenCV, OpenAI Gym

Relevant Coursework

Mechanical: Kinematics and Dynamics of Machinery, Machine Design, Control Systems, Applied Non-linear control.
Robotics and AI: Mechatronics, Robotic Vision and Control, Fundamentals of AI, Robotics and Robot Applications.
Mathematics: Basic Calculus, Linear Algebra, Complex analysis, Optimization Methods in Engineering.
MOOCs: Neural Networks and Deep Learning, Robotics: Computational Motion Planning, Estimation and Learning.

Positions of Responsibility

- **Team Lead - Yuvaan Mars Rover Team**, Robotics Club, IIT Guwahati *Apr. 2023 - Present*
  - Managed the design, development, and execution of intricate multi-disciplinary subsystems.
  - Innovated novel approaches in rover design and automation, leveraging technical skills.
  - Achieved project milestones and secured accolades at national-level competitions.
- **Contingent Manager - Hardware**, Inter-IIT Tech meet 12.0 contingent, IIT Guwahati *Oct. 2023 - Dec. 2023*
  - Managed logistics, procurement, and allocation of resources ensuring seamless operations throughout the event.
  - Provided comprehensive training and guidance to team members, developing the necessary skill-set.
- **Project Manager**, Robotics Club, IIT Guwahati *Apr. 2022 - Apr. 2023*
  - Responsible for the conceptualization, ideation, and successful delivery of projects within specified timelines.
  - Acted as a liaison between the Robotics Club and industrial partners to secure funding for innovative projects.
- **Lead - Robotic Manipulator**, Yuvaan Mars Rover, IIT Guwahati *Jun. 2022 - Apr. 2023*
  - Led the design, control systems development, and manufacturing of the robotic manipulator.
  - Managed and guided team members, ensuring a seamless transfer of knowledge critical for ongoing and future participants.
  - Implemented robust documentation and mentorship strategies to equip successors with essential insights.

Extra-curriculars

Techniche 2021: Organized events like chess and case study competitions under the Competitions module.
Automobile Club: Was in the core team, participated in Srijan CAD Design competition and PiEV 2022.
Robotics Club: Conducted Summer Course 2022-23, with a view to acquaint freshers with basics of robotics.
E-yantra, IIT Bombay: Participated in e-Yantra's Robotics Challenge 2022-23 and 2023-24.
Inter-IIT Techmeet 10.0 and 11.0: Participated in High Prep problem statements as part of the IITG contingent.
Sports: Silver Medal for Water Polo in Spardha 2023, completed NSO Certification in Football.