S Hari Preetham

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RESEARCH INTERESTS

Robotics and Autonomous Systems · Adaptive and Robust Control · Compliant Mechanisms · Sensor Fusion and Perception · Reinforcement Learning

EDUCATION

University College of Engineering, Science & Technology-JNTUH   Aug 2021 – Apr 2026
Integrated Dual Degree in Mechanical Engineering (Advanced Manufacturing Systems)   GPA: 8/10

Narayana Junior College, Hyderabad   Apr 2019 – Apr 2021
Intermediate (Mathematics, Physics, Chemistry)   Score: 97.2%

RESEARCH EXPERIENCE

Real-Time Vibration Compensation in Low-Cost Laser Steering Systems via Visual-Inertial Fusion and Comparative Control Strategies   Jun 2025 – Present
Link: [Github Repository](#)
Master's Thesis Supervisor: Dr. A. Chennakesava Reddy

- Project aims to develop a line-of-sight stabilization algorithm for laser beam steering applications (e.g., UCAS, precision agriculture laser weeding).
- Designed and fabricated a 2-axis galvo scanner using salvaged Voice Coil Motors (VCMs); CAD modeling and open-loop operation demonstrated.
- Developed a simulation environment (PyQtGraph + OpenGL) to model kinematics, ray-plane intersection, and laser scanning control.
- Built real-time object detection and tracking pipeline using YOLOv8 + DeepSORT for visual servoing.
- Planning implementation of sensor fusion (IMU + camera) and control algorithms (PID, LQR, MPC) for vibration rejection and precision pointing.
- Creating hardware-in-the-loop testing framework to integrate simulated sensors and real camera feedback prior to full hardware deployment.

Enhancement of Surface Finish and Material Properties of 3D Printed PLA via Vapor Treatment   Nov 2024 – May 2025
Bachelor's Thesis
Supervisor: Prof. G. Krishna Mohana Rao

- Investigated acetone, Dichloromethane (DCM), and chloroform vapor treatments on FDM 3D-printed PLA components.
- Conducted tensile testing (UTM) and surface roughness analysis, achieving a 40% improvement in surface finish and a 15% increase in tensile strength.
- Simulated thermal and fluid flow conditions in ANSYS to optimize treatment uniformity and analyze material phase effects.

EXPERIENCE

Defence Research and Development Organisation, DRDO-DRDL   Hyderabad
Link: [Github Repository](#)
Project Intern   Sept 2023 - Oct 2023

- Under the guidance of Scientist 'F' Shaik Ismail, developed Python-based tools to analyze 13,000+ data points across 25+ parameters for MIRV aerodynamic heating and re-entry thermal assessment.
- Transitioned legacy MATLAB workflows to optimized NumPy/SciPy pipelines, improving computational efficiency and enabling high-fidelity parametric studies of skin temperature and transient heat behavior.
- Implemented PyROOT for advanced data processing and visualization, calculating isentropic flow properties, stagnation temperatures, and standard atmospheric parameters across altitudes.
- Provided actionable insights into thermal protection and trajectory design, supporting validation of re-entry vehicle components.

Indian Institute of Technology-BHU Varanasi
Workshop Trainee June 2023 - June 2023

- Gained hands-on proficiency in CAD modeling, reverse engineering, and design simulations in ANSYS, focusing on structural and thermal performance of components.
- Explored topology optimization and design-for-additive-manufacturing across multiple processes: (FDM, SLA, SLS) to create lightweight, high-strength structures.
- Rapidly prototyped components using multiple 3D printing technologies, validating designs and improving manufacturability for functional testing.
- Applied design-for-3D-printing principles to ensure structural integrity, thermal tolerance, and manufacturability of complex geometries.

SKILLS

Programming Languages:	Python, C++, Javascript
Control & Embedded Systems:	ROS2, Linux (PREEMPT_RT), Microcontroller Programming, Controller Design
Simulation & CAD:	SolidWorks, Fusion 360, ANSYS, Gazebo, 3D Printing
Other Tools:	Git, Docker, Mathematical Modeling, System Identification, OpenCV

PROJECTS

Bio-Inspired Navigation for Featureless Environments
Link: [Github Repository](#)

- Developed a simulation framework to address **perceptual aliasing** in warehouses where Visual SLAM fails due to lack of unique landmarks.
- Implemented a bio-mimetic spectral compass (Inspired from Cataglyphis ants) to correct stochastic sensor drift using sparse global cues, enabling infrastructure-free navigation.
- Achieved an **81% reduction in terminal positioning error** compared to blind dead-reckoning by decoupling orientation from translation.

ROS2 Visual Processor for Real-Time Robotics
Link: [Github Repository](#)

- Developed a low-latency visual perception system in ROS2 for control and vision for remote-operated robotics.
- Integrated a YOLOv8-based ROS2 node using WebRTC for real-time, browser-based object detection visualization.
- Optimized system for deterministic performance on embedded platforms using the Linux PREEMPT_RT patch.

Quadruped Spider Robot
Link: [Github Repository](#)

- Designed and built a Bluetooth-controlled quadruped robot using an Arduino Uno and 12 servo motors.
- Implemented inverse kinematics for precise leg positioning and developed multiple gait generation algorithms for stable locomotion.
- Programmed kinematic calculations and control loops for seamless operation via a custom mobile application.

Low-Cost Motion Capture System for Robotics

- Developed an indoor motion capture system utilizing calibrated high-speed PS3 Eye cameras (operating at 187 fps) to capture motion data.
- Implemented principles of epipolar geometry for accurate and real-time 3D localization of physical markers within the capture volume.
- Applied system identification techniques (e.g., frequency response analysis, impulse response modeling) to derive dynamic characterization and facilitate precise control of associated robotic platforms.