SOUTRIK MUKHERJEE

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EDUCATION

Harrisburg University of Science and Technology Mar 2024 - Feb 2026
Master's of Science, Computer & Information Sciences (Scientific Computing) **GPA: 3.75/4.0**
Master's Thesis: Implementing DeepSeek R1 LLM in ROS2 manipulation pipeline

University of Pennsylvania Aug 2022 - Jan 2024
Graduate Studies, Mechanical Engineering (Robotics & Manufacturing)
Transferred to focus on computational approaches to engineering problems

National Institute of Technology Rourkela Jun 2018 - May 2022
Bachelor's of Technology, Design & Manufacturing Engineering, GPA: 9.19/10.0 **Highest CGPA in the cohort**
Undergrad Thesis: Topology Optimization using Computational Optimization Techniques

PUBLICATIONS

- *Structural Optimization of Headphone Design Using Topology Optimization*, DOI:10.35940/ijrte.F7462.0712223 - Link
  - Iteratively generated an optimized (higher structural stiffness/material mass) headphone using **design as data points in space** concept and implementing **Physics Informed Neural Netoworks (PINNs)** for the most optimized data point distribution
- *Bi-Directional Drone Design and Path Planning for Agricultural Applications*, DOI:10.35940/ijrte.B6393.0910321 - Link
  - Designed a functional **CAD** model of a novel **Bi-directional Drone**, and used **ROS2** in **Gazebo** to **simulate** and test **path planning** algorithm in **unsupervised** environment, documented challenges and **hardware configurations** for the design
- *Design and Analysis of Automatic Rotating System for Industrial De-scaling*, DOI: 10.35940/ijrte.B6395.0910321 - Link
  - Engineered a perforated cylindrical agro-fishery system—**CAD**, **FEA**/structural tests, and **embedded control**—for **remote** operation with **adjustable blades** sized to case-specific dimensions

TECHNICAL SKILLS

Languages: Python, C++, MATLAB, LaTeX
AI/ML Frameworks: PyTorch, JAX; ONNX Runtime, TensorRT
Parallel & Performance: CUDA, OpenCL, OpenMP, MPI, NCCL
Robotics & Simulation: ROS 2/DDS, MoveIt 2, Gazebo, RViz
Techniques (Perception & Control): Sensor Fusion, Kalman filtering (EKF), Proportional–integral–derivative (PID); quantization (INT8/FP16)
Build & Tooling: CMake, Git, Docker, VS Code
Hardware/Embedded: ARM Cortex-M/A, STM32; FPGA (Xilinx); PCB (KiCad/Altium); I^2C/SPI/CAN
CAD/CAE: SolidWorks, CATIA V5, Fusion 360, AutoCAD; ANSYS Mechanical (FEA)

PROFESSIONAL EXPERIENCE

Graduate Researcher | *GRASP Lab, University of Pennsylvania* March 2023 - March 2024
- Developed the **perception-planning-control** loop of a fetch mobile manipulator**(7-DOF arm, telescoping spine, pan-tilt head; 11 total DOF with base and gripper)** on a Freight differential-drive base to operate in an **unsupervised** manner in our indoor test.
- Fused **LiDAR + RGB-D + IMU** for navigation, tuned the **motion planning** stack to avoid stalls, hardened the **ROS 2 messaging** over flaky Wi-Fi, and built a **regression harness** to fix bugs and prove improvements.
- Integrated **SMORES-EP** modular robot "faces" into the manipulation pipeline to do **contact-aware** grasps and re-tries on odd shapes. SMORES-EP modules has large area-of-acceptance; processor runs **Kalman filters**; Wi-Fi to central controller

Embedded Systems Intern | *ISRO - Indian Space Research Organisation* Sep 2021 - Mar 2022
- **Built** and **validated** a **three-axis** reaction-wheel **attitude dynamics model** in **MATLAB Simulink**, then closed the **sim-to-real** loop on a **hardware-in-the-loop (HIL)** bench with actual **motor electronics**.
- **Scripted sweeps** to **tune** the **controller** and designed **fixtures** so *vibe/thermal* tests could be repeated exactly from **Flight-class** reaction **wheel assemblies** from ISRO's **Inertial Systems Unit (IISU)**.
- Tech Stack: MATLAB/Simulink + **Simscape Multibody** for multi-body **attitude** dynamics; **quaternion kinematics** + **reaction-wheel** torque models. **Extended Kalman Filters (EKF)** for rate estimation. **PID** attitude controllers step + slew.

Research Fellow | *Indian National Academy of Engineering (INAE)* Apr 2021 - Aug 2021
- **Tuned** a **robotic welding process** using structured experiments, closed the loop with **temperature feedback**, and **automated weld quality** checks with **computer vision** so defects dropped and line operators had fewer reworks
- **Design of Experiment (DOE)** with **Taguchi orthogonal arrays** for factor screening; **Response Surface Methodology (RSM)** for optimization. **IR** camera for **bead temperature**; Proportional-Integral (PI) control for adaptive wire-feed; **PLC** via **Modbus**.

SELECTED PROJECT

Implementing DeepkSeek R1 LLM ROS2 manipulation pipeline | *Master's Thesis*
- Built **LLM→ROS 2 bridge**: containerized **DeepSeek R1** service with REST API, implemented **command parser** + **context manager**; integrated **MoveIt2** for trajectory execution and **Gazebo** for testing and validation framework
- Engineered a **low-latency pipeline**: <**2s** end-to-end command processing (1.85s avg), **423ms** action-goal generation, supporting **8** concurrent users at **99.3%** uptime. Shipped **CI/CD + test harness**: ROS 2 Humble container builds, unit/integration tests, and performance benchmarks. Ran **user study (n=60)** across novice–expert users; natural-language control cut task times by **48–64%**

COMMUNITY IMPACT & LEADERSHIP

- **MANAV Founder & Director**: Launched in 2019 to bridge the rural tech gap; scaled from weekend effort to a program in **12 government schools**, serving **200+ students** with **math**, **engineering demos**, and **career guidance**.
- **Peer Mentoring**: Mentor at Institute Student Counseling wing - helping students suffering from mental health issues
- **Athletics**: Represented as the caption of **Under-16 inter-state** Cricket team