Rajatsurya Madhusudhana

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Education

University of Michigan - Ann Arbor **August 2024 – May 2026**
Master of Science in Robotics GPA: 4.0/4.0 *Ann Arbor, Michigan*

- Relevant Coursework:- Mathematics for Robotics, Programming for Robotics, Controls for Robotics & Robotics Lab

Ramaiah Institute of Technology **August 2017 – July 2021**
Bachelor of Engineering in Mechanical GPA: 3.96/4.0 *Bengaluru, Karnataka*

Publications

1. Sandula,A.K, **Rajatsurya, M.**, Ghose, D & Biswas, P.(2024, August) *Human(s) On The Loop Demand Aware Robot Scheduling: A Mixed Reality-based User Study In 2024 33rd IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*

2. Sandula,A.K, **Rajatsurya, M.**, Ghose, D & Biswas, P.(2024, January).*Human-On-The-Loop Multi-Robot Demand-Aware Task Scheduling: A Mixed Reality Approach In 2024 Intelligent User Interface*

Research Experience

Indian Institute of Science - URSC ISRO Rover Systems **April 2024 – August 2024**
Associate Research Fellow, Advisor: Prof.Pradipta Biswas, I3D Lab *Bengaluru, Karnataka*

- Designed a six-wheel rover with a rocker-bogie mechanism capable of climbing a 15% slope and carrying a 25 kg payload.
- Worked with a team to device the rover's sensing system, incorporating a camera with 2D LiDAR, using the camera for object detection and the LiDAR for SLAM, and implemented the Cartographer SLAM technique to guide the rover.
- Validated the Cartographer localization technique as 15 to 20% more accurate than the conventional AMCL technique.
- Developed customized inverse kinematics for the rover's 6-DOF robotic arm using its URDF and controlled it without ROS 2, but with a customized client-server HTTP firmware, resulting in a 30% reduction in computational load.
- Assisted in developing a unique recovery system for the rover, enabling teleoperation via a mixed reality interface activated when the onboard recovery system fails, utilizing a ROS-Unity bridge to achieve this functionality.

Indian Institute of Science - Robert Bosch Cyber - Physical Systems **August 2023 – April 2024**
Associate Research Fellow, Advisor: Prof.Pradipta Biswas, I3D Lab *Bengaluru, Karnataka*

- Developed an innovative approach to streamline data transfer from the camera with an HTTP message via a web server, instead of the traditional ROS Topic, resulting in a latency reduction of 50 to 60%—key for visual SLAM applications.
- Collaborated with a team of four to evaluate SLAM algorithms like LSD, ORB, and Gaussian Splatting SLAM—using a monocular camera, finding GS SLAM superior by reducing SLAM time by 15% and achieving 5x higher resolution.
- Integrated GS SLAM with ROS by visualizing splatting in RViz and using Depth Anything models to provide depth data to the SFM model, producing point cloud data for the splatting algorithm, which enhanced robot localization by 15%.

Industry Experience

Saint-Gobain Surface Solutions **August 2021 – August 2023**
Business Development and Application Engineer *Bengaluru, Karnataka*

- Collaborated with Fanuc to introduce cutting-edge robotics to a high-intensity labor market, skillfully modifying 6-axis single-arm articulated robots for weld fabrication and precise burr removal in both forged and casted materials.
- Partnered with HAL to automate their creep feed grinding process, demonstrating the potential of robotics in grinding.
- Implemented IoT technology and anomaly detection systems for grinding components at BOSCH-Bidadi and Sansera.
- The implementation resulted in a significant 15-20% reduction in defects and a 10% improvement in product finish.
- Achieved a significant share gain of 200 lakh (INR) by gaining customer trust and delivering tailored IoT solutions.

DEEYEM CNC Machining Pvt. Ltd. **July 2019 – September 2019**
Automation Intern *Bengaluru, Karnataka*

- Contributed to a 3-month internship automation project, revolutionizing a pick-and-place application and alleviating operator workload by designing a 2-jaw gripper module equipped with pressure sensors and hydraulics.
- Achieved an impressive 30% improvement in productivity through the successful automation project, gaining valuable hands-on experience in addressing intricate challenges encountered during the implementation and design phases.

Projects

For more information about my projects, please refer to my portfolio website rajatsurya.github.io/Projects.

Human(s) On The Loop Demand aware Robot Scheduling **December 2023 – April 2024**
Advisor: Prof.Pradipta Biswas, I3D Lab, Indian Institute of Science (IISc)

- Developed a mixed reality interface using Unity, enabling multiple users to control multiple robots with a HoloLens.
- Facilitated autonomous robot localization with Pb Stream while using Cartographer SLAM for environmental analysis.
- Developed a visualizing aid for users to anticipate robot collisions using the collision cone approach, enabling prediction.
- Conducted a user study where participants, in pairs, performed task scheduling first without visual aids and then with visual aids. Found that visual aids improved task scheduling time by 15% and reduced collisions by 30 to 40%.

Human-On-The-Loop Multi-Robot Demand aware Task Scheduling **August 2023 – November 2023**
Advisor: Prof.Pradipta Biswas, I3D Lab, Indian Institute of Science (IISc)

- Formulated a novel task scheduling algorithm, DARTS (Demand-Aware multi-Robot Task Scheduling), for warehouses
- Implemented simultaneous localization (AMCL) and movement (DWA planners) on a multi-robot system using ROS
- Conducted a mixed reality user study, recording time and distance for tasks performed independently and with autonomous assistance, revealing decreased task time and increased robot travel distance, which was counter-intuitive.
- DARTS competes and outperforms rate-monotonic scheduling, yielding a 7.1% time reduction in warehouse automation.

Design and Manufacture of an Autonomous Cube-Sat Antenna Booming Mechanism **July 2020 – July 2021**
Advisor: Suresh Kumar HN, Indian Space Research Organization (ISRO) and Raji George (MSRIT)

- The project aimed to autonomously deploy an RF antenna system within a 2U volume for transmitting RF signals.
- Conducted dynamic and kinematic analysis on the mechanism; based on results, suitable materials were selected.
- Gained proficiency in various software tools such as Catia V5, Catia DMU Kinematic, Adam's, Fusion 360, Ansys Static Structural and Autodesk Inventor for designing and verifying the workings of the Autonomous Booming mechanism.
- Mechanism was actuated using electronic sensors and the loads were balanced vertically; the assembly was 2 kg's lighter.
- The successful deployment of the design was achieved, with antennas deploying 1.2 seconds faster than previous designs

Assembly and palletizing of Space Frame using Fanuc M10ID/12 Robot **April 2020 – June 2020**
Advisors: Prof.Hemavathy and Prof.Sunith Babu (MSRIT)

- The project's objective was to automate the assembly of a space frame in a limited work volume with obstacles
- Used the state-of-the-art 6-axis articulated arm Robot Developed by Fanuc (M10ID/12) to automate the assembly.
- Utilized Fanuc Roboguide for simulating the Robot, Gaining insights into automating processes within a confined space.
- Designed magnetic and Vacuum Grippers to grip the magnetic and ferromagnetic materials of the Space Frame.
- Automated the assembly in 384.1 cubic meters; this volume was 5 % less than the total available work volume.
- Robot assembled 3 space frames in 17.5 seconds, which led to a 24.3 % time reduction compared to the manual assembly

Technical Skills

Languages: Python, Matlab, C++, C#
Tools: VS Code, Sublime Text Editor, CATIA V5, ROS, ROS-2, AutoDesk, RoboGuide, Fusion 360, Ansys, GIT, Unity
Frameworks: Linux, TensorFlow, PyTorch, OpenCV, NumPY, Docker

Academic and Athletic Accolades

- In 2017, achieved a Centum in Pre-University Mathematics, earning the state topper award for the subject.
- Recognized as one of the school's top students upon successfully completing the 10th-grade board exam.
- Part of the SKCHEC Quiz Team. SKPB School Tech-quiz winner and GAP Tech Quiz Runner-up (2014)
- Attained State-level standing in Squash and reached the quarter-finals in the Bengaluru Squash League (2023)
- In 2014, played for the Karnataka DDPI State cricket team, reaching the semi-finals in the tournament.

Volunteering Experience

National Service Scheme[NSS] **June 2017 – September 2018**
Volunteer *Bengaluru, Karnataka*

- Organized a successful blood drive that collected 300 litres of life-saving donations for medical assistance.
- Participated actively in community development, improved schools significantly, offered vocational training opportunities, conducted skill programs diligently, and contributed to environmental conservation activities.