Anujith Muraleedharan

anujithmuralidharan@gmail.com +91 7025138725 Personal website

EDUCATION

Rajiv Gandhi Institute of Technology **August 2018 – August 2022**
Bachelor of Technology in Electronics and Communication Engineering GPA: 8.16/10 [Transcript] *Kottayam, India*

Amrita Vidyalayam **April 2014 – March 2017**
Class XII AISSCE, CBSE; 85% ; Class X AISSE, CBSE; 9.8/10.0 *Pandalam, India*

RESEARCH EXPERIENCE

Indian Institute of Science **August 2023 – Present**
*I3D LAB, Research Associate Advised by **Prof. Pradipta Biswas** [Website]* *Bangalore, India*

- Developed and analyzed controllers (LQR, PD, Stanley, SMC), performed sensor fusion, and contributed to the robotic system development for an autonomous aircraft taxiing system [AVIATION Journal Vol 27 No 4 (2023)].
- Developed a comprehensive Eye-gaze-controlled assistive robotic system, including user interface design, control algorithm development, and hardware integration for a stamp printing application for individuals with Severe Speech and Motor Impairment [ACM IUI 2024].
- Enhanced the eye-gaze-controlled robotic system for individuals with Severe Speech and Motor Impairments by incorporating safety protocols inspired by Asimov's Laws, utilizing a monocular camera for hand detection and path planning algorithms (MDP, BFS) to ensure safe operation.
- Worked on an ISRO-funded project focused on developing a Mixed Reality (MR) environment using Unity customized for the astronaut cockpit, aligning with preparations for the upcoming Gaganyaan mission.

Rajiv Gandhi Institute of Technology **Jan 2021 – June 2022**
*CASP LAB, Undergraduate Research Assistant Guided by **Prof. Manju Manuel** [Website] [Certificate]* *Kottayam, India*

- Implemented a Modified Booth Encoding (MBE) multiplier to reduce partial products and a Wallace tree adder for efficient summation in Verilog HDL. Integrated these components into a processing element unit for a CNN accelerator.
- Simulated and verified the design using Verilog testbenches, synthesized the design using FPGA synthesis tools, and programmed the design onto an Artix-7 FPGA board. Achieved significant improvements in hardware efficiency and power savings through iterative refinement and testing.
- Developed a functional prototype of a 3D holographic projection system using the Pepper's Ghost technique and a Raspberry Pi controller for interactive hand gesture controls, and optimized the Pepper's Ghost phenomenon by varying acrylic sheet tilt angle and thickness to enhance image quality.
- Enhanced 2D to 3D video conversion by using depth-based segmentation of foreground objects from the background, significantly improving the depth and immersive experience of the holographic display system.

PUBLICATIONS

**Denotes Equal Contribution*

1. **Towards Efficient and Safe HRI for Users with SSMI: A Gaze Controlled Robotic Arm for Block Printing**
   Anujith Muraleedharan*, Anamika J H*, Pradipta Biswas
   ACM Transactions on Human-Robot Interaction **(Under-Review)**
   [Project Page]

2. **Eye-Gaze-Enabled Assistive Robotic Stamp Printing System for Individuals with Severe Speech and Motor Impairment**
   Anujith Muraleedharan, Anamika J H, Himanshu Vishwakarma, Kudrat Kashyap, Pradipta Biswas
   ACM Conference on Intelligent User Interfaces (ACM IUI) 2024
   [Project Page] [Paper]

3. **Developing a Computer Vision based system for Autonomous taxiing of Aircraft**
   Prashant Gaikwad, Abhishek Mukhopadhyay, **Anujith Muraleedharan**, Mukund Mitra, Pradipta Biswas
   AVIATION Journal Vol 27 No 4 (2023)
   [Project Page] [Paper]

PROJECTS

Human AV Interaction [Website] **Feb 2024 - May 2024**
Associated with I3D Lab
Anujith Muraleedharan, Anamika J H, Naveen R Talawar

- Developed a system to extract lane coordinates, apply curve fitting, and calculate the middle lane, generating control inputs for autonomous UGV navigation.
- Implemented real-time fusion of proximity sensor data with person detection models to autonomously halt the UGV at safe distances.
- Mapped the detected person crossing the road and real-time wheel odometry data to a virtual simulation for accurate interaction with the pedestrian crossing with head-mounted displays.

Interactive 3D Holographic Display [Website] **Dec 2021 - Jun 2022**
Undergraduate Thesis
Anujith Muraleedharan, Anamika J H, Jose Martin M J

- Developed a 3D holographic projection system using the Pepper's Ghost technique to create illusionary 3D images by reflecting light on a semi-reflective surface, with interactive hand gesture control managed by a Raspberry Pi controller.
- Converted 2D frames to 3D by segmenting foreground objects from the background and integrated interactive 3D objects controlled by Leap Motion and OMNI Haptic, allowing for advanced interactions such as spawning, picking up, and coloring 3D objects.
- Explored optimization techniques for the Pepper's Ghost phenomenon, including acrylic sheet tilt angle and thickness variation, to enhance image quality.

Autonomous Racing: MPC vs. LQR [Website] **Dec 2020**
Undergraduate Minor Project
Anujith Muraleedharan, Anamika J H, Karthik Suresh

- Developed a Model Predictive Control (MPC) algorithm for vehicle trajectory tracking, integrating linear model approximations and optimizing state and control variables for real-time applications.
- Designed and implemented a reference trajectory generation system using waypoints interpolation and nearest neighbor indexing for accurate vehicle path following.
- Conducted simulations with PyBullet, showcasing the MPC algorithm's effectiveness in real-time vehicle control and trajectory tracking, including visualizing results and analyzing performance metrics.

PROFESSIONAL EXPERIENCE

NSS Indian Institute of Technology, Roorkee **July - August 2023**
Industrial Training *Remote*

- Completed 6 Weeks Industrial Training on Machine Learning and Artificial Intelligence.

AWARDS

Division of Mechanical Sciences Research Symposium [Certificate] **May 2024**
IISc Bangalore

- Participated in the 3-minute Research Video Contest and got shortlisted among the top 10 out of 28 teams.
- Secured 5th position after the final round presentation.

Technoxian World Robotics Championship [Certificate] **July 2023**
AICRA

- Participated in innovation contest in which around 150 teams participated.
- Selected for finals presentation at Noida NCR, India.

Graduate Aptitude Test in Engineering (GATE) [Scorecard] **February 2023**
IIT Kanpur

- Achieved an overall rank within the top 1.58 percentile among 70,361 candidates registered in the Electronics and Communication Engineering stream.
- Offered admissions to M.Tech. Programme in IISc Bangalore, IIT Madras, IIT Bombay and IIT Kharagpur.

PROGRAMMING SKILLS

Subjects of Interest: Reinforcement Learning, Control, Robotic Vision, Machine Learning
Languages: Python, C/C++, C#, JavaScript, SQL
Tools: MATLAB, Fusion 360, GIT, Unity
Frameworks: ROS, TensorFlow, PyTorch, PyBullet

SERVICE

Prominence **January 2021**
Chief Organizer *Department TechFest*

- Organized a competition on fastest line follower robot with a total participation of 10 teams. The objective of the robot is to efficiently navigate through a predefined course by detecting and tracking a black line.
- Conducted a seminar on Solar Electric Propulsion.
- Organized a workshop on Advanced Driver Assistance Systems (ADAS).