

ANTAREEP SINGHA

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EDUCATION

Puducherry Technological University, Puducherry

B.Tech in Mechatronics Engineering (Top 3 in class of 54)

2020 - 2024

9.08/10 CGPA

RESEARCH EXPERIENCE

International Institute of Information Technology, Hyderabad (IIITH)

Jan, 2024 – present

Research Assistant @ RRC-(Autonomous Wheelchair) Optimal Control, Machine Learning

On-site

Advisors: **Prof. K. Madhava Krishna, Prof. Arun Kumar Singh**

- Worked at **Robotics Research Center(RRC)** on a **Non-Linear Model Predictive Control** for Social Navigation in extremely Dynamic scenes and built its **ROS** port for deployment on the wheelchair.
- Built a pipeline for **multi-modal trajectory generation** for social navigation in Dynamic Scenes using **VQ-VAE**, conditioned on real-world semantics. Trained the model using custom dataset collected on campus. A manuscript based on this has been submitted to **IEEE ICRA, 2025**.
- Migrated the entire Autonomous Wheelchair stack from **ROS Noetic** to **ROS2**. Adapted the VQVAE stack to work with 3D point cloud data.
- The **Autonomous Wheelchair Project** at IIIT, Hyderabad is a funded project of **Department of Science and Technology(govt. of India)** and **IHub Data**.

Indian Institute of Technology, Madras (IITM)

May 2023 – July 2023

Summer Fellow - (SFP 2023) FPGAs, RTL and Digital Design

On-site

Advisors: **Prof. Anil Prabhakar, Prof. Nitin Chandrachoodan**

- Worked on FPGA-based Data Acquisition using a **RedPitaya StemLab 125-10** in a **Fluorescence Activated Droplet Sorting (FADS)** experiment.
- Developed and implemented a novel Verilog based DAQ module on **Zynq 7010 SoC** that reads 10-bit ADC data, runs a peak detection algorithm, stores the output on the RedPitaya Block RAM and later displays the output on the RP Linux Terminal.
- Generated the expected Gaussian peaks from the Photomultiplier tube of the FADS experiment using **PYNQ** Overlay to simulate the Verilog based DAQ module.

Indian Institute of Technology, Hyderabad (IIITH)

May 2023 – July 2023

Research Intern - (ITSAR Project) Hardware Security, Embedded Systems

Remote

Advisor: **Prof. Abhinav Kumar**

- Contributed to the development of a centrally funded project entitled "**Smart Meter**" according to "**Indian Telecommunication Security Assurance Requirements(ITSAR)**"
- Worked on the Hardware Security R&D team and developed Python based security models to ensure Hardware Security according to existing ITSAR standards.

PUBLICATIONS

CrowdSurfer: Sampling Optimization Augmented with Vector-Quantized Variational AutoEncoder for Dense Crowd Navigation

Antareep Singha*, Naman Kumar*, Laksh Nanwani*, Dhruv Potdar, Tarun R, Fatemeh Rastgar, Simon Idoko, Arun Kumar Singh, K. Madhava Krishna

Under Review - *IEEE ICRA 2025*, RRC @ IIITH, University of Tartu

An FPGA based Real-Time Video Processing system on Zynq 7010

Antareep Singha*

accepted and presented at the *2nd International Conference on Advances in Computational Intelligence and Communication (IEEE ICACIC) 2023* conference proceedings.

HIGHLIGHTED PROJECTS

Social Navigation on an Autonomous Wheelchair

[Source Code](#)

Optimal Control, Machine Learning, Path Planning

- Developed an **Non-Linear Model Predictive Control(NMPC)** pipeline using CasADi as a part of my final-year project titled "Social Navigation on a Wheelchair using Non-Linear Model Predictive Control". This also served as a baseline for a subsequent VQVAE based model.
- Worked on a VQ-VAE based pipeline(**CrowdSurfer**) with a PixelCNN based Sampler for generating optimal trajectories in dense crowds. Input to the model are dynamic obstacle positions, heading to goal and occupancy grid at every timestep and output is an collision-free path avoiding any obstacle.
- The VQVAE based planner builds upon a Sampling Optimization based planner (**PRIEST**) and produces a trajectory distribution for it to optimize bringing down convergence by 6 times.

Real-Time Human Body Pose Estimation using RTMO

[Source Code](#)

Computer Vision, Machine Learning, ROS

- A real-time body pose estimation pipeline using RTMO and RealSense depth, used in deployment of CrowdSurfer.
- RTMO provides keypoints on the shoulder and face. The points are deprojected to 3D and the cross-product of the keypoints are computed for the real-time human body pose.
- This pipeline was used to provide body pose information on which a VQVAE model (a version of CrowdSurfer) was trained to learn social behavior.

An FPGA based Real-Time Video Processing system on Zynq 7010

[Source Code](#)

FPGAs, RTL and Image Processing

- Interfaced an OV7670 CMOS VGA camera with a Zynq 7010 based FPGA that outputs **Transition Minimized Differential Signaling(TMDS)** data on HDMI lines.
- Developed a novel architecture using two Video DMA channels for fast reading and writing of data. This eventually led to an IEEE publication.
- Built custom low-level modules using VHDL to control the CMOS camera.

SKILLS & INTERESTS

Areas of Interest: Deep Learning, Optimization & Control, Computer Vision, FPGAs & RTL

Languages: Python, C/C++, Verilog, Assembly x86, MATLAB, Shell

Frameworks: PyTorch, ROS/ROS2, Pandas, OpenCV, CasADi

Softwares & Clouds: Xilinx Vivado, HLS, Docker, WSL, VMWare

TEACHING & MENTORING

- As the president, held seminars on Mobile Robotics, ROS and Intro to Machine Learning as a part of RoboVed Summer School at Puducherry Technological University.
- Worked as a TA under Dr. R. Elansezhian for the course MT201 Manufacturing Processes, arranging assignments and designing coursework.
- Designed MCQ questionnaires, hosted learning webinars online for over 60 courses provided by L&T EduTech on Machine Learning, Data Analytics and Time Series.

HONOURS & AWARDS

- Awarded **Best Paper Award** at PTU Genesis 2023, a National Level Technical Symposium. Presented my research *An FPGA based Real-Time Video Processing System on Zynq 7010* to jury of 5 members.
- Received the prestigious monetary **Summer Fellowship Award** for the May-July 2023 internship season from Indian Institute of Technology, Madras (IITM). Got a chance to work at the OCEAN Lab, EE Department, IITM.
- State-level Cricketer at **Cricket Association of Bengal(CAB)**. Played several state-level U-14 tournaments and won several accolades.