Chaitanya Sriram Gaddipati

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Education

Worcester Polytechnic Institute 2022-2024
Master of Science - Robotics Engineering *GPA: 4.0/4.0*
- **Coursework :** Robot Control, Deep Learning, Motion Planning, Hands-on Autonomous Aerial Robotics

Indian Institute of Technology Hyderabad 2018 - 2022
Bachelor of Technology - Mechanical Engineering (Major) *GPA: 9.29/10.0*

Experience

Comet Lab, WPI May 2023 – Present
Research Assistant
- Design a **Model Predictive Controller** with thermal diffusion **partial differential equation constraints** for optimal tissue surface temperature control in **robotic laser surgery** to minimize tissue damage.
- Conduct experiments on animal tissues to test the controller performance using a Franka Emika robot arm mounted with a laser and a thermal imaging system.

Technology Innovation Hub on Autonomous Navigation (TiHAN) May 2021 – Sep 2021
Research Intern
- Designed CAD models and conducted structural and fluid-structure interaction analyses to assess deflections, stresses, and aerodynamic properties of the models for a micro aerial vehicle and passenger drone.

Projects

Optical flow based structure-less gap detection for drone flight Nov 2023 – Dec 2023
- Developed a minimalist sensori-motor framework for quadrotor flight through **unknown gaps** without 3D scene reconstruction, leveraging solely a **monocular camera** and onboard sensing.
- Employed a deep learning network **RAFT** for **dense optical flow estimation**, facilitating identification of unknown-shaped, textured gaps.
- Created post-processing techniques for gap contour detection and center identification, integrated **visual servoing** methods to align the drone with gap centers for successful navigation. - **Github**

Sim2Real Learning stack for Robust Gate Perception in Autonomous Drone Racing Oct 2023 – Nov 2023
- Engineered a perception stack for DJI Tello EDU drone, enabling precise navigation through diverse drone racing gates.
- Used Blender to generate a robust synthetic dataset with **domain randomization** techniques.
- Trained YOLOv8 neural network for front gate identification and **segmentation** in complex environments.
- Extracted corners and used **PnP algorithm** to determine the relative pose of front gate for drone navigation. - **Github**

3D RRT* Drone Motion Planning Sep 2023 – Oct 2023
- Developed Motion Planning Stack for a drone comprising of cascaded velocity and position PID controllers, a RRT* path planner generating collision free paths using **Bresenham's line algorithm** on given map, and **minimum snap dynamically feasible smooth trajectory** from these RRT* waypoints.
- Validated planner through Blender simulation and real drone testing. - **Github**

Quaternion based Attitude Estimation of IMU Aug 2023 – Sep 2023
- Implemented a Complimentary, **Madgwick**, and **Unscented Kalman filters** for attitude estimation of a 6-DoF IMU and benchmarked it against ground truth data from Vicon motion capture system. - **Github**

Real-time collision free navigation for multiple autonomous agents Jan 2023 – Apr 2023
- Implemented a **model predictive controller** (MPC) for path planning of multiple autonomous vehicles in a 2D environment.
- **Dynamic Collision avoidance** is performed by utilizing acceleration velocity obstacle (AVO) and generalized velocity obstacle (GVO) methods. - **Github**

Technical Skills

Programming Languages: Python, C, C++, BASH
Software: Linux, ROS, Gazebo, Blender, OpenCV, PyTorch, TensorFlow, SolidWorks, ANSYS, Git, Docker
Hardware: DJI Tello EDU drone, Jetson Orin Nano, Franka-Emika
Deep Learning Architectures: YOLOv8, RAFT, SAM, UNet, VGG, ResNet

Publications

N. P. Babu M, P. Kumar Duba, **G. C. Sriram** and P. Rajalakshmi, **"Autonomous Bio-Inspired Micro Aerial Vehicle (MAV)"**, 2022 IEEE IAS Global Conference on Emerging Technologies (GlobConET), Arad, Romania, 2022, pp. 661-666, doi: 10.1109/GlobConET53749.2022.9872352.