

# Jeffin Johny Kachappilly

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## EDUCATION

**University of Maryland** | *M.Eng. in Robotics* College Park, MD, US | **08.2021 – 05.2023 (expected)**

- Relevant Coursework: Manufacturing Robotic Software, Planning, Advanced Perception, Robot Modeling, Control Systems, Rehabilitation Robots, Fundamentals of Deep Learning, Hands-on Aerial Robotics.
- Cumulative **GPA**: 3.95/4.0

**National Institute of Technology, Calicut (NITC)** | *B.Tech in Mechanical Eng.* Kerala, India | **07.2016 – 05.2020**

- Relevant coursework: Automobile Engineering, CAD/CAM, Manufacturing and Machine Design.

## SKILLS

**Programming Languages:** C++, Python, Matlab

**Tools & libraries:** Gazebo, Solidworks, OpenCV, ROS 1, ROS 2, PyTorch, git, PX4, Arduino, ANSYS, MS Office, Lucidchart

**Controls:** LQR, LQG, Kalman Filter, EKF, Impedance Control

**Deep Learning Models:** Neural networks, CNN, VAE, RNN, Transformers

## EXPERIENCE

**Graduate Research Assistant** | *ROS, Arduino, C, Ardupilot (Team)* UMD | **(09/22 – PRESENT)**

- Developing a **quadrotor** for NIST's First Responder Indoor Challenge(UAS 4.0) and **current finalist**.
- Implemented **Obstacle Avoidance** using Time of Flight sensors.
- Working on **flight controller** settings for different flight modes and assisting in manufacturing process.

**Research Assistant for SPOT** | *ROS, C++, Python (Team)* UMD | **(01/23 – PRESENT)**

- Integrating ROS packages for **localization** on Spot robot dog for **autonomous outdoor navigation**.
- Utilizing a suite of advanced sensors including **GPS, IMU, LiDAR**, and **stereo cameras**.
- Developing algorithms for various sensors on Spot for **vital signs** detection for triage.

## PROJECTS

**Anomaly Detection in video surveillance** | *PyTorch, seaborn (Team)* UMD | **(10/22 – 12/22)**

- Trained **Multi-Task Variational Auto-Encoder (VAE)** to generate pseudo features in **weakly supervised** setting.
- Augmented recent works which used **Attention mechanisms** with these pseudo features.
- Tested model on ShanghaiTech & UCF-crime datasets, achieving **improved AUC**: 94.21% and 83%.

**Adaptive Impedance Control (AIC) on the Anklebot** | *Python (Team)* UMD | **(11/22 – 12/22)**

- Validated existing work, where AIC strategy was used for assistive-resistive robot-aided therapy.
- Enhanced backdrivability of system by introducing **force feedback** and showcased its efficacy.
- Reduced jerk motion of **ankle trajectory** by modifying the cost function of position and actuator torque.

**First Principles of Computer Vision** | *numpy, matplotlib (Individual)* UMD | **(09/22 – 12/22)**

- Implemented fundamental concepts: Edge detection, **Keypoints estimation** using corners , **Optical Flow** using Lucas-Kanade algorithm, **Iterative Closest Point** using Affine Transforms and Image Stitching.
- Furthermore **Structure from Motion, Epipolar Geometry** and corresponding depth map estimation, **Superpixel** segmentation and scene segmentation using Gaussian Mixture Model.
- Performed transfer learning-assisted **Semantic Segmentation** on VGG16 images using the FCN-32 model.

**Agile Robotics for Industrial Automation Competition (ARIAC)** | *C++, ROS (Team)* UMD | **(01/22 – 05/22)**

- Formulated a complex control system to handle **kitting** and **assembly** operations in automated warehouse.
- Manipulated the robot arms (**arm on linear rail and gantry robot**) using Moveit! Interface and **AGV** using ARIAC plugins in Gazebo.
- Addressed **challenges** in manufacturing: sensor blackout, faulty parts, flipped parts and high-priority orders.
- Created a competitor ROS package and was **victorious** out of the 6 participating teams.

**A-star implementation with non-holonomic constraints** | *Python, ROS (Individual)* UMD | **(01/22 – 02/22)**

- Designed a 2D environment with obstacles using matplotlib and implemented algorithm for a circular robot.
- Programmed an **open loop controller** in ROS and effected it on actual turtlebot3.
- Traversed the **physical map** quickly, earning a **top 5 rank** among competing teams.

- Developed **LQR** controller for a crane suspending two masses to minimize oscillations.
- Derived motion equations, linearized the model, and performed controllability and observability checks.
- Deployed **Kalman filter** for state estimation and implemented **LQG**.

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**EXTRA CURRICULAR ACTIVITIES**

- Supervised gaming stalls at Ragam (one of the largest cultural fests in India). *NITC* | (2019)
- Contributed to Kerala flood relief campaign as a participant. *India* | (2019,2020)