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Education

- **NMIMS(Mukesh Patel School of Technology Management and Engineering)** Shirpur, India
  Bachelor of Technology in Mechatronics; GPA: 2.77/4 *Jun. 2016 – Jun. 2020*

Experience

- **NewSpace Research and Technologies** Bengaluru, India
  Robotics Engineer II *May 2021 - Present*
  - **Core Responsiblity**: Working on single agent and multiagent decentralized path and motion planning stack for UAVs in GPS-denied, dense environments like forests, following are my contributions
  - **Swarming**: Developed a novel solution that compensates for localization drift among the agents and guarantees a smooth inter-agent collision-free path
  - **Speed Improvments**: Worked on a trajectory tracking solution based on a Geometric tracking controller, tuned it, and made required changes in FCU's attitude and rate controller to attain a tracking error of < 7cm
  - **Recovery Behaviour**: restructured the existing state machine and added new states to account for failure cases and corresponding recovery behavior to gracefully recover and continue the mission
  - **Optimisation**: The existing stack used a fixed-size grid for planning, Implemented a moving ring buffer which makes the stack independent of grid size, and also modified the existing single-threaded implementation to incorporate multi-threading which resulted in a performance boost of 15-20%
  - **Inter-UAV comms**: Developed a module to minimize the trajectory data to be sent and guarantee data reception, with a novel queuing mechanism that resulted in 30 % decrease in latency
  - **Aerial Formation**: Devised a novel approach to maintain a specific aerial formation throughout a mission for a coordinated flight by incorporating formation penalty in trajectory optimization
  - **Terrain Navigation**: Built a solution to navigate to a specified goal with unknown height on uneven or hilly terrain by dynamically calculating gradients using real-time point cloud and range data
  - **Fallback Mechanism**: Developed a tightly coupled solution to handle localization source corruption. It also incorporates strategies to recover from a corrupted state
  - **Simulation**: Built the complete pipeline for GPS-denied UAV-swarm navigation in simulation
  - **Open-Source Contributions**: Ardupilot Mavros_controllers Mavros
  - **Tools and technologies used**: C++, Multi-threading, PCL, ROS, 3D-Lidar, L-BFGS, LCM

  Machine Learning Engineer I
  - **Data Augmentation**: Built a complete pipeline to convert RGB to IR/Thermal images using conditional GANs
  - **Detection and Tracking**: Worked on the task of detecting and tracking extremely small objects from aerial images, and was able to devise a solution that helped in increasing the mAP@0.75 by 10-12%
  - **Aerial mapping**: developed a learning-based real-time mapping solution that utilizes Aerial images and IMU data to create an Aerial map in a GPS-denied environment, which can be further used for UAV localization at high altitudes without GPS
- **Om Siddh Vinayak Impex Pvt. Ltd.** Gandhidham, India
  Product Developer *Jul 2020 - May 2021*
  - **Face Recognition**: Built a Face Recognition Pipeline for the attendance system with modules for detection, tracking, head pose estimation, and recognition, achieving an overall accuracy of 91%.
  - **Automatic Numberplate Recognition System**: To overcome the drawbacks of RFID based system for Heavy vehicles, Implemented a Vision-based identification stack with modules for detecting, tracking, and OCR, developed a novel approach for OCR which reduced the recognition time by 40-45% Also incorporated strategies to handle failure cases, achieved an overall accuracy of 82%
  - **Segmentation**: Worked on segmentation of Jeans to determine the area to be cut by the Laser cutting Machine
  - **Optimisation**: Worked on model quantization, Pruning, and other optimization techniques to deploy the models on edge devices
  - **Open-Source Contributions**: HeadPoseEstimation FaceNet-using-TensorRT Open-Source-Models Darknet(YOLO Framework)
  - **Tools and technologies used**: C++, Python, Nvidia's Deepstream SDK, object detection, recognition, tracking, and segmentation

- **Edureka** Bengaluru, India
  internship *Jul 2019 - Oct 2019*
  - **Programming articles**: Created more than 40 articles related to algorithms, data structures, and other essential programming concepts such as Heap sort, Merge sort, Priority queue, Event Handling in Java, etc
  - **Implementation**: All the concepts mentioned above are explained and demonstrated in languages such as C, C++, and Java. More than 70% of the articles are ranked among the top 10 search results by Google.
  - **Relevant links**: Heap sort Merge sort Default value of char Priority queue

Academic Projects

- **Versatile Robotic Arm** Jul 2019 - Mar 2020
  Apps- Material handling in Micro, Small, and medium scale industries, Segregation, Hydroponics
  - **Description**: Designed and built 5 DoF Robotic arm, mounted on a mobile platform for carrying out tasks such as pick and place, surveillance, monitoring, etc. The full project report can be found Here
  - **Design**: The design is inspired by the Kuka KR 360 FORTEC series of robotic arms. The arm uses Servo motors for precision and high torque capability. The arm is mounted on a car with mecanum wheels for extreme maneuverability and mobility in congested environments
  - **Operations**: Created a cloud-based dashboard for arm control, surveillance monitoring, and real-time feed visualization. Added a feature to store the motions of the cart and the arm to perform repeatable tasks with ease
  - **Surveillance and Monitoring**: The onboard computer utilizes the camera feed to detect workers' use of safety equipment, sending notifications to the dashboard if not observed. Additionally, temperature, humidity, and toxic gas sensors onboard alert the dashboard to anomalies when detected
  - **Technologies Used**: CAD, 3D Printing, Jetson nano, MQTT, Object detection
- **Sign Language Identification** Oct 2019 - Dec 2019
  Apps- communication aid
  - **Description**: Developed a device designed to facilitate communication for individuals with special needs, capable of real-time detection, recognition, and translation of hand signs
  - **Training and validation**: Collected a dataset for American Sign Language (24 characters) by scraping from the web, supplemented with manually generated data. The dataset incorporates diverse elements such as varied lighting conditions, skew, scale, and skin tones to ensure its robustness. Prior to training, conducted preprocessing on the compiled dataset. Established a detection and recognition pipeline that achieved an accuracy of 96%
  - **Optimisation**: Deployed various optimization techniques such as model pruning and quantization to improve performance on edge devices like Raspberry Pi
  - **Deployment**: Developed a web interface that connects to mobile devices, allowing users to select between text-based interpretation or Text-to-Speech (TTS) for communication
  - **Technologies Used**: Raspberry Pi, Object detection and classification, TensorFlow

Programming Skills

- **Languages**: C, C++, Python
- **DL Frameworks**: Darknet, TensorFlow, PyTorch, Keras
- **Robotics**: ROS, ROS2, OpenCV, PCL

Additional Courses

- **C++ Nanodegree**: Acquired knowledge in areas encompassing Memory management, concurrency, and Object-Oriented Programming (OOPs)
- **ROS I**: Gained insights into concepts associated with Localization, Navigation, and Simultaneous Localization and Mapping (SLAM)
- **ROS II**: learned concepts related to lidars, cameras, Motion, computer vision
- **Machine Learning**: Learned fundamentals of ML such as regression, decision trees, clustering best practices
- **Deep Learning Specialisation**: Learned concepts related to CNNs, Hyperparameter Tuning, Optimization and regularization