AJAY ANAND

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Academic Qualifications:

- **Master of Science in Engineering - Robotics**
  University of Pennsylvania
  May 2022
- **Bachelor of Technology - Mechatronics Engineering**
  Minor in Robotics and Automation
  Manipal University
  Oct 2019

Student Activities and Awards:

- **Director of Fund Management, Graduate and Professional Student Assembly, University of Pennsylvania**
- **Robotics Department Representative at Graduate Student Engineering Government.**
- **Member, Institute of Electrical and Electronics Engineers (Robotics and Automation Society)**
- **2018,2019 Award for Academic Excellence, Manipal University**
- **Mechatronics Department Representative, Manipal University.**
- **2014 School Topper Award in the All India Secondary School Certificate Examination,The Velammal International School**
- **2013 National Finalist in the British council DEBATING MATTERS competition at the British Embassy, New Delhi.**

Profile Overview

I am a robotics engineer with primary interests in Perception, Robot Design and Artificial Intelligence. My research has primarily been in the field of Medical Robotics developing systems to improve telerehabilitation experience and to create better diagnostic tools for rehab progress using Computer Vision. I have also participated in multiple projects using my skills in these fields.

Technical Skills

- **Programming Languages:** Python, Matlab, C++, SQL, Assembly Language(Microcontrollers)
- **Software:** CATIA, Solidworks, ROS, Simulink, National Instruments LabView, S7 for PLC (Siemens), Wonderware InTouch for SCADA.
- **Hardware:** Siemens PLC 313C and PLC 312C, National Instruments MyRio, ELVIS and Quanser, Bosch Sensorics Kit, 8051 family microcontrollers, Arduino family microcontrollers, Raspberry Pi family microprocessors.

Project Experience (View https://github.com/ajyanand/ProjectReports for a more complete list of Projects)

Comparing Rehabilitation Interactions Using Social Robot Augmented Telepresence to Classical Telepresence April '21 - Current

- The objective of this long term project was to compare the effects of using socially assistive robots to augment telepresence interactions for rehabilitation vs traditional telerehabilitation methods.
- Conducted clinical trials with over 40 research subjects. Different metrics such as engagement, enjoyability, value and level of perceived difficulty were used to perform these comparisons.
- Currently using 3D video data collected from this project to develop diagnostic systems to improve rehabilitation progress tracking for upper extremity impaired individuals.

Airbnb Price Prediction March '22 - May '22

- The objective of this project was to predict pricing for an Airbnb listing as well as ascertain if current pricing was optimal for maximum profitability.
- Three different methods were used to carry out this task namely; traditional regression, tree based ensembles and a deep learning based method.
- Our final model was able to achieve a performance of 62.33 Root Mean Squared Error on Listing Price Prediction and predict with an accuracy of 85% whether a listing was correctly priced for maximum profitability.

Counting Machine Parts: Segmenting Dense Objects in Occluded Environments Oct '21 - Dec '21

- The goal of this project was to count machined parts in poorly lit workshop environments. The environments were also highly prone to occlusions and other optical hindrances such as shadows which complicate the already challenging task of counting large numbers of objects in a single image.
- Performed the task using three different methods; traditional image processing techniques using hough transforms, instance segmentation and density map estimation.
- Our approach achieved a performance of below 2 Mean Average Error in poorly lit, highly occluded environments containing over 40 instances per image.

Linear Quadratic Regulator Minimum Snap Trajectory Planning for Quadrotor in ROS Feb '21 - April '21

- Used an A* path planner used to get dense waypoints, and further the Douglas-Peucker algorithm was used to produce sparse waypoints.
- The produced waypoints were used to set up constraints for a quadratic program with the cost function being the integral of snap squared to produce a minimum snap trajectory for the quadrotor to follow.
- Testing was performed in both a python quadrotor simulation as well as in the ROS Gazebo environment with a Hector quadrotor model to validate robustness of the model.

Lane Detection, Steering Control and Object Detection for Self-Driving Cars Oct '20 - Dec '20

- Designed and implemented a camera based system intended to provide limited self driving capabilities to a simulated vehicle. (Microsoft Airsim used as the simulation environment)
- Lane detection was done using both traditional image transformation techniques as well as using a CNN based method.
- Lightweight YOLO (You only look once) network was used for object detection.

Intelligent Car using Drive-by wire and RFID March '19 – June '19

- Project was aimed to increase road safety by providing speed limiting mechanisms in dangerous and accident prone zones such as schools and hospitals.
- Converted a Mechanical Vehicle Platform with a conventional drive system to an electronically controlled drive by wire system using servo motors to control the position of the throttle valve and brake.
- Rfid tags were used to provide infrastructure to vehicle (I2V) communication, allowing the vehicle to self regulate its speed based on signals received from ultra high frequency long range Rfid tags mounted on road signs.

Relevant Work Experience

Rehabilitation Robotics Lab (University of Pennsylvania) April '21 – Current
Graduate Research Assistant
Developed Computer Vision based models to detect rehab effectiveness and progress in upper extremity impaired individuals. Conducted research trials to test the impact of a socially assistive robot on tele rehab care. Maintained and updated the hardware and software of the research robot.

University of Pennsylvania May '21 – Jan '22
Graduate Teaching Assistant
Participated in creation of assignments and projects, grading, project demonstrations and conducting recitations for graduate students.