# Pratik Walunj

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## Education

**University of Nevada, Reno** **2024 - Present**
*M.S. in Computer Science and Engineering* ***(AI and Robotics)*** *3.3/4.0 GPA*

**University of Pune** **2018 - 2022**
*B.E. in Computer Science & Engineering,* ***Honours in Data Science*** *9.1/10 CGPA*

## Work Experience

**ARA Lab** **Nov 2023 – Present**
*Research Assistant* *On-site*

- Designed and developed a multi-terrain hybrid robotic system capable of flying, running on ground and water, and adhering to walls and ceilings for inspection.
- Created 3D models in SolidWorks and designed custom PCBs in EasyEDA for sensor integration (Benewake TF min LiDAR) and actuator control (servo motors, BLDC motors).
- Integrated Cube Orange flight controller and NVIDIA Jetson Nano for hardware functionality.
- Developed and implemented PID control algorithms for efficient wall and ceiling adhesion, ensuring precise navigation across diverse terrains.
- Edited the **ArduCopter firmware** to incorporate new capabilities. Added **custom flight modes** for: Ceiling climbing, Wall climbing, Ground navigation, Water navigation

**SAS Research and Development** **June 2022 – Aug 2023**
*Associate Software Engineer* *On-site*

- Managed DevOps operations in the Risk Cloud Infrastructure team, focusing on securing sensitive credentials (passwords, keys, certificates).
- Leveraged Azure Key Vault for automated retrieval and management of secrets during runtime.
- Increased protection by 100% by eliminating the direct declaration of passwords as variables in automation workflows.
- Ensured secure and seamless integration of credentials within automated processes.
- Utilized shell scripting for automation tasks.

**Parc Robotics** **Oct 2019 – Feb 2021**
*Student Intern* *On-site*

- Contributed to the development of a six-axis robot designed for precise pick-and-place operations with a 2 kg payload capacity.
- Achieved repeatability of 0.01 mm.
- Used Teensy 4.1 microcontroller for programming and stepper motors for actuation.
- Developed a GUI using python Tkinter library to control the robot.

## Projects

**Culbot for Culvert Inspection (IROS 2024):** **Link**

- Designed hardware for culvert inspection, utilizing the Agile Bunker Pro as a UGV.
- Added a custom-developed 5-axis robotic arm along with an Electrical Resistivity (ER) sensor.
- Used 3 OAK-D Pro depth cameras and integrated a Velodyne 3D LiDAR for enhanced sensing capabilities.
- Designed power distribution PCB and peripheral connection PCB to connect sensors and the stepper driver of the robotic arm using EasyEDA software.
- Used ROS to control the robot through ROSserial.

**Office Assisting Robot:** **Link**

- Integrated NVIDIA Jetson Nano as the onboard computer and Teensy 4.1 for controlling actuators and gathering sensor data.
- Paired the system with the Robotics Operating System (ROS) framework.
- Used Google Cartographer for mapping and navigation, with 2D LiDAR as the source of odometry.
- Designed the robot in SolidWorks and created the circuit board to connect all peripherals together.
- Used servo motor for actuation.

**Drone Delivery:** **Link**

- Developed a **simulation environment** for drone package delivery.
- Utilized **ROS Melodic** and **Gazebo** for simulation tools.
- Used **Python** for programming the system.
- Employed **computer vision cascade classifier** to detect markers for package delivery.

**License Plate Recognition using Easy OCR:** **Link**

- Developed a License Plate Recognition system using Python and the EasyOCR library.
- Handled both camera feeds and static images for license plate recognition.
- Applied image enhancement techniques such as smoothing with a Gaussian filter.
- Experimented with frequency domain filtering for image processing.

**Image Blurring using computer vision:** **Link**

- Employed the **MediaPipe** library to detect hand gestures.
- Calculated the distance between the **thumb and index finger**.
- Based on the distance, internal calculations were performed to determine the blurring value.
- Used **Gaussian smoothing filter** to blur the image.
- **OpenCV** was utilized for: Processing the video feed and Applying the Gaussian filtering technique for image blurring.

**Virtual gym assistant:** **Link**

- Developed a program using the **MediaPipe** library to detect key points on the human body.
- Designed to assist users in tracking and counting repetitions during **bicep curls**.
- The **MediaPipe** library accurately identifies key landmarks on the body.
- Enables **real-time count** of bicep curl repetitions.
- Integrated a **voice output feature** that encourages users to perform more repetitions.

## Technical Skills

**Languages**: Python, Matlab (begineer), Shell Script, C/C++, HTML
**Tools and Technologies**: ROS, ROS2, TensorFlow, Pandas, MediaPipe, EasyOCR, Opencv, Numpy, Matplotlib, Pytorch, CUDA
**Hardware** : Arduino, Teensy, STM32, ESP-8266, ESP-32, Nvidia Jetson, Raspberry Pi, Latte Panda, Stereo labs Zed, Velodyne Lidar, Intel real sense, IMU MPU6050, BMO055, ICM20948, GPS Neo m8n
**Software**: Gazebo, RViz, AutoCAD, CATIA, Creo, SolidWorks, Fusion 360, EasyEDA
**Devops**: Docker, Kubernetes, CI/CD, Git
**Hardware Tools**: Oscilloscope, Multimeter
**Controls and sensor Fusion**: PID Control, Model Predictive Control, Lag-lead compensators, Kalman Filter Complementary Filter
**Navigation Stack**: Motion Planning, path planning

## Achievement

- **Student of the Year Award**
  Awarded by *Pimpri Chinchwad College of Engineering and Research.*
- **First Rank in UGICON**
  Stood first in the UGICON project competition for presenting an Artificial Intelligence-based Document Sharing Robot.
- **Second Place in Science Competition**
  Stood second in the Science Competition organized by *Tata Institute of Fundamental Research (TIFR)* for presenting the patent *Automatic Termination of Ignition System Using Gyro Sensor* (2019-2021).
- **Third Place in National Level Project Competition**
  Stood third in the National Level Project Competition organized by *Nutan Maharashtra Institute of Engineering and Technology* for presenting the project *AI-based Office Assisting Robot.*
- **First Place in I Cube Competition**
  Stood first in the Integrate Section of the I Cube competition. Along with my team, developed a simple hydraulic arm for pick-and-place operations.
- **Courses Completed**
  Completed 50+ online and offline Courses