

# SHATAYU AVINASH MEHTA

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## EDUCATION

### University of Minnesota Twin Cities

Sept. 2024 –present

Masters of Science, Robotics

- **Coursework:** Machine Learning, Robot Vision, Feedback Control Systems, Robotics and Principles and Design of Wearable Technology

### KJ Somaiya College of Engineering,Mumbai

July. 2018 –June. 2022

Bachelors of Technology, Mechanical Engineering

## SKILLS

**Domain Expertise:**CNC milling, Laser Cutting, 3D Printing, Computer-Aided Engineering, Fundamentals of Design, FEA, Stereo Vision, PID control, Lead and Lag compensator, controllability, observability, Robustness, Estimator Design, Digital control, Image processing, 3D pose estimation, Visual servoing, feature extraction, Supervised and unsupervised Learning, Reinforcement Learning, CNN, DNN, DQN, forward & Inverse Kinematics, Mechanical Sensing, Biometric sensing, Sewing & Soft Goods, E-textile Fabrication,GD&T, Rapid Prototyping.

**Programming:** Python, C++, Arduino IDE

**Hardware Platforms:** Arduino, Raspberry Pi, Ardupilot, UR5e Cobot

**Software :**Solidworks, FUSION 360, CREO, ANSYS fluent& Workbench, CURA, PrusaSlicer, chitubox, XFLR5, E-Calc, AutoCAD, MATLAB, RoboDK,TensorFlow, PyTorch, RobotiqGripper Python library, Anaconda .

## EXPERIENCE

### RESEARCH AND DEVELOPMENT ENGINEER

Nov 2022 – Nov 2023

Indrones Solutions PVT LTD.

Mumbai, INDIA

- **Spearheaded the FUJIN VTOL project** from **inception to completion of the design** and **testing** of the second prototype.
- **Established a streamlined process for the efficient manufacturing** of the VTOL aircraft **reducing the time** from prototype design to completion **by 1.5 Weeks**.
- **Engineered a prototyping solution** for EPP foam machining, **reducing manufacturing costs by 10%** and increasing prototype body durability, enabling **5 additional test flights**.
- **Conducted market analysis** for UAVs, influencing aircraft parameters, target customer identification, and market differentiation strategies.
- Achieved optimized aerodynamic calculations, improving the coefficient of lift from MVP stage to near-prototype values, **reaching 0.428 for enhanced aircraft performance**.
- Designed prototypes and components using **SOLIDWORKS, AUTODESK FUSION 360** and collaborated with the manufacturing team also **providing training on 3D printing** using **CURA** and **CHITU BOX**.
- **Evaluated and tested powerhouse options using ECALC** for both VTOL and UAVs achieving a **Time-of-flight increase by 25%** for FUJIN VTOL , also established parameters for the aircraft prior to testing.
- Conducted aircraft testing and refined aerodynamics, and design based on results using XFLR5 and ANSYS fluent and analyzed flight data to document the design improvements.
- **Documented the development** of FUJIN VTOL and contributed to technical certification documentation for the S25 UAV.
- Created and tested components for the S25 and S75 UAVs, improving mechanical performance, including the development of a **hot-swappable payload mechanism** for the S75.

### DESIGN TEAM LEAD

May 2019 – August 2019

Team Onyx India

Mumbai, India

- Fronted the design team for **TEAM ONYX INDIA** in SAE Aero Design 2021.
- Fostered and advised the design team during **SAE Aero design 2022**.
- Led key aircraft design decisions, material selection, and frame manufacturing for the regular class aircraft in SAE Aero Design East.
- **Developed a self-gliding aircraft with a wingspan of 30cm** that automatically landed after being dropped from the mothership, utilizing a flight controller for autonomous landing.
- **Conducted market research** and testing to identify flexible, durable, and **cost-efficient alternatives** to Aero ply, **reducing material costs by 45%**.
- Designed and implemented a torsion box to prevent tail torsion issues caused by the fuselage's rectangular cross-section, improving aircraft stability.
- Engineered a tension spring-based nose landing gear attached to a fork mechanism for enhanced weight distribution and landing efficiency.
- Developed the vertical tail base to effectively mount the vertical tail, optimizing aerodynamic performance.
- **Designed and 3D-printed joints** for the carbon fiber chassis, **improving structural integrity and cost-efficiency for multiple prototyping iterations**.
- **Analyzed and tested four aircraft prototypes** through test flights to determine maximum takeoff weight and structural limits, **ensuring compliance with performance standards**.

## ACADEMIC PROJECTS

### Wearable Ring Mouse Device Development

May 2025

- Developed a wearable ring mouse using an **Arduino Nano 33 BLE Sense Rev2**, enabling click, cursor movement (swipe-to-tab), and scroll functionalities.
- Engineered the device with a push button for clicks, **IMUs** for swipe gestures, and **Hall effect sensors** with magnets for scrolling.
- Created **firmware** (Wearable Mouse Controller.ino) to process sensor data and send **BLE messages**, and a **Python script** (wearable\_mouse\_receiver.py) to interpret messages and execute actions using pynput.
- Designed and **3D-printed** custom PLA ring and wrist modules to house components, including a 3.7V LiPo battery and step-up converter; assembled and wired components using **Vectran-based conductive thread** and **sewing** techniques for the wrist strap.
- Conducted **user testing** with 3 volunteers, achieving an average **System Usability Scale (SUS)** score of 35.67, indicating ease of use.

### Computer Vision Based Tool Sorting (ME5286 Robotics Lab)

April 2025

- Developed a **Python** program to enable a **UR5 robot** to identify and sort tools into designated bins whose locations were dynamically estimated at runtime.
- Implemented **computer vision** techniques using **OpenCV** and its **ArUco module** for **6DoF pose estimation** of tool bins.
- Trained and deployed a **Convolutional Neural Network (CNN)** using **TensorFlow/Keras** for tool identification from images captured by a **Robotiq Wrist Camera**.
- Integrated control of the **UR5 arm (via RoboDK API)**, **Robotiq Gripper (via Python library and Modbus)**, and camera image processing within a unified **Python script**.
- Programmed **pick-and-place** operations, applying **homogeneous transformations** for precise tool handling and camera positioning, simulated in **RoboDK**.
- Utilized **Object-Oriented Programming (OOP)** principles and developed custom modules within an **Anaconda environment**.

### Flashlight Assembly with UR5 Robot (ME5286 Robotics Lab)

March 2025

- Programmed a **UR5 robot** using the **RoboDK Python API** to perform a multi-step assembly of a three-part flashlight (head, battery, endcap).
- Integrated and controlled a **pneumatic chuck** (via custom post-processor and **URScript** commands) to hold flashlight components during assembly, ensuring safe operation with a **photoelectric sensor** to detect part presence.
- Developed **pick-and-place sequences** for all parts, including endcap rotation and placement onto a 3D-printed pedestal, and precise battery insertion considering polarity.
- Implemented a **screwing operation** to attach the endcap to the flashlight head, utilizing custom code for initial rotations and a provided `tighten_torque()` function (monitoring the **Robotiq Force Torque sensor**) to achieve a specified 2Nm torque.
- Managed **TCP and Robotiq gripper configurations**, and developed functions for precise part handling from a custom tray to the chuck, optimizing the assembly sequence.
- Utilized the teach pendant for **location finding** and fine-tuning of part positions to ensure reliable grasping and assembly.

### Real-Time 3D Reconstruction with Custom Stereo Camera and OpenCV

December 2024

- Designed and tested a **custom stereo camera** using **Raspberry pi zero 2W** and **Arduino camera module 3**.
- Implemented a **Stereo camera-based 3D reconstruction** system to generate 3D models of real world environment in **real time** within a acceptable time of **3 milliseconds**.
- Calibrated the camera using **checkerboard patterns** using **OpenCV** with a **0.2 RMSE Error**.
- Developed **Disparity maps** using **Semi-global Block Matching(SGBM)** for depth estimation.
- Utilized **Open3D** library to create **3D reconstruction from Depth Data**.

### Classification of predefined set of fruits and vegetables using ResNet 18 (CNN) Model

December 2024

- Developed a **Deep Learning model** for classifying 5 fruit categories using **ResNet18** and transfer learning with **PyTorch**.
- Created and tested on **custom dataset**, combining images from Fruits-262 and Fruits-360, with additional **unique test data**.
- Preprocessed the Dataset by **resizing the images** to 224x224 pixels and **normalizing using imageNet parameters**.
- Applied **Data augmentation techniques** including random, rotation and flipping and zooming to **improve robustness and address class imbalance**.
- Achieved **99%** training accuracy, **97.5%** validation accuracy, and **85%** testing accuracy, demonstrating strong generalization with minor challenges on unseen data.
- Evaluated performance using metrics such as **accuracy, precision, recall, and F1-score**, highlighting challenges with visually similar classes.

### Design and prototyping of a fruit/vegetable plucking Robot

April 2022

- Implemented **computer vision algorithms** using **RGB color segmentation** using **MATLAB**.
- Calculated **coordinates for bounding boxes** around detected strawberries and transmitted them to an Arduino Uno via **Bluetooth**.
- Programmed an Arduino Uno** to control stepper motors, actuating the robot's frame based on a **Gantry robot mechanism**.
- Engineered and controlled a **scissor-inspired gripper mechanism**, powered by a servo motor, to cut the stems of the strawberries.