Abhishek Manish Lele

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Education

University of California San Diego, M.Eng. in Bioengineering (Medical Device Engineering) Sept 2025 – Dec 2026
GPA: 3.78/4.0

Relevant Coursework: Soft Robotics, Biomedical Integrated Circuits, Design & Control Haptic Systems, Biomaterials For Medical Devices, Finite Element Methods I, Regulatory Affairs, Patient-Centric Clinical Medicine, MDE Capstone Design I & II

Dr. Vishwanath Karad MIT World Peace University, B.Tech. in Mechanical Engineering Aug 2021 – May 2025
GPA: 3.98/4.0

Work Experience

Mechanical Engineering Intern, Madison Scientific Inc. – Chicago, IL June 2026 – Sept 2026

- Led mechanical design of ShuntBuddy™, a wearable barometric pressure sensor enabling atmospheric compensation for the SmartShunt™ implantable hydrocephalus system, reducing device volume by 27% through iterative SolidWorks modeling and SLA-printed prototypes of enclosures and external accessories.
- Achieved IP67 ingress protection (IEC 60529) by specifying PTFE vent membranes and adhesive sealing, and drove design-for-manufacturing with injection molding vendors under an ISO 13485 quality system.
- Integrated ShuntBuddy™ with the SmartShunt™ implant to enable pressure-compensated shunt operation, ensuring reliable barometric sensing on-wrist.

Mechanical Engineering Intern, Precima Technologies Pvt. Ltd. – Pune, India Jan 2025 – June 2025

- Developed 3D dental and maxillofacial implant models in SolidWorks from 2D specifications, incorporating realistic and worst case scenario boundary conditions and load paths as specified in ISO 14801.
- Conducted experimental fatigue testing of implants under cyclic loading, according to ISO 1099, using a Universal Testing Machine compliant with ISO 7500. Performed Abaqus-based finite element simulations to predict fatigue life, achieving 93% agreement with experimental results.
- Iteratively refined geometry and modeling assumptions to improve simulation–experiment correlation to 96%. Optimized the implant thread geometry and the CNC toolpaths in Mastercam to improve manufacturability.

Academic Projects (Portfolio ↗)

ContinuEar: PPG and BCG-Based Continuous Blood Pressure Monitoring Earbud Jan 2026 – May 2026

- Designed a wearable earbud for cuffless, continuous blood pressure monitoring using pulse transit time (PTT), integrating a MAX30102 IR-channel PPG sensor (880 nm) and a GY-906 MLX90614 non-contact tympanic thermometer in a custom SLA 3D-printed housing ergonomically contoured to the ear canal.
- Utilized the onboard IMU of an Arduino Nano 33 BLE Sense to capture ballistocardiogram (BCG) waveforms, fusing BCG and PPG signals to extract PTT for BP estimation. Incorporated tympanic temperature readings as a physiological correction factor.
- Achieved an estimated accuracy of ± 12 mmHg systolic and ± 7 mmHg diastolic against reference cuff measurements. Implemented real-time signal processing to identify fiducial points across BCG and PPG waveforms, achieving a measurement-to-reading latency of <200 ms.

AccuSense Cath: Soft-Tip Cardiac Catheter with Contact-Force Haptic Feedback Sep 2025 – Dec 2025

- Designed a 6 Fr cardiac ablation catheter with an elastic resin distal tip, Pebax braided shaft, and Nitinol-based flexure, complying with ISO 10993. Integrated a piezoresistive force-sensing system in the tip by CNT-doping and utilized tip deformation, contact angle, and speed to estimate applied force.
- Generated simulation data by mapping input values to contact force, and trained a regression model for real-time force estimation. Implemented real-time estimation and haptic feedback using Arduino Nano 33 BLE and MATLAB, driving graded vibrotactile alerts via 3V coin motors.
- Modeled and prototyped using SolidWorks, ANSYS, and SLA 3D printing, achieving force sensing in the 0.02–0.4 N range with <50 ms latency.

SmoothOperator: Teleoperated Surgical Manipulator with Haptic Feedback Jul 2024 – Dec 2024

- Developed a wearable master-controller glove integrating force-sensitive resistors (FSRs) at the fingertips, flex sensors for finger joint movement, and an IMU mounted on the dorsal wrist to capture hand position and finger-bending to replicate the surgeon-side input interface.
- Sensor data were fused to map position and motion over a bidirectional control loop to drive both a real-time virtual environment in Unity and a physical 3-DoF robotic arm, enabling surgical gesture replication including grasping, retraction, and tissue manipulation analogues.
- Implemented haptic feedback using vibrotactile motors at the outer fingertips proportional to slave-side contact forces. Achieved <100 ms virtual mapping latency and <150 ms end-to-end latency for haptic feedback from movement onset.

Technical Skills

CAD/FEA: AutoCAD, SolidWorks, Creo, Fusion360, Catia, Ansys (Structural, Fluent), Abaqus, Mastercam
Programming & Visualization: MATLAB, Python, C++, SQL, Arduino IDE, Processing, Unity, OpenSim, LabChart
Prototyping & Manufacturing: SLA/FDM 3D Printing, CNC Machining, Injection Molding, Laser Cutting, PCB Assembly