Jal Panchal

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Boston, MA

SUMMARY

Experienced R&D Scientist with 5+ years in physiological signal processing, clinical validation and product development. Developed a novel stress metric within 6 months, offering innovative insights into user physiological states. Transformed research prototypes into a production-ready product within 2 years. Committed to creating meaningful health solutions through scientific innovation.

PROFESSIONAL EXPERIENCE

MindMics Inc, Boston, MA

Senior R&D Scientist | Jun 2022 - Present (2.7 years +)

- **Algorithm Development and Implementation:** Led the development of a personalized stress metric, from **hypothesis to product launch in 6 months**, by managing studies and cross-functional integration.
- **Project Management:** Led New Product Introduction for wireless earbuds line, collaborating with cross-functional teams and manufacturers. Developed infrasound testing fixtures that **reduced product rejection rates by 50% within 6 months.**
- **Clinical Validation Study:** Conducted a clinical study (n = 20) to validate blood pressure prediction, developing a real-time data quality monitoring and analysis system that addressed device fit issues, **increasing usable data by more than 10%.**
- **Blood Pressure Prediction:** Developed advanced signal processing and feature engineering techniques to train machine learning models for blood pressure estimation from in-ear signals, **reducing prediction error by over 20%**

Clinical Trials Coordinator | Aug 2020 - Aug 2021 (~1 year)

- Developed **novel data collection system synchronizing earbud signals with clinical gold standards** including (ECG, cardiac catheterization) within 5 ms, enhancing cardiovascular research precision.
- Successfully **managed and executed two remote clinical studies** (n = 15, NCT05103579 and n=35, NCT04636892) validating biosensing earbuds against established cardiac diagnostic standards.

Chief Engineer | Jul 2019 - Jul 2020 *(~1 year)*

- **Project Management:** Led a multidisciplinary team, advanced **prototypes to a production-ready product in under 2 years** through effective resource management, vendor communications, and fostering cross-functional collaboration.
- **Instrumentation Lab:** Established an in-house acoustics lab for calibrating and characterizing earbuds, achieving **precise infrasound calibration down to 1 Hz** to ensure repeatability, reproducibility, and reliability in early-stage hardware development.

Mechatronics Engineer | Nov 2018 - Jun 2019 (~ 8 months)

- **Early-Stage Product Development:** As the first employee, led project planning, prototyping, sensor testing, and cross-functional collaboration across hardware and software teams, while conducting user testing to refine usability and product design standards.

ModeliCon InfoTech, Bangalore, India

Systems Engineer - Instrumentation and Control | Apr 2017 - Apr 2018 (~ 1 year)

- **Early-Stage Product Development:** As the first employee, designed, developed, and delivered ModeliCon's inaugural product—an integrated system for a **closed-loop real-time simulation using mathematical models** and industrial control systems—all within a year.

Sunlux Technologies, Bangalore, India

Software Engineer - Instrumentation and Control | Feb 2016 - Mar 2017 (~ 1 year)

- Modeled the internal environment of an Indian Navy vessel to develop and implement a new control **algorithm that increased equipment efficiency by 15%** while ensuring the system met rigorous military standards for reliability and performance.

RESEARCH PROJECTS

University Of Pennsylvania, Philadelphia, PA

Litt Lab, Center for Neuroengineering and Therapeutics | May 2021 - May 2022 (~1 year)

- Conducted a clinical study for my Master's thesis to explore the relationship between wearable biometrics, behavior, and brain states in epilepsy patients. Designed study protocols, led recruitment, data acquisition, and analysis, and evaluated commercial wearables (Apple Watch and Fitbit Sense) for brain state biomarker detection.

Rehabilitation Robotics Lab | Sep 2020 - May 2021 (~8 months)

- Conducted an independent study, constructing a robotic infant simulator to analyze the impact of limb movements on the center of pressure, aiming to detect biomarkers for early detection of neuro-motor disabilities such as Cerebral Palsy in infants [link].

Indian Institute of Technology, Kanpur, India

Smart Materials, Structures and Systems Lab | Jan 2015 - May 2015 (~4 months)

- Capstone Project - Designed, fabricated, and tested a proof-of-concept Helmholtz resonator-based low-power tracking system for long-range monitoring of natural gas pipeline robots within 4 months for GAIL, India.

EDUCATION

University Of Pennsylvania, Philadelphia, PA

Master of Science in Engineering in Robotics (May 2022)
Award: *Penn Engineering Outstanding Service Award*

Manipal Institute of Technology, Manipal, India

Bachelor of Technology in Mechatronics (May 2015)
Award: *Valedictorian, Dr. TMA Pai Gold Medal 2014-15*

TECHNICAL SKILLS & TOOLS

- **Technical Skills:** Biomedical Signal Processing, Biophysics, Time series analysis, Multi-variate Analysis, Machine Learning, Deep Learning, Algorithm Development, Testing & Validation, Prototyping, Data Visualization
- **Research and Clinical Expertise:** Statistical Analysis, Monte-Carlo Analysis, Exploratory Data Analysis, First Principles Thinking, Root Cause Analysis, Mathematical Modeling, Human Subject Research, Clinical Study Design
- **Sensor Technologies:** ECG, EEG, PPG, Acoustic Sensing, Temperature Sensing, Pressure Sensing, Motion Sensing
- **Software & Tools:** Python, PyTorch, MATLAB, SQL, InfluxDB, Embedded C, SolidWorks, LabVIEW, REDCap, Git
- **Project Management:** Agile Project Management, Cross-Functional Team Leadership, Product Development
- **Certifications:** CITI Program: Human Research - Group 1 Biomedical Research Investigators and Key Personnel (Basic Course).

SELECTED PUBLICATIONS

- Shen CP, **Panchal J**, et al. (2023). A Novel Earbud Detects Aortic Stenosis Murmur Before and After Transcatheter Aortic Valve Replacement. JACC Case Rep. 28:102089.
- **Panchal J**, Sowande OF, Prosser L, Johnson MJ. (2022). Design of pediatric robot to simulate infant biomechanics for neuro-developmental assessment in a sensorized gym. Proc IEEE RAS EMBS Int Conf Biomed Robot Biomechatron.
- Gilliam FR, Ciesielski R, Shahinyan K, Shakya P, Cunsolo J, **Panchal JM**, et al. (2022). In-ear infrasonic hemodynography with a digital health device for cardiovascular monitoring using the human audiome. NPJ Digit Med. 5(1):189.

SELECTED PATENTS

- Barnacka, A., **Panchal, J. M.**, Ring, M. D., Devlin, T. Earbud for detecting biosignals from and presenting audio signals at an inner ear canal and method therefor. US Patent App. 18/752,692 (2024).
- Barnacka, A., **Panchal, J. M.** Synchronous clinical data collection, analysis and reporting system and method therefor. US Patent App. 17/900,815 (2023).
- Barnacka, A., **Panchal, J. M.**, Ring, M. D., Shakya, P. System and method for leak correction and normalization of in-ear pressure measurement for hemodynamic monitoring. US Patent App. 17/359,001 (2021).

updated Mar 2025