Unnathi Annapurna Shashikumar

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EDUCATION

MSE in Biomedical Engineering | *Johns Hopkins University* | Baltimore, MD | GPA:**3.6/4.0**

- Courses - Medical Robotics, Computer Integrated Surgery, Advanced Optical Imaging, Imaging physics, Machine Intelligence on Embedded Systems, Product Management, Medical Instrumentation, machine learning for medical applications.

BE in Medical Electronics Engineering | *Visvesvaraya Technological University* | Bengaluru, India | GPA:**9.01/10.0**

- Courses - Wearable sensors, Embedded systems, Machine learning, biomedical instrumentation, FMEA, Electrical circuit theory, medical device development, Quality, Control, and regulation of Medical Devices, biomaterials, analog & digital circuits.

WORK EXPERIENCE

Pre-doctoral research associate | *Lehigh University* | Bethlehem, PA | August 2025 - Present

- Formulated gel-based bioelectrodes from agricultural surplus materials, fabricated flexible electrodes and validated signal quality for physiological data acquisition in wearable systems.
- Designed and fabricated a flexible PCB-based wearable biosensing platform using the MAX30003 biopotential AFE with LiPo battery power and charging circuitry, enabling continuous, untethered monitoring.
- Programmed the Nordic nRF52840 for bio signal acquisition, BLE data transmission, and power management, achieving low-noise, low-power embedded operation.
- Developed quantitative metrics and analysis pipelines to assess muscle oxygen saturation as a rehabilitation biomarker, collecting physiological data from healthy participants.

Biomechanical Engineer | *NanoBioFab* | Frederick, MD | Jan 2025 - May 2025

- Conducted Design of Experiments to evaluate dressing materials, guiding selection for optimal VOC diffusion properties.
- Designed and iterated a low-profile CAD housing and flexible PCB stack to meet the product requirements.
- Built and calibrated benchtop fixtures for prototype validation, testing the behavior of multilayer dressings under simulated conditions.
- Collaborated with biosensor and microbiology teams to translate biological requirements into mechanical validation protocols aligned with MedTech standards.
- Developed Python scripts and Excel dashboards to process experimental data, generate calibration curves, and reduce prototyping cycles by 40 %, accelerating validation milestones by two months.

Research Assistant | *Johns Hopkins Hospital - Pathak Lab* | Baltimore, MD | Jun 2024 - Jun 2025

- Led the mechanical design of a next-generation optical microscope for in vivo imaging in mice, developing detailed CAD models in SolidWorks.
- Designed pipeline for an incubator-based cell monitoring device, integrating embedded system programming and MATLAB for automated analysis.
- Optimized fluorescence imaging configurations for tumor visualization, improving channel separation and reducing crosstalk in live imaging; developed a MATLAB dashboard to assess and select optical filters based on defined imaging criteria.

Ultrasound Surgical Research Assistant | *Johns Hopkins University, MusiiC Laboratory* | Baltimore, MD | Oct 2023 - Feb 2024

- Designed a bracket system for an ultrasound probe using SolidWorks, integrating sensors for photoacoustic signal transmission.
- Optimized a computational tool deploying K-Wave and MATLAB to improve needle detection accuracy.

Electronics Testing & Validation Intern | *InnAccel Pvt. Ltd* | Bengaluru, India | Sept 2022 - Mar 2023

- Designed a mechanical setup involving stepper motors and Arduino to automate 12-hour lifecycle testing of neonatal devices.
- Engineered an ECG gel dispensing module with sensor-driven feedback control to ensure consistent application.
- Improved product testing workflow efficiency by 35% through automation, heat mitigation strategies using embedded control.
- Documented testing protocols and contributed to test reports supporting product validation and compliance.

CONFERENCE ABSTRACTS

- Shashikumar, U., Carten, W., Lindley, M., Koranteng, V., & Seshadri, D. R. (n.d.). *Engineering sustainable electrodes at the intersection of materials innovation and health equity, Materials Research Society*
- Shashikumar, U., Alawani, I. M., Bhanu Prashanth, S. B., & Shastri, R. (n.d.). *Non-invasive thoracic bioimpedance system for continuous CHF fluid monitoring.* BMS College of Engineering, Bengaluru, India; Johns Hopkins University, Baltimore, Maryland; iMedrix Systems Pvt. Ltd, Bengaluru, India, *IEEE Body Sensor Networks*
- Shashikumar, U., Carten, W., Lindley, M., Koranteng, V., & Seshadri, D. R. (n.d.). *Developing an affordable hydrogel-based ECG electrode from agricultural surplus for physiological monitoring in low-resourced countries.* Department of Bioengineering, Lehigh University, PA, USA., *BMES*
- Shashikumar, U., Stein, B , Seeley, M & Seshadri, D. R. (n.d.). *Predictive analytics for using muscle oxygen saturation for rehabilitation in lower limb injury, Eastern Orthopedic Association.*

CONFERENCE PAPERS

- IEEE EMBC : U. A. Shashikumar and D. R. Seshadri, "Engineering sustainable low-cost hydrogel electrodes for physiological data acquisition," Dept. of Bioengineering, Lehigh Univ., Bethlehem, PA, USA, submitted.

ACADEMIC PROJECTS

Bio gaming for amputees*, Johns Hopkins University*, Sept 2024 - Dec 2024
- Innovated EOG-based retinal glasses for individuals with upper limb impairments for hands-free Minecraft gaming.

Bioimpedance Device Development*, iMedrix Pvt.Ltd,* Nov 2022 - Jun 2023
- Developed, validated a bioimpedance-based fluid monitoring system for CHF patients using an AD5940 AFE circuit.

Alert system for posture correction, Apr 2021 - Jul 2021
- Engineered a setup to monitor bad posture utilizing flex sensors, Arduino, and Relay systems. [Link to paper]

Regulatory & Quality Assurance of LCS Total Knee System, Mar 2022 - May 2022
- Researched on FDA laws, regulations, and premarket approvals for a device LCS Total knee system by Philips.

Personal Desktop Assistant using Python, Jan 2024 - May 2024
- Developed an AI-powered desktop assistant using Python, integrating Agile methodologies with sprint-based development.

Flex sensing glove, Sept 2024 - Dec 2024
- Developed a wearable ASL-to-speech glove using flex sensors, IMU, and BLE for real-time gesture recognition

Multimodal gesture recognition, Jan 2025 - May 2025
- Developed a dual-channel intent detection system that fuses passive acoustic and active ultrasonic signals using a Multi-Head Attention Residual CNN for robust gesture recognition.

SKILLS

- **Programming** - C/C++, Embedded system programming, Arduino, Python, MATLAB, Raspberry Pi.
- **Technical tools** - Altium, ARM, SOLIDWORKS, Minitab, Proteus, AutoCAD, Keil, Multisim, KWave, Digilent, LabVIEW.
- **Medical Device Regulatory & Quality** - Quality Management System (QMS), ISO 13485, ISO 14971, IEC 60601, device validation, Waterfall, Iterative, V models, Software Development Lifecycle (SDLC), Test Method Development.
- **Managerial** - Agile, Scrum, Lean, Feature-driven Development, Dynamic Systems Development Methods, Extreme Programming, Kanban, FMEA, UAT, Jira, Asana, product management, and technical writing.
- **Machine** - 3D printing, soldering, troubleshooting, hardware debugging, prototyping, benchtop testing.

LEADERSHIP EXPERIENCE

Physiology of Applied BME Teaching Assistant | *Engineering for Professionals, JHU* | Baltimore, MD | Sept 2024 - Present
- Provide constructive feedback to students & Grade Physiology course assignments.

BME Design project Mentor | *BME, Johns Hopkins University* | Baltimore, MD | Sept 2024 - May 2025
- Mentored 4 teams in product development & startup foundation, fostering teamwork, critical thinking, and goal setting.
- Reviewing progress, evaluating Design History files, and providing constructive feedback.

Head of Marketing | *Johns Hopkins Product Management Club* | Baltimore, MD | Jan 2024 - Sept 2024
- Led marketing strategy and outreach initiatives for the Club, increasing engagement and event participation.

CERTIFICATIONS

Biomedical Equipment Training Programme, Skill Biomed Pvt Ltd – [Certificate]
Build a Face Recognition Application using Python, Guvi – [Certificate]
Medical Device Software Process Black Belt, Udemy – [Certificate]
Software Development Life Cycle, Udemy – [Certificate]