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Nithesh Kumar

PhD Student in Electrical Engineering

Research in Robotics, Architectural robotics, Robotics Prototyping, Adaptive Environments, and Bio-Sensing Technologies.

Summary

I am a PhD candidate in Electrical and Electronics Engineering at Clemson University, specializing in robotics hardware development with a focus on architectural robotics. My dissertation centers on the Robot-Rooms, which explores morphing robotic surfaces and reconfigurable environments that envelop and adapt to human needs. This research represents a transformative approach to human-robot interaction, allowing spaces to physically evolve in response to occupants' activities. In addition to my dissertation work, I have led the development of continuum robots, hybrid robotic grippers. I have also worked on bio-sensing technologies, developing rugate filters for colorimetric biosensing. I have successfully designed innovative systems like a self-deploying space bridge and a self-reorienting tent. My research is grounded in rapid prototyping and human-centered design, as evidenced by user studies integrated into the Robot-Rooms project. My experience extends to industry, where I worked as an Electrical Engineer at Fiber Mountain, designing PCBs and test fixtures. I hold a Six Sigma Green Belt certification and am proficient in tools such as OrCAD and Allegro PCB. I am passionate about advancing robotics research and contributing to academic projects focused on adaptive environments, robotics-assisted systems, and human-centered technology.

Research Interests

- Robotics
- Bio-sensing technologies
- Adaptive environments
- Robot-assisted living spaces
- Structural color sensors
- Continuum robotics
- Hybrid robotic grippers

Education

PhD in Electrical and Electronics Engineering, *Clemson University*, **2020–Present**
Clemson, SC, *Expected Graduation: 2025*.
Research focus: Robotic surfaces and bio-sensing devices for adaptive living spaces.

Bachelor of Science in Electrical and Electronics Engineering, *University of New Haven*, West Haven, CT, **2013–2017**
Graduated May 2017.

Research Experience

Graduate Research Assistant, *Clemson University*, Clemson, SC. **2020–Present**

- Designed morphing robotic surfaces for dynamic, adaptable living spaces.
- Developed hybrid robotic grippers, increasing object manipulation efficiency by 30%.
- Designed a self-deploying 'space bridge', and other robot prototypes.
- Researched dual-band porous silicon rugate filters for optical bio-sensing.
- Mentored and supervised an undergraduate student through a project semesters, providing guidance on experimental design, data analysis, and prototyping.
- Published findings in peer-reviewed journals and conferences.

Professional Experience	Electrical Engineer , <i>Fiber Mountain</i> , Cheshire, CT. 2017–2020 <ul style="list-style-type: none"> ○ Designed PCB test fixtures and FPGA circuits for Fiber Mountain's product line. ○ Reduced production errors by redesigning application circuits for the SENSUS product line. ○ Managed cross-functional agile teams, reducing time-to-market by 15%.
Teaching Experience	Invited Guest Lecturer , <i>Clemson University</i> , Clemson, SC. 2023 Course: ECE 8690 – Advanced Kinematics in Robotics. Teaching Assistant , <i>Clemson University</i> , Clemson, SC. 2022–2024 Course: ECE 8680 – Architectural Robotics. Teaching Assistant , <i>University of New Haven</i> , West Haven, CT. 2014–2017 <ul style="list-style-type: none"> ○ Tutored Pre-Calculus, Analog Circuits, and other Electrical Engineering courses. ○ Assisted with grading, mentoring students, and organizing instructional materials.
Publications	<p>2024: N. Kumar, H.M. Chao, B.D.D.S. Tassari, E. Sabinson, I.D. Walker, K.E. Green, "Design of Two Morphing Robot Surfaces and Results from a User Study On What People Want and Expect of Them, Towards a 'Robot-Room'," Presented at 2024 IEEE International Conference on Robotics and Automation (ICRA).</p> <p>2024: N. Kumar, E.M. Dos Santos, T.H. Talukdar, J.D. Ryckman, "Quantitative Dynamic Structural Color: Dual-Band Hyperchromatic Sensing with Mesoporous Meta-materials," <i>Advanced Optical Materials</i>, 2401152. (Featured on the cover of the issue).</p> <p>2024: P. Malhotra, N. Kumar, C. Frazelle, I.D. Walker, G. Lv, "Soft Robotics for Fall Mitigation: Preliminary Design and Evaluation of a Wearable System using Continuum Robots," Presented at 2024 6th International Conference on Reconfigurable Mechanisms and Robots (ReMAR).</p> <p>2023: N. Kumar, E.M. Dos Santos, T.H. Talukdar, J.D. Ryckman, "Spatiotemporally Resolved Dual-band Hyperchromatic Structural Color with a Mesoporous Metamaterial," Abstract Presented at CLEO: Science and Innovations, SF1A.6.</p> <p>2023: I.D. Walker, N. Kumar, K.E. Green, "Animated Surfaces for Novel Robot-Rooms," Abstract Presented at Human-Focused Robotics Workshop (HFR2023).</p>
Technical Skills	PCB Design: OrCAD, Allegro PCB Programming: MATLAB, ARM Microcontrollers, C 3D Modeling: SOLIDWORKS Other Tools: SMT Soldering, Linux, Arena PLM, Jira, Agile Project Management

Leadership and Service	<p>Graduate Student Government Delegate, <i>Clemson University</i>, Clemson, SC. 2020–2023</p> <ul style="list-style-type: none"> ○ Represented graduate students in policy discussions in the Graduate Student Senate. ○ Served as a member of the GSG Activities Committee, responsible for planning, organizing, and running events for graduate students. <p>Project Lead and Mentor, Robot-Rooms Project, <i>Clemson University</i>, Clemson, SC. 2021–2023</p> <ul style="list-style-type: none"> ○ Managed and mentored a team of multidisciplinary undergraduate students, facilitating collaboration across engineering and design disciplines to advance the Robot-Rooms project. ○ Oversaw project tasks, guiding students in prototype development, experimental design, and achieving project milestones in a structured timeline.
Press and Media Coverage	<p>This Clemson News article features my former advisor, Dr. Judson Ryckman, and myself discussing our work on nano-manufactured sensor chips. The research, which aims to make diagnostic tests more accessible through visible color changes, directly contributed to our publication in <i>Advanced Optical Materials</i>.</p> <p>Link to article: New Research Could Open the Door to Quick, Simple Diagnostic Tests.</p>
Certifications	<p>Six Sigma Green Belt (CSSGB)</p>