AKSHITH ULLAL

573-529-6843 akshithullal@gmail.com www.linkedin.com/in/akshithullal https://akshith-ullal.github.io/web/

EDUCATION

Vanderbilt University — Nashville, TN
Ph.D. in Electrical and Computer Engineering — *2018-2024*
Thesis: Generation of Naturalistic Interactions for Large-Scale Avatar Telepresence in Mixed Reality
Advisor: Dr. Nilanjan Sarkar

University of Missouri - Columbia — Columbia, MO
M.S. in Electrical and Computer Engineering — *2015–2018*
Thesis: Non-Invasive Monitoring of Vital Signs using Recliner Chairs
Advisor: Dr. Marjorie Skubic , GPA: 3.81/4.0

Visvesvaraya Technological University — Belagavi, India
B. Tech. in Electronics and Communication Engineering — *2011-2015*
GPA: 3.7/4.0

RESEARCH FOCUS

- Develop mixed reality systems that bridge the gaps between the virtual and the real worlds with seamless and realistic interactions made possible by the latest Generative AI and AR technologies. I am also interested in applying these developed technologies to improve people's lives and health.

PATENTS AND PUBLICATIONS (Full list: https://scholar.google.com/citations?user=2ihJFWwAAAAJ&hl=en)

Patents

A1 US Patent: System and Method for Efficient Redirection of User Interactions and Gestures between Remote and Local Environments in Augmented Reality **(US20240177434A1)**.
A2 US Patent: System and Method for Efficient Mapping of User Locomotion between Remote and Local Environments in Augmented Reality **(US20240177426A1)**.
A3 US Patent application under progress: System and method to generate naturalistic locomotion paths for avatar telepresence interactions that involve large size differences between user and avatar environments **(VU24205)**.
A4 US Patent application under progress: System and method to generate naturalistic walking gait body poses based on given input velocity and body joint constraints for performing naturalistic avatar-based telepresence interactions in mixed reality **(VU24206)**.
A5 US Provisional patent: Non-wearable Heartrate, Respiratory Rate and Motion Monitoring System (**US62/481,968)**.

Journal Articles

J1 Watkins, A., **Ullal, A**., Sarkar, N. "Every "Body" gets a say: An Augmented Optimization Metric to Preserve Body Pose during Avatar Adaptation in Mixed/Augmented Reality." *IEEE Transactions on Visualization and Computing*.
J2 Migovich, M**.**, **Ullal, A**., Fu, C." Feasibility of wearable devices and machine learning for sleep classification in children with Rett syndrome: A pilot study." *Digital Health*, pp. 1-9. 2023.
J3 Fan, J., **Ullal, A.**, Beuscher, L. et. al. "Field testing of Ro-Tri, a robot mediated triadic interaction for older adults." *International Journal of Social Robotics*, 13, pp. 1711-1727,2021.
J4 Fan, J., Mion, L.C., Beuscher, L., **Ullal, A.**, et al. "SAR-connect: A socially assistive robotic system to support activity and social engagement of older adults." *IEEE Transactions on Robotics,* 38 *(2),* pp. 1250-1269, 2021.
J5 Nie, G., **Ullal, A.,** et al. "An Immersive Computer-Mediated Caregiver-Child Interaction System for Young Children with Autism Spectrum Disorder." *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, 29, pp.884- 893, 2021.
J6 **Ullal, A.,** Su B.Y., et al. "Non-invasive monitoring of vital signs for older adults using recliner chairs." *Health and Technology*, 11, pp.169- 184, 2021.

Conference Proceedings

C1 **Ullal, A**., Tauseef, M., Watkins, A., et al. " An Iterative Participatory Design Approach to Develop Collaborative Augmented Reality Activities for Older Adults in Long-Term Care Facilities." In 2024 *ACM Conference on Human Factors in Computing (CHI).*
C2 **Ullal, A.**, Watkins, A., Sarkar, N. "A Multi-Objective optimization framework for redirecting pointing gestures in Remote-Local mixed/augmented reality." In 2022 *ACM Symposium on Spatial User Interaction (SUI),* pp. 1-11.
C3 **Ullal, A.,** Watkins, C., Sarkar, N. "A Dynamically Weighted Multi-Objective Optimization Approach to Positional interactions in Remote-Local Augmented/Mixed Reality." In *2021 IEEE International Conference on Artificial Intelligence and Virtual Reality (AIVR)*, pp. 29-37,2021.
C4 **Ullal, A.**, et al. "Design of an intelligent and immersive system to facilitate the social interaction between caregivers and young children with autism." In Proceedings of the 2019 HCI International Conference, pp. 123-132,2019.

Book Chapters

B1 **Ullal, A.**, and Pachori, R. "Variational mode decomposition based automated diagnosis method for epilepsy using EEG signals." In *Deep learning, machine learning and IoT in biomedical and health informatics*, *CRC Press*, pp. 89 – 111, 2022.

Posters

P1 Maxwell, C., Tauseef, M., **Ullal, A.** et. al. "Designing Collaborative augmented reality activities with older adults in long term care." In *Innovation in Aging*, vol. no. 7, pp. 1017. 2023.
P2 **Ullal, A.**, and Sarkar, N."A Piecewise Approach to Mapping Interactions between Room-scale Environments in Remote Mixed/Augmented Reality." In *2023 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, pp. 663-664. 2023.
P3 **Ullal, A.**, and Sarkar, N. "Mapping of Locomotion Paths between Remote Environments in Mixed Reality using Mesh Deformation." In Proceedings of the *28th ACM Symposium on Virtual Reality Software and Technology,* pp. 1-2. 2022.

HONORS AND AWARDS

- Best student paper award IEEE Artificial Intelligence and Virtual Reality (AIVR) 2021
- Top 4 finalist Best paper award IEEE AIVR 2021
- Graduate Travel Grant, Vanderbilt University to present at the IEEE AIVR 2021, IEEE VR 2023 and ACM CHI 2024 conferences
- Deaton Scholar, The Brady and Anne Deaton Institute
- Curators Grant-in-Aid scholarship, University of Missouri

FUNDING AND GRANTS

- Helped write a National Science Foundation (NSF) Smart and Connected Communities (S&CC) grant **# 2225890 "Reducing Loneliness for Long Term Care Older Adults through Collaborative Augmented Reality"** based on my thesis with my advisor Dr. Nilanjan Sarkar as PI and my dissertation committee member Dr. Lorraine Mion as Co-PI that was funded for **$2.25 million**.
- Helped write a National Institute of Health (NIH) R21 grant **# 1R21AG078480-01 "Reducing Loneliness of Older Adults in Long Term Care Facilities through Collaborative Augmented Reality"** based on my thesis with my advisor Dr. Nilanjan Sarkar as PI and my dissertation committee member Dr. Lorraine Mion as Co-PI that was funded for **$433,495**.

WORK EXPERIENCE

Intelligent Clinical Care Center, University of Florida Gainesville, FL
Research/Omniverse Engineer V *June 2024 – Present*

- Developing LLM-driven, role-specific AI characters (patients, doctors, staff, family) for intelligent ICU digital twins.
- Establishing real-time data integration pipelines for non-protected health information (PHI) streaming between the ICU and its digital twin.

Robotics and Autonomous Systems Lab, Vanderbilt University Nashville, TN
Graduate Research Assistant *Aug 2018 – May 2024*

- Developed a multiobjective optimization framework for redirecting humanoid kinematic structure motion with physics-based pose preservation between remote environments in AR/VR using Unity, C# and HoloLens 2.
- Developed a mesh deformation-based method to generate locomotion trajectories of users between remote environments of any irregularly shaped topology in AR/VR.
- Developing generative AI-based naturalistic gait locomotion for an avatar based on the given input speed.
- Developed an AR telepresence system where users can remotely interact in 3D with other users and objects in their mutual environment through their Metahuman photorealistic avatars. The application was developed using Unreal, C#, Python, AWS and Photon networking engine and was tested on 62 participants with statistically significant results.
- Classified sleep stages in children with Rett Syndrome, based on physiological features using a SVM machine learning model with 85.1% accuracy.
- Developed a multimodal machine learning based stress detection classifier for older adults with 75% detection accuracy. The classifier model can be used to dynamically adjust the difficulty levels in closed loop HCI intervention systems for older adults.

Center to Stream Healthcare in Place, University of Missouri Columbia, MO
Graduate Research Assistant *Aug 2016 – May 2018*

- Developed an accelerometer sensor system for recliner chairs that can noninvasively extract heart and respiration rates from the occupants' ballistocardiogram signals using a deep regression network.
- Tested the sensor system with 45 older adult subjects having an average age of 78.8 years. The average heartbeat and respiratory error rate were 3.6% and 6.25% respectively.

Biomedical Signal Processing Lab, IIT Indore Indore, India
Summer Research Intern *May 2017 – Aug 2017*

- Developed a deep neural network to classify seizure vs seizure-free EEG signals based on the features obtained from Variational Mode Decomposition (VMD) of the signals.
- Invited to write a book chapter for the developed automated VMD based seizure classifier in *Deep learning, machine learning and IoT in biomedical and health informatics, CRC Press*.

Uniq Technologies Chennai, India
Application Developer Intern *May 2014 – July 2014*

- Developed a code using NS-2(Network Simulator 2) that compares AODV (Ad-hoc On-Demand Vector and DSDV (Destination

Sequenced Vector Routing) with different node configurations.
- Simulated TCP and UDP protocols using NS-2 with emphasis on their bit rates.

Mangalore Refineries and Petrochemicals Limited (MRPL) Mangalore, India

Instrumentation Intern *Dec 2013 – Jan 2014*

- Involved Analyzed and helped in the maintenance and working of the Distributed Control System (DCS) and Programmable Logic Controller (PLC) systems used in the fail-safe mechanisms of the refinery.
- Conducted in-plant studies of wireless transponders, pyrometers, pressure gauges and gas detectors used during running, maintenance and repair operation of the refinery.

SERVICE

- **Academic reviewer** for International Journal of Social Robotics (IJSC), IEEE Virtual Reality (VR), IEEE Robot and Human Interactive Communication (ROMAN) conferences.
- **Academic reviewer** for ACM Conference on Human Computing Factors (CHI), ACM Symposium on Eye Tracking Research and Applications (ETRA), Proc. of ACM Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT), European Conference on Information Systems (ECIS), AAAI Conference on Web and Social Media (ICWSM).

TEACHING EXPERIENCE

- **Introduction to Logic Systems (2210):** Spring 2016, University of Missouri, Columbia
- **Capstone Project (ECE 3110):** Fall 2017, University of Missouri, Columbia
- **Senior Capstone Project Design (ECE 4970):** Spring 2017, Spring 2018, University of Missouri, Columbia

MENTORSHIP

- **PhD students:** Mahrukh Tauseef (Vanderbilt University)
- **Masters students:** Jiaqi Liu (Vanderbilt University)
- **Undergraduates:** Nathaniel Lathrop (Middle Tennessee State University (MTSU)), Zalen Ingram (MTSU), Isaac Shirk (MTSU), Gwyneth Polak (MTSU), Kyle Nicholson (MTSU), Bryan Schuder (MTSU), Narayan Rizal (MTSU), Jonah Weaver (MTSU), Martin Weaver (MTSU)

INVITED TALKS

- *Use of Collaborative AR telepresence technologies to reduce loneliness in older adults*, Rutherford County Chamber of Commerce, Murfreesboro, TN
- *Potential of Avatar-based telepresence technologies for interventions with Autistic populations,* Multisensory Research Lab at Vanderbilt University

SKILLS

Programming	OOP, C/C++, C#, Python, MATLAB, Simulink, PHP, Java, HTML, CSS, SQL
Modelling Software	SOLIDWORKS, COMSOL Multiphysics
Graphical Software	Unity, Unreal, Blender, Maya, Adobe Photoshop
Machine Learning (ML)	Deep Learning, Tensor Flow, Pytorch, Regression, Supervised and Unsupervised learning
Artificial Intelligence (AI)	Optimization, Generative AI, Large Language Models (LLM)
AR/VR	3D interaction, UX/ UI, Telepresence, pose generation, Avatars
Sensing and Signals	EEG, PPG, IMUs, actigraphy, signal processing
Robotics	Path planning, motion planning, Inverse Kinematics