Unnikrishnan Radhakrishnan

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OBJECTIVE

I am a passionate researcher, educator, and technologist with expertise in virtual reality, haptics, educational technologies and applied AI. My goal is to push the boundaries of technology-driven innovation, empowering students and industry partners to leverage smart manufacturing, automation, and immersive training technologies for the future.

WORK EXPERIENCE

Aarhus University **November 2024 – Present**
Postdoctoral Researcher *Herning, DK*

- Developing generative AI prototypes for helping automate lifecycle assessment, customer support and compliance checks for Danish small and medium scale companies.
- Researching methods for controlling quality of AI output using retrieval augmented generation and custom testing and evaluation frameworks.

AI Consultant **February 2024 – October 2024**

- Consulted on the application of AI technologies for initiatives at the UNESCO Chair for Women Empowerment and Gender Equality (CWEGE), Amrita University.
- Led the organization of a student hackathon for CWEGE, focusing on developing AI-driven solutions for challenges affecting women (link).

Aarhus University **June 2023 – November 2023**
Postdoctoral Researcher *Aarhus, DK*

- Created rapid prototyping tools for VR/AR concept development by designers.

Aarhus University **February 2020 – April 2023**
PhD Fellow *Herning, DK*

- Investigated the links between performance, user stress levels and simulated touch (haptics) in VR.
- Designed and taught the "Python fundamentals for Machine Learning (2021)" course at Aarhus University's Summer School for 40 students (link).
- Teaching assistant for two machine learning courses at BTECH, Aarhus University.

AMMACHI Labs **June 2010 – December 2019**
Research Software Engineer, Team Lead *India*

- Developed desktop VR training simulation software for clients in the industry and government.
- Developed educational games and related curriculum for teaching programming, conducted workshops for 400 students and 50 trainers across India.
- Led the Virtual Reality & Serious Games group for three years. As part of the team, developed an award-winning social robot, electronics prototyping toolkits and a motorcycle repair simulator in immersive VR.
- Received two patents for innovative techniques in improving skill training and rehabilitation.

EDUCATION

Aarhus University **August 2023**
PhD in Business Development and Technology *Herning*

- Thesis title – "Investigating Immersive Virtual Reality Skill Training with Focus on Training Performance, Haptic Feedback, Physiological Arousal, and Adaptive Training Strategies."

Amrita University **May 2010**
Masters in Computer Applications *Kerala, India*

Amrita University **May 2010**
B.Sc. Computer Science *Kerala, India*

- Ranked 3rd in the graduating class.

PUBLICATIONS & RESEARCH IMPACT

- Publications & Citations: **29 peer-reviewed publications** with **590 citations** (Google Scholar) and an **h-index of 13**.
- Patents:
  - Indian Patent No. 422918: "A Progressive Computer Simulated Haptic Training System for Bar Bending Skills."
  - Indian Patent No. 94860: "Balance Monitoring and Training System."
- Awards & Recognitions:
  - Awarded Best Social Robot at the 2019 IEEE RoMan Conference (Socialis Impremiere Contest).
  - Research featured in IEEE, ACM, and top-tier conferences.

PROJECTS

AI-powered Analysis of Unstructured Image Data **2024**
Technologies: Python, LLMs

- Developed a novel generative AI pipeline for analyzing hand drawn images generated during rural appraisal activities conducted by the UNESCO Center for Women Empowerment and Gender Equality and mapping them to a rural development framework.
- Used prompt engineering techniques such as chain-of-thought reasoning and XML tagging to ensure structured output across state-of-the-art models (GPT-4o, Claude 3.5 Sonnet, Gemini 1.5 Pro).
- This approach saves time and effort required for analysing unstructured image data in developmental contexts.

Intelligent Lego Assembly Assistant – Developer **2024 - Present**
Technologies: Python, Label Studio, Yolo, LLMs

- Currently developing an intelligent system to assist users in Lego assembly as a personal project.
- Created a dataset of images under various lighting conditions and backgrounds of Lego bricks from a specific Lego set.
- Labeled the bricks in the images using Label Studio, augmented the images, and fine-tuned a Yolov8 model for detection, labeling, and drawing bounding boxes.
- Tested system feasibility by using GPT-4 and Claude vision language models to analyze pre-labeled images of a person assembling the Lego set.

VR Skill Training Simulators – Developer, PhD Student **2020 - 23**
Technologies: C# (Unity), C++, Python (Pandas, SciPy)

- Developed VR simulation, including 3D models (Unity Probuilder, Blender), visualisation and custom collision logic in C# for Unity. Tested on over 300 participants in controlled experiments.
- Developed force rendering algorithms in C++ for a robotic touch device and integrated them as a plugin for Unity.
- Developed python-based data pipelines for processing data on performance and stress metrics.
- Performed parametric and non-parametric statistical analyses on experimental results to quantify improvements in training performance, stress levels, and subjective user experience both within and between groups. Proved VR training can be as effective as real-world training for a particular skill.
- Developed a multiuser VR simulation for teaching agile project management, used by more than 100 students at Aarhus University.

- Links: https://unnik.me/project/industrialskillstraining/, https://educate.au.dk/en/teaching-cases/scrum-in-virtual-reality

Social Robot for Promoting Handwashing Behaviour – Developer, Team Lead **2019**
Technologies: C# (Unity), Java (Android), Arduino

- Led a team of software and mechanical engineers in collaboration with Glasgow University to develop a social robot to encourage children in rural India to engage in proper handwashing behavior.
- Developed communication stack for robot control, a custom Bluetooth Android library, robot mouth animations in Unity as well as initial physical prototypes of the robot.
- Led deployment efforts and conducted a Human-Robot Interaction (HRI) pilot study among young children attending a government primary school in North Kerala.
- Published findings in two peer-reviewed IEEE RO-MAN conference papers, highlighting design insights and behavioral influence outcomes.
- Link: https://unnik.me/project/pepe/

Haptic Construction Skills Training Simulator – Developer, Team Lead **2015 - 2016**
Technologies: C# (Unity)
Client: Larsen & Toubro

- Led an engineering team to create a simulator for the client in an accelerated development schedule of 6 months.
- Developed procedural mesh generation, deformation algorithms, and user interface in C# and Unity for the simulation, while working closely with electronics and mechanical engineers.
- Granted Indian Patent No. 422918, "A Progressive Computer Simulated Haptic Training System for Bar Bending Skills."
- Link: https://ammachilabs.org/bar-bending-simulator/

Medical Rehabilitation Device – Developer, Team Lead **2015**
Technologies: C# (Unity), C++
Client: Amrita Hospitals

- Led a team of engineers to create a rehabilitation system for patients with balance neuropathies.
- Designed software architecture, and implemented microcontroller logic to process raw pressure sensor data, and developed device communication interface for the Unity game engine.
- Designed and implemented database schema for storing data from experiments in SQLite. Implemented queue-based logic to ensure all real time data generated by the device was stored.
- Granted Indian Patent No. 94860, "Balance Monitoring and Training System."
- Link: https://unnik.me/project/amba/

Haptic Carpentry/Plumbing Training Simulators – Developer
2010-2013
Technologies: OpenGL, CHAI3D, C++
Client: Ministry of Human Resources Development, Embracing the World (NGO)

- Developed training simulations in C++ using OpenGL (graphics), CHAI3D (haptics), Boost and Qt (GUI) libraries.
- Collected requirements from industrial training institutes and formulated lesson plans.
- Developed device driver code for communicating with custom made haptic feedback devices.
- Link: https://ammachilabs.org/haptic-simulators/

Interactive Music Installation **2012 - 13**
Technologies: OpenCV, openFrameworks, C++, Puredata
Client: GVK industries (Mumbai International Airport)

- Worked with a team of creatives to create a prototype art music installation at the Mumbai international

airport where music is generated when passengers touched streams of flowing water.

- Developed a prototype where depth data from Kinect sensors was used to detect is a user is touching a water stream and the height at which the interaction occurred. Information for triggering music and associated parameters (pitch, decay etc.) was sent to Puredata through the open sound control protocol.
- Developed a scaled down prototype in 2018 using webcam instead of the Kinect, used image thresholding features in OpenCV to detect water-user interaction and trigger music in Puredata.

Tangible Game for Toilet Location Survey Training **2018**

Technologies: Unity/C#, C++, OpenCV

Client: Embracing the World

- Designed and developed a game in Unity which helped women in rural India consider all the factors needed for identifying locations for constructing toilets.
- Designed the system for digitally illiterate users so that they interacted with the game through physical/tangible proxies of toilets and see in real-time, the effects of their choices.
- Developed a background image processing service for tracking tangible objects through markers and sending the normalized cartesian coordinates to the game running in Unity using named pipes.
- Link: https://unnik.me/project/tangibletoilet/

Waste sorting game – Designer, Developer **2013**

Technologies: Unity/C#

Client: Embracing the World

- Designed and developed a game for teaching waste sorting skills.
- Hand tracking from Microsoft Kinect was integrated with Unity to enable players to interactively sort waste.
- Link: https://unnik.me/project/abc/

Haptic Device Integration with Blender – Intern Developer **2009**

Technologies: Python, C++

Client: Sakshat Amrita Vocational Education (S.A.V.E.) project, Amrita University

- Developed Python code for integrating a haptic force feedback device, Novint Falcon with Blender to enable designers to sculpt 3D models.

TECHNICAL SKILLS

- **Programming languages:** Python, C#, C++, R, Java, Javascript.
- **AI & Data Science:** Pandas, Scikit-learn, Tensorflow, Keras, Langchain, Gradio, Langflow.
- **3D Graphics & Simulation:** Unity game engine, Processing, OpenFrameworks, OpenGL.
- **Hardware & Physical Prototyping:** Arduino, 3D printing.

PUBLICATIONS

Journals

1. Lui, Lasse F., **Unnikrishnan Radhakrishnan**, Francesco Chinello, and Konstantinos Koumaditis. "The efficacy of adaptive training in immersive virtual reality for a fine motor skill task." *Virtual Reality* 29, no. 1 (2025): 20.
2. **Unnikrishnan Radhakrishnan**, Lisheng Kuang, Konstantinos Koumaditis, Francesco Chinello, & Claudio Pacchierotti. (2023). Haptic feedback, performance, and arousal: A comparison study in an immersive VR motor skill training task. IEEE Transactions on Haptics.

3. **Unnikrishnan Radhakrishnan**, Francesco Chinello, & Konstantinos Koumaditis. (2023). Investigating the effectiveness of immersive VR skill training and its link to physiological arousal. Virtual Reality, 27(2), 1091-1115. Springer London.
4. **Unnikrishnan Radhakrishnan**, Konstantinos Koumaditis, & Francesco Chinello. (2021). A systematic review of immersive virtual reality for industrial skills training. Behaviour & Information Technology, 40(12), 1310-1339. Taylor & Francis.

Book Chapters

1. Ajay Balakrishnan, Srividya Sheshadri, Akshay Nagarajan, **Unnikrishnan Radhakrishnan**, Sreeram Kongeseri, & Rao R. Bhavani. (2018). Role of ICT in enhancing scale, quality, and reach of TVET in India. In Handbook of Vocational Education and Training: Developments in the Changing World of Work. Springer, Cham.

Conferences

1. Srividya Sheshadri, **Unnikrishnan Radhakrishnan**, Aswathi Padmavilochanam, Christopher Coley, and Rao R. Bhavani. "Generative AI for Analyzing Participatory Rural Appraisal Data: An Exploratory Case Study in Gender Research." Paper presented at the International Conference on Gender and Technology, 2025. (*To be published in IEEE Xplore)*.
2. Lasse F. Lui, **Unnikrishnan Radhakrishnan**, Francesco Chinello, & Konstantinos Koumaditis. (2023). Adaptive immersive VR training based on performance and self-efficacy. In 2023 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW) (pp. 25-29). IEEE.
3. Ioana Visescu, Alin Blindu, **Unnikrishnan Radhakrishnan**, Maja Kadenic, Francesco Chinello, & Konstantinos Koumaditis. (2022). Teaching project management in a virtual environment: The Virtual Scrum Simulator (ScrumSim). In Adjunct Proceedings of the 2022 Nordic Human-Computer Interaction Conference (pp. 1-2). *(poster)*
4. **Unnikrishnan Radhakrishnan**, Konstantinos Koumaditis, & Francesco Chinello. (2022). Investigating haptic feedback and arousal for motor skill training in virtual reality. In EuroHaptics 2022, Lecture Notes in Computer Science (Vol. 13235, pp. 472-474). *(poster)*
5. **Unnikrishnan Radhakrishnan**, Francesco Chinello, & Konstantinos Koumaditis. (2021). Immersive virtual reality training: Three cases from the Danish industry. In 2021 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW) (pp. 1-5). IEEE.
6. **Unnikrishnan Radhakrishnan**, Alin Blindu, Francesco Chinello, & Konstantinos Koumaditis. (2021). Investigating motor skill training and user arousal levels in VR: Pilot study and observations. In 2021 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW) (pp. 625-626). IEEE. *(poster)*
7. **Unnikrishnan Radhakrishnan**, & Konstantinos Koumaditis. (2020). Teaching scrum with a virtual sprint simulation: Initial design and considerations. In Proceedings of the 26th ACM Symposium on Virtual Reality Software and Technology (pp. 1-2). ACM. *(poster)*
8. Sooraj K. Babu, Parameswari Anitha, **Unnikrishnan Radhakrishnan**, E. S. Rahul, Deepu D. Sasi, K. Ayyappan, & Roopak Seshadri. (2019). Igniting the maker spirit: Design and pilot deployment of the kappa tangible electronics prototyping kit. In 2019 IEEE Tenth International Conference on Technology for Education (T4E) (pp. 23-26). IEEE.
9. **Unnikrishnan Radhakrishnan**, Amol Deshmukh, Shanker Ramesh, Sooraj K. Babu, Parameswari Anitha, & Rao R. Bhavani. (2019). Design and perception of a social robot to promote hand washing among children in a rural Indian school. In 2019 28th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN) (pp. 1-6). IEEE.
10. Amol Deshmukh, Sooraj K. Babu, **Unnikrishnan Radhakrishnan**, Shanker Ramesh, Parameswari Anitha, & Rao R. Bhavani. (2019). Influencing hand-washing behaviour with a social robot: HRI

study with school children in rural India. In 2019 28th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN) (pp. 1-6). IEEE.
11. Parameswari Anitha, Sooraj K. Babu, **Unnikrishnan Radhakrishnan**, & Rao R. Bhavani. (2018). Scratching out problems: Exploring the use of computational thinking for social work in Rural India. In 2018 IEEE Tenth International Conference on Technology for Education (T4E) (pp. 16-19). IEEE.
12. Sooraj K. Babu, Sooraj Krishna, **Unnikrishnan Radhakrishnan**, & Rao R. Bhavani. (2018). Virtual reality learning environments for vocational education: A comparison study with conventional instructional media on knowledge retention. In 2018 IEEE 18th International Conference on Advanced Learning Technologies (ICALT) (pp. 385-389). IEEE.
13. **Unnikrishnan Radhakrishnan**, & Rao R. Bhavani. (2018). Tangible user interface for sanitation education in rural India: Design and preliminary observations. In 2018 IEEE 18th International Conference on Advanced Learning Technologies (ICALT) (pp. 125-127). IEEE.
14. Balu M. Menon, Sasi Deepu, Mohan T. Harish, **Unnikrishnan Radhakrishnan**, Manikutty Gayathri, Marco Sangiorgio, Shanker S., Prathap Vishnu, S. Nishok, Menon Mahima, & others. (2017). Virtual rebar bending training environment with haptics feedback. In Proceedings of the 2017 3rd International Conference on Advances in Robotics (pp. 1-6).
15. Balu M. Menon, **Unnikrishnan Radhakrishnan**, Alexander Muir, & Rao R. Bhavani. (2017). Serious game on recognizing categories of waste, to support a zero waste recycling program. In 2017 IEEE 5th International Conference on Serious Games and Applications for Health (SeGAH) (pp. 1-8). IEEE.
16. Natarajan Amritha, Menon M. Mahima, K. Namitha, **Unnikrishnan Radhakrishnan**, Mohan T. Harish, M. D. Sankaran Ravi, & Rao R. Bhavani. (2016). Design and development of balance training platform and games for people with balance impairments. In 2016 International Conference on Advances in Computing, Communications and Informatics (ICACCI) (pp. 960-966). IEEE.
17. James Jose, **Unnikrishnan Radhakrishnan**, Delmar Marshall, & Rao R. Bhavani. (2016). Haptics enhanced multi-tool virtual interfaces for training carpentry skills. In 2016 International Conference on Robotics and Automation for Humanitarian Applications (RAHA) (pp. 1-6). IEEE.
18. **Unnikrishnan Radhakrishnan**, N. Amrita, Alexander Muir, & Rao R. Bhavani. (2016). Of elephants and nested loops: How to introduce computing to youth in rural India. In Proceedings of the 15th International Conference on Interaction Design and Children (pp. 137-146). ACM.
19. James Jose, **Unnikrishnan Radhakrishnan**, Delmar Marshall, & Rao R. Bhavani. (2014). Haptic simulations for training plumbing skills. In 2014 IEEE International Symposium on Haptic, Audio and Visual Environments and Games (HAVE) Proceedings (pp. 65-70). IEEE.
20. Ranjith R., Nagarajan Akshay, **Unnikrishnan Radhakrishnan**, & Rao R. Bhavani. (2014). Do it yourself educational kits for vocational education and training. In Proceedings of the 2014 International Conference on Interdisciplinary Advances in Applied Computing (pp. 1-5).
21. Nagarajan Akshay, Sasi Deepu, E. S. Rahul, R. Ranjith, James Jose, **Unnikrishnan Radhakrishnan**, & Rao R. Bhavani. (2013). Design and evaluation of a haptic simulator for vocational skill training and assessment. In IECON 2013-39th Annual Conference of the IEEE Industrial Electronics Society (pp. 6108-6113). IEEE.
22. **Unnikrishnan Radhakrishnan**, Karen Moawad, & Rao R. Bhavani. (2013). A physiotherapy toolkit using video games and motion tracking technologies. In 2013 IEEE Global Humanitarian Technology Conference: South Asia Satellite (GHTC-SAS) (pp. 90-95). IEEE.
23. Bhavani B., Srividya Sheshadri, & **Unnikrishnan Radhakrishnan**. (2010). Vocational education technology: Rural India. InProceedings of the 1st Amrita ACM-W Celebration on Women in Computing in India (pp. 21). ACM.