Dr. Aishwari Talhan, (Ph.D.)

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Career Summary

- A research scientist in haptics and Human-Computer Interaction (HCI) having intercultural competencies in the field.

- Managed government-funded national research projects (eg., NRF, ETRI, and KIST) in the Republic of Korea.

- Touched major and diverse fields such as **biomedical, education, entertainment, and training simulators**.

- Ph.D. in Computer Engineering (Haptics and AR) from Kyung Hee University, South Korea.

- 6+ years of academic and leadership, 9+ years of research and development (R&D), and one year of industry experience.

- 19+ publications, including six peer-reviewed SCI/SCIE journals (one submitted), international-national conferences, and 1 Korean patent.

- Recipient of **Grenander Award** (2023-24) for Non-Animal Methodologies in Research, Testing, and Education.

- Established soft and multi-modal haptic interfaces for virtual and augmenting reality-based (VR/AR/HCI) applications.

- Proposed projects' ideas and mentored engineering graduate and undergraduate students.

Education

Doctor of Philosophy (Ph.D.)   **Computer Engineering**
Kyung Hee University, Republic of Korea   *2014.03 – 2018.08*
    Dissertation: Augmented haptic based medical palpation simulator: an example of DRE prostate palpation
    Advisor: Prof. Dr. Seokhee Jeon
    GPA: 4.125/4.3
    Percentage: 92.92%

Master of Engineering (M.E.)   **Embedded Systems and Computing**
G. H. Raisoni College of Engineering, India   *2007 – 2009*

Bachelors of Engineering (B.E.)   **Information Technology**
R. T. M. Nagpur University, (India)   *2002 – 2005*

Research Experience

- **University at Albany, State University of New York, Albany, New York, USA**
  Research Scientist   *Dec. 2022 – Present*
      * Currently, I am working on an NSF-funded project aiming to develop a haptic wearable for a K12 science topic.
      -Engaged in the design and development of wearable,
      - Artificial realistic human touch,
      - Haptic actuators in VR/AR environment,
      - Developing Haptic laser device

- **McGill University, Montreal, Canada**
  Postdoctoral Research Fellow, Shared Reality Lab.   *Jun. 2021 – Dec. 2022*
      * I was an individual contributor on realistic wearable multi-mode haptic interfaces.
      -Engaged in the research of the design and the development,
      - Soft multi-mode actuators,
      - Wearable haptic,
      - Proposed and mentored Summer Undergraduate Research in Engineering (SURE) 2022 project
      - Touching human in VR,

- Artificial realistic human touch,
- Haptic actuators in VR/AR environment,
- Mentored CAPSTONE students for Haptic furniture for the 4D experience of streaming media content and Touching Faces in VR.

- **Kyung Hee University, Republic of Korea**
  Postdoctoral Researcher, Haptics and VR Lab. *Sep. 2018 – Nov. 2019*
  * Engaged in diverse projects funded by the Korea National Research Foundation (NRF) and KIST for haptic modeling and rendering technologies.
  - Designed and developed wearable soft haptic actuators,
  - Led VR/AR and HCI-based applications.
  - Designed and developed two novel soft, wearable, multi-modal haptic actuators.

- **Research Assistant, Haptics and VR Lab.** *Mar.2014 – Aug. 2018*
  * Managed R&D projects funded by the NRF and KIST.
  - Designed and developed haptic medical simulators,
  - Developed HCI-based applications.
  - Assisted several lab projects.

Industry Experience

- EnMedia Software Technologies Pvt. Ltd. Bangalore, India
  Software Engineer *Apr. '11 – Apr. '12*
  -The former company was acquired by Nagravision, by a Kudelski Group.
  - Responsible for, test harness, test set-up compilation, and testing projects of the Jazztel project. - Directly reported to the general director.

Teaching, Mentoring and leadership Experience

- G. H. Raisoni College of Engineering, (MH), India
  Assistant Professor *Jun. '09 – Jan. '11*
  Computer Science and Engineering Department
  * Deeply engaged in teaching, mentoring, assessing, developing projects, and curriculum schemes for B.E. and M.E.
  - Experienced as a co-coordinator of M.E. Embedded Systems and Computing.
  Lecturer *Jun. '08 – May. '09*
  * Engaged in teaching, mentoring, evaluating, and developing projects and curriculum activities for Bachelors of Engineering (B.E.) over 60+ students.

- Priyadarshini College of Engineering, (MH), India.
  Lecturer *Jan. '08 – Apr. '08*
  * Engaged in teaching, mentoring, and evaluating projects for Bachelor of Engineering (B.E.) over 60+ students. - Involved in curriculum and co-curriculum activities for Bachelor of Engineering (B.E.) 45+ students.

- Umrer College of Engineering Umrer, (MH), India.
  Lecturer *Jun. '07 – Dec. '07*
  * Engaged in teaching, mentoring, and evaluating projects for Bachelor of Engineering (B.E.) over 60+ students. - Involved in curriculum and co-curriculum activities for Bachelor of Engineering (B.E.) 45+ students.

- Smt. Radhikabai Pandav College of Engineering, Nagpur, (MH), India
  Lecturer *Jul. '05 – May. '07*
  * Engaged in evaluating, and curriculum activities. - Assisted in training and placement officer.

Successful Projects

- **Touching Faces Within VR For Immersive Social Interaction**
  - The face, which is an important area of social touch, especially for couples and parent-children relationships.
  - For delivering remote touch to the face, and eventually, feeling a sensation of doing so, in the virtual environment.
  - Designed and developed a multi-modal haptic actuator to simulate KISS and human touch.
  - Implemented a wireless network within a VR environment.
  - Modified HMD structure to implant actuators and hardware.

- Evaluating the prototype to determine the explicit physical properties of the developed actuator to render haptic feedback.
- Tools and technology used: Microcontroller, sensors, 3D modeling software, Unity, VR, Prototyping, Electro-pneumatic control, PCB design, soft robotics and haptics.

- **Digital Human Presence Via Haptic Wearable for Embodied Immersive Experience**
  - Focusing on creating high-fidelity realistic human touch at particular body sites.
  - Designed and developed a multi-modal haptic actuator.
  - Designed and fabricated a novel bio-inspired finger-like soft actuator to simulate human touch.
  - Implemented a wireless body area network (WBAN) for a haptic suit.
  - Evaluating the prototype to determine the explicit physical properties of the developed actuator to render haptic feedback.
  - Evaluating quantitative analysis to achieve high qualitative results.
  - Tools and technology used: Microcontroller, sensors, 3D modeling software, Unity, VR, Prototyping, Electro-pneumatic control, WBAN, PCB designed, soft casting, and soft haptics.

- **Multi-modal Haptic Thimble for Human skin and Texture Rendering in VR** - Designed and developed a novel wearable soft thimble end-effector - Led the development of two diverse applications in Mixed Reality (MR).
  * **Application 1:** Rendering human skin versus fabric texture in VR.
  * **Application 2:** Feel-through haptic device, to overlay virtual textures and crisp clicks on a physical surface.
  - Characterized device and evaluated system by user studies using psychophysical experiments.
  - Submitted article is under review.
  - Tools and technology used: Unity, 3D modeling software, 3D printing, Leap-motion, magnetic tracker, sensors, data analysis, Electron-pneumatic control, PCB, prototyping, and soft-material.

- **Multi-modal Wearable Soft Haptic Interfaces in Support with VR**
  - Tackled the issues related to the conventional mechanical haptic actuators.
  - Lead the design and development of a haptic texture rendering VR scenes in Unity.
  - Developed multi-modal wearable haptic interfaces using a single actuation mechanism.
  - Successful attempt to create high-frequency, static pressure, and impact using pneumatic actuation.
  - Characterized system and evaluated device capability.
  - Resolved various issues in terms of wearability such as size, weight, and noise created by convention methodology.
  - Demonstrated this work in World Haptics '19 (in hands-on demo category) and SIGGRAPH 2019 (a poster and exhibition categories)
  - Resulted in a filed patent for the wearable haptic device.
  - Tools and technology used: Microcontroller, Unity, Sensors, 3D modeling, Control systems, Electronics pneumatic assembly, PCB designed, molding and casting, and soft-material

- **Haptic Glove to Interact with Digital Human Avatar** - Project lead from design, implement, to the demonstration.
  - Designed a prototype for a lightweight, wearable, pneumatically actuated haptic glove.
  - Designed a VR environment of the human avatars in Unity.
  - Demonstrated and published this work in the demo-based international haptic conference, Asia Haptics '18, South Korea.
  - Tools and technology used: Microcontroller programming, Unity, C, 3D modeling, Hardware, Electronics, data analysis, processing, pneumatic system control, Oculus, and Prototype.

- **Multimodal Haptic Armrest for Immersive 4D Movie Experiences** - Mentored CAPSTONE undergraduate students for the development of a multimodal haptic armrest for immersive 4D entertainment experiences.
  - Used vibrotactile sensations using large and small vibration motors, and generates airflow, thermal, and poking sensations using a fan, a Peltier module, and solenoids.
  - Published in the work in progress (WIP) category in World Haptics '21.
  - Tools and technology used: Microcontroller programming, and Electronics system control.

- **Soft Haptic Mouse to Render Virtual Shapes and Textures** - Designed and guided a multi-modal haptic mouse to render virtual shapes and textures of graphics on the screen.
  - Designed hardware of haptic Mouse.
  - Published in the SCIE journal.
  - Tools and technology used: Microcontroller programming, force sensors, 3D modeling, Electronics, and Pneumatic control, PCB designed, molding and casting, soft-material.

- **AH-based Medical Prostate Palpation Simulator**
  - Individual contributor to funded by National Research Foundation (NRF) a funded project (USD 60,000

per year) for 5 years.
- Designed, implemented, evaluated augmented haptics for a prostate medical palpation simulator.
- Developed a single programmable end-effector to arguments thousand of abnormalities using systematic rendering algorithms.
- Characterized and evaluated system by medical experts in psychophysical experiments.
- Presented and demonstrated the work internationally at prestigious conferences and workshops.
- Achieved the highest realism and high display fidelity when compared with the other four commercially available simulators.
- Introduced the first guideline to design and develop pneumatic-based haptic systems.
- Published this work in the peer-reviewed Elsevier SCI journal SCIE journal.
- Tools and technology used: C++, Visual Studio, NI-DAQ, Windows, 3D modeling, Electronics, and Pneumatic control systems, and soft actuation mechanism.

- **Realistic Haptic-based fire extinguisher** - Developed the haptic-based fire extinguisher that mimics the effect of a physical extinguisher.
- Contributed to multi-organizational research collaboration between KHU and ETRI, Republic Korea. - Designed prototype and lead the development of a haptic fire extinguisher training simulator.
- Presented poster in VRST'19.
Tools and Technology used: Haptuator, pneumatic artificial muscles(PAM), NRF24L01 with Arduino, Windows, Tracker, 3D modeling, Electronics assembly, and Pneumatic control, hardware development .

Selected Publications

- ## Journals:

  1. **Aishwari Talhan**, Younge Yoo, and Jeremy Cooperstock,"Soft Pneumatic Haptic Wearable to Create the Illusion of Human Touch" **under review** in "Transactions oh Haptics" (SCIE IF 3.44).

  2. **Aishwari Talhan**, Sanjeet Kumar , Hwangil Kim, Waseem Hassan, and Seokhee Jeon,"Multi-Mode Soft Haptic Thimble for Haptic Augmented Reality Based Application of Texture Overlaying,""Displays" (SCIE IF 3.074).

  3. Waseem Hassan, Hwangil Kim, **Aishwari Talhan** and Seokhee Jeon, "A Pneumatically-Actuated Mouse for Delivering Multimodal Haptic Feedback, Appl. Sci. 2020"(SCIE IF 2.679).

  4. **Aishwari Talhan**, Hwangil Kim, and Seokhee Jeon, "Tactile Ring: Multi-Mode Finger-Worn Soft Actuator for Rich Haptic Feedback, IEEEAccess (Volume: 8), pp. 957 - 966, 2019."(SCIE IF 3.476).

  5. **Aishwari Talhan**, and Seokhee Jeon, "Programmable Prostate Palpation Simulator Using Property-Changing Pneumatic Bladder, Elsevier Computers in Biology and Medicine 96C (2018) pp. 166-177, 2018. " (SCI IF 3.434).

  6. **Aishwari Talhan**, and Seokhee Jeon, "Pneumatic Actuation in Haptic-Enabled Medical Simulators: A Review, IEEEAccss (Volume: 6), pp. 3184 - 3200, 2017." (SCIE IF 4.098).

- **Selected International conference/Workshop/Hand-on-demo:**

  1. Nathan Joseph, Adam Pollet, Emanuel Uzan, Patricia Batista Ruivo, Tal Abravanel, **Aishwari Talhan**, Yongjae Yoo, Jeremy Cooperstock "Multimodal Haptic Armrest for Immersive 4D Experiences" in proceeding of IEEE World Haptics Conference (WHC), Work in Progress (WIP) category, Montreal, Canada, July 6-9, 2021.

  2. Sang-Woo Seo, SeungJoon Kwon, Waseem Hassan, **Aishwari Talhan**, and Seokhee Jeon, "Interactive Virtual-Reality Fire Extinguisher with Haptic Feedback," In Proceedings of **VRST'19**, 25th ACM Symposium on Virtual Reality Software and Technology Article No. 75, Australia, November 12 - 15, 2019.

  3. **Aishwari Talhan**, Hwangil Kim, and Seokhee Jeon, "Wearable Soft Pneumatic Ring with Multi-Mode Controlling for Rich Haptic Effects," In Proceedings of **SIGGRAPH '19**, Los Angeles, CA, USA, July 28 - August 01, 2019.

  4. **Aishwari Talhan**, Hwangil Kim, and Seokhee Jeon, "Wearable Soft Pneumatic Ring with Multi-Mode Controlling for Rich Haptic Effects for VR/AR Based Application," Exhibited demonstration on the univeristy booth at **SIGGRAPH '19**, Los Angeles, CA, USA, July 28 - August 01, 2019.

  5. **Aishwari Talhan**, Hwangil Kim, and Seokhee Jeon, "Pneumatic actuated multi-mode ring-shaped soft haptic actuator for VR/AR application," **IEEE World Haptics Conference 2019, Tokyo, Japan, July 09 - 12, 2019. (Hand-on Demo)**

6. **Aishwari Talhan**, Hwangil Kim, Sanjeet Kumar, Ahsan Raza, and Seokhee Jeon, "Pneumatic Actuated Haptic Glove to Interact with the Virtual Human," AsiaHaptics 2018, Songdo, Korea. Nov 14th- 16th, 2018.

7. Ahsan Raza, Muhammad Abdullah, Waseem Hasan, Arsen Abdulali, **Aishwari Talhan** and Seokhee Jeon, "Painting Skill Transfer Through Haptic Channel," AsiaHaptics 2018, Songdo, Korea., Nov 14th- 16th, 2018.

8. **Aishwari Talhan** and Seokhee Jeon, "Generalizing Pneumatic-Based Augmented Haptics Palpation Training Simulator," AsiaHaptics 2018, Songdo, Korea. Nov 14th- 16th, 2018.

9. **Aishwari Talhan** and Seokhee Jeon, "Prostate Tumor Palpation Simulator Based on Pneumatic and Augmented Haptics," AsiaHaptics 2016, Chiba, Japan. Nov 29th- Dec 1st, 2016.

10. **Aishwari Talhan** and Seokhee Jeon, "Reconfigurable DRE Simulator using Augmented Haptics," In Proceedings of Engineering in Medicine and Biology Conference (EMBC), Jeju Island, South Korea. July 11 to 15, 2017.

11. **Aishwari Talhan** and Seokhee Jeon, "An Application of Augmented Haptics: Prostate Palpation Simulator with Realism," APMAR 2017-Asia-Pacific Workshop on Mixed-Reality, Beijing, China-2017.

- **Selected national conferences/Abstract/Talk:**

  1. **Aishwari Talhan**, Hwangil Kim, and Seokhee Jeon, "Wearable Soft Pneumatic Ring with Multi-Mode Controlling for Rich Haptic Effects," The 11th Korea Haptics Community Workshop (제11회 한국 햅틱스 연구회 워크샵), August 2019.

  2. **Aishwari Talhan** and Seokhee Jeon, "Property Changing End-Effector using Pneumatic Bladder: Application to Prostate Palpation Simulator," The 10th Korea Haptics Community Workshop (제10회 한국 햅틱스 연구회 워크샵), November 2017.

Honors and Awards

- Grenander Award for Non-Animal Methodologies in Research, Testing and Education
  Seed funding USD 20000   June 2023- Nov 2024

- Brain Korea 21 Plus (BK21Plus) scholarship (tuition and monthly stipend)   2017-2018

- President Scholarship from Republic of Korea (tuition and monthly stipend)   2014-2017

Patent

- "Wearable device and method for generating haptic effects using the same" - 1315001411 Korea patent.

Professional Memberships and Services

- Keynote talk on: "The role of pneumatic actuation in haptic-enabled VR/AR systems" IEEE international conference on Sustainable Energy, electronics computing systems, Oct 2018, I.T.S Engineering College Greater Noida, India.

- **"Travel Information Chair"** during the pandemic for 23rd ACM International Conference on Multimodal Interaction (ICMI) 2021, Montreal Canada.

- **External Reviewer** for Peer Reviewed Journals and International Conferences:

  - Sensors and actuator
  - Transactions on Haptics (ToH)
  - IEEEAccess
  - Frontier
  - World Haptics Conference
  - Haptic Symposium
  - IEEE VR 2019

- Membership:

  - Institute of Electrical and Electronics Engineers (IEEE): 90718834
  - Communications Of The Acm (ACM): 4842186

Coursera Accomplishments

- Introduction to User Experience Design by, Georgia Institute of Technology

- Learning How to Learn: Powerful mental tools to help you master tough subjects by, Deep Teaching Solutions

- Introduction and Programming with IoT Boards by, Pohang University of Science and Technology

Skills

- Technical Expertise: Haptics, soft-haptics, Human-computer-interface, VR, AR, MR, haptic feedback generation, actuators,pneumatic actuation, haptic interface design and development, simulators, design, analysis, and development, medical devices, control, and soft actuators and soft feedback development, soft robotics, silicone mold making, 3D Modeling and Fabrication, C, C++, Arduino, Matlab, and software engineering (methodologies).

- Transferable Skills: Self-motivated, presentation, strong interpersonal skills, public speaking, organizing, multi-tasking, decisiveness, cross functional collaborator, team player, adaptable, flexible.

- Natural languages: **English** (*professional proficiency*), **Marathi** (*mother tongue*), **Hindi** (*professional proficiency*), and **Korean** (*limited proficiency*).

Personal Information

- Residency: USA

- Gender: Female

Professional References

- Prof. Dr. Seokhee Jeon, (Ph.D. Supervisor and Ex-employer)
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COVID-19 Impact on Career and Research Productivity

* Left KHU postdoc (Dec- 2019) to join next opportunity. * Unable to join postdoc position IIT, Italy, due to COVID-19 situation during the time and gave up the offer. * Secured Postdoc position from McGill, Canada., in March 2020, however, due to lockdown and travel restrictions could not join until Jun 2021.

Albany, NY, USA.
Date: 21st June., 2023

Dr. Aishwari Talhan