Waseem Hassan

🏛 University of Copenhagen, Denmark   🎓 Scholar
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Area of Specialization

Modular Haptic Devices	Wearable Haptics	Contactless Haptic Devices	Soft Robotics
Haptic Modeling	Haptic Rendering	Applied Machine and Deep Learning	
Haptic Perception	Psychophysics	Cross-Modal Integration	User Studies

Education

2016/09 – 2022/02 **Ph.D., Computer Engineering**
Kyung Hee University, South Korea
Thesis: *Towards Haptic Texture Content Library: Texture Synthesis Through Automatic Model Assignment and Texture Authoring in Haptic Attribute Space*
Advisor: Professor Seokhee Jeon

2014/09 – 2016/08 **M.S. Computer Engineering**
Kyung Hee University, South Korea
Thesis: *Towards Universal Haptic Library–Library-Based Haptic Texture Assignment Using Image Texture*
Advisor: Professor Seokhee Jeon

2008/09 – 2012/08 **B.S. Electrical (Telecomm) Engineering**
National University of Science and Technology, Pakistan

Academic Experience

2023/02 – 2025/01 **Postdoc, Computer Science**
Human-Centred Computing, University of Copenhagen, Denmark

Funded Research Projects

- **Touchless AI (EU Horizon 2020):** Led the design and development of new touchless haptic technologies and interaction techniques for non-contact haptic feedback.

Academic Experience (continued)

Other Responsibilities

- **Supervision:** Supervised Bachelor's and Master's thesis projects.

- **Communication:** Served as communication liaison for the University of Copenhagen, coordinating with Principal Investigators during bi-weekly meetings.

- **Skill Development:** Organized weekly research seminars and mentoring workshops to enhance research skills within the section.

2022/03 – 2023/02 **Postdoc, Computer Engineering**
Haptics and VR Lab., Kyung Hee University, South Korea

Funded Research Projects

- **Haptic Simulation Technology for Moving Interface (Hyundai Korea):** Quantified haptic affection of car doors through data-driven analysis of physical parameters of the door.

- **Data Processing and Multi-Modal Interaction through EdgeCPS (ETRI Korea):** Developed modular *on-demand* haptic interfaces to provide multimodal feedback, including vibrations, thermal, normal force, impact, and shear force.

- **Model-Mediated Adaptive Tele-Operation for Realistic Haptic Experience Sharing (NRF Korea):** Created a model-mediated teleoperation system for remote haptic texture modeling and rendering in real-time.
  I was strongly involved in developing the concept and in writing the proposal for this grant.

Other Responsibilities

- **Teaching:** Taught two undergraduate courses on Technical Writing and Presentation. Responsible for designing course material, written exams and project presentations, and grading.

- **Supervision:** Supervised Bachelor's, Master's, and Ph.D. students, guiding their research projects and thesis work.

2016/09 – 2022/02 **Ph.D. Research Assistant, Computer Engineering**
Haptics and VR Lab.,Kyung Hee University, South Korea

Funded Research Projects

- **Development of Virtual Objects Interaction Techniques in Life-Safety Situations (Ministry of the Interior and Safety):** Developed simulators for safety training, including an earthquake simulator with VR and haptics, and a fire training simulator featuring VR and a haptic fire extinguisher.
  I was strongly involved in developing the concept and in writing the proposal for this grant.

- **Drone-Based Haptic Interface with Unlimited Workspace (NRF Korea):** Used a drone as a haptic interface to provide haptic interaction feedback and stiffness rendering.

- **Perceptual Performance Enhancement of Ultrasonic Haptic Display (ETRI Korea):** Developed the algorithm for perceptually correct haptic rendering in mid-air using ultrasound phased arrays.

- **Haptic Modeling and Rendering Technology for Mirror World (Global Frontier, NRF Korea):** Created a "Universal Haptic Texture Library" encompassing two sub-projects:

  - Authoring new realistic haptic textures based on interpolation of data-driven models of real textures.
  - Establishing a haptic texture attribute space to perceptually compare haptic textures and designing a deep learning system using 1D-CNN to predict perceptual haptic attributes of unseen textures from image features.

Other Responsibilities

- **Supervision:** Supervised Bachelor's and Master's students, guiding their research projects and thesis work.

2014/09 – 2016/08 **M.S. Research Assistant, Computer Engineering**
Haptics and VR Lab., Kyung Hee University, South Korea

Funded Research Projects

- **Haptic Modeling and Rendering Technology for Mirror World (Global Frontier, NRF Korea):** Created a "Universal Haptic Texture Library" which enabled the automatic assignment of perceptually correct haptic textures to unseen objects using image textures only.

Selected Publications

[1] **W. Hassan**, A. Marzo, and K. Hornbæk, "Using low-frequency sound to create non-contact sensations on and in the body," in *Proceedings of the CHI Conference on Human Factors in Computing Systems*, ser. CHI '24, Honolulu, HI, USA: Association for Computing Machinery, 2024, ISBN: 9798400703300. DOI: 10.1145/3613904.3642311.

[2] **W. Hassan**, J. B. Joolee, and S. Jeon, "Establishing haptic texture attribute space and predicting haptic attributes from image features using 1d-cnn," *Scientific Reports*, vol. 13, no. 1, p. 11 684, 2023, ISSN: 2045-2322. DOI: 10.1038/s41598-023-38929-6.

[3] **W. Hassan**, A. Abdulali, and S. Jeon, "Authoring new haptic textures based on interpolation of real textures in affective space," *IEEE Transactions on Industrial Electronics*, vol. 67, no. 1, pp. 667–676, 2020. DOI: 10.1109/TIE.2019.2914572.

[4] **W. Hassan**, A. Abdulali, M. Abdullah, S. C. Ahn, and S. Jeon, "Towards universal haptic library: Library-based haptic texture assignment using image texture and perceptual space," *IEEE Transactions on Haptics*, vol. 11, no. 2, pp. 291–303, 2018. DOI: 10.1109/TOH.2017.2782279.

Teaching and Supervision

Teaching

2022   **CSE20800, Technical English 1**
Kyung Hee University, South Korea

CSE30900, Technical English 3
Kyung Hee University, South Korea

Teaching Assistant

2017 – 2019   **Advanced Human-Computer Interaction**, MS-PhD course (2017)
Machine Learning, MS-PhD course (2018)
Advanced Artificial Intelligence, MS-PhD course (2019)

Supervision/Co-supervision

2017   **Bachelor Thesis,** Baek Seung Jin
Kyung Hee University, South Korea
Publication: *Hands-On Demonstration of Heterogeneous Haptic Texturing of Mesh Models Based on Image Textures*, AsiaHaptics 2018.

Master Project, Muhammad Abdullah
Kyung Hee University, South Korea
Publication: *HapticDrone: An Encountered-Type Kinesthetic Haptic Interface with Controllable Force Feedback: Initial Example for 1D Haptic Feedback*, UIST 2017.

2018   **Master Thesis,** Ruslan Rakhmatov
Kyung Hee University, South Korea
Publication: *Virtual Reality Bicycle with Data-Driven Vibrotactile Responses from Road Surface Textures*, IEEE Games, Entertainment, Media Conference (GEM) 2018.

Master Project, Ahsan Raza
Kyung Hee University, South Korea
Publication: *Perceptually Correct Haptic Rendering in Mid-Air Using Ultrasound Phased Array*, IEEE *Transactions on Industrial Electronics 2019*.

2021   **Bachelor Project,** Seungchae Kim
Modular thermal and vibrotactile module for haptic feedback in VR.

Master Thesis, Mohammad Shadman Hashem
Kyung Hee University, South Korea
Publication: *Soft Pneumatic Fingertip Actuator Incorporating a Dual Air Chamber to Generate Multi-Mode Simultaneous Tactile Feedback*, Applied Sciences 2021.

Teaching and Supervision (continued)

2022   **PhD Project,** Mudassir Ibrahim Awan
Kyung Hee University, South Korea
Publication 1: *Model-Mediated Teleoperation for Remote Haptic Texture Sharing: Initial Study of Online Texture Modeling and Rendering*, IEEE International Conference on Robotics and Automation (ICRA) 2023.
Publication 2: *Predicting Perceptual Haptic Attributes of Textured Surface from Tactile Data Based on Deep CNN-LSTM Network*, Virtual Reality Software and Technology (VRST) 2023.

2024   **Bachelor Thesis,** Naomi Knudsen
University of Copenhagen, Denmark
Haptic painting on a tablet/phone.

Bachelor Thesis, Sara Selman
University of Copenhagen, Denmark
Haptic painting on a tablet/phone.

Master Project, Liyue Da
University of Copenhagen, Denmark
Moving Phantom Sensation Induced by Whole-body Vibration.

Honors and Awards

2019   **Best Student Innovation Challenge Award**
World Haptics Conference (WHC) 2019
Friction wheel: Bringing in-car controls to driver's fingertips by embedding dual ubiquitous haptic friction displays into a steering wheel

Outstanding Paper Award
Ubiquitous Robotics and Ambient Intelligence (URAI) 2019
Perceptual thresholds for haptic texture discrimination

2018   **Nominated for Best Paper Award**
EuroHaptics, 2018
Haptic Logos: Insight into the feasibility of digital haptic branding

2016   **Outstanding Paper Award**
Korean Computer Congress (KCC) 2016
Building haptic texture perceptual space from real-life textured surfaces using multidimensional scaling

2016 – 2022   **Doctoral Research Scholarship**
Kyung Hee University, South Korea

2014 – 2016   **Masters Research Scholarship**
Kyung Hee University, South Korea

2014 – 2022   **Graduate Student Scholarship**
Kyung Hee University, South Korea

2011 – 2012   **President, Telecomm Society**
MCS, National University of Science and Technology, Pakistan

2008 – 2009   **Undergraduate Merit Scholarship**
National University of Science and Technology, Pakistan

Outreach

Workshops and Conferences

2024/05 **SCIENCE Postdoc Day**
University of Copenhagen, Denmark
Organized the Postdoc Day event which included workshops, panels, and networking sessions to equip attendees with the tools and knowledge needed for successful careers.

2023/10 **HCC Open House**
University of Copenhagen, Denmark
Organized the HCC Open House event to showcase research activities and foster engagement with the broader academic and local community.

2016/07 **HCI Korea '16**
Kyung Hee University, South Korea
Organized and conducted a conference focused on human-computer interaction, engaging participants in hands-on activities and discussions.

Demonstrations and Exhibitions

2024/07 **Exhibition:** Using Low-Frequency Sound to Create Non-Contact Sensations on and in the Body
EuroHaptics '24, Lille, France

2019/07 **Demonstration:** Heterogeneous Haptic Texture Assignment to Mesh Models Based on Image
SIGGRAPH 2019, Los Angeles, USA

Demonstration: Tactile and Kinesthetic Feedback for Safety Experience/Training Simulators: A Case Study of Fire Extinguisher
SIGGRAPH 2019, Los Angeles, USA

2018/03 **Demonstration:** Authoring New Haptic Textures Based on Interpolation of Real Textures in Affective Space: A Demo
Haptics Symposium 2018, California, USA

2016/07 **Demonstration:** Towards Universal Haptic Library: Library-Based Haptic Texture Selection Using Image Texture
EuroHaptics 2016

Professional References

Dr. Kasper Hornbæk
Designation: Professor
Relation: Postdoc Supervisor
Affiliation: Department of Computer Science and Engineering, University of Copenhagen, Denmark
Email: kash@di.ku.dk

Dr. Seokhee Jeon
Designation: Associate Professor
Relation: Ph.D. Supervisor
Affiliation: Department of Computer Science and Engineering, Kyung Hee University, South Korea
Email: jeon@khu.ac.kr

Professional References (continued)

Dr. Asier Marzo
Designation: Assistant Professor
Relation: Collaborator
Affiliation: Department of Mathematics and Computer Engineering, Public University of Navarra, Spain
Email: asier.marzo@unavarra.es

Reference letters can be directly requested from the referees.

Academic Service

Professional Memberships

IEEE

ACM

EuroHaptics Society

IEEE Robotics and Automation Society

IEEE Transactions on Haptics

Committee Member

Associate Editor Asiahaptics 2024

Researcher Grants to Young Researchers - Technical Committee on Haptics

Peer Review

2024	ACM Conference on Human Factors in Computing Systems (CHI)
	User Interface Software and Technology (UIST)
2022	IEEE Transactions on Vehicular Technology
2022 – current	The International Conference on Robotics and Automation
2021	ACM Augmented Humans Conference
2019 – current	IEEE Robotics and Automation Letters
2018 (special issue)	IEEE Transactions on Industrial Electronics
2018 – current	EuroHaptics Conference
	IEEE Virtual Reality Conference
2016 – current	IEEE Haptics Symposium
	IEEE World Haptics Conference
	IEEE Transactions on Haptics
	AsiaHaptics Conference

Full Publications List

Journal Articles

[1] **W. Hassan**, M. I. Awan, A. Raza, K.-U. Kyung, and S. Jeon, "Quantifying haptic affection of car door through data-driven analysis of force profile," arXiv: 2411.11382 [cs.HC].

[2] J. B. Joolee, M. S. Hashem, **W. Hassan**, and S. Jeon, "Deep encoder–decoder network based data-driven method for impact feedback rendering on head during earthquake," *Virtual Reality*, vol. 28, no. 1, p. 23, 2024, ISSN: 1434-9957. DOI: 10.1007/s10055-023-00906-9.

[3] A. Raza, **W. Hassan**, and S. Jeon, "Pneumatically controlled wearable tactile actuator for multi-modal haptic feedback," *IEEE Access*, vol. 12, pp. 59 485–59 499, 2024. ⊘ DOI: 10.1109/ACCESS.2024.3376753.

[4] C. Lee, S. Jeon, **W. Hassan**, and H. Kang, "Vr unseen gaze: Inducing feeling of being stared at in virtual reality," *Virtual Reality*, vol. 27, no. 2, pp. 1529–1548, 2023, ISSN: 1434-9957. ⊘ DOI: 10.1007/s10055-023-00751-w.

[5] **W. Hassan**, J. B. Joolee, and S. Jeon, "Establishing haptic texture attribute space and predicting haptic attributes from image features using 1d-cnn," *Scientific Reports*, vol. 13, no. 1, p. 11 684, 2023, ISSN: 2045-2322. ⊘ DOI: 10.1038/s41598-023-38929-6.

[6] M. S. Hashem, J. B. Joolee, **W. Hassan**, and S. Jeon, "Soft pneumatic fingertip actuator incorporating a dual air chamber to generate multi-mode simultaneous tactile feedback," *Applied Sciences*, vol. 12, no. 1, 2022, ISSN: 2076-3417. ⊘ DOI: 10.3390/app12010175.

[7] A. Talhan, S. Kumar, H. Kim, **W. Hassan**, and S. Jeon, "Multi-mode soft haptic thimble for haptic augmented reality based application of texture overlaying," *Displays*, vol. 74, p. 102 272, 2022, ISSN: 0141-9382. ⊘ DOI: https://doi.org/10.1016/j.displa.2022.102272.

[8] **W. Hassan**, A. Raza, M. Abdullah, M. S. Hashem, and S. Jeon, "Hapwheel: Bringing in-car controls to driver's fingertips by embedding ubiquitous haptic displays into a steering wheel," *IEEE Transactions on Intelligent Transportation Systems*, vol. 23, no. 10, pp. 18 526–18 534, 2022. ⊘ DOI: 10.1109/TITS.2022.3160496.

[9] **W. Hassan**, A. Abdulali, and S. Jeon, "Authoring new haptic textures based on interpolation of real textures in affective space," *IEEE Transactions on Industrial Electronics*, vol. 67, no. 1, pp. 667–676, 2020. ⊘ DOI: 10.1109/TIE.2019.2914572.

[10] **W. Hassan**, H. Kim, A. Talhan, and S. Jeon, "A pneumatically-actuated mouse for delivering multimodal haptic feedback," *Applied Sciences*, vol. 10, no. 16, 2020, ISSN: 2076-3417. ⊘ DOI: 10.3390/app10165611.

[11] A. Raza, **W. Hassan**, T. Ogay, I. Hwang, and S. Jeon, "Perceptually correct haptic rendering in mid-air using ultrasound phased array," *IEEE Transactions on Industrial Electronics*, vol. 67, no. 1, pp. 736–745, 2019. ⊘ DOI: 10.1109/TIE.2019.2910036.

[12] **W. Hassan**, A. Abdulali, M. Abdullah, S. C. Ahn, and S. Jeon, "Towards universal haptic library: Library-based haptic texture assignment using image texture and perceptual space," *IEEE Transactions on Haptics*, vol. 11, no. 2, pp. 291–303, 2018. ⊘ DOI: 10.1109/TOH.2017.2782279.

[13] T. Ali, M. Hussain, W. Ali Khan, *et al.*, "Multi-model-based interactive authoring environment for creating shareable medical knowledge," *Computer Methods and Programs in Biomedicine*, vol. 150, pp. 41–72, 2017, ISSN: 0169-2607. ⊘ DOI: https://doi.org/10.1016/j.cmpb.2017.07.010.

[14] A. Abdulali, **W. Hassan**, and S. Jeon, "Stimuli-magnitude-adaptive sample selection for data-driven haptic modeling," *Entropy*, vol. 18, no. 6, 2016, ISSN: 1099-4300. ⊘ DOI: 10.3390/e18060222.

[15] M. Idris, S. Hussain, M. H. Siddiqi, **W. Hassan**, H. Syed Muhammad Bilal, and S. Lee, "Mrpack: Multi-algorithm execution using compute-intensive approach in mapreduce," *PLOS ONE*, vol. 10, no. 8, pp. 1–18, Aug. 2015. ⊘ DOI: 10.1371/journal.pone.0136259.

Conference Proceedings

[1] M. Cibulskis, D. Yu, E. S. Mortensen, **W. Hassan**, M. S. Christensen, and J. Bergström, "Tendon vibration for creating movement illusions in virtual reality," in *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems*, ser. CHI '25, Association for Computing Machinery, 2025, ISBN: 9798400713941. ⊘ DOI: 10.1145/3706598.3714003.

[2]   **W. Hassan**, L. Da, S. Elizondo, and K. Hornbæk, "Heartbeat resonance: Inducing non-contact heartbeat sensations in the chest," in *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems*, ser. CHI '25, Association for Computing Machinery, 2025, ISBN: 9798400713941. ⊘ DOI: `10.1145/3706598.3713959`.

[3]   **W. Hassan** and K. Hornbæk, "Audio-tactile integration: Concurrent audio feedback can shift vibrotactile frequency perception," in *Haptics: Science, Technology, and Applications*, vol. 4, 2024, p. 8. ⊘ URL: `https://eurohaptics.org/ehc2024/wp-content/uploads/sites/5/2024/06/1093-doc_s.pdf`.

[4]   **W. Hassan**, A. Marzo, and K. Hornbæk, "Using low-frequency sound to create non-contact sensations on and in the body," in *Proceedings of the CHI Conference on Human Factors in Computing Systems*, ser. CHI '24, Honolulu, HI, USA: Association for Computing Machinery, 2024, ISBN: 9798400703300. ⊘ DOI: `10.1145/3613904.3642311`.

[5]   M. I. Awan, T. Ogay, **W. Hassan**, D. Ko, S. Kang, and S. Jeon, "Model-mediated teleoperation for remote haptic texture sharing: Initial study of online texture modeling and rendering," in *2023 IEEE International Conference on Robotics and Automation (ICRA)*, 2023, pp. 12 457–12 463. ⊘ DOI: `10.1109/ICRA48891.2023.10160503`.

[6]   M. S. Hashem, J. B. Joolee, **W. Hassan**, and S. Jeon, "Multi-mode simultaneous tactile feedback using soft pneumatic fingertip actuator with dual air chamber," in *Intelligent Autonomous Systems 18*, Cham: Springer Nature Switzerland, 2023, pp. 617–620, ISBN: 978-3-031-44851-5.

[7]   A. Abdulali, **W. Hassan**, B. S. Jin, and S. Jeon, "Hands-on demonstration of heterogeneous haptic texturing of mesh models based on image textures," in *Haptic Interaction*, H. Kajimoto, D. Lee, S.-Y. Kim, M. Konyo, and K.-U. Kyung, Eds., Singapore: Springer Singapore, 2019, pp. 61–65, ISBN: 978-981-13-3194-7. ⊘ DOI: `10.1007/978-981-13-3194-7_13`.

[8]   A. Raza, M. Abdullah, **W. Hassan**, A. Abdulali, A. Talhan, and S. Jeon, "Painting skill transfer through haptic channel," in *Haptic Interaction*, H. Kajimoto, D. Lee, S.-Y. Kim, M. Konyo, and K.-U. Kyung, Eds., Singapore: Springer Singapore, 2019, pp. 66–68, ISBN: 978-981-13-3194-7. ⊘ DOI: `10.1007/978-981-13-3194-7_14`.

[9]   S.-W. Seo, S. Kwon, **W. Hassan**, A. Talhan, and S. Jeon, "Interactive virtual-reality fire extinguisher with haptic feedback," in *Proceedings of the 25th ACM Symposium on Virtual Reality Software and Technology*, ser. VRST '19, Parramatta, NSW, Australia: Association for Computing Machinery, 2019, ISBN: 9781450370011. ⊘ DOI: `10.1145/3359996.3364725`.

[10]   **W. Hassan**, A. Abdulali, and S. Jeon, "Haptic texture authoring: A demonstration," in *Haptic Interaction*, H. Kajimoto, D. Lee, S.-Y. Kim, M. Konyo, and K.-U. Kyung, Eds., Singapore: Springer Singapore, 2019, pp. 18–20, ISBN: 978-981-13-3194-7. ⊘ DOI: `10.1007/978-981-13-3194-7_5`.

[11]   M. Abdullah, M. Kim, **W. Hassan**, Y. Kuroda, and S. Jeon, "Hapticdrone: An encountered-type kinesthetic haptic interface with controllable force feedback: Example of stiffness and weight rendering," in *2018 IEEE Haptics Symposium (HAPTICS)*, 2018, pp. 334–339. ⊘ DOI: `10.1109/HAPTICS.2018.8357197`.

[12]   M. Abdullah, **W. Hassan**, A. Raza, and S. Jeon, "Haptic logos: Insight into the feasibility of digital haptic branding," in *Haptics: Science, Technology, and Applications*, Cham: Springer International Publishing, 2018, pp. 696–708. ⊘ DOI: `10.1007/978-3-319-93399-3_59`.

[13]   R. Rakhmatov, A. Abdulali, **W. Hassan**, M. Kim, and S. Jeon, "Virtual reality bicycle with data-driven vibrotactile responses from road surface textures," in *2018 IEEE Games, Entertainment, Media Conference (GEM)*, 2018, pp. 1–9. ⊘ DOI: `10.1109/GEM.2018.8516277`.

[14] **W. Hassan**, A. Abdulali, and S. Jeon, "Towards universal haptic library: Library-based haptic texture assignment using image texture and perceptual space," in *Haptic Interaction: Science, Engineering and Design 2*, Springer, 2018, pp. 415–417.

[15] A. Abdulali, **W. Hassan**, and S. Jeon, "Sample selection of multi-trial data for data-driven haptic texture modeling," in *2017 IEEE World Haptics Conference (WHC)*, 2017, pp. 66–71. 🔗 DOI: `10.1109/WHC.2017.7989878`.

[16] M. Abdullah, M. Kim, **W. Hassan**, Y. Kuroda, and S. Jeon, "Hapticdrone: An encountered-type kinesthetic haptic interface with controllable force feedback: Initial example for 1d haptic feedback," in *Adjunct Proceedings of the 30th Annual ACM Symposium on User Interface Software and Technology*, ser. UIST '17 Adjunct, Québec City, QC, Canada: Association for Computing Machinery, 2017, pp. 115–117. 🔗 DOI: `10.1145/3131785.3131821`.

[17] **W. Hassan**, A. Abdulali, and S. Jeon, "Perceptual thresholds for haptic texture discrimination," in *2017 14th International Conference on Ubiquitous Robots and Ambient Intelligence (URAI)*, 2017, pp. 293–298. 🔗 DOI: `10.1109/URAI.2017.7992733`.

[18] **W. Hassan** and S. Jeon, "Evaluating differences between bare-handed and tool-based interaction in perceptual space," in *2016 IEEE Haptics Symposium (HAPTICS)*, 2016, pp. 185–191. 🔗 DOI: `10.1109/HAPTICS.2016.7463175`.

Patents

[1] **W. Hassan** and S. Jeon, "Haptic cigarette: Creating perception of smoking using vibrotactile haptic feedback," Application Pending.

[2] **W. Hassan**, J. B. Joolee, and S. Jeon, "Establishing haptic texture attribute space and predicting haptic attributes from image features using 1d-cnn," KR20240106312A, Published, Aug. 2024. 🔗 URL: `https://patents.google.com/patent/KR20240106312A/en`.

[3] **W. Hassan**, A. Raza, M. Abdullah, and S. Jeon, "Apparatus for controlling electronic function module in the vehicle using steering wheel with dual ubiquitous haptic sensor," KR102275761B1, Jul. 2021. 🔗 URL: `https://patents.google.com/patent/KR102275761B1/en`.

[4] **W. Hassan** and S. W. Seo, "Apparatus and method for simulating interactive virtual-reality fire extinguisher with haptic feedback," KR20210111542A, Published, Sep. 2021. 🔗 URL: `https://patents.google.com/patent/KR20210111542A/en`.