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EDUCATION	**Post Doctorate:** Department of the Built Environment, Eindhoven University of Technology, Eindhoven, Netherlands (March 2022 to Dec 2022) **Ph.D. (Dr. rer. nat.):** Institute of Technical Acoustics, RWTH Aachen University, Aachen Germany (March 2017 to Feb 2022) • Thesis: **Virtual Building Acoustics: Auralization with Contextual and Interactive Features** **Ph.D. Course Completion:** Hanyang University, Seoul Korea {March 2013 to Feb 2016} **M.Sc. (Masters) Physics:** Department of Physics, University of the Punjab, Lahore Pakistan **B.Sc. {Graduation}**: University of the Punjab, Lahore Pakistan
AREAS OF EXPERTISE	Acoustics, Audio-Video signal processing and rendering, Virtual Reality, Machine Learning, Microphone array signal processing, In particular: • Machine Learning and its application in acoustic signal processing and image processing • Room and Building acoustic auralization in virtual reality environments • Virtual acoustics for audio-visual virtual reality applications (Indoor and outdoor environments) • Microphone array design, development and signal processing {Localization and Tracking} • Audio and video coding
EMPLOYMENT	**Media Engineering**, Technical University, Ilmenau Germany (October 2022 to Present) Job Description: *Teaching* • Teaching audio and video coding and Supervision of Master thesis projects **Department of the Built Environment,** Eindhoven University of Technology, Netherlands (March 2022 Dec 2022) (LINK) Job Description: *Post Doctorate/Teaching* • Digital learning platform for building acoustics **Brandenburg Labs**, Ilmenau Germany (October-2021 to October-2022) (LINK) Job Description: *Research Engineer* • Theranostics and therapy of tinnitus using spatial hearing • Room Acoustics and Realtime Auralization **Institute of Technical Acoustics** RWTH Aachen University, Germany (May 2017 to April 2021) Job Description: *Research Assistant/Teaching* • Acoustic Virtual Reality • Room and Building Acoustics • Sound Insulation Filters and Auralization **Architectural Acoustics Labs** Hanyang University, Korea (March-2013 to March-2017) Job Description: *Research Assistant* • Room Acoustics, Architectural Acoustics (Spatial-temporal analysis of sound field) • Acoustic Virtual Reality • 3D sound reproduction (Binaural Technology) • Microphone array design, development and data processing (sound capturing) **CESAT Islamabad, Pakistan** (March, 2004 to Feb, 2013) Job Description: **Research Manager** • Microphone arrays: Design, development and Beamforming Techniques • Developed "A sound detection and ranging system (SODAR®)" • Developed "Absolute Gravity Model for Pakistan (PGM®)"

PROGRAMMING And TOOLS	Python (Scikit-learn, Keras, Pytorch, TensorFlow, OpenCV), YOLO, C++, C#, Unity 3D, SketchUp, Blender, Matlab and Simulink, Jupyter (Hub, Lab), HTML/CSS/JS/Flask
PROJECTS	**In-Progress RESEARCH PROJECTS:** {2023 - now} ○ **Project**: Audio-Visual-Based Assistive Navigation for the Visually Impaired Persons (LINK) ○ **Project:** Sign Language Detection, Interpretation, Conversion in Augmented Reality (LINK) ○ **Project:** Driver Assistive system based on Spatial Audio Rendering and Auralization (LINK) **ACCOMPLISHED RESEARCH PROJECTS:** {2004 TO 2024} ✓ **Project**: Prediction of room acoustics parameter using machine learning {March 2023} at Brandenburg Labs, Ilmenau, Germany ✓ **Project**: TheraTin: Theranostics and therapy of tinnitus using spatial hearing {Oct 2021} at Brandenburg Labs, Ilmenau, Germany ✓ **Project**: Digital learning platform for building acoustics {Mar-Dec 2022} at TU/e Eindhoven ✓ **Project**: Extension of the software tool "Real-time building acoustics simulator" for Open Data und Open Access {2020-2021} at ITA, RWTH Aachen University, Germany (LINK) ✓ **Project**: "Building-acoustic auralization test environment for psychoacoustic experiments with contextual and interactive features" {2017-2020}: ITA, RWTH Aachen University, Germany (LINK) ✓ **Project**: "Real time virtual spatial sound rendering for Virtual reality" {2015-2016} at Hanyang University, Seoul Korea ✓ **Project:** "Development of real time methods for rendering dynamic/interactive 3d virtual sound for telepresence and coexistence virtual reality environment" CHIC, KIST {2014-2016} at Hanyang University, Seoul Korea ✓ **Project:** "Design and development of spherical microphone arrays for 3D sound analysis, synthesis and visualization {2014-2015} at Hanyang University, Seoul Korea ✓ **Project:** Real time Localization, Tracking and Beamforming using microphone arrays for speech processing and synthesis {2013-2015} at Hanyang University, Seoul Korea ✓ **Project:** High Speed Train Noise Measurement and Design {2013} at Hanyang University, Seoul Korea ✓ **Project:** Design and development of Sonic Detection and Ranging (SODAR) System. {2007-2012} at CESAT, Islamabad, Pakistan ✓ **Project:** Gravimetric Geoid Model for Pakistan {2005-2006} at CESAT, Islamabad, Pakistan ✓ **Project:** Absolute Gravity Model for Pakistan (Pakistan Gravity Model) {2004-2005} at CESAT, Islamabad, Pakistan
TEACHING and SUPERVISION	**Technical University, Ilmenau Germany** COURSE: • Advanced Digital Signal Processing • Audio Coding, Video Coding, Computer Animation • Multi-rate Signal Processing Supervision OF Student PROJECTS • Master Thesis 2023: Instrumental timbre transfer based on disentangled representation of timbre and pitch • Media Projects 2024: Advancing Audio Copyright Protection: A Comprehensive Study of FFT and IntMDCT Watermarking Techniques **Technical University, Eindhoven Netherlands** Seminar COURSES • Sounds Good • Building Physics **RWTH University Aachen, Germany** Laboratory COURSES • Laboratory on Acoustic Virtual Reality • Laboratory on Technical Acoustics

	Supervision OF Student PROJECTS • Master Thesis 2019: Filter Design for Sound Insulation Auralization (awarded: DEGA-Studienpreis 2020) 2019: Effects of sound in buildings on the human cognitive performance 2018: Virtual Scene Handling for implementation of sound insulation filters for Building acoustics auralization • Bachelor Thesis 2020: Interface between acoustic simulation of street canyons with façade sound insulation 2019: Source Distribution on Sound Radiating Walls
INTERNATIONAL CONFERENCES	o Asilomar Conference on Signals, Systems, and Computers (**ACSSC**): IEEE Signal Processing Society, 27-30 October, 2024, **Asilomar**, USA o 23rd International Congress on Acoustics (**ICA**), Sept. 09-13, 2019, **Aachen** Germany o **DAGA** 2019 - 45. Jahrestagung für Akustik, März 2019 **Rostock** Germany o INTER-**NOISE** 2019, 48th International Congress and Exhibition on Noise Control Engineering, **Madrid** Spain June 2019 o **Euronoise** 2018: Heraklion, **Crete** Greece, May 2018 o **DAGA** 2018, 44th Jahrestagung für Akustik, **Münch** Germany, March 2018 o **AES** 2016, Conference on Sound Field Control, July, 2016: **Guildford**, UK o **ICSV**-23 Conference Sound and Vibration: **Athens**, Greece from July, 2016 o **AES** 61st Conference on Audio for Games: **London**, UK February 2016 o **AES** 60th Conference on Dereverberation and Reverberation of Audio, Music, and Speech, **Leuven**, Belgium, February 2016 o **Academic Visit:** Institute of Technical Acoustics RWTH University Aachen, Germany, 2016 o **Euronoise**: International Conference on Sound and Noise, **Maastricht** Netherlands, 2015 o **EAA**: Auralization and Ambisonics Symposium, **Berlin**, Germany April, 2014 o International symposium on temporal design (**ISTD**), **Taipei**, Taiwan, November, 2013
PATENTS	• 3D Sound Capturing Microphone Array for wearable Display and Mobile Devices *Patent Number: 201500000002773 (P20160525OP)-Korea* • Design and development of hybrid microphone array system for telepresence *Patent Number: 201400000002416 (P20150363OP)-Korea* • Method for transferring stereophonic sound between remote users *Patent Number: 201500000002773 (P20150468OP)-Korea*
PUBLICATIONS	**JOURNAL PUBLICATIONS** 1. Nazmiye Gulenay Yilmaz, Pyoung-Jik Lee, Muhammad Imran, Jeong-Ho Jeong, Role of sounds in perception of enclosure in urban street canyons, Sustainable Cities and Society, Volume 90, 2023, 104394, ISSN 2210-6707. (DOI) 2. Muhammad Imran, Heimes A & Vorländer M. 2021. Interactive real-time auralization of airborne sound insulation in buildings. Acta Acustica, 5, 19. (DOI) 3. Muhammad Imran, Michael Vorländer and Schlittmeier, S.J. "Audio-video virtual reality environments in building acoustics: An exemplary study reproducing performance results and subjective ratings of a laboratory listening experiment," The Journal of the Acoustical Society of America 146, EL310 (2019); (DOI) 4. Lim Hansol, Muhammad Imran and Jin Yong Jeon, "A new approach for acoustic visualization using directional impulse response in room acoustics." Building and Environment 98 (2016): 150-157; (DOI) **CONFERENCE PAPERS** 1. Lin Ye, Gerald Schuller, Muhammad Imran, "Instrumental timbre transfer based on disentangled representation of timbre and pitch", Conference: Asilomar Conference on Signals, Systems, and Computers, Oct. 27th - Oct. 30th, 2024, Asilomar USA. (LINK) 2. Gerald Schuller, Muhammad Imran, "A psycho-acoustic loss function based on a psycho-acoustic model", Conference: Asilomar Conference on Signals, Systems, and Computers, Oct. 27th - Oct. 30th, 2024, Asilomar USA. (LINK) 3. Anne Heimes, Muhammad Imran and Michael Vorländer; "Real-Time Sound Insulation Auralization Framework for Virtual Environments for Indoor and Outdoor Sources", DAGA 2020 - 46. Jahrestagung für Akustik, March 2020; Hannover, Germany (LINK)

4. Muhammad Imran, Anne Heimes and Michael Vorländer; "Perceptual Localization in Virtual Reality Environments of Pass-by Outdoor Sources under Sound Insulation Conditions", DAGA 2020, 46.Jahrestagung für Akustik, March 2020; Hannover, Germany (LINK)

5. Muhammad Imran, Anne Heimes and Michael Vorländer. "Sound insulation auralization filters design for outdoor moving sources." In Proceeding of 23rd International Congress on Acoustics (ICA 2019): September 9-13, 2019, Aachen, Germany: 2019. (LINK)

6. Anne Heimes, Muhammad **Imran** and Michael Vorländer. "A real-time virtual reality building acoustic auralization framework for psychoacoustic experiments with contextual and interactive features." In Proceeding of 23rd International Congress on Acoustics (ICA 2019): September 9-13, 2019, Aachen, Germany: 2019. (LINK)

7. Muhammad Imran, Anne Heimes and Michael Vorländer. "A new approach for real-time sound insulation filters development" in Proceedings of Internoise 2019, 48th International Congress and Exposition on Noise Control Engineering, Impact of Noise Control Engineering, Madrid, Spain: June, 2019. (LINK)

8. Muhammad Imran, Anne Heimes and Michael Vorländer. "Real-time building acoustics noise auralization and evaluation of human cognitive performance in virtual reality" DAGA 2019 - 45. Jahrestagung für Akustik, 18-21 March 2019 (551-554), Rostock, Germany. (LINK)

9. Michael Vorländer and Muhammad Imran. "Real-time auralization of sound insulation." in Proceedings of Internoise 2018, 47th International Congress and Exposition on Noise Control Engineering, Impact of Noise Control Engineering, Chicago, Illinois: 2018

10. Muhammad Imran, Anne Heimes and Michael Vorländer. "Auralization of Airborne Sound Transmission and Framework for Sound Insulation Filter Rendering." In Proceeding of Euronoise-2018: Heraklion, Crete – Greece, 27-31 May 2018: (283-288). (LINK)

11. Muhammad Imran, Anne Heimes, Michael Vorländer. "Auralization of Airborne Sound Transmission for Coupled Rooms in Virtual Reality." DAGA 2018 - 44. Jahrestagung für Akustik, 19-22 March 2018. (LINK)

12. Muhammad Imran and Jin Yong Jeon. "Immersive Audio Rendering for Interactive Complex Virtual Architectural Environments." Audio Engineering Society: AES International Conference on Audio for Virtual and Augmented Reality, 2016. (LINK)

13. Muhammad Imran and Jin Yong Jeon. "Feature Based Impact Sound Synthesis of Rigid Bodies Using Linear Modal Analysis for Virtual Reality Applications." Audio Engineering Society Conference: 61st International Conference: Audio for Games. 2016. (LINK)

14. Muhammad Imran, A. Hussain, N. M. Qazi and M. Sadiq, "A methodology for sound source localization and tracking: Development of 3D microphone array for near-field and far-field applications," 2016 13th International Bhurban Conference on Applied Sciences and Technology (IBCAST) 2016, pp. 586-591 ([DOI](DOI))

15. Muhammad Imran, J. Y. Jeon and A. Hussain, "Plane wave decomposition and beamforming for directional spatial sound localization," 2016 13th International Bhurban Conference on Applied Sciences and Technology (IBCAST), Islamabad, (2016), pp. 528-534. ([DOI](DOI))

16. Muhammad Imran und Jin Yong Jeon, "A Steered-Response Power (SRP) based Framework for Sound Source Localization using Microphone Arrays in Reverberant Rooms for Enhancement of Speech Intelligibility", Fortschritte der Akustik: 42. Jahrestagung für Akustik, DAGA-2016, Aachen: 14.-17. März (2016)

17. Jong Gak Seo, Jin Yong Jeon und Muhammad Imran, "A robust 3D microphone array development for speaker tracking in ambient and noisy environments using GCC-PHAT Technique with improved SNR in speech", Fortschritte der Akustik: 42. Jahrestagung für Akustik, DAGA-2016, Aachen: 14.-17. März (2016)

18. Muhammad Imran and Jin Yong Jeon, A robust rigid body interaction model for friction-induced sound synthesis, Proceedings of the 23rd International Congress on Sound and Vibration, Athens, Greece, 10-14 July (2016)

19. Jong Gak Seo, Muhammad Imran and Jin Yong Jeon, Design of a real-time MUSIC-based sound localizer for multiple sources in real environments, Proceedings of the 23rd International Congress on Sound and Vibration, Athens, Greece, 10-14 July (2016)

20. Muhammad Imran and Jeon, Jin Yong, "Virtual sound generation by linear modal synthesis based on recorded audio examples", Conferences Paper: EURONOISE 2015, Maastricht, Netherlands, (2015)

21. Yongwon Cha, Muhammad Imran, Jonggak Seo and Jin Yong Jeon "Development of an integrated smart sensor system for sound synthesis and reproduction in telepresence", Proceeding: 22nd International Congress on Sound and Vibration, Florence, Italy, (2015)
22. Muhammad Imran and Jin Yong Jeon, "Spatial and Temporal Estimation of Sound Field Diffuseness in Concert Halls Employing Spherical Microphone Array by Using Beamforming", In Proceedings on CD of the 5th Berlin Beamforming Conference, 19-20 February (2014)
23. Muhammad Imran and Jin Yong Jeon, "Detecting Specular and Diffusive Reflections for Investigation Sound Field Diffuseness" International Symposium On Fusion Tech Hanyang University, Seoul Korea, 15-17 January (2014)
24. Muhammad Imran and Jin Yong Jeon, "Detecting and Identifying Specular and Diffusive Reflections and Determination of Sound Field Diffuseness by Wavelet Analysis" 6TH International Symposium On Temporal Design Taipei, 16-17 November (2013)
25. Muhammad Imran, Jae Ho Kim and Jin Yong Jeon, "Evaluation Of Directivity Patterns In Floor Impact by using Nearfield Acoustic Holography (NAH)", Proceeding of The Korean Society for Noise and Vibration Engineering, (KSNVE) 23-25 October (2013)
26. Jae Hyeon Kim, Hyung Suk Jang, Muhammad Imran and Jin Yong Jeon "The direction of the interior noise and directivity patterns measurements using Spherical microphone in high-speed train" Proceeding of The Korean Society for Noise and Vibration Engineering, (KSNVE) October, 2013
27. Muhammad Imran, Jong Gak Seo, Hyung Suk Jang and Jin Yong Jeon "Sound rendering framework for coexistence in real and virtual architectural environments" Proceeding of The Korean Society for Noise and Vibration Engineering, (KSNVE) 19-22 October (2016)
28. Jong Gak Seo, HyunIn Jo, Muhammad Imran and Jin Yong Jeon "Evaluation of GCC-PHAT based Real-time Localization System in Noisy Environment" Proceeding of The Korean Society for Noise and Vibration Engineering, (KSNVE) 19-22 October (2016)
29. Sung Min kim, Hyung Suk Jang, Muhammad Imran and Jin Yong Jeon "Development of Audio Rendering Technologies for Complex Interactions in Virtual Architectural Environments" Proceeding of The Korean Society for Noise and Vibration Engineering, (KSNVE) October, 2016
30. HyunIn Jo, Sung Min kim, Muhammad Imran and Jin Yong Jeon "Perceptual Evaluation of Materials for Virtual Sounds Reproduced by Linear Modal Synthesis Methods" Proceeding of The Korean Society for Noise and Vibration Engineering, (KSNVE) 19-22 October (2016)
31. Jun Kim, Muhammad Imran and Jin Yong Jeon "Noise Measurement and Filtering Techniques in Acoustical Space" Proceeding of The Korean Society for Noise and Vibration Engineering, (KSNVE) October, 2016

CONFERENCE PRESENTATIONS
1. Jin Yong Jeon, Joo Young Hong, Hansol Lim and Muhammad Imran, "Monitoring floor impact sounds using detection algorithms in multi-story residential buildings, "The Journal of the Acoustical Society of America 137, 2258 (2015); (DOI)
2. Jin Yong Jeon, Muhammad Imran and Lim, Hansol, "Analysis of room acoustical characteristics by plane wave decomposition using spherical microphone" The Journal of the Acoustical Society of America 136, 2151 (2014); (DOI)
3. Y. Cha, Muhammad Imran and J. Y. Jeon, "Sound field diffusion by number of peak by continuous wavelet transform, "The Journal of the Acoustical Society of America 136, 2244 (2014); (DOI)
4. Jin Yong Jeon, Muhammad Imran and H. S. Jang, "Characterization of the uncertainty and error propagation in sound field diffusion measurements, "The Journal of the Acoustical Society of America 134, 4005 (2013); (DOI)
5. Jin Yong Jeon and Muhammad Imran, "Detection of specular and diffuse reflections in concert halls using continuous wavelet transforms," The Journal of the Acoustical Society of America, vol. 134, pp. 4005-4005, (2013); (DOI)
6. Jin Yong Jeon, Muhammad Imran and H. Lim, "Analysis of room acoustical characteristics by plane wave decomposition using spherical microphone arrays," The Journal of the Acoustical Society of America 136, 2151 (2014); (DOI)
7. Muhammad Imran and Jin Yong Jeon, "Determination of material parameters to recreate realistic audio quality for sounding materials in virtual sound reproduction based on modal analysis" The Journal of the Acoustical Society of America 137, 2330 (2015); (DOI)

8. Jo, HyunIn and Afzal, Rehan H. and Muhammad Imran and Jeon, Jin Y., "Sound synthesis methods of fire flame sound for predicting hidden images," The Journal of the Acoustical Society of America 139, 1986 (2016); ([DOI](#))