Ahammed Waseem Palliyali

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Professional Summary

- Simulation and R&D software engineer focused on real-time 3D medical simulation and XR (VR/MR) surgical training, with experience building mixed-reality simulators integrating physical instruments, tracking, computer vision, and virtual anatomy.
- Strengths: C++ real-time simulation (OpenGL, VTK), Unity-based XR prototyping (Meta XR, Oculus Quest), computer vision integration (OpenCV, YOLOv8, SAM, XMem), and performance-minded interactive systems.
- Co-inventor on mixed-reality simulation patents; contributor to grant-backed research prototypes and peer-reviewed surgical simulation work.

Technical Skills

- **Languages:** C++, Python, TypeScript/JavaScript, Java
- **Real-Time 3D & Simulation:** OpenGL, VTK, real-time interaction, deformation and cutting (simulation prototype work)
- **XR Development:** Unity, Meta XR SDK, Oculus Quest development, mixed-reality prototyping
- **Computer Vision:** OpenCV, optical/marker tracking, YOLOv8, SAM, XMem; ONNX inference validation (sample sets)
- **Tooling:** Git, Docker (for reproducible development where applicable)

Experience

R&D Software Engineer (Clinical Research Analyst) Oct 2018 – Present
Hamad Medical Corporation (HMC) *Doha, Qatar*

- Built mixed-reality surgical simulation systems combining real instruments, physical tissue models, tracking, and virtual anatomy for training and planning.
- Delivered a mixed-reality laparoscopic simulator in C++ using VTK and OpenCV; implemented tracking, virtual-physical alignment, interactive training flows, and metrics-oriented capture.
- Developed an open surgery mixed-reality simulator in Unity for Oculus Quest 3 using Meta XR; integrated real-time vision inference (YOLOv8, SAM, XMem) for instrument and tissue segmentation to support MR interaction.
- Developed a C++ OpenGL robot-assisted surgery simulation prototype; implemented real-time deformation, virtual cutting behavior, instrument kinematics, and interactive instrument-tissue manipulation.
- Built a VR hysteroscopy training prototype on Oculus Quest 3 including camera/lens control, navigation tasks, scoring, and visual feedback for residents.
- Created Python-based preprocessing and QA utilities for segmentation datasets (mask/label validation, preprocessing, export); supported ONNX inference validation on representative samples.

Selected Simulation Projects

Mixed-Reality Laparoscopic Surgical Simulator (C++, VTK, OpenCV) 2024 – Present

- Integrated physical laparoscopic instruments with virtual anatomy via tracking and virtual-physical alignment for training workflows.
- Implemented interaction logic and data capture to support skills assessment and repeatable practice scenarios.

Open Surgery Mixed-Reality Simulator (Unity, Oculus Quest 3, Meta XR, YOLOv8, SAM, XMem) 2025 – Present

- Built interactive MR training flows and integrated real-time segmentation/tracking to support instrument and tissue understanding in MR scenes.

Robot-Assisted Surgery Simulation Prototype (C++, OpenGL) 2016 – 2019

- Implemented real-time deformation and virtual cutting behaviors; developed kinematics and interactive instrument-tissue manipulation.

Patents

System and Methods for Mixed Reality Surgical Simulation Filed 17 Nov 2024

- Co-inventor; status: national phase applications filed; assignee: Hamad Medical Corporation.

Mixed Reality-Based Training System for Surgical Scope Maneuvering Filed 12 Feb 2025

- Co-inventor; status: provisional patent filed; assignee: Hamad Medical Corporation.

Research & Publications

Journal Publications

[J1] W. Palliyali et al., "Mixed reality-based training simulator for learning scope maneuvering skills in hysteroscopy," *Virtual Reality (Under Review)*, 2025.

[J2] W. Palliyali et al., "Hysim: Towards development of a hybrid simulation framework with improved visual and tactile realism for minimally invasive surgeries," *Virtual Reality (Accepted with minor changes)*, 2025.

[J3] A. Abo-eleneen, A. Palliyali, and C. Catal, "The role of reinforcement learning in software testing," *Information and Software Technology*, p. 107 325, 2023.

[J4] S. Malhotra, O. Halabi, S. Dakua, J. Padhan, S. Paul, and W. Palliyali, "Augmented Reality in Surgical Navigation: A Review of Evaluation and Validation Metrics," *Applied Sciences*, vol. 13, no. 3, p. 1629, 2023, Impact Factor: 2.70.

Conference & Abstract Publications

[C1] W. Palliyali, S. Paul, J. Abinahed, A. Mohamed, E. Yaacoub, and N. Navkar, "Towards Development of a Mixed-Reality Surgical Simulator," in *Towards Development of a Mixed-Reality Surgical Simulator*, Springer, 2023, pp. 106–107.

[C2] J. Padhan et al., "A Complete System For Visualizing Fusion Between Pre-Operative CT And Intra-Operative Ultrasound Images In Augmented Reality," in *Int'l Conference on Mathematical Modeling in Physical Sciences*, IC-MSQUARE, Virtual, online Conference, 2022.

[C3] W. Palliyali, M. Al-Khalifa, S. Farooq, J. Abinahed, A. Al-Ansari, and A. Jaoua, "Comparative Study of Extractive Text Summarization Techniques," in *AICCSA 2021: 18th ACS/IEEE International Conference on Computer Systems and Applications*, IEEE, Tangier, Morocco, 2021, p. 5.

[C4] C. Velasquez et al., "Correlation between pandemic phases and N95 stock variation: Lessons Learnt," in *Qatar Health Virtual Conference 2021*, Marhaba, 2021, pp. 1–1.

[C5] J. Abinahed et al., "Face and Content Validity of a Physically-Based Simulator for Urethral Transection during Robot-Assisted Radical Prostatectomy," in *International Engineering in Medicine and Biology Conference (EMBC)*, IEEE Engineering in Medicine & Biology Society, Berlin, Germany, 2019, pp. 1–1.

[C6] J. Abinahed et al., "Preliminary Validation of Urethral Transection Simulation during RARP," in *Hamlyn Symposium on Medical Robotics*, Imperial College London, London, United Kingdom, 2019, pp. 59–60.

[C7] W. Palliyali et al., "Dynamic Textures for Topologically-Changing Volumes," in *SOFA Week Symposium 2019*, Hyper Articles en Ligne (HAL), Paris, France, 2019, pp. 1–3.

Education

Master of Science in Computing — Feb 2021 – Dec 2023
Qatar University — *Doha, Qatar*

- Thesis: Mixed-Reality Surgical Simulator for Minimally Invasive Surgery.
- Focus: real-time tracking, virtual-physical fusion, mixed-reality interfaces; integration of real surgical instruments with virtual anatomy using VTK and C++.

Bachelor of Science in Computer Science — Feb 2014 – May 2018
Qatar University — *Doha, Qatar*