Muhammad Bilal, PhD

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Contact Information

Melbourne, Australia

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Research Interests

Robotics, Human-Robot Interaction, Robot Learning

Education

PhD in Computing and Information Systems 2023 – 2026

The University of Melbourne, Australia

- Research Topic: Understanding and Improving Novice Kinesthetic Teaching for Robot Learning from Demonstration (PhD Thesis Link)
- Supervisors: A/Prof Wafa Johal; A/Prof Nir Lipovetzky; Prof Denny Oetomo

MSc in Mechatronics Engineering 2018 – 2020

University of Engineering and Technology, Lahore, Pakistan

- Research Topic: Implementation of Adaptive Variable Impedance Control for Dynamic Force Tracking on Redundant Manipulator

BSc in Mechatronics and Control Engineering 2014 – 2018

University of Engineering and Technology, Lahore, Pakistan

- **Awarded with Honours**
- Research Topic: Design and Control of 6 DoF Robotic Manipulator

Research Experience [4 Years]

Human-Centered Robotics Lab, National Center of Robotics and Automation, Pakistan

Team Lead Oct 2021 – Feb 2023 (40-hr/week)

- Led cross-functional research to deliver three core lab projects: Collaborative Robots (5-DoF & 7-DoF), Upper Limb Exoskeleton, and Lower Limb Prosthesis
- Managed technical operations, component procurement, and managerial tasks

Research Officer Mar 2019 – Sep 2021 (40-hr/week)

- Developed kinematic and dynamic models of robotic systems for motion planning
- Developed and optimized mathematical models of semi-active prosthetic ankle joint
- Designed and controlled an upper-limb exoskeleton for human power augmentation

Conference Publications

[1] **Muhammad Bilal**, Tharaka Ratnayake, D. Antony Chacon, Nir Lipovetzky, Denny Oetomo, and Wafa Johal. *Design and Evaluation of AR-Based Real-Time Feedback System for Kinesthetic Robot Teaching.* In Proceedings of the ACM Designing Interactive Systems Conference (DIS), pp. 332–356, 2026. doi:10.1145/3800645.3812951
Honorable Mention Award

[2] **Muhammad Bilal**, D. Antony Chacon, Nir Lipovetzky, Denny Oetomo, and Wafa Johal. *Investigating the Impact of Robot Degree of Redundancy on Learning from Demonstration.* In Proceedings of the 21st ACM/IEEE International Conference on Human-Robot Interaction (HRI), pp. 825–833, 2026. doi:10.1145/3757279.3785606

[3] Chen, Jiahao, D. Antony Chacon, **Muhammad Bilal**, Qiushi Zhou, and Wafa Johal. *Mr. LfD: A Mixed Reality Interface for Robot Learning from Demonstration*. In Proceedings of the 36th Australasian Conference on Human-Computer Interaction (OzCHI), pp. 275–285, 2024. doi:10.1145/3726986.3727004

[4] **Muhammad Bilal**, Nir Lipovetzky, Denny Oetomo, and Wafa Johal. *Beyond Success: Quantifying Demonstration Quality in Learning from Demonstration*. In Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 5120–5127, 2024. doi:10.1109/IROS58592.2024.10802187

[5] Syed Ali Huzaifa, Abdurrehman Akhtar, Meeran Ali Khan, and **Muhammad Bilal**. *Detection of Parkinson's Tremor in Real Time Using Accelerometers*. In Proceedings of the IEEE 7th International Conference on Smart Instrumentation, Measurement and Applications (ICSIMA), pp. 5–9, 2021. doi:10.1109/ICSIMA50015.2021.9526327

[6] **Muhammad Bilal**, Ali Raza, Mohsin Rizwan et al. *Towards Rehabilitation of Mughal Era Historical Places Using 7-DOF Robotic Manipulator*. In Proceedings of the IEEE International Conference on Robotics and Automation in Industry (ICRAI), pp. 1–6, 2019. doi:10.1109/ICRAI47710.2019.8967360

Journal Publications

[7] Muhammad Ali, **Muhammad Bilal**, M. Nadeem Akram, and Mohsin Rizwan. *Hybrid Position and Force Control for Upper Limb Rehabilitation of Stroke Patient*. American Journal of Mechanical and Industrial Engineering, 9(2), pp. 28–42, 2024. doi:10.11648/j.ajmie.20240902.12

[8] **Muhammad Bilal**, Mohsin Rizwan et al. *Design Optimization of Powered Ankle Prosthesis to Reduce Peak Power Requirement*. Science Progress, vol. 105, no. 3, pp. 1–16, 2022. doi:10.1177/00368504221117895 IF = 2.774

[9] **Muhammad Bilal**, M. Nadeem Akram, Mohsin Rizwan. *Adaptive Variable Impedance Control for Multi-Axis Force Tracking in Uncertain Environment Stiffness with Redundancy Exploitation*. Journal of Control Engineering and Applied Informatics, vol. 24, no. 2, pp. 35–45, 2022. IF = 1.299

[10] **Muhammad Bilal**, M. Nadeem Akram. *Indigenously Designed Development and Motion Control of Multi-DoF Robotic Manipulator*. International Research Journal of Engineering and Technology, vol. 9, no. 1, pp. 1–9, 2022.

Awards

- **Honourable Mention Paper** at ACM Designing Interactive Systems 2026, Singapore
- **PhD Write up Award** (AUD 3,500) 2026, the University of Melbourne, Australia
- Winner, **Robot Competition** at HRI 2024, Boulder, Colorado, United States
- Runner-up, **Robotics Vision Summer School** 2024, ANU, Australia
- **Melbourne Research Scholarship** (AUD 110,449), the University of Melbourne, Australia

Teaching Experience

School of Computing and Information Systems, The University of Melbourne, Australia

1) **AI Planning for Autonomy (COMP90054)**
   Semester 2, 2023 — Semester 1, 2026
   - Search algorithms and heuristic functions, Classical (AI) planning, Markov Decision Processes, Reinforcement learning, Game theory, Ethics in AI planning

2) **Designing Novel Interactions (INFO90003)**
Semester 1, 2024 and Semester 1, 2025

- Design and implementation of interactive systems, electronics prototyping, digital fabrication, and implementation with Unity game engine

Department of Mechatronics and Control Engineering, UET Lahore, Pakistan

Graduate Assistant Oct 2018 – Mar 2019 (20-hr/week)

- Supervised undergrad final year projects, including 3R planar robotic manipulator and lower limb ankle prosthesis
- Prepared and graded quizzes, assignments, and maintained subject files

Teaching Certification

- Melbourne Teaching Certificate 2025, the University of Melbourne, Australia

Technical Skill-Set

- Mathematical modelling of robotic systems, including **kinematics** and **dynamics**
- Development of **motion planning** algorithms using ROS 2 and MoveIt 2 on Linux (Ubuntu)
- Simulation of robotic systems using **MATLAB & Simulink**, **LabVIEW**, and **Gazebo**
- Statistical analysis using ANOVA and Linear/Cumulative-Link Mixed-Effects Models
- Development of **Vision Systems** for robotic manipulation using **OpenCV**
- Numerical computation and data analysis with **NumPy, SciPy, Scikit-learn,** and **MATLAB**
- 2D and 3D CAD modelling with **AutoCAD** and **SolidWorks**.
- Circuit design and simulation using **Multisim, Proteus**, and **Autodesk Fusion**
- Programming proficiency in **Python, R, C/C++, MATLAB**, and graphical programming (**LabVIEW**)

Academic Service

- Peer reviewer for
  ACM/IEEE Human-Robot Interaction (HRI) 2025, 2026, 2027
  International Conference on Robotics and Automation (ICRA) 2026
  IEEE Robotics and Automation Letters (RA-L) 2026
  Conference on Robot Learning (CoRL) 2025
- Student Volunteer at HRI 2025

Professional Memberships

- ACM Professional Member (2026 – Present)
- ACM Student Member (2025 – 2026)
- IEEE Student Member (2025 – Present)
- IEEE Robotics and Automation Society Member (2025 – Present)
- CoRL Foundation (Robot Learning Foundation) (2025 – Present)

References

Available upon Request