

# Humayun Khan

## Office Address:

- 1) Haptics, Human-robotics and Condition Monitoring Lab (HHRM Lab – NCRA NEDUET), Department of Electrical Engineering, NED University of Engineering and Technology, Karachi, Pakistan.  
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## My Bio

As an Electrical and Computer Systems Engineer with focus on **Haptics, Human-Robotics, Communication Networks, Industrial IoT** and **Automation**, I am committed to driving technological advancements that have real-world applications. My experience at NCRA-NEDUET has been characterized by cutting-edge projects/products design and development like **Smart Tape Measure, Smart Industrial Liquid Level, Industrial Pull Tester, Smart Oxygen Analyzer, and Battery Management Systems for Electric Vehicles**, demonstrating my commitment to cutting-edge solutions. I hold a Bachelor's degree from NED University of Engineering and Technology and am currently pursuing a Master's in Computer Networks and System Security.

I have successfully managed grants (NCRA, SRSP-CPAP, NRPU, ASRB, British Council - Global Partnership PAK-UK Education Gateway Mobility Partnership for Faculty and Students) under dynamic leadership of Dr. Riaz Uddin and negotiated with a variety of sectors, such as E-BEX (EV Bikes), Patel Hospital, Medicare Networks Pvt. Ltd, and Multinational Export Bureau (MEB) for product design and collaboration. Furthermore, my technical capacity is demonstrated by my ability to handle and fix complex devices like the **Premium Phantom, Denso and Mitsubishi Robotic arms**.

Parallel to this, I served in significant ventures along with Dr. Riaz Uddin like the '**British Council - Global Partnership PAK-UK Education Gateway Mobility Partnership for Faculty and Students**' and the '**Organizer**' roles at the **Sindh Research and Technology Showcases by Sindh Higher Education Commission (2022,2023 and 2024)**, demonstrating my commitment to promoting networking and technological advancement. My dedication to sharing knowledge is demonstrated by my participation in events like the **Vice Chancellors' Forum** hosted by **HEC Pakistan** and the **Pakistan US Alumni Network's Country Project** on Digital Skills, STEM and Innovation.

To further demonstrate my dedication to scholarly contributions, I am also contributing to IEEE Internet of Things Journal and IEEE Transaction on Haptics. Additionally, I have successfully completed courses accredited by **Google** and **Coursera**, taken part in **Goldman Sachs' Forge** program, competed in events held by **FSAE-A (AustralAsia)**, and passed tests administered by **Signify** and the **Confucius Institute**, Pakistan.

## Education

**(2023-Present) – Master of Engineering** (Computer Networks and System Security) from NED University of Engineering and Technology, Karachi, Pakistan (3.85 out of 4 CGPA- In Progress).

**(2017-2021) – Bachelor of Engineering** (Electrical and Computer Systems) from NED University of Engineering and Technology, Karachi, Pakistan (3.6 out of 4 CGPA).

## Work Experience

**Current:**

1. **Team Lead**, Haptics, Human-Robotics and Condition Monitoring Lab, National Centre of Robotics and Automation (NCRA), NED University of Engineering and Technology, Karachi, Pakistan. (May 2023 – Present)

**Past:**

2. **Research Engineer/Lead**, Haptics, Human-Robotics and Condition Monitoring Lab, National Centre of Robotics and Automation (NCRA) under Sindh Research Support Program (SRSP) Grant, NED University of Engineering and Technology, Karachi, Pakistan. (July 2024 – Present)
3. **Research Associate**, Haptics, Human-Robotics and Condition Monitoring Lab, National Centre of Robotics and Automation (NCRA), NED University of Engineering and Technology, Karachi, Pakistan. (Aug 2022 – April 2023)
4. **Research Assistant**, Haptics, Human-Robotics and Condition Monitoring Lab, National Centre of Robotics and Automation (NCRA), NED University of Engineering and Technology, Karachi, Pakistan. (Dec 2021 – July 2022).
5. **Research Intern**, Haptics, Human-Robotics and Condition Monitoring Lab, National Centre of Robotics and Automation (NCRA), NED University of Engineering and Technology, Karachi, Pakistan. (June 2020 – Nov 2021).
6. **Automation Intern**, Libra Engineering Pvt. Ltd., Karachi, Pakistan. (Feb 2020 -Mar 2020)

## Software/Hardware Proficiencies:

- **Haptic Technology and Virtual Environments:**

- CHAI3D, Force Dimension, Open Haptics frameworks
- Haptic Virtual Environment Development
- GUI Designing, Interface Optimization
- Networking and Interface Design
- Application Development
- STEM Haptics
- AR VR Haptics

- **Industrial Tele-robotics and Automation:**

- Industrial Robotic Arms: Denso, Mitsubishi, indigenously designed robotic arms, etc.
- ORIN2 SDK, WincapsIII for Robotic Control
- Smart Automation Systems
- SCADA, RTU, PLC, etc.
- IoT Integration: Arduino (Pro, Mega, Lilypad), ESP boards (ESP32, ESP8266, NodeMCU, WeMos), STM32, etc.
- Raspberry Pi (rp2040, Pi3, Pi4, etc.), Nvidia Jetson Nano for Embedded Solutions

- **3D Modelling and Industrial Design:**

- Expertise in 3D printing, including managing and developing 3D printing facilities for lab work.
- Proficient in additive manufacturing, slicing software such as Elegoo, Orca and handling various 3D printers, including the Elegoo Neptune 4 Max, Flashforge 5m.
- Skilled in 2D, 3D modelling and industrial design using SolidWorks and AutoCAD.
- Experienced in PCB design with tools such as Altium and EasyEDA.

- **Programming Expertise:**

- C/C++, C#, Python, Micro Python
- Arduino IDE and Interfaces: SPI, UART, FTDI, I2C
- Embedded Programming with Keil  $\mu$ Vision
- MATLAB, Simulink, .NET for Engineering Analysis

- **Embedded Systems and Instrumentation:**

- Microcontroller programming for customized sensor integration
- Data processing and analysis for real-time measurements
- GUI development for user-friendly data visualization
- Sensor Integration, Data Analysis, GUI optimization

- **Robotics and Kinematics:**

- Gait Control and Kinematic Analysis for Quadruped, Humanoid, and STEM Robots
- Kinematic modeling and analysis for precise motion planning
- Expertise in robotic gait control algorithms

- **Other Software Skills:**

- MS Visual Studio, MS Office for Project Management
- Unity, Blender, Fusion360 for 3D Modeling and Simulation
- Product and PCB Design, EasyEDA, KiCAD, IFTTT, Google Sheets API
- ETAP, Mathtype, Multisim, Proteus for Electrical Design and Simulations
- Endnote, AutoCAD, Shopify, Canva for Projects, DialUX for Lighting Design
- AI Prompt Engineering, ChatGPT, VocifyAI, DALL-E 2, Bard, Bing Chat
- Adobe Suite: XD, Dimensions, Illustrator, Premiere Pro, Lightroom, Photoshop for Visual Design
- Filmora, Invideo, Zapier, Blynk IoT for Versatile Applications

- **Project Management and Soft Skills:**

- Team Management
- Procurement & Vendor Negotiation
- Office Clearance
- Lab Management
- Event Planning and Management
- Financial Management

## **Products:**

### **1. IoT-Enabled Digital Tape Measure Device:**

Indigenously designed an IoT-enabled digital tape measure under Dr. Riaz Uddin's leadership. This device integrates precision measurement with digital capabilities, optimized for sensor data transmission and management, with Power BI functionality for data visualization.

### **2. Shake Table:**

Developed and demonstrated an indigenous shake table with UNDP funding, under the profound leadership of Vice Chancellor NEDUET Dr. Sarosh Lodi and Dr. Riaz Uddin.

### **3. Smart Industrial Liquid Level:**

Indigenously designed and developed an industrial liquid level measuring device under the Leadership of Dr. Riaz Uddin that logs data to the cloud and provides insights into flow and liquid levels. It features a visual dashboard on Power BI.

#### 4. Smart Cammeasure:

Designed and developed an intelligent measuring solution Smart Cammeasure, for textile and manufacturing industries, utilizing Python, AI and ML algorithms.

#### 5. LiFePO4 Battery Management System for Industrial EVs:

Designed and developed an industrial battery management system, under the Leadership of Dr. Riaz Uddin for Lithium Iron Phosphate (LiFePO4) batteries in Electric Vehicles.

#### 6. Industrial Pull Tester:

Designed and executed under the mentorship of Dr. Riaz Uddin, an innovative Industrial Pull Tester for assessing material strengths.

#### 7. Smart Oxygen Analyzer:

Engineered a cutting-edge Smart Oxygen Analyzer, under the supervision of Dr. Riaz Uddin, for real-time air oxygen percentage calculation.

## Language Skills

- English
- Chinese
- Sindhi
- Urdu

## Certifications

- **Introduction to Virtual Reality** by **University of London** (Coursera) (2023)
- **Bits and Bytes of Computer Networking** by **Google** (Coursera) (2022)
- **Engineering Virtual Program** by **Goldman Sachs, Forage** (2021)
- **Formula SAE-A** On-line competition by **FSAE – A** (AustralAsia) (2020)
- **Lighting Essentials Exam** by **Signify** (2020)
- **HSK-1** (Chinese Language Certificate) by **Confucius Institute**, Pakistan (2018)

## Research Publications

### JOURNALS

#### Local/ International

- 1) **Humayun Khan** and Riaz Uddin, "Preliminary Results of the Optimized Network Interface for Long Distance Haptic Teleoperation", *Engineering Proceedings*, 32(1), 9. **2023 (MDPI)**.
- 2) Haziq Iqbal, Muhammad Muhamid Ali Khan, Imtisal Ahmed, Huzaifa Yousuf, **Humayun Khan** and Riaz Uddin, "Design Procedure for Motor Selection for Custom-made Multi-axis CNC Machine.," *Engineering Proceedings*, 20(1), 26. **2022 (MDPI)**.
- 3) Ahsan Sami, Marium Irfan, Riaz Uddin, Abdullah Haider Ali, **Humayun Khan**, Erij Khan, and Muhammad Sameer, "Oxygen Concentrator Design: Zeolite based Pressure Swing," *Engineering Proceedings*, 20(1), 29. **2022 (MDPI)**.
- 4) Abdullah Haider Ali, Syed Murtaza Hassan Kazmi, **Humayun Khan**, Hasnain Ali Poonja, Ayaz Shirazi and Riaz Uddin, "Motor Parametric Calculations for Robot Locomotion," *Engineering Proceedings*, 20(1), 8, **2022 (MDPI)**.

- 5) Hasnain Ali Poonja, Muhammad Soleman Ali Shah, Riaz Uddin, Syed Murtaza Hassan Kazmi, **Humayun Khan**, Abdullah Haider Ali, and Muhammad Ayaz Shirazi, "Walking Algorithm using GAIT Analysis for 17-DOF Humanoid Robot," *Engineering Proceedings*, 20(1), 35. **2022 (MDPI)**.

## CONFERENCES

- 6) **Humayun Khan** and Riaz Uddin, "Optimized Network Solution for Bilateral Haptic Teleoperation: Improving Robustness over Long Distances", to be presented at 2<sup>nd</sup> International Conference on Emerging Trends in Electronic and Telecommunication Engineering (INTERACT 2023), Karachi, Pakistan, **2023**.
- 7) Syed Murtaza Hassan Kazmi, Abdullah Haider Ali, **Humayun Khan**, Husnain Ali Poonja, Ayaz Shirazi and Riaz Uddin, "Motor parametric calculation for robot locomotion", presented at the 7th International Electrical Engineering Conference (IEEC 2022), Karachi, Pakistan, **2022**.
- 8) Haziq Iqbal, Muhammad Muhamid Ali Khan, Imtisal Ahmed, Huzaifa Yousuf, **Humayun Khan** and Riaz Uddin, "Design Procedure for Motor Selection for Custom-made Multi-axis CNC Machine" presented at the 7th International Electrical Engineering Conference (IEEC 2022), Karachi, Pakistan, **2022**.
- 9) Ahsan Sami, Marium Irfan, Muhammad Sameer, Abdullah Haider Ali, **Humayun Khan**, Riaz Uddin and Erij Khan "Oxygen Concentrator Design: Zeolite based Pressure Swing", presented at the 7th International Electrical Engineering Conference (IEEC 2022), Karachi, Pakistan, **2022**.
- 10) Hasnain Ali Poonja, Muhammad Soleman Ali Shah, Syed Murtaza Hassan Kazmi, Muhammad Ayaz Shirazi, Riaz Uddin and **Humayun Khan**, "Walking Algorithm using GAIT Analysis for 17-DOF Humanoid Robot", presented at the 7th International Electrical Engineering Conference (IEEC 2022), Karachi, Pakistan, **2022**.
- 11) **Humayun Khan**, Subhan Ahmed, Afsheen Bibi, Muhammad Affan, Sadiq Rasheed and Riaz Uddin, "Revamped Haptic Tele-Operation with Optimized Latency" *presented at the 6th International Electrical Engineering Conference (IEEC 2021)*, Karachi, Pakistan, **2021**.
- 12) Muhammad Affan, **Humayun Khan**, Subhan Ahmed, Riaz Uddin and Ayaz Sherazi "Haptic-Enabled Virtual Laboratory for Hands-on E-Learning: A Technology for and Beyond the Pandemic Era", *to be presented at 4th International Conference on Robotics and Automation in Industry - ICRAI 2021 (IEEE)*, Rawalpindi, Pakistan, **2021**.

## Patents

- |   |                        |
|---|------------------------|
| 13) IoT-Enabled Digital Measuring Tape. | (In review since 2023) |
| 14) Digital Oxygen Analyzer.            | (In review since 2023) |
| 15) Automated Air-Oxygen Blender.       | (In review since 2023) |
| 16) Force attachment device.            | (Accepted)             |

## Grants/Fundings (National/International)

- National Centre of Robotics and Automation (NCRA)
- Indigenous Design and Development of Universal CPAP Machine- (SRSP)
- Design and Development of Universal Smart Robotic Manipulation System for Packaging Industry – NRPU
- Design and Development of RoboDoc - NCRA
- British Council - Global Partnership PAK-UK Education Gateway Mobility Partnership for Faculty
- British Council - Global Partnership PAK-UK Education Gateway Mobility Partnership for Students
- Advanced Studies Research Board (ASRB) for development of Indigenously designed ICU Ventilator
- NED Alumni Association of Southern California (NEDAASC)
- National Grassroots ICT Research Initiative (NGIRI)

## Research Interests

- Haptics and Teleoperation
- Haptic Virtual Environments and METaverse
- Smart Industrial Automation
- Industrial Tele-robotics
- PLCs, SCADA, Automation Systems
- Electric Vehicles
- Industrial IoT
- Wearable Haptics and Smart Electronics
- Control Systems and Automation
- Robot Dynamics and Controls
- Sensors, Smart Energy and Mechatronic Systems
- Electrical Power Systems Control

### Consultancy/Services

- Short-term Robotic Consultant at NCRA NEDUET under NRPU Project titled "Design and Development of Universal Smart Robotic Manipulation System for Packaging Industry" (**May-June 2024**).

### Referee to Reputed Journals and Conferences (Direct / Indirect)

- IEEE Haptic Symposium 2022
- IEEE Transaction on Instrumentation and Measurement (Joint reviewer with Dr. Riaz Uddin)
- IEEE Robotics and Automation Letters (RA-L) (Joint reviewer with Dr. Riaz Uddin)
- IEEE Euro Haptics 2022
- International Conference on Robotics Automation in Industry (ICRAI)
- International Electrical Engineering Conference (IEEC)
- International Bhurban Conference on Applied Sciences & Technology, IBCAST
- MDPI Journals (Joint reviewer with Dr. Raja Masood Larik)

### Written Grants/Proposals (National/International)

- Asi@Connect TIEN Horizon
- Sindh Research Support Programme (SRSP)
- National Research Program for Universities (NRPU)
- HEC funding for Ready-for-Market Products
- Rapid Technology Transfer Grant (RTTG)
- Pakistan Science Foundation (PSF)
- Pakistan Innovation Fund (PIF)

### Teaching Assignments

- Instructor "Haptics and STEM Robotics" at CEDAR College in February 2023.

- Lead Trainer "Haptics and Robotics" in the Workshop "Current Trends in Haptics, Human-Robotics and Healthcare Innovations" organized by HHRCM Lab in January 2023.
- Lead Trainer "Immersive Haptics" in the Workshop "Immersive Haptics, Tele-robotics and Innovations" organized by HHRCM Lab in October 2022.
- Lead Trainer "Robotronics, Haptics and STEM" at Intensive Tech camp, organized by Humanities department NEDUET under the funding of USAID ACCESS Micro-Scholarship Program in June 2022.
- Instructor "Robotics and STEM" at CREDO College in October-December 2021.
- Teaching Assistant under Dr. Riaz Uddin (June 2020-Present).

## Supervisor for Final Year Design Project (FYDP)

- External Supervisor for the FYDP "Implementation of Control Algorithm for Watch-Dog Robot: Experimental Validation of Kinematic Control and GAIT Control Strategy", **2025** (in progress).
- External Supervisor for the FYDP "Experimental Implementation of Kinematic Control and GAIT Control Strategy for Biped Humanoid Robot of Haptics Lab at NEDUET", **2025** (in progress).
- External Supervisor for the FYDP "SLAM extension of Social Interactive Robot of Haptics Lab at NEDUET", **2025** (in progress).
- External Supervisor for the FYDP "Design of BiPAP Machine: Extension of Existing CPAP Machine Haptics Lab at NED University to Bi-PaP feature for respiratory syndrome Patients", **2025** (in progress).
- External Supervisor for the FYDP "Customized Robotic Arm Development for Packaging Industry: Inclusion of Automatic Control and Kinematic Design for Pick and Place Task", **2025** (in progress).
- External Supervisor for the FYDP "5-axis CNC machine: Control design of simultaneous operation of all axis with updated software and mechanical structure", **2025** (in progress).
- External Supervisor for the FYDP "Design of an intelligent algorithm for CPAP machine to treat sleep apnea patients", **2024**.
- External Supervisor for the FYDP, "Design and Development of Motor Controller for Industrial Automation", **2024**.
- External Supervisor for the FYDP, "Customized Robotic Arm Development for Packaging Industry", **2024**.
- External Supervisor for the FYDP, "SLAM Extension of a Social Interactive Robot", **2024**.
- External Supervisor for the FYDP "Design of a Gait Control Algorithm for Humanoid Robot", **2023**.
- External Supervisor for the FYDP "Design of a Gait control algorithm for a Quadruped Robot", **2023**.
- External Supervisor for the FYDP "Design and development of CPAP/BiPAP respiratory assistive device", **2023**.
- External Supervisor for the FYDP "Design of a Network Jitter regulator for advance Tele-robotic System", **2023**.
- External Supervisor for the FYDP "To Study and Analyze the Dynamic features of prosthetic hand gloves using a stable Network for Tele-handshaking Setup", **2022**.
- External Supervisor for the FYDP "Design and Development of a Quadruped Robot for Disaster Management", **2022**.
- External Supervisor for the FYDP "Design of Low Cost, Medical, Portable Oxygen Concentrator", **2022**.
- External Supervisor for the FYDP "Design and Development of Human Sized Humanoid Robot for Social Interaction", **2022**.

## Research Projects

- GTS (Generalized Teleoperation Setup Developed for Any Haptic/Robotic Device over any network)

- Number of Haptic Virtual Environments developed (using Openhaptics, Chai3d and customized frameworks)
- AR, VR and STEM Haptics
- Multi-axis CNC Machine
- Intercontinental Haptic Teleoperation
- Electric Vehicles Dashboard Design
- Network and Interface design for adaptive packet control
- Industrial Telerobotic Control Automation

## Invited Speaker/Judge/Organizer

- "Organizer" at the 3<sup>rd</sup> Sindh Higher Education Commission Research and Technology Showcase along with Dr. Riaz Uddin as "Chief Organizer" in June 2024.
- "Host" and "IT Facilitator" – Invent for the Planet 2024 event by Texas A&M organized at NEDUET, Pakistan along with Dr. Riaz Uddin as the Organizer in Feb 2024.
- "Host" of "British Council - Global Partnership PAK-UK Education Gateway Mobility Partnership for Faculty and Students" along with Dr. Riaz Uddin, Nov-Dec 2023.
- "Organizer" at the 2<sup>nd</sup> Sindh Higher Education Commission Research and Technology Showcase along with Dr. Riaz Uddin as "Chief Organizer" in May 2023.
- Invited "Presenter and Teleoperator" (HHRM-NCRA NEDUET) at "Vice Chancellors' Forum" held on 19<sup>th</sup> 20<sup>th</sup> March, 2023 at Islamabad Marriott hotel by HEC Pakistan.
- Invited Talk on "Haptics, Robotronics and Current Trends in Technology" at Pakistan US Alumni Network (PUAN) Country Project on Digital Skills and STEM in July 2022.
- Invited "Judge" in Robotics Project Exhibition Competition at MPERC 2022.
- "Organizer" at the 1<sup>st</sup> Sindh Higher Education Commission Research and Technology Showcase along with Dr. Riaz Uddin as "Chief Organizer" in May 2022.

## Honors/Awards

- **Intercontinental Teleoperator:** Intercontinental (Asia-Europe) Haptic Teleoperation performed between HHRM Lab-NCRA NEDUET **Karachi-Pakistan** and IGS group, University of Innsbruck, **Innsbruck-Austria** on 10<sup>th</sup> November 2022. (Dr. Riaz Uddin served as Client-Side Teleoperator at IGS Group, University of Innsbruck).
- **Interprovincial Teleoperator:** Interprovincial (Sindh-Punjab, Pakistan) Haptic Teleoperation performed between HHRM Lab-NCRA NEDUET **Karachi-Pakistan** and UET Peshawar, **Peshawar, Pakistan** in March 2023. (Dr. Riaz Uddin served as Client-Side Teleoperator at UET Peshawar (Peshawar, Pakistan).)

## References

- **Dr. Riaz Uddin**, Associate Professor, Director ORIC and Director HHRM-NCRA NEDUET Lab, NED University of Engineering and Technology (email: [riaz.nedian@gmail.com](mailto:riaz.nedian@gmail.com)).
- **Muhammad Uzair Khan**, Lecturer and PhD Scholar (HHRM-NCRA), NED University of Engineering and Technology (email: [uzairkhan@neduet.edu.pk](mailto:uzairkhan@neduet.edu.pk)).