Hassam Khan Wazir

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Multidisciplinary researcher with 5+ years of experience in mechatronics, deep learning, data analysis, robotics development (software and hardware), human-robot interaction, and electrical/electronic engineering.

EDUCATION

Ph.D. in Mechanical Engineering (Digital Health and Telerehabilitation)   May 2024
New York University, Brooklyn, NY
   Dissertation title: "Exploratory research at the convergence of frontier technologies to advance digital health and telerehabilitation with emphasis on applications for geriatric population"
   Advisor: Professor Vikram Kapila

M.S. in Mechatronics and Robotics (Mobile and Swarm Robotics)   May 2018
New York University, Brooklyn, NY
   Project title: Mobile mixed-reality interaction using computer vision for robot control

B.Eng. (Hons) in Electrical and Communication Engineering (Telecommunication)   November 2014
Universiti Teknologi Brunei[1], Bandar Seri Begawan, Brunei Darussalam
   Project title: Real-time 3D object orientation in a virtual environment.

EXPERIENCE

New York University   New York, USA

Research Scientist *(ML for wellness and LLMs for robot task completion)*   *July 2024 - Present*
- Developed a device-free exercise tracking system using RGB camera for physical exercises and audio data for breathing
- Achieved successful robot navigation by integrating an LLM to translate natural language into executable robot commands

Research Fellow *(Assistive Technology Research)*   *September 2018 – May 2024*
- Led multidisciplinary research to improve elderly care and health monitoring through AI-driven and analytical solutions for real-time exercise tracking, location tracking, and pathogen exposure reduction
- Developed wearable sensors for precise arm movement tracking, using IMUs for stroke rehabilitation and a gravity-based sensor to monitor arm elevation during physical exercises, achieving real-time motion analysis for targeted rehabilitation
- Developed AI/ML models with over 90% accuracy for real-time audio and exercise tracking, supporting health monitoring by classifying breathing phases and tracking physical exercises via deep learning on mobile device cameras
- Enabled precise remote control of a dialysis machine with less than 2 mm accuracy, reducing patient exposure to pathogens by developing an augmented reality solution and integrating human-robot interaction for touch-free operation
- Improved indoor navigation safety for elderly individuals with sub-0.5 m accuracy by developing sensor fusion and localization algorithms, enabling precise and reliable real-time tracking in home environments
- Carried out Institutional Review Board (IRB) application process for data collection involving human subjects
- Collaborated with 8 PhD students and mentored 31 master's and bachelor's students across multiple projects, leading to successful project completions and publications, by providing technical expertise, guidance, and project oversight

Graduate Instructor *(Automatic Controls Laboratory)*   *January 2019 – May 2024*
- Instructed over 450 students in control systems, enhancing their understanding of system identification, PID, LQR, and signal processing techniques through lectures and hands-on labs over a six-year period

Graduate Instructor *(Measurement Systems Laboratory)*   *September 2018 – December 2018*
- Instructed 80 students in measurement systems, introducing them to standard laboratory equipment, data acquisition and control boards, and measurement techniques related to temperature, frequency, electricity, rotation, and harmonics

K12 Center of STEM Education, NYU   New York, USA

Instructor *(SPARC Program)*   *June 2019 – August 2019*
- Lead instructor for the NYU Summer Program in Automation, Robotics, and Coding (SPARC)
- Designed the curriculum and introduced high school students to robotics, mechatronics, and programming

LearnOBots   Islamabad, Pakistan

Trainee Engineer *(Product Development)*   *June 2016 – August 2016*
- Designed and developed educational STEM kits and taught STEM concepts to high school students, enhancing their understanding of robotics and electronics by managing the design and production of hands-on learning tools

[1] Formerly known as Institut Teknologi Brunei

Universiti Teknologi Brunei   Bandar Seri Begawan, Brunei Darussalam

Research Assistant (Unmanned Aerial Vehicle (UAV) Research)   *August 2013 – November 2014*

- Built an integrated test bed and 3D flight simulator for quadcopters, enabling real-time hardware-in-the-loop testing by translating physical movements into a virtual environment, ensuring flight performance accuracy before actual deployment

Engineering Intern (Lab maintenance and equipment repair)   *January 2013 – June 2013*

- Installed, tested, calibrated, troubleshot, and repaired a diverse array of electrical and electronic laboratory equipment, ensuring peak functionality and precision

PUBLICATIONS

- **H. K. Wazir**, Z. Waghoo, and V. Kapila, "Wireless earphone-based real-time monitoring of breathing exercises: A deep learning approach," in *IEEE International Conference on Engineering in Medicine & Biology Society*, 2024, accepted for publication.

- C. Lourido, Z. Waghoo, **H. K. Wazir**, N. Bhagat, and V. Kapila, "VR game for upper arm range of motion evaluation and rehabilitation using capability maps," in *IEEE International Conference on Engineering in Medicine & Biology Society*, 2024, accepted for publication.

- V.Kapila, V. Siderskiy, A. Granado, S. Kumar, T. Sowers, **H. K. Wazir**, M. Q. Kilcourse, S. P. Krishnamoothy, R. Gonzalez, "Containment, treatment, and removal of aerosolized viral contamination," U.S. Patent Appl. US20230218463A1, Jul. 13, 2023.

- M. Pawar, **H. K. Wazir**, and V. Kapila, "A lymphatic drainage robot for lymphedema rehabilitation," in *IEEE International Conference on Engineering in Medicine & Biology Society*, 2022, pp. 2598–2601.

- **H. K. Wazir**, K. Gaikwad, and V. Kapila, "Range of motion assessment using a digital voice assistant," in *IEEE International Conference on Engineering in Medicine & Biology Society*, 2022, pp. 2577–2580.

- **H. K. Wazir**, C. Lourido, S. M. Chacko, and V. Kapila, "A COVID-19 emergency response for remote control of a dialysis machine with mobile HRI," *Frontiers in Robotics and AI*, vol. 8, 2021.

- A. RajKumar, F. Vulpi, S. R. Bethi, **H. K. Wazir**, P. Raghavan, and V. Kapila, "Wearable inertial sensors for range of motion assessment," in *IEEE Sensors Journal*, 20(7):3777–3787, 2020.

- **H. K. Wazir**, S. R. Bethi, A. R. Kumar, F. Caruso, and V. Kapila, "A wearable pendant sensor to monitor compliance with range of motion lymphatic health exercise," in *IEEE International Conference on Engineering in Medicine & Biology Society*, 2020, pp. 4588–4591.

- **H. K. Wazir**, F. Y. Annaz, "Using unity for 3D object orientation in a virtual environment," in *Brunei International Conference on Engineering and Technology*, 2014, pp. 1–6.

- F. Y. Annaz, **H. K. Wazir**, "Hardware-virtual environment integration," in *Brunei International Conference on Engineering and Technology*, 2014, pp. 1–5.

SKILLS

Programming: C, C++, Python, C#, MATLAB/Simulink, Assembly, R, SQL
Development Tools: ROS2, OpenCV, SciPy, Linux, HPC, Solidworks, KiCad, Unity, Unreal, iOS, Android
ML/AI Frameworks: PyTorch, Tensorflow/Keras, Scikit-learn, Fast.ai, Hugging Face, WandB
Hardware: UR16e, Raspberry Pi, Arduino, PIC, AVR, STM32, ESP32/8266, Propeller, Basic Stamp 2, Zilog Z80
Specializations: Mechatronics, Embedded Systems, Signal Processing, Robotics, AR/VR development, CAD, PCB Design

AWARDS AND HONORS

- NYU Tandon School of Engineering Fellowship (Sep 2018 – May 2024), 100% tuition and monthly stipend
- Fulbright Scholarship for Graduate Students (Sep 2016 – May 2018), 100% tuition and monthly stipend
- Best Student Award in Electrical and Communication Engineering, 2014
- Government of Brunei Darussalam Scholarship (Aug 2010 – May 2014), 100% tuition and monthly stipend