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

Adjunct Faculty *(Automatic Controls Laboratory)*　　　　　　　　　　*September 2024 – Present*
- Instructed students in control systems, enhancing their understanding of system identification, PID, LQR, and signal processing techniques through lectures and hands-on labs

Research Scientist *(ML for wellness and LLMs for robot task completion)*　　　　*July 2024 – August 2024*
- Utilizing a UR16e 6-axis robotic arm integrated with mixed reality for collaborative pick-and-place and stacking tasks
- Developing 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

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[1] Formerly known as Institut Teknologi Brunei

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

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. Krishnamoorthy, 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