Muhammad Shahzad, PhD

Assistant Professor
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Skill Summary

I am an expert in:

- Industrial noise and vibration analysis
- AI-based predictive maintenance of industrial machines
- Generative AI, Agentic AI
- Developing cancellable fingerprints
- Developing light-weight fingerprint encryption for user authentication in IoT-based applications
- Pattern recognition

Qualification

2021	PhD Engineering/Image Processing	La Trobe University, Melbourne, Australia
2015	MS Electrical Engineering with Emphasis on Signal Processing	Blekinge Institute of Technology (BTH) Karlskrona, Sweden
2009	BSc Electrical Engineering	Bahauddin Zakariya University (BZU) Multan, Pakistan

Work Experience

May 2021 – Present

Assistant Professor, Department of Energy Systems Engineering (ESE), University of Agriculture, Faisalabad.

Subjects Teaching:

- Basic Electrical Circuits and Network Analysis (ESE-401)
- Power Transmission, Distribution, and Utilization (ESE-507)
- Energy Economics, Policy and Management (ESE-604)
- Control Systems (ESE-614)
- Electrical Machines (ESE-615)
- Energy System Modelling and Simulation (ESE-711)

July 2017 – April 2021

Academic Tutor & Lab Demonstrator, Department of Engineering, La Trobe University, Australia.

Subjects Taught:

- Signal Processing & Control (ELE3SPC)
- Advanced Signal Processing (ELE4ASP)
- Communication Network (ELE5FCM)
- Digital Control Theory (ELE4DCT)
- Telecommunication Design (ELE5TD)

July 2014 – April 2017

Lecturer, The University of Faisalabad, Pakistan.

Subjects Taught:
- Signals and Systems
- Digital Signal Processing
- Image Processing
- Final Year Project Supervision

July 2013 – May 2014

Research Assistant, University of Portsmouth, England

Project Manager, Prosig Ltd, Fareham, England

Project Title: Prototype development for fault diagnostics and prognostics of dairy machines in United Kingdom (A joint venture of University of Portsmouth and Prosig. Ltd., Fareham, UK).

Duties:
- Development of algorithms in MATLAB and Python for data management, pre-data processing and data processing of vibration signals acquired from dairy machines.
- Development of anomaly detection algorithms involving feature extraction and potential feature selection to identify faults and setting up the alarms.
- Arranging regular team meetings to track the progress, quality and risks involved.
- Market analysis of the existing health monitoring practices of dairy machines and the service providers in UK.

Skills/Certification gained:
- Project management skills: A diploma on project management from Technology Strategy Board (TSB), London, UK
- Independent work and decision making
- Machine condition monitoring, fault diagnosis and prognosis
- Marketing skills

Project Outcome:

The project resulted a system called "The Virtual Engineer (TVE)".[1] TVE uses the anomaly detection algorithms which I designed to capture the early signs of a fault and alarms the supervisor to address it during normal maintenance. This way, it is estimated to have saved at least **£2 million** in terms of avoiding lost production, repairs and breach of supermarket supply contracts.[2]

Journal Publications

[1] **M. Shahzad**, S. Wang, G. Deng, W. Yang, Alignment-free cancellable fingerprint templates with dual protection, Pattern Recognition, 2020, Vol. 111 (IF 8.518)

[2] W. Yang, S. Wang, **M. Shahzad**, W. Zhou, A cancellable biometric authentication system based on feature-adaptive random projection, Journal of Information Security and Applications, 2021, Vol. 58 (IF 4.96)

[3] X, Yin, S. Wang, **M. Shahzad**, J. Hu, An IoT Oriented Privacy-Preserving Fingerprint Authentication System, IEEE Internet-of-Things Journal, 2021 (IF 10.238)

[4] F. Saeed, A. Ghafoor, M.I. Hussain, K. Ikram, M. Faheem, **M. Shahzad**, W. Amjad, M. M. Omar, G. H. Lee, Empirical and Numerical-based Predictive Analysis of a Single-axis PV System under Semi-arid Climate Conditions of Pakistan, *Frontiers in Energy Research*, Vol. 11, 2024, (IF 3.4)

[5] Furqan Asghar, M. Imtiaz Hussain, Fahad Abdullah Alshahrani, M. Imran Akhtar, Waseem Amjad, M. Shahzad, Syed Nabeel Husnain, Gwi Hyun Lee, "Technoeconomic

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analysis of standalone hybrid renewable energy systems for telecommunication sector under different climatic conditions in Saudi Arabia", Energy Reports, Elsevier, 2024 (IF 5.2)

Popular Articles

1. Muhammad Shahzad et. al., "The Application of Retrieval Augmented Generation in Agriculture", 2024, published on "knowledge hub".
   https://knowledgehub.link/the-application-of-retrieval-augmented-generation-in-agriculture
2. Muhammad Shahzad et. al., The Impact of Artificial Intelligence on Precision Farming, published on "knowledge hub".
   https://knowledgehub.link/the-impact-of-artificial-intelligence-on-precision-farming
3. Dr. Muhammad Rizwan Tabassum, Dr. Muhammad Shahzad, Dr. Arifa Mahreen, "Potential of Bioenergy Technologies to Mitigate Climate Change Effect", published on "knowledge hub".
   https://knowledgehub.link/potential-of-bioenergy-technologies-to-mitigate-climate-change-effect
4. Dr. Muhammad Rizwan Tabassum, Dr. Muhammad Shahzad, Dr. Arifa Mahreen, "Sustainable Disposal of Agricultural Residues via Green Technologies", published on "knowledge hub".
   https://knowledgehub.link/sustainable-disposal-of-agricultural-residues-via-green-technologies

Student Supervision

Sr. No	Student Name	Registration Number	Thesis Title	Status
1	Ghulam Murtaza	2021-ag-856	Smart Graphene Quality Testing	Completed
2	Muhammad Ahmad	2022-ag-898	Fault diagnosis of Solar PV panels based on machine learning	Completed
3	Hamza Ali	2023-ag-655	Course work in progress	In Progress

Participation in scientific activities

1. Resource person for CPD training session on "IoT Systems and Biometric Security" in FAST National University, Chiniot-Faisalabad Campus on December 23, 2021.
2. Member steering committee in organizing two-days IEEE Pakistan Student/YP/WIE/SIGHT Congress (PSYWSC) February 26-27, 2022.
3. Member of Technical Committee in organizing One Day CPD activity on 'Applications and Hands-on Training of Artificial Intelligence (AI) in Water, Food, and Energy Sector" on March 16, 2022.
4. Member of Technical Committee in organizing "International seminar on World Water Day-2022" on March 30, 2022.
5. Keynote speaker in CPD activity on "Establishing Science and Technology Parks in Pakistan" on March 02, 2022.
6. Participated in Professional Development Workshop for Young faculty on 23rd, 24th and 25th November 2021 organized by Directorate of Academics & Teaching Resource Centre, University of Agriculture Faisalabad

7. Participated in "Hand-on training on the application of AI, IoT and Robotics in kitchen gardening using Vege-Bot" on September 22, 2022.
8. Participated in workshop on "Data science with Python in Agriculture" on October 27-29, 2022.
9. Committee member in organizing one-day CPD activity on "Opportunities of the Bioenergy-based Stove Technologies in Developing Countries" on April 07, 2023
10. Participated in an online one-day CPD course on "New trends in PV technology – HJT ERA and its advantages over previous technologies" on October 14, 2023.
11. Committee member in organizing a Pakistan Engineering Council (PEC) event entitled "2nd Phase of Financial of Final Year Design Projects, 2023-24" on December 13, 2023.
12. Participated in the "Brainstorming session OBE and Blended Learning" on February 27, 2023.
13. Completed a course on "Enhancing Learner-centered Pedagogical Skills" organized by Academics without Borders, AWB | USF, February23, 2024.

Community service

1. I am honorary advisory committee member at Germany based company named "EPTeck Technologies". We have developed an IoT product related to AgriTech named RemoteWell. RemoteWell has innovative features, including remote control of agriculture tube well via a mobile app, scheduling the operation, monitoring electricity consumption, predicting motor faults, and detecting water theft. During product development phase, I provided essential support to the technical team at EPTeck Technologies, offering insights and guidance to assist in the development process. I was also engaged in crafting product variants such as RemoteWell Pro, RemoteWell Ultra, Remote Hybrid. As an international recognition, RemoteWell brought us the United Nations AgriInno Challenge award (silver medal) in 2021. So far, RemoteWell has been installed at 200 farms across more than 30 districts of Pakistan.
2. Member technical committee for the installation of 1.5MWp grid-tied solar PV system with net metering at different sites of the University of Agriculture, Faisalabad. My role is to help optimizing the layout of solar panels, inverters, and transformers, considering shading and orientation to achieve maximum power point. I'll also review and approve safety measures such as grounding and overcurrent protection to avoid faults. I am responsible for evaluating technical specifications and compatibility to choose the most suitable PV modules and inverters and getting them tested from respective labs before installation. Moreover, I shall be assisting in integrating PV system with grid, synchronization, and protection setup. I have already established the monitoring protocols and maintenance practices to optimize system reliability and efficiency as part of service level agreement, to ensure long-term performance of system.

3. Participated in the Wheat Campaign organized by University of Agriculture, Faisalabad during 07.11.2023 – 14.11.2023.
4. Provided technical evaluation for the installed 120kW solar system at Al-Noor International.

Research Papers Reviewed (Conference/Journal)

1. The manuscript entitled 'Microwave electro-technological installation for processing vegetable origin organic materials and agricultural crops' (Manuscript No: PAKJAS-2023-221) submitted in Pakistan Journal of Agricultural Sciences (PAKJAS).
2. The manuscript entitled 'An accurate and lightweight algorithm for caged chickens detection based on deep learning' (Manuscript No: PAKJAS-2023-138) submitted in PAKJAS.
3. The manuscript entitled "Studying the effects of feature selection approaches on machine learning techniques for Mushroom classification problem" submitted at "2023 International Conference on IT and Industrial Technologies (ICIT2023)".
4. The manuscript entitled "Prediction of Polycystic Ovary Syndrome Using Genetic Algorithm-driven Feature Selection" submitted at "2023 International Conference on IT and Industrial Technologies (ICIT2023)".
5. The manuscript entitled "Comparative Study of the Accuracy and Efficiency of Wideband Delphi and Planning Poker Software Effort Estimation Techniques" submitted at "2023 International Conference on IT and Industrial Technologies (ICIT2023)".
6. The manuscript entitled "Low-cost Highly Sensitive Interdigitated Capacitive Humidity Sensor for Breathing Applications" submitted at "2023 International Conference on IT and Industrial Technologies (ICIT2023)".

Assignments related to Academics

1. Asst. Superintendent Teepu Hall and Faisal Kashmir Hall to look after hostel affairs.
2. Secretary departmental board of studies (BoS) at Energy Systems Engineering.
3. Co-Advisor for B.Sc. Energy Systems Engineering (5th and 7th Semesters).
4. Convener Program Educational Outcomes (PEO) assessment committee as part Outcome-based Education (OBE) system.
5. Member lab committee as part of OBE system.
6. Member Final Year Project (FYP) thesis scrutiny committee.
7. Convener of the committee look after100 kW solar at Punjab Bioenergy System (PBI).
8. Assigned as member faculty's timetable and examination committee under campus management system (CMS)
9. Tutor for the tutorial group meetings every week.
10. Numerous additional short-term duties.

References

Will be presented on demand