UZAIR AHMED

CONTACT

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RESEARCH ARTICLES

1. R Arshad, A Raheem, U Ahmed, H Khan,"Business Model Evaluation for Peer-to-peer Energy Sharing Systems: Insights from Off-grid DC Microgrid Deployment in Pakistan," 2023 IEEE Global Humanitarian Technology Conference (GHTC), pp. 77-83
   Contribution:
   - Developed DC-DC converters for the DC Microgrid (**DCMG**), enabling the system to have distributed solar generation with local battery storage and the capability of bidirectional sharing of surplus energy.
   - Led the **DCMG** deployment in Pakistan alongside developing the cloud-based energy management system **(EMS)** for enabling remote system control and tracking system's energy generation, consumption and bi-directional sharing for monthly **prosumer** (producer+consumer) billing.

2. A Raheem, SM Ahsan, U Ahmed, R Arshad, S Hussain, M Nasir, NA Zaffar, H Khan,"Analysis of Power Distribution Efficiency and Cost Effectiveness in Decentralized Solar DC Microgrids." , IECON 2024, pp. 1-6
   Contribution:
   - Modified the **IEEE-24 bus** system in **ETAP** to represent a **DCMG** of 24 individually interlinked Nanogrids (**NG**s) to study power flow analysis and distribution losses using AWG 10, 12, and 14 cables.
   - Developed the bidirectional energy sharing algorithm for the connected **NG**s in the **DCMG** alongside setting-up a scaled-down hardware version of the 24-Bus simulated **DCMG** in the Lab, to compare experimental and simulated results.

EDUCATION

MS Electrical Engineering *Aug 2015-May 2018*	**BSc. Electrical Engineering** *Dec 2014-Feb 2015*
Lahore University of Management Sciences (LUMS), Lahore, Pakistan	**University of Punjab (PU), Lahore, Pakistan**
Stream: Electrical Power and Energy Systems	**Stream:** Electrical Power and Energy Systems
CGPA: 3.40/4.00	**CGPA:** 3.55/4.00

RESERACH WORK EXPERIENCE

Team Lead Development, Horizon Europe-funded LoCEL-H2 project & *Jan 2023-present*,
Solar-Powered Decentralised Microgrid (DCMG), Electrical Power Systems Lab *June 2019-Dec 2022*
Dept. of Electrical Engineering, Syed Babar Ali School of Science and Engineering (SBASSE), LUMS

- Leading the development of a cloud-based **Energy Management System (EMS)** for decentralised DC microgrids (DCMG), enabling real-time energy data visualisation, Over-the-Air (OTA) firmware updates, local flash drive data synchronisation, remote system monitoring, diagnostics, and control of onboard DC-DC power electronics converters.
- Designed and scaled an IoT-enabled **Power Processing and Control Unit (PPCU)** as a modular product for decentralised microgrids, integrating real-time data analytics, a **600W MPPT Buck converter**, and **intelligent battery** and **load management**. Developed under the **Horizon Europe-funded Locel-H2 project**, the PPCU enables clean, off-grid energy access by managing solar energy and advanced lead battery storage in remote communities in the Ivory Coast and Zambia. More information on the pilot deployment and the product's impact in Pakistan can be found **here**
- Developed as part of the **Horizon Europe-funded Locel-H2 project**, enabled **peer-to-peer (P2P) energy trading** at **48V** by developing a **200W bidirectional buck-boost converter** within the PPCU, allowing surplus solar energy from neighbouring units to power community loads such as electric sewing machines and water pumps, and to energise a **1kW DC-DC converter** (designed under my technical leadership) operating at **48V–72V** for charging a lead battery–electrolyser system that generates green hydrogen for clean cooking. .
- Leading development of a **1 kW** DC-DC converter operating at **48V-380V** for enabling P2P trading over long distances using energy exchange from the **48V** DC microgrid interface.

Key Achievements

- Developed a **data-driven cloud-based EMS**, incorporating real-time analytics and anomaly detection for microgrid operation, addressing data imputation challenges in decentralized power systems.
- Simulated and developed the MPPT buck converter and bidirectional buck-boost converter in **LTspice, PSIM, and Proteus** to analyze the converter response and operation, optimize the performance before the physical prototype, and develop dual layer PCBS for the converters.
- Led the deployment of a decentralized microgrid for energy access in underserved communities, ensuring equitable power distribution among 45 off-grid homes, analyzing energy consumption patterns, and developing an adaptive demand-side management algorithm to optimize resource allocation.
- Completed the design and lab trials of a 48V-72V **1KW bidirectional-buck boost** converter for battery charging applications.

TEACHING WORK EXPERIENCE

Visiting Lecturer, Introduction to Computer Programming   *Feb 2019-May 2019*
Institute of Chemical Engineering & Technology, **PU**

Teaching Assistant, Power System Planning   *Sep 2018-Dec 2018*
Dept. of Electrical Engineering, **SBASSE**, **LUMS**

Teaching Assistant, Senior Year Design Projects   *Feb 2018-June 2018*
Dept. of Electrical Engineering, **SBASSE**, **LUMS**

Teaching Assistant, Electrical Power Systems   *Feb 2017-May 2017*
Dept. of Electrical Engineering, **SBASSE**, **LUMS**

MASTER'S SEMESTER PROJECTS

- **MPPT Boost Converter for battery charging using Solar PV system** Designed and implemented the hardware of MPPT boost converter to charge 48V battery from a string of solar panels of 40Voc. The converter was also simulated in MATLAB (Simulink) for design validation before hardware implementation.
- **Single phase inverter** Designed and implemented the hardware of 380V DC to 220V AC single phase H-bridge inverter circuit for household applications. Simulation of inverter circuit was performed on MATLAB

TECHNICAL SKILLS:

- **Python** for real-time data processing, forecasting, and optimisation .
- **MATLAB**, **PSIM**, **Proteus,** and **LTSpice** modelling of DC-DC power electronics converters.
- **C++** programming of PIC/DSPIC microcontrollers using MikroCpro.
- **PlatformIO for ESP32** interfaces with the cloud-based EMS.
- **ETAP** and **PSSE** for power flow, faults, and contingency analysis.

AREA OF INTERESTS:

- Data Analytics for Distributed Energy Resources (DERs).
- Applications of Distributed Energy Sources (DERs) in Decentralized Microgrid Systems (DCMG).
- Power Electronics Converters and Inverters for Microgrid Applications.

REFERENCES:

Reference 1:
Dr Hassan A Khan
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Reference 2:
Mr. Nauman Ahmad Zaffar
Professor, Electrical Engineering
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