

Daud Mustafa Minhas (Ph.D.-Eng)

Digitalization & AI Engineer | Green Energy & OT/IT Security Researcher | Educator in AI Automation | CISM® Certified

Nationality: German

DOB: 03 October 1985

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Digital Profiles

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DMMinhas
0000-0002-4861-6862
Daud Mustafa Minhas
Daud-Minhas

Languages

English: C1 (Full Professional)
German: B1 (Working Knowledge)
Urdu / Hindi: C2 / C1 (Native)
Arabic: A2 (Elementary)

Skills

TEACHING

Agentic AI for Automation · Engineering Mathematics · Project-based Learning · Evidence-Based Technical Teaching · Grant Writing & Consortium Building

DIGITALIZATION & AGENTIC AI

Agentic AI · LLMs & RAG · LangGraph · MCP · Digital Twins · Co-simulation · ML Forecasting · Process Automation

CRITICAL ENERGY INFRASTRUCTURE

Smart Grid / DERs · iEMS & MPC · TRNSYS · PyPSA, · PV · EV · Heat Pump · BESS · SCADA / PLC · Modbus-TCP

CYBER-PHYSICAL TRUST LAYER

CISM® · IEC 62443 · NIS2 · KRITIS · BSI · OT Pentesting · STRIDE Threat Modelling · Intrusion / Anomaly Detection

ENGINEERING & DEV STACK

Python · PyTorch · scikit-learn · MATLAB/Simulink · TRNSYS · R · C++ · Git · Streamlit · LaTeX · MathCad · Arduino · ESP · Raspberry Pi

Professional Memberships

- **ISACA CISM®** (ID: 242639970)
- **IEEE & IEEE ComSoc** (ID: 93374210)
- **Engineers Australia** – Recognized Professional Engineer Skill Level 1 (ID: 3878628)
- **Pakistan Engineering Council** – Registered Engineer (ELECT/23735)

About Me

Digitalization Engineer, AI Researcher, and University Educator with a Ph.D. in Systems Engineering and 10+ years of teaching and 2+ industrial R&D experience. His core foundation is **Critical Energy Grids & Power Electronics**, elevated by **Smart-Grid Optimization, Digital Twins, and Agentic AI/LLMs**, and protected by **CISM®-certified OT/IT Cybersecurity**. Currently leading digital flexibility and security research at **ZeMA gGmbH** and lecturing on **Agentic AI for Automation** and **Mathematical Mastery** at **Saarland University** and the **Scheer School of Digital Sciences**.

Interests **Continuous Learning:** Exploring emerging Agentic AI frameworks, embedded drone systems, green energy, cyber-physical security, and evidence-based learning sciences. **Sports & Endurance:** Running, Climbing, Cycling, Swimming, Exploring new tech, Cross-Cultural Collaboration.

€4.3M	**15+ yrs**	**35**	**CISM®**
SURF grid-flexibility project (ZeMA lead)	university teaching in AI, automation & maths	publications · 240+ citations (ResearchGate)	+ 7 cybersecurity certificates

Working Experience

Currently (2025–Present) — **ZeMA gGmbH (SEI), Saarbrücken, GER**
OT Security R&D Engineer – Industrial Security Lab

- **SEI-Partner Lead (SURF – 4.3M € BMWE-Funded):** Spearheading the security and digitalization work package for the *Smart, User-Based Regional Flexibility Platform for Electricity Markets*, integrating AI-driven analytics and cybersecurity frameworks into distributed energy grids.
- **Automated Digital Grid Toolkits:** Built a nine-phase Python security and compliance automation toolkit for DER monitoring platforms, mapped to **NIS2, IEC 62443, BSI IT-Grundschutz, KRITIS, and §14a EnWG**.
- **Critical Energy Hardware/Software Testing:** Led full-stack penetration tests of commercial Home Energy Management Systems (HEMS) and designed `pymodbus`-based fuzzing/validation frameworks for prosumer grid interfaces.
- **Soft/Hardware Fuzzing:** Modbus-TCP fuzzing & validation of prosumer devices (PV, wallbox, heat pump, storage); AI-driven anomaly detection and threat modelling for critical energy infrastructure.

Currently (2023–Present) — **Saarland University (AES), GER**
Teaching Associate (Adjunct Faculty) – Chair of Automation & Energy Systems

- **Agentic AI & Automation Teaching:** Designing and lecturing postgraduate M.Sc. courses including **AI in Automation (ML to LLMs built from scratch)**, **Automation Systems** (introductory + advanced: LLM agents, RAG, LangGraph, MCP), **Soft Control** (Fuzzy, ML, Optimization), **OT/ICS Security**, and **Data Science for Threat Analysis**.
- **Digital Teaching Methods:** Integrating project-based learning, live coding, Git, and Python to translate complex control, optimization, and AI agent concepts into practical engineering skills.
- **Mentorship Track Record:** Supervised numerous Master's and Bachelor's theses on Power load disaggregation, digital twins, appliance classification, and cyber-physical network security.
- **Grant Acquisition:** Key contributor and work-package lead on the 4.3M € BMWE-funded *SURF* smart-grid flexibility proposal across cross-functional academic and industrial teams.
- **Erasmus+ Leadership:** Led EU Erasmus+ capacity enhancement proposals (*Energy4U/DigiCRAFT/ReCAP*) and international researcher mobility programs.

Currently (2025–Present) — **Scheer School of Digital Sciences, GER**
Ambassador & Mathematics Expert – Digital Sciences for Transformation

- **Mathematics Expert:** Academic lead for **Foundations in Mathematical Mastery**, an intensive English-taught Master's course (teaching, weekly feedback, assessment of final pitches).
- **Digital Sciences Ambassador:** Promote the digital-sciences curriculum and guide students on pathways linking mathematics and business processes with digital transformation.

2016–2023 — **Saarland University, GER**
Research Associate – Chair of Automation & Energy Systems

- **Project 01 (ECO Microgrid):** Developed Machine Learning-based Model Predictive Control (MPC) and digital twin co-simulation for plug-and-play microgrids, reducing simulated operational energy costs by **15%**.
- **Project 02 (SE-ProEng):** Contributed to an EU-funded cloud-based networked simulator for flexible systems engineering product design.

2008–2016 — **University of Lahore (UOL) & CUST, PAK**
Assistant Professor / Lecturer – Department of Electrical Engineering

- Conducted **R&D** on optimal control strategies for AC/DC smart power systems (CUST, 2013–2016).
- **Undergraduate and graduate teaching and project supervision:** Taught Machine Learning, Smart Grid, Big Data with R, Power System Protection, Power Electronics, Instrumentation & Measurement, Circuit Analysis (UOL).

2007–2008 — **SoulTech Pvt Ltd & Supernet Ltd, PAK**
System Engineer (Electrical (PLC/SCADA) & Telecom Networks)

- Hands-on industrial commissioning of LV/MV electrical equipment, Allen-Bradley/Siemens PLCs, SCADA panels (SoulTech).
- Field installation and commissioning of wireless point-to-(multi) point, VSAT and iDirect networks.

Certifications

Cybersecurity

2023 **Certified Information Security Manager (CISM®)** – ISACA
ID: 242639970

2024 **Penetration Testing, Threat Hunting & Cryptography** – IBM
Coursera Credential ID: UU4515ZXWZG3

2024 **Cybersecurity Architecture** – IBM
Coursera Credential ID: US7F7F4ZMOXW

2024 **Cybersecurity Threat Vectors & Mitigation** – Microsoft
Coursera Credential ID: 98SOKNZ7RM8N

2024 **Cyber Security in Manufacturing** – SUNY
Coursera Credential ID: H9V5RF3I1G7X

2024 **Cybersecurity and the Internet of Things** – Kennesaw State Univ.
Coursera Credential ID: 2UNT4XHFSKNW

2024 **Gen AI in Cybersecurity** – Edureka
Coursera Credential ID: YLJEZT1BTKDV

Digitalization, AI & Industrial

2024 **Generative AI & LLMs: Architecture and Data Preparation** – IBM
Coursera Credential ID: 1LD0GE77VGI0

2023 **Mastering Digital Twins** – EIT Digital, EU
Coursera Credential ID: S7BESAUN68E4

2023 **Machine Learning** – Stanford Online
Coursera Credential ID: KH8AS35EZTMT

2018 **Learn and Teach in Academics and Profession** – Saarland University

2011 **Certified Associate in PLC & SCADA** – NUST, PAK
CAPS-9-1-2011-0032

2011 **Project Planning, Scheduling & Progress Monitoring** – NIDA, PAK
NA-0911-1133

2011 **Pro/Engineer: Machine Modelling & Analysis** – Aeromotive, PAK

Education & Postgraduate Training

2017–2023	**Doctor of Engineering (Dr.-Ing.) in Systems Engineering** (*magna cum laude*) *Thesis:* "Component-Based Dynamic Modelling of Energy Entities and Energy Management Strategies for a Smart Home Area Power Network (HAPN)." Researched ML-based Model Predictive Control (MPC) and mathematical modeling of intelligent power entities to enable smart grid flexibility and cost/emission reduction.	**Saarland University, Germany,** **Supervisor:** **Prof. Dr.-Ing. Georg Frey.** **Award: DAAD scholarship**
2013–2016	**Postgraduate Research Stay (Smart Grid Applications)** Worked in R&D developing optimal control strategies and queueing-theory models for AC/DC smart power systems.	**Capital Univ. of Science & Tech., PAK**
2008–2011	**Master of Science (M.Sc.) in Electrical Engineering** (CGPA: 3.58 / 4.00) *Specialization:* Power Engineering & Electromagnetic Compatibility.	**The University of Lahore, PAK**
2003–2008	**Bachelor of Science (B.Sc.) in Electrical Engineering** (CGPA: 3.44 / 4.00) *Specialization:* Electronics, Control & Communication Networks.	**The University of Lahore, PAK**

Projects (Digitalization, AI & Energy Grids)

2025–2026	**Applied Agentic AI & Green AI Benchmarking:** Designed an agentic workflow for automated document/tender intelligence (RAG, vector DB, OCR) and benchmarked energy, latency, and CO_2 footprints of LLM prompting strategies (Gemma, Llama, Qwen).	**ZeMA / Saarland Univ.**
2025	**Digital Twins in Energy Systems:** Architectures, AI Integration, and Pathways to Resilient and Sustainable Smart Grids (ProjSe 2025).	**ZeMA gGmbH**
2025	**Bridging the Cyber-Physical Divide:** Cybersecurity Challenges and AI-Driven Innovations in Smart Grids	**ZeMA gGmbH**
2024	**Security Framework for Digital Transformation in Energy Networks:** Compliance-mapped security architecture and anomaly detection in cyber-physical networks.	**Saarland University**
2023	**Simulation of a Fast-Charging Station for Electric Vehicles:** Co-simulation and grid impact modeling for high-power EV integration.	**Saarland University**
2021	**Home Load Disaggregation Using Multiple CNNs:** Deep learning-based non-intrusive load monitoring (Master's Thesis Supervision).	**Saarland University**
2018–2020	**Smart Building Digitalization:** Model-Driven Classification of Power Appliances, Wireless Network Control, and Master/Slave Power Node Communication.	**Saarland University**
2010–2011	**Industrial Grid & PLC/SCADA Rollouts:** Remote PLC/SCADA operations (Honda Power / Japan Power), commercial PV/inverter installations, and 132kV grid station ETAP harmonic/load-flow optimization.	**SoulTech / Industry**

Talks, Awards & Service

Talks & Presentations

2026 LLM energy/CO_2 benchmarking for cybersecurity – IEEE CyberAI, Bucharest

2023 Doctoral poster – ABB Energy Efficiency Symposium, Mannheim

2023 Technical workshop for high-school students – Tag der Technik, VDE Saar

2021/23 IEEE EEEIC / I&CPS Europe, Madrid

2019 IEEE CoDIT, Paris

2015/16 IEEE MELECON, Cyprus · IEEE ASCC, Malaysia · invited talk, MAJU Islamabad

[10pt,a4paper]article

Awards

2023 *magna cum laude*, PhD defence – Saarland University

2016 DAAD PhD Scholarship

2015/16 HEC travel grants (Malaysia, Cyprus)

2013 Postgraduate Fellowship – CUST

Academic Service & Leadership

Served on TPCs for IEEE international conferences. Regular expert reviewer for premier journals and conferences across **IEEE, Elsevier, MDPI, ACM, and IET** (including *IEEE Access, IET Cyber-Physical Systems, ACM TIST, and MDPI Energies/Smart Cities*)

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Daud Mustafa Minhas, Dr.-Ing.
Complete Publications List

Note: Journal metrics change annually. The grouping below highlights peer-reviewed articles in internationally indexed and higher-visibility outlets; it does not imply that an impact factor measures the quality of an individual publication.

1. Higher-Impact and Internationally Indexed Journal Articles

[1] M. Shahzad, B. Ali, **D. M. Minhas**, and G. Frey, "A Multi-Stage Framework for Intrusion Detection and Attack-Path Reconstruction in Advanced Metering Infrastructure (AMI) Networks", *Smart Cities*, vol. 9, no. 9, art. 158, 2026. doi:10.3390/smartcities9090158

[2] U. M. Shah, **D. M. Minhas**, K. Kifayat, K. A. Shah, and G. Frey, "Threat Modeling and Attacks on Digital Twins of Vehicles: A Systematic Literature Review", *Smart Cities*, vol. 8, no. 5, art. 142, 2025. doi:10.3390/smartcities8050142

[3] **D. M. Minhas** et al., "Invisible Eyes: Real-Time Activity Detection Through Encrypted Wi-Fi Traffic Without Machine Learning", *Internet of Things*, vol. 31, art. 101602, 2025.

[4] **D. M. Minhas** et al., "Rolling Horizon Based Time-Triggered Distributed Control for AC/DC Home Area Power Network", *IEEE Transactions on Industry Applications*, 2021. doi:10.1109/TIA.2021.3074901

[5] **D. M. Minhas** et al., "Modeling and Optimizing Energy Supply and Demand in Home Area Power Network (HAPN)", *IEEE Access*, vol. 8, pp. 2052–2072, 2020. doi:10.1109/ACCESS.2019.2962660

[6] **D. M. Minhas** et al., "Mathematical Modeling and Stability Analysis of DC Microgrid Using SM Hysteresis Controller", *International Journal of Electrical Power & Energy Systems*, 2018.

2. Peer-Reviewed Journal Articles

[7] M. T. Jamalabad, E. Abohamzeh, **D. M. Minhas**, S. Kim, D. Kim, A. Yoon, and G. Frey, "Comparative Assessment of Supervised Machine Learning Models for Predicting Water Uptake in Sorption-Based Thermal Energy Storage", *Energies*, vol. 19, no. 7, art. 1619, 2026. doi:10.3390/en19071619

[8] **D. M. Minhas**, M. Usman, I. B. Raja, A. Wakeel, M. Ali, and G. Frey, "Virtual Energy Replication Framework for Predicting Residential PV Power, Heat Pump Load, and Thermal Comfort Using Weather Forecast Data", *Energies*, vol. 18, no. 18, art. 5036, 2025. doi:10.3390/en18185036

[9] T. Mehmood, T. ur Rashid, M. Usman, M. Ali, **D. M. Minhas**, and G. Frey, "Adapting Energy Conservation Building Code-2023 for the Diverse Climates of Pakistan: A Path to Affordable Energy Efficiency and Sustainable Living", *Buildings*, vol. 15, no. 17, art. 3053, 2025. doi:10.3390/buildings15173053

[10] **D. M. Minhas** et al., "Electric Vehicle Battery Storage Concentric Intelligent Home Energy Management System Using Real-Life Data Sets", *Energies*, vol. 15, no. 5, art. 1619, 2022. doi:10.3390/en15051619

[11] **D. M. Minhas** et al., "Mitigation of Circulating Currents for Parallel Connected Sources in a Standalone DC Microgrid", *Engineering Proceedings*, 2021.

3. Book Chapters

[12] H. Khalil, G. Ali, and **D. M. Minhas**, "Explainable AI in Threat Intelligence: Improving Human–Machine Teaming", in *Cybersecurity, Cybercrimes, and Smart Emerging Technologies*, 2025. doi:10.1201/9781003614197

[13] H. Khalil, **D. M. Minhas**, et al., "Optimizing Cloud Virtual Machine Management Through AI-Enabled Infrastructure-as-Code", book chapter, 2025.

[14] **D. M. Minhas** et al., "Efficient Control Strategies to Optimize Electricity Cost and Consumer Satisfaction", book chapter, 2016.

4. Refereed Conference Papers and Proceedings

[15] **D. M. Minhas**, P. Kushare, H. Khalil, and G. Frey, "Carbon-Aware Benchmarking of Prompting Strategies Across Open-Source LLM Families", *IEEE Cyber-AI*, 2026. *(Proceedings citation/DOI to be added when available.)*

[16] **D. M. Minhas** et al., "Co-Simulation Strategy for Photovoltaic Power Prediction and Validation of Digital Twin", *EEEIC / I&CPS Europe*, 2023. doi:10.1109/EEEIC/ICPSEuro

[17] **D. M. Minhas** et al., "Energy Optimization of a Residential Building Using Model Predictive Control: A Case Study in Temperate Oceanic Climate", conference paper, 2022.

[18] **D. M. Minhas** et al., "A Rule-Based Expert System for Home Power Management Incorporating Real-Life Data Sets", *IEEE Smart Grid and Renewable Energy Conference*, 2022. doi:10.1109/SGRE53517.2022.9774212

[19] **D. M. Minhas** et al., "Stochastic Optimization Scheme to Schedule Energy Supply and Demands in an Islanded Microgrid", *IEEE IECON*, 2020. doi:10.1109/IECON43393.2

[20] **D. M. Minhas** et al., "Two-Stage Multi-Time-Scale Energy Management and Control Framework for Home Area Power Network", *EEEIC / I&CPS Europe*, 2020. doi:10.1109/EEEIC/ICPSEurope49358.2020.9160519

[21] **D. M. Minhas** et al., "Optimal Scheduling of Energy Supply Entities in Home Area Power Network", *IEEE Conference on Control, Decision and Information Technologies (CoDIT)*, pp. 732–737, 2019. doi:10.1109/CoDIT.2019.8820673

[22] **D. M. Minhas** et al., "SoMAS Based Cooperative Control for Cyber Physical Energy Systems", conference paper, 2018.

[23] **D. M. Minhas** et al., "Activation of Electrical Loads Under Electricity Price Uncertainty", *IEEE Smart Energy Grid Engineering (SEGE)*, 2017. doi:10.1109/SEGE.2017.805282

[24] **D. M. Minhas** et al., "Real-Time Power Balancing in Photovoltaic-Integrated Smart Micro-Grid", *IEEE IECON*, pp. 7469–7474, 2017. doi:10.1109/IECON.2017.8217308

[25] **D. M. Minhas** et al., "Short-Term Load Forecasting Using Hybrid Adaptive Fuzzy Neural System: The Performance Evaluation", *IEEE PowerAfrica*, 2017. doi:10.1109/PowerAfrica.2017.7991270

[26] **D. M. Minhas** et al., “Load Control for Supply-Demand Balancing Under Renewable Energy Forecasting”, *IEEE International Conference on DC Microgrids*, 2017. doi:10.1109/ICDCM.2017.8001071

[27] **D. M. Minhas** et al., “PFC Topologies for AC to DC Converters in DC Micro-Grid”, conference paper, 2016.

[28] **D. M. Minhas** et al., “Cost-Effective Bidirectional Power Transactions for Queueing Energy Requests in Smart Micro-Grids”, conference paper, 2016.

[29] **D. M. Minhas** et al., “Load Balancing in Smart DC Micro-Grid Using Delay Tolerant User Demands”, *IEEE SmartGridComm*, pp. 157–162, 2015.

[30] **D. M. Minhas** et al., “Comparison of S-Band Diplexer Design Using Multiplexer Theory with Coupling Matrix Synthesis”, conference paper, 2015.

[31] **D. M. Minhas** et al., “Optimal Control of Power Cost and Consumer Satisfaction Using Smart Grid Intelligent Energy Management System”, *Asian Control Conference*, 2015.

5. Posters, Preprints and Additional Scholarly Contributions

[32] **D. M. Minhas** et al., “Verteilte Simulation zur flexiblen Produktgestaltung im Systems Engineering (SE-ProEng / TP3)”, poster, 2022.

[33] **D. M. Minhas** et al., “Efficient Energy Management Strategies in Smart Grids Using Shiftable Power Loads”, poster, 2017.

[34] T. Mehmood et al., including **D. M. Minhas**, “Adapting Passive Houses for the Diverse Climates of Pakistan: A Path to Affordable Energy Efficiency and Sustainable Living”, preprint, 2024. *(Precursor to the 2025 Buildings article; normally omit this version when the journal article is cited.)*

Doctoral dissertation: **D. M. Minhas**, “Component-Based Dynamic Modelling, Optimization and Distributed Control of Home Area Power Networks”, doctoral dissertation, Universität des Saarlandes.