

# Dr. Mahmoud Abdelrahman

Architectural Engineer · Built-Environment Researcher · AI Scientist

[arch.mahmoud.ouf111@gmail.com](mailto:arch.mahmoud.ouf111@gmail.com) · [mahmoud.work](http://mahmoud.work) · Singapore · [Google Scholar](#) · [GitHub](#) · [LinkedIn](#)

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## PROFILE

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Architectural engineer and built-environment researcher with **16 years** of experience across academia, applied R&D, and entrepreneurial practice. Specialises in **AI-enabled spatial analytics, digital twins, and performance-driven design. 885 Google Scholar citations · h-index 15 · i10-index 17.** Software inventor (SpaceBrain, Ref. 2021-140) and co-founder of two technology ventures.

## EDUCATION

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2018 – 2022 **PhD, Built Environment**

National University of Singapore (NUS), Singapore · GPA 4.83 / 5.00

*Thesis: Spatial-Temporal Indoor Environmental Satisfaction Prediction using Graph Neural Networks*

2012 – 2017 **MSc, Architectural Engineering**

Mansoura University, Egypt

*Thesis: The Role of CFD Techniques in Environmental Sustainability in Architecture and Urban Design: A Case Study on Intermediate Cities*

2004 – 2009 **BSc, Architectural Engineering**

Mansoura University, Egypt

## ACADEMIC & RESEARCH EXPERIENCE

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Nov 2023 – Jul 2025 **Postdoctoral Research Fellow**

National University of Singapore — Urban Analytics Lab, Singapore

- Produced **4 publications** in *Nature Cities, Building and Environment, and Computers, Environment and Urban Systems.*
- Co-supervised **5+ graduate students** on GNN, GeoAI, and street-view imagery research.
- Co-authored **SGD 1,686,100** Cities of Tomorrow R&D; grant (NRF/MND) as **Co-PI.**

2020 – Mar 2022 **Research Associate**

Building and Urban Data Science (BUDS) Lab, NUS, Singapore

- Authored **10+ publications** on digital twins and indoor environmental quality, accumulating **850+ citations.**
- Invented **SpaceBrain** (Ref. 2021-140) — a GNN platform for spatial IEQ prediction at campus scale.
- Co-developed and delivered the **edX MOOC** *Data Science for Construction, Architecture and Engineering.*

Aug 2018 – 2020 **Research Assistant**

IDEAS Lab, NUS, Singapore

- Conducted research on integrating **BIM/BEM with data science** for building performance analysis.
- Authored comprehensive **NLP text-mining review** of data science for building energy efficiency — published in *Energy and Buildings* (850+ citations).
- Developed **ANT** (ML plugin for Grasshopper) and **GhCPython** (scipy, numpy, scikit-learn bridge for parametric design).
- Mentored undergraduate and MSc students on computational built-environment research projects.

2014 – **Founder — Ain Academy · YouTube Educator**

Present Online (Arabic-language)

- Built and run a free Arabic-language learning platform reaching **tens of thousands of learners** across the Arab world.
- Published curriculum in computational design, CFD, Python for architecture, and AI for the built environment.

Sep 2011 – **Teaching Assistant / Assistant Lecturer**

Jan 2018 Kafrelsheikh University, Egypt

- Delivered studio and lecture courses to **60+ students per cohort**; supervised graduation projects from proposal through final defence.
- Authored the full department curriculum in computer applications and computational design.

Sep 2017 – **Teaching Assistant / Research Assistant**

Aug 2018 The American University in Cairo, Egypt

- Supported studio delivery, formal student assessment, and applied built-environment research.

2014 – **Founder — Ain Academy · YouTube Educator**

Present Arabic-language online platform

- Built a free curriculum reaching **tens of thousands of learners** across the Arab world in computational design, CFD, Python, and AI for architecture.

## PROFESSIONAL & ENTREPRENEURIAL EXPERIENCE

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Mar 2021 – **CEO & Co-Founder — SpaceMatch Pte. Ltd.**

Present Singapore

- Scaled AI-powered digital twin platform from research to commercial deployment.
- Led technical strategy and product architecture; promoted to **CEO (Jul 2025)**.

Jan 2022 – **CTO — iRAD LLC (prev. Scientific Advisor & AI Lead)**

Present Remote

- Lead AI strategy for medical diagnostics platform; directed model pipelines as AI Lead (2022–2023).

Mar 2022 – **Research Scientist & Technical Product Manager**

Aug 2023 Saltmine Pte. Ltd., Singapore

- Led workplace analytics R&D; promoted to Product Manager overseeing a team of **50 engineers and designers**.
- Translated AI research into deployed workplace optimisation products integrating IoT, behavioural, and portfolio data.

Jan 2010 – **Co-Founder & CEO — Ain Design**

Aug 2018 Egypt · Saudi Arabia · UAE

- Delivered architecture projects across three countries, managing multidisciplinary teams.

## SELECTED PUBLICATIONS · 18 INDEXED · 885 CITATIONS · H-INDEX 15

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- **Abdelrahman M.**, et al. (2025). What is a Digital Twin Anyway? Deriving the Definition from 15,000+ Publications. *Building and Environment*. [10.1016/j.buildenv.2025.112748](https://doi.org/10.1016/j.buildenv.2025.112748)
- Quintana M., ..., **Abdelrahman M.**, Biljecki F. (2025). Global Urban Visual Perception Across Demographics. *Nature Cities*. [10.1038/s44284-025-00330-x](https://doi.org/10.1038/s44284-025-00330-x)

- Quintana M., ..., **Abdelrahman M.**, et al. (2026). Greenery Perception Across Demographics in Multiple Cities. *Landscape and Urban Planning*. [10.1016/j.landurbplan.2026.105618](https://doi.org/10.1016/j.landurbplan.2026.105618)
- Ito K., ..., **Abdelrahman M.**, et al. (2025). ZenSVI: Open-Source Street View Imagery Analysis Platform. *Computers, Environment and Urban Systems*. [10.1016/j.compenvurbsys.2025.102283](https://doi.org/10.1016/j.compenvurbsys.2025.102283)
- **Abdelrahman M.**, Chong A., Miller C. (2022). Personal Thermal Comfort Models via Digital Twins and Build2Vec. *Building and Environment*. [10.1016/j.buildenv.2021.108532](https://doi.org/10.1016/j.buildenv.2021.108532)
- **Abdelrahman M.**, Miller C. (2022). Adaptive Spatial-Temporal Thermal Preference Sampling via Digital Twins. *Building and Environment*. [10.1016/j.buildenv.2022.109090](https://doi.org/10.1016/j.buildenv.2022.109090)
- **Abdelrahman M.**, Zhan S., Miller C., Chong A. (2021). Data Science for Building Energy Efficiency: Text-Mining Review of 10,000+ Papers. *Energy and Buildings*. [10.1016/j.enbuild.2021.110885](https://doi.org/10.1016/j.enbuild.2021.110885)

## AWARDS & GRANTS

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- **Best Poster Award** — Indoor Air 2022 (ISIAQ), Kuopio, Finland.
- **Best Paper Award** — *Buildings Journal* (2022), Humans-as-a-Sensor for Buildings.
- **Best Paper Award** — Building Simulation Conference BS-Cairo 2013.
- **1st Place** — Engineering Club Design Competition, New Menya City, Egypt.
- **2nd Place** — Prince Mohammad Bin Nasser Charitable Housing Project, Saudi Arabia.
- **3rd Place** — Future Intermediate Cities Competition, Centre of Sustainability and Future Studies (CSFS), The British University in Egypt (BUE), 2009.
- **Recognition** — Taking Leave Competition, CSFS, The British University in Egypt (BUE), 2011.

## GRANT APPLICATIONS

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- **Co-PI** — Cities of Tomorrow R&D; Programme, NRF/MND Singapore; budget **SGD 1,686,100**; 3 years. (*submitted, not awarded*)
- **Co-Investigator** — High-Resolution Real-Time GNSS Signal Coverage Prediction in Singapore Using Digital Twins. (*submitted, not awarded*)

## TALKS & INVITED LECTURES

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- Aug 2022 **Digital Transformation in the Corporate Real Estate (CRE) Industry**  
CoreNet Global Singapore Chapter · Singapore  
Represented Saltmine alongside leaders from Johnson Controls and WiredScore before **75+ attendees**.
- Jan 2018 **Machine Learning and Computational Design Adoption**  
SFDUG — San Francisco Dynamo User Group  
Computational intelligence methods in architecture and ML applied to design. [youtu.be/tTUGVeeNs9U](https://youtu.be/tTUGVeeNs9U)
- 2016 **The Design Infinite Loop**  
Delta University · Egypt
- 2013 **The Project — The Dream**  
MET Institute · Egypt

## SKILLS & TECHNOLOGIES

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**AI & ML** GNN, RNN, CV, RL, NLP, GeoAI · **Digital Twins** End-to-end pipelines; IoT / MQTT; campus & city scale · **Building Science** CFD, thermal comfort, daylighting, IAQ; Rhino / Grasshopper · **Spatial & Web** React, three.js, Cesium · **Programming** Python, JavaScript, C++; GCP, AWS