

Zain Ahmed Usmani

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EDUCATION

Habib University, Bachelor of Science in Computer Science
CGPA 3.68/4.00 | Minor in Social Development & Policy
Yohsin Scholar (100% merit-based scholarship)

2020 – 2024 | Karachi, Pakistan

Notable Electives:

Social Network Analysis, Artificial Intelligence, Mobile Robotics, Computational Intelligence,
Cryptography & Network Security, Qualitative Research Methods, Right to the City: Urban Design & Public Space.

United World College of Changshu China 🌐,
International Baccalaureate Diploma Programme (IBDP)

2018 – 2020 | China

PROFESSIONAL EXPERIENCES

Research Associate, Dr. Hassan F. Khan, Tufts University (Remote)

Jan 2025 – present

- Development of a micro-level simulator / **agent-based model (ABM)** to study urban water dynamics for Global South cities like Karachi.
- Designing and implementing the simulator architecture using Mesa and Python. Integrating techniques like Fuzzy Inference Systems and Reinforcement Learning to drive adaptive decision-making in otherwise heuristic-driven agents.
- **Maintaining a streamlit-based front-end** for the simulator.
- **Performing data analysis** on multi-year primary survey and smart-meter data from Karachi, as well as model outputs.
- Reviewing literature, writing, and producing peer-reviewed manuscripts under review (at **Nature Cities**), with more in preparation.
- Driving and **maintaining the project as the primary developer** using software development tools and strategies like **Taiga (Jira-alt)**, and **agile** methodology.
- Studied, proposed and evaluated water policy interventions under competing definitions of equity and distributive justice on household-level metrics.
- Analyzed and proposed water **policy interventions** under competing definitions of **equity and distributive justice** on household-level metrics.
- Extending the research framework to industrial water users (textile factories) to understand the influence of commercial demand on household-level water usage.

Tools: Python (Mesa, Pandas, Matplotlib, Scikit-learn), Agent-Based Modeling, Streamlit, Reinforcement Learning, Fuzzy Inference

LLM Development and Analytics, Data Science Dojo

Jul 2024 – Oct 2024

- **Designed a novel solution** and **built API endpoints** for enabling **requests through chats** on platforms like Slack and ClinicalTrials.gov.
- **Architected integration** of the feature into a **RAG-based LLM framework**.
- Developed **LLM user analytics** pipelines, supporting over 100+ daily user interactions for global clients, including the **IMF and World Bank**.

Tools: LangChain, Django, Python, Azure Cloud Services

Fintech Trainee, YPay Financial Services

Jun 2023 – Jul 2023

- **Set up Heap for data collection and analytics** on user interactions and **created dashboards** to support decision-making.
- **Investigated and identified key drop-off points** in user journeys, informing data-driven improvements to the UI.
- Redesigned the fintech startup's website based on customer conversion flows.

Tools: Figma, ReactJS and Heap Analytics.

WebDev & Github Workshop for Teens, Habib University

Jun 2024

Taught a hands-on course to a class of 15 A-level/HSSC students. Covered HTML, CSS and some JavaScript with essentials of Github over a 9-day workshop. By the end of the workshop, students successfully deployed their own Github Pages-based websites accessible [here](#) 🌐.

Teacher's Assistant for Social Network Analysis, Habib University
(CS 361/SDP 352)

Sep 2023 – Dec 2023

Assisted students with **R** and queries in **data scraping, modelling and analysis**. Also assisted and advised on final projects involving research **climate activism, politics** and **development**.

Tutor at EHSAAS Center, Habib University

Jun 2022 – Feb 2023

Facilitated and lead multi-day **workshops** for Career Curation Program involving skills like **MS Excel and PowerAutomate**. Managed volunteers and worked with co-facilitators to cater to audiences of up to 40 students.

Designed and set up a web portal for Habib University's Engineering Workshop. Used the Office 365 Suite (**SharePoint, PowerAutomate** etc.) for automating processes like **3D printing**, reducing delays and human-errors. Also, improved on **safety policies** and made said policies more accessible.

SKILLS

Programming

Python (*pandas, scikit-learn, numpy, langGraph*)
C++, R for data analytics

Database Management

MS SQL, MongoDB

Languages

English (*fluent*), Urdu (*fluent*),
Mandarin (*intermediate*), Arabic (*intermediate*)

Soft skills

Research, writing & documentation, team management, facilitation

General Tools

Git, Docker, Figma, Linux, LaTeX

Web & Mobile Development

ReactJS, Django, React Native

Miscellaneous

LangGraph,
Azure Cloud Services,
Blender, DaVinci Resolve, Fusion 360,
MS Office Suite (Excel, PowerAutomate,
PowerBI, advanced PowerPoint)
Engineering workshop tools (welding, lathe
machines, CNC milling etc.)

PUBLICATIONS

H. F. Khan and **Z. A. Usmani**. "Navigating Water Equity Tradeoffs in Cities of the Global South".

(Manuscript under review at Nature Cities - Nov. 2025)

We developed a household-level agent-based model of urban water access in Karachi, combining survey and smart-meter data to evaluate policy trade-offs across affordability, access, and scarcity under competing equity lenses. Results quantitatively demonstrate how policy evaluations reverse with varying interpretations of equity and fair distribution.

Z. A. Usmani, M. Rai and F. Khan. "**Reconfigurable Cryptoprocessor Design for RSA and Rabin- p Cryptosystems**," 26th International Multi Topic Conference (INMIC), 2024. (IEEE Xplore Preview here [↗](#)).

We proposed a reconfigurable cryptoprocessor design supporting both RSA and Rabin- p cryptosystems, enhancing security and efficiency by eliminating quadratic residue identification in decryption. This design ensures RSA compatibility while leveraging Rabin- p 's more reliable mathematical background for hardware-based cryptographic applications.

Presented: Dec 12, 2024 | **Runner-up:** Best Presentation Award

S. M. Mustafa, **Z. A. Usmani**, O. Rizvi, A. B. Memon, and M. M. Movania, "**Context-aware Mamba-based Reinforcement Learning for Social Robot Navigation**," 12th International Conference on Control, Mechatronics, and Automation (ICCMA), 2024.

<http://ieeexplore.ieee.org/document/10843924/> [↗](#) (read here [↗](#)).

We developed **CAMRL**, a novel reinforcement learning approach for social robot navigation using Mamba, a deep learning-based State Space Model. CAMRL enhances decision-making, reducing collisions and improving pedestrian safety. Outperformed CADRL, LSTM-RL, and SARL in complex, pedestrian-rich environments, showcasing the potential of deep-state space modelling in the field.

AWARDS & HONORS

Yohsin Scholarship, Habib University

Aug 2020

100% Scholarship for academic excellence and upholding Habib University's core values.

Grant, UWC Changshu China

Aug 2018

100% merit-based scholarship awarded to attend United World College of Changshu China.

SELECTED PROJECTS

Analyzing Social Networks at Habib University

Nov 2022 – Dec 2022

Supervisors: Dr. Shah Jamal Alam, Dr. Qasim Pasta

Graph-based Network Analysis research.

- Used **graph modelling** and **data analysis** to analyze HU faculty's communication patterns. Evaluated the culture of interdisciplinarity between faculty members' through inter & intra department interactions.
- Used a variety of tools (**R, Gephi, Python**) for **data scraping, cleaning and analysis**.

Sentiment Analysis for Social Media

Nov 2022 – Dec 2022

Created a supervised learning filter for negative posts on social media feeds.

- Implemented sentiment analysis using **Naive Bayes classification** and Sentiment140 [dataset](#).
- Integrated model with an in-house **MERN-based social media platform** to filter posts.

Tools: ScikitLearn, React, FastAPI

Summer Tehqiq Research Project

Jun 2023 – Jul 2023

A theoretically motivated redesign of pedagogical practices for Nature of Computing course at Habib University.

- Connected theoretical computer science and direct real-world applications to make concepts more accessible.
- Designed worksheets to enable better linking of ideas for students.

Her City & Her Stories

Feb 2021 – Dec 2021

Supervisor: Hira Zuberi

Assistant for a research project on challenges of Urban Mobility for women in Karachi.

- Designed interviews and conducted UX tests
- Made research results more accessible by hosting current work on a website

EXTRACURRICULAR COMMITMENTS

TEDx Youth Speaker, *TEDx Youth@TCSGCA*

Jan 2023

Delivered a TEDx talk on consumerism, development and sustainability.

Teaching & Resource Portal Website Development for NJV Highschool

Dec 2023

- Volunteered to enhance digital literacy for 100+ students at NJV Government High School by teaching classes at the 2023 Winter Camp.
- Created and hosted an educational resource website using **Github Pages, React and MUI**.

Clubs and Services:

SERVICE Leading Wujood, an **Adult Literacy Program**. Managed team of 15 teachers for 70+ members of HU's housekeeping staff.

SERVICE Leading the Executive Council at Habib University **Student Government**. Negotiated admin-student interests across a variety of issues relating to student equity, academic systems and university ethos.

CLUB Leading the **Sustainable Recycling** Project at Habib University. Organized recycling drives and explored issues of waste management in Karachi.

- Worked on long-term green patch management projects.
- Collaborated with formal waste management companies.

Have also continuously collaborated with the administration on improving and developing policies. **Involved in curriculum reviews and course redesigns.**