# Syed Muhammad Danish

Email: syed-muhammad.danish.1@ens.etsmtl.ca
Phone: 438-408-2358 | Personal Website

## Education

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| 2019 - 2022 | PhD Scholar, **ETS Montreal**, Quebec, Canada<br>Thesis: Service Selection Middleware using Blockchain for IoT Applications<br>Supervisor: Prof. Kaiwen Zhang<br>Co-supervisor: Prof. Hans-Arno Jacobsen |
| 2016 - 2018 | Master of Science in Electrical Engineering, **NUST**, Pakistan<br>Thesis: "Security & Interference Analysis of Jamming Attacks in LoRaWAN based IoT Networks" |
| 2010 - 2014 | Bachelor of Science in Telecom Engineering, **UET Taxila**, Pakistan |

## Work Experience

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| Current<br>Sep 2022 | Post-Doctoral Researcher and Blockchain Developer at ETS Montreal and Hydro-Quebec<br>- Research and investigate blockchain-based solutions for transactive energy trading and distributed energy resources (DERs) integration.<br>- Implementation of solidity-based smart contracts to support the transactive energy market.<br>- Design and development a decentralized web3 application to implement financial services using EVM-based blockchain.<br>- Architect the end-to-end decentralized energy markets to ensure transparency and security.<br>- Performance modelling and evaluation of blockchain-based solutions. |
| Aug 2022<br>Oct 2021 | Research Intern (Blockchain Developer) at Hydro-Quebec<br>Worked with Hydro-Quebec on blockchain projects for future IoT-based smart grid use-cases. |
| Aug 2018<br>Feb 2018 | Research Assistant at Frederick University Cyprus (Erasmus + Project)<br>- Explored the security vulnerabilities in LoRaWAN IoT authenticaton protocol.<br>- Investigated blockchain integration in the IoT network to enhance IoT security.<br>- Enhanced the authentication security of LoRaWAN IoT protocol using blockchain.<br>- Researched multi-factor authentication for LoRaWAN IoT networks using blockchains. |

## Research and Development Projects

**Blockchain-based financial management system:** This project is a part of Hydro-Quebec's blockchain energy project in which I developed a decentralized web3 application to implement the transparent and verifiable financial system for the customers using Energy Web Chain. In this project, I have

- Developed a full-stack decentralized application, which includes a customer-side front-end written in React and an ExpressJS back-end server connected to a set of solidity smart contracts to implement the financial system algorithms on Energy Web Chain.
- Explored the decentralized storage technologies including Amazon QLDB, IFPS, Filecoin network to optimize the blockchain storage problem.
- Gained an in-depth knowledge of Identity and Access Management using Decentralized Identifiers (DIDs) and Verifiable Claims (VCs).

**Blockchain-based decentralized energy market:** This project is also a part of Hydro-Quebec's

blockchain energy project in which I am currently developing a decentralized energy market for peer-to-peer energy trading. In this project,

- I have gained an in-depth knowledge on the decentralized exchanges and automated market makers algorithms.
- I am currently developing smart contracts to implement peer-to-peer energy market by following UniSwap architecture to ensure best practice guidelines.

**Decentralized storage technologies for IoT applications:** This project is a part of my PhD research in which the main goal is to integrate decentralized storage technologies in IoT data storage system. In this project, I have

- Gained an in-depth knowledge on the decentralized storage technologies including Storj, Filecoin, IPFS, etc and mathematically modelled the underpinning characteristics.
- Developed a decentralized application using web3py and a REST API in Python flask to retrieve the real-time parameters.
- Explored the use of deep learning and recurrent neural network to improve the computational efficiency of IoT applications.

## Skills

Blockchain Platforms (Ethereum, Energy Web Chain, Quorum, Hyperledger, Avalanche, Iotex, Polygon Matic, Chainlink Oracles)
Blockchain Development Frameworks (Truffle (web3js), Hardhat (Etherjs), Brownie (web3py))
Web3 development (Solidity, HTML, CSS, Javascript)
Programming Languages (Python, JavaScript, Solidity, TypeScript)
Frameworks (React, Python Flask, Django, Nodejs)
Databases (InfluxDB, MongoDB, IPFS, Filecoin web3 storage)
AWS Cloud (EC2, Lambda, DynamoDB, IAM service, S3, SNS, SQS, ECS)
Hardware (Arduino, Raspberry Pi)
Other tools (Docker, Gitlab (CI/CD), Linux Ubuntu, bash scripting)
Applied Machine Learning/Deep Learning (Keras, TensorFlow)

## Selected Publications

1. **Syed Muhammad Danish**, Kaiwen Zhang, Hans-Arno Jacobsen. *BlockAIM: A Neural Network-Based Intelligent Middleware For Large-Scale IoT Data Placement Decisions*. **2021 IEEE Transactions on Mobile Computing** (IF 5.112)
Link: **https://ieeexplore.ieee.org/document/9398554**

2. **Syed Muhammad Danish**, Kaiwen Zhang, Hans-Arno Jacobsen, Nouman Ashraf, Hassaan Khaliq Qureshi. *BlockEV: Efficient and Secure Charging Station Selection for Electric Vehicles* **2020 IEEE Transaction on Intelligent Transportation Systems** (IF 6.319)
Link: **https://ieeexplore.ieee.org/document/9310692**

3. **Syed Muhammad Danish**, Kaiwen Zhang, Hans-Arno Jacobsen. *BlockAM: An Adaptive Middleware for Intelligent Data Storage Selection for Internet of Things*. 2020 IEEE International Conference on Decentralized Applications and Infrastructures (DAPPS)
Link: **https://ieeexplore.ieee.org/abstract/document/9126003/** (Best Paper Award)

4. **Syed Muhammad Danish**, Marios Lestas, Hassaan Khaliq Qureshi, Kaiwen Zhang, Waqar Asif, Muttukrishnan Rajarajan. *Securing the LoRaWAN Join Procedure using Blockchains* (IF 3.458)
Link: **https://link.springer.com/article/10.1007/s10586-020-03064-8**

5. Muhammad Munim Shabir, **Syed Muhammad Danish**, Kaiwen Zhang. *BlockQoS: Fair Monetization of On-Demand Quality-of-Service using Blockchains*
Link: **https://dl.acm.org/doi/10.1145/3580284**

6. Subhasish Goswami, **Syed Muhammad Danish**, and Kaiwen Zhang. *Towards a middleware design for efficient blockchain oracles selection*
Link: **https://ieeexplore.ieee.org/document/9922433**

## Public Research Profile

1. Google Scholar
2. DBLP
3. Research Gate

## Languages

1. English (Bilingual Proficiency)
2. French (Limited Working Proficiency)

## Achievements and Certificates

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| Aug. 2022 | Nominated for best PhD thesis award |
| Jan. 2019 | International Research Collaboration Scholarship (TU Munich, Germany) |
| Jan. 2019 | Scholarship for Securing Top Position in MSEE 2016 (Gold Medalist) |
| Feb. 2018 | Erasmus + Exchange Scholarship |

## References

1. Prof. Kaiwen Zhang
Associate Professor | École de technologie supérieure, Montreal | kaiwen.zhang@etsmtl.ca

2. Prof. Hans-Arno Jacobsen
Professor | University of Toronto, Canada | jacobsen@eecg.toronto.edu

3. Prof. Marios Lestas
Associate Professor | Frederick University, Cyprus | eng.lm@frederick.ac.cy

4. Prof. Ali Motamedi
Associate Professor | École de technologie supérieure, Montreal | ali.motamedi@etsmtl.ca