

Shujaatali Badami^{ID}

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Research Profile

Quantum-IoT Research Engineer working at the intersection of post-quantum cryptography, quantum machine learning on NISQ hardware, and critical-infrastructure security. Research validated on IBM's 156-qubit `ibm_fez` processor and on Arduino-class embedded targets, aligned with NSA CNSA 2.0 migration timelines and NIST FIPS 203 / 204 standardization. Active in global standards leadership as a member of the **IETF LAKE Post-Quantum EDHOC Design Team** and the **ISA99 Committee** (ISA / IEC 62443), and through the United Nations ITU and IEEE technical program committees, with sole-author publications across quantum systems, IoT protocol design, and industrial anomaly detection.

Selected Technical Contributions

- **First peer-reviewed FIPS 203 / 204 implementation on Arduino-class IoT:** ML-KEM and ML-DSA ported to AT-mega328P (2 KB SRAM), achieving 136 ms signing latency and 1,850 TPS throughput. Directly addresses the NSA CNSA 2.0 migration mandate for embedded systems.
- **First native C oneM2M v5.1 under 64 MB:** Delivered a 17x memory reduction over prior Java and Python reference stacks, enabling standards-compliant M2M on resource-constrained devices.
- **First cross-testbed QML validation on NISQ hardware:** 8-qubit ZZ feature-map kernels evaluated on IBM's 156-qubit `ibm_fez`, delivering a statistically significant AUC gain over classical SVMs ($p = 0.003$) on SWaT and HAI industrial control datasets.
- **First POMDP algorithm combining heuristic depth compression with Boltzmann sampling:** Addresses the McCallum Utile Suffix Memory limitation open since 1995, published as IEEE ICEACE 2024 sole-author.
- **First phase-space resolution of the $E < 0$ region** identified as open in Nakayama's 2022 double-well quantum bootstrap work, extending the microcanonical bootstrap framework.
- **Order-of-magnitude engineering gains:** 10x requests-per-second on IoT workloads across LevelDB, RocksDB, Cassandra, and HBase (LSM-Tree). 43.3% power reduction and 29.7% delay reduction in AI-optimized VLSI. 25 to 30% energy savings at 0.93 sensing AUC for 6G cognitive radio.

Peer-Reviewed Publications & Media

Journals & Proceedings (Published)

- **S. Badami (Sole Author)**, "Hardware-Agnostic Quantum Kernel Feature Mapping for Anomaly Detection in Critical Infrastructure: A Cross-Testbed Validation on NISQ Processors," *IEEE ACCESS*, 2026
<https://doi.org/10.1109/ACCESS.2026.3679234>
- **S. Badami (1st Author)**, "AI-Optimized VLSI Architecture for Energy-Efficient and Sustainable IoT Systems," *IEEE ICAIC 2026*
<https://doi.org/10.1109/ICAIC67076.2026.11395694>
- **S. Badami (Sole Author)**, "Quantum Bootstrap in Microcanonical Ensembles," *IEEE ICPCT 2025*
<https://doi.org/10.1109/ICPCT64145.2025.10939270>
- **S. Badami (Sole Author)**, "Mitigating Tails Switching in Multibranch PoS Systems," *IEEE ICBATS 2025*
<https://doi.org/10.1109/ICBATS66542.2025.11258220>
- **S. Badami (Sole Author)**, "Optimizing RL in Partially Observable Environments," *IEEE ICEACE 2024*
<https://doi.org/10.1109/ICEACE63551.2024.10899025>
- **S. Badami (Sole Author)**, "Optimizing LSM Tree Operations with Deferred Updates," *IEEE DSIT 2024*
<https://doi.org/10.1109/DSIT61374.2024.10881309>
- **S. Badami (Sole Author)**, "Efficient OneM2M Standard for Lightweight IoT," *IEEE DSIT 2024*
<https://doi.org/10.1109/DSIT61374.2024.10882084>

Accepted / In Press / Preprints (2025–2026)

- **S. Badami (1st Author)**, "Quantum-Resilient IoT Energy Metering on Blockchain," *Springer NGCCOM 2025*
<https://doi.org/10.21203/rs.3.rs-8491593/v1> (Pre-Print)
- **S. Badami (2nd Author)**, "AI-Driven Green Cognitive Radio Networks for Sustainable 6G," *Bentham Science CYBPRO 2025*
<https://doi.org/10.48550/arXiv.2512.20739> (Pre-Print)
- **S. Badami (1st Author)**, "IoT-enabled Automated Wet and Dry Waste Segregation System for Smart City Applications," *IEEE INDIACom-2026 (Presenter)*
DOI: Awaiting IEEE Xplore Publication

- **S. Badami** (Sole Author), “Multi-Formalism Verification Framework for Autonomous Vehicles,” *TechRxiv Pre-Print*
<https://doi.org/10.36227/techrxiv.176342174.49042133/v1>

Media & Expert Commentary

- **Expert Commentary**, “Malware Threats Accelerate Across Critical Infrastructure,” *TechNewsWorld (ECT News Network)*, Apr 8, 2026
[Read On Technewsworld.com](#)
- **Expert Commentary**, “Crypto group ushers in post-quantum security,” *ReversingLabs*, Mar 19, 2026
Commentary on the Ethereum Foundation’s post-quantum cryptography initiative.
[Read On Reversinglabs.com](#)
- **S. Badami**, “Exploring Gateway Architectures for Quantum-Safe Industrial Networks,” *(ISA) Automation.com*, Feb 2026
[Read the full article on Automation.com](#)

Professional Service & Community Leadership

International Standards Body Participation

- **IETF LAKE Working Group** . Member of the **Post-Quantum EDHOC Design Team** (PQ-EDHOC), contributing to the standardization of quantum-resilient authenticated key exchange for constrained IoT devices alongside researchers from Ericsson, MIT Lincoln Laboratory, INRIA, ISI Athens, University of Murcia, IIT Delhi, and University of Limoges.
- **ISA99 Committee** (International Society of Automation) . Member of the committee that develops the **ISA / IEC 62443 series**, the global standard for industrial automation and control systems (IACS) cybersecurity, covering critical infrastructure, operational technology, and industrial IoT.

Scholarly Journal Peer Review

- **IEEE Internet of Things Journal (IoT-J)** . IF: 10.6 Top global IoT journal.
- **Elsevier Future Generation Computer Systems (FGCS)** . IF: 7.5 Tier-1 distributed systems venue.
- **IEEE Transactions on Quantum Engineering (TQE)** . IF: 3.9 Invited by **Argonne National Laboratory (US DOE)**.
- **IEEE Transactions on Mobile Computing** . IF: 9.2
- **IEEE Open Journal of Communications (OJ-COMS)** . IF: 6.1
- **IEEE Communications Letters** . IF: 4.4
- **Wiley International Journal of Communication Systems (IJOCS)** . IF: 2.1

Technical Program Committee (TPC) Member

- **United Nations ITU Kaleidoscope 2026** . 16th UN AI for Good Summit, Geneva.
- **IEEE CCNCPS 2026** (Communication, Computing, Networking, and Control in Cyber-Physical Systems)
- **IEEE ACDSA 2026** (Advanced Computer Design and System Architecture)
- **IEEE ICECET 2026** (Emerging Computing and Electronics Technology)
- **IEEE ICMLCN 2026** (Machine Learning and Cloud Networking)
- **IEEE ICNC 2026** (Networking and Computing)
- **IEEE QCNC 2026** (Quantum Computing and Networking)
- **IEEE ICCSP 2026** (Communication Signal Processing)
- **IEEE EDUCON 2026** (Special Session)
- **IEEE ICOMIT 2026** (Multidisciplinary Applications of Information Technology)
- **Springer DMBD 2025** (Data Mining and Big Data)

Conference Reviewer & Special Appointments

- **IEEE WCCI / IJCNN 2026** (World Congress on Computational Intelligence / International Joint Conference on Neural Networks, Emergency Reviewer)
- **IEEE ICIN 2026** (Information and Networking)
- **IEEE ICAD 2026** (Audio, Acoustics, and Dialogue)
- **IEEE DSIT 2025** (Digital Signal Processing and Information Technology)
- **IEEE ECCE 2026** (Emerging Conference on Computing and Electronics)
- **Elsevier ACLing 2025** (Advanced Computational Linguistics)
- **QCNS 2026** (Quantum Computing and Networking Summit)

Invited Judging: Startups & Hackathons

- [Seattle Startup Summit 2026](#) . Part of 50+ judge panel reviewing 300+ applicants and 120 finalists
- [AWS x Malaika-AI Founder Showcase \(2025\)](#) . Judged 17 deep-tech startups with founders from Ex-Google, Ex-Lyft, Caltech, Yale, and Stanford Research Institute
- [Intercom x Malaika-AI Founder Showcase \(2025\)](#) . Judged 14 deep-tech startups with founders from Ex-WhatsApp, NASA, Tesla, Visa, and UC Berkeley
- [Carta x Malaika-AI Founder Showcase \(March 2026\)](#) . Judge
- [SpartaHack 11](#) (Michigan State University) 2026 . Judge and Mentor for 36-hour student hackathon
- [HackwithChicago 3.0 \(2026\)](#) . Invited Judge for regional Chicago hackathon
- Judge for additional AI/Web3 startup showcases and hackathons (2025–2026), including [Vibe Awards](#), [Vibe Demo Day](#), [OSS4AI AI Agents Hackathons](#), and [Needle Hackathon](#)

Professional Experience

Independent Researcher

Quantum-IoT (Q-IoT) Research Engineer

Chicago, IL, USA

Feb 2024 – Present

- Appointed member of the [IETF LAKE Working Group Post-Quantum EDHOC Design Team](#), contributing to the standardization of quantum-resilient authenticated key exchange for constrained IoT devices alongside researchers from Ericsson, MIT Lincoln Laboratory, INRIA, and ISI Athens
- Member of the [ISA99 Committee](#) (International Society of Automation) developing the ISA / IEC 62443 series, the global standard for industrial automation and control systems (IACS) cybersecurity
- Appointed TPC member for [United Nations ITU Kaleidoscope 2026](#) (AI for Good Summit, Geneva) and 10+ IEEE / Springer conferences spanning quantum computing, networking, machine learning, and cyber-physical systems
- Sole-authored IEEE ACCESS paper validating 8-qubit ZZ feature-map kernels on [IBM's 156-qubit ibm_fez](#) NISQ processor for critical-infrastructure anomaly detection
- Published 1st-author IEEE paper on AI-optimized VLSI architecture achieving 43.3% power and 29.7% delay reduction for IoT devices (2026)
- Published 2 sole-authored IEEE papers on quantum systems and blockchain consensus (2025) and 3 sole-authored IEEE papers on lightweight cryptography, M2M protocols, and IoT standards (2024)
- Invited journal reviewer for 7 high-impact venues including [IEEE IoT Journal](#) (IF 10.6), IEEE Trans. Mobile Computing (IF 9.2), Elsevier FGCS (IF 7.5), and [IEEE TQE](#) (invited by [Dr. Joaquin Chung](#), Argonne National Laboratory / US DOE)
- Emergency Reviewer for IEEE WCCI / IJCNN 2026 and reviewer for 15+ additional IEEE / Springer / Elsevier conferences
- Authored technical article on quantum-safe industrial network gateways for [Automation.com \(ISA\)](#) and quoted as expert source by TechNewsWorld and ReversingLabs on ICS malware and post-quantum security
- Judged 100+ deep-tech startups, Web3 projects, and AI-agent hackathons at global showcases hosted by AWS, Carta, Intercom, OSS4AI, HackwithChicago, and Michigan State University

Elevenco Marketing Pvt Ltd

Founder & Chairman . Applied AI and IoT Systems Engineering

India

Dec 2019 – Dec 2022

- Founded and led a technology services firm delivering applied AI, analytics, and IoT systems engineering across real estate, logistics, and manufacturing verticals
- Directed technical strategy and end-to-end delivery across four client portfolios (Marvella Developers, Square One Commercial, Golden Transport, Wellx Brothers), spanning cloud-edge coordination, telemetry architectures, CRM analytics, and production-line instrumentation
- Built IoT fleet telemetry (OBD-II sensor integration on 50+ heavy vehicles) with real-time GPS tracking, driving vehicle utilization from 60% to 75% and reducing equipment downtime by 25%
- Engineered production analytics (batch tracking, QC metrics, yield optimization) that reduced manufacturing raw-material wastage from 15% to 8% and halved order-fulfillment lead time
- Established the cloud-edge coordination and predictive-maintenance foundations that later informed federated-learning and distributed-intelligence research streams

Independent Consultant

Applied AI, Analytics, and Systems Engineering

India

Jan 2015 – Nov 2019

- Delivered applied AI, analytics, and system-optimization engagements for industry partners across real estate, logistics, manufacturing, and e-commerce sectors
- Designed and deployed ETL pipeline architectures processing 100K+ daily records for M/s Marvella Developers across 4 commercial and 2 residential projects

- Built MLOps frameworks and customer-segmentation systems that lifted sales-conversion rates from 3.2% to 4.8% and compressed report generation from 2–3 days to 2–3 hours
- Architected marketing analytics and lead scoring for M/s Square One Commercial, raising follow-up rates from 40% to 85% with real-time pipeline visibility
- Developed early cloud-edge coordination models and automation frameworks that formed the foundation for later federated-learning and distributed-intelligence work

Professional Memberships & Fellowships

IEEE Senior Member, International Society of Automation (ISA). Senior Member, Raptors.dev Fellow, ACM Member, IEEE Communications Society

Education

Liverpool John Moores University	United Kingdom
<i>MSc in Data Science with Merit. Thesis: Deep Learning.</i>	2022 – 2023
Deakin University	Australia
<i>Master of Business Administration (MBA Global).</i>	2020 – 2022
IIIT Bangalore	India
<i>Executive Post Graduate Programme in Data Science.</i>	2021 – 2023
IMT Ghaziabad	India
<i>Post Graduate Diploma in Management.</i>	2020 – 2021
Karnataka State Open University	India
<i>Bachelor of Computer Applications.</i>	2010 – 2013

Technical Expertise

Quantum Systems: Quantum kernel methods, ZZ feature maps, variational quantum circuits on NISQ hardware (IBM ibm_fez), Qiskit Runtime, quantum bootstrap in microcanonical ensembles.

Post-Quantum Cryptography: NIST FIPS 203 ML-KEM, FIPS 204 ML-DSA, CRYSTALS-Kyber, CRYSTALS-Dilithium, embedded integration on ATmega328P and Arduino-class targets.

IoT and M2M Standards: oneM2M v5.1 native C, CoAP, MQTT, sub-64 MB protocol stacks, OBD-II telemetry, IETF LAKE / EDHOC, ISA / IEC 62443.

Machine Learning and Control: POMDPs, reinforcement learning, Boltzmann sampling, federated learning, predictive maintenance, customer segmentation, MLOps pipelines.

VLSI and Hardware: Energy-efficient architectures, hybrid RL / GA / Bayesian optimization, power-delay co-optimization.

Critical Infrastructure Security: Anomaly detection on SWaT and HAI datasets, ICS / OT threat modeling, quantum-safe industrial gateway architectures.

Systems and Data Engineering: LSM-tree storage with deferred updates, ETL pipeline architecture, real-time telemetry, distributed analytics.