

Faisal Haque Bappy

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Research Interests

My research focuses on improving the **security**, **scalability**, and **performance** of decentralized systems while also investigating the **human factors** that influence security in emerging technologies. Across both areas, I combine **technical experimentation** with **empirical, human-centered methods** to understand and strengthen how people and systems interact securely.

Education

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|--|---|
| University of Maryland Baltimore County
<i>PhD in Information Systems</i> | <i>Aug 2025 – May 2027
(expected)
GPA: 3.91</i> |
| <ul style="list-style-type: none">◦ Dissertation: Secure and Scalable Distributed Ledger Architectures: An Algorithmic Approach to Transaction Contention Resolution◦ Advisor: Dr. Md Tariqul Islam ‘Pavel’ | |
| Syracuse University
<i>PhD in Information Science and Technology (Transferred)</i> | <i>Aug 2022 – May 2025
GPA: 3.91</i> |
| Shahjalal University of Science and Technology
<i>BS in Computer Science and Engineering</i> | <i>Jan 2017 – Dec 2020
GPA: 3.56</i> |
| <ul style="list-style-type: none">◦ Thesis: Modelling and Simulating Attacks in a Private Blockchain System◦ Advisor: Dr. Md Sadek Ferdous | |

Experiences

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|---|--|
| Graduate Research Assistant
University of Maryland Baltimore County | <i>Baltimore, MD, USA
Aug 2025 - Present</i> |
| <ul style="list-style-type: none">◦ Led research on a provably secure, gas-bounded smart contract migration framework, coordinating with collaborators to design the security model and formal correctness proofs.◦ Directed the design and evaluation of SWORD, a secure offline-first authentication scheme for resource-constrained networks, overseeing protocol design and experimental validation across distributed testbeds.◦ Conducted a qualitative study on AI coding assistants and developer security awareness, leading a team through study design, participant recruitment, thematic analysis, and manuscript preparation.◦ Guided an investigation into LLM-based program validation against natural-language specifications, driving the research methodology and grammar-grounded compliance verification approach.◦ Tools Used: Solidity, Ethereum, Python, Hyperledger Fabric, Azure OpenAI | |
| Cryptography Research Engineer Intern
Ripple | <i>New York, NY, USA
May 2025 – Aug 2025</i> |
| <ul style="list-style-type: none">◦ Benchmarked RISC-V vs WebAssembly VMs for smart contract execution and zero-knowledge proof verification on the XRP Ledger, identifying trade-offs in execution speed, security, and portability.◦ Conducted deep evaluations of multiple ISAs, analyzing performance bottlenecks, security models, and implementation feasibility to guide blockchain-native computation design.◦ Authored comprehensive technical assessments that shaped Ripple’s long-term strategy for extending XRPL’s computational capabilities.◦ Collaborated with senior engineers and researchers to align VM evaluations with broader blockchain architecture roadmaps.◦ Tools Used: Rust, WebAssembly, RISC-V, C++ | |
| Graduate Research Assistant
School of Information Studies (iSchool), Syracuse University | <i>Syracuse, NY, USA
Aug 2022 - May 2025</i> |
| <ul style="list-style-type: none">◦ Developed and implemented a novel scheme to mitigate the impact of conflicting transactions in blockchain networks, improving system efficiency and reducing transaction delays. | |

- Designed a consensus mechanism leveraging multi-agent reinforcement learning to enhance the security of Proof of Stake blockchains, improving detection and mitigation of malicious nodes.
- Redesigned the workflow of an existing radio spectrum frequency-sharing scheme and implemented multiple APIs optimized for low-resource IoT devices.
- **Tools Used:** Hyperledger Fabric, Ethereum, GoLang, PostgreSQL, Azure Functions

Software Engineer

FConnect (formerly Footylight Pty Ltd.)

Sydney, NSW, Australia

Mar 2021 – Jul 2022

- Developed a content monetization solution from scratch that is now used by 1000+ partner websites and the system is handling 500 million video plays per month on average.
- Developed a search infrastructure for maintaining ever-growing data using ELK Stack & AWS.
- **Tools Used:** NextJS, React, AWS Lambda, .NET, DynamoDB, MSSQL, ElasticSearch

Research and Development Intern

Pipilika - Bangla Search Engine

Sylhet, Bangladesh

Sep 2019- Aug 2020

- Collaborated on a project titled “Pipilika Media Monitor” which was used to generate different analytics and analyze public reaction to trending news of Bangladesh.
- **Tools Used:** React, ExpressJS, Django, Tensorflow, MongoDB, ElasticSearch

Publications

Conference Papers

[C17] **FH Bappy**, T Hossain, SM Meheraj, AS Akhand, T Tabassum, TS Zaman, R Hasan, T Islam, **From Preventive to Reactive: How AI Coding Assistants Transform Developers’ Security Awareness** in *Proceedings of the 2026 USENIX Symposium on Usable Privacy and Security (SOUPS)* [PrePrint](#) [🔗](#)

[C16] **FH Bappy**, T Hossain, R Hasan, K Hasan, M Younis, T Islam, **“SWORD: A Secure LoW-Latency Offline-First Authentication and Data Sharing Scheme for Resource Constrained Distributed Networks”** in *Proceedings of the 2026 IEEE International Conference on Communications (ICC)* [PrePrint](#) [🔗](#)

[C15] **FH Bappy**, E Cheon, T Islam, **“Centralized Trust in Decentralized Systems: Unveiling Hidden Contradictions in Blockchain and Cryptocurrency”** in *Proceedings of the 2025 ACM Conference on Fairness, Accountability, and Transparency (FAccT)* [10.1145/3715275.3732130](#) [🔗](#)

[C14] T Hossain, **FH Bappy**, TS Zaman, T Islam, **“SmartShift: A Secure and Efficient Approach to Smart Contract Migration”** in *Proceedings of the 2025 ACM International Conference on the Foundations of Software Engineering (FSE)* [10.1145/3696630.3728517](#) [🔗](#)

[C13] T Hossain, S Hassan, **FH Bappy**, MN Yanhaona, TS Zaman, T Islam, **“Bridging Immutability with Flexibility: A Scheme for Secure and Efficient Smart Contract Upgrades”** in *Proceedings of the 2025 IEEE International Conference on Blockchain and Cryptocurrency (ICBC 2025)* [10.1109/ICBC64466.2025.11114684](#) [🔗](#)

[C12] R Haque, SM Aziz, T Hossain, **FH Bappy**, MN Yanhaona, T Islam, **“Collaborative Proof-of-Work: A Secure Dynamic Approach to Fair and Efficient Blockchain Mining”** in *Proceedings of the 2025 IEEE 15th Annual Computing and Communication Workshop and Conference (CCWC)* [10.1109/CCWC62904.2025.10903711](#) [🔗](#)

[C11] T Hossain, S Hassan, **FH Bappy**, MN Yanhaona, STA Rumeen, M Zaber, T Islam, **“FlexiContracts: A Novel and Efficient Scheme for Upgrading Smart Contracts in Ethereum Blockchain”** in *Proceedings of the 2024 23rd IEEE International Conference on Trust, Security and Privacy in Computing and Communications (TrustCom)* [10.1109/TrustCom63139.2024.00319](#) [🔗](#)

[C10] **FH Bappy**, T Islam, K Hasan, MSI Sajid, MMA Pritom, **“Securing Proof of Stake Blockchains: Leveraging Multi-Agent Reinforcement Learning for Detecting and Mitigating Malicious Nodes”** in *Proceedings of the 2024 IEEE Global Communications Conference (GLOBECOM)* [10.1109/GLOBECOM52923.2024.10900961](#) [🔗](#)

[C9] **FH Bappy**, T Islam, K Hasan, JS Park, C Caicedo, **“Impact of Conflicting Transactions in Blockchain: Detecting and Mitigating Potential Attacks”** in *Proceedings of the 2024 IEEE Global Communications Conference (GLOBECOM)* [10.1109/GLOBECOM52923.2024.10901049](#) [🔗](#)

[C8] **FH Bappy**, TS Zaman, MSI Sajid, MMA Pritom, T Islam, **“Maximizing Blockchain Performance: Mitigating Conflicting Transactions through Parallelism and Dependency Management”** in *Proceedings of the 2024 IEEE International*

Conference on Blockchain (Blockchain) [10.1109/Blockchain62396.2024.00027](https://doi.org/10.1109/Blockchain62396.2024.00027) 

[C7] T Islam, **FH Bappy**, MNUH Shifat, F Ahmad, K Hasan, TS Zaman, “**An Efficient and Scalable Auditing Scheme for Cloud Data Storage using an Enhanced B-tree**” in *Proceedings of the 2024 IEEE International Conference on Communications (ICC)* [10.1109/ICC51166.2024.10622517](https://doi.org/10.1109/ICC51166.2024.10622517) 

[C6] S Ahmed, M Nahiduzzaman, T Islam, **FH Bappy**, TS Zaman, R Hasan, “**FASTEN: Towards a Fault-tolerant and Storage Efficient Cloud: Balancing Between Replication and Deduplication**” in *Proceedings of the 2024 IEEE Consumer Communications & Networking Conference (CCNC)* [10.1109/CCNC51664.2024.10454894](https://doi.org/10.1109/CCNC51664.2024.10454894) 

[C5] **FH Bappy**, S Zaman, T Islam, RA Rizvee, JS Park, K Hasan, “**Towards Immutability: A Secure and Efficient Auditing Framework for Cloud Supporting Data Integrity and File Version Control**” in *Proceedings of the 2023 IEEE Global Communications Conference (GLOBECOM)* [10.1109/GLOBECOM54140.2023.10436828](https://doi.org/10.1109/GLOBECOM54140.2023.10436828) 

[C4] **FH Bappy**, T Islam, TS Zaman, R Hasan, C Caicedo, “**A Deep Dive into the Google Cluster Workload Traces: Analyzing the Application Failure Characteristics and User Behaviors**” in *Proceedings of the 2023 10th International Conference on Future Internet of Things and Cloud (FiCloud)* [10.1109/FiCloud58648.2023.00023](https://doi.org/10.1109/FiCloud58648.2023.00023) 

[C3] MKB Shuhan, T Islam, EA Shuvo, **FH Bappy**, K Hasan, C Caicedo, “**Quarks: A Secure and Decentralized Blockchain Based Messaging Network**” in *Proceedings of the 2023 IEEE 10th International Conference on Cyber Security and Cloud Computing (CSCloud)* [10.1109/CSCloud-EdgeCom58631.2023.00053](https://doi.org/10.1109/CSCloud-EdgeCom58631.2023.00053) 

[C2] MA Shahriar, **FH Bappy**, AF Hossain, DD Saikat, MS Ferdous, MJM Chowdhury, MZA Bhuiyan, “**Modelling Attacks in Blockchain Systems using Petri Nets**” in *Proceedings of the 2020 IEEE 19th International Conference on Trust, Security and Privacy in Computing and Communications (TrustCom)* [10.1109/TrustCom50675.2020.00142](https://doi.org/10.1109/TrustCom50675.2020.00142) 

[C1] AHM Linkon, MM Labib, **FH Bappy**, S Sarker, M Jannat, MS Islam, “**Deep Learning Approach Combining Lightweight CNN Architecture with Transfer Learning: An Automatic Approach for the Detection and Recognition of Bangladeshi Banknotes**” in *Proceedings of the 2020 11th International Conference on Electrical and Computer Engineering (ICECE)* [10.1109/ICECE51571.2020.9393113](https://doi.org/10.1109/ICECE51571.2020.9393113) 

Journal Papers

[J1] CM Abdullah, F Shaiara, S Arifin, **FH Bappy**, R Hasan, T Islam, “**Blockchain Integration in VANETs: Challenges and Research Frontiers in Security and Trust**” in *Vehicular Communications, Volume 59, ISSN 2214-2096, 2026* [10.1016/j.vehcom.2026.101015](https://doi.org/10.1016/j.vehcom.2026.101015) 

Workshop Papers

[W2] T Hossain, **FH Bappy**, TS Zaman, T Islam, “**CrossLink: A Decentralized Framework for Secure Cross-Chain Smart Contract Execution**” in *Proceedings of the 2025 IEEE International Conference on Blockchain and Cryptocurrency Cross-Chain Workshop (ICBC-CCW)* [10.1109/ICBC64466.2025.11185102](https://doi.org/10.1109/ICBC64466.2025.11185102) 

[W1] T Islam, **FH Bappy**, TS Zaman, MSI Sajid, MMA Pritom, “**MRL-PoS: A Multi-agent Reinforcement Learning based Proof of Stake Consensus Algorithm for Blockchain**” in *Proceedings of the 2024 IEEE 14th Annual Computing and Communication Workshop and Conference (CCWC)* [10.1109/CCWC60891.2024.10427777](https://doi.org/10.1109/CCWC60891.2024.10427777)  | 🏆 Awarded as best paper

Posters

[P3] T Hossain, **FH Bappy**, TS Zaman, T Islam, “**SEAM: A Secure Automated and Maintainable Smart Contract Upgrade Framework**” in *Proceedings of the 2025 IEEE Consumer Communications & Networking Conference (CCNC)* [10.1109/CCNC54725.2025.10976211](https://doi.org/10.1109/CCNC54725.2025.10976211) 

[P2] **FH Bappy**, JS Park, K Hasan, T Islam, “**ChainGuard: A Blockchain-based Authentication and Access Control Scheme for Distributed Networks**” in *Proceedings of the 2025 IEEE Consumer Communications & Networking Conference (CCNC)* [10.1109/CCNC54725.2025.10976009](https://doi.org/10.1109/CCNC54725.2025.10976009) 

[P1] **FH Bappy**, T Islam, TS Zaman, MSI Sajid, MMA Pritom, “**ConChain: A Scheme for Contention-free and Attack Resilient BlockChain**” in *Proceedings of the 2024 IEEE Consumer Communications & Networking Conference (CCNC)* [10.1109/CCNC51664.2024.10454692](https://doi.org/10.1109/CCNC51664.2024.10454692) 

Projects

ConChain: Mitigating Conflicting Transactions in Blockchain

[Full paper](#) 

- Developed a blockchain scheme integrating transaction parallelism with an intelligent dependency manager to minimize conflicting transactions.
- Achieved superior performance compared to existing Hyperledger Fabric networks in terms of transaction success rates, throughput, and latency.
- Demonstrated that the scheme effectively addresses the challenges posed by conflicting transactions.
- Showcased potential for enhancing the performance and stability of blockchain networks in real-world applications.

MRL-PoS+: Multi-agent Reinforcement Learning based Proof of Stake Consensus

[Full paper](#) 

- Developed a consensus algorithm that enhances PoS blockchain security using Multi-agent Reinforcement Learning techniques.
- Introduced a penalty-reward system for detecting and eliminating malicious nodes, effectively mitigating potential attack behaviors.
- Achieved significant improvements in attack resilience against six major attack types without additional computational overhead.

Auditing Scheme for Cloud Data Storage using an Enhanced B-tree

[Full paper](#) 

- Developed a dynamic auditing solution that leverages an enhanced B-tree structure for efficient insert, update, and delete operations while maintaining balance.
- Outperformed traditional blockchain-based approaches in terms of time, storage efficiency, and overall performance.
- Demonstrated high suitability for scalable cloud auditing applications, particularly for dynamic data updates.

BRAC Dishari

[Google play store](#) 

- Developed Dishari, a learning platform for health workers at BRAC, aimed at enhancing training and resources.
- Created an Android application and a web dashboard to provide an integrated solution supporting users' learning needs.
- Currently utilized by 4,000 health workers across Bangladesh, offering essential tools and information to improve their field performance.

SUST CSE Online Judge

[sustcseoj.com](#) 

- This online judge was created to host internal programming contests at SUST. I was responsible for designing and implementing the website's frontend, ensuring a user-friendly interface that allows participants to easily navigate the platform, submit their solutions, and view their scores in real time.

Ekushe Bangla Keyboard

[Google play store](#) 

- This was the first Bangla keyboard to incorporate a swipe-to-type feature, revolutionizing the typing experience for users. In this project, I developed various keyboard layouts tailored to different user preferences and integrated the swipe capabilities, enabling seamless and efficient text input in Bangla.

Technical Skills

Programming: Rust, Go, C++, Python, JavaScript, Java, Bash, Dart, PHP

Blockchain & Security: Ethereum, Hyperledger Fabric, Consensus Design, WebAssembly, ZKPs

ML Tools: PyTorch, RLLib, PettingZoo

Cloud & Databases: AWS, Azure, PostgreSQL, MySQL, MSSQL, DynamoDB, MongoDB, Redis, ElasticSearch

Other Tools: Docker, Git, CI/CD, Apache Kafka, LaTeX