

Zahidur Talukder

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TLU Faculty Profile | STAIL Lab | Google Scholar | GitHub

Seguin, Texas

Research Identity

Trustworthy and Sustainable AI Systems. My research asks how AI systems can remain accurate and useful while operating under real constraints on privacy, fairness, hardware, communication, energy, water, and carbon. I pursue this question through two mutually reinforcing pillars: **(1) trustworthy federated and distributed AI** and **(2) sustainable AI systems and computing infrastructure**. Across both, I study adaptation under heterogeneity – in data, devices, accelerators, networks, geography, and environmental conditions. My current work increasingly connects these pillars, with the long-term goal of optimizing statistical objectives, systems constraints, and environmental impact together rather than treating them as separate afterthoughts.

Selected Highlights

- **2024 MLCommons Rising Star in Machine Learning and Systems**, recognizing my work across federated learning, trustworthy AI, and sustainable computing.
- Published across **ACM SIGMETRICS**, **ACM SenSys**, **ACM e-Energy**, **ACM TOMPECS**, **IEEE EDGE**, **AAAI/ICWSM**, and **IEEE COMPSAC**, spanning federated/distributed learning, systems measurement, cybersecurity, and sustainable computing.
- Built a multi-paper program in **trustworthy federated AI**: FedASL (robust aggregation), FedSRC (client autonomy and efficiency), FairHetero (hardware-sensitive fairness), and data-quality-aware federated learning.
- **SAW-Fed (ongoing)** directly bridges my two research pillars by combining environmental client selection with learning utility, participation fairness, exploration, and bias-corrected aggregation.
- Current independent TLU research includes two manuscripts **submitted to the ACM e-Energy 2027 Fall Cycle**: **GPU-OASIS**, on online GPU-aware SAW/carbon/cost scheduling for geo-distributed AI, and **When EV Charging Helps / EcoCharge**, on joint carbon- and water-stress-aware EV charging.
- Awarded a **TLU Faculty-Student Summer Research Grant (2026, approx. \$10,000)**; supervise the **STAIL Lab** and lead student research in trustworthy and sustainable AI.
- **External PI proposal in development**: *Stress-Adjusted Water Sustainability for Data Centers and AI Infrastructure*; longer-term proposal direction in *Trustworthy and Sustainable Federated AI*.
- Developed and launched **CSCI 379 Artificial Intelligence** in Fall 2026 and lead departmental planning toward a future **AI minor**.

Academic Appointments

Texas Lutheran University – Department of Math and Computer Science

Assistant Professor

Aug 2025 – Present

- Lead an independent research program spanning privacy-preserving/federated learning, sustainable AI, and resource-aware computing; supervise undergraduate research through STAIL Lab.
- Serve as **Supervisor of STAIL Lab**, coordinating student research projects, research meetings, project development, and manuscript preparation.
- Developing a PI-led external proposal on **stress-adjusted water sustainability for data centers and AI infrastructure**.
- Developed and launched **CSCI 379 Artificial Intelligence** in Fall 2026 and lead departmental planning toward an AI minor.
- Faculty Advisor, ACM Student Chapter; contribute to departmental curriculum development and research mentoring.

University of Texas at Arlington – Department of Computer Science and Engineering

Graduate Research Assistant, Rigorous Design Lab (RiDL)

Aug 2019 – Aug 2025

Graduate Teaching Assistant

Aug 2019 – May 2023

Education

Ph.D., Computer Science and Engineering, University of Texas at Arlington

2025

B.S., Electrical and Electronic Engineering, Bangladesh University of Engineering and Technology

2018

Research Lab Leadership

Supervisor, STAIL Lab

2026 – Present

- Supervise a student-centered research group connecting **trustworthy AI, privacy-preserving/federated learning, and sustainable AI systems**.
- Define research directions, mentor students in experiment design and implementation, organize project progress, and guide technical writing and conference-paper development.
- Use the lab as the umbrella for the growing TLU research program around SAW-aware computing, federated learning, GPU scheduling, and undergraduate research.

Research Program and Expertise

Pillar I: Trustworthy Federated and Distributed AI

2019 – Present

- **Research direction.** Develop distributed-learning methods that keep raw data local while addressing unreliable or low-quality updates, statistical heterogeneity, unequal device capability, participation cost, fairness, privacy, and security. I treat data locality as a structural systems constraint rather than assuming that federated learning is automatically private, fair, or robust.
- **FedASL – robust auto-weighted aggregation.** Developed lightweight server-side aggregation that adaptively reduces the influence of unfavorable client updates without trusted validation data or substantial additional server computation. [Paper]
- **FedSRC / self-regulating clients.** Designed client-side mechanisms that let devices decide whether local training and model upload are worthwhile, reducing unnecessary computation and communication while remaining compatible with standard FL backends. [SIGMETRICS Paper] [Code]
- **FairHetero – hardware-sensitive fairness.** Developed fairness-aware optimization across heterogeneous model/device groups, reducing disparity for resource-constrained clients; analyzed convergence under heterogeneous architectures. [Paper]
- **Data-quality-aware FL.** Extended client self-regulation to heterogeneous local data quality so participation and communication decisions reflect update utility and reliability. [Paper] [Code]
- **SAW-Fed – bridge to sustainable distributed AI (ongoing).** Treats stress-adjusted water and carbon as client-selection costs while preserving learning utility, participation fairness, exploration, and objective fidelity. The design uses inclusion probabilities, fairness debt, dependent rounding, and importance-corrected aggregation so environmental preference does not silently redefine the target FL population.
- **Next directions.** Privacy-preserving environmental accounting; robust selection/aggregation under differential privacy, secure aggregation, adversarial participation, and partial observability; federated adaptation of foundation models and collaborative AI agents under heterogeneous hardware, privacy, and resource constraints.

Pillar II: Sustainable AI Systems and Computing Infrastructure

2022 – Present

- **Balancing Bits and Drops – ACM e-Energy 2026.** Developed stress-adjusted water (SAW) accounting for data centers by combining water consumption with spatial and temporal water scarcity and separating on-site cooling from off-site electricity-generation impacts. Studied stress-aware workload scheduling, rainwater harvesting, and dry cooling across U.S. data-center markets. [Paper]
- **GPU-OASIS – submitted to ACM e-Energy 2027, Fall Cycle.** Extends stress-aware scheduling from generic IT load to modern AI infrastructure. The online controller jointly reasons about SAW, carbon, electricity cost, GPU type/memory, topology, model residency, checkpoint state, deadlines, inference routing, and latency SLOs so environmental optimization occurs only over executable GPU-feasible actions.
- **EcoCharge / When EV Charging Helps – submitted to ACM e-Energy 2027, Fall Cycle.** Led a funded TLU project with undergraduate researchers studying joint carbon- and SAW-aware EV charging using Texas/ERCOT environmental signals and residential charging traces; the work extends stress-aware scheduling beyond data centers to flexible electric loads.
- **Data, measurement, and infrastructure foundations.** Built and analyzed U.S. data-center/environmental datasets integrating climate, cooling, water scarcity, electricity provenance, and water-efficiency signals. Contributed to low-cost server-level power monitoring using conducted EMI, connecting sustainability optimization with practical systems measurement. [SenSys Paper]
- **External proposal in development (PI).** *Stress-Adjusted Water Sustainability for Data Centers and AI Infrastructure: a*

broader program spanning measurement, forecasting, on-site/off-site water provenance, GPU/workload flexibility, carbon, cooling, and operational decision-making.

- **Next directions.** Deployment-oriented GPU scheduling under forecast uncertainty; renewable/storage and cooling integration; multi-region/multi-year sustainable charging; and sustainable edge/federated AI where privacy, fairness, environmental impact, and system performance are optimized jointly.

Selected Foundations in Security, Privacy, and Cyber-Physical Systems

- Investigated **remote-access attacks on active sensors in autonomous vehicles** and broader attack surfaces in networked and cyber-physical systems.
- Published work and surveys on privacy trade-offs during emergency data collection, malware detection and analysis, and attacks/defenses in mobile IP.
- These contributions provide a continuing security foundation for my trustworthy distributed-AI agenda and motivate future work on adversarial participation, private telemetry, and secure decentralized learning.

Publications

Manuscripts Submitted / Under Review

- **GPU-OASIS: Online GPU-Aware Stress-Adjusted Water, Carbon, and Cost Scheduling for Geo-Distributed AI Workloads.** Submitted to **ACM e-Energy 2027, Fall Cycle**, September 2026.
- **When EV Charging Helps: EcoCharge for Joint Carbon- and Water-Stress-Aware Charging in Texas.** Submitted to **ACM e-Energy 2027, Fall Cycle**, September 2026.

Refereed Journal Papers

- **Zahidur Talukder**, Bingqian Lu, Shaolei Ren, Mohammad A. Islam. "Fair Federated Learning with Heterogeneous Devices." **ACM Transactions on Modeling and Performance Evaluation of Computing Systems (TOMPECS)**, 2024.
- Sai Puppala, Ismail Hossain, Md Jahangir Alam, Sajedul Talukder, **Zahidur Talukder**, Sayed Bahauddin. "SCALE: Self-regulated Clustered Federated Learning in a Homogeneous Environment." **Journal of Data Analytics and Engineering Decision Making**, 2024.
- Sajedul Talukder, Md. Iftekharul Islam Sakib, **Zahidur Talukder**. "Giving Up Privacy For Security: A Survey on Privacy Trade-offs During Pandemic Emergencies." **International Journal on Cryptography and Information Security**, 2020.
- Sajedul Talukder, **Zahidur Talukder**. "A Survey on Malware Detection and Analysis Tools." **International Journal of Network Security & Its Applications**, 2020.

Refereed Conference Papers

- **Zahidur Talukder**, Imtiaz Bin Rahim, Pranjol Sen Gupta, Shaolei Ren, Mohammad A. Islam. "Balancing Bits and Drops: Stress-Adjusted Water Management for Data Centers." **The 17th ACM International Conference on Future and Sustainable Energy Systems (ACM e-Energy 2026)**, Banff, Canada. doi:10.1145/3744255.3811726.
- **Zahidur Talukder**, Mohammad Rana, Keaton Hamm, Mohammad A. Islam. "Empowering Clients: Self-Adaptive Federated Learning for Data Quality Challenges." **IEEE EDGE 2025**.
- Md Jahangir Alam, Sultan Ahmed, Ismail Hossain, Sai Puppala, **Zahidur Talukder**, Sajedul Talukder. "SocialGuard: Bangla Text-Based Gender Identification for Enhancing Integrity in Social Networks." **IEEE COMPSAC 2024**.
- Ismail Hossain, Sai Puppala, Md Jahangir Alam, Sajedul Talukder, **Zahidur Talukder**. "SCALE: Self-Regulated Clustered Federated Learning in a Homogeneous Environment." **IEEE COMPSAC 2024**.
- Sai Puppala, Ismail Hossain, Md Jahangir Alam, **Zahidur Talukder**, Syed Bahauddin, Sajedul Talukder. "A Visual Approach to Tracking Emotional Sentiment Dynamics in Social Network Commentaries." **AAAI ICWSM 2024**.
- P. Gupta, M. Hossen, P. Li, S. Ren, **Zahidur Talukder**. "A Dataset for Research on Water Sustainability." **ACM e-Energy 2024**.
- Pranjol Gupta, **Zahidur Talukder**, Tasnim Abir, Phuc Nguyen, Mohammad A. Islam. "Enabling Low-Cost Server-Level Power Monitoring in Data Centers Using Conducted EMI." **ACM SenSys 2023**.
- Paul Agbaje, Afia Anjum, **Zahidur Talukder**, Mohammad Islam, Ebelechukwu Nwafor, Habeeb Olufowobi. "Fed-Cime: An Efficient Federated Learning Approach for Clients in Mobile Edge Computing." **IEEE EDGE 2023**.
- **Zahidur Talukder**, Mohammad A. Islam. "FedSRC: Efficient Federated Learning with Self-Regulating Clients." **ACM SIGMETRICS 2022**.
- **Zahidur Talukder**, Mohammad A. Islam. "Computationally Efficient Auto-Weighted Aggregation for Heterogeneous Federated Learning." **IEEE EDGE 2022**.
- **Zahidur Talukder**, Kazi Nishat, Md Shamim Reza. "A Comparative Study of Various Methods of Phasor Measurement Unit Algorithms." **ICASERT 2019**.
- Sajedul Talukder, Md. Iftekharul Islam Sakib, **Zahidur Talukder**. "Attacks and Defenses in Mobile IP: Modeling with Stochastic Game Petri Net." **IEEE ICCTCEEC 2017**.

- Sajedul Talukder, Md. Iftekharul Islam Sakib, **Zahidur Talukder**. "USenSewer: Ultrasonic Sensor and GSM-Arduino Based Automated Sewerage Management." **IEEE ICCTCEEC 2017**.

Posters and Workshop Publications

- **Zahidur Talukder**, Mohammad A. Islam. "Ensuring Data Quality and Hardware Sensitive Fairness in Federated Learning." **MLCommons Rising Stars 2024** (Poster).
- Pranjol Gupta, **Zahidur Talukder**, Mohammad A. Islam, Phuc Nguyen. "Towards Server-Level Power Monitoring in Data Centers Using Single-Point Voltage Measurement." **ACM SenSys 2022** (Poster).
- **Zahidur Talukder**, Mohammad A. Islam. "FedSRC: Efficient Federated Learning with Self-Regulating Clients." **ACM SIGMETRICS 2022** (Poster).
- **Zahidur Talukder**, Mohammad A. Islam. "FedASL: Auto-Weighted Aggregation Techniques for Federated Learning." **SCRF@UTA 2022**; Best Poster Award Honorable Mention.

Research in Progress

- **SAW-Fed: Stress-Adjusted Water-Aware Client Selection for Federated Learning under Statistical and Environmental Heterogeneity**. Ongoing research manuscript.
- **Zahidur Talukder**, Mohammad A. Islam. "Remote Access Attack for Active Sensors in Autonomous Vehicles." Manuscript in submission.

Research Funding and Grant Activity

- **Faculty-Student Summer Research Grant**, Texas Lutheran University, 2026. **Faculty Project Lead/Mentor**. Approx. **\$10,000**. Supports undergraduate research, faculty effort, and institutional summer housing for joint carbon- and water-stress-aware EV charging.
- **External research proposal in development (PI)**, planned 2026–2027 submission. *Stress-Adjusted Water Sustainability for Data Centers and AI Infrastructure*. Builds on my SAW research toward measurement, forecasting, on-site/off-site water provenance, GPU/workload flexibility, carbon-aware operation, and data-center/AI infrastructure decision-making.
- **Longer-term proposal direction in development**: *Trustworthy and Sustainable Federated AI*, integrating privacy-preserving distributed learning, robust/fair client participation, resource heterogeneity, and environmental sustainability; intended to mature into a broader externally funded research program.
- **Travel Grant**, IEEE EDGE 2025, \$1,500.
- **MLCommons Rising Stars Travel Support**, 2024, \$1,600.
- **I-Engage Graduate Mentor Scholarship**, 2024, \$2,000; 2023, \$2,000.
- **Travel Grant**, ACM/IEEE Supercomputing Conference (SC), 2022, \$1,800; **Travel Grant**, IEEE EDGE 2022, \$1,100.

Sponsored Research and Proposal Contributions

- Research/proposal contributor, NSF *Collaborative Research: DESC: Type I: A User-Interactive Approach to Water Management for Sustainable Data Centers: From Water Efficiency to Self-Sufficiency*; PI Mohammad A. Islam; \$299,957; 2023–2026.
- Proposal/manuscript contributor, NSF *Utilizing Conducted Electromagnetic Interference (EMI) for Low-Cost Server-Level Power Monitoring in Data Centers*; PI Mohammad A. Islam; Co-PI Phu V. Nguyen; \$400,000; 2022–2025.

Teaching and Curriculum Leadership

Texas Lutheran University – Assistant Professor

- **CSCI 379 Artificial Intelligence** (developer and instructor, Fall 2026): created and launched a new AI course covering intelligent agents, search, adversarial reasoning, constraint satisfaction, logic, uncertainty, machine learning, neural networks, NLP/LLMs, generative AI, and responsible AI. The course combines conceptual foundations with guided demonstrations, AI audits, verification activities, and a research-style group project.
- **AI curriculum leadership**: leading departmental planning to use CSCI 379 as a curricular foundation for a future AI minor and broader AI offerings in the Computer Science program.
- **CSCI 436 Computer and Network Security**: cryptography, software/hardware security, network security, security analysis, and research-oriented project work.
- **CSCI 332 Computer Networks**: layered network architectures, TCP/IP, routing, network services, and security-oriented applications.
- **CSCI 248 Object-Oriented Programming**: object-oriented design, software engineering principles, and programming practice.
- **STAT 374 Statistics**: descriptive and inferential statistics, probability, data interpretation, and computational exam-

ples.

- **CSCI 437 Senior Seminar and Research Project:** supervised six undergraduate capstone/research projects.

University of Texas at Arlington – Graduate Teaching Assistant

Algorithms and Data Structures; Quantitative Computer Architecture; Professional Practices; Topics in Computer Science; Introduction to Computer Science and Engineering. Responsibilities included labs, assessment design/grading, office hours, tutoring, course materials, and individualized student support.

Student Research Mentoring

- **STAIL Lab Supervisor, 2026–Present:** lead student research planning and mentoring across trustworthy AI, federated learning, sustainable computing, experimental evaluation, and research writing.
- **TLU Faculty-Student Summer Research Program, 2026:** Duncan Rene Jenkins and Morgan Grimm – carbon- and SAW-aware EV charging; supervised experiments, data analysis, visualization, research writing, and conference-paper development.
- **TLU CSCI 437 Senior Seminar, 2025–2026:** supervised six undergraduate students on independent research and capstone projects.
- **UTA I-Engage Graduate Mentor, 2023–2024:** mentored Areeb Khan and Edward Alkire on federated learning research; supported technical learning, implementation, and research development.
- **UTA LSAMP Summer Research Academy, 2022:** mentored undergraduate research on the social impact, privacy, and security of machine learning and AI.
- **OurCS@DFW Team Mentor:** mentored a computer-security team project that received a Best Team Presentation Award.
- **Summer High-School Research Mentoring:** introduced a student to machine learning and AI concepts including clustering, PCA/ICA, and tree-based methods.

Honors and Recognition

- **Machine Learning and Systems Rising Stars 2024,** MLCommons.
- **Best Paper Award,** ACM e-Energy 2024.
- **Best Poster Award Honorable Mention,** SCRF@UTA, 2022 and 2023.
- **Dean's Merit List Award,** BUET, 2017 and 2018.
- **Honorable Mention, Undergraduate Thesis Poster Competition,** Department of EEE, BUET, 2018.
- **Bangladesh Government Merit Scholarship, Secondary and Higher Secondary public exams,** 2011 and 2013.

Professional Service

- **Faculty Advisor,** ACM Student Chapter, Texas Lutheran University, 2025–Present.
- **AI curriculum development,** Texas Lutheran University, 2026–Present; leading planning for expanded AI coursework and a future AI minor.
- **Peer Reviewer:** ICLR 2025; NeurIPS 2024; ACM TOMPECS 2024 and 2026; Workshop on Online Abuse and Harms (WOAH) 2020 and 2024.
- **Organizer,** OurCS@UTA workshops, 2022–2024; Judge, UTA Innovation Day, 2023; Student Volunteer, SC22.

Invited Talks

- “Addressing Water Footprint for Growing AI,” MLCommons Rising Stars, NVIDIA Headquarters, Santa Clara, 2024.
- “Computationally Efficient Auto-Weighted Aggregation for Heterogeneous Federated Learning,” Massachusetts General Hospital / Harvard Medical School, 2022.
- “Ensuring Data Quality and Hardware Sensitive Fairness in Heterogeneous Federated Learning,” Ph.D. Lightning Talk, University of Texas at Arlington, 2023.

References

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