# Mahfuz Ahmed Anik

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## Education

**Industrial and Production Engineering**, *(2020 – 2025)*
*Shahjalal University of Science and Technology, Sylhet, Bangladesh.*
CGPA: 3.80; CGPA (last two semesters – 4-1 & 4-2): 3.93

## Research Interests

⇒ **Operations Research and ML-based Optimization:** Applying OR principles with ML-driven optimization across transportation, industrial, and healthcare systems, focusing on linking predictive models with optimization frameworks (including Linear and non-linear Programming, Mixed-Integer Linear Programming, Convex Optimization) to improve planning, scheduling, and resource allocation in real-world operational environments.

⇒ **AI and Machine Learning for Intelligent Transportation Systems:** Developing ML-driven approaches for passenger demand modeling, service reliability, and routing optimization, leveraging predictive modeling combined with agent-based decision systems for real-time transport operations.

⇒ **Digital Twins and AI/LLM-Agent Enhanced Manufacturing and Smart Systems Control:** Researching the integration of Digital Twins with Large Language Models (LLMs) and AI agents to enable intelligent automation and decision-making in manufacturing and production systems. Exploring smart system control through real-time data fusion, simulation, and predictive analytics in cyber-physical environments.

⇒ **AI-Powered Supply Chain Systems:** Focusing on intelligent optimization of logistics, inventory planning, and end-to-end supply chain operations using AI. Research includes demand forecasting, route and delivery optimization at the logistics level, disruption mitigation, and sustainability-driven decision-making in real-world supply chains.

## Experience

- **Research Assistant,** Computational Intelligence and Operations Laboratory (CIOL) *[Link]* Sept 2024 – Present
  A non-profit, community-driven virtual research lab advancing AI and ML applications in industrial systems, Digital Twin, and interdisciplinary domains. Engaged in machine learning and deep learning research, participating in international competitions. Currently working on projects in Agentic AI, healthcare, and Graph Neural Networks, while contributing to community outreach through seminars and workshops.
- **Industrial Attachment** Walton Hi-Tech Industries PLC *[Link]* May 2025
  Worked under the Process Development Department of the Electrical Appliance Products (EAP) Unit, focusing on manufacturing process optimization for LED lights, fans, and switch sockets.
  Gained hands-on experience in production line analysis, quality control systems, Lean tools (KANBAN, 5S, PDCA), and proposed data-driven process improvements aligned with industrial standards.
- **Content Representative (Part-time),** Shabash Fakibaj (LLC) *[Link]* Dec 2022 – January 2025
  A global educational organization supporting Bangladeshi students in pursuing graduate studies abroad through accessible guidance and resources.
  I assisted with the coordination of team schedules to ensure timely project delivery, and managed content planning and publishing for LinkedIn in alignment with the organization's outreach strategy.
- **Executive Member,** RoboSUST February 2020 – February 2021
  Participated in the SUST Robotics Club, gaining hands-on experience with Arduino and basic robotics, including a line-following robot competition and team-based projects.
- **Organizer,** Graduate Development Network (GDN-SUST) March 2020 – February 2021
  Contributed to organizing university-wide seminars and career development programs at SUST, coordinating communication among speakers, attendees, and organizing teams.

## Publications

MD Shafikul Islam, Mahfuz Ahmed Anik, Azmine Toushik Wasi, Dr. Mahathir Mohammad Bappy **Fracture Finder: Computer-Aided Real-Time Diagnosis of Vertebral Fractures in Thoracic Spine X-Rays Using YOLOv8 with Weighted Box Fusion and Augmentation Strategies**, Accepted in IISE Transactions on Healthcare Systems Engineering.

[**NAACL'25W**] Mahfuz Ahmed Anik, Abdur Rahman, Azmine Toushik Wasi, Md Manjurul Ahsan. **Preserving Cultural Identity with Context-Aware Translation Through Multi-Agent AI Systems**. LM4UC Workshop at NAACL 2025. [PDF] [Code]

[**NAACL'25W**] Mahfuz Ahmed Anik, Md. Iqramul Hoque, Wahid Faisal, Azmine Toushik Wasi, Md Manjurul Ahsan. **Akatsuki-CIOL@DravidianLangTech 2025: Ensemble-Based Approach Using Pre-Trained Models for Fake News Detection in Dravidian Languages**. DravidianLangTech Workshop at NAACL 2025. [PDF] [Code]

[**ACL'25W**] Md. Iqramul Hoque, Mahfuz Ahmed Anik, Abdur Rahman, Azmine Toushik Wasi. **CIOL at SemEval-2025 Task 11: Multilingual Pre-trained Model Fusion for Text-based Emotion Recognition**. SemEval Workshop at ACL 2025. [PDF] [Code]

[**ICLR'25W**] Azmine Toushik Wasi, Mahfuz Ahmed Anik. **Pathway-Attentive GAN for Interpretable Biomolecular Design**. ML for Genomics Explorations Workshop, ICLR 2025. [PDF]

[**ICLR'25W**] Azmine Toushik Wasi, Mahfuz Ahmed Anik, Riashat Islam. **Risks and Safety Considerations for Foundation Model-based Autonomous Agents' Interaction with the Environment**. Foundation Models in the Wild Workshop, ICLR 2025. [PDF]

[**NAACL'25W**] Md. Iqramul Hoque, Mahfuz Ahmed Anik, Azmine Toushik Wasi. **CIOLat CLPsych 2025: Using Large Language Models for Understanding and Summarizing Clinical Texts**. [PDF] CLPsych Workshop at NAACL 2025.

[**AAAI'25W**] Mahfuz Ahmed Anik, Abdur Rahman, Azmine Toushik Wasi, Md Manjurul Ahsan. **Social Impact of AI: Research, Diversity, and Inclusion Frameworks**. Short Papers and Posters Track, SIAI-ReDI 2025 at AAAI.[PDF]

[**CSCW'25P**] Wahid Faisal*, Azmine Toushik Wasi*, Drishti Sharma*, Mahfuz Ahmed Anik, Taki Hasan Rafi, Dong-Kyu Chae. **Knowledge Explorer: An Agentic AI Framework for Interactive, Personalized and Multilingual Learning Experience**. CSCW 2025 Posters (Track A). [PDF]

## In-Progress Studies and In–Review Submissions

Azmine Toushik Wasi, Mahfuz Ahmed Anik, MD Shafikul Islam, Abdulelah S. Alshehri. **GRAPHINE: Enhancing Spatiotemporal Supply Chain Forecasting Using Virtual Node-Augmented Graph Diffusion Recurrent Networks**, *In Review*, *International Journal of Production Research (IJPR)*. [PDF]

Mohsin Mahmud Topu*, Mahfuz Ahmed Anik*, Azmine Toushik Wasi, Md Manjurul Ahsan. **Graph-based Digital Twins for Pavement Health Monitoring and Maintenance**, *In Review*, *Innovative Infrastructure Solutions*,.

Azmine Toushik Wasi*, Mahfuz Ahmed Anik*, Abdur Rahman, Md. Iqramul Hoque, MD Shafikul Islam, MD Manjurul Ahsan. **Exploring Graph-based Digital Twins for Supply Chain Management and Optimization**, *In Review*, *Internet of Things* [PDF]

Mahfuz Ahmed Anik*, Azmine Toushik Wasi*, Abdur Rahman, MD Manjurul Ahsan. **Digital Twin-based Multi-Agent Framework for Understanding and Optimizing Smart Building HVAC Systems**, *In Review*, *Computers in Electrical Engineering* [PDF]

Mahfuz Ahmed Anik, Abdur Rahman, Azmine Toushik Wasi, Dr. Abul Mukid Mohammad Mukaddes. **SleepSense: Predicting and Optimizing Sleep Quality Using Machine Learning.**, *In Progress*.

Mahfuz Ahmed Anik*, Abdur Rahman, MD Shafikul Islam, Azmine Toushik Wasi, Md Manjurul Ahsan. **Digital Twin–Enabled Additive Manufacturing: A Systematic Review of Architectures, Integration Layers, and Operational Maturity**, *In Progress*,

Mahfuz Ahmed Anik, Azmine Toushik Wasi, Abdur Rahman, Md. Iqramul Hoque, Dr. Abul Mukid Mohammad Mukaddes. **Digital Twin-Based Traffic Management in Dhaka Using Deep Learning Object Detection**, *Under Review*

## Projects

1. **Simulation of a Super Shop Using Arena Simulation Software**
   Modeled a super shop using Arena simulation software and analyzed customer flow, service time, and checkout efficiency to optimize operational parameters.
2. **Operations Management in a Retail Shop: Quantity Discount Model and Safety Stock Analysis**
   Collected real-time data from a retail shop and applied quantity discount and safety stock models to improve inventory management and cost efficiency.
3. **Design and Development of SUST IPE Logo using Laser Beam Machining (LBM)**
   Designed and fabricated the official SUST IPE logo using LBM, showcasing precision manufacturing techniques and creative branding through machining.

## Technical and ML Modeling Skills

- **Languages:** Python, C, MATLAB
- **DS&ML Tools (Python):** NumPy, Pandas, Matplotlib, Seaborn, Scikit-learn, TensorFlow, PyTorch, LangChain, CrewAI
- **Data Science Techniques:** EDA, Experiment Design, Hypothesis Testing, Sampling, Data-Driven Decision Making
- **Machine Learning Techniques:** Statistical ML Methods, Deep Learning, NLP, Computer Vision, Graph Neural Networks (GNNs), Agentic Decision-Making, Agentic LLMs, AI Reasoning, RAG
- **Operations Research & Optimization:** LP, NLP, MILP, Convex Optimization, Discrete Optimization, Simulation Modeling, Gurobi

## Achievements

- 3rd Place at QCRE Data Challenge Competition (2025 IISE Annual Conference & Expo) [Link]
- Champion at Inter-Department Business Case Competition (IPE Association)
- Won 70% scholarship in ISCEA Global Supply Chain Case Competition 2023
- 2nd Runners Up, Sylhet Division Math Olympiad 2019 (Qualified for National Round)
- 9th Place, Sylhet Division Science Olympiad 2019

## Professional Development & Training

- Deep Learning (Interactive Track, 68 hours) – Neuromatch Academy, July 2025 [Link]
- Industrial Training (Two-Week) – Bangladesh Industrial Technical Assistance Center (BITAC), Chittagong
- Industrial Attachment (One-Day) – Khadim Ceramics Limited, Sylhet
- Winter ML Bootcamp (Six-Week) – Computational Intelligence and Operations Lab (CIOL)

## Reference

- **Dr. Abul Mukid Mohammad Mukaddes**, Professor, SUST, +8801777891684,mukaddes-ipe@sust.edu
- **Engr. Mohammed Abdul Karim**, Associate Professor, SUST, +8801717093510, karim-ipe@sust.edu
- **Dr. Md Manjurul Ahsan**, Research Asst. Professor, University of Oklahoma, ahsan@ou.edu