Meftah Uddin

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Personal Website: Meftah Uddin   **Other Weblinks:** GitHub, Google Scholar

SUMMARY

Specializing in machine learning and large language models (LLMs) for energy systems, I have developed AI-driven tools for HVAC analysis using EnergyPlus, fine-tuned LLMs (QLoRA) for text-to-IDF generation, and created a multilingual RAG system for extracting domain-specific insights. My work includes applying LSTM for energy forecasting and XGBoost for digital twin modeling. With deep expertise in HVAC systems, building energy modeling, and sustainable design, I have conducted 40+ energy audits, identifying $6.2M+ in savings and reducing 100M+ lbs. of CO_2.

EDUCATION

PhD Mechanical and Aerospace Engineering, University of Missouri-Columbia, CGPA: 3.92	**Aug 2021- present**
MS Mechanical and Aerospace Engineering, University of Missouri-Columbia, CGPA: 3.89	**July 2024**
BS Mechanical Engineering, Bangladesh University of Engineering & Technology (BUET), CGPA: 3.54	**Feb 2017**

Skills: Design of Experiment (DoE), LLM Fine-tuning, Prompt Engineering, Statistical Analysis (ANOVA, Regression, Optimization etc.), Machine Learning, Financial Analysis, Time Series Analysis.

EXPERIENCE

Graduate Research Assistant, University of Missouri-Columbia   **Aug 2021 - present**

- Developed AI-driven methods for HVAC energy analysis using EnergyPlus and Machine Learning.
- Fine-tuned small LLMs using QLoRA for text-to-IDF code generation.
- Implemented Multilingual RAG for domain-specific knowledge extraction.
- Dataset creation for implementing RAG pipeline and finetune small LLM models.
- Applied ML techniques for time series (LSTM) energy forecasting and Digital Twin (XGBoost) implementation.

Energy Auditor, Midwest IAC, Columbia, Missouri   **Sep 2022 - present**

- Conducted 40+ industrial and commercial energy audits, serving as lead auditor on 16+ projects.
- Evaluated facility utility use (electricity, gas, water, HVAC, lighting, wastewater) and conducted on-site measurements.
- Recommended energy conservation measures with ROI analysis, projected savings, and carbon reduction metrics based on ASHRAE Level II standards.
- Provided clients with practical roadmaps to improve efficiency and integrate renewable systems.

Graduate Teaching Assistant, University of Missouri-Columbia   **Jan 2023 - present**

- MAE 3800: Instruct and evaluate around 100 students in both Fall and Spring semester for Instrumentation and Measurement lab. Key Experimental Devices: Oscilloscope, Digital Multimeter, Function Generator, Operational Amplifier, Soldering, etc.
- MAE 7001: Teach building energy simulation, compliance study with ASHRAE 90.1 for energy, ASHRAE 55 for thermal comfort, and ASHRAE standard 62.1 for ventilation requirement during Fall semester.

Assistant Engineer, Sirajganj 225x3 MW CCPP (NWPGCL), Bangladesh   **Jul 2018 - Aug 2021**

- Certified CCPP Operations Engineer with 1000+ hours of Gas and Steam Turbine operation.
- Maintained and troubleshot Gas Turbines (Siemens SGT5-2000E), Steam Turbines, HRSG, Compressed Air Systems, Nitrogen Generation Systems, and Water Treatment Plants.
- Managed procurement of spares, tools, and consumables; assisted in Annual Procurement Plan execution.
- Led Major Overhaul of Steam Turbine (HRSG leak test, X-ray and Dye Penetration tests of turbine rotor and blades).
- Conducted Minor Inspection of Gas Turbine (borescope inspection, Dye Penetration tests of combustion chamber).

TECHNICAL PROFICIENCIES

Programming Language: Python, Ruby, MATLAB, R.
Data Analysis & Visualization: Excel, Power BI, R, SQL and Python.
Cloud Platforms: Google Cloud Platform, Kubernetes, Docker.
HVAC Energy Simulation: Grasshopper-Ladybug and Honeybee with Open Studio (Energy Plus), BEopt.
Drawing and Design Tool: SOLIDWORKS, AutoCAD 2D, Rhino, Revit.
CFD Simulation: ANSYS Fluent.

MASTER'S THESIS

Smart strategy for building energy efficiency: Integrating occupancy-based HVAC control and machine learning prediction.
DOI: 10.13140/RG.2.2.14818.34241

- Implementing occupancy-based control (OBC) for ventilation rate and temperature setpoints/setback can save up to 26% energy consumption in campus building.
- Neural network based timeseries forecasts facilitate demand prediction and tuning HVAC schedules.

PROJECT EXPERIENCE

OpenStudio Measure Development

- Developed and contributed five energy modeling measures, for example: AddPCMtoEnv and AddSolarPVT, to the OpenStudio ecosystem, enabling users to simulate phase change materials (PCM) and solar photovoltaic-thermal (PVT) systems in building energy models. Measures are published on the NREL Building Component Library (BCL) and available on GitHub under Openstudio_Measures_meftah for public use and collaboration.
- AddPCMtoEnv allows users to create custom materials with phase change properties and integrates them into EnergyPlus IDF files for simulation.
- AddSolarPVT facilitates the addition of PVT systems to air-loop outdoor air systems or plant loops, enhancing renewable energy modeling capabilities.

Statistical Analysis of building energy use intensity (EUI)

- The energy use intensity (EUI) between commercial and residential building among five cities in the United States are statistically compared using dataset from BPD website.

Net Zero Building Design

- To design a baseline residential building model complying with ASHRAE Standard 90.1.2016 using perspective path.
- Addition of renewable source to the baseline model to ensure NetZero building.

PUBLICATIONS

- Uddin, M., Virk, A. S., and Park, C. (August 29, 2023). "Natural Convection in the Melting of Phase Change Materials in a Cylindrical Thermal Energy Storage System: Effects of Flow Arrangements of Heat Transfer Fluid and Associated Thermal Boundary Conditions." ASME. J. Thermal Sci. Eng. Appl. November 2023;15(11): 111010. https://doi.org/10.1115/1.4063045
- JB Kim, F Wang, … Uddin, M. "Digital Twin Framework for Smart Campus to Reduce Greenhouse Gas Emission." Accepted, 2023 IEEE Smart World Congress (SWC) https://doi.org/10.1109/SWC57546.2023.10448799.
- Uddin, M., Aman, J., JB Kim. "A Digital Twin Framework for Carbon Emission Monitoring and Building Operation Feedback." Accepted in CAADRIA25

AWARD

- First Prize in poster presentation, Engineering & Science, Show Me Research Week **Apr 2024**

CAMPUS INVOLVEMENT

President, Bangladesh Student Association (BSA), University of Missouri **Sep 2023 – Sep 2024**
Department Representative, Graduate Professional Council (GPC), University of Missouri **Aug 2023 – Sep 2024**