

Data Science Plan

Project Title: Evaluating HVAC Efficiency in the Ashraf Islam Engineering Building (AIEB)

Institution: Tennessee Technological University

Team Members

- **Samuel Hartmann** (@Hartmann, Samuel – slhartmann42)
- **Fengjun Han** (@Han, Fengjun – fhan43)
- **Garrett Green** (@Green, Garrett – ggreen42)
- **Dalton Sloan** (@Sloan, Dalton – dwsloan42)

Domain Experts

- **Chandler Norman**
- **Norman Walker**
- **Elisabeth Humphrey**
- **Dr. Steven Anton**

Problem

The Ashraf Islam Engineering Building (AIEB) at Tennessee Tech is equipped with a comprehensive network of sensors that continuously monitor HVAC system performance, including environmental conditions and system operation metrics. While these sensors generate substantial volumes of data, the information is not routinely analyzed to evaluate HVAC efficiency or identify potential performance issues.

The objective of this project is to analyze AIEB sensor data to assess the operational efficiency of the building's HVAC system under real-world conditions. The project will focus on identifying inefficiencies

such as inconsistent zone control, over-conditioning, and excessive equipment runtime. By combining quantitative data analysis with expert knowledge of HVAC system design and operation, the team aims to produce actionable, data-driven insights that can inform future optimization efforts.

Guidance from domain experts **Chandler Norman, Norman Walker, Elisabeth Humphrey, and Dr. Steven Anton** will be incorporated throughout the project to ensure that analytical choices and conclusions align with engineering realities and system constraints.

Schedule / Plan

The project will be executed in clearly defined phases aligned with course deadlines.

Phase 1: Data Acquisition and Context Development

Late February – Early March

- Collect and organize available AIEB HVAC sensor datasets
- Identify sensor locations, types, and data characteristics
- Consult domain experts to understand system architecture and operational expectations
- Define efficiency metrics and evaluation criteria

Phase 2: Data Cleaning and Exploratory Analysis

Early – Mid March

- Address missing values, sensor noise, and data inconsistencies
- Synchronize time-series data across multiple sensors
- Engineer relevant features (e.g., temperature differentials, runtime indicators)
- Conduct exploratory data analysis to identify trends and anomalies

Phase 3: Efficiency Evaluation and Modeling

Mid – Late March

- Apply statistical and/or machine learning methods to assess HVAC efficiency
- Compare observed system behavior across zones and operating conditions
- Validate findings with domain experts

Abstract Due: March 23

Phase 4: Results Interpretation and Visualization

Late March – Early April

- Refine analysis based on expert and instructor feedback
- Develop clear, interpretable visualizations
- Translate technical results into insights suitable for a poster audience

Phase 5: Poster Development and Finalization

Early – Mid April

- Design and assemble the project poster
- Review content for clarity, accuracy, and professionalism

Poster Due to Dr. Eborle: April 13

Final Poster Due: April 20