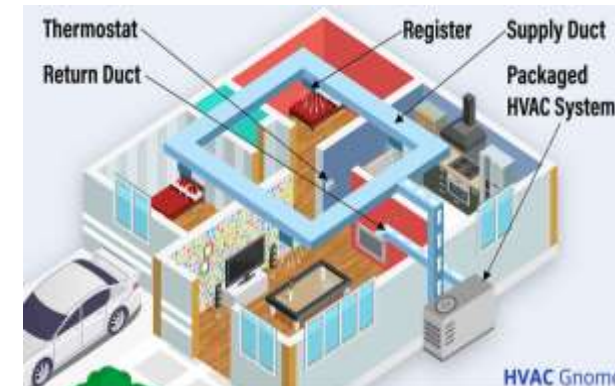
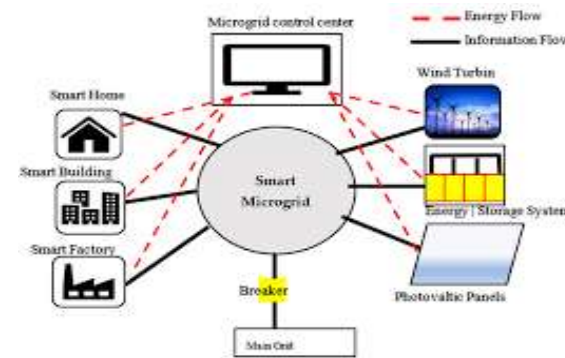
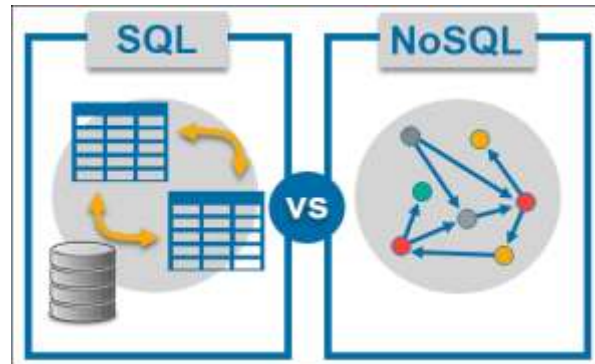


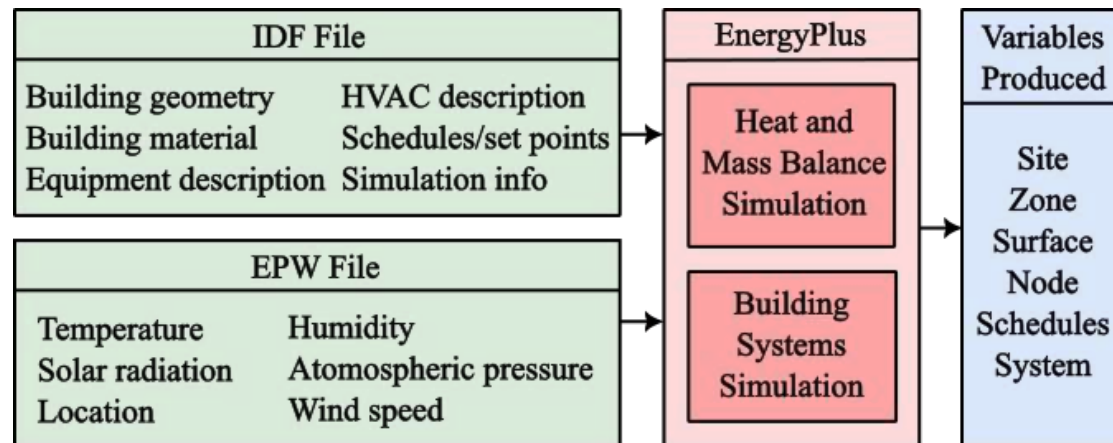
Exploratory Analysis of EnergyPlus Simulation Data with Database Management and Web-Based Visualization

Athul Jose P and Kunal Shankar

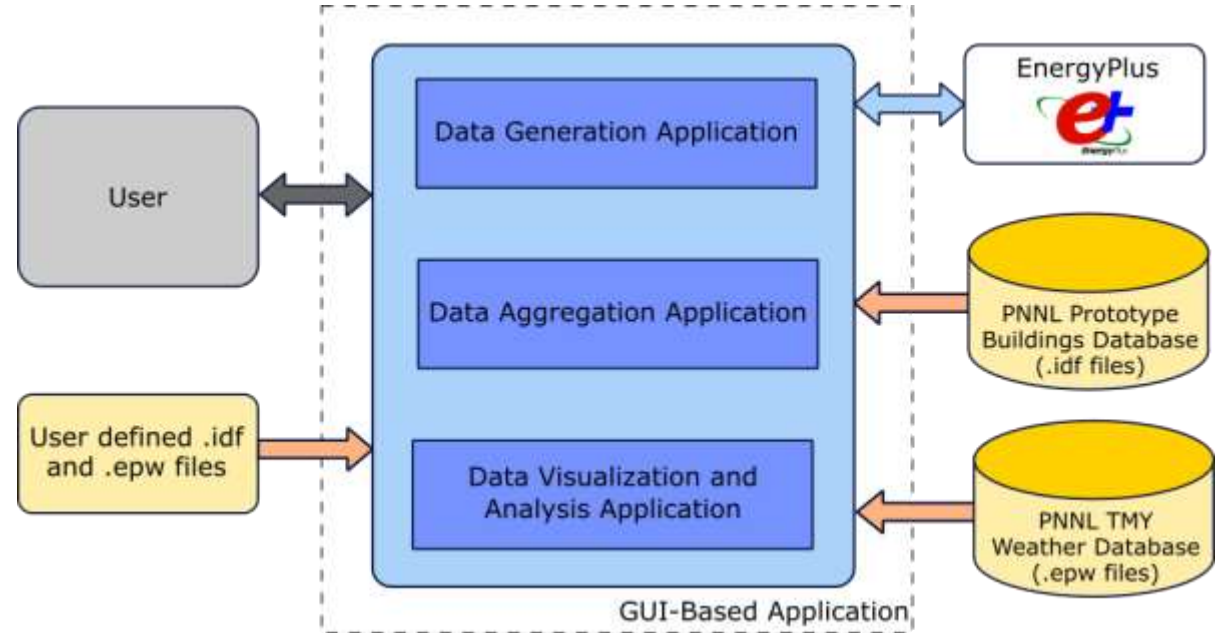
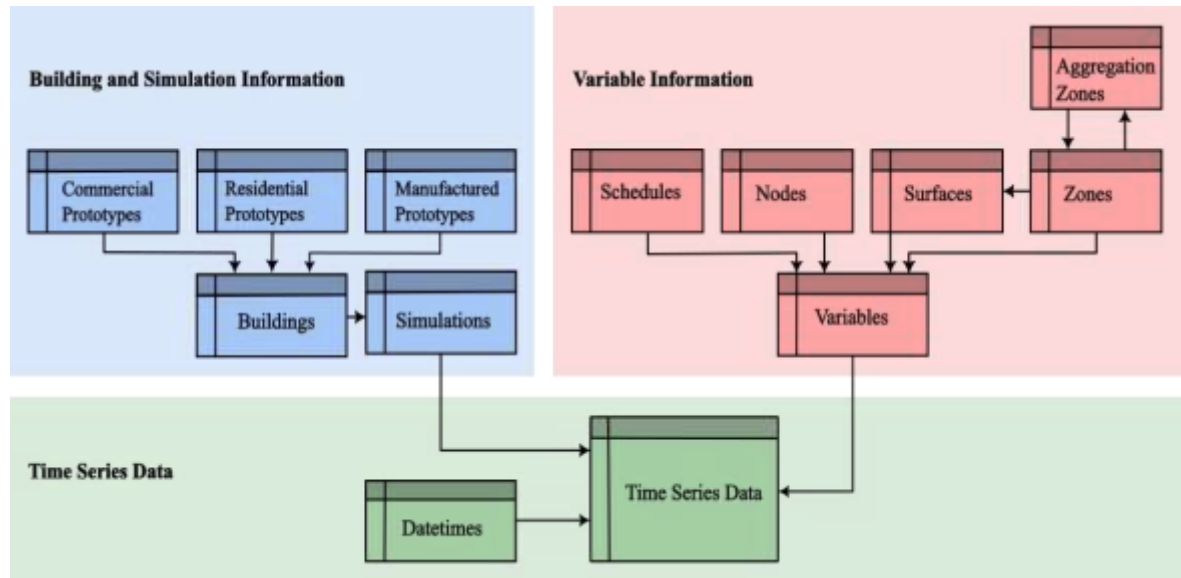


BACKGROUND and MOTIVATION

- Buildings account for over 40% of electricity consumption in the U.S. Modeling buildings for power system optimization is critical
- Our project leverages a prototypical dataset from Pacific Northwest National Laboratory (PNNL), rich in building and weather data.
- EnergyPlus developed by PNNL is used to simulate the buildings and generate data to study the performance
- EnergyPlus is a high-value simulation tool, providing detailed insights into building energy consumption and HVAC performance across various zones within the building.



EnergyPlus Simulations and Data Management

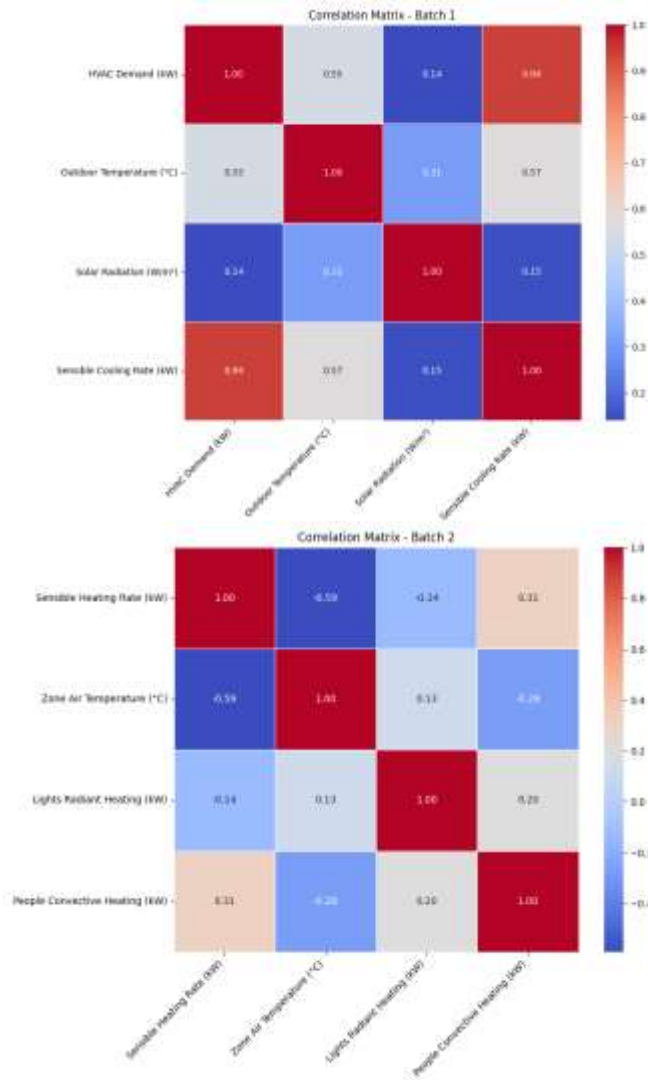


- To manage the volume and complexity, NoSQL databases provide efficient and flexible storage solutions.
- The goal is to create a web app for interactive analysis, enabling visualization of energy performance across climate zones and schedules.

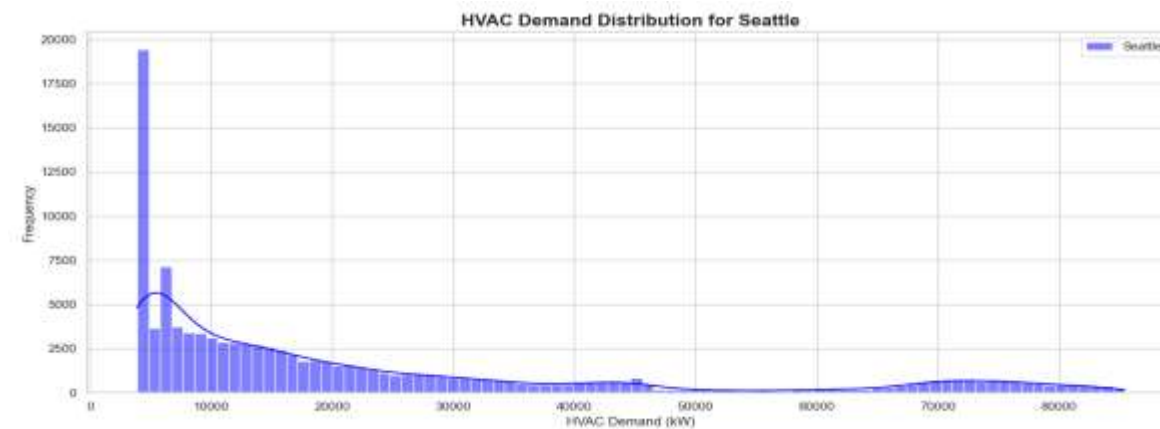
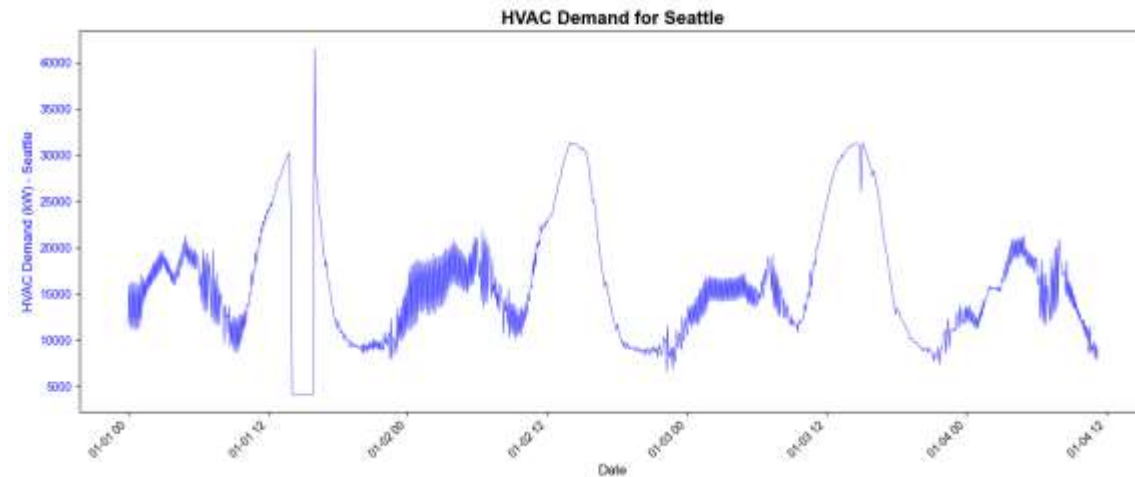


Exploratory Data Analysis

Correlation Matrix



Time Series Plot



Histogram



WEB-APP VISUALIZATION

EnergyPlus Simulation Management Tool

☐ Continue Session
☒ Upload File

Upload Picked Variable File
 Upload EIO File

☐ Presetted Variables
☒ Custom Variables
 Presetted Variables:
 Select custom variables:

Zone Data
 (CORE_ZN)

☒ Aggregate to row
☐ Custom Aggregation
 Input Custom Aggregation Zone (id this space only "1" and "2" for aggregation)

Type of Aggregation
 Average

EnergyPlus Simulation Management Tool

Simulation_1
☒ Our Database
☐ Your Files

Time Step:
 Simulation Run Period:
 1/1 → 12/31
 Simulation Reporting Frequency: timestep

Select Custom Variables:
☒ Electric Equipment Electric Power
 Presetted variables:

☐ Presetted Variables
☒ Custom Variable Selection
☐ Edit Schedules
☒ Keep Original Schedules
☒ Simulation Variables
☒ EIO

Building Type
 Commercial Prototype
 Sub Level 1
 ASHRAE
 Sub Level 2
 90.1_2003
 Sub Level 3
 ASHRAE189.1-OfficeSmall-STUD101_SouthEast
 Location
 USA_WA_Seattle-TecomaInLAR.22PER3_T1

EnergyPlus Simulation Management Tool

Data Source
☒ Continue Session
☐ Upload File

Data to be selected
☐ Generated Data
☐ Aggregated Data
☒ Both

Data Range from Uploaded File:
 1/1/1/2020 → 12/31/2020
 Select Date Range for Visualizations:
 1/1/1/2020 → 12/31/2020

Select Variable:
 Generated Data
 Surface Inside Face Temperature
☒ ATTC_FLOOR_CORE Surface Inside Face Temperature (CCTimeStep)

Aggregated Data
 Zone Air Temperature
☒ Aggregation_Zone_1

Distribution Plot:

Legend:

- ATTC_FLOOR_CORE Surface Inside Face Temperature (CCTimeStep)
- Aggregation_Zone_1

Scatter Plot:

Legend:

- ATTC_FLOOR_CORE Surface Inside Face Temperature (CCTimeStep)
- CORE_IN_WALL_WEST Surface Inside Face Temperature (CCTimeStep)
- PERIMETER_ZN_1_WALL_SOUTH Surface Inside Face Temperature (CCTimeStep)
- PERIMETER_ZN_2_WALL_EAST_WINDOOR Surface Inside Face Temperature (CCTimeStep)
- PERIMETER_ZN_3_WALL_NORTH_WINDOOR Surface Inside Face Temperature (CCTimeStep)
- PERIMETER_ZN_4_FLOOR Surface Inside Face Temperature (CCTimeStep)
- Aggregation_Zone_1 Zone Air Temperature

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