

# Visualization Term Project

20141087 Ryeongyang Kim

20161206 Jaewoong Lee

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# 1 Introduction

## 2 Materials

### 2.1 Building Layout

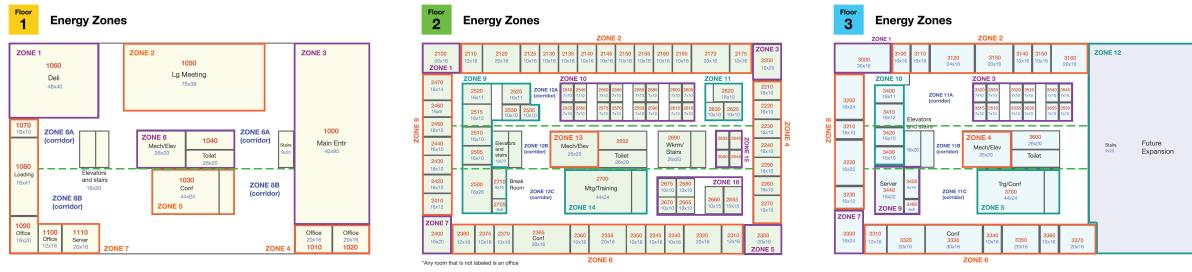
#### 2.1.1 Basic



(a) First Floor (b) Second Floor (c) Third Floor

Figure 1: Main Layout of the building

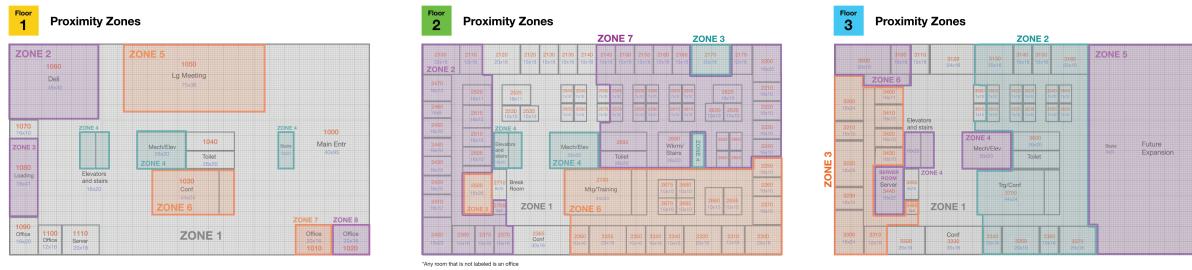
The main layout of this building is as figure 1.



(a) First Floor (b) Second Floor (c) Third Floor

Figure 2: Energy Zone of the Building

The energy zone of this building is as figure 2.



(a) First Floor (b) Second Floor (c) Third Floor

Figure 3: Prox zone of the Building

The prox zone of this building is as figure 3.

## 3 Methods

### 3.1 Scikit-learn: Machine Learning in Python

*Scikit-learn* is a Python module integrating a wide range of state-of-the-art machine learning algorithms for medium-scale supervised and unsupervised problems [1].

### 3.2 Matplotlib

*Matplotlib* is a Python 2D plotting library which produces publication quality figures in a variety of hardcopy formats and interactive environments across platforms [2].

### 3.3 Pandas

*Pandas* is a Python library of rich data structures and tools for working with structured data sets common to statistic, finance, social sciences, and many other fields [3].

### 3.4 SciPy

*SciPy* is a Python-based ecosystem of open-source software for mathematics, science, and engineering [4].

### 3.5 TSNE

T-distributed Stochastic Neighbor Embedding (TSNE) is a machine learning algorithm for visualization high-dimensional data in a low-dimensional space [5].

## 4 Results

- 4.1 What are the typical patterns in the prox card data? What does a typical day look like for GAStech employees?
- 4.2 Describe up to five of the most interesting patterns that appear in the building data. Describe what is notable about the pattern and explain its possible significance.

First of all, we drew the distribution of the building data using TSNE technique. The TSNE plot of general building data is shows as figure 4.

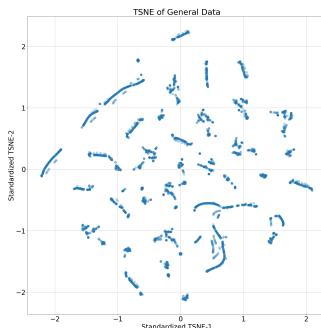


Figure 4: TSNE Plot for General Building Data

To find patterns which appear in the building data, we should find that normality/abnormality in the building data. To find abnormality, we used these four algorithms which are included in scikit-learn: *EllipticEnvelope* [6], *OneClassSVM*, *IsolationForest* [7, 8], and *LocalOutlierFactor* [9].

- 4.3** Describe up to five notable anomalies or unusual events you see in the data. Prioritize those issue that are most likely to represent a danger or a serious issue for building operations.
- 4.4** Describe up to three observed relationships between the proximity card data and building data elements. If you find a causal relationship, describe your discovered cause and effect, the evidence you found the support it, and your level of confidence in your assessment of the relationship.

## 5 Discussion

## References

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