**Overview**

**Sensors for Measuring Utilization**

One of the fundamental challenges in real estate is understanding how many people should occupy a space. There is a balance between having too many, which is unproductive because of distraction or inability to find a space, or too few, which is unproductive because the space feels like a ghost town. At a fundamental level, this utilization question can be measured based on the number of people, the number of rooms, and the number of seats. This can also be used, indirectly, to understand the way groups use a space to understand productivity.

Increasingly, organizations are beginning to rely on sensor technologies to monitor their space utilization continuously – rather than periodically. This is a significant shift. Many organizations monitor utilization through assigning an individual to a seat that might be used as a metric as people join or leave a company. Organizations with more robust monitoring might check badge ins – who showed up to the space on a given day. Almost all narratives around space utilization as measured or monitored by companies is based on this ‘static’ and incomplete view.

Utilization is the primary or underlying measure for many important fields that are developing rapidly. It prompts questions about building energy usage through heating and cooling demands. It relates to questions of building security and supplies (how much to order for the group lunch?). It also connects to questions of productivity. For example, does a company or team collaborate in large groups or small? Does collaboration happen in open areas or behind closed doors?

**Part 1: Data from Sensors**

There are many providers of physical sensors that collect the raw data, typically some form of binary to record physical presence. While many sensor providers have standardized dashboards, none have leveraged the potential of the information being collected.

The first part of the project is to take a sample set of data and determine the best way to organize the information. This will include cleaning the information to the most useful format and determining a functional level of detail. For example, what is the increment of time that is meaningful – every second, every minute, every hour? Is there a useful way to test the dataset for its amount of noise or data that has likely been collected in error? Additionally, understanding the minimum number of transformations of the needed to create the output should also be understood. Once a methodology has been determined – datasets from different sensor providers will be introduced to understand the ease of collecting information from multiple inputs to generate the same export.

**Part 2: Visualization**

We are open to exploring new ways to visualize the collected information. A group may want to take the discussion towards actionable metrics or a group may want to take the discussion towards visualizing information in 2D/3D space within a building (floor plans, building plans at scale). Either or both would be worthwhile explorations.

This portion of the project would begin with a review of existing “dashboards” or summary visualizations of sensor data. Subsequently, a web-based portal for viewing the information will be created. The tools used for creating the interactive visuals will be at the discretion of the group (R, Python, D3, JS.) While the number and type of visualizations will be determined over the course of the project, at a minimum histograms, time series, spaghetti diagrams, distribution functions, and density functions are anticipated.