

Dataset Description

I. DATASET CONSTRUCTION

This dataset originated from the data collected from an office building in Melbourne, stored in the DCH database and constructed using Brick. We collect the data points stored in the model and apply them to the most current versions of the building ontologies: Brick Schema (abbr. Brick) v1.2, RealEstateCore (abbr. RECore) v3.3, Project Haystack (abbr. Haystack) v3.9.7 (referred to Version 4 in marketing material) and Google’s Digital Buildings (abbr. DigitalBuildings) v0.0.1. The namespaces used are shown in Table I.

TABLE I
BUILDING ONTOLOGIES AND NAMESPACES

Ontology	Namespaces
Brick 1.2	https://brickschema.org/schema/Brick#
RECore 3.3	https://w3id.org/rec/core/
Haystack 3.9.11	https://project-haystack.org/def/ph/3.9.11#
DigitalBuildings 0.0.1	http://www.google.com/digitalbuildings/0.0.1#

We also evolve these data points to ensure each category contains various types of individuals. For the equivalent classes within one ontology (e.g., Break_Room and Breakroom in Brick), we only create one individual instance. For the synonym classes across building ontologies (e.g., Hallway in Brick and Atrium in RECore), we have a mapping process and create the same named individual in each ontology. For these individuals cannot find an exact subclass (e.g., the zone temperature sensor in Haystack), we categorise them into the super class (e.g., sensor).

II. CONCEPT CONVERGE

1) *Building Space*: The concept of building spaces is twofold: spaces surrounding the building and spaces within the building. For spaces surrounding the building, we capture the geographical information (e.g., region, site) and outside facilities (e.g., barbeque area and surface parking). The spaces within the building include physical space (e.g., floor and room) and logical spaces (e.g., HVAC zone). Note that the definition of the room is generalised and also includes common spaces (e.g., hallway, lobby and lounge). Based on the levels of detail in nature, rooms are categorised into different super-classes and subclasses. For example, Room B.100, 1.112 and G.120 are categorised into Room (unspecified), Office (semi-specified) and Enclosed_Office(specified) classes respectively. A room is usually assigned to an HVAC zone. In particular, Room B.116 is a service room and does not belong to any HVAC zone. The number of data points in the building space captured: building (1), building environment (5), floor (3), room (69) and HVAC zone (18).

2) *Building Equipment*: The majority of the building equipment captured is the HVAC equipment. We include five types of HVAC equipment: air handling unit (AHU), fan coil unit (FCU), air conditioner (AC), exhaust fan and fresh air fan. HVAC is a large unit responsible for air discharging, filtering, heating and cooling. The basic components include supply fan, return damper, outside damper, filter, heating/cooling valve and coil. FCU is a smaller unit that only ventilates the internal air in the building; therefore, the outside damper is excluded. AC only has supply fan, heating/coiling valve and coil to provide heating and cooling functions. The exhaust fan is installed in rooms that require additional air discharge (e.g., server room and kitchen), while the fresh air fan is used for rooms that require additional air supply (e.g., conference room and enclosed office). Note that based on the level of air ventilation requirement, one room may have multiple devices (e.g., Room G.112 is an office kitchen and has two exhaust fans). We also modelled other related equipment in the building. The number of data points captured in building equipment: AHU (5) and related components (40), FCU (7) and related components (35), AC (8) and related components (40), exhaust fan (5), fresh air fan (4), pump (1), boiler (1) and chiller (1), weather station (1), gas meter (1) and fire panel (1).

3) *Building system*: The building systems contain a centralised energy management system and three dependent sub-systems: the chilled water system, the hot water system, and the domestic hot water system. The data collected from the sub-systems is uploaded into the energy management system. The energy management system does not contain any building equipment and is only for data analysis. Air ventilation systems usually include damper, filter, heating/cooling coil and supply fan. (Domestic) hot/chilled water systems include boiler/chiller, pump, heating/cooling valve and coil. Note that heating/cooling coils are the shared components across these three sub-systems.

4) *Building Things*: Building things refers to IoT mounted or installed in a building space, equipment or system. We provide a wide range of building things operating for different purposes, including alarm, command, parameter, sensor, setpoint and status. Most of the alarm points appear in the fire panel, while setpoint and status are related to the system and sub-systems. Command, parameter and sensor points can be seen in all kinds of building entities (e.g., building space, equipment and system). These building things measure a wide range of building information and provide useful data for building information management (BIM). The classification of building things is different in different building ontologies. Based on the functions and outputs, we map the same individuals into the corresponding classes.