



Brains4Buildings Open Knowledge Platform

Practical insights into data in the built environment for the wider community

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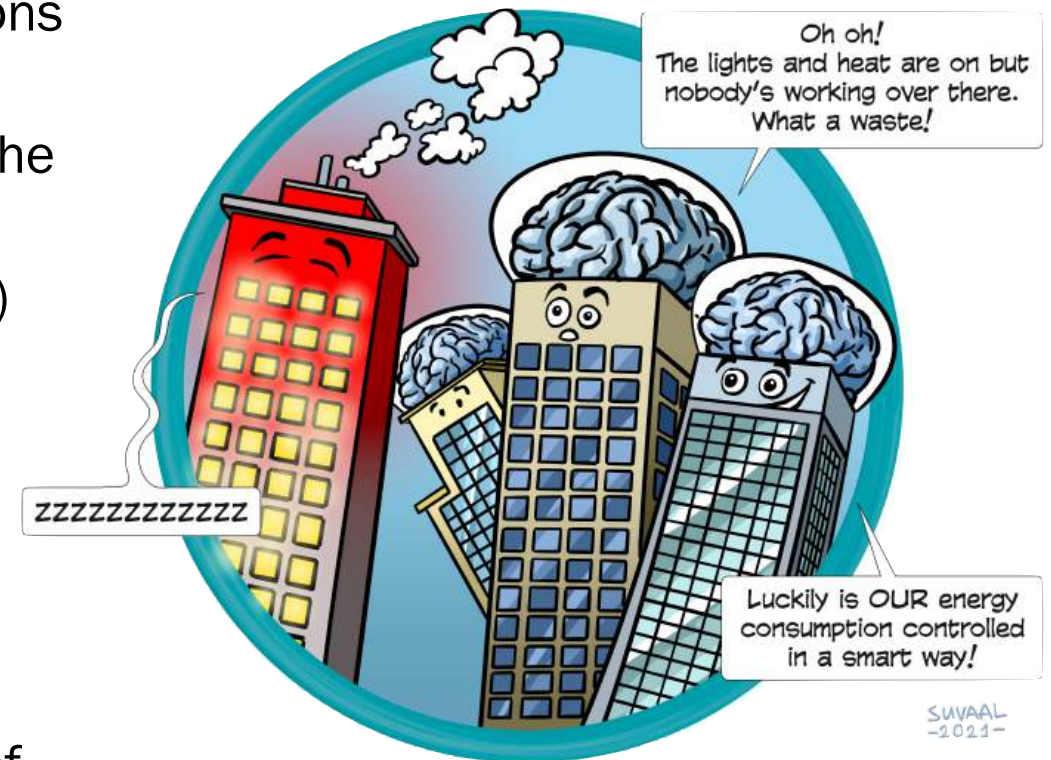
20 February 2025



Background

Motivation

- Even in the most modern buildings,
 - **10–30 % energy is lost** due to faulty installations or incorrect use of systems
 - the **indoor climate is often substandard** and the operational costs are high.
- More affordable sensors and Internet of Things (IoT) technologies, enable the monitoring, collection, and storage of a **huge amount of data from building energy systems**
- New data science technologies might bring many **technical challenges**
- ...but also raise very significant **educational challenges** for professionals who work in the field of energy management systems

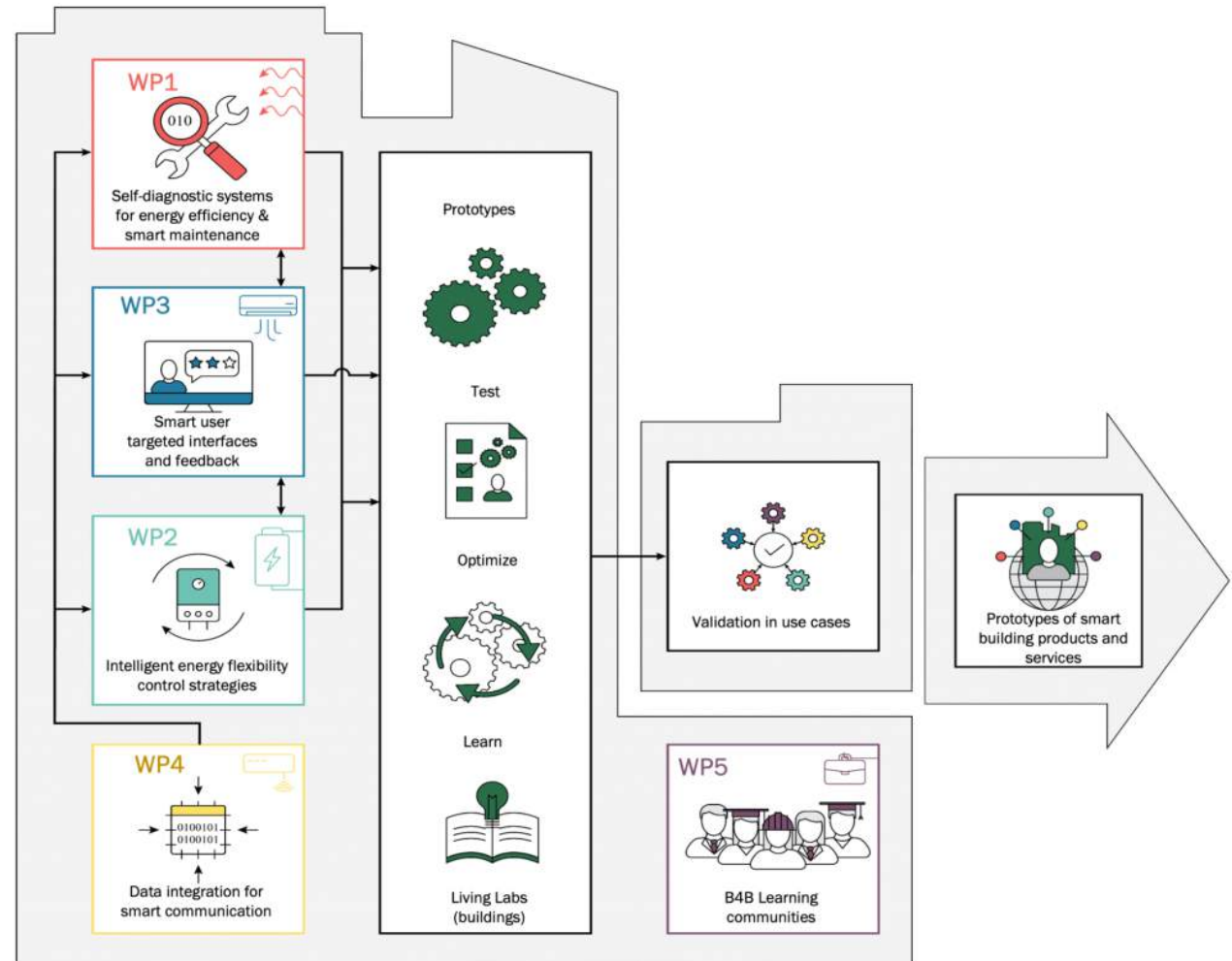


Brains4Buildings

Methods to harness **big data** from smart meters, building management systems and IoT devices to **reduce energy consumption**, **increase comfort**, **respond flexibly** to user behavior and local energy supply and demand, and save on installation **maintenance costs** through the development of faster and more efficient **Machine Learning and Artificial Intelligence** models and algorithms

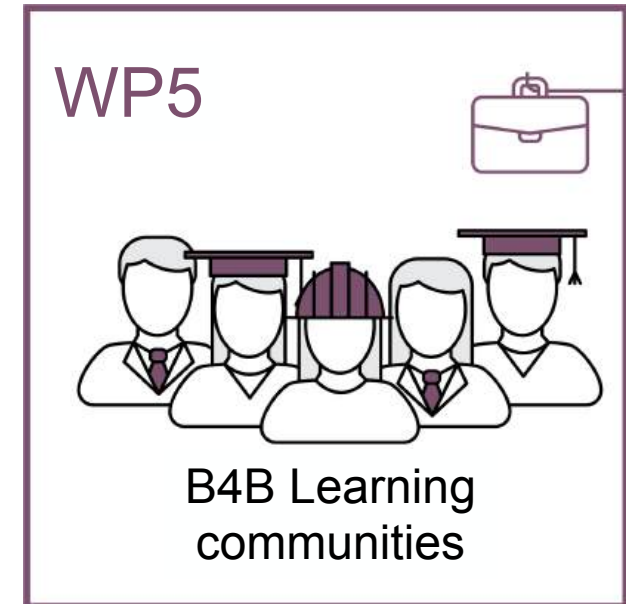
B4B: Key Figures

- 39 partners
- Coordination by TU Delft
- 5 Working Packages
- Living Labs, Use & validation cases
- 6.9 Million Funding from Dutch Ministry of Economic Affairs & Climate
- Start: May 1, 2021
- Duration: 4 years



B4B Learning Community

The B4B learning community encompasses various activities

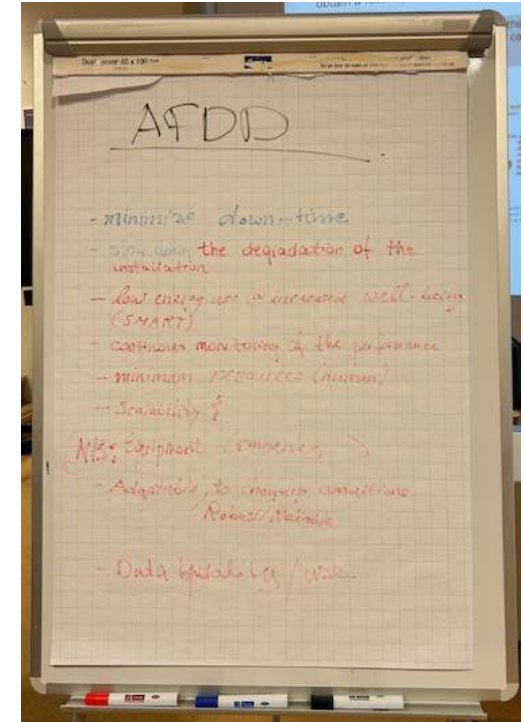
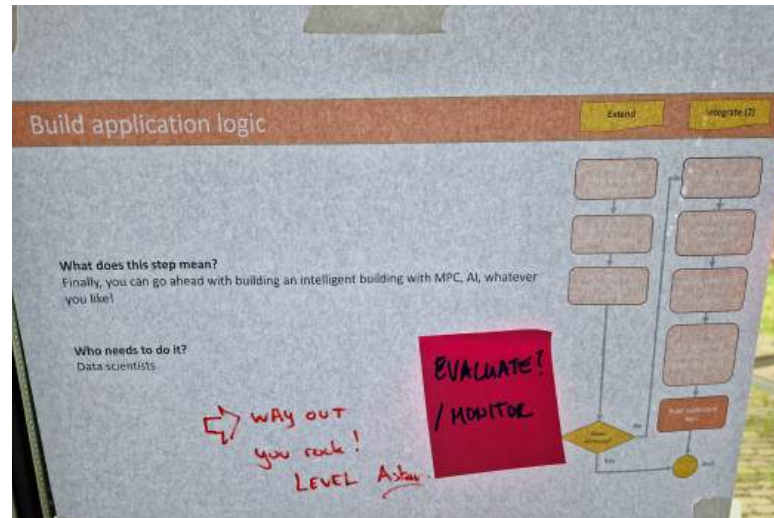
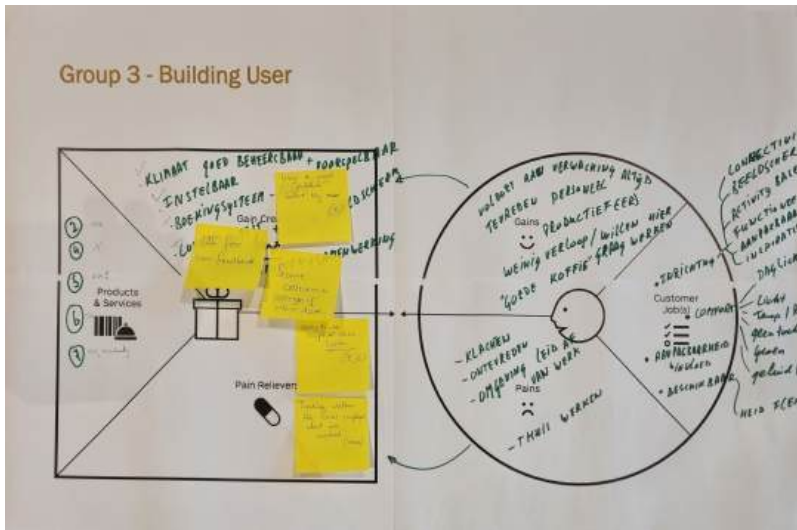


B4B Learning Community

The B4B learning community encompasses various activities

1. Consortium meetings:

- 39 project partners (60–70 people)
- presentations and workshops



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2. B4B webinar series:

- online, one-hour presentations open to the public
- broad (international) audience

A promotional graphic for a BRAINS4BUILDINGS webinar. The background is a modern glass building with a network of blue nodes and lines overlaid. The text is in white and yellow. At the top left, it says "BRAINS4BUILDINGS WEBINARS" in large letters. Below that, it says "Monthly webinars on smart buildings energy systems". The main title is "Brains4Buildings Open Knowledge Platform: Practical insights into data in the built environment for the wider community". The date and time are "20.02.2025 | 16.00 - 17.00 CET | ONLINE". There is a small circular portrait of Martin Mosteiro Romero, a "Principal researcher: Architectural Engineering and Technology at TU Delft". At the bottom right, there is a yellow "JOIN" button with a hand cursor icon. Social media icons for LinkedIn, Facebook, and Twitter are at the bottom right.

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<https://brains4buildings.org/learning-community/>

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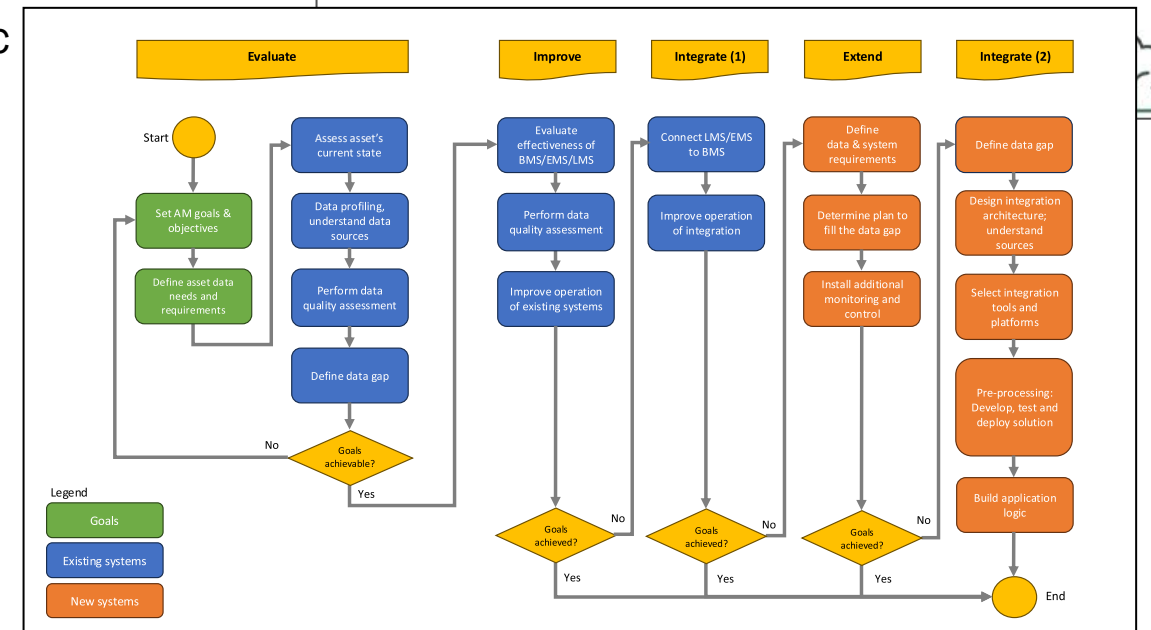
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3. Roadmap for leveraging Smart Buildings

Roadmap for leveraging Smart Buildings

A practical roadmap for achieving asset management goals through data-driven building solutions



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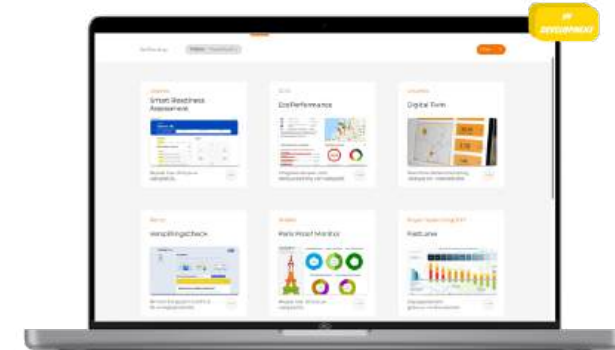
3. Roadmap for leveraging Smart Buildings

4. DGBC knowledge hub

Online dictionary



Toolbox for CO₂ reduction



Learning tracks





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3. Roadmap for leveraging Smart Buildings

4. DGBC knowledge hub

5. Open knowledge platform

TU Delft TransACT01
Brains4Buildings Open Knowledge Platform

Course Dates

Brains4Buildings Open Knowledge Platform

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- ✓ Section 1: Introduction +
- ✓ Section 2: For data scientists who want to know more about HVAC systems +
- ✓ Section 3: For HVAC engineers who want to know more about data analytics for building operation +
- ✓ Section 4: Commissioning and quick wins in optimization of HVAC systems operation +
- ✓ Section 5: In-depth look at data labelling, pre-processing & integration +
- ✓ Section 6: In-depth look at Data-driven prediction of energy use +
- ✓ Section 7: In-depth look at Fault Detection and Diagnosis methods for HVAC systems +

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B4B Open Knowledge Platform



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Course Dates

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Course Tools

[Bookmarks](#)

Important dates

Mon, Feb 17, 2025

The knowledge platform provides content for **self-paced learning** on various topics relating to **data science and the built environment**, along with **examples** from practice and **hands-on exercises**

Course Handouts



Background

Transact

Analyze and advance existing **Learning Networks (LN) in the installation sector** using a model of personalized lifelong knowledge development and trans-sector sharing



Validated integrated **prototypes** for smart monitoring and control of buildings, **guidelines** and standards, and a **learning community** to share and exchange knowledge



+ ...





Goals

- The aim of this Open Knowledge Platform is twofold:
 - On the one hand, we seek to share the **state-of-the-art on the use of data science in the built environment** as well as the **knowledge generated by the Brains4Buildings project** with the wider community
 - On the other hand, we seek to start a **lively community** and **share as much information** as possible
 - *All topics have a **discussion forum** which makes it possible to share information and provide feedback on the content*



Who are the target audience?

Course Dates

Brains4Buildings Open Knowledge Platform

Expand all

Course Tools

[Bookmarks](#)

Important dates

Mon, Feb 17, 2025

Some sections provide **deep dives** into specific topics, while others might provide **quick tips** for building professionals or links to **external resources** where you can learn more about a subject.

Section 1: Introduction

+

Section 2: For **data scientists** who want to know more about HVAC systems

+

Section 3: For **HVAC engineers** who want to know more about data analytics for building operation

+

Section 4: Commissioning and quick wins in optimization of **HVAC systems operation**

+

Section 5: **In-depth look at** data labelling, pre-processing & integration

+

Section 6: **In-depth look at** Data-driven prediction of energy use

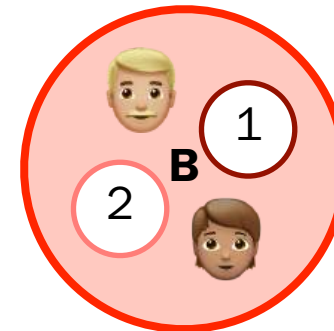
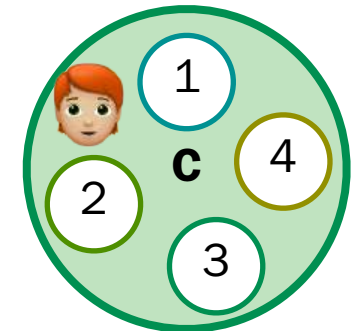
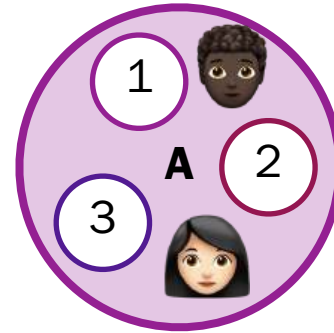
+

Section 7: **In-depth look at** Fault Detection and Diagnosis methods for HVAC systems

+

Not a typical online course!

- Sections are not ordered sequentially but **thematically**
- Different sections may have **different audiences**
 - ***Pick and choose the sections that are most relevant to you!***





Learning objectives

- **Gain insight** into various topics relating to data science and the built environment
- Gain **practical experience** on some of these topics through **examples** from practice and **hands-on exercises**
- **You can freely choose the topics that interest you** and you may skip any section that is not relevant to your needs
- Add to the **discussion with your peers** or provide feedback to us in the comment sections.



Section-by-section breakdown

Section 2: HVAC knowledge for data scientists



TU Delft MOOCs (4 weeks each)

- **ECObuild1x: Energy Demand in Buildings**
- **ECObuild2x: Energy Supply Systems for Buildings**
- **ECObuild3x: Comfort and Health in Buildings**
- **ECObuild4x: Efficient HVAC Systems**



Examples
Standards
Data sources

Section 3: Data science for HVAC Engineers

NUS MOOC (7 weeks)

- **Data Science for Construction, Architecture and Engineering**

Examples:

- **Building energy prediction**
- **Fault Detection and Diagnosis**
- **Data labeling and preprocessing**
- **Data visualization**



- Exceeding boundaries of a single screen (User needs to scroll)



- Fragmenting data into separate screens (multipage web apps)



- Displaying excessive details of precision (time up to milliseconds)



- Expressing measures indirectly (User needs to search for intended message)



- Introducing a meaningless variety




- Encoding quantitative data inaccurately (Bar plot: begin the scale at zero)



- Cluttering the display with visual effects (useless and destructing decoration)

Section 4: Commissioning & Quick Wins

Correct settings Air Handling Units

Measure	Description	Points of Attention	Comments
Make sure the inlet temperature is not higher than the room temperature. Pay attention to the setting of the Air Handling Unit.	<p>Set the maximum supply temperature (winter) back to approx. 19°C or a setting of a maximum of 18°C for the AHU from 5°C and lower, because the air still heats up through the fan and in the ducts before it reaches the grilles. Depending on the installation concept, the flow temperature at higher</p> <p>- all air constant volume with radiators (top cooling). Set 15°C at 14°C outdoors and above. The radiators can then be adjusted if they are used correctly.</p> <p>- induction units/fan coil units. Set 15°C from 5°C outside. Possibly between 14°C and 20°C outside temperature, an increasing supply temperature, especially at higher outside temperatures, to reduce</p>	<p>- In addition to a lot of energy savings, this measure results in (much) better comfort for offices, education and meetings</p> <p>- indoor rooms can become colder if there is no additional heating. Installing an (electric) heating element solves this. This usually does not concern workplaces because daylight is lacking in those indoor spaces. This can also be accepted for consultation or meeting functions, or short-term electrical heating will suffice.</p> <p>- Make sure that any dew point controls are functioning properly to prevent surface condensation.</p> <p>- Use as little as possible so-called compensation controls on the central flow temperature of the ventilation</p>	<p>It does not matter whether the air in the rooms is heated by the local heating system in the air handling unit. That goes against the feeling, but quickly turns out to be correct if you think about it for a while. It is true that a higher inlet temperature than necessary results in unnecessary heating of the ventilation air.</p>  <p>The internal heat production and/or solar radiation is often more than sufficient to heat well-insulated buildings during a large part of the year. Then blowing in at a higher</p>

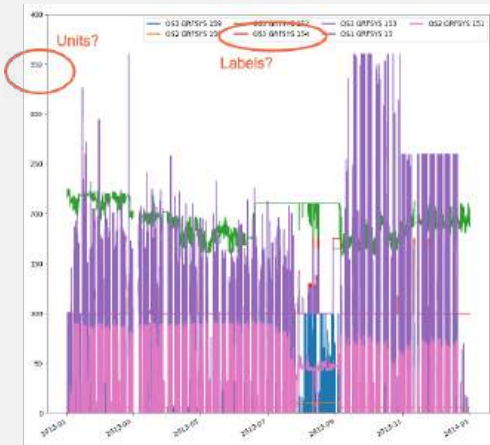
Tips and Tricks about setpoints *Verspilling eruit!*



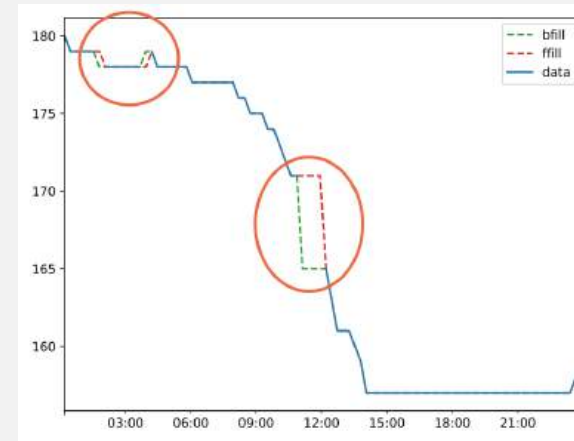
Standards

Section 5: Data labelling, pre-processing and integration

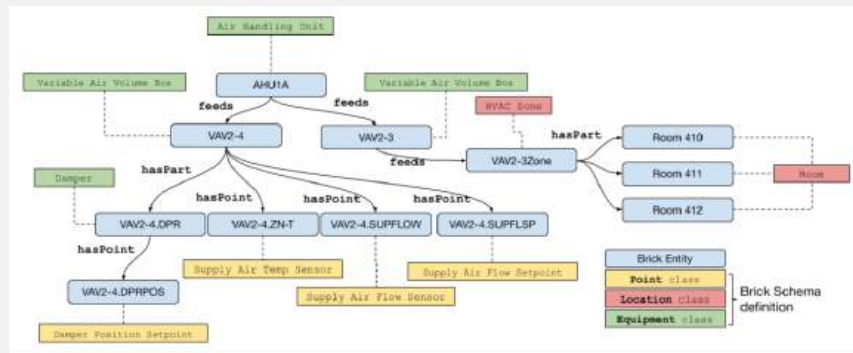
Data Labeling



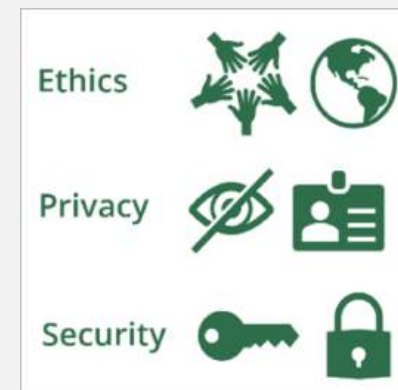
Data Preprocessing



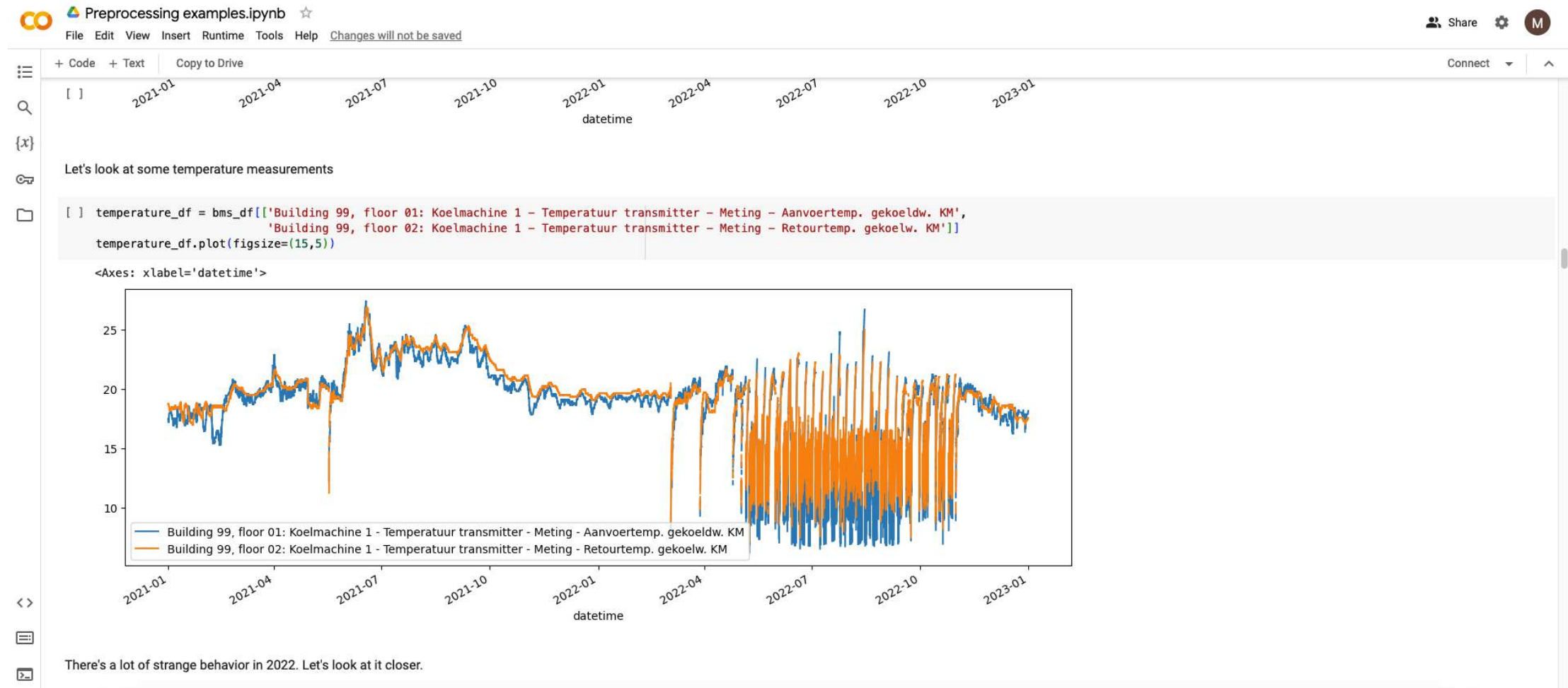
Data Integration



Data Privacy

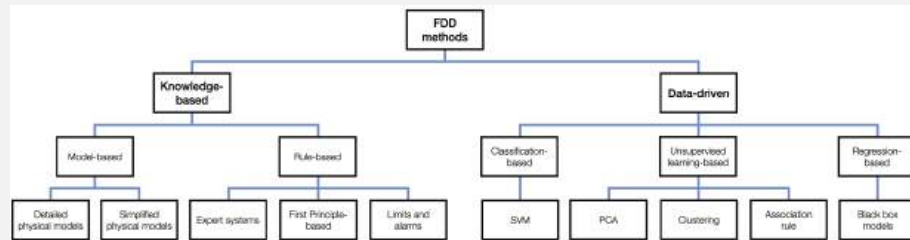


Section 5: Data labelling, pre-processing and integration

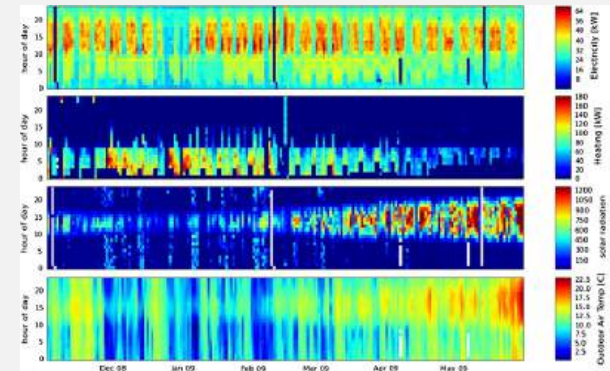


Section 7: Fault Detection and Diagnosis

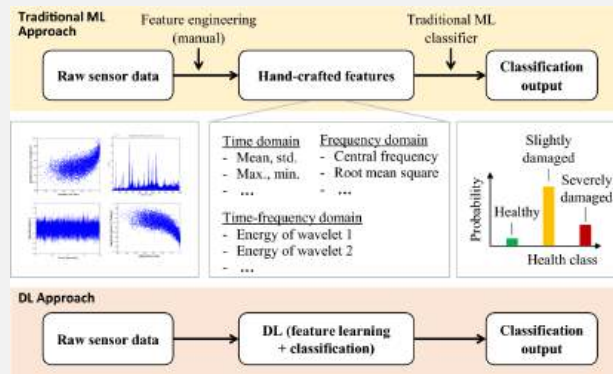
Classification



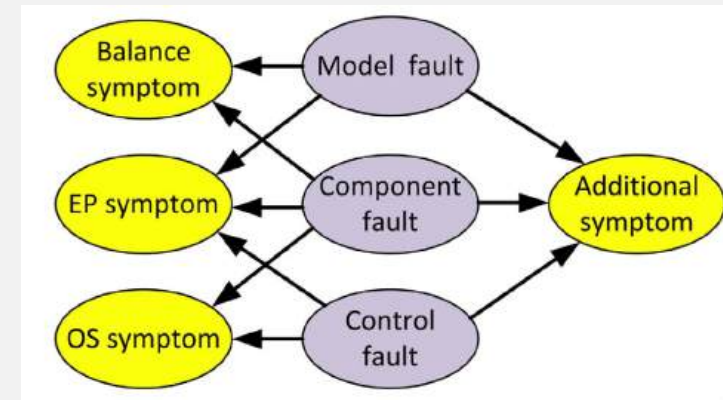
Pattern-based



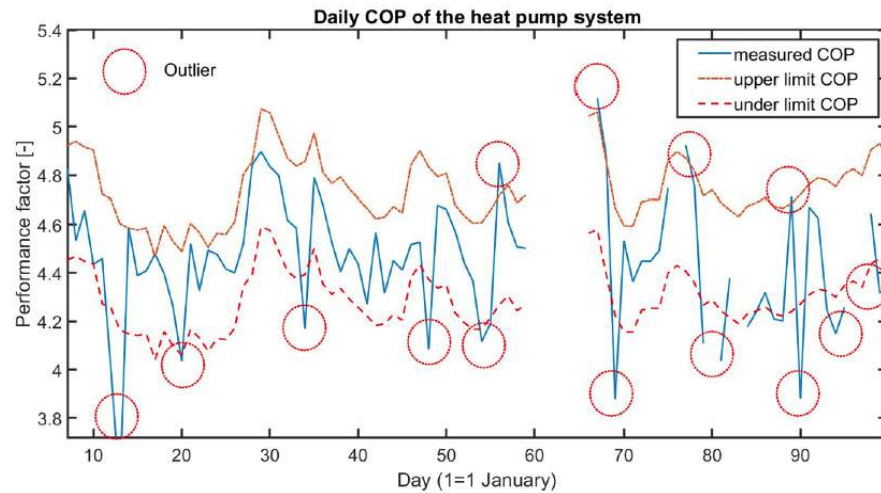
ML-based



Bayesian networks



Section 7: Fault Detection and Diagnosis



Examples:

- **Diagnostic Bayesian Networks**
- **4S3F**



Standards
Data sources



Ready to go!




Ready to go!

https://onlinecourses.tudelft.nl/courses/course-v1:TU Delft+TransACT01+2023_Q1/

 TU Delft TransACT01
Brains4Buildings Open Knowledge Platform

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Course

Brains4Buildings Open Knowledge Platform

You must be enrolled in the course to see course content.

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Thank you!

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