Instructions for the Sensor BIM Application

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Overview

This application allows building models and the measured sensor value to be displayed in 2D. An IFC file can be uploaded which contains information, such as the name of floors, rooms, their sensors, etc.
Each sensor must have certain parameters, which are explained in more detail in the chapter Sensors. In the application, the sensor family for Revit is available for download.
A 2D view of the building can be found under “Building” → “View. ” Those rooms that contain a sensor are colored, depending on the measured value. You can select which unit to be displayed in a drop-down menu. If sensors are in the room, but not for the selected unit, the room is coloured black.
If you click on the rooms with sensors, you will be redirected to a sensor overview. There you can see the minimum, maximum and average values in a selected time window. At the beginning, the time window is the current day. Furthermore, a line chart is displayed which graphically displays the time series data of each sensor of the selected unit.
The measured values can be exported as a csv file. This file then contains all measured values in the selected time window. Information about the sensor and the time of measurement is stored in the file.

From model to analysis

Since the application only works if the Revit model and InfluxDB are configured correctly, this document describes the most important processes.
The most important error messages and a description on how they can be corrected are then listed at the end of this chapter.

Revit Modell

Revit is a BIM software with which building models can be displayed. In order to have sensors in the model that have enough information to extract their measured values from InfluxDB, a family file is provided in the application, accessible at http://localhost:4200/home. This can then be placed in a room. The filling of the parameters is also an important part. If not all parameters are filled, they are not recognized and ignored as sensors and therefore not displayed in the application.

Place sensors and fill them with parameters

If the sensor has been placed in a room, it can be filled with parameters. These are described in the following.

Sensor ID

The ID of the sensor. If the data transmission is wired, the ID is ECP, otherwise the hardware ID. This ID must match the ID in influx. Otherwise, this sensor cannot be displayed.

Abtastrate

The sampling rate indicates at which intervals the sensor measures the values.

Messbereich_Obergrenze

The upper limit of the sensor. The sensor cannot measure a higher value. This parameter is needed for the correct representation of the colors.

Messbereich_Untergrenze

The lower limit of the sensor. The sensor cannot measure a lower value. This parameter is needed for the correct representation of the colors.

Sensor1_Sensortyp

The sensor type specifies what the sensor measures. This may include temperature or humidity. The sensor type is used to display graphs, depending on the sensor type. You can also download the measured values as a CSV file, depending on the sensor type.

Bucket Name

The bucket name is important for InfluxDb. This specifies in which bucket the time series data of the sensor are stored. If this is incorrectly specified or contains a typo, the data cannot be read from the time series database.

Datenübertragung drahtlos

If the data transmission is wireless, the value is true, otherwise it is false.

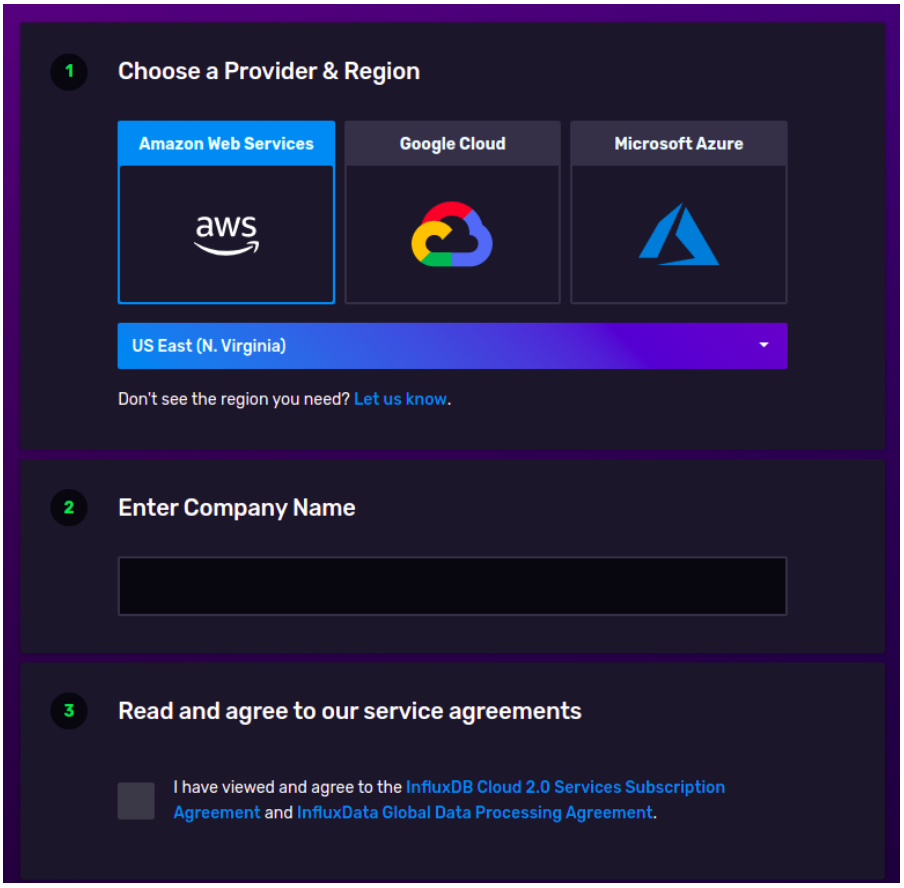
Export IFC file

Once the sensors have been placed and parameterized and the building model has been created, the model can be exported as an IFC file. This file must be in the 2x3 version and contain information about geometry and parameters. A configuration file containing the required export configurations can be found on the start page of the application.

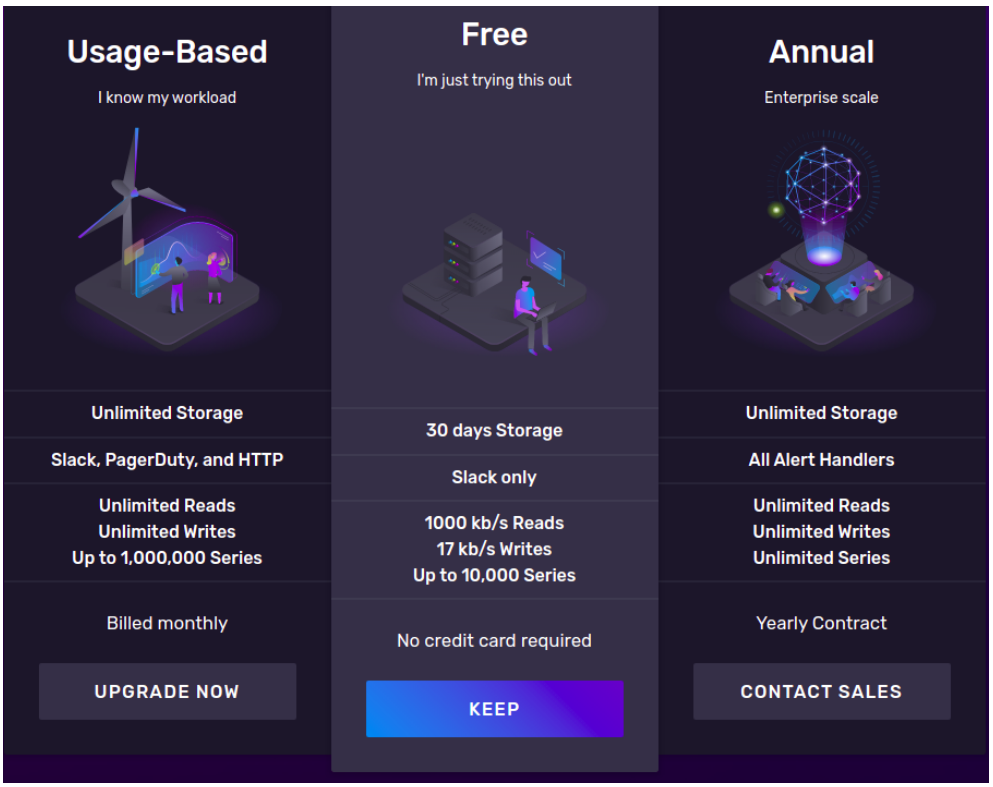
InfluxDB

An Account for InfluxDB can be created under this link.

After creating an account, you can choose which provider you want. You can choose between AWS, Google Cloud and Microsoft Azure.

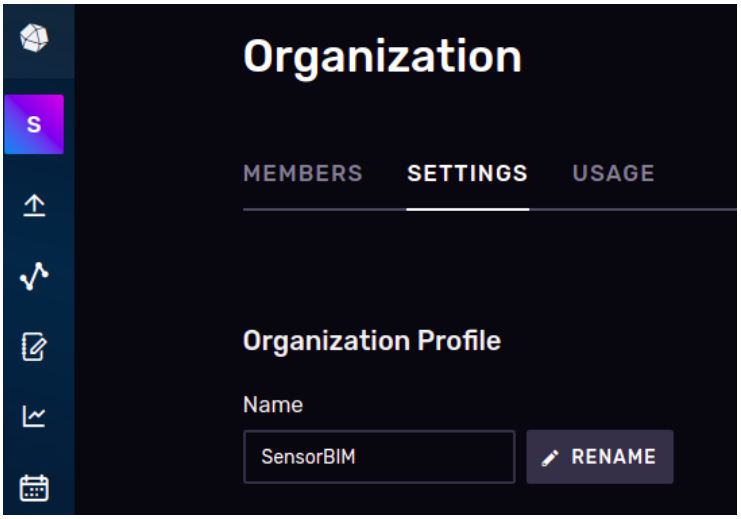


At InfluxDB there is a free version, which should suffice for testing. Otherwise, there is the option to pay according to use or annually.



Organization Creation

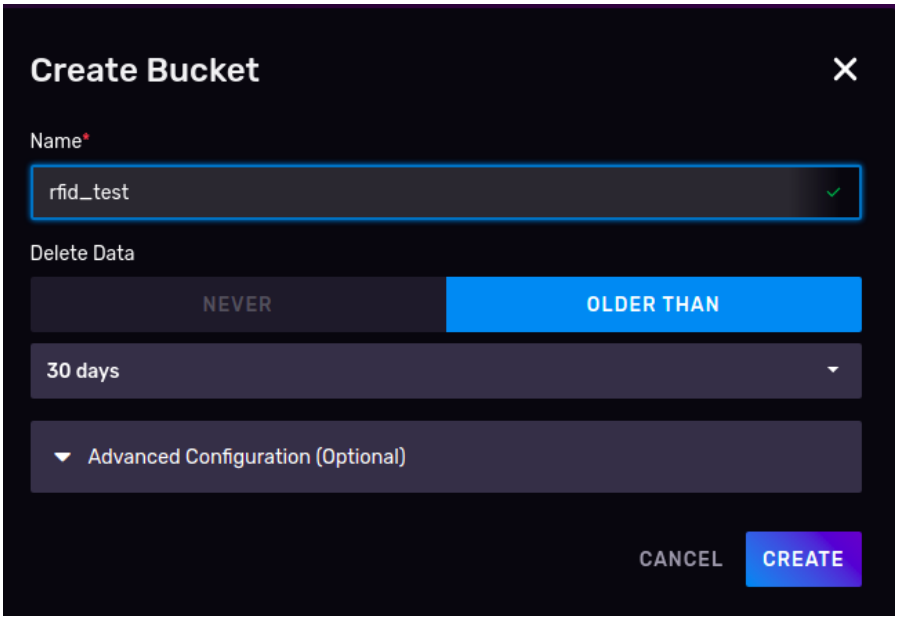
For the SensorBIM application, the organization name is important. This is at the beginning the email address with which you have logged in. However, you can change this by clicking on the colorful symbol, in this case marked with an “S”. Then you can change the name of the organization at the bottom of the “Settings”:



Bucket Creation

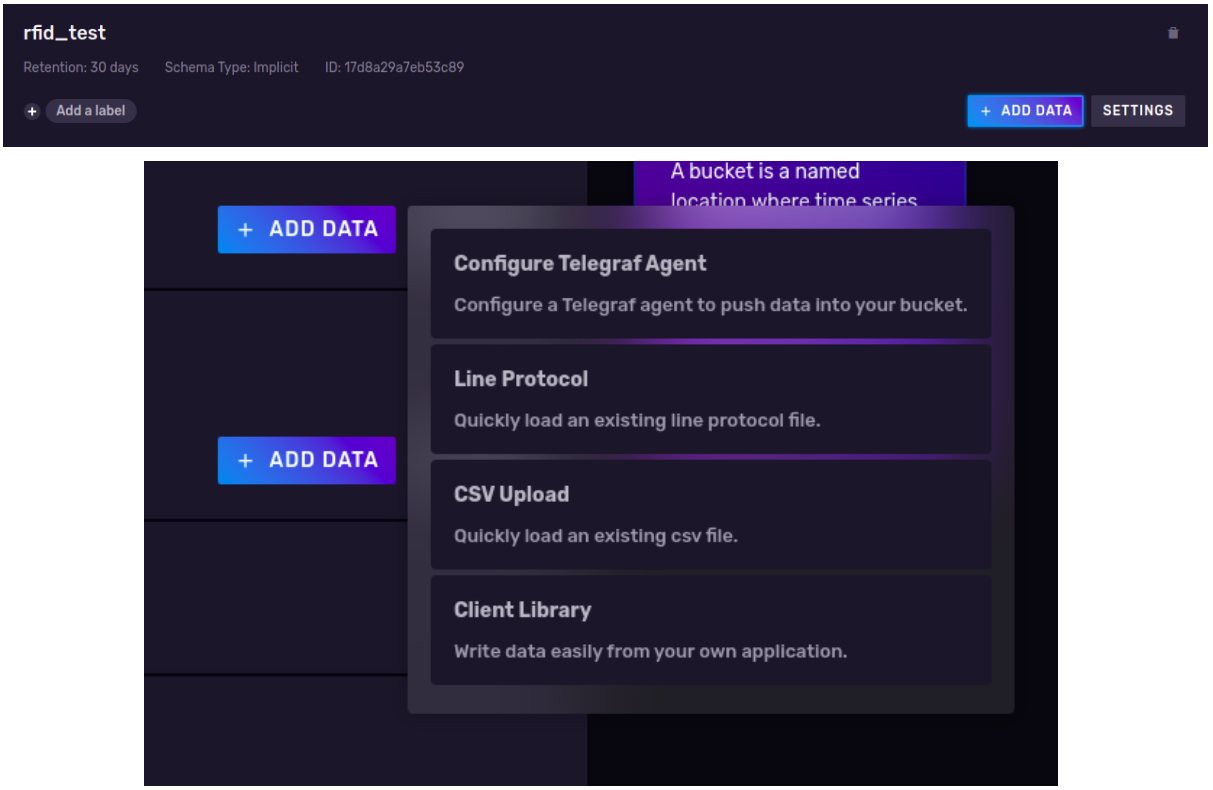
The next step is to create a new bucket. The measured data are then stored in this bucket. The bucket name must be specified for each sensor in Revit.

It can be configured when the data should be deleted.
If you use the test data provided by the vendors, which is available under GitHub, you must not delete old data. The reason is that the data were collected in March 2022 and would be deleted automatically in May, for example.



Add Data

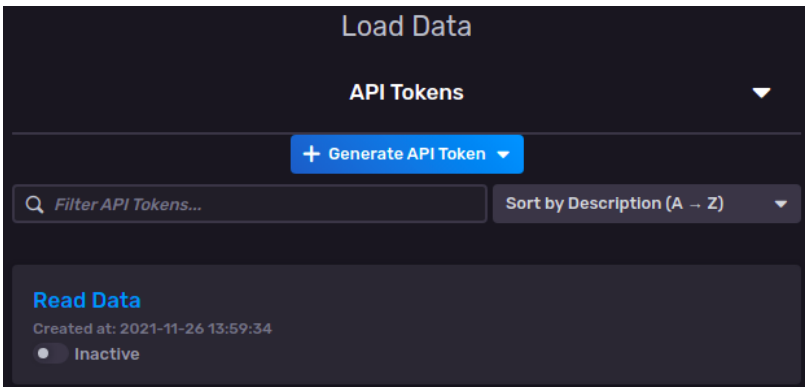
If you click on “Add Data”, you can choose how to write the data to the database.
To test, click on “CSV Upload” and upload the CSV file, available in Github. However, it is recommended to write the data to the database automatically, e. g. with telegraph.
How to write data into a bucket can be found under this link.



Important: The ID of the sensor must be stored under *epc*, if available. Otherwise under *hardware_id*. The sensor type, which was also specified in Revit, must be stored under *_measurement*. Furthermore, the values that are to be read out and used in the application for graphical representation and download should be stored under *_field* as *value*.

Token Generation

In InfluxDB a token has to be generated with which one has the rights to read the measured values of all buckets in the building model. Write permissions are not required for the application.

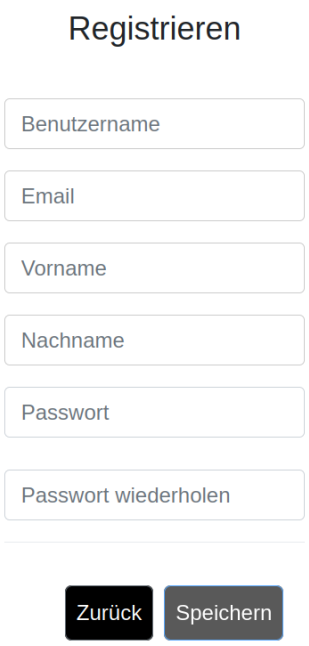


Application

The application graphically displays the data stored in InfluxDB. How the application works and how it can be used is discussed below.

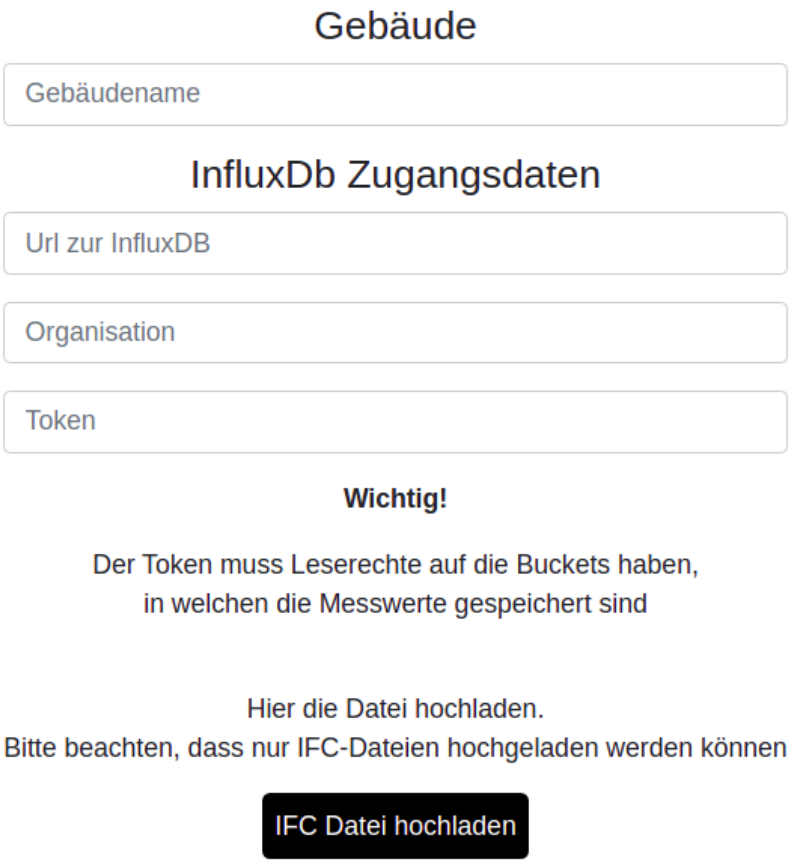
Create/login user

If you don’t have an account yet, you can register here.
If a user forgets his password, a newly generated password is sent via email. The email should then be deleted immediately and the password updated.



Creating buildings

If InfluxDB has been configured and a building model created and exported in Revit, a building can be created in the application. For this, the building name, the URL to the InfluxDB, the organization name and the token must be specified.



Name of building

The building name can be any name. However, it must be unique, it is not possible to create several buildings with the same name.

Url to the InfluxDB

The URL to InfluxDB is the URL under which InfluxDB can be reached. When saving the building, it checks whether the URL exists and is valid. If this is not the case, an error message will appear.

Organization

Organization is the name of the organization defined in InfluxDB.

Token

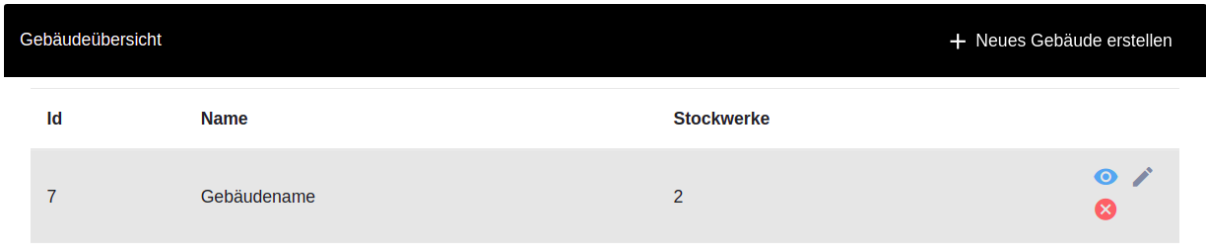
With the token you must have the rights to read data from all buckets that are used by sensors in the building model. This token can be created directly in the InfluxDB application described in this chapter.

IFC file

The building model created in Revit can be uploaded as an IFC file. The supported version is 2x3.

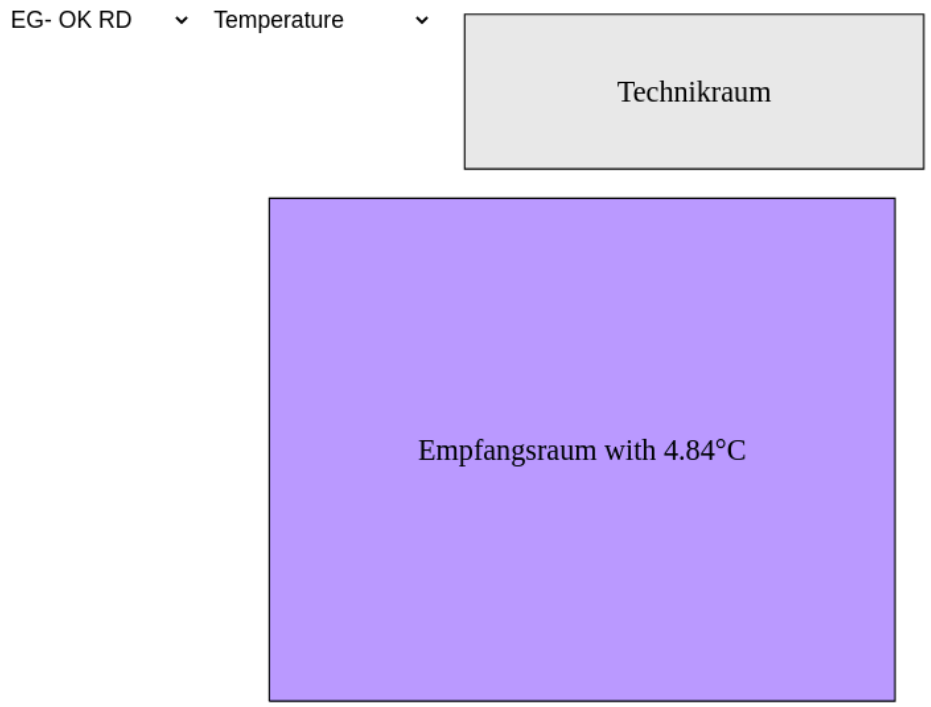
Overview of buildings and 2D view

By clicking on *My Buildings* you can see a table of all self-created buildings. The buildings can be edited, deleted and viewed. If you click on the eye icon, you will be redirected to the 2D view of the building.

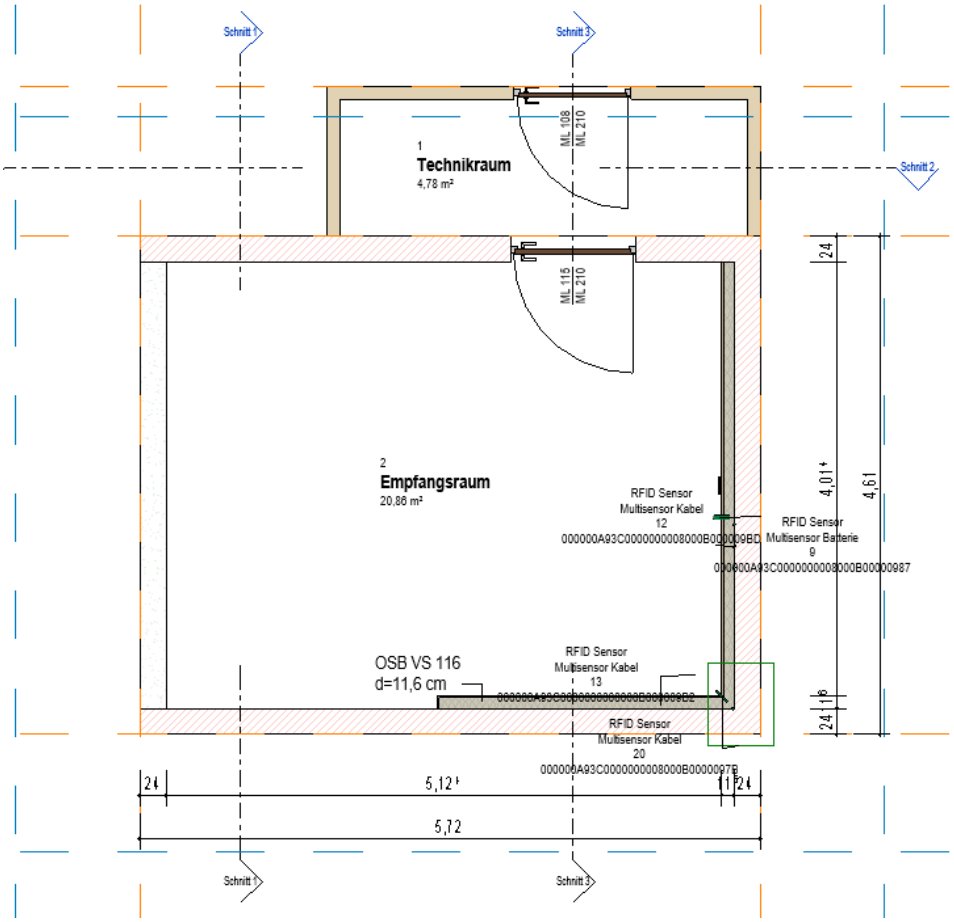


2D view

In the 2D view of the selected building, you can see, per floor, the rooms and their current measurement, displayed in color. If there is no sensor on the floor, the room is coloured gray. If a room is black, it means that there is a sensor in that room, but there are no measurements for the selected room in the last 24 hours.
In the left corner, the floor can be selected in a drop-down menu, and in the right the measure. Zooming is also possible in this view. By pressing Alt you can move the floor.
The screenshot shows the ground floor, in which there are two rooms: one does not contain a sensor and is thus colored gray, the other has been colored green, since the last measurement, in this case the temperature, is 21.6 degrees.

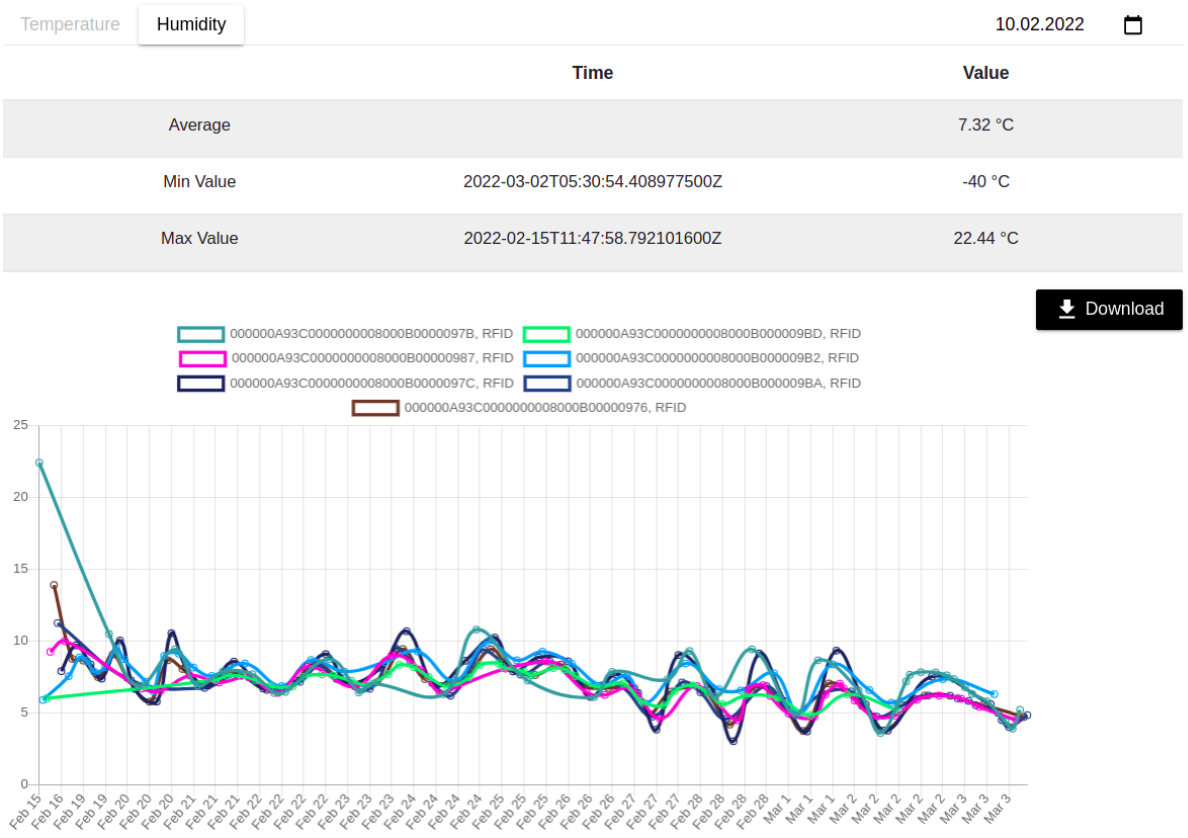


In Revit the used building looks like this:



View sensor values

If you click on a room containing sensors, you get a view in which you can graphically display and download the measured values.



1. **Measurements**
   Depending on how many different measures are measured in a room, buttons are displayed. In the example photo there are sensors for humidity, temperature and material humidity. In Revit, this is stored as Sensor Type.

2. **Select date**
   To view measurements in a certain period of time, you can change the date. The default is today.
   When selecting, the start date can be entered or selected. Thus, if, as in the picture of 31. 12. 2021 is selected, measured values from this to the present day are displayed.

3. **Graph**
   The graph visualizes the measurement data in the selected period. If there are several sensors that measure the same measures in a room, several lines are displayed.

4. **Sensor name and type**
   The legend of the graph shows the sensor name and type of the sensor.

5. **Download button**
   The measured values can be exported as a csv file. The file contains all measured values of the selected measure and the selected period.

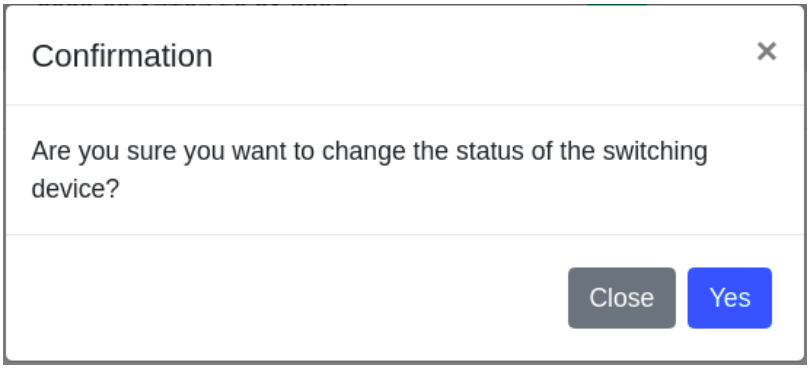
6. **Average, maximum and minimum values**
   For a quick and minimal analysis, average, maximum and minimum values are presented in a table. These depend on the selected period and the selected measure.

Switching Devices

If you click on the control icon on the building overview, you will be redirected to an overview of all the controls in the selected building.
You can see the name and status of the device, when the status was last changed, and whether the device is controlled manually or automatically.

Name	Last changed	On/Off	
Temperature Switcher	2022-03-04T10:33:15.99Z	UNKNOWN	Manual
SD Room 1	2022-02-28T10:08:39.8Z	ON	Manual
SD 2nd Floor	2022-02-12T08:07:15.356Z	ON	Automatic
SD Room 17	2022-03-04T06:02:28.584Z	OFF	Manual
Humidity Switcher	2022-03-04T02:45:28:698Z	OFF	Automatic
SD 1st Floor	2022-03-01T05:33:24.376Z	ON	Automatic
SD Room 21	2022-03-12T12:18:03:985Z	OFF	Automatic
Humidity Switcher 2	2022-03-04T02:45:28:698Z	OFF	Manual

To change the status of a device, simply click on the status button. A pop-up window will appear where you have to confirm the action:



If the switching device is set to automatic, it is not possible to change its status.

The user also has the option to control the device automatically. All he has to do is click on the Automatic/Manual button. This action must then be confirmed:

Error messages and how to fix them

User management

1. **A user with the email address already exists!**
   A user with the specified email address already exists. You can click on *Forgot Password*, enter your email address and immediately receive an email with a new password.

2. **An error occurred while saving!**
   There was an error on the server side when saving or updating the user data. It is best to contact the admin or tech support.

3. **The user could not be saved!**
   The server could not be reached. It is best to contact the Admin or Tech Support.

Building Management

1. **The file could not be uploaded.**
   The server could not be reached. Please contact the Admin or the Tech Support.

2. **The file could not be converted!**
   The IFC file could not be read correctly. Make sure that all required parameters (geometry, sensors) have been exported and that the IFC file is a valid IFC file.

3. **The file is not a valid Turtle file!**

The uploaded file was not a valid IFC file. The extraction of important data could not be performed. Make sure that all required parameters (geometry, sensors) have been exported and the IFC file is a valid IFC file.

4. **The uploaded file does not contain any floors.**
   The IFC file is valid but does not contain floors. Therefore, the building cannot be saved. Make sure that all required parameters (geometry, sensors) have been exported and that the IFC file is a valid IFC file.

5. **The building does not/do not contain any sensors in InfluxDB!**
   There are no sensors in the model that have valid parameters. Check whether sensors have been correctly parameterised in the building and compare the values (id, type, etc) with InfluxDB.

6. **The uploaded file does not contain any rooms. Make sure that the IFC file including geometry has been exported.**
   The IFC file is valid but does not contain any rooms. Therefore, the building cannot be saved. Make sure that all required parameters (geometry, sensors) have been exported and that the IFC file is a valid IFC file.

7. **The URL does not seem to be correct.**
   The URL given is not correct or cannot be reached. Check if the URL is correct and publicly accessible.

8. **The building could not be updated!**
   The server could not be reached. It is best to contact the Admin or Tech Support.

2D View/Chart

1. **The sensor with the ID id could not be loaded.**
   No sensor with the id could be found in the database. Please contact the Admin or the Tech Support.

2. **No values were measured in the last 24h**
   No values could be found in InfluxDB that measured the selected measure. Select another measure or click on the room and change the date (show data from the last two weeks). If still no data can be displayed, it is best to contact Admin or Tech Support.

3. **There is no sensor measuring sensor type on this floor.**
   There is no sensor which measures sensor type. Select a different sensor type to colour the rooms, depending on the reading.

4. **A connection to InfluxDB could not be established.**

A connection to InfluxDB could not be established. Check whether the token and the organization name are correct and whether you have sufficient rights with the token.

Tech Support

If you have any problems, please email melanie.ernst@uibk.ac.at for questions regarding the application and zoe.pfister@student.uibk.ac.at for questions regarding InfluxDB.