HEF sensorHUB Documentation

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Section 1   HEF sensorHUB Application

HEF SensorHUB is a web platform built using React.js for the front end and powered by Flusk (Python) for the back end. For every TUM account registered, this web application sets up two important components. First, it creates an instance of The Fraunhofer Open Source SensorThings-Server (FROST), which is a well-known open-source solution and the official reference implementation of the OGC SensorThings standard. This allows users to efficiently manage and work with sensor data. Additionally, HEF SensorHUB also provides an instance of Node-RED Essentials, an application designed for connecting hardware devices. It comes with a user-friendly, browser-based editor that simplifies the process of creating complex flows using various nodes available in the palette.

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Section 2   NodeRED and FROST-Server

2.1 NodeRED

Node-RED is a powerful, open-source, and flow-based visual programming tool primarily used for simplifying the development of Internet of Things (IoT) applications. IoT involves connecting various devices and sensors to the internet to collect and exchange data, enabling automation, monitoring, and control in diverse contexts. Node-RED streamlines IoT development by offering a user-friendly interface where users can drag and drop nodes representing hardware interfaces, data processing functions, and communication protocols. This makes it exceptionally useful for IoT applications, where it can orchestrate the collection and processing of data from sensors, the execution of commands to actuators, and the integration with cloud services or other systems. It simplifies the creation of IoT solutions, reducing development time and the need for extensive coding, and allows developers to focus on building the logic and applications that drive real-world IoT scenarios.

2.2 FROST-Server

The FRaunhofer Opensource SensorThings-Server (FROST) is the first complete, open-source official reference implementation of the OGC SensorThings. The OGC SensorThings API provides an open, geospatial-enabled and unified way to interconnect the Internet of Things (IoT) devices, data, and applications over the Web. It provides a standard way to manage and retrieve observations and metadata from heterogeneous IoT sensor systems.

SensorThings API provides up-to-date measurement information such as:

- RESTful
- (Geo)JSON encoded
- Available via OASIS Odata URL patterns and query options
- Capable of directly including sensor data via the ISO MQTT protocol

REST Cheat Sheet for SensorThings API:

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	GET	POST	PATCH	DELETE
v1.1	Get index			
v1.1/Type	Get all of type	Create		
v1.1/Type(id)	Get one of type		Update	Delete
v1.1/Type(id)/Entity	Get linked entity			
v1.1/Type(id)/EntitySet	Get all linked	Create Linked		

Figure 1 - REST Cheat Sheet SensorThings API

Attributes:

1. Thing
2. Location
3. ObservedProperty
4. Sensor
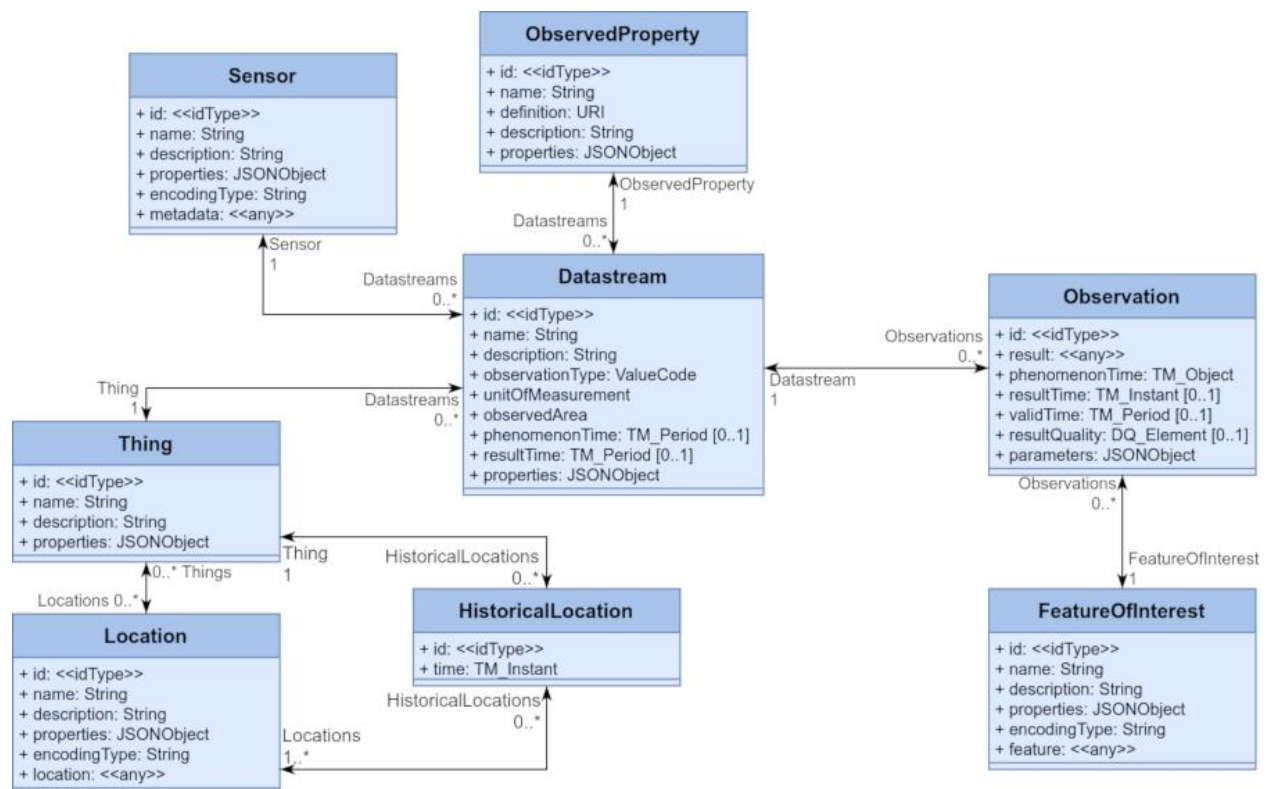5. Datastream
6. Observation

Figure 2 - SensorThings API Data Model

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Section 3   Application Component

3.1 Devices

To access devices (referred to as "Things" in SensorThings terminology), you can navigate to the /devices page. Here, you will find a table displaying essential information such as the ID, name, and description of each device. You have the option to perform various actions on these devices, including updating or deleting them. Moreover, the real-time coordinates of these devices can be visualized on a map component.

To create a new device, you will need to provide the following attributes:

- Device Name
- Device Description
- Device Location Name
- Device Location Description
- Location Latitude
- Location Longitude

3.2 Sensor Types

You can access Sensor Types (referred to as "Sensors" in SensorThings terminology) by visiting the /sensors page. On this page, you'll find a table listing the available sensors, and you have the option to update or delete them as needed. To create a new sensor, you will be required to provide the following information:

- Sensor Name
- Sensor Description
- Sensor Metadata

3.3 Measurement Property

Measurement Properties, which are alternatively referred to as "Observed Properties" in SensorThings terminology, are available for management through the /observation_properties page. This page presents a table containing essential information, including ID, name, description, and definition, for each Measurement Property. You have the flexibility to make updates or deletions to these Measurement Properties as needed. For the creation of a new Measurement Property, you will be required to provide the following mandatory details:

- Measurement Property Name
- Measurement Property Description
- Measurement Property Definition

3.4 Datastreams

Datastreams play a crucial role in the application as they establish connections between devices, sensor types, and measurement properties. You can access Datastreams through the /datastreams page. To create a new Datastream, the following information is mandatory:

- Datastream Name
- Datastream Description
- Datastream Observation Type
- Unit Of Measurement Name
- Unit Of Measurement Symbol
- Unit Of Measurement Definition
- Selection of a previous Sensor Type
- Selection of a previous Device
- Selection of a previous Measurement Property

3.5 Location

You can access Locations by navigating to the /locations page. Here, you will find a list of all the locations associated with devices. The information displayed includes the ID, Name, Description, Longitude, and Latitude of each location. Additionally, you have the option to visualize these location coordinates on a map for your convenience.

3.6 Observations

You can access Observations by visiting the /observations page. Each observation is accompanied by its unique ID, the phenomenon time (indicating when it occurred), the result, and the associated datastream that it is linked to.

Section 4   Dataspace Specs

To access Dataspace Specs, you can simply click on "Quick Entry" within the "Data Space" tab located in the sidebar menu. The Dataspace Specs page provides two prominent buttons: "Stepper" and "Observations." The "Stepper" button leads to a page that allows you to efficiently create a sequence comprising Device, Sensor Type, Measurement Property, and Datastream in a single form. The "Observations" button redirects you to the Observations page. Furthermore, on this page, you'll find valuable information including the URL of the FROST Server instance being used, the FROST port, and

general details about the FROST Server. Additionally, it displays the counts of devices and datastreams currently available.
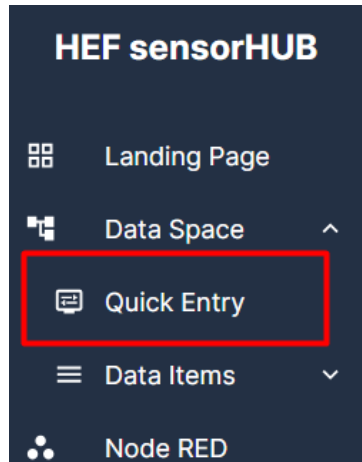
Figure 3 - Accessing Datspace Specs

4.1 Stepper

The "Stepper" feature is an incredibly efficient tool that enables the creation of a sequence of components all on one convenient page.
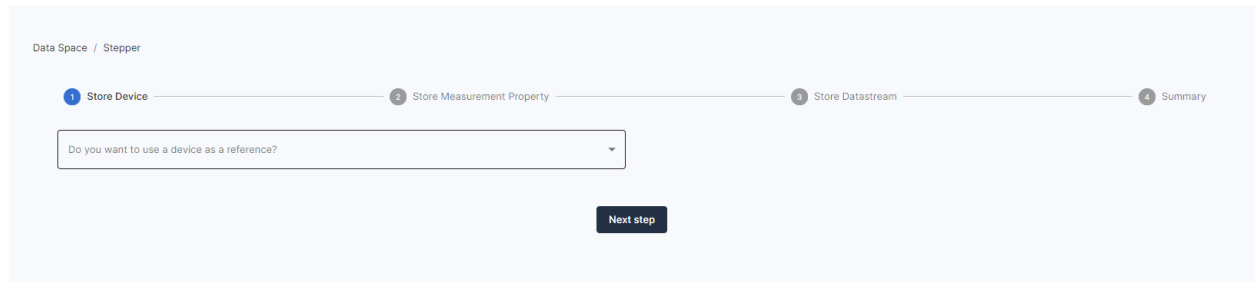
When it comes to the device section, users have the flexibility to either utilize an existing device along with its associated information or create a new device. It's worth noting that device names must be unique within the Stepper process.

For the Measurement Property section, users have the option to either select a previously defined measurement property or create a new one based on their needs.

Moving on to the Datastream section, users can effortlessly generate a datastream by entering its name manually or simply by clicking "Generate Name."

This automated naming convention combines the device and measurement property, streamlining the process. Finally, users are presented with a summary page that allows them to double-check for any potential errors or oversights before proceeding. This comprehensive approach ensures accuracy and ease of use throughout the Stepper workflow.

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Figure 4 - Stepper Page

Section 5   Contact Form

You can access the contact form by navigating to the /contact page. This form serves as a direct channel for users to reach out to the administrator at any time, whether they have questions or need assistance with an incident. Messages submitted through this form will be promptly forwarded to the administrator for a quick and efficient response.

Section 6   Knowledge Section

The Knowledge Section holds significant importance within our application, as it provides users with essential information regarding three critical components:

a) Node Red:

This section offers comprehensive insights into Node-RED, including valuable links to crucial resources and tutorials that can help users better understand and utilize Node-RED effectively.

b) Sensor Database

 Here, users can access information and links related to the FROST server, as well as documentation from the Open Geospatial Consortium. This resource empowers users to explore and leverage the Sensor Database with confidence.

c) Web App

In this segment, users have the opportunity to download the manual for the HEF SensorHUB. This manual serves as a valuable guide, aiding users in navigating and making the most of the application's features and functionalities.