System Requirements Specification

TINF21C, Software Engineering I

Practical project 2022/23

Project

AAS-Web client

Customer

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Version	*Date*	*Author*	*Comment*
0.1	01.11.2022	S. Helms	Created Document, added structure
0.2	04.11.2022	S. Helms	Product requirements added
0.3	06.11.2022	S. Helms	Product requirements added
0.4	03.05.2023	S. Helms	Added final requirements

Purpose

The ultimate end goal of this software shall be that the web-based-interface written in java-script displays the products in a user-friendly and structured way. It should be possible to search for products and filter them. It should also be possible to add new servers.

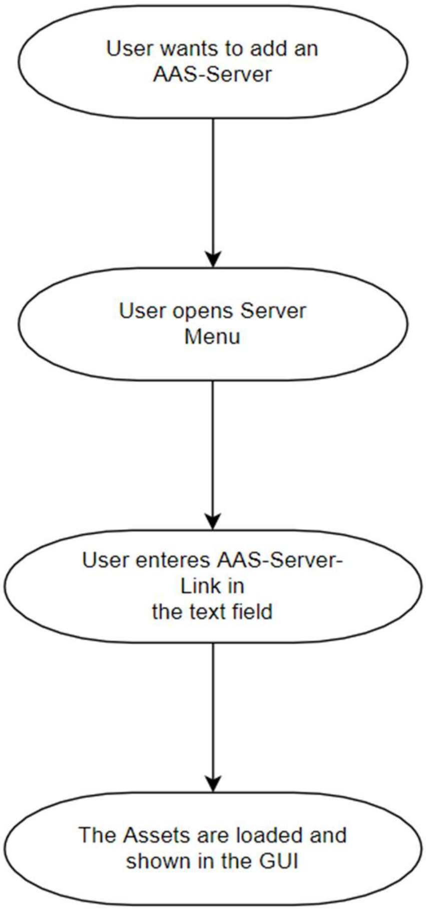
Product Environment

The Asset Administration Shell (AAS) is the Standard for modelling digital twins in Industry 4.0. Digital twins are models of so-called assets. Those can be tools, systems and products, etc. The twins shall be as like the existing asset as possible, even if it hasn't even been built before. It should simulate a real asset in every (technical) detail. You can virtually build machines with digital twins or test them in virtual environments before building the machine to test its functionality, usability, etc.

Use Cases

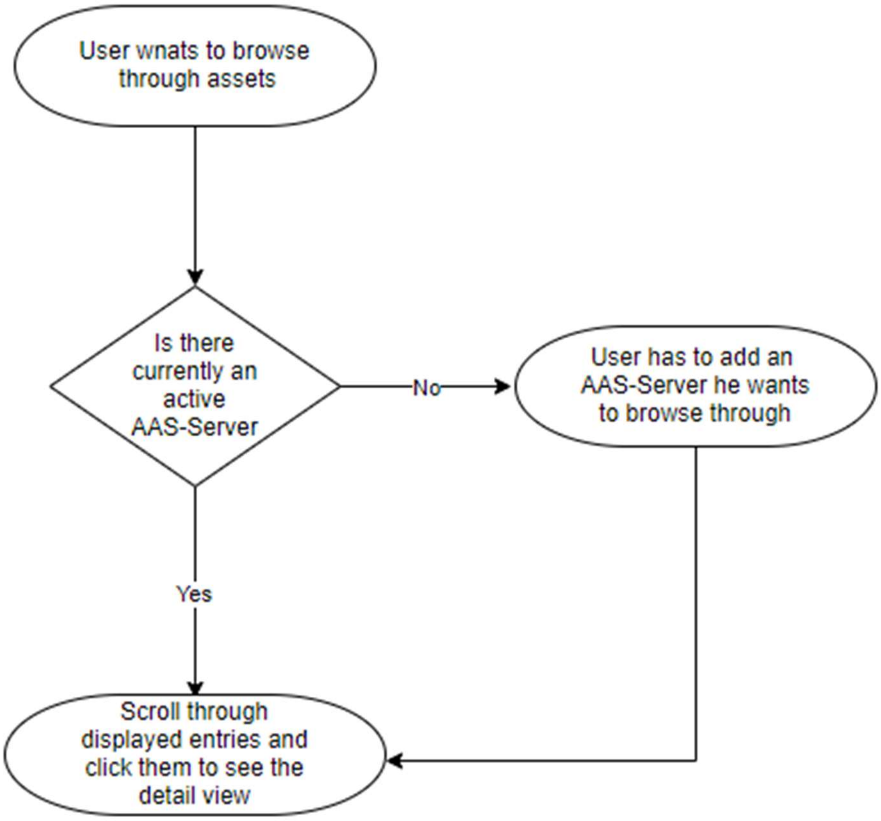
<UC.001>: Add AAS-Server

Use Cases Objective:	*User wants to add an AAS-Server by inserting the server's URL manually into the webpage.*
System Boundary:	*The application itself.*
Precondition:	*The user needs to have the URL to the AAS-Server. The webpage must be open and connected to the Internet. There must not be a currently active AAS-Server.*
Postcondition on success:	*The server's content is displayed on the webpage.*
Involved Users:	*Every end-user of the application.*
Triggering Event:	*When the user presses "Server Menu" on the webpage, the user enters the URL and presses "Add Server".*


User wants to add an AAS-Server
User opens Server Menu
User enteres AAS-Server-Link in the text field
The Assets are loaded and shown in the GUI

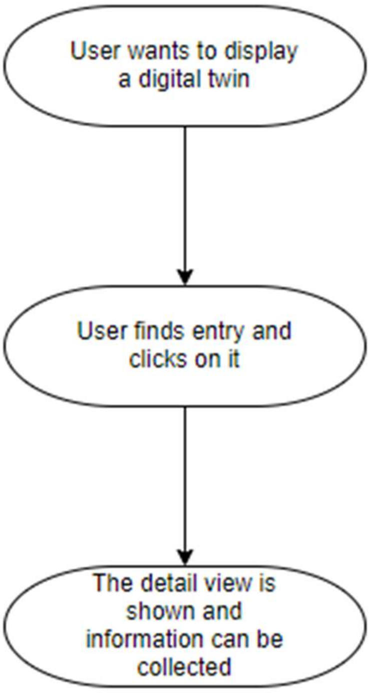
<UC.002>: Browse through digital twins

Use Cases Objective:	*The digital twins are displayed alphabetically sorted on the webpage. The user can scroll through them.*
System Boundary:	*The application itself*
Precondition:	*The user added a working AAS-Server.*
Postcondition on success:	*The user can browse through all content of the server and find digital twins coincidentally.*
Involved Users:	*Every end-user of the application.*
Triggering Event:	*When the user wants to look through all content of the server without the need to find a specific digital twin.*


User wnats to browse through assets
Is there currently an active AAS-Server
No
User has to add an AAS-Server he wants to browse through
Yes
Scroll through displayed entries and click them to see the detail view

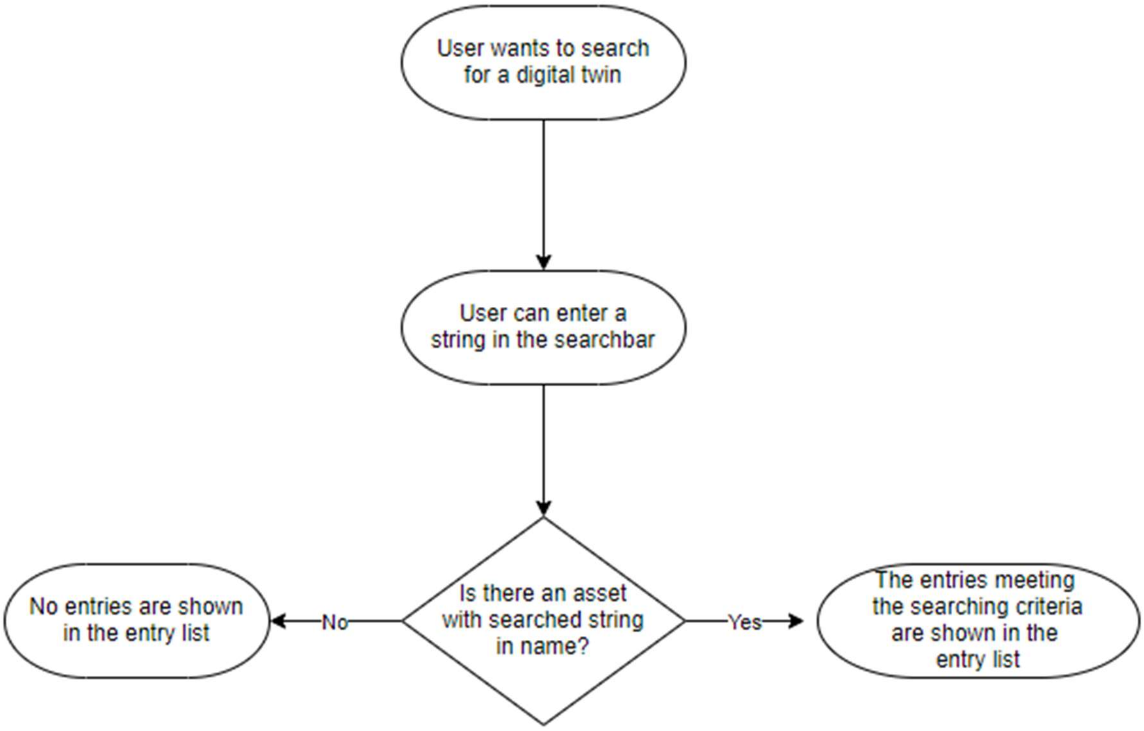
<UC.003>: Display digital twin

Use Cases Objective:	*User can see the information of a specific digital twin*
System Boundary:	*The application itself*
Precondition:	*The user added a working AAS-Server.*
Postcondition on success:	*The user can see the information regarding a specific digital twin*
Involved Users:	*Every end-user of the application.*
Triggering Event:	*The user clicks on an entry of a digital twin on the webpage*


User wants to display a digital twin
User finds entry and clicks on it
The detail view is shown and information can be collected

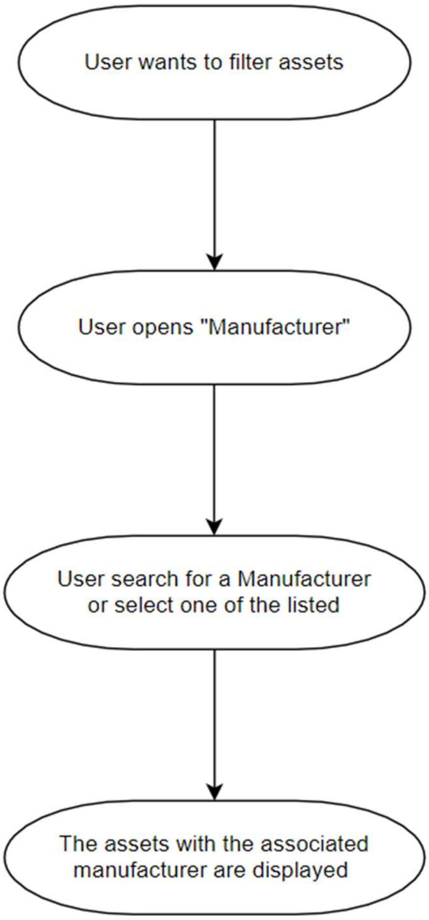
<UC.004>: Search for digital twin

Use Cases Objective:	*Search for a specific digital twin by serial number or by free text search.*
System Boundary:	*The application itself*
Precondition:	*The user added a working AAS-Server.*
Postcondition on success:	*A reduced number of digital twins is displayed on the webpage in the same way it was displayed before the search.*
Involved Users:	*Every end-user of the application.*
Triggering Event:	*The user enters a text in the search bar and presses "search" or Enter and wants to find a specific digital twin. For each letter, a clickable list of corresponding assets is displayed.*


User wants to search for a digital twin
User can enter a string in the searchbar
Is there an asset with searched string in name?
No
No entries are shown in the entry list
Yes
The entries meeting the searching criteria are shown in the entry list

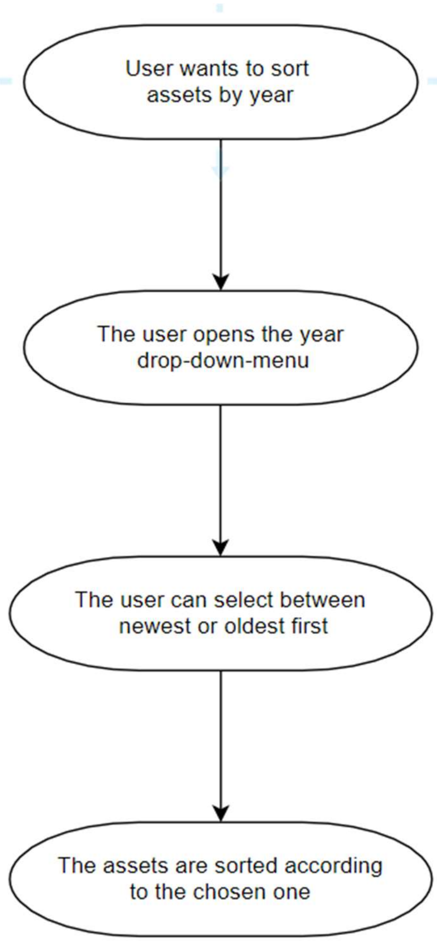
<UC.005>: Filter for manufacturer

Use Cases Objective:	*Filter all content on the webpage to only show assets of one manufacturer name.*
System Boundary:	*The application itself.*
Precondition:	*The user added a working AAS-Server.*
Postcondition on success:	*The entries are specified and displayed on the webpage.*
Involved Users:	*Every end-user of the application.*
Triggering Event:	*The user enters wished manufacturer in designated area.*


User wants to filter assets
User opens "Manufacturer"
User search for a Manufacturer or select one of the listed
The assets with the associated manufacturer are displayed

<UC.006>: Sort by year

Use Cases Objective:	*Sort all content on the webpage to show the newest/oldest assets at the top of the list based on manufacturing year*
System Boundary:	*The application itself.*
Precondition:	*The user added a working AAS-Server.*
Postcondition on success:	*The entries are sorted and displayed on the webpage and entries without manufacturing year are shown at the end of the list.*
Involved Users:	*Every end-user of the application.*
Triggering Event:	The user opens the drop-down menu for the year and can choose between the newest and the oldest year.


User wants to sort assets by year
The user opens the year drop-down-menu
The user can select between newest or oldest first
The assets are sorted according to the chosen one

Product Requirements

The following functions should be implemented in the applications.

/LF10/ Import Server

The webpage should be able to import a server by its URL and display its content.

Input Description	Expected Output
Server URL	JSON containing the AAS data

/LF20/ Server validation

The system shall be able to detect false server-URLs when adding a new server and throw an error to the user.

Input Description	Expected Output
Wrong Server URL	Error message

/LF30/ Error handling

The system shall be able to handle errors (no entries found, unexpected errors, false server-URL, …) and throw an error to the user.

Input Description	Expected Output
Unexpected Input	Error message

/LF40/ Display content in a clear way

The entries including the digital twins are shown in a clear and readable way as a list one entry under the other.

Input Description	Expected Output
Server URL	List of AAS items

/LF50/ Display digital twin

The user should be able to see more information about the digital twin.

Input Description	Expected Output
Click on an asset	listed information

/LF60/ Sort by year

The user should be able to sort the displayed assets by manufacturer year.

Input Description	Expected Output
Selected sorting direction (oldest/newest first)	Sorted list of AAS items

/LF70/ Filter for manufacturer

The user should be able to filter the assets by manufacturer.

Input Description	Expected Output
Manufacturer name	List of AAS items only by the specific manufacturer.

/LF80/ Search for digital twin

The user can search for digital twins by entering the name of the asset.

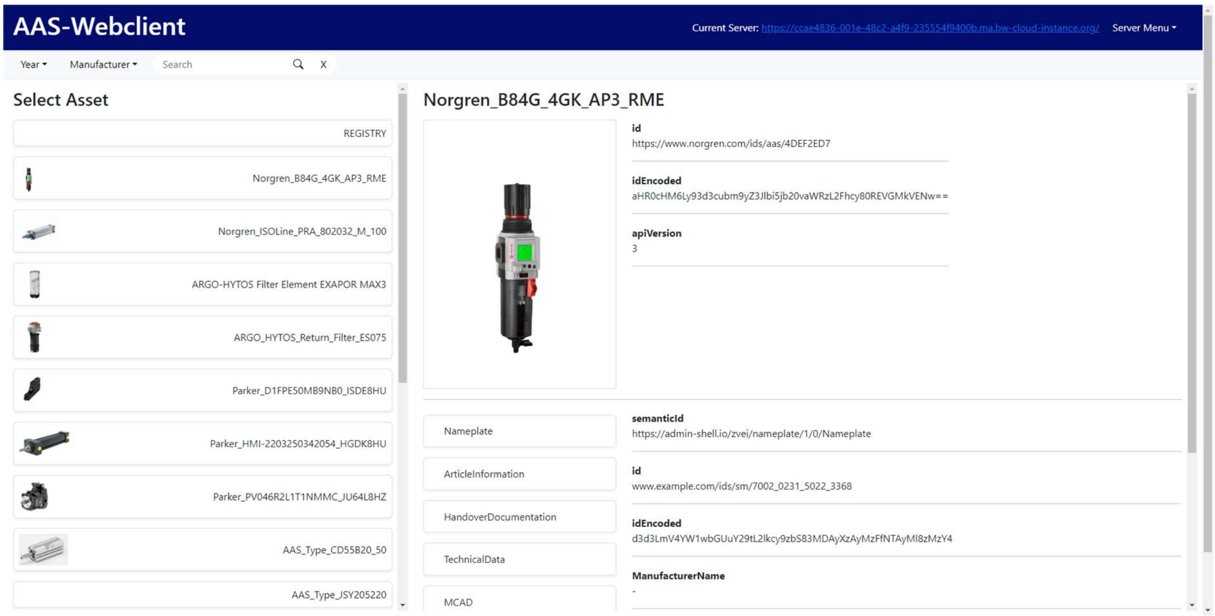
Input Description	Expected Output
Name of asset	List of AAS items with the specific name

Non-functional Requirements

This section describes the already known non-functional requirements for the product.

/NF10/ GUI

The webpage shall display a graphical user interface (GUI) to the user. This GUI must display every function provided to the user in a simple and intuitive way. It will be the only way to interact with the application.



Current Server: https://ccae4836-001e-48c2-a4f9-235554f9400b.ma.bw-cloud-instance.org/

Select Asset

- REGISTRY
- Norgren_B84G_4GK_AP3_RME
- Norgren_ISOLine_PRA_802032_M_100
- ARGO-HYTOS Filter Element EXAPOR MAX3
- ARGO_HYTOS_Return_Filter_ES075
- Parker_D1FPE50MB9NB0_ISDE8HU
- Parker_HMI-2203250342054_HGDK8HU
- Parker_PV046R2L1T1NMMC_JU64L8HZ
- AAS_Type_CD55B20_50
- AAS_Type_JSY205220

Norgren_B84G_4GK_AP3_RME

id
https://www.norgren.com/ids/aas/4DEF2ED7

idEncoded
aHR0cHM6Ly93d3cubm9yZ3Jlbi5jb20vaWRzL2Fhcy80REVGMkVENw==

apiVersion
3

- Nameplate
- ArticleInformation
- HandoverDocumentation
- TechnicalData
- MCAD

semanticId
https://admin-shell.io/zvei/nameplate/1/0/Nameplate

id
www.example.com/ids/sm/7002_0231_5022_3368

idEncoded
d3d3LmV4YW1wbGUuY29tL2lkcy9zbS83MDAyXzAyMzFfNTAyMl8zMzY4

ManufacturerName
-

/NF20/ Browser

The webpage shall work in every Browser supporting the HTML 5 standard.

/NF30/ Efficiency

The webpage shall add servers and apply filters in the fastest way possible as well as the user being able to find desired results with the lowest possible amount of steps.

/NF40/ Usability

A user searching a specific product shall find that product as fast as possible, intuitively know how the webpage works and there shall be enough online documentation for new users. No further training or experience is required.

Data Model

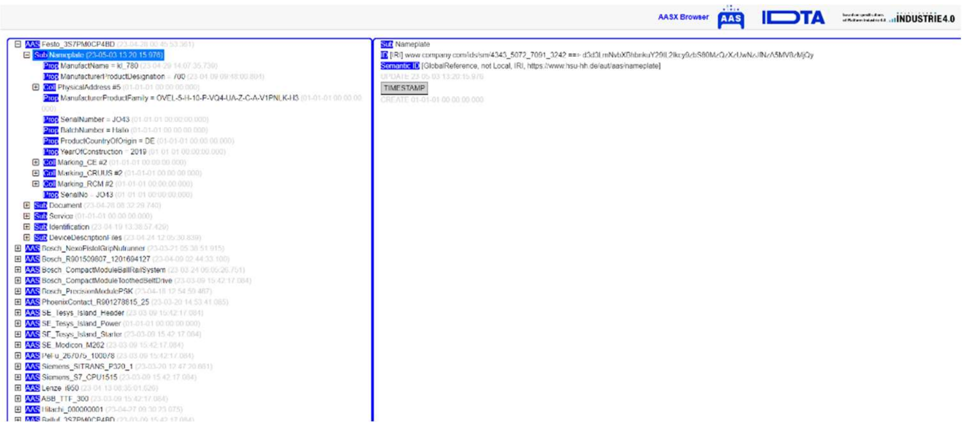
This section describes the data, that should be displayed on the webpage.

/LF10/ Data

The data displayed in the webpage is delivered through an AAS-Server with REST-Calls. There is no functionality to export data or import other data than an AAS-Server by its URL.

Analysis of Existing Solutions

Admin-shell-io.com

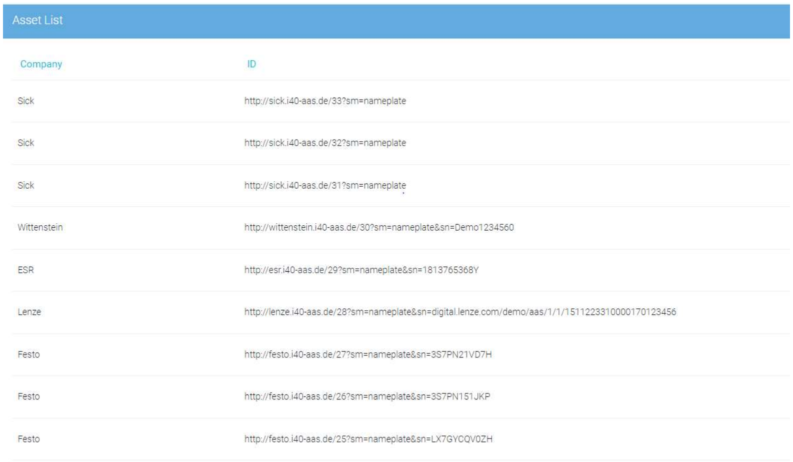


```
⊟ AAS Festo_3S7PM0CP4BD (23-04-28 00:45:53.361)
  ⊟ Sub Nameplate (23-05-03 13:20:15.976)
      Prop ManufactName = kl_780 (23-04-29 14:07:35.739)
      Prop ManufacturerProductDesignation = 700 (23-01-09 09:18:00.801)
    ⊞ Coll PhysicalAddress #5 (01-01-01 00:00:00.000)
      Prop ManufacturerProductFamily = OVEL-5-H-10-P-VQ4-UA-Z-C-A-V1PNLK-H3 (01-01-01 00:00:00.000)
      Prop SerialNumber = JO43 (01-01-01 00:00:00.000)
      Prop BatchNumber = Hallo (01-01-01 00:00:00.000)
      Prop ProductCountryOfOrigin = DE (01-01-01 00:00:00.000)
      Prop YearOfConstruction = 2019 (01-01-01 00:00:00.000)
    ⊞ Coll Marking_CE #2 (01-01-01 00:00:00.000)
    ⊞ Coll Marking_CRUUS #2 (01-01-01 00:00:00.000)
    ⊞ Coll Marking_RCM #2 (01-01-01 00:00:00.000)
      Prop SerialNo = JO43 (01-01-01 00:00:00.000)
  ⊞ Sub Document (23-04-28 08:32:29.740)
  ⊞ Sub Service (01-01-01 00:00:00.000)
  ⊞ Sub Identification (23-04-19 13:38:57.429)
  ⊞ Sub DeviceDescriptionFiles (23-04-24 12:05:30.839)
⊞ AAS Bosch_NexoPistolGripNutrunner (23-03-21 05:38:51.915)
⊞ AAS Bosch_R901509807_1201694127 (23-04-09 02:44:33.100)
⊞ AAS Bosch_CompactModuleBallRailSystem (23-03-24 06:05:26.751)
⊞ AAS Bosch_CompactModuleToothedBeltDrive (23-03-09 15:42:17.084)
⊞ AAS Bosch_PrecisionModulePSK (23-04-18 12:54:59.487)
⊞ AAS PhoenixContact_R901278815_25 (23-03-20 14:53:41.085)
⊞ AAS SE_Tesys_Island_Header (23-03-09 15:42:17.084)
⊞ AAS SE_Tesys_Island_Power (01-01-01 00:00:00.000)
⊞ AAS SE_Tesys_Island_Starter (23-03-09 15:42:17.084)
⊞ AAS SE_Modicon_M262 (23-03-09 15:42:17.084)
⊞ AAS Pel-u_267075_100078 (23-03-09 15:42:17.084)
⊞ AAS Siemens_SITRANS_P320_1 (23-03-20 12:47:20.881)
⊞ AAS Siemens_S7_CPU1515 (23-03-09 15:42:17.084)
⊞ AAS Lenze_i950 (23-04-13 08:35:01.620)
⊞ AAS ABB_TTF_300 (23-03-09 15:42:17.084)
⊞ AAS Hitachi_000000001 (23-04-27 09:30:23.075)
⊞ AAS Balluf_3S7PM0CP4BD (23-03-09 15:42:17.084)
```

Sub Nameplate
ID [IRI] www.company.com/ids/sm/4343_5072_7091_3242 ==> d3d3Lm NvbXBhbnkuY29tL2lkcy9zbS80MzQzXzUwNzJfNzA5MV8zMjQy
Semantic ID [GlobalReference, not Local, IRI, https://www.hsu-hh.de/aut/aas/nameplate]
UPDATE 23-05-03 13:20:15.976
TIMESTAMP
CREATE 01-01-01 00:00:00.000

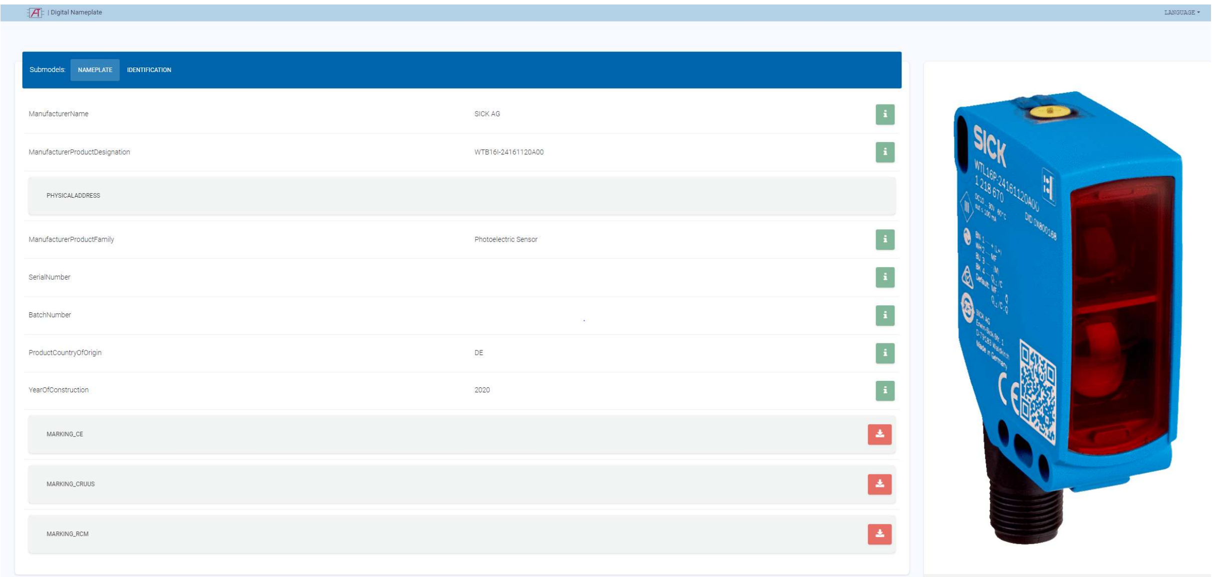
Strengths	Weaknesses
The list shows the assets clearly	It quickly becomes confusing due to the many dropdown menus on the website
	It is difficult to look for the content and find the right one

ZVEI Online Demonstrator



Asset List

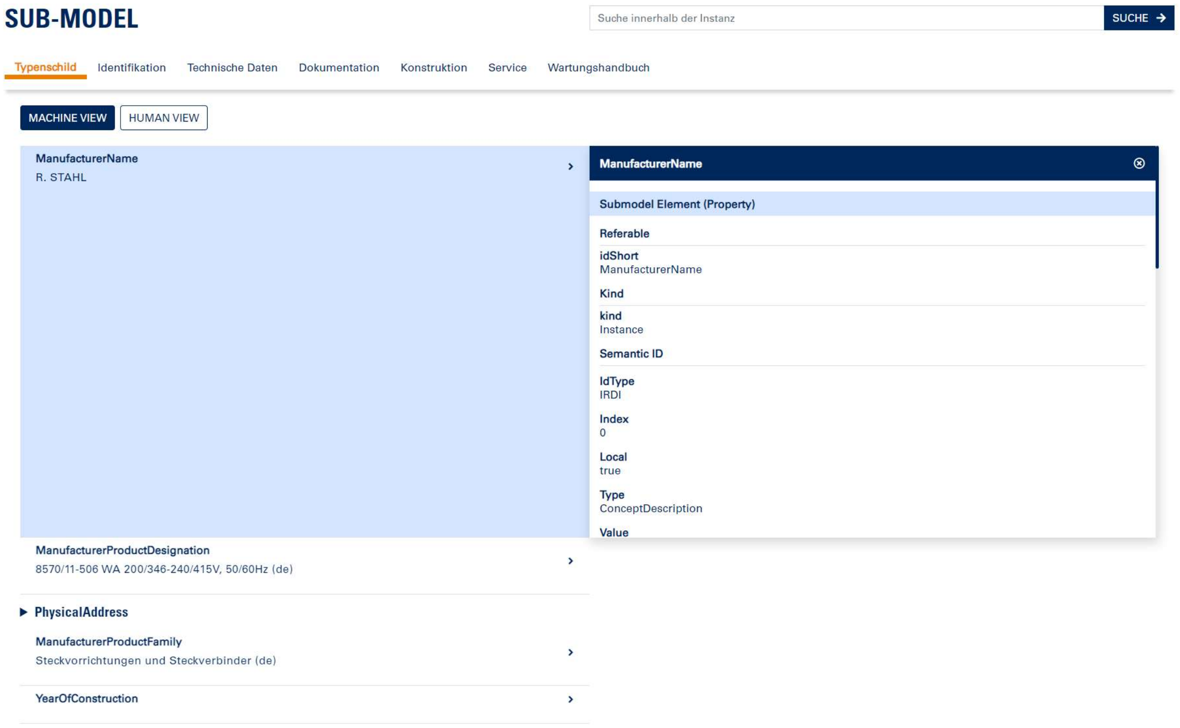
Company	ID
Sick	http://sick.i40-aas.de/33?sm=nameplate
Sick	http://sick.i40-aas.de/32?sm=nameplate
Sick	http://sick.i40-aas.de/31?sm=nameplate
Wittenstein	http://wittenstein.i40-aas.de/30?sm=nameplate&sn=Demo1234560
ESR	http://esr.i40-aas.de/29?sm=nameplate&sn=1813765368Y
Lenze	http://lenze.i40-aas.de/28?sm=nameplate&sn=digital.lenze.com/demo/aas/1/1/1511223310000170123456
Festo	http://festo.i40-aas.de/27?sm=nameplate&sn=3S7PN21VD7H
Festo	http://festo.i40-aas.de/26?sm=nameplate&sn=3S7PN151JKP
Festo	http://festo.i40-aas.de/25?sm=nameplate&sn=LX7GYCQV0ZH



ManufacturerName	SICK AG
ManufacturerProductDesignation	WTB16I-24161120A00
PHYSICALADDRESS	
ManufacturerProductFamily	Photoelectric Sensor
SerialNumber	
BatchNumber	
ProductCountryOfOrigin	DE
YearOfConstruction	2020
MARKING_CE	
MARKING_CRUUS	
MARKING_RCM	

Strengths	Weaknesses
The list shows the assets clearly	There are no names in the asset selection
The submodels are clear and structured	

demo-digital-twin.r-stahl.com/



ManufacturerName
R. STAHL

ManufacturerName

Submodel Element (Property)

Referable

idShort
ManufacturerName

Kind

kind
Instance

Semantic ID

IdType
IRDI

Index
0

Local
true

Type
ConceptDescription

Value

ManufacturerProductDesignation
8570/11-506 WA 200/346-240/415V, 50/60Hz (de)

▶ PhysicalAddress

ManufacturerProductFamily
Steckvorrichtungen und Steckverbinder (de)

YearOfConstruction

Strengths	Weaknesses
-	The display of an asset is extremely confusing, nested and unclear because of the many dropdowns and many fields.