CONTROLᴵᴺ**STEEL**

Deliverable 3.1:
Project Database and Semantic Search

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CONTROL_{IN}STEEL

1. Project summary

The project ControlInSteel is a dissemination activity. Focus of the dissemination are advanced control and automation concepts in the downstream process chain of the European steel production.

Today, knowledge engineering is a mature tool for analyzing problem solutions paths chosen by research projects as functions of impact, effort and problems. In ControlInSteel, controlled vocabularies will be developed, extended to taxonomies and ontologies to describe the interplay between chosen method, targeted problem and impact. Outcome of the project will be a systematic analysis which methods have been the most effective ones for reaching the desired impact.

At the center of any dissemination project is the distribution of results. On the one hand by discussing the results found by the ControlInSteel evaluation. On the other hand. by broadening the knowledge about those former project results that are evaluated by the project.

ControlInSteel started within the global COVID-19 crisis. The projects initial plan to conduct face-to-face workshops for the dissemination was slightly changed towards digital workshops and on-demand course material. The project team believes, that with this approach, the dissemination work will be even more reusable for the future.

2. Project Database

2.1. Construction of database entries

In ControlInSteel, an evaluation was performed by all project partners. This evaluation was conducted, using the project reports of all projects that are within the dissemination context.

Practically, taxonomies for problem space, solutions space, impact space and barriers and issues were derived from the most frequently encountered aspects in the projects. These taxonomies were compiled into an Excel table with appropriate sheets and shared digitally among the partners. As sharing tool, we used Microsoft Teams (and Microsoft Sharepoint).

The Excel table was read-out via a special ControlInSteel Python Notebook that was programmed in Jupyter-Lab. The Python notebook contains all necessary connectors for establishing an ontology of the project information. In this context, relationships between impact and methods are constructed and triple data points are created that link problems, impacts and methods.
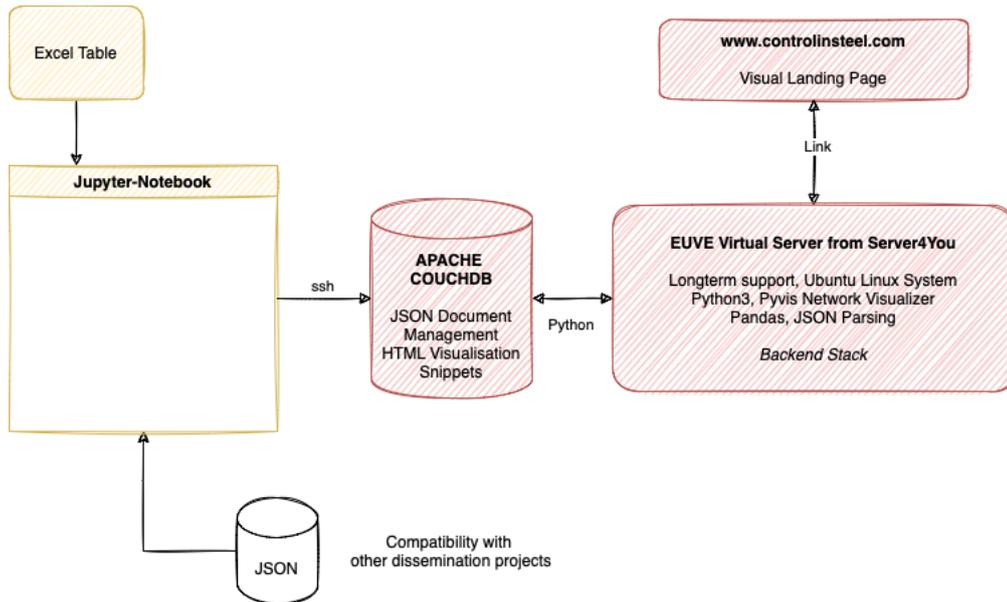
Figure 1. Construction principle of the ControlInSteel DB infrastructure.

2.2. Backend concept

The www.controlinsteel.com webpage was created substantially earlier than the searchable database to have a web presence and advertising platform as soon as possible. The backend for the database was setup on a virtual server that is hosted on a secure workstation in Strasbourg. It is purchased

```python
import pandas as pd
import numpy as np
import os, json

abstracts = pd.read_excel('ProjectsList.xlsx')
data = pd.read_excel('ProjectsClassification.xlsx')

class Projects(object):

    def __init__(self, abstracts, data):

        self.acronyms = []
        self.repo = {}

        for i in range(0,len(abstracts['Acronym'])):
            obj = {}
            obj['Acronym'] = abstracts['Acronym'][i]
            self.acronyms.append(obj['Acronym'])
            obj['Duration'] = abstracts['Start-End Date'][i]
            obj['Title'] = abstracts['Title'][i]
            obj['Abstract'] = abstracts['Abstract'][i]
            obj['Coordinator'] = abstracts['Coordinator'][i]

            obj['T1ProblemSpace'] = []
            obj['T1ProductType'] = []

            for i in range(1, 27):
                if data[obj['Acronym']][i]==1:
                    obj['T1ProblemSpace'].append(data['Type'][i])
            for i in range(27, 29):
                if data[obj['Acronym']][i]==1:
                    obj['T1ProductType'].append(data['Type'][i])
```

Figure 2. Snapshot of the Jupyter Notebook that compiles the projects into a digital library.

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via server4you and maintained by mndevelopments web services, which conduct common updates and provide longterm support for the content.

The backend uses a Python webservice that drives a HTML5 visualisation engine. For the innovative impact visualization, the package Pyvis is used. It contains a network visualization technique that shows the project evaluation in form of graphical diagram.
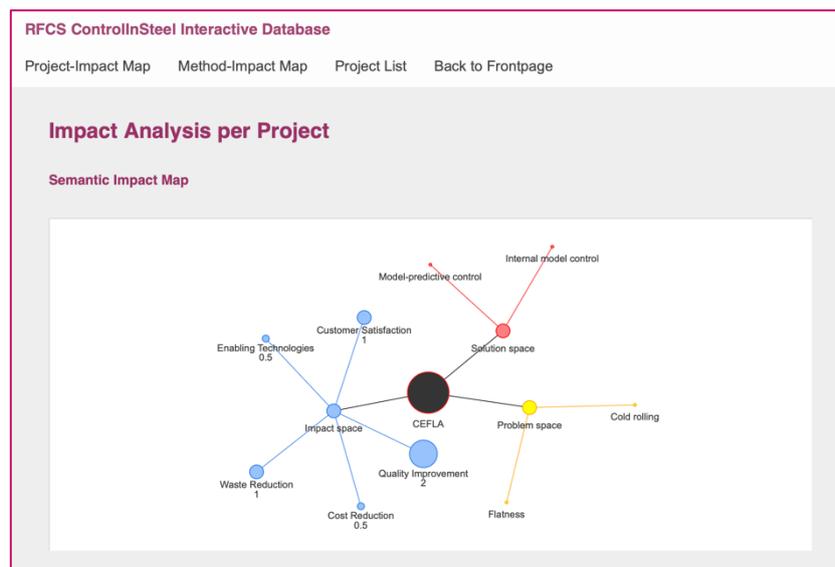
2.3. Database frontend concept

Figure 3. Screenshot of the web page front end for the database.

Figure 2 shows the semantic parser for the impact analysis per project. This view allows to study all projects of our dissemination activity with respect to methods and impact.

A different view is the impact analysis with respect to the choice of method. Here, a cumulative analysis is performed that sums up all project impacts associated with a specific type of method. With this tool, methods can be effectively compared with each other and evaluated in terms of usability. Figure 3 yields a screenshot of this impact analysis with respect to the methods.
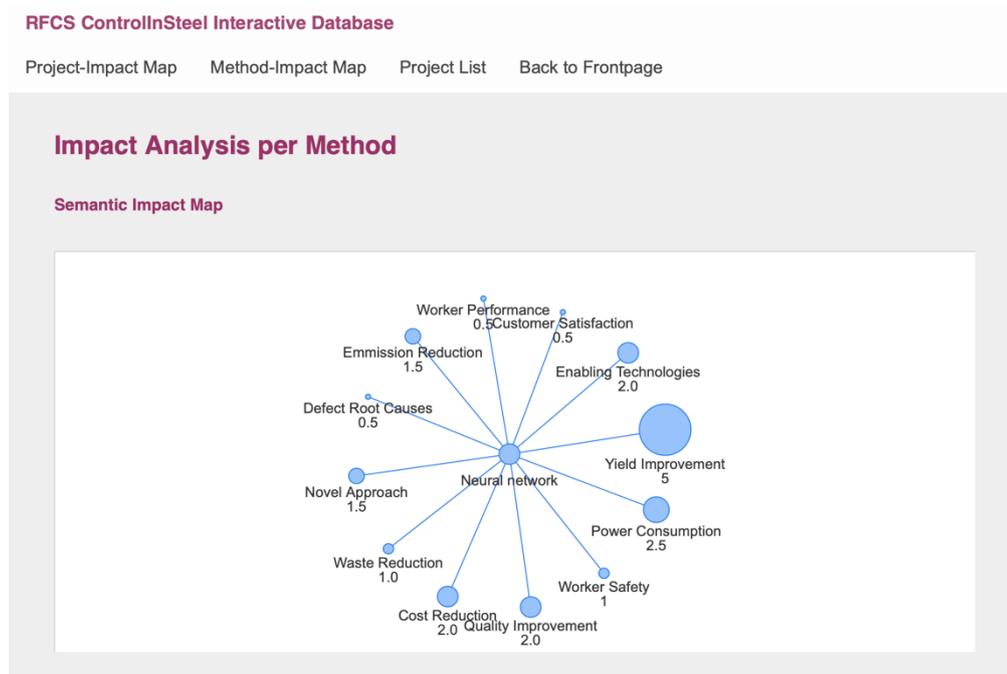
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Figure 4. Screenshot of the impact analysis per Method.

2.4. Project List

The project list compiles a table of all relevant projects. It contains the impact assessment results of ControlInSteel and the associated taxonomy terms. The table takes some time to be processes, as the whole presentation is rendered online and real-time.

2.5. Extendibility

Each project is represented by an entry in an Apache CouchDB. These entries are comparable to JSON documents. Documents generated by former dissemination projects (like DissI2M) are compatible and can be uploaded to this infrastructure. Therefore, the demonstrated technology is not limited and allows longterm sustainability of the project data. Additionally, future evaluations with respect to impact or transferability can be easily uploaded to the platform.

2.6. Accessing the database

The database can be reached via the landing page of ControlInSteel, namely www.controlinsteel.com, following the link on the first page as shown in Figure 5.
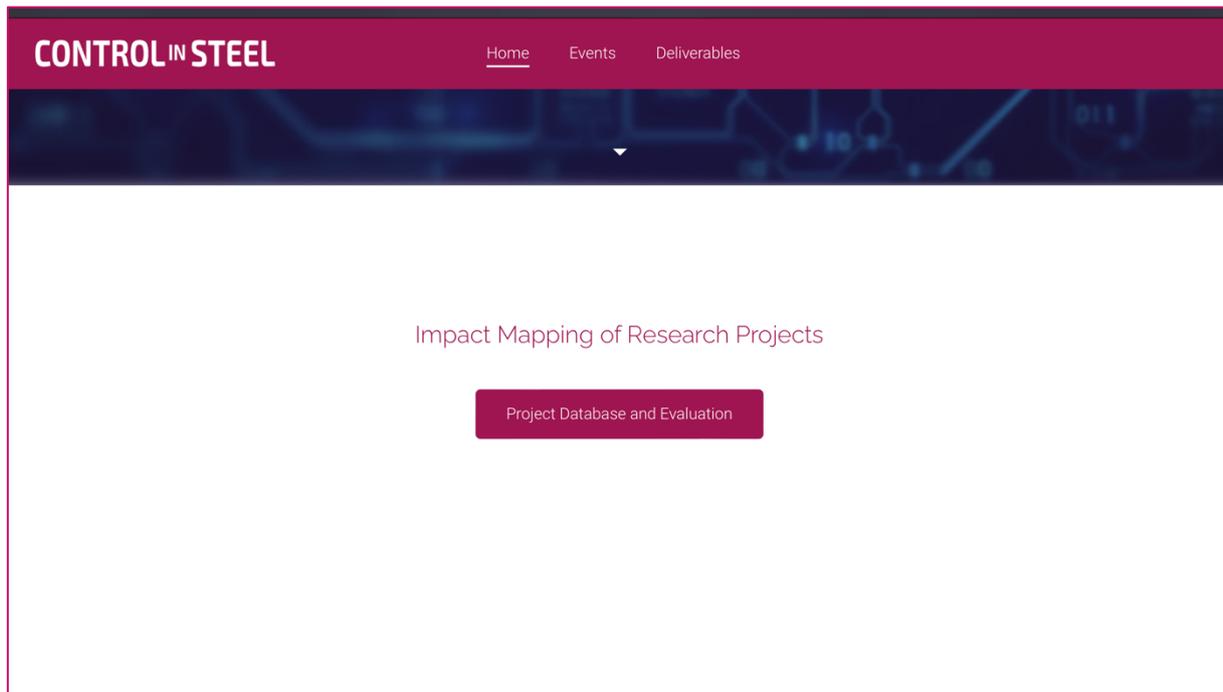

Figure 5. Landing page link location to access the database infrastructure on the virtual server environment.