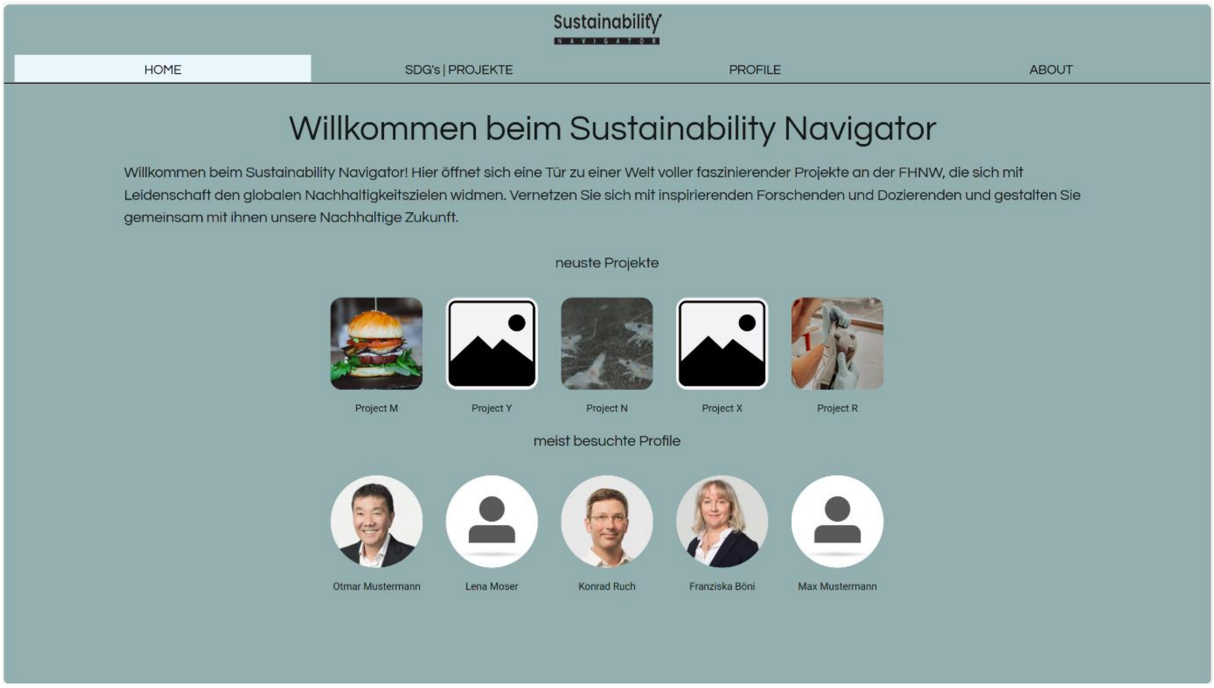
Fachhochschule Nordwestschweiz
Hochschule für Technik

Documentation

Sustainability
NAVIGATOR



Willkommen beim Sustainability Navigator

Willkommen beim Sustainability Navigator! Hier öffnet sich eine Tür zu einer Welt voller faszinierender Projekte an der FHNW, die sich mit Leidenschaft den globalen Nachhaltigkeitszielen widmen. Vernetzen Sie sich mit inspirierenden Forschenden und Dozierenden und gestalten Sie gemeinsam mit ihnen unsere Nachhaltige Zukunft.

IP5 - Semesterproject HS2023	Client:	FHNW, Dr. Andrea Flora Bauer
Studiengang iCompetence	Authors:	Philippe Fasel
		Kevin Würsch
	Supervisors:	Prof. Dr. Norbert Seyff
		Dr. Nitish Patkar
	Project nr.:	23HS_IIT38

University of Applied Sciences and Arts Northwestern Switzerland, School of Engineering

Windisch, January 2024

1 Abstract

Sustainability is increasingly becoming a focal point at FHNW, making it essential for those both within and outside the institution to stay informed.

However, this is such a huge topic and projects about this are all over the place. This complexity often makes it challenging to pinpoint specific sustainability projects of interest. While the FHNW does maintain a comprehensive overview of its academic publications, a dedicated resource for easily locating sustainability-focused projects is currently lacking. This gap highlights the need for a more targeted and accessible platform or system to streamline the search for sustainability initiatives within the FHNW community.

This is where our platform, the Sustainability Navigator, plays a vital role. Designed as a standalone platform, the Navigator enables users to effortlessly locate specific projects or individuals without the hassle of navigating through multiple web pages.

At the heart of the Sustainability Navigator is its main page, which displays the latest sustainability projects. This feature keeps users updated on the most current trends in the field. Additionally, the page highlights a 'Most Clicked Profile' section, offering insights into key contributors in sustainability.

The projects section of the Navigator is particularly comprehensive, listing all FHNW sustainability projects. Users can even conduct searches for specific initiatives. Each project is categorized according to the European Sustainable Development Goals (SDG's), providing clarity on the sustainability domain it addresses. Clicking on a project opens a detailed view, revealing the team members involved and other pertinent information.

Similarly, the profiles section offers detailed views, allowing users to explore the projects associated with everyone, along with their areas of expertise.

In essence, the Sustainability Navigator serves its purpose. It provides a user-friendly platform for anyone interested in FHNW's sustainability efforts, requiring no prior knowledge or experience with FHNW. This feature is particularly beneficial for external partners, fostering collaborative and effective engagements in these crucial sustainability projects.

This project served as a first prototype on which the customers then can test and decide whether it should be continued or not. Early usability tests were already done, and the first impressions seem promising.

2 Keywords

Angular, NodeJS, Sequelize, MySQL Database, Docker Container, SWITCH Server, Sustainability

Content

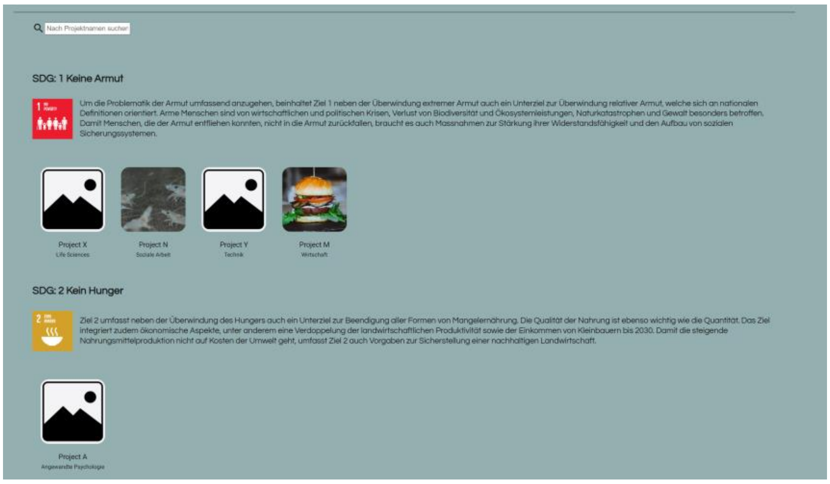
3 List of Figures

4 Introduction

In recent years, sustainability has become an imperative, not just as a societal need but as an integral part of academia and business. The Fachhochschule Nordwestschweiz (FHNW) has been at the forefront of this movement, conducting extensive research and launching numerous initiatives. Despite these efforts, the dissemination and accessibility of information regarding these sustainability projects have remained fragmented and challenging to navigate. This predicament underscores the demand for a tool that not only consolidates this wealth of information but also presents it in an accessible and user-friendly manner. This paper introduces the Sustainability Navigator, an innovative platform designed to address these needs.

4.1 What was achieved?

The Sustainability Navigator serves as a standalone platform, enabling visitors to efficiently locate and engage with sustainability projects and contributors within the FHNW ecosystem. Notably, users have the capability to create their own profiles and publish projects, thereby contributing to the growing repository of sustainability initiatives. The platform displays the latest sustainability projects on its main page, providing a snapshot of current trends and highlighting prominent contributors through a 'Most Clicked Profile' section. The comprehensive projects section allows for targeted searches, categorizing each initiative according to the European Sustainable Development Goals (SDGs), thereby offering clarity on the sustainability domains addressed as shown in Figure 1.



SDG: 1 Keine Armut

Um die Problematik der Armut umfassend anzugehen, beinhaltet Ziel 1 neben der Überwindung extremer Armut auch ein Unterziel zur Überwindung relativer Armut, welche sich an nationalen Definitionen orientiert. Arme Menschen sind von wirtschaftlichen und politischen Krisen, Verlust von Biodiversität und Ökosystemleistungen, Naturkatastrophen und Gewalt besonders betroffen. Damit Menschen, die der Armut entfliehen konnten, nicht in die Armut zurückfallen, braucht es auch Massnahmen zur Stärkung ihrer Widerstandsfähigkeit und den Aufbau von sozialen Sicherungssystemen.

SDG: 2 Kein Hunger

Ziel 2 umfasst neben der Überwindung des Hungers auch ein Unterziel zur Beendigung aller Formen von Mangelernährung. Die Qualität der Nahrung ist ebenso wichtig wie die Quantität. Das Ziel integriert zudem ökonomische Aspekte, unter anderem eine Verdoppelung der landwirtschaftlichen Produktivität sowie der Einkommen von Kleinbauern bis 2030. Damit die steigende Nahrungsmittelproduktion nicht auf Kosten der Umwelt geht, umfasst Ziel 2 auch Vorgaben zur Sicherstellung einer nachhaltigen Landwirtschaft.

Figure 1: SDG's & projects

Similarly, detailed profile views provide insights into individual contributions and expertise, fostering a deeper understanding and engagement with the sustainability community. This interactive and participatory feature ensures the platform remains a dynamic and up-to-date resource for all users interested in sustainability at FHNW. The Sustainability Navigator serves as a standalone platform, enabling users to efficiently locate and engage with sustainability projects and contributors within the FHNW ecosystem. The platform displays the latest sustainability projects on its main page, providing a snapshot of current trends and highlighting prominent contributors through a 'Most Clicked Profile' section. The comprehensive projects section allows for targeted searches, categorizing each initiative according to the European Sustainable Development Goals (SDG's), thereby offering clarity on the sustainability domains addressed. Similarly, detailed profile views provide insights into individual contributions and expertise, fostering a deeper understanding and engagement with the sustainability community.

4.2 Initial Position

The FHNW has a strong focus on sustainability, boasting a team of experts in various sustainability domains, actively engaging in research projects, and offering courses on this crucial subject. Nonetheless, there exists a lack of awareness among many regarding the wide array of sustainability-related skills, projects, and offerings available at FHNW. This lack of clarity poses a challenge for external individuals, staff, and students in fully comprehending the extent of what FHNW provides in terms of sustainability. To address this issue, a tool called the "Sustainability Navigator" is set to be developed.

The client for this project is the FHNW, and it involves three primary stakeholders: Andrea Flora Bauer, Norbert Seyff, and Benedikt Jäggi, whose needs and expectations need to be assessed and considered. Additionally, this initiative is built upon a bachelor’s thesis conducted by Gülce Acikkol and Julia Rawyler in August 2023, which delved into the research and analysis required for such a tool. Their research, comprising interviews and various investigations, revealed that users prefer a tool that can seamlessly integrate into their existing workflow. However, due to the ongoing relaunch of the FHNW website, immediate integration is not feasible. Consequently, the plan is to create a solution that can be adapted and integrated later, while currently functioning as a standalone tool.

As part of the broader effort to revamp the entire FHNW website, it is essential to determine if and how the solution can be integrated into various FHNW systems down the line. This decision will significantly influence the choice of technology. The Hochschule für Gestaltung und Kunst (HGK) has already developed an initial Figma design prototype other than that the project starts from scratch, server setup, database concept and implementation, backend, frontend, design improvements, and validation of the functional prototype will be done in this ip5 project.

The envisioned platform should be engaging and user-friendly, with a simple and interactive design to motivate users to utilize it. To achieve this, rigorous user testing is imperative. It is crucial to understand that the project aims to create a prototype, not a final product. This first version of the SN gives a feel of the final product to show the benefits of such a platform and can then be used to discuss the implementation with the marketing- and IT- department. Additionally, the site's user-friendliness is of utmost importance to Ms. Bauer, the client, and it should cater to the needs of external visitors as well.

4.3 How was it solved?

The solution involved a multi-faceted approach combining technology, design, and user experience. Starting from scratch, the project entailed setting up a server, conceptualizing the database, and implementing both the backend and frontend components. User-centric design was paramount, informed by usability testing to ensure an intuitive and engaging experience. Throughout the development process, discussions with various stakeholders were conducted to gather their requirements and expectations, ensuring the platform meets a wide range of needs. These interactions helped in refining the platform's features and functionalities, aligning them closely with user preferences and institutional goals. The platform was initially developed as a standalone tool, with considerations for future integration into the broader FHNW system amidst ongoing website relaunch efforts. The collaborative input from primary stakeholders, coupled with insights from the previous bachelor's thesis regarding this topic (by Gülce Acikkol and Julia Rawyler in August 2023), guided the design and functionality to align with user preferences and institutional needs.

4.4 Direction for reader

Main Body

Theoretical Part & Research Questions: Explores the scientific foundations of the project and answers specific research questions / project goals.

Practical Part: Covers the technical implementation, including database, server configuration, programming, performance, and more. It also discusses scalability and potential future enhancements.

Conclusion

Reflection: Reviews what was achieved and what was learned.
Recommendations: Provides suggestions for future developments and updates.
Usability Tests: Presents the results of usability testing and resulting recommendations.
Limitations and Next Steps: Discusses the project's limitations and proposes future directions.

5 Main Body

5.1 Theoretical Part & answers to research questions

5.1.1 Methodology

Due to our previous experience, we chose to adopt an Agile workflow for this project, as we believe it facilitates a smooth and well-structured process in software development. We followed the typical Agile methodology, organizing our work into sprints that were aligned with specific milestones. This approach ensured we consistently stayed on track and maintained clear visibility of the project's progress.

The project was successfully completed using this method. Particularly beneficial was the use of Fibonacci sequence numbers for issue sizing, which provided a clear understanding of the scale of tasks assigned to each team member and their expected completion timelines. This level of granularity in task management ensured efficient workload distribution and progress tracking.

The detailed planning and tracking of these tasks were conducted using GitLab. For those interested in the specifics of our project management and workflow, the relevant details and records can be found in the links section of this document. The Gitlab link offers insight into our Agile practices and how they contributed to the successful execution of the project.

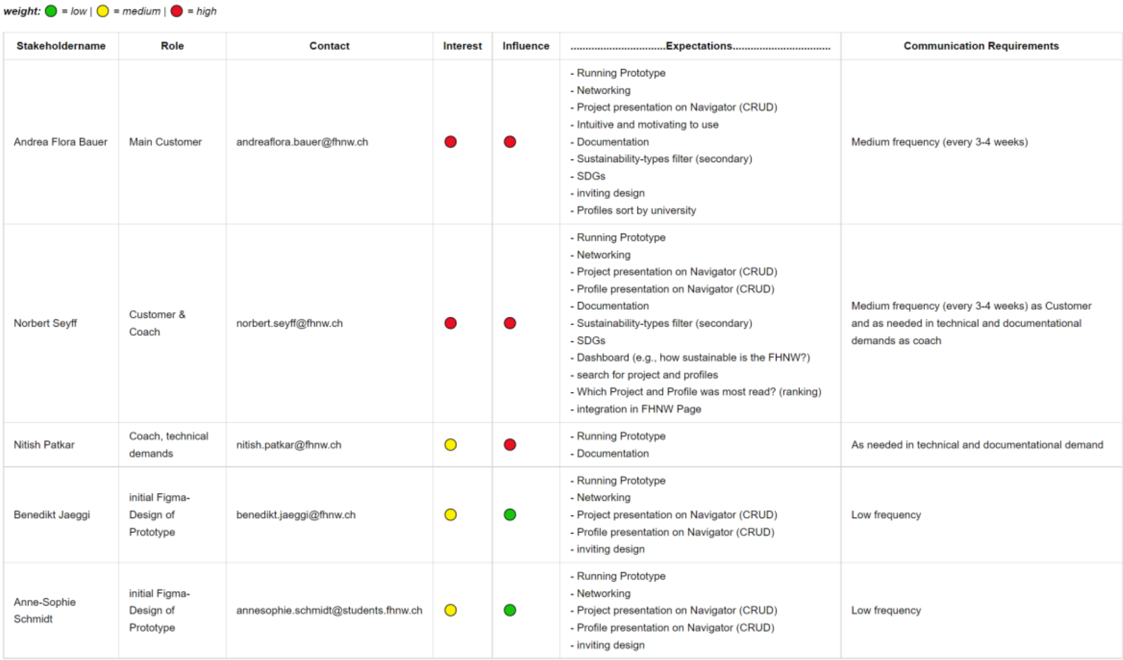
5.1.2 Research Question A

A. **Analyze:**

   What are the core requirements that are necessary to satisfy the main Stakeholders?
   Due to the great amount of stakeholders we need to figure out the main stakeholder and the core requirements for a satisfying mvp. This means we must have various meetings with all the departments and create a clear goal for this project.

5.1.2.1 Stakeholder needs

As the project had multiple stakeholders with varying expectations, we created a stakeholder register (Figure 2) to capture and visualize the most significant and common desires.



weight: 🟢 = *low* | 🟡 = *medium* | 🔴 = *high*

Stakeholdername	Role	Contact	Interest	Influence	...............................Expectations...............................	Communication Requirements
Andrea Flora Bauer	Main Customer	andreaflora.bauer@fhnw.ch	🔴	🔴	- Running Prototype - Networking - Project presentation on Navigator (CRUD) - Intuitive and motivating to use - Documentation - Sustainability-types filter (secondary) - SDGs - inviting design - Profiles sort by university	Medium frequency (every 3-4 weeks)
Norbert Seyff	Customer & Coach	norbert.seyff@fhnw.ch	🔴	🔴	- Running Prototype - Networking - Project presentation on Navigator (CRUD) - Profile presentation on Navigator (CRUD) - Documentation - Sustainability-types filter (secondary) - SDGs - Dashboard (e.g., how sustainable is the FHNW?) - search for project and profiles - Which Project and Profile was most read? (ranking) - integration in FHNW Page	Medium frequency (every 3-4 weeks) as Customer and as needed in technical and documentational demands as coach
Nitish Patkar	Coach, technical demands	nitish.patkar@fhnw.ch	🟡	🔴	- Running Prototype - Documentation	As needed in technical and documentational demand
Benedikt Jaeggi	initial Figma-Design of Prototype	benedikt.jaeggi@fhnw.ch	🟡	🟢	- Running Prototype - Networking - Project presentation on Navigator (CRUD) - Profile presentation on Navigator (CRUD) - inviting design	Low frequency
Anne-Sophie Schmidt	initial Figma-Design of Prototype	annesophie.schmidt@students.fhnw.ch	🟡	🟢	- Running Prototype - Networking - Project presentation on Navigator (CRUD) - Profile presentation on Navigator (CRUD) - inviting design	Low frequency

Figure 2: Stakeholder register

Since the expectations for this project were extremely high and would have exceeded the scope of an IP5 project, a selection was made based on the importance of the requirements. The following Venn diagram (Figure 3) illustrates the key expectations of the three main stakeholders that were also implemented in the software or prepared in the theoretical part.

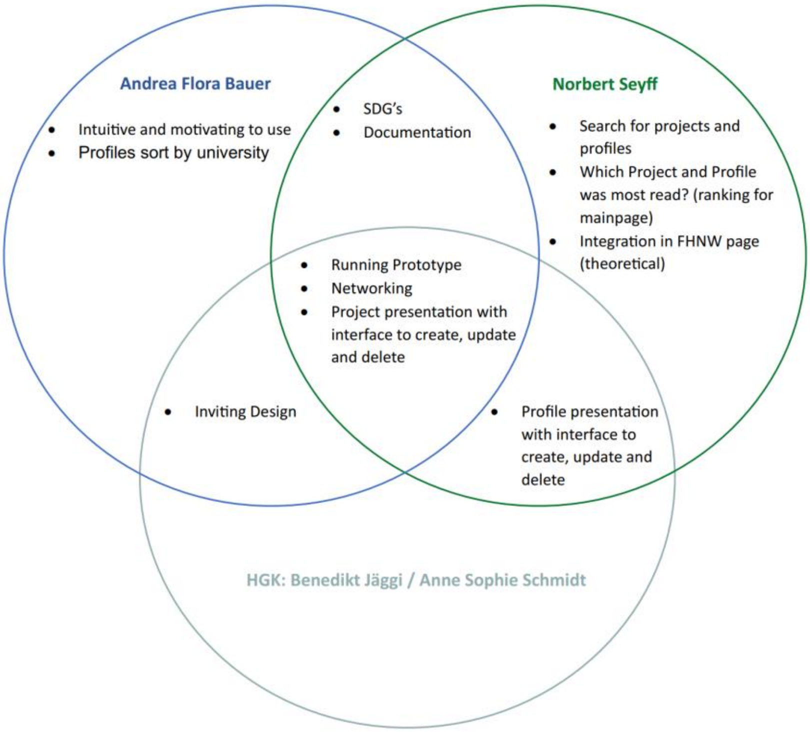

Andrea Flora Bauer
• Intuitive and motivating to use
• Profiles sort by university
• SDG's
• Documentation
Norbert Seyff
• Search for projects and profiles
• Which Project and Profile was most read? (ranking for mainpage)
• Integration in FHNW page (theoretical)
• Running Prototype
• Networking
• Project presentation with interface to create, update and delete
• Inviting Design
• Profile presentation with interface to create, update and delete
HGK: Benedikt Jäggi / Anne Sophie Schmidt

Figure 3: Venn diagram stakeholder needs

5.1.2.1.1 Sustainability-themes

To be able to develop the SN the sustainability themes had to be detected, so that users can describe their competencies in those specific fields in their profiles and projects can have their main sustainability theme to which they are related. The following themes were found and discussed with the main customer Andrea Flora Bauer.

Sustainability in:

1. Agriculture
2. Biodiversity
3. Ecology
4. Economy
5. Education
6. Energy
7. Health
8. Politics
9. Social
10. Society
11. Software
12. Technology
13. Urban Development

5.1.2.2 Sustainable Development Goals SDG's

Since it was a major wish of the main stakeholder to have the SDG's integrated in the SN these are the 17 SDG's according to admin.ch (Communication, 2024). Each project is related to one SDG and the whole project list is sorted by the SDG's which makes the SDG's a main part of the SN now. This was also a major part of the restructuring of the initial Figma designs of the HGK, which will be closer mentioned in the answer of the research question B.

1. No Poverty
2. Zero Hunger
3. Good Health and Well-being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation, and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace and Justice, Strong Institutions
17. Partnerships for the Goals

5.1.3 Research Question B

B. UI/UX Concept:

What are innovative solutions for building an engaging platform?
The HGK already designed some Figma prototypes. We must figure out which one of those is the most valuable and usable and which one is the favorite of the stakeholders. There needs to be validation so that we can confirm that those designs are understandable and usable for the end user.

5.1.3.1 Figma Design prototype of HGK

The following two Figma Designs (Figure 5 and Figure 4) where created by the HGK. The Design 1 was the preferred one by the stakeholders, so the development went on with it. In the received Designs from the HGK, the user interface to create, update and delete profiles and projects was not taken into account as well as content to sustainability themes and the sustainable development goals, main- and about- page was not written yet and was created by us during the development phase of our IP5.

Figma-Design 1

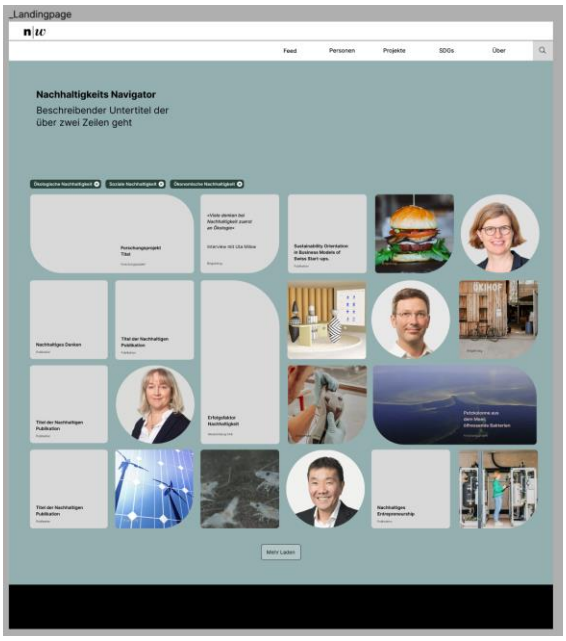
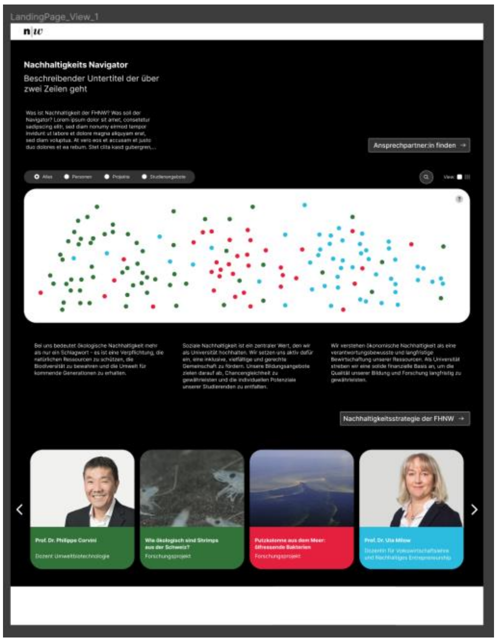

_Landingpage
Feed
Personen
Projekte
SDGs
Über
Nachhaltigkeits Navigator
Beschreibender Untertitel der
über zwei Zeilen geht
Ökologische Nachhaltigkeit
Soziale Nachhaltigkeit
Ökonomische Nachhaltigkeit
Forschungsprojekt Titel
«Viele denken bei Nachhaltigkeit zuerst an Ökologie»
Interview mit Ute Milow
Sustainability Orientation in Business Models of Swiss Start-ups.
Nachhaltiges Denken
Titel der Nachhaltigen Publikation
Titel der Nachhaltigen Publikation
Erfolgsfaktor Nachhaltigkeit
Putzkolonne aus dem Meer: Ölfressende Bakterien
Titel der Nachhaltigen Publikation
Nachhaltiges Entrepreneurship
Mehr Laden

Figure 5: HGK Design 1

Figma-Design 2


LandingPage_View_1
Nachhaltigkeits Navigator
Beschreibender Untertitel der über
zwei Zeilen geht
Ansprechpartner:in finden →
Alles
Personen
Projekte
Studienangebote
View:
Nachhaltigkeitsstrategie der FHNW →
Prof. Dr. Philippe Corvini
Dozent Umweltbiotechnologie
Wie ökologisch sind Shrimps aus der Schweiz?
Forschungsprojekt
Putzkolonne aus dem Meer: ölfressende Bakterien
Forschungsprojekt
Prof. Dr. Ute Milow
Dozentin für Volkswirtschaftslehre und Nachhaltiges Entrepreneurship

Was ist Nachhaltigkeit der FHNW? Was soll der Navigator? Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren,...

Bei uns bedeutet ökologische Nachhaltigkeit mehr als nur ein Schlagwort – es ist eine Verpflichtung, die natürlichen Ressourcen zu schützen, die Biodiversität zu bewahren und die Umwelt für kommende Generationen zu erhalten.

Soziale Nachhaltigkeit ist ein zentraler Wert, den wir als Universität hochhalten. Wir setzen uns aktiv dafür ein, eine inklusive, vielfältige und gerechte Gemeinschaft zu fördern. Unsere Bildungsangebote zielen darauf ab, Chancengleichheit zu gewährleisten und die individuellen Potenziale unserer Studierenden zu entfalten.

Wir verstehen ökonomische Nachhaltigkeit als eine verantwortungsbewusste und langfristige Bewirtschaftung unserer Ressourcen. Als Universität streben wir eine solide finanzielle Basis an, um die Qualität unserer Bildung und Forschung langfristig zu gewährleisten.

Figure 4: HGK Design 2

5.1.3.2 Requirements for the Design

During the Meetings with the stakeholders, it was mentioned that they want the Sustainability Navigator to be a simple and inviting Platform which is informative, functional, and intuitive to use. User should be able to create a profile and publish projects themselves, therefor it needs create, update, and delete interfaces (CRUD). According to these requirements and the feedback of the usability tests, the following improvements and additions have been made.

5.1.3.3 Design improvements

Logo & favicon

A logo (Figure 6) and favicon (Figure 7) was designed to increase the recognizability of the Sustainability Navigator.

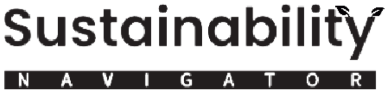


Figure 6: logo

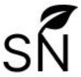
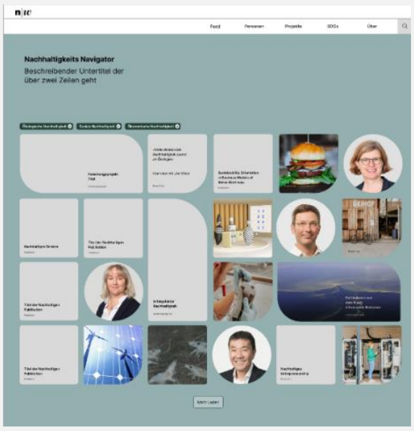


Figure 7: favicon

Landing page

Initial Design (HGK)



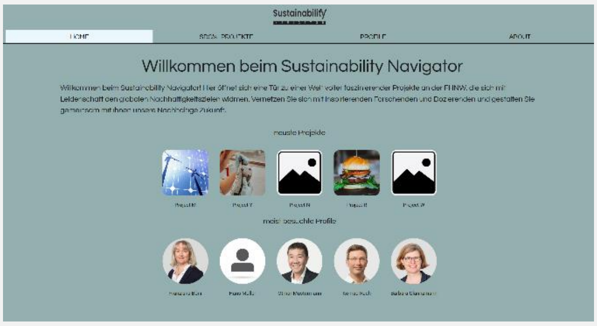
Nachhaltigkeits Navigator

Beschreibender Untertitel der über zwei Zeilen geht

Figure 9: HGK design of main page

In the HGK mainpage Design was everything mixed: profiles, projects, Blogs & publications. (Figure 9)

Final Design



Willkommen beim Sustainability Navigator

Willkommen beim Sustainability Navigator! Hier öffnet sich eine Tür zu einer Welt voller faszinierender Projekte an der FHNW, die sich mit Leidenschaft den globalen Nachhaltigkeitszielen widmen. Vernetzen Sie sich mit inspirierenden Forschenden und Dozierenden und gestalten Sie gemeinsam mit ihnen unsere Nachhaltige Zukunft.

Figure 8: final Main Page design

We changed that view to gain clarity and overview. And added an informational welcoming text. The idea with the different forms of profiles and projects was kept throughout all pages.

The final landing page (Figure 8) shows the newest projects and the most visited profiles. This gives the visitor of the SN the latest news about sustainable projects at the FHNW and rewards those users who publishes the most, since they will most certainly generate more clicks on their profiles due to their several projects.

Project overview

Initial Design (HGK)

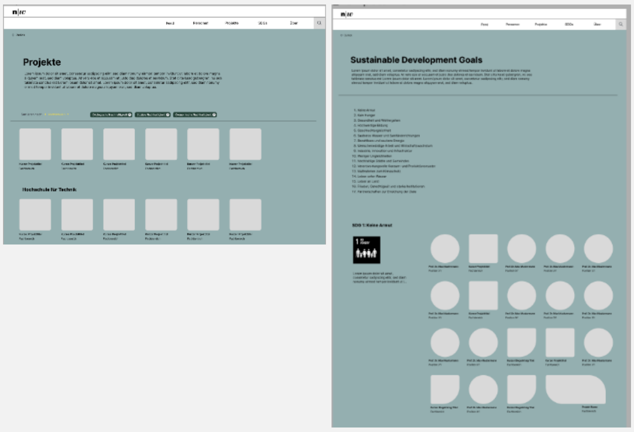
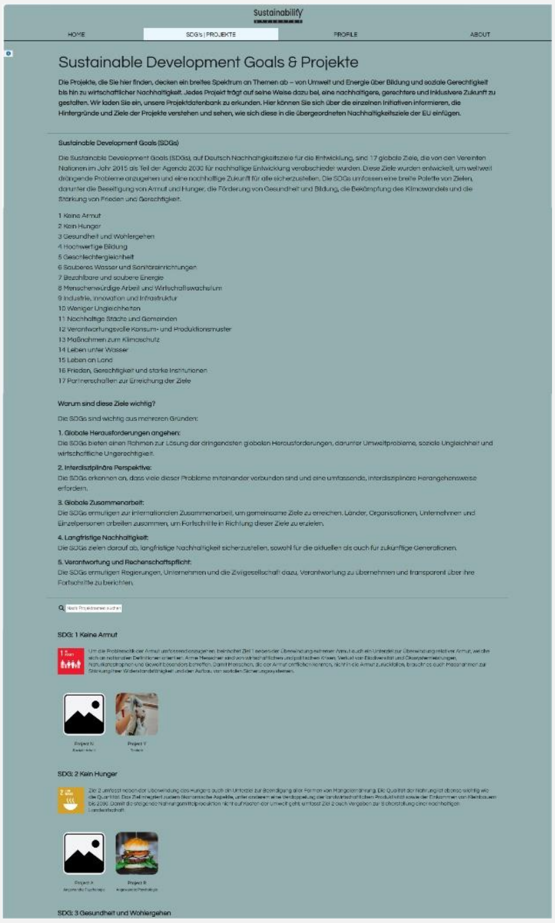


Figure 10: HGK design projectoverview

In the initial Design by HGK (Figure 10) the projects were on two different pages. Once sorted by university and once by SDG's.

Final Design



Sustainable Development Goals & Projekte

Die Projekte, die Sie hier finden, decken ein breites Spektrum an Themen ab – von Umwelt und Energie über Bildung und soziale Gerechtigkeit bis hin zu wirtschaftlicher Nachhaltigkeit. Jedes Projekt trägt auf seine Weise dazu bei, eine nachhaltigere, gerechtere und inklusivere Zukunft zu gestalten. Wir laden Sie ein, unsere Projektdatenbank zu erkunden. Hier können Sie sich über die einzelnen Initiativen informieren, die Hintergründe und Ziele der Projekte verstehen und sehen, wie sich diese in die übergeordneten Nachhaltigkeitsziele der EU einfügen.

Sustainable Development Goals (SDGs)

Die Sustainable Development Goals (SDGs), auf Deutsch Nachhaltigkeitsziele für die Entwicklung, sind 17 globale Ziele, die von den Vereinten Nationen im Jahr 2015 als Teil der Agenda 2030 für nachhaltige Entwicklung verabschiedet wurden. Diese Ziele wurden entwickelt, um weltweit drängende Probleme anzugehen und eine nachhaltige Zukunft für alle sicherzustellen. Die SDGs umfassen eine breite Palette von Zielen, darunter die Beseitigung von Armut und Hunger, die Förderung von Gesundheit und Bildung, die Bekämpfung des Klimawandels und die Stärkung von Frieden und Gerechtigkeit.

1 Keine Armut
2 Kein Hunger
3 Gesundheit und Wohlergehen
4 Hochwertige Bildung
5 Geschlechtergleichheit
6 Sauberes Wasser und Sanitäreinrichtungen
7 Bezahlbare und saubere Energie
8 Menschenwürdige Arbeit und Wirtschaftswachstum
9 Industrie, Innovation und Infrastruktur
10 Weniger Ungleichheiten
11 Nachhaltige Städte und Gemeinden
12 Verantwortungsvolle Konsum- und Produktionsmuster
13 Maßnahmen zum Klimaschutz
14 Leben unter Wasser
15 Leben an Land
16 Frieden, Gerechtigkeit und starke Institutionen
17 Partnerschaften zur Erreichung der Ziele

Warum sind diese Ziele wichtig?

Die SDGs sind wichtig aus mehreren Gründen:

1. Globale Herausforderungen angehen:
Die SDGs bieten einen Rahmen zur Lösung der dringendsten globalen Herausforderungen, darunter Umweltprobleme, soziale Ungleichheit und wirtschaftliche Ungerechtigkeit.

2. Interdisziplinäre Perspektive:
Die SDGs erkennen an, dass viele dieser Probleme miteinander verbunden sind und eine umfassende, interdisziplinäre Herangehensweise erfordern.

3. Globale Zusammenarbeit:
Die SDGs ermutigen zur internationalen Zusammenarbeit, um gemeinsame Ziele zu erreichen. Länder, Organisationen, Unternehmen und Einzelpersonen arbeiten zusammen, um Fortschritte in Richtung dieser Ziele zu erzielen.

4. Langfristige Nachhaltigkeit:
Die SDGs zielen darauf ab, langfristige Nachhaltigkeit sicherzustellen, sowohl für die aktuellen als auch für zukünftige Generationen.

5. Verantwortung und Rechenschaftspflicht:
Die SDGs ermutigen Regierungen, Unternehmen und die Zivilgesellschaft dazu, Verantwortung zu übernehmen und transparent über ihre Fortschritte zu berichten.

Nach Projektnamen suchen

SDG: 1 Keine Armut

Um die Problematik der Armut umfassend anzugehen, beinhaltet Ziel 1 neben der Überwindung extremer Armut auch ein Unterziel zur Überwindung relativer Armut, welche sich an nationalen Definitionen orientiert. Arme Menschen sind von wirtschaftlichen und politischen Krisen, Verlust von Biodiversität und Ökosystemleistungen, Naturkatastrophen und Gewalt besonders betroffen. Damit Menschen, die der Armut entfliehen konnten, nicht in die Armut zurückfallen, braucht es auch Massnahmen zur Stärkung ihrer Widerstandsfähigkeit und den Aufbau von sozialen Sicherungssystemen.

SDG: 2 Kein Hunger

Ziel 2 umfasst neben der Überwindung des Hungers auch ein Unterziel zur Beendigung aller Formen von Mangelernährung. Die Qualität der Nahrung ist ebenso wichtig wie die Quantität. Das Ziel integriert zudem ökonomische Aspekte, unter anderem eine Verdoppelung der landwirtschaftlichen Produktivität sowie der Einkommen von Kleinbauern bis 2030. Damit die steigende Nahrungsmittelproduktion nicht auf Kosten der Umwelt geht, umfasst Ziel 2 auch Vorgaben zur Sicherstellung einer nachhaltigen Landwirtschaft.

SDG: 3 Gesundheit und Wohlergehen

Figure 11: final projectoverview design

To improve the overview and reduce the redundancy, both views were combined in one page. (Figure 11)

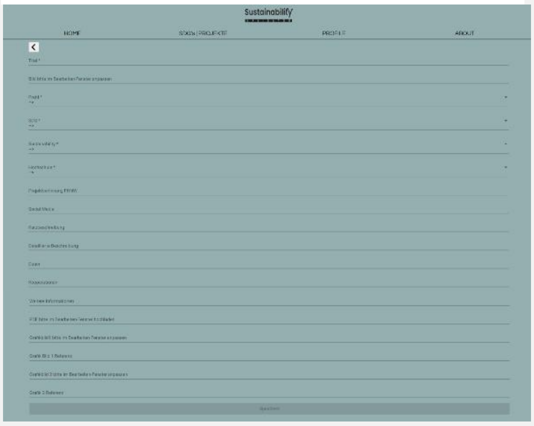
To improve the informative manner of the page we added information about the SDG's.

A search function was implemented to search for projects by project names.

A Button was added to be able to create a new project.

Some fields in the editor (Figure 12) are mandatory to guarantee all functions are working properly.

New user interface to create a project.



Titel *
Bild bitte im Bearbeiten Fenster anpassen
SDG *
Sustainability *
Hochschule *
Projektbetreuung FHNW
Social Media
Kurzbeschreibung
Detaillierte Beschreibung
Weitere Informationen
PDF bitte im Bearbeiten Fenster hochladen
Grafik Bild 1 Referenz
Grafik 2 Referenz

Figure 12: project editor

Profile overview

Final Design

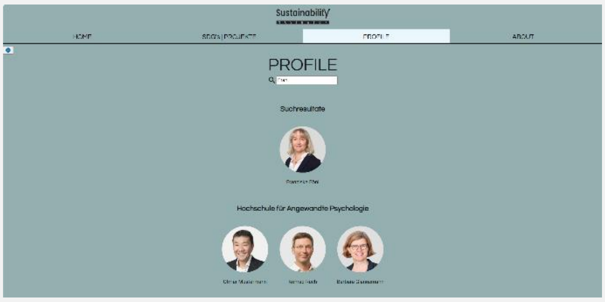


Figure 13: final design profileoverview

The basic design idea was taken from the HGK.

A Search function was added where you can search by first name and surname. A part of the name is sufficient. So, the user does not need to know the exact spelling.

Profile overview as shown in Figure 13.

Profile- & Project detail view

Final Design

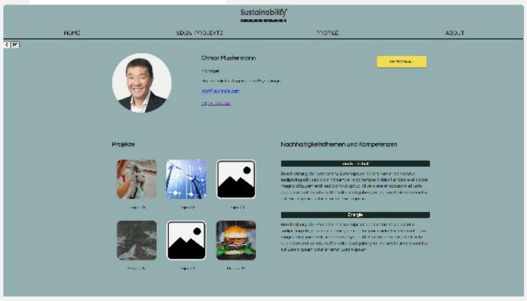
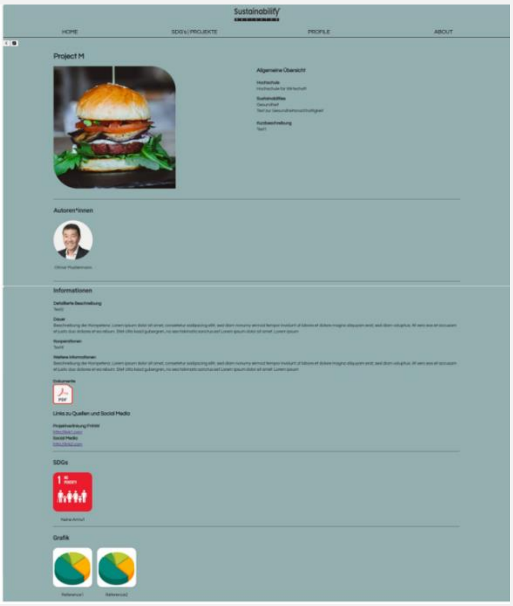


Figure 14: profile and project detail view



In the profile detail view and project detail view (Figure 14) a return button and edit button was added to be able to navigate.

In projects the user can upload a project picture as well as two diagrams.

For the diagrams there is also a field reference so the user can reference in the text to the specific chart.

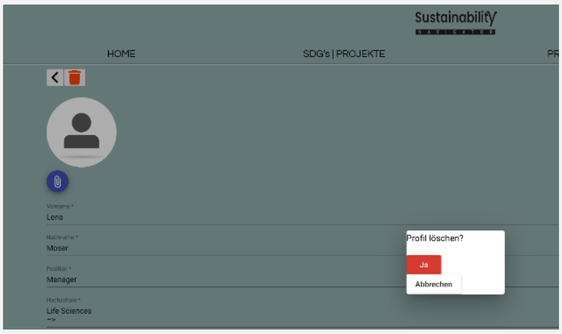
The user can also upload a pdf file to publish a paper.

The basic design idea was taken from the HGK Figma and made some improvements with the alignment.

For project- and profile- items an overflow was added to manage long names.

Profile and Project edit & create view

Final Design



Vorname *
Lena

Nachname *
Moser

Position *
Manager

Hochschule *
Life Sciences
-->

Figure 15: delete function

The edit and create interfaces are completely new.

They contain image and file uploaders.

In the edit view is a delete function implemented. To make sure the deletion does not happen accidentally, a popup window asks for permission to delete the profile or project. (Figure 15)

Responsive design

Final Design

The design is fully responsive to increase the user experience on all screen sizes.

Hamburger Navigation for small screens. (Figure 16)

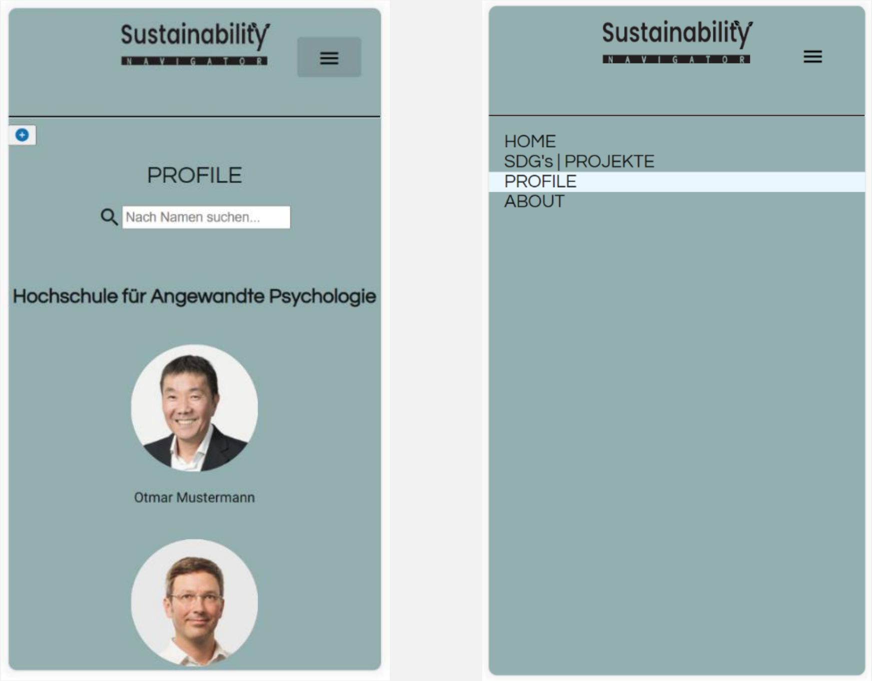


Figure 16: responsive design

5.1.4 Research Question C

C. Implementation:

What needs to be considered to create a software solution that can be updated and integrated into FHNW system later?
We need to know about the current FHNW infrastructure and how the SN can be implemented in the FHNW system in the future.
This means we want to know about the tech stack and whether we should aim to be implemented directly or if we should start with a standalone application that then can take data from the current setup.

5.1.4.1 FHNW Website Relaunch

Since the Sustainability Navigator should be implemented in the FHNW Website at some point in the future we need to know what is necessary to achieve that.
We were in contact with the IT-Department to gather this information. Turns out the Website will be relaunched soon that is why a lot of answers were not available at the time we were asking.

The IT Department recommended that we should create a standalone application. The Website Relaunch of the FHNW is still years away and currently a Sustainability Navigator is not in their roadmap. This means we must create our own standalone solution to be able to deliver a valuable solution within the provided time. This solution can then be used as a prototype version to test and understand the needs of future user and helps to determine whether this platform should be continued or not.

5.1.4.2 Architecture Decision

We knew that https://studenthub.technik.fhnw.ch/ should be integrated into the FHNW Website as well at some point, so it made sense to use a similar architecture as they are using, since they are in a similar situation as we are.
They use Angular in the Frontend which is why we chose the same option. The database they are using is a relational database. This was all the information we had. A Relational Database made sense as since all bigger platforms like the FHNW itself use these.
With this basic idea of the FHNW tech stack we had to make our decision on what technology we want to use. Our Goal was to be as inclusive an adaptive as possible so that even if there are smaller issues, they can be fixed with our tech stack concept. Future Teams can easily adapt and improve our concept because we tried to stay as close as possible to the recommended industry standards of angular, nodejs and MySql.

The Current Architecture of the Sustainability Navigator as shown in Figure 17:

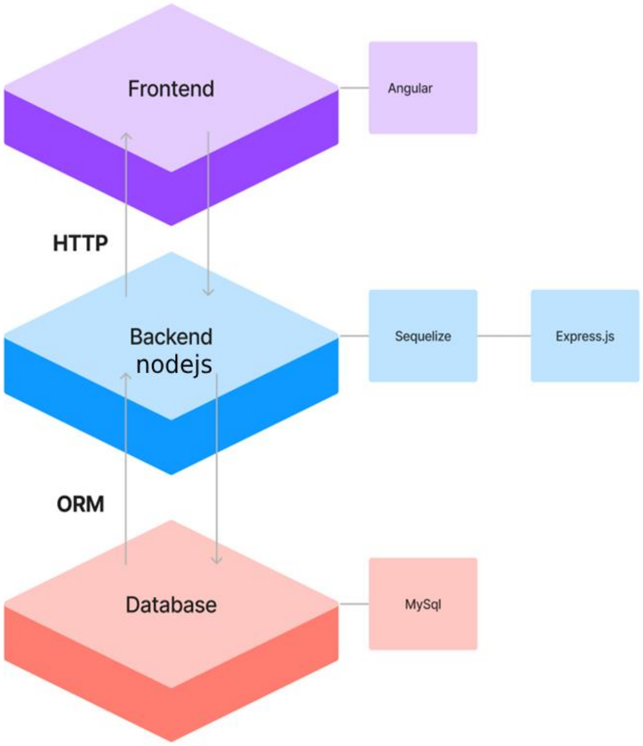


Figure 17: Tec stack

In the Frontend we are using Angular and, in the Backend, nodejs and MySql as Database. The communication with the database was done via Sequelize. This enables us to have a highly customizable project structure that can be modified easily to our customer's needs. Extra fields can easily be added in the Relational Database and more pages and content can be added via the frontend or backend as well. The whole Application is stored in form of docker containers on a switch server, which makes it easy adjustable and easy to change the hosting destination.
More detailed information about the Architecture can be found in the following chapters.

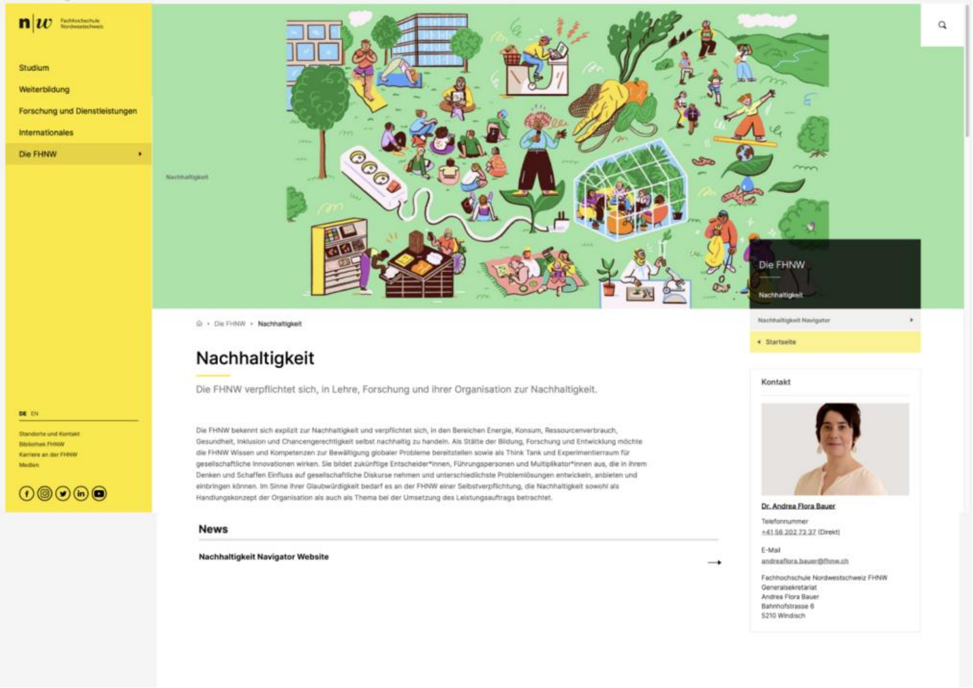
5.1.4.3 FHNW Integration

With our Tech stack it would be very easy to integrate the Sustainability Navigator into all kinds of web applications like the FHNW itself.

Angular is highly customizable and the Relational Database could be connected to the current Database of the FHNW. We would just need the Email addresses of the profiles from the FHNW Page. Since the SN Profiles have a lot more specific information about sustainability it would still be needed to be created separately on our platform as well.
It is unlikely that the FHNW database updates profiles to accommodate Sustainability expertise areas soon. And even if they do so with our current architecture this then could be implemented quite easily.

5.1.4.4 FHNW Integration/ Linking

Currently the easiest approach would be to give our Sustainability Navigator a subdomain of the fhnw.ch website and then add a link on a page to it. (Figure 18)



Nachhaltigkeit

Die FHNW verpflichtet sich, in Lehre, Forschung und ihrer Organisation zur Nachhaltigkeit.

Die FHNW bekennt sich explizit zur Nachhaltigkeit und verpflichtet sich, in den Bereichen Energie, Konsum, Ressourcenverbrauch, Gesundheit, Inklusion und Chancengerechtigkeit selbst nachhaltig zu handeln. Als Stätte der Bildung, Forschung und Entwicklung möchte die FHNW Wissen und Kompetenzen zur Bewältigung globaler Probleme bereitstellen sowie als Think Tank und Experimentierraum für gesellschaftliche Innovationen wirken. Sie bildet zukünftige Entscheider*innen, Führungspersonen und Multiplikator*innen aus, die in ihrem Denken und Schaffen Einfluss auf gesellschaftliche Diskurse nehmen und unterschiedlichste Problemlösungen entwickeln, anbieten und einbringen können. Im Sinne ihrer Glaubwürdigkeit bedarf es an der FHNW einer Selbstverpflichtung, die Nachhaltigkeit sowohl als Handlungskonzept der Organisation als auch als Thema bei der Umsetzung des Leistungsauftrags betrachtet.

News

Nachhaltigkeit Navigator Website →

Kontakt

Dr. Andrea Flora Bauer

Telefonnummer
+41 56 202 73 37 (Direkt)

E-Mail
andreaflora.bauer@fhnw.ch

Fachhochschule Nordwestschweiz FHNW
Generalsekretariat
Andrea Flora Bauer
Bahnhofstrasse 6
5210 Windisch

Figure 18: link to SN

A subdomain and a link on the Website could ensure a seamless integration on the Website without it having to be on the FHNW Server itself. This is very helpful since the link could just be added to the new website as well as soon as it is launched again, without having to reprogram the SN itself. The Standalone approach gives a lot of freedom in general.
Link to the page: [Nachhaltigkeit | FHNW]

5.1.4.5 Corporate Design

Since we used the design of the HGK, it currently does not match the corporate identity of the FHNW. If it stays truly a standalone platform this is not an issue if it will be integrated completely into the FHNW Page, this must be changed. This is why the design is easily adjustable in our project. The primary Color must be white and the secondary yellow, See FHNW corporate design guidelines for that.
This and a small FHNW Banner on top of the page should be mostly enough to fulfill the guidelines. The purpose of this project was to have a version that the HGK and others can test and see if there is interest in such a platform, so we decided to fulfil their design wishes for this project, the small identity changes can be done if it comes to the integration.

5.1.4.6 User Management

The user management was not in the scope of this project on purpose since it would be too big of a topic. And there already is a user management system on the FHNW page itself. This in combination with the additional data of the SN can then be used in future versions. There will always be some extra information stored in the SN because many fields are just too specific for the FHNW overall User-entity. We use fields like expertise in certain sustainability areas, those kinds of information are not stored on the current page, so there must be some extra information added from our sustainability navigator.

5.1.4.7 User Management Future integration

A Future integration could be for example that the SN uses the User management of the FHNW to login into the SN and then there the extra field like Sustainability area expertise can be filled out and stored on our platform. This ensures that the correct user can edit his information, without the need of a change to the FHNW profile entity.

5.1.4.8 Future integration

After the relaunch of the website the following people could help with the integration:

- norbert.seyff@fhnw.ch Coaching
- nitish.patkar@fhnw.ch Coaching
- it-support@fhnw.ch IT
- jan.rothenberger@fhnw.ch Generalsekretariat Kommunikation
- andreaflora.bauer@fhnw.ch Main Customer

5.2 Practical Part

5.2.1 Database

5.2.1.1 Entity Relationship Diagram

Owing to the selected database structure, as illustrated in Figure 19 (entity relationship diagram), the database exhibits high flexibility for scaling up. The system allows for the seamless addition of entities, each connected to another entity through the introduction of an additional junction table. A script was written to create the database, which can also be used by future development teams to go on with this project.

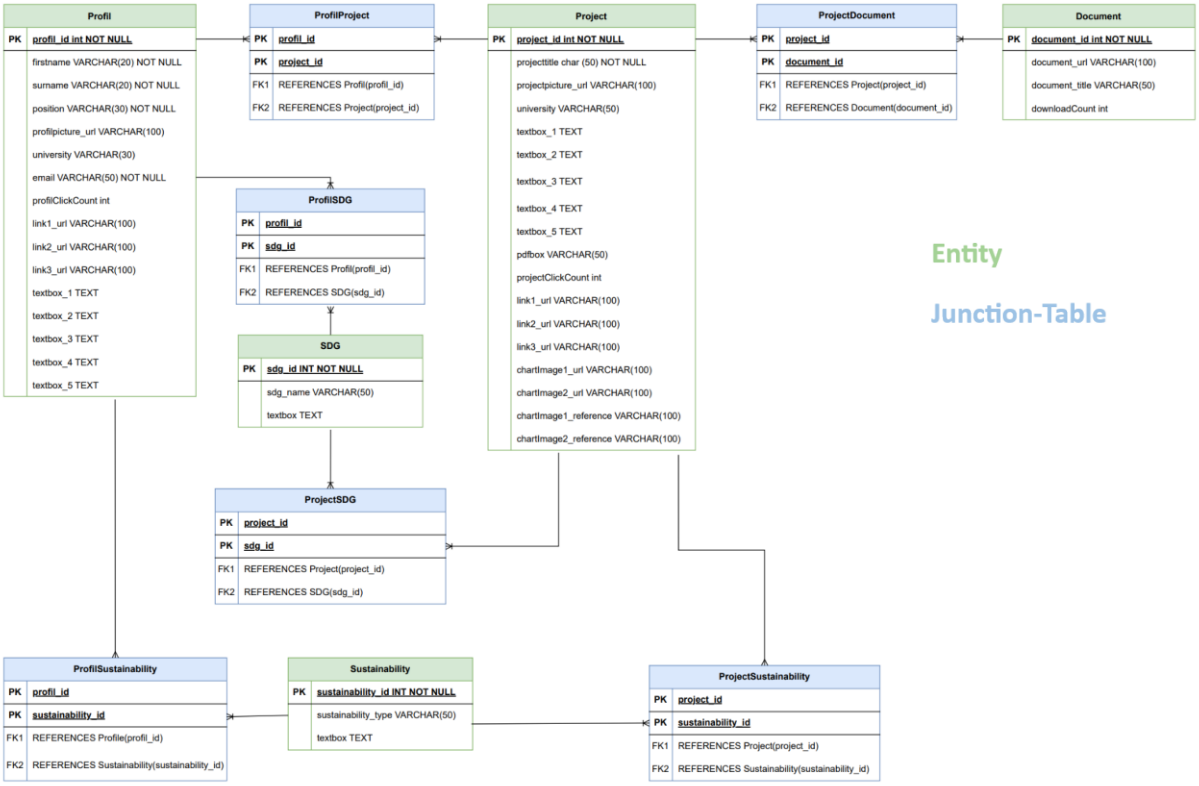

Profil
PK profil_id int NOT NULL
firstname VARCHAR(20) NOT NULL
surname VARCHAR(20) NOT NULL
position VARCHAR(30) NOT NULL
profilpicture_url VARCHAR(100)
university VARCHAR(30)
email VARCHAR(50) NOT NULL
profilClickCount int
link1_url VARCHAR(100)
link2_url VARCHAR(100)
link3_url VARCHAR(100)
textbox_1 TEXT
textbox_2 TEXT
textbox_3 TEXT
textbox_4 TEXT
textbox_5 TEXT
ProfilProject
PK profil_id
PK project_id
FK1 REFERENCES Profil(profil_id)
FK2 REFERENCES Project(project_id)
Project
PK project_id int NOT NULL
projecttitle char (50) NOT NULL
projectpicture_url VARCHAR(100)
university VARCHAR(50)
textbox_1 TEXT
textbox_2 TEXT
textbox_3 TEXT
textbox_4 TEXT
textbox_5 TEXT
pdfbox VARCHAR(50)
projectClickCount int
link1_url VARCHAR(100)
link2_url VARCHAR(100)
link3_url VARCHAR(100)
chartImage1_url VARCHAR(100)
chartImage2_url VARCHAR(100)
chartImage1_reference VARCHAR(100)
chartImage2_reference VARCHAR(100)
ProjectDocument
PK project_id
PK document_id
FK1 REFERENCES Project(project_id)
FK2 REFERENCES Document(document_id)
Document
PK document_id int NOT NULL
document_url VARCHAR(100)
document_title VARCHAR(50)
downloadCount int
ProfilSDG
PK profil_id
PK sdg_id
FK1 REFERENCES Profil(profil_id)
FK2 REFERENCES SDG(sdg_id)
SDG
PK sdg_id INT NOT NULL
sdg_name VARCHAR(50)
textbox TEXT
Entity
Junction-Table
ProjectSDG
PK project_id
PK sdg_id
FK1 REFERENCES Project(project_id)
FK2 REFERENCES SDG(sdg_id)
ProfilSustainability
PK profil_id
PK sustainability_id
FK1 REFERENCES Profile(profil_id)
FK2 REFERENCES Sustainability(sustainability_id)
Sustainability
PK sustainability_id INT NOT NULL
sustainability_type VARCHAR(50)
textbox TEXT
ProjectSustainability
PK project_id
PK sustainability_id
FK1 REFERENCES Project(project_id)
FK2 REFERENCES Sustainability(sustainability_id)

Figure 19: entity relationship diagram

5.2.1.2 Database script

Since profile is a keyword in sql which caused errors in the script, the spelling “profil“ was used throughout the project for consistency reasons.

```
-- First: Create Database "nameOfDB"
CREATE DATABASE IP5_SustainabilityNavigator_DB;

-- then: use "nameOfDB"
USE IP5_SustainabilityNavigator_DB;

DROP TABLE ProfilProject CASCADE;
DROP TABLE ProjectDocument CASCADE;
DROP TABLE ProfilSustainability CASCADE;
DROP TABLE ProjectSustainability CASCADE;
DROP TABLE ProfilSDG CASCADE;
DROP TABLE ProjectSDG CASCADE;
DROP TABLE Profil CASCADE;
DROP TABLE Project CASCADE;
DROP TABLE Document CASCADE;
DROP TABLE Sustainability CASCADE;
DROP TABLE SDG CASCADE;


CREATE TABLE Profil (
   profil_id INT AUTO_INCREMENT,
   firstname VARCHAR(20) NOT NULL,
   surname VARCHAR(20) NOT NULL,
   position VARCHAR(30) NOT NULL,
   profilpicture_url VARCHAR(100),
   university VARCHAR(30),
   email VARCHAR(50) NOT NULL,
   profilClickCount INT,
   link1_url VARCHAR(100),
   link2_url VARCHAR(100),
   link3_url VARCHAR(100),
   textbox_1 TEXT,
   textbox_2 TEXT,
   textbox_3 TEXT,
   textbox_4 TEXT,
   textbox_5 TEXT,
   CONSTRAINT PK_profil_id PRIMARY KEY (profil_id)
);

CREATE TABLE Project (
   project_id INT AUTO_INCREMENT,
   projecttitle CHAR(50) NOT NULL,
   projectpicture_url VARCHAR(100),
   university VARCHAR(50),
   textbox_1 TEXT,
   textbox_2 TEXT,
   textbox_3 TEXT,
   textbox_4 TEXT,
   textbox_5 TEXT,
   pdfbox VARCHAR(50),
   projectClickCount INT,
   link1_url VARCHAR(100),
   link2_url VARCHAR(100),
   link3_url VARCHAR(100),
   chartImage1_url VARCHAR(100),
   chartImage2_url VARCHAR(100),
   chartImage1_reference VARCHAR(100),
   chartImage2_reference VARCHAR(100),
   CONSTRAINT PK_project_id PRIMARY KEY (project_id)
);

CREATE TABLE Document (
   document_id INT AUTO_INCREMENT,
   document_url VARCHAR(100),
   document_title VARCHAR(50),
   downloadCount INT,
   CONSTRAINT PK_document_id PRIMARY KEY (document_id)
);

CREATE TABLE Sustainability (
   sustainability_id INT AUTO_INCREMENT,
   sustainability_type VARCHAR(50),
   textbox TEXT,
   CONSTRAINT PK_sustainability_id PRIMARY KEY (sustainability_id)
);

CREATE TABLE SDG (
   sdg_id INT AUTO_INCREMENT,
   sdg_name VARCHAR(50),
   textbox TEXT,
   CONSTRAINT PK_sdg_id PRIMARY KEY (sdg_id)
);


CREATE TABLE ProfilProject (
   profil_id INT,
   project_id INT,
   PRIMARY KEY (profil_id, project_id),
   FOREIGN KEY (profil_id) REFERENCES Profil(profil_id) ON UPDATE CASCADE ON DELETE CASCADE,
   FOREIGN KEY (project_id) REFERENCES Project(project_id) ON UPDATE CASCADE ON DELETE CASCADE
);

CREATE TABLE ProjectDocument (
   project_id INT,
   document_id INT,
   PRIMARY KEY (project_id, document_id),
   FOREIGN KEY (project_id) REFERENCES Project(project_id) ON UPDATE CASCADE ON DELETE CASCADE,
   FOREIGN KEY (document_id) REFERENCES Document(document_id) ON UPDATE CASCADE ON DELETE CASCADE
);

CREATE TABLE ProfilSustainability (
   profil_id INT,
   sustainability_id INT,
   PRIMARY KEY (profil_id, sustainability_id),
   FOREIGN KEY (profil_id) REFERENCES Profil(profil_id) ON UPDATE CASCADE ON DELETE CASCADE,
   FOREIGN KEY (sustainability_id) REFERENCES Sustainability(sustainability_id) ON UPDATE CASCADE ON DELETE CASCADE
);

CREATE TABLE ProjectSustainability (
   project_id INT,
   sustainability_id INT,
   PRIMARY KEY (project_id, sustainability_id),
   FOREIGN KEY (project_id) REFERENCES Project(project_id) ON UPDATE CASCADE ON DELETE CASCADE,
   FOREIGN KEY (sustainability_id) REFERENCES Sustainability(sustainability_id) ON UPDATE CASCADE ON DELETE CASCADE
);

CREATE TABLE ProfilSDG (
   profil_id INT,
   sdg_id INT,
   PRIMARY KEY (profil_id, sdg_id),
   FOREIGN KEY (profil_id) REFERENCES Profil(profil_id) ON UPDATE CASCADE ON DELETE CASCADE,
   FOREIGN KEY (sdg_id) REFERENCES SDG(sdg_id) ON UPDATE CASCADE ON DELETE CASCADE
);

CREATE TABLE ProjectSDG (
   project_id INT,
   sdg_id INT,
   PRIMARY KEY (project_id, sdg_id),
   FOREIGN KEY (project_id) REFERENCES Project(project_id) ON UPDATE CASCADE ON DELETE CASCADE,
   FOREIGN KEY (sdg_id) REFERENCES SDG(sdg_id) ON UPDATE CASCADE ON DELETE CASCADE
);
```

5.2.1.3 Script for example Data

Since there was no data available that was necessary to develop the Sustainability Navigator, a script for example data was written, which you will find in the Zip-Folder of this project. This is also important for future developers to go on with this project.

5.2.2 CI/CD

From previous experience we learned that having an early working Continuous integration and continuous deployment is crucial for an efficient project. In this section we will focus on the Repository side and how the CI/CD was possible there. The Server where it was hosted and the docker installation as well as the overall architecture which will have its own topic.

5.2.2.1 Repositories

First a Backend and Frontend Repository was created the Frontend was done with angular and the backend with nodejs. The initial idea was to only have one repository, but we quickly learned that for a clean separation between front and backend two repositories are necessary. Because this enables us to have two docker containers as well, those two then communicate with each other, more information to docker will be shown later.
Both Repositories were created on GitLab of the FHNW we used this runner as well to run the script of the CI/CD for both repositories.

Both Repositories got a CI/CD Script which then was used to tell the runner what it should do in which state of the pipeline.

5.2.2.1.1 Frontend:

This is **the gitlab-ci.yml** file this tells the runner on GitLab what there is to do inside the pipeline. The image on top of the file tells the runner which version to use.

<u>There are various stages:</u>

Install dependencies:
This stage installs all the npm commands etc. that are used for the angular project to function.

Build-job:
This builds the application itself it basically “compiles it”(not really compiling technically speaking) and therefore creates the frontend App.

Build-docker-job:
This creates a docker container out of the previously created app, this allows it to be run on docker.

Deploy-docker-job:
This takes the previously created docker container and pushed it to the prepared docker instance on our switch server. The keys are stored on GitLab itself, this and the server will be explained further later. Just know that the Deployment_Key1 is a variable that is saved in GitLab itself but created from us it is necessary to open the server that hosts our application and upload something to it. So, this key is a private key that then recognizes the matching public key on our server.

Summary

This file triggers the pipeline commands that are run every time someone pushes something into the main branch on the repository. It only affects the main branch on purpose because that is our master and is the only one that always should be online and reachable live in production mode.

```
variables:
  CI_REGISTRY_FE_IMAGE_NAME: "$CI_REGISTRY_IMAGE/ip5_sn_frontend"
  CI_REGISTRY_FE_IMAGE_TAG: "latest"

image: node:18-alpine
stages:
  - install_dependencies
  - build
  - deploy
cache:
  key: ${CI_COMMIT_REF_SLUG}
  paths:
    - node_modules/

install_dependencies:
  stage: install_dependencies
  script:
    - npm ci
  only:
    - main

build-job:
  stage: build
  artifacts:
    name: "build"
    untracked: true
    expire_in: 30 mins
    paths:
      - dist/
  script:
    - npm ci --silent
    - echo "Running frontend build"
    - npm run build


build-docker-job:
  stage: build
  tags:
    - csrunner1
  image: docker:19.03.1
  services:
    # To obtain a Docker daemon, request a Docker-in-Docker service
    - docker:19.03.1-dind
  script:
    #- docker info
    - docker login -u $CI_REGISTRY_USER -p $CI_REGISTRY_PASSWORD
$CI_REGISTRY
    - docker build --pull -t
"$CI_REGISTRY_FE_IMAGE_NAME:$CI_REGISTRY_FE_IMAGE_TAG" .
    - docker push "$CI_REGISTRY_FE_IMAGE_NAME:$CI_REGISTRY_FE_IMAGE_TAG"
  needs:
    - job: build-job
  only:
    refs:
      - main
```

```
deploy-docker-job:
  stage: deploy
  tags:
    - csrunner1
  image: docker/compose:latest
  services:
    # To obtain a Docker daemon, request a Docker-in-Docker serviceee
    - docker:dind
  variables:
    DOCKER_TLS_CERTDIR: ''
    DOCKER_HOST_SSH: "ssh://$DEPLOYMENT_USER@$DEPLOYMENT_HOST"
  before_script:
    - docker login -u $CI_REGISTRY_USER -p $CI_REGISTRY_PASSWORD
$CI_REGISTRY
    - apk add openssh-client
    - eval $(ssh-agent -s)
    - echo "$DEPLOYMENT_KEY1" | tr -d '\r' | ssh-add -
    - mkdir -p ~/.ssh
    - chmod 700 ~/.ssh
  script:
    - echo "$DOCKER_HOST_SSH"
    - ssh -v -o StrictHostKeyChecking=no $DEPLOYMENT_USER@$DEPLOYMENT_HOST
echo "SSH OK"
    - docker -H $DOCKER_HOST_SSH ps
    - docker-compose -f .gitlab-ci/docker-compose.yml -H $DOCKER_HOST_SSH
pull
    - docker-compose -f .gitlab-ci/docker-compose.yml -H $DOCKER_HOST_SSH
up -d
  only:
    - main
```

Docker File

This is the **dockerfile** which is inside the same repository the yml file needs this one to know how to even create the docker container in the first place. Here the yml file can see inside the dockerfile and sees which ports need to be created, which version of docker is needed and how the folder structure must be implemented.

Nginx is responsible for routing the request correctly we use it to let the front and backend talk to each other without exposing the backend to the internet.

Summary:

The dockerfile explains to the yml file how it must create a docker container and where to put it and the nginx part helps with the communication.

```
# Stage 1: Compile and Build Angular codebase
# Using Node 16 LTS
FROM node:18-alpine as build

WORKDIR /dist/src/app

COPY package*.json ./
RUN npm install
COPY . .
RUN npm run build --prod

# Stage 2: Serve app with NGINX
FROM nginx:1.21.6 AS ngi
```

```
WORKDIR /usr/share/nginx/html

RUN rm -rf ./*
# Ensure the path matches where Angular CLI builds your app
#COPY --from=build /app/ip5_sustainability_navigator .
COPY --from=build /dist/src/app/dist/IP5_SN_Frontend /usr/share/nginx/html
# Optional: if you have custom NGINX config
COPY ./nginx/nginx.conf /etc/nginx/conf.d/default.conf

EXPOSE 80

# Containers run nginx with global directives and daemon off
ENTRYPOINT ["nginx", "-g", "daemon off;"]
```

Dockercompose

This gives the version and the name of the container, it lets the yml file know what version and where the container should be stored before it gets uploaded to its destination.
We see that Port 80 is mapped to port 80 it can be necessary to do it differently depending on use case but since we only have this one it is fine. The hostname helps to identify the container later not necessary via Ip address but via the name as well which can be very helpful in terms of security and confusion in case of an error.

```
version: '3.8'
services:
   ip5_sustainability_navigator:
    container_name: ip5_sn_frontend
    image: cr.gitlab.fhnw.ch/ip5-sustainability-
navigator/ip5_sn_frontend/ip5_sn_frontend:latest
    restart: always
    ports:
      - "80:80"
    hostname: ip5_sn_frontend
```

5.2.2.1.2 Backend:

This is the gitlab-ci.yml file this tells the runner on GitLab what there is to do inside the pipeline. The image on top tells it which version is
It is similar to the frontends yml file but has some key differences because it is not an angular application it is a nodejs backend, so the process of building and creating is different the container and docker part will be roughly the same.

There are various stages:

Build-job:
This builds the application itself.

Build-docker-job:

This takes the previously created app and creates a docker container.

Deploy-docker-job:

This takes the previously created docker container and pushes it to GitLab it also uses the key stored on GitLab.

```
image: node:latest

variables:
  CI_REGISTRY_BE_IMAGE_NAME: "$CI_REGISTRY_IMAGE/ip5_sn_backend"
  CI_REGISTRY_BE_IMAGE_TAG: "latest"

stages:
  - build
  - deploy

cache:
  key: ${CI_COMMIT_REF_SLUG}
  paths:
    - node_modules/
    -
build-job:
  stage: build
  tags:
    - csrunner1
  artifacts:
    name: "build"
    untracked: true
    expire_in: 30 mins
    paths:
      - dist/
  script:
    - echo "Running backend build"
    - npm ci --silent
    - npm run build

build-docker-job:
  stage: build
  tags:
    - csrunner1
  image: docker:19.03.1
  services:
    # To obtain a Docker daemon, request a Docker-in-Docker servicee
    - docker:19.03.1-dind
  script:
    #- docker info
    - docker login -u $CI_REGISTRY_USER -p $CI_REGISTRY_PASSWORD
$CI_REGISTRY
    - docker build --pull -t
"$CI_REGISTRY_BE_IMAGE_NAME:$CI_REGISTRY_BE_IMAGE_TAG" .
    - docker push "$CI_REGISTRY_BE_IMAGE_NAME:$CI_REGISTRY_BE_IMAGE_TAG"
  needs:
    - job: build-job
  only:
    refs:
      - main

deploy-docker-job:
  stage: deploy
  image: docker/compose:latest
  services:
    # To obtain a Docker daemon, request a Docker-in-Docker service
    - docker:dind
  variables:
    DOCKER_TLS_CERTDIR: ''
    DOCKER_HOST_SSH: "ssh://$DEPLOYMENT_USER@$DEPLOYMENT_HOST"
  before_script:
    - docker login -u $CI_REGISTRY_USER -p $CI_REGISTRY_PASSWORD
$CI_REGISTRY
    - apk add openssh-client
    - eval $(ssh-agent -s)
    - echo "${DEPLOYMENT_KEY1}" | tr -d '\r' | ssh-add -
    - mkdir -p ~/.ssh
    - chmod 700 ~/.ssh
  script:
    - docker-compose -f .gitlab-ci/docker-compose.yml -H $DOCKER_HOST_SSH
pull
    - docker-compose -f .gitlab-ci/docker-compose.yml -H $DOCKER_HOST_SSH
up -d
  only:
    - main
```

Dockerfile

This is the dockerfile which is inside the same repository the yml file needs this one to know how to even create the docker container in the first place.

Summary:

The dockerfile explains to the yml file how it must create a docker container and where to put it. It also gives it an entry point.

```
FROM node:18-alpine as build

WORKDIR /dist/src/app

COPY package*.json ./
RUN npm install
COPY . .
RUN npm run build --prod

# Stage 2: Serve app with NGINX
FROM nginx:1.21.6 AS ngi

WORKDIR /usr/share/nginx/html

RUN rm -rf ./*
# Ensure the path matches where Angular CLI builds your app
#COPY --from=build /app/ip5_sustainability_navigator .
COPY --from=build /dist/src/app/dist/IP5_SN_Frontend /usr/share/nginx/html
# Optional: if you have custom NGINX config
COPY ./nginx/nginx.conf /etc/nginx/conf.d/default.conf

EXPOSE 80

# Containers run nginx with global directives and daemon off
ENTRYPOINT ["nginx", "-g", "daemon off;"]
```

Docker compose:

This gives the version and the name of the container, it lets the yml file know what version and where the container should be stored before it gets uploaded to its destination.
We see that Port 8000 is mapped to port 8000 it can be necessary to do it differently depending on use case but since we only have this one it is fine. The hostname helps to identify the container later not necessary via Ip address but via the name as well which can be very helpful in terms of security and confusion in case of an error.

Summary:
The docker compose explains the yml file de containers hostname weather on GitLab to store it and its version.

```
version: '3.8'
services:
    ip5_sn_backend:
        container_name: ip5_sn_backend
        image: cr.gitlab.fhnw.ch/ip5-sustainability-
navigator/ip5_sn_backend/ip5_sn_backend:latest
        restart: always
        ports:
            - "8000:8000"
        hostname: ip5_sn_backend
```

5.2.2.2 Nginx

We use it to route the request from the frontend container to the correct backend container. This way we are less reliant on Ip addresses and other things that can change. We use the hostname of the backend container to tell the frontend via nginx which one it should try to access. This also allowed us to have the backend container only available on the docker network not on the internet which enhances security.

This is the nginx.conf file:

The **server_name** is the frontend since it is the one that needs to know where to access the backend.

The **proxy pass** is the location the frontend needs to access. As you can see the address is http://ip5_sn_backend:8000/;
this gives us the huge benefit that we don't need the Ip address rather than the hostname which will not change anytime and can always be accessed very clearly.

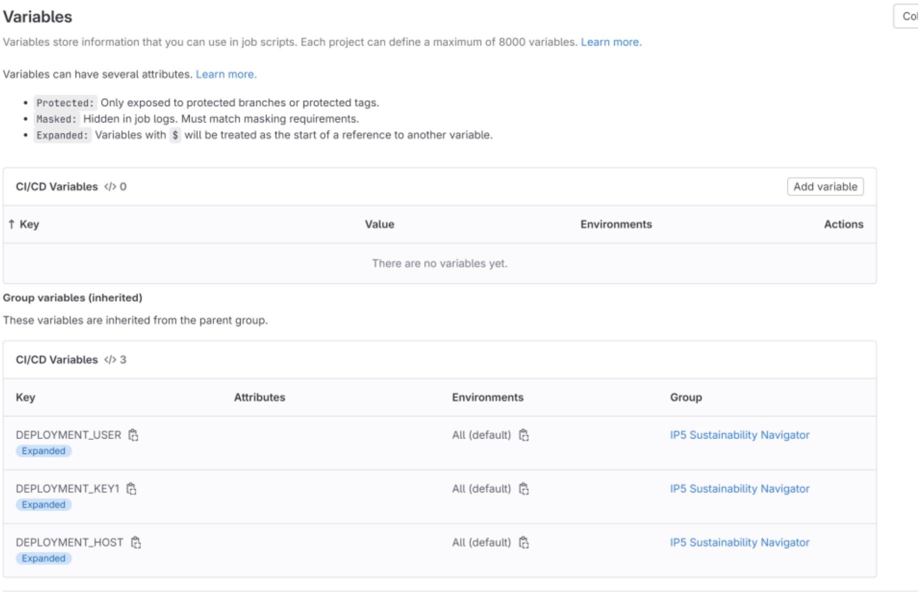
In the future the nginx file could be used to route the traffic from outside the server as well and access an SSL encryption file to ensure a https connection. However, this was not in the scope of this project anymore.
The nginx file allowed us to have a more clear and simple routing and reduced a great error source quite a lot.

```
server {
    listen 80;
    server_name ip5_sn_frontend;
    location / {
        # document root
        root /usr/share/nginx/html;
        try_files $uri /index.html;
    }
    location /api {
        rewrite /api/(.*) /$1  break;
        proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;
        proxy_set_header Host $host;

        proxy_pass http://ip5_sn_backend:8000/;

        proxy_http_version 1.1;
        proxy_set_header Upgrade $http_upgrade;
        proxy_set_header Connection "upgrade";
    }
}
```

5.2.2.3 Variables in Gitlab

The yml file uses various keys and usernames as well as the public Ip address of our server so that it knows where it must deploy the container to. Those variables are all stored in GitLab which is more secure than writing them into the file, especially the private key for the server should not be stored in plain text.

The variables are stored in the GitLab repository under settings in ci/cd. The menu looks as shown in Figure 20:



Variables

Variables store information that you can use in job scripts. Each project can define a maximum of 8000 variables. Learn more.

Variables can have several attributes. Learn more.

- `Protected:` Only exposed to protected branches or protected tags.
- `Masked:` Hidden in job logs. Must match masking requirements.
- `Expanded:` Variables with `$` will be treated as the start of a reference to another variable.

CI/CD Variables </> 0

↑ Key	Value	Environments	Actions
There are no variables yet.			

Group variables (inherited)

These variables are inherited from the parent group.

CI/CD Variables </> 3

Key	Attributes	Environments	Group
DEPLOYMENT_USER Expanded		All (default)	IP5 Sustainability Navigator
DEPLOYMENT_KEY1 Expanded		All (default)	IP5 Sustainability Navigator
DEPLOYMENT_HOST Expanded		All (default)	IP5 Sustainability Navigator

Figure 20: gitlab variables

The name of those variables must be written in the yml file script as well and can then be used if a change occurs it can just be changed here directly and not in the script which is more convenient and secure.

5.2.2.4 Production and Deployment Branches

First to our logic in the branches themselves:
we have one main Branch (essentially the master branch) and a develop Branch. We have this in the backend and in the frontend. We use Feature branch development strategy. So every New Feature gets a new Branch out of the develop branch and gets merged back into the develop branch if it is completed.
As soon as we want to publish the current state of our project we just merge the develop branch into the master branch this then activates the pipeline and automatically creates and pushes the correct container to our server where it then is publicly available.
This is possible due to our yml file and our gitignore file. In the gitignore file in the master branch we put in all the server specific details that should not be changed so when we merge the develop branch with the develop configuration it will not overwrite the production configurations.

We usually push to the master branch every time we have reached a major milestone or if we want to show the customer something important.

5.2.3 Server

5.2.3.1 Initial Order

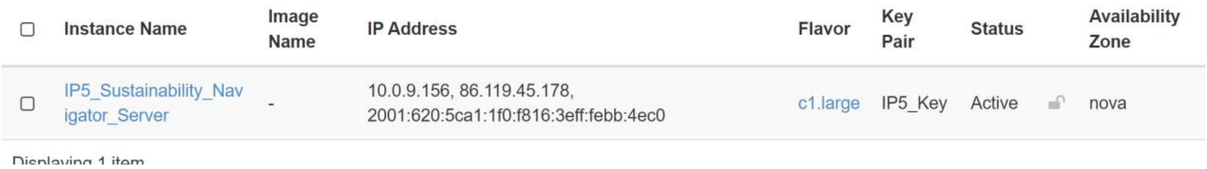
We ordered a switch server via the FHNW. This ensures that we have a standalone application that also can be taken over and implemented by the FHNW if someone wants to.
Our order was:

- 6gb RAM

- 50gb Storage

- And 4 CPU

Instance on the Switch Server as shown in Figure 21:



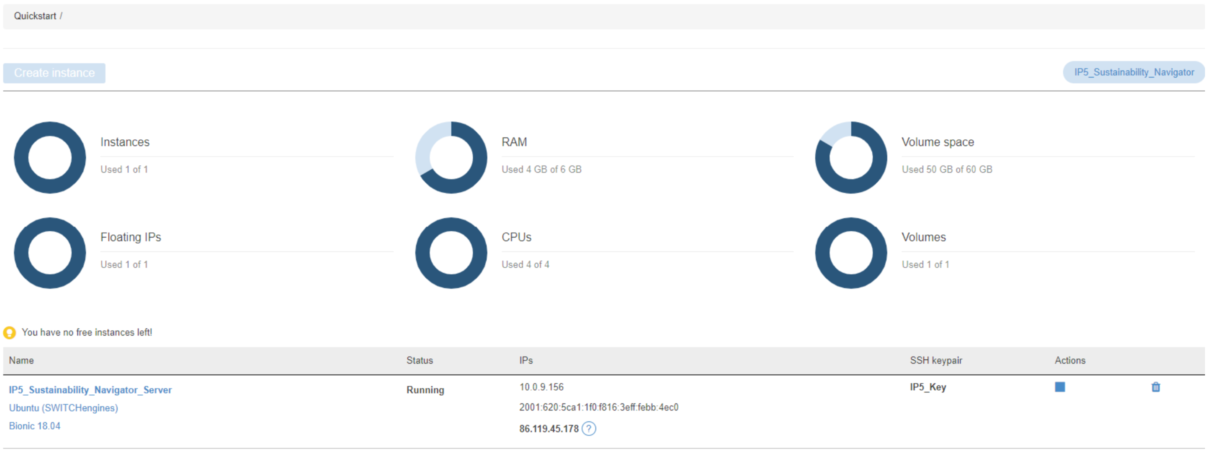
☐	Instance Name	Image Name	IP Address	Flavor	Key Pair	Status	Availability Zone
☐	IP5_Sustainability_Navigator_Server	-	10.0.9.156, 86.119.45.178, 2001:620:5ca1:1f0:f816:3eff:febb:4ec0	c1.large	IP5_Key	Active	nova

Displaying 1 item

Figure 21: server

5.2.3.2 Setup

We followed the explanation given by the FHNW on confluence to create the server instance. This enabled us to have a simple Linux server where we can deploy our software to. After that we built a key pair one is a public key which is stored on the Server itself and one is a private key which we then use to connect to the server via the repository and our laptops as well. (Figure 22)



Instances: Used 1 of 1
RAM: Used 4 GB of 6 GB
Volume space: Used 50 GB of 60 GB
Floating IPs: Used 1 of 1
CPUs: Used 4 of 4
Volumes: Used 1 of 1

You have no free instances left!

Name	Status	IPs	SSH keypair	Actions
IP5_Sustainability_Navigator_Server Ubuntu (SWITCHengines) Bionic 18.04	Running	10.0.9.156 2001:620:5ca1:1f0:f816:3eff:febb:4ec0 86.119.45.178	IP5_Key	■ 🗑

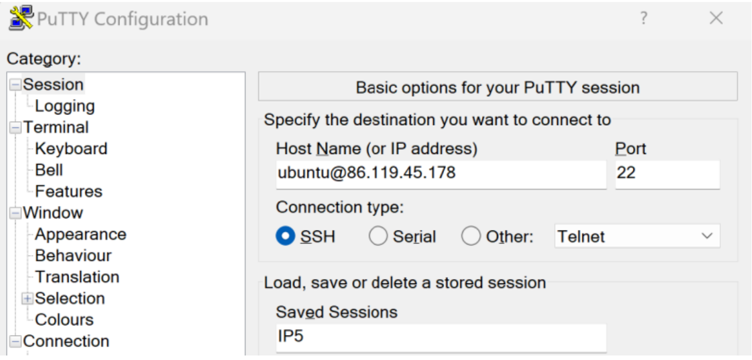
Figure 22: server setup

5.2.3.3 Connection to the Server

To connect the server, we used the default port 22 and our private key enabled us to access it. On our own PCs we used the software Putty to ensure a safe and efficient connection.

Putty connection:

In the hostname we defined the Ip address and the user. (Figure 23)



Basic options for your PuTTY session

Specify the destination you want to connect to

Host Name (or IP address): ubuntu@86.119.45.178
Port: 22

Connection type:
● SSH ○ Serial ○ Other: Telnet

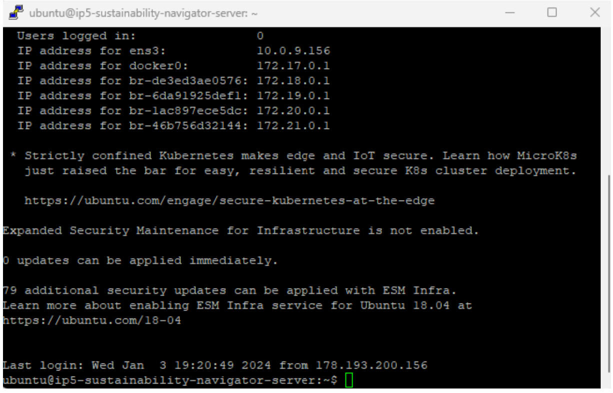
Load, save or delete a stored session

Saved Sessions: IP5

Figure 23: putty configuration

In the Authorization section we put in the private key this way putty knew where to connect and had the key to open the connection.

This allowed us to have a direct connection to the server (Figure 24):

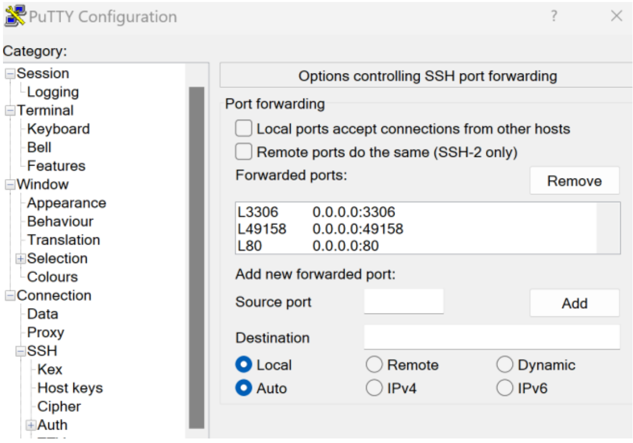


```
  Users logged in:                0
  IP address for ens3:            10.0.9.156
  IP address for docker0:         172.17.0.1
  IP address for br-de3ed3ae0576: 172.18.0.1
  IP address for br-6da91925def1: 172.19.0.1
  IP address for br-1ac897ece5dc: 172.20.0.1
  IP address for br-46b756d32144: 172.21.0.1

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
   just raised the bar for easy, resilient and secure K8s cluster deployment.

   https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Infrastructure is not enabled.

0 updates can be applied immediately.

79 additional security updates can be applied with ESM Infra.
Learn more about enabling ESM Infra service for Ubuntu 18.04 at
https://ubuntu.com/18-04


Last login: Wed Jan  3 19:20:49 2024 from 178.193.200.156
ubuntu@ip5-sustainability-navigator-server:~$ 
```

Figure 24: server connection

In putty we configured port forwarding this way as well we only had port 22 open to the internet, but we were able to have other ports sent through the tunnel which helped us in the development stage. The tunnels were used to connect to various docker containers as well as the database. This gave us the great advantage that all our data could be at one place, the server itself, and no one had to setup extra docker containers on his own laptop.

Here you can see the port forwarding configuration (Figure 25):



Port forwarding

□ Local ports accept connections from other hosts

□ Remote ports do the same (SSH-2 only)

Forwarded ports:

```
L3306     0.0.0.0:3306
L49158    0.0.0.0:49158
L80       0.0.0.0:80
```

Add new forwarded port:

Source port

Destination

● Local ○ Remote ○ Dynamic

● Auto ○ IPv4 ○ IPv6

Figure 25: putty port forwarding configuration

5.2.3.4 Docker and Portainer

To deploy our containers, we first had to install Docker on our server. To have a simpler way of handling docker we decided to install portainer as well. This is a docker container itself which allows us via port forwarding to have a GUI of the container management as well as just the containers in the terminal. This was a great advantage since we had some issues with the network and seeing everything in a Gui helped to solve the issue right away.

Docker install script:

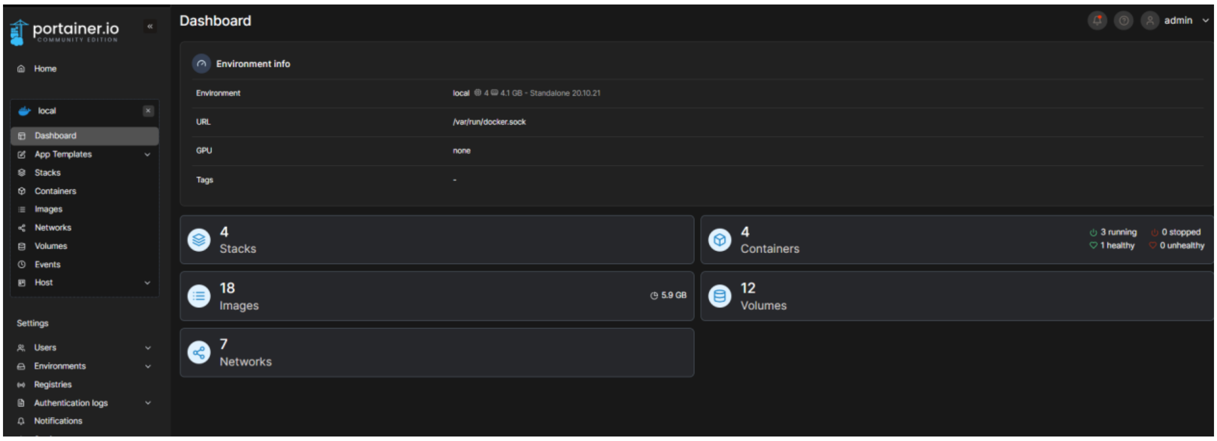
This installs docker and prepares the storage for portainer:

```
apt install docker.io -y
sudo apt install docker.io -y
sudo docker volume create portainer_space
```

This installs portainer:

```
sudo docker run -d -p 9000:9000 -p 9443:9443 --name=portainer --restart=always -v
/var/run/docker.sock:/var/run/docker.sock -v portainer_data:/data portainer/portainer-ce:latest
```

After that portainer can be used to access the containers via the web browser (Figure 26):



Dashboard

Environment info

Environment	local 4 4.1 GB - Standalone 20.10.21
URL	/var/run/docker.sock
GPU	none
Tags	-

4 Stacks

4 Containers — 3 running, 0 stopped, 1 healthy, 0 unhealthy

18 Images — 5.9 GB

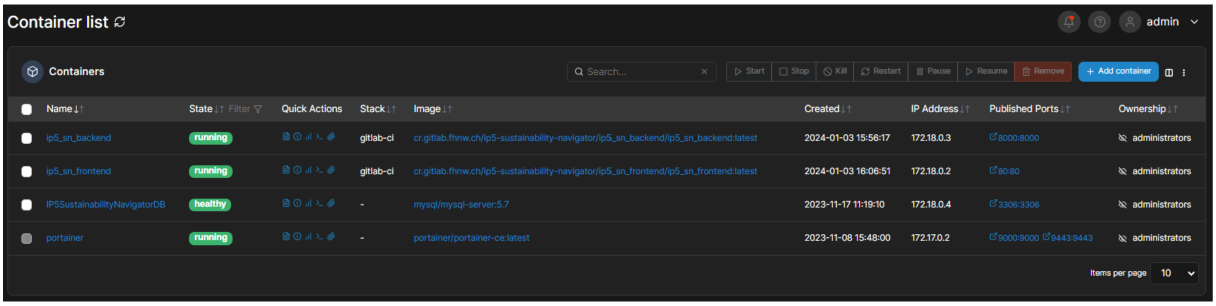
12 Volumes

7 Networks

Figure 26: portainer dashboard

This way we were able to see and manage our containers directly via the graphical user interface:

The ip5_sn_backend and frontend are the ones that are directly pushed from the CI/CD if anything goes wrong it is quite easy to check here what happened and why it did not work. (Figure 27)



Container list

Containers

Name	State	Quick Actions	Stack	Image	Created	IP Address	Published Ports	Ownership
ip5_sn_backend	running		gitlab-ci	cr.gitlab.fhnw.ch/ip5-sustainability-navigator/ip5_sn_backend/ip5_sn_backend:latest	2024-01-03 15:56:17	172.18.0.3	8000:8000	administrators
ip5_sn_frontend	running		gitlab-ci	cr.gitlab.fhnw.ch/ip5-sustainability-navigator/ip5_sn_frontend/ip5_sn_frontend:latest	2024-01-03 16:06:51	172.18.0.2	80:80	administrators
IP5SustainabilityNavigatorDB	healthy		-	mysql/mysql-server:5.7	2023-11-17 11:19:10	172.18.0.4	3306:3306	administrators
portainer	running		-	portainer/portainer-ce:latest	2023-11-08 15:48:00	172.17.0.2	9000:9000 9443:9443	administrators

Figure 27: portainer container list

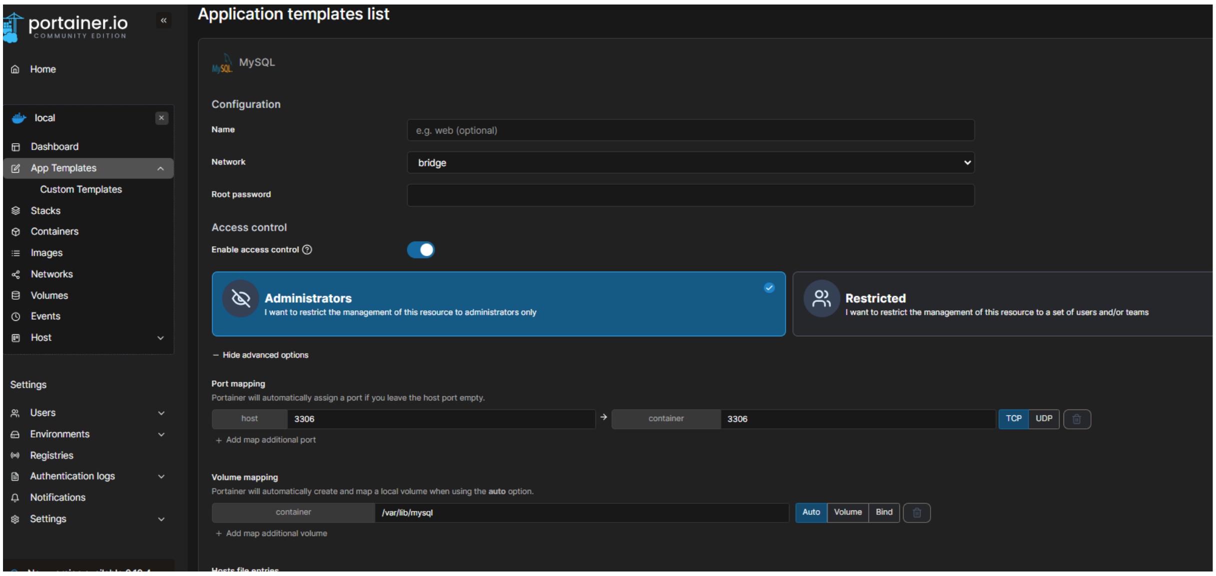
As you can see the database container is also displayed, more information to that later.

Overall, this setup allows an easy and fast handling of the webpage and error handling as well as continuous work for future teams which was a big part of our thought process during this setup.

5.2.3.5 Database Container

The Database is just one more container just like the backend and the frontend, the only difference is that we do not push it via GitLab, it needed to be created just once via portainer and then we could use that container for the deployment and the develop part.

As seen down below all that was necessary is to find a template and configure it correctly. (Figure 28)



Application templates list

MySQL

Configuration

Name: e.g. web (optional)

Network: bridge

Root password:

Access control

Enable access control: ●

☑ Administrators
I want to restrict the management of this resource to administrators only

□ Restricted
I want to restrict the management of this resource to a set of users and/or teams

Port mapping
Portainer will automatically assign a port if you leave the host port empty.
host 3306 → container 3306 [✓ TCP] UDP

Volume mapping
Portainer will automatically create and map a local volume when using the **auto** option.
container /var/lib/mysql [✓ Auto] Volume Bind

Hosts file entries

Figure 28: portainer application templates list

Via the port 3306 we during development and the backend container can access all the valuable information inside the database.

We used DataGrip to access the data, but this is by no means necessary we just recommend a tool that can manage relational databases.

5.2.4 Code

To explain the whole connection between frontend, backend and the database, the entire process of creating a profile is explained in detail here in this part. This is only tiny part of the code but gives a little insight into the technology and structure of the code.

5.2.4.1 Create Profile

5.2.4.1.1 Frontend

1) A click on the button routes the user to the create profile view.

```
<button class="justify-items-end justify-end flex"><fa-icon
[icon]="faCirclePlus" style="color: #1171B2" size="1x"
routerLink="/create/profil"></fa-icon></button>
```

2) In the create view are the formfields or dropdowns to enter the required information.

```
<form [formGroup]="profilFrom" fxLayout="column" fxFlex="100">

  <mat-form-field appearance="legacy">
    <mat-label>Vorname</mat-label>
    <input matInput formControlName="firstname" required>
  </mat-form-field>
```

3) In the typescript-file the FormControls get initialized, mandatory fields and specific patterns are defined where necessary.

```
ngOnInit(): void {

  this.profilFrom = this.formBuilder.group({
    firstname: new FormControl(null, [Validators.required]),
    surname: new FormControl(null, [Validators.required]),
    position: new FormControl(null, [Validators.required]),
    profilpicture_url: new FormControl(null,),
    university: new FormControl(null, [Validators.required]),
    email: new FormControl(null,[Validators.required]),
    //profilClickCount: new FormControl(null,),
    link1_url: [null,
[Validators.pattern(/^(https?|ftp):\/\/(www\.)?[^\s/$.?#]+$/i)]],
    link2_url: [null,
[Validators.pattern(/^(https?|ftp):\/\/(www\.)?[^\s/$.?#]+$/i)]],
    link3_url: [null,
[Validators.pattern(/^(https?|ftp):\/\/(www\.)?[^\s/$.?#]+$/i)]],
    textbox_1: new FormControl(null,),
    textbox_2: new FormControl(null,), // sustainability 1
    textbox_3: new FormControl(null,), // sustainability 1
    textbox_4: new FormControl(null,), // sustainability 2
    textbox_5: new FormControl(null,), // sustainability 2
  })
}
```

4) The save button triggers the function submitForm(). To make sure all the essential information is entered in the formfields, the save button is disabled until the profilFrom is valid.

```
<button mat-raised-button color="primary" style="margin-bottom: 2em"
(click)="submitForm()"
        [disabled]="!profilFrom.valid">Speichern
</button>
```

5) The submitForm() function triggers the createProfil function and submits the profilForm, then resets the profilForm for the next use and navigates back to the profil-list view.

```
public submitForm(): void {
  const profilForm: Profil = {
    firstname: this.profilFrom.controls['firstname'].value,
    surname: this.profilFrom.controls['surname'].value,
    position: this.profilFrom.controls['position'].value,
    profilpicture_url:
this.profilFrom.controls['profilpicture_url'].value,
    university: this.profilFrom.controls['university'].value,
    email: this.profilFrom.controls['email'].value,
    profilClickCount: null,
    link1_url: this.profilFrom.controls['link1_url'].value,
    link2_url: this.profilFrom.controls['link2_url'].value,
    link3_url: this.profilFrom.controls['link3_url'].value,
    textbox_1: this.profilFrom.controls['textbox_1'].value,
    textbox_2: this.profilFrom.controls['textbox_2'].value,//
sustainability 1
    textbox_3: this.profilFrom.controls['textbox_3'].value,//
sustainability 1
    textbox_4: this.profilFrom.controls['textbox_4'].value,//
sustainability 2
    textbox_5: this.profilFrom.controls['textbox_5'].value,//
sustainability 2
  }
  this.profilService.createProfil(profilForm);
  this.profilFrom.reset();
  this.router.navigateByUrl("/profil-list").finally();
}
```

6) The createProfil function sends a http post to the backend and logs the result of the action.

```
public createProfil(profil: Profil) {
  return this.http.post(BACKEND_HOST + `/profils/create/profil`,
profil).subscribe(
    (val: Object) => {

      console.log('error save:', val);
    },
    (error) => {
      console.error('error save ', error);
    }
  );
}
```

5.2.4.1.2 Backend

7) This is the route profil.ts in the backend which connects the front and backend and is called from the frontend. In this case controller.createProfil is called.

```
import express from "express";
import controller, {upload} from '../controllers/profil';
const router = express.Router();

router.post('/create/profil', controller.createProfil);
router.get('/get/profils', controller.getAllProfils);
router.get('/get/profil/:id', controller.getProfilByID);
router.get('/get/profil/:id/projects',
controller.getProjectsByProfilId);
router.patch('/update/profil/:id', controller.updateProfil);
router.delete('/delete/profil/:id', controller.deleteProfil);
router.patch('/incrementClickCount/profil/:id',
controller.incrementProfilClickCount);

router.post("/create/profil/image", upload.single('image'), (req, res)
=> {
    return res.status(200);
});

export = router;
```

8) The Controller profil.ts:

createProfil Function:

- This is an asynchronous function intended to manage the creation of a new "Profil".
- It logs the initiation of a profile creation process.
- It extracts profile-related data (like firstname, surname, position, etc.) from the req.body—this is the data sent from the client-side.
- Then, it attempts to create a new Profil with the provided data using the Profil.create() method from a Sequelize model.
- If successful, it sends back a 200 HTTP status code along with the created profile response.
- In case of failure (e.g., database errors), it logs the error and sends back a 400 HTTP status code with the error message.

```
import logging from "../configs/logging";
import {Profil} from "../models/profil";
import {Request, Response} from "express";
import {Model} from "sequelize";
import {Project} from "../models/project";
import fs from "fs";
const multer = require('multer')

const NAMESPACE = 'Profil'

const createProfil = async (req: Request, res: Response) => {
    logging.info(NAMESPACE, 'Creating Profil');

    let { firstname, surname, position,  profilpicture_url,university,
email, profilClickCount, link1_url,
        link2_url, link3_url, textbox_1, textbox_2, textbox_3,
textbox_4, textbox_5 } = req.body;
```

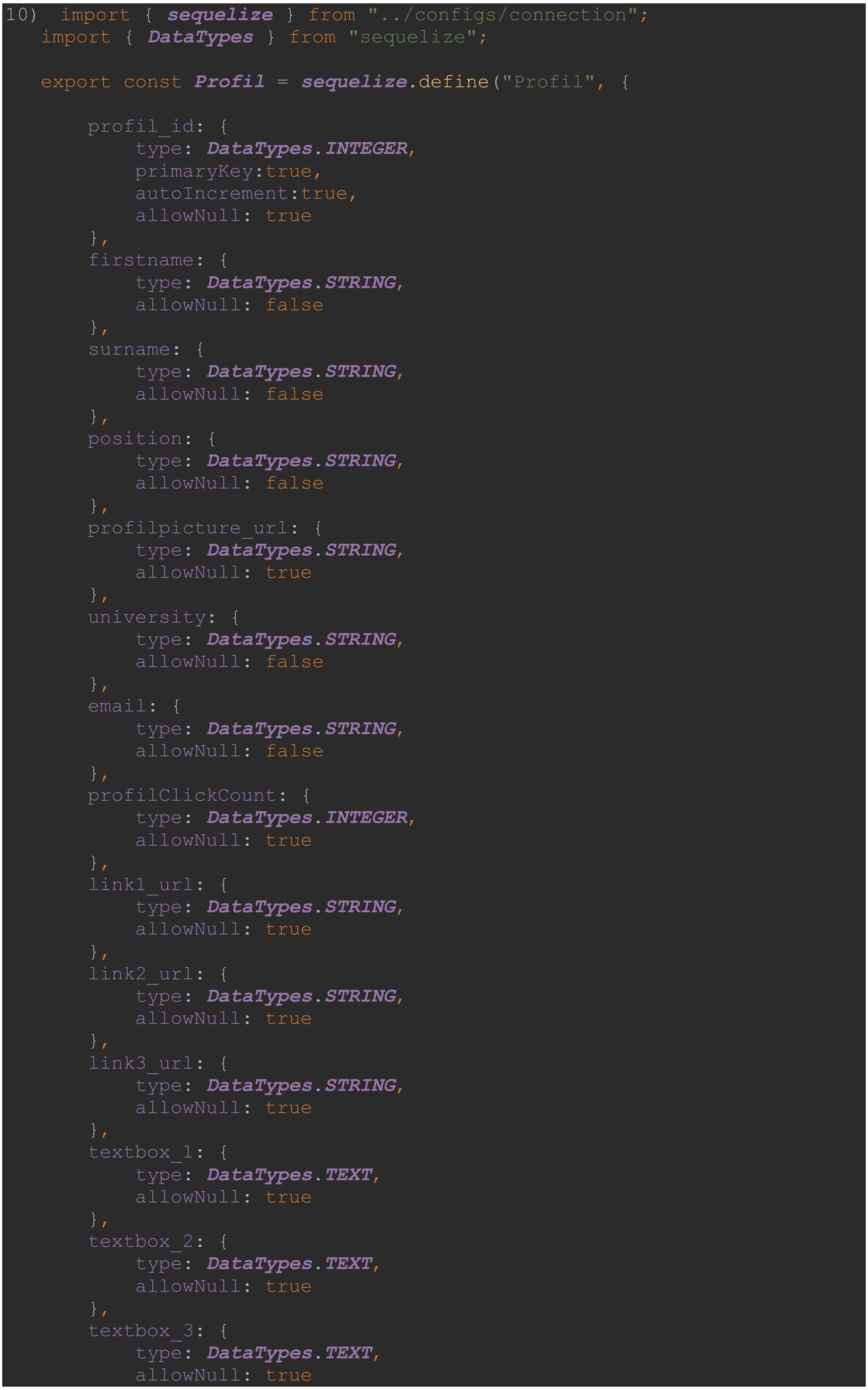
```
    logging.info(NAMESPACE, firstname + " " + surname);

    Profil.create({
        firstname: firstname,
        surname: surname,
        position: position,
        profilpicture_url: profilpicture_url,
        university: university,
        email: email,
        profilClickCount: profilClickCount,
        link1_url: link1_url,
        link2_url: link2_url,
        link3_url: link3_url,
        textbox_1: textbox_1,
        textbox_2: textbox_2,
        textbox_3: textbox_3,
        textbox_4: textbox_4,
        textbox_5: textbox_5
    }).then((response: Response) => {
        return res.status(200).json({
            response
        })
    }).catch((error: string) => {
        logging.error(NAMESPACE, error, error);

        return res.status(400).json({
            message: error,
            error
        });
    });
};
…


export default { createProfil: createProfil, getAllProfils:
getAllProfils, getProfilByID: getProfilByID, updateProfil: updateProfil,
deleteProfil: deleteProfil,getProjectsByProfilId:getProjectsByProfilId,
incrementProfilClickCount:incrementProfilClickCount}
```

9) Profil Model Definition:

- It uses the sequelize.define method to create a new model named "Profil" with a structure reflecting various attributes such as profil_id, firstname, surname, position, profilpicture_url, university, email, profilClickCount, various link_urls, and textboxes.
- Each attribute in the model is defined with a specific data type (like DataTypes.STRING or DataTypes.INTEGER) and an allowNull constraint that dictates whether the field can be empty.
- Notably, the profil_id is set as the primary key and will auto-increment, which is typical for an ID field.

Model Configuration:

- The model is explicitly linked to the 'Profil' table in the database, ensuring the table name is not pluralized (a common automatic behavior in Sequelize) by setting freezeTableName: true.
- Timestamps are disabled for this model (timestamps: false), meaning Sequelize will not automatically add createdAt and updatedAt fields to the table. The Profil model:



```
10)  import { sequelize } from "../configs/connection";
    import { DataTypes } from "sequelize";

    export const Profil = sequelize.define("Profil", {

        profil_id: {
            type: DataTypes.INTEGER,
            primaryKey:true,
            autoIncrement:true,
            allowNull: true
        },
        firstname: {
            type: DataTypes.STRING,
            allowNull: false
        },
        surname: {
            type: DataTypes.STRING,
            allowNull: false
        },
        position: {
            type: DataTypes.STRING,
            allowNull: false
        },
        profilpicture_url: {
            type: DataTypes.STRING,
            allowNull: true
        },
        university: {
            type: DataTypes.STRING,
            allowNull: false
        },
        email: {
            type: DataTypes.STRING,
            allowNull: false
        },
        profilClickCount: {
            type: DataTypes.INTEGER,
            allowNull: true
        },
        link1_url: {
            type: DataTypes.STRING,
            allowNull: true
        },
        link2_url: {
            type: DataTypes.STRING,
            allowNull: true
        },
        link3_url: {
            type: DataTypes.STRING,
            allowNull: true
        },
        textbox_1: {
            type: DataTypes.TEXT,
            allowNull: true
        },
        textbox_2: {
            type: DataTypes.TEXT,
            allowNull: true
        },
        textbox_3: {
            type: DataTypes.TEXT,
            allowNull: true
        },
        textbox_4: {
            type: DataTypes.TEXT,
            allowNull: true
        },
        textbox_5: {
            type: DataTypes.TEXT,
            allowNull: true
        },
    }, {
        tableName: 'Profil',
        freezeTableName: true, // Prevents table name pluralization
        timestamps:false, //disable createdAt and updatedAt
    });
```

5.2.4.2 Backend Connection to Database

The .env and the configuration file allowed the Sequelize in the backend to access the data that is stored in the database container. The Frontend only had to access the backend it did not do anything with the database directly.

The backend checks the data given in the configuration and then accesses the database via the port 3306 this way it always has the correct information no matter if it is in deployment or production mode.

In the image the configuration for that backend to database connection is shown this is the configuration:

```
const MYSQL = {
    host: process.env.MYSQL_HOST || '172.18.0.4',
    database: process.env.MYSQL_DATABASE ||
'IP5_SustainabilityNavigator_DB',
    user: process.env.MYSQL_USER || 'root',
    pass: process.env.MYSQL_PASS || 'yoyo',
    port: process.env.MYSQL_PORT || 3306
};
```

```
# Server
SERVER_HOSTNAME="localhost"
SERVER_PORT=8000
# MySQL
MYSQL_HOST="172.18.0.4"
MYSQL_DATABASE="IP5_SustainabilityNavigator_DB"
MYSQL_USER="root"
MYSQL_PASS="yoyo"
MYSQL_PORT=3306
MYSQL_DIALECT="MYSQL"
```

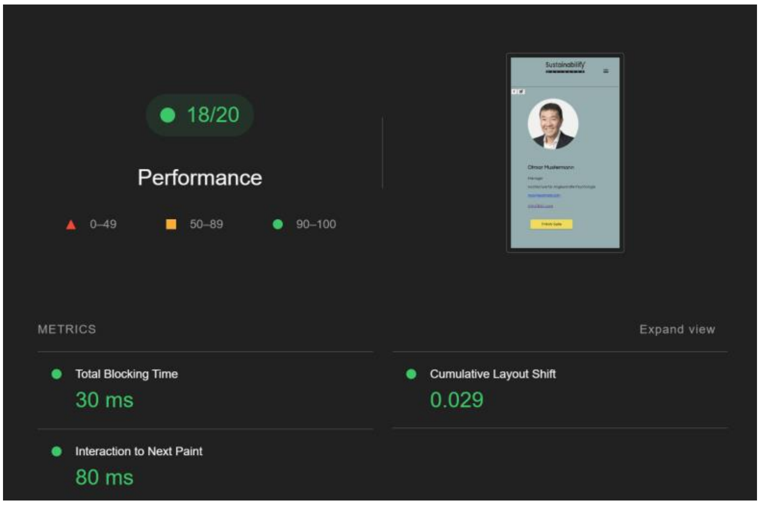
These configurations allow a clean connection to the database.

5.2.5 Performance

Since the purpose of this project was to create a usable real life deployed prototype, not everything is optimized perfectly yet. However, since we believe that a responsible and quick page is detrimental for a good webapp we run a quick google lighthouse check to ensure that is the case:

The Performance is as shown in Figure 29.

The performance is very usable and provides a good user experience.



● 18/20

Performance

▲ 0–49 ■ 50–89 ● 90–100

METRICS

Expand view

● Total Blocking Time
30 ms

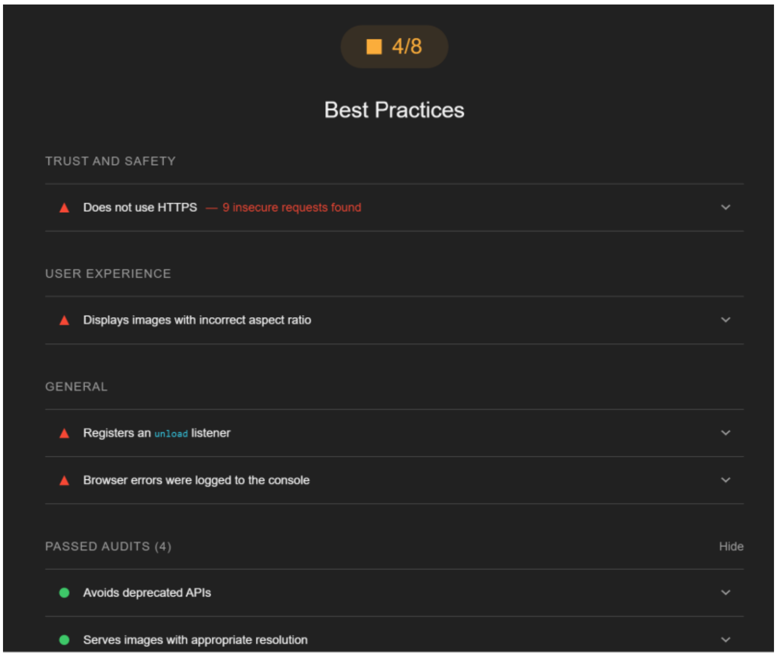
● Cumulative Layout Shift
0.029

● Interaction to Next Paint
80 ms

Figure 29: performance

Best Practices (Figure 30):

The main part is that https is not established yet and some smaller issues with browser, those will be fixed in future iterations of the project, however for the current prototype goals those are only minor details and are quick to fix later.



■ 4/8

Best Practices

TRUST AND SAFETY

▲ Does not use HTTPS — 9 insecure requests found

USER EXPERIENCE

▲ Displays images with incorrect aspect ratio

GENERAL

▲ Registers an `unload` listener

▲ Browser errors were logged to the console

PASSED AUDITS (4) Hide

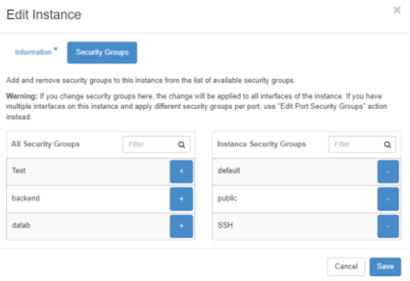
● Avoids deprecated APIs

● Serves images with appropriate resolution

Figure 30: best practices

5.2.6 Internet accessibility

Since a lot of our customers and stakeholders are not in the technical field it was not enough to share a repository or access to the server, that is why we opened the server as well to the internet. We only opened port 80 and not too many for security reasons.
To achieve this in the server management of switch we created a custom port group called "public" This opens port 80 and therefore allows users to connect to it. (Figure 31)



Edit Instance

Add and remove security groups to this instance from the list of available security groups.

Warning: If you change security groups here, the change will be applied to all interfaces of the instance. If you have multiple interfaces on this instance and apply different security groups per port, use "Edit Port Security Groups" action instead.

All Security Groups	Instance Security Groups
Test	default
backend	public
datab	SSH

Figure 31: internet accessibility

To avoid having to tell the customers an Ip address we used a free DNS service called noip.com .

There you can get a free Ip address with some random suffix after it, but that is normal for non-paid domains. This allowed us to send a normal link to the customers and therefore increase the user experience for non-technical users.

Link: http://snavigator.ddns.net/home

5.2.7 Scalability

In terms of users the current architecture is very scalable. The storage and memory of the server is enough to scale up the current userbase by quite a lot. The same goes for feature scalability. The project is designed in such a way that future developers can easily adapt the current logic and add features to it. This is due to clean codebase, a standard framework approach and a clean database structure. Same goes for integration the current solution can easily be integrated to other services.

5.2.8 Continuation/ integration of this project

From the beginning, this project was strategically designed to ensure ease of continuation and expansion by future development teams. We employed a standard web development approach, meticulously setting up CI/CD pipelines, configuring the server, codebase, database, and containerization with clarity and simplicity in mind. This approach is aimed at making the project accessible and straightforward for future developers.

Integration into the existing FHNW system has been a key consideration. Our database, being a relational model, aligns well with FHNW's existing database structures, allowing for straightforward importation. In the event direct integration proves challenging, an alternative approach could involve merging the user data from FHNW's database into ours. This flexibility in integration methods ensures that our solution can be effectively incorporated into FHNW's existing database framework.

However, certain adaptations will be necessary. The FHNW database currently lacks specific fields, such as those detailing an individual's area of sustainability expertise. But this is the beauty of professionally written relational databases, it can be easily adjusted as soon as more information from the IT department is available.

5.2.9 Concept of future key features

5.2.9.1 User management

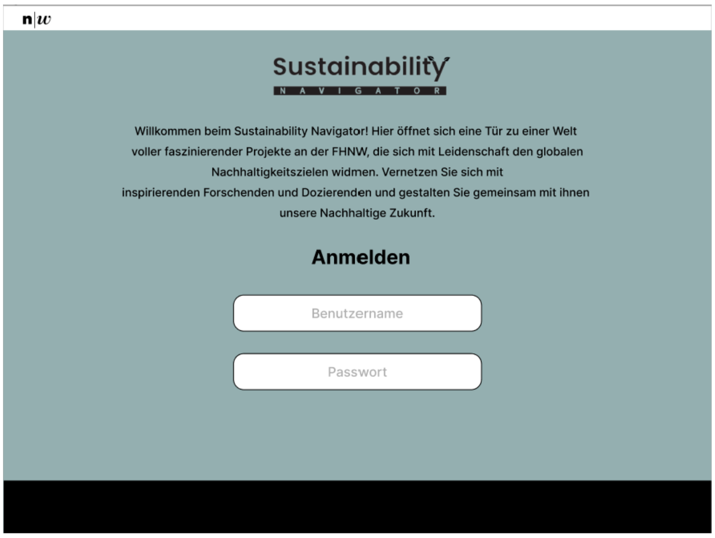
For future iterations of this project, implementing a robust user management system is essential. This includes not only the creation of a login screen but also the integration of an admin user role. The admin user would have elevated permissions, enabling them to edit other user profiles and projects.

This functionality is crucial for maintaining the integrity of the platform, allowing for necessary corrections or the removal of users or projects when needed.

The Figma screens provide a conceptual visualization of how this user management interface could be structured, serving as a valuable guide for future developers. These designs illustrate the proposed layout and functionalities, offering a clear idea for the development of this feature in the project's next phases.

Login screen:

The login screen (Figure 32) is intentionally designed to be straightforward and user-friendly, ensuring that users can access the system without any complications. Ideally, the initial account creation for logging into the Sustainability Navigator could be integrated with the existing FHNW login system. This integration would provide a seamless and inviting login process, enhancing user experience by simplifying access and maintaining consistency with the overall FHNW digital ecosystem. Such an approach not only streamlines the login procedure but also reinforces a sense of familiarity and ease for users who are already part of the FHNW community.



Willkommen beim Sustainability Navigator! Hier öffnet sich eine Tür zu einer Welt voller faszinierender Projekte an der FHNW, die sich mit Leidenschaft den globalen Nachhaltigkeitszielen widmen. Vernetzen Sie sich mit inspirierenden Forschenden und Dozierenden und gestalten Sie gemeinsam mit ihnen unsere Nachhaltige Zukunft.

Figure 32: login design

Admin User:

Every user management system requires an admin user who has the capability to oversee the entire platform. In this context, the admin user's role includes the ability to delete and edit users and projects. Such controls are essential for a variety of reasons, and it is beneficial to have this level of management to maintain the integrity and order of the platform.

The concept of this kind of administrative management is a critical aspect for future development of the project. The Figma screens are designed to serve as a guide for future developers, providing a visual and functional idea of how it could be done in the future. (Figure 33)

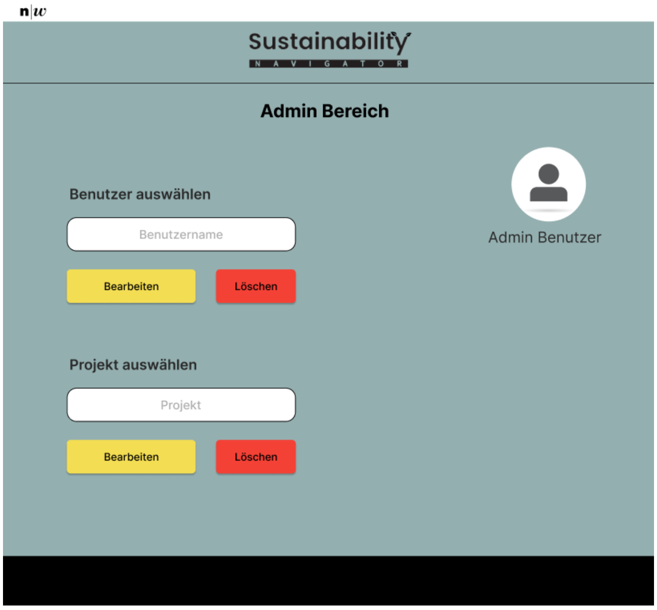


Figure 33: admin area

5.2.9.2 Calendar of professors having a sustainability lecture

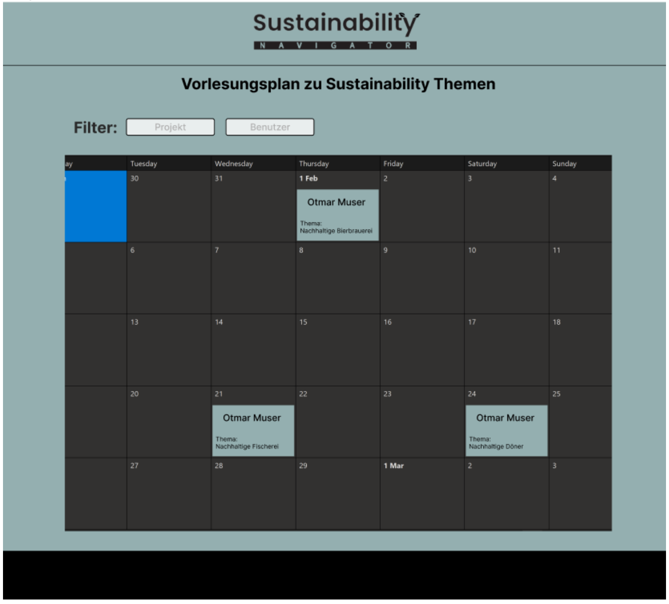
It was brought to our attention later that sometimes it is difficult for users to know when and where there are lectures regarding sustainability. To solve this problem, it would be best to have some form of a calendar view to check all the available lectures.

This overview would provide users with a centralized and easily accessible schedule of upcoming sustainability lectures, including details about the time, location, and topics. Such a feature would enhance the platform's utility, making it easier for users to stay informed and participate in relevant events and discussions.

Lecture Planning Calendar:

The proposed Lecture Calendar feature for the Sustainability Navigator would display a calendar where users can easily find out the timing and location of upcoming lectures on various sustainability topics. The functionality would include a straightforward calendar overview complemented by a filtering system. This filter would allow users to refine their search based on specific lecturers or projects, this guarantees quick and easy access to information about where and when these events are occurring.

Integrating such a Lecture Calendar (Figure 34) would be a valuable enhancement to the SN, significantly improving the platform's utility for users interested in sustainability education and events. This feature, designed for user-friendliness and efficiency, could be developed, and implemented by future developers, further enhancing the capabilities of the Sustainability Navigator.



Vorlesungsplan zu Sustainability Themen

Filter: Projekt Benutzer

ay	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	30	31	**1 Feb** Otmar Muser Thema: Nachhaltige Bierbrauerei	2	3	4
	6	7	8	9	10	11
	13	14	15	16	17	18
	20	21 Otmar Muser Thema: Nachhaltige Fischerei	22	23	24 Otmar Muser Thema: Nachhaltige Döner	25
	27	28	29	**1 Mar**	2	3

Figure 34: calendar design

6 Conclusion

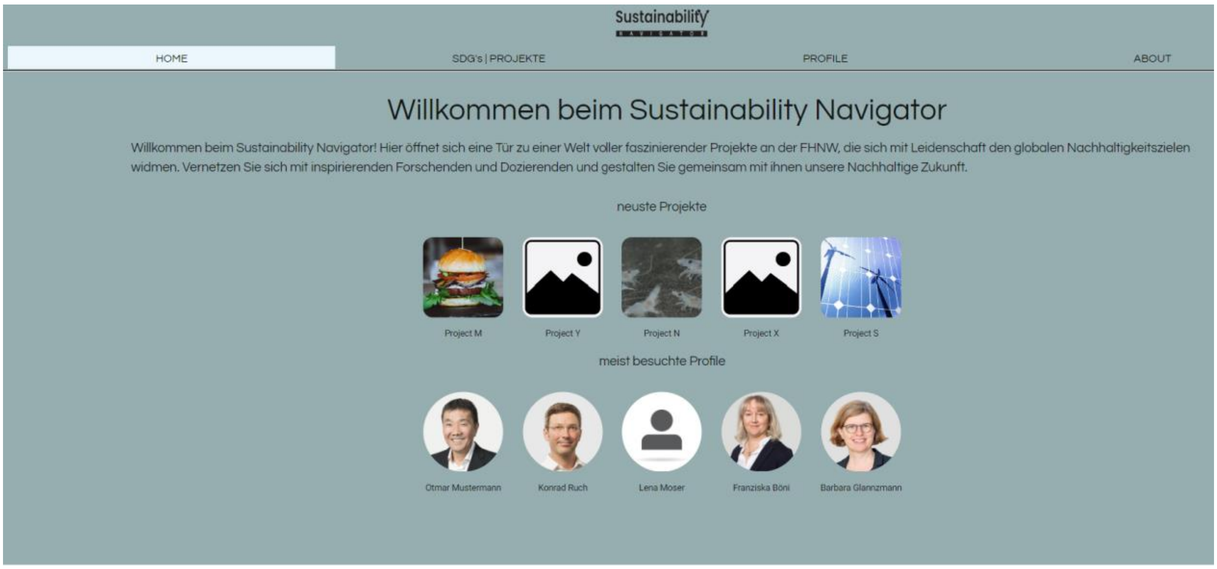
6.1 Reflection

6.1.1 What did we achieve?

In this project, we successfully developed a highly functional and detailed initial prototype of the Sustainability Navigator. This prototype will serve as a critical tool for further assessing the need and viability of the Sustainability Navigator. The availability of all databases and the online accessibility of the page allow our customers to utilize this tool in real-world scenarios. Such practical application provides invaluable insights into the necessity and effectiveness of the Sustainability Navigator, offering a clear perspective on its potential impact and utility.

Main page:

The main page (Figure 35) features a well-organized display of the latest projects and the most frequently visited profiles. This design ensures that inexperienced users can quickly grasp the most significant trends and key contributors in the field of sustainability with just a glance. This approach not only enhances user engagement but also provides immediate insight into current and influential sustainability efforts.



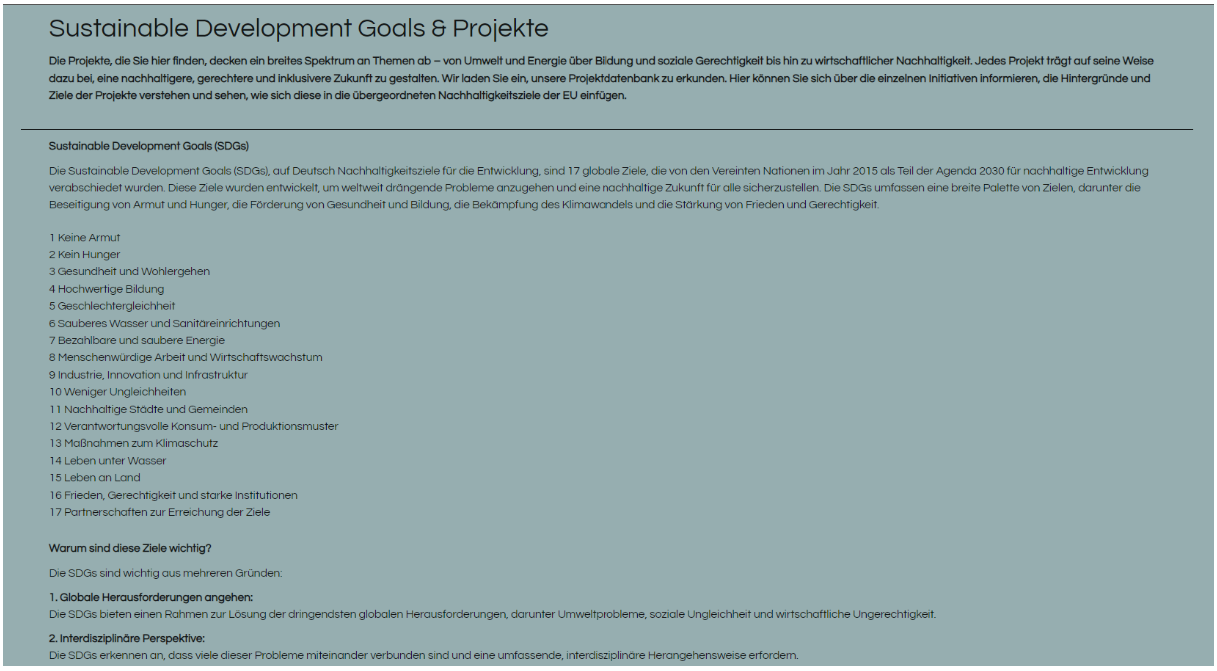
Willkommen beim Sustainability Navigator

Willkommen beim Sustainability Navigator! Hier öffnet sich eine Tür zu einer Welt voller faszinierender Projekte an der FHNW, die sich mit Leidenschaft den globalen Nachhaltigkeitszielen widmen. Vernetzen Sie sich mit inspirierenden Forschenden und Dozierenden und gestalten Sie gemeinsam mit ihnen unsere Nachhaltige Zukunft.

Figure 35: main page

SDGs | Projekte Top section

Above the section SDGs | Projekte (Figure 36), there is a concise explanation detailing what the SDGs are and emphasizing their importance. This informative addition helps users understand the significance of these goals and why they are a critical focus in sustainability efforts.



Sustainable Development Goals & Projekte

Die Projekte, die Sie hier finden, decken ein breites Spektrum an Themen ab – von Umwelt und Energie über Bildung und soziale Gerechtigkeit bis hin zu wirtschaftlicher Nachhaltigkeit. Jedes Projekt trägt auf seine Weise dazu bei, eine nachhaltigere, gerechtere und inklusivere Zukunft zu gestalten. Wir laden Sie ein, unsere Projektdatenbank zu erkunden. Hier können Sie sich über die einzelnen Initiativen informieren, die Hintergründe und Ziele der Projekte verstehen und sehen, wie sich diese in die übergeordneten Nachhaltigkeitsziele der EU einfügen.

Sustainable Development Goals (SDGs)

Die Sustainable Development Goals (SDGs), auf Deutsch Nachhaltigkeitsziele für die Entwicklung, sind 17 globale Ziele, die von den Vereinten Nationen im Jahr 2015 als Teil der Agenda 2030 für nachhaltige Entwicklung verabschiedet wurden. Diese Ziele wurden entwickelt, um weltweit drängende Probleme anzugehen und eine nachhaltige Zukunft für alle sicherzustellen. Die SDGs umfassen eine breite Palette von Zielen, darunter die Beseitigung von Armut und Hunger, die Förderung von Gesundheit und Bildung, die Bekämpfung des Klimawandels und die Stärkung von Frieden und Gerechtigkeit.

1 Keine Armut
2 Kein Hunger
3 Gesundheit und Wohlergehen
4 Hochwertige Bildung
5 Geschlechtergleichheit
6 Sauberes Wasser und Sanitäreinrichtungen
7 Bezahlbare und saubere Energie
8 Menschenwürdige Arbeit und Wirtschaftswachstum
9 Industrie, Innovation und Infrastruktur
10 Weniger Ungleichheiten
11 Nachhaltige Städte und Gemeinden
12 Verantwortungsvolle Konsum- und Produktionsmuster
13 Maßnahmen zum Klimaschutz
14 Leben unter Wasser
15 Leben an Land
16 Frieden, Gerechtigkeit und starke Institutionen
17 Partnerschaften zur Erreichung der Ziele

Warum sind diese Ziele wichtig?

Die SDGs sind wichtig aus mehreren Gründen:

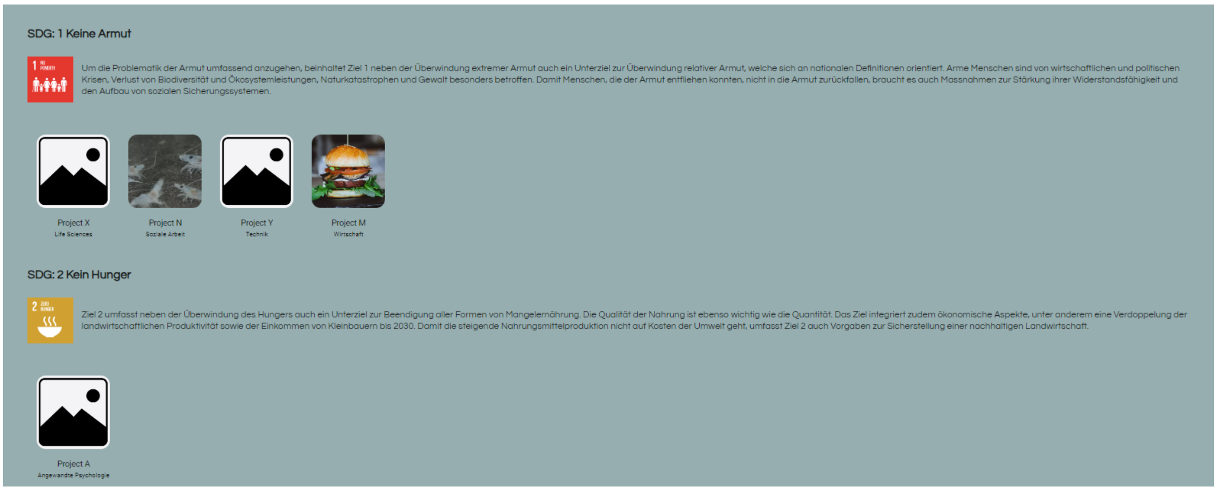
1. Globale Herausforderungen angehen:
Die SDGs bieten einen Rahmen zur Lösung der dringendsten globalen Herausforderungen, darunter Umweltprobleme, soziale Ungleichheit und wirtschaftliche Ungerechtigkeit.

2. Interdisziplinäre Perspektive:
Die SDGs erkennen an, dass viele dieser Probleme miteinander verbunden sind und eine umfassende, interdisziplinäre Herangehensweise erfordern.

Figure 36: SDG's and projects top section

SDGs | Projekte

In the "SDGs | Projekte" section of the Sustainability Navigator, users have access to a comprehensive list of all the projects currently stored on the platform. This feature allows users to effortlessly browse through all the significant projects. The projects are systematically organized according to their respective Sustainable Development Goals (SDGs). This organization ensures that users can quickly identify the number of projects associated with each specific SDG, providing a clear and direct understanding of the focus and distribution of sustainability efforts within the platform. (Figure 37)



SDG: 1 Keine Armut

Um die Problematik der Armut umfassend anzugehen, beinhaltet Ziel 1 neben der Überwindung extremer Armut auch ein Unterziel zur Überwindung relativer Armut, welche sich an nationalen Definitionen orientiert. Arme Menschen sind von wirtschaftlichen und politischen Krisen, Verlust von Biodiversität und Ökosystemleistungen, Naturkatastrophen und Gewalt besonders betroffen. Damit Menschen, die der Armut entfliehen konnten, nicht in die Armut zurückfallen, braucht es auch Massnahmen zur Stärkung ihrer Widerstandsfähigkeit und den Aufbau von sozialen Sicherungssystemen.

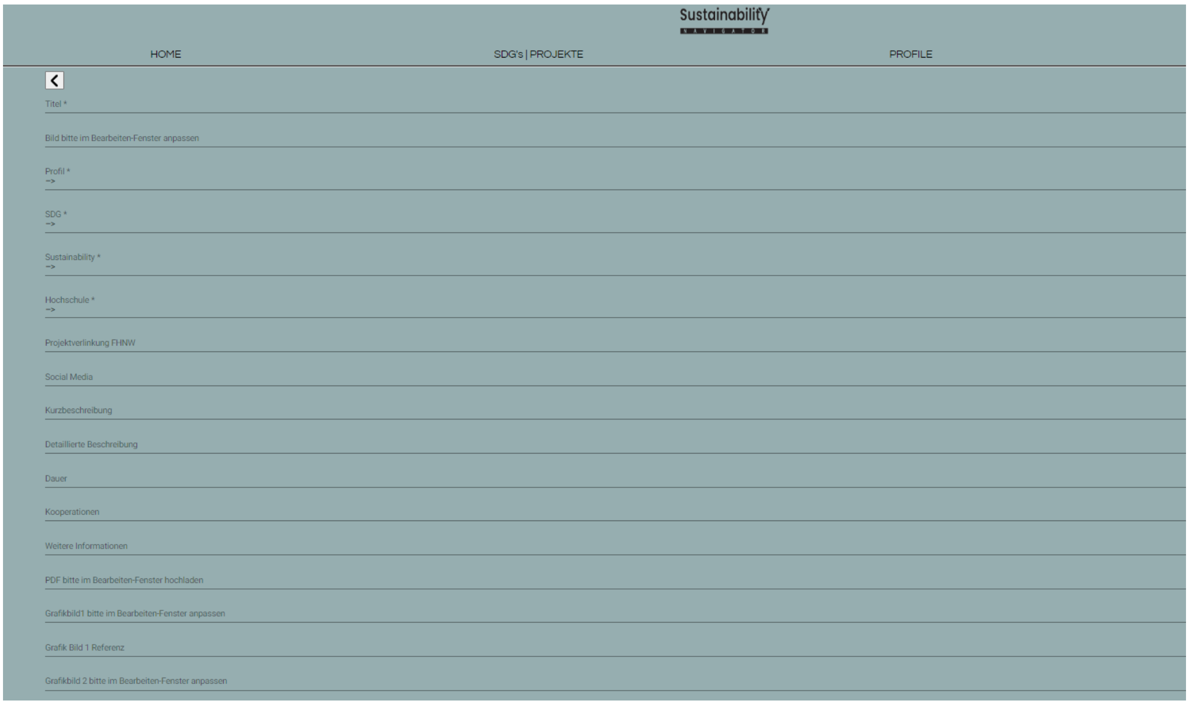
SDG: 2 Kein Hunger

Ziel 2 umfasst neben der Überwindung des Hungers auch ein Unterziel zur Beendigung aller Formen von Mangelernährung. Die Qualität der Nahrung ist ebenso wichtig wie die Quantität. Das Ziel integriert zudem ökonomische Aspekte, unter anderem eine Verdoppelung der landwirtschaftlichen Produktivität sowie der Einkommen von Kleinbauern bis 2030. Damit die steigende Nahrungsmittelproduktion nicht auf Kosten der Umwelt geht, umfasst Ziel 2 auch Vorgaben zur Sicherstellung einer nachhaltigen Landwirtschaft.

Figure 37: SDG's and projects

Create a Project

A project can be effectively created and stored in the system, with all essential fields available and editable. This ensures that users are fully informed about each project's details. (Figure 38)



Titel *

Bild bitte im Bearbeiten-Fenster anpassen

Profil *
–>

SDG *
–>

Sustainability *
–>

Hochschule *
–>

Projektverlinkung FHNW

Social Media

Kurzbeschreibung

Detaillierte Beschreibung

Dauer

Kooperationen

Weitere Informationen

PDF bitte im Bearbeiten-Fenster hochladen

Grafikbild1 bitte im Bearbeiten-Fenster anpassen

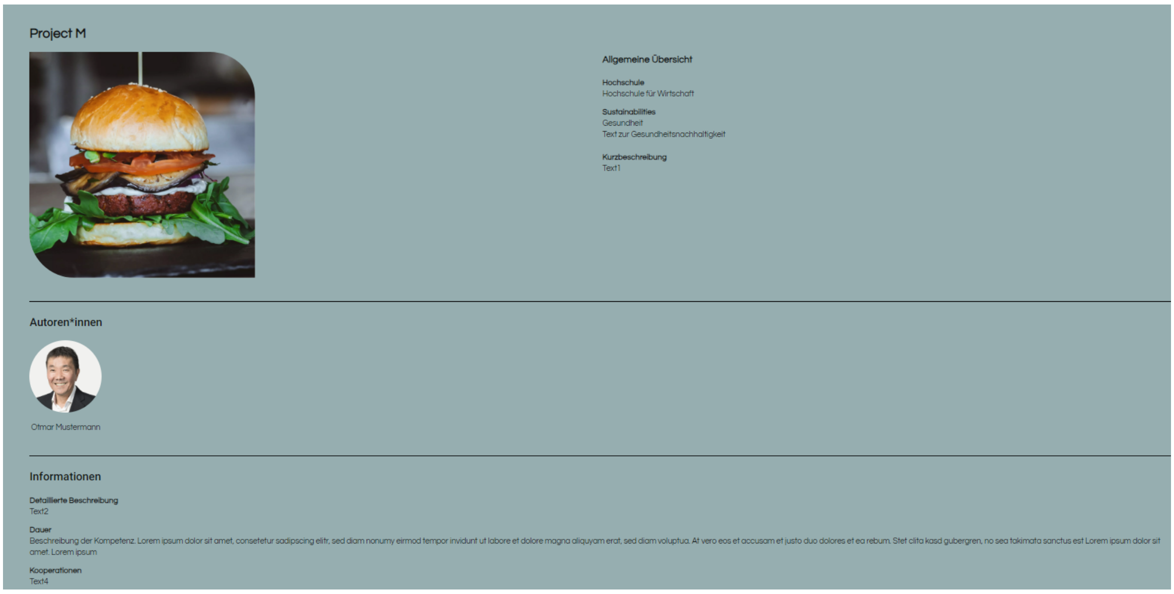
Grafik Bild 1 Referenz

Grafikbild 2 bitte im Bearbeiten-Fenster anpassen

Figure 38: create project

Project Detail view

In the project detail view, all information is displayed in an easily understandable format, offering a quick overview at the top with more comprehensive details provided below. This layout ensures a user-friendly experience, allowing for both an at-a-glance summary and in-depth exploration of each project. (Figure 39)



Project M

Allgemeine Übersicht

Hochschule
Hochschule für Wirtschaft

Sustainabilities
Gesundheit
Text zur Gesundheitsnachhaltigkeit

Kurzbeschreibung
Text1

Autoren*innen

Otmar Mustermann

Informationen

Detaillierte Beschreibung
Text2

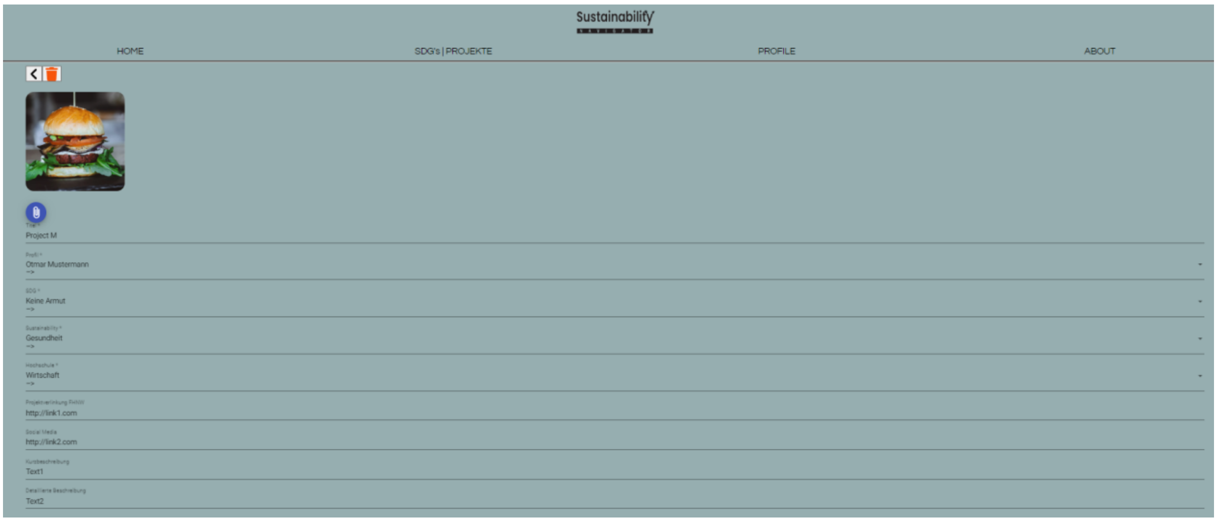
Dauer
Beschreibung der Kompetenz. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. Lorem ipsum

Kooperationen
Text4

Figure 39: project detail view

Project Edit Screen

In the project edit screen, users have the capability to modify any project. Additionally, this interface allows for the uploading of images and PDFs. Currently, these uploads can only be done in the edit screen, not during the initial creation of the project. This is due to the requirement that a project must already exist in the system to associate images and PDFs with it. However, this limitation should be easily addressable by future developers. In the meantime, both PDFs and images can be uploaded and updated at any time through the project edit screen. (Figure 40)



Titel *
Project M

Profil *
Otmar Mustermann
-->

SDG *
Keine Armut
-->

Sustainability *
Gesundheit
-->

Hochschule *
Wirtschaft
-->

Projektverlinkung FHNW
http://link1.com

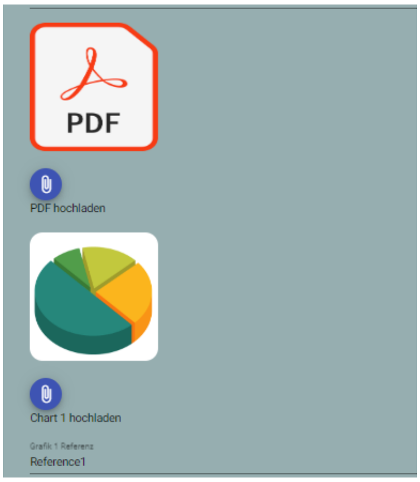
Social Media
http://link2.com

Kurzbeschreibung
Text1

Detaillierte Beschreibung
Text2

Figure 40: project edit view

Uploader (in the edit screen)



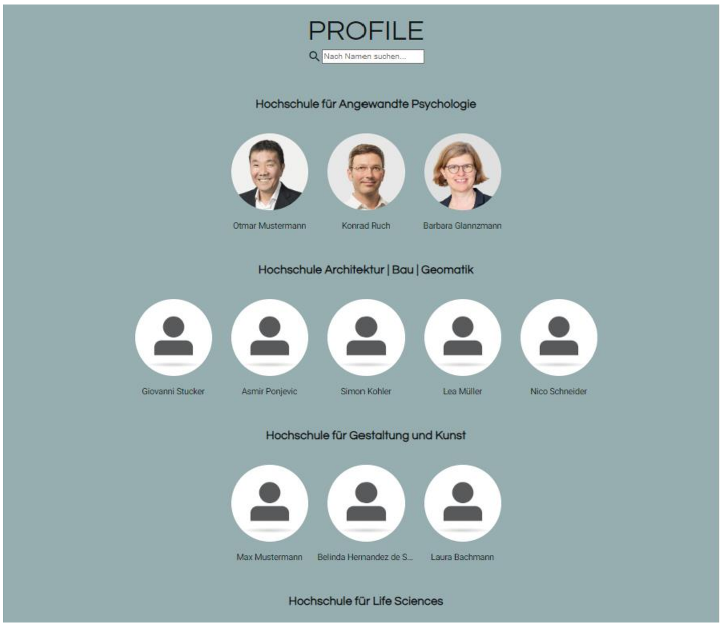
Grafik 1 Referenz
Reference1

Figure 41: uploader

In the edit section, users can upload images by clicking on the blue button (Figure 41), allowing them to update or change the images associated with a project. Additionally, there is an option to upload PDFs. This feature is particularly useful for professors or researchers, as it enables them to upload their pre-existing papers in PDF format and link them directly to the project. Such functionality enhances the platform's practicality in real-world scenarios, making it a valuable tool for academic and research purposes.

Profile Section

In this section, a user can view every individual who has registered on the platform. The users are organized based on the university they are affiliated with. (Figure 42)



PROFILE

Nach Namen suchen...

Hochschule für Angewandte Psychologie

Otmar Mustermann
Konrad Ruch
Barbara Glannzmann

Hochschule Architektur | Bau | Geomatik

Giovanni Stucker
Asmir Ponjevic
Simon Kohler
Lea Müller
Nico Schneider

Hochschule für Gestaltung und Kunst

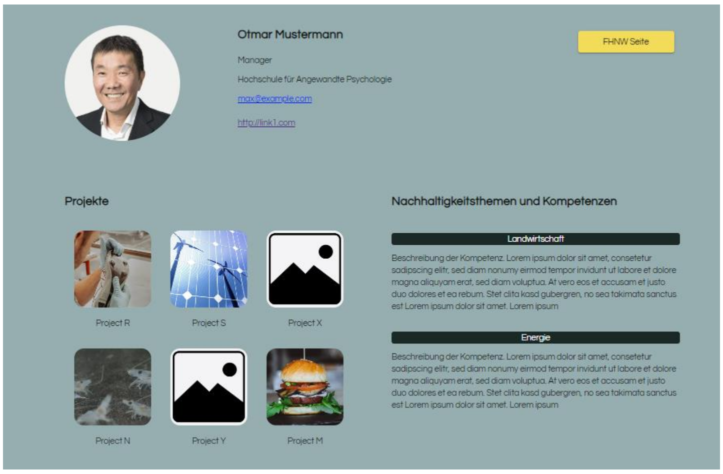
Max Mustermann
Belinda Hernandez de S...
Laura Bachmann

Hochschule für Life Sciences

Figure 42: profile overview

Profile Detail View

In the profile detail view (Figure 43), users can access comprehensive information about everyone registered on the platform. This includes the area of sustainability expertise, as well as other details. Alongside a list of projects, the person has contributed to, the profile provides all essential information regarding their involvement in sustainability. This includes their area of expertise, their university or workplace affiliation, the specific projects they have worked on, and contact information, ensuring that users have a thorough understanding of each person's role and contributions in the field of sustainability.



Otmar Mustermann

Manager

Hochschule für Angewandte Psychologie

max@example.com

http://link1.com

FHNW Seite

Projekte

Project R
Project S
Project X
Project N
Project Y
Project M

Nachhaltigkeitsthemen und Kompetenzen

Landwirtschaft

Beschreibung der Kompetenz. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. Lorem ipsum

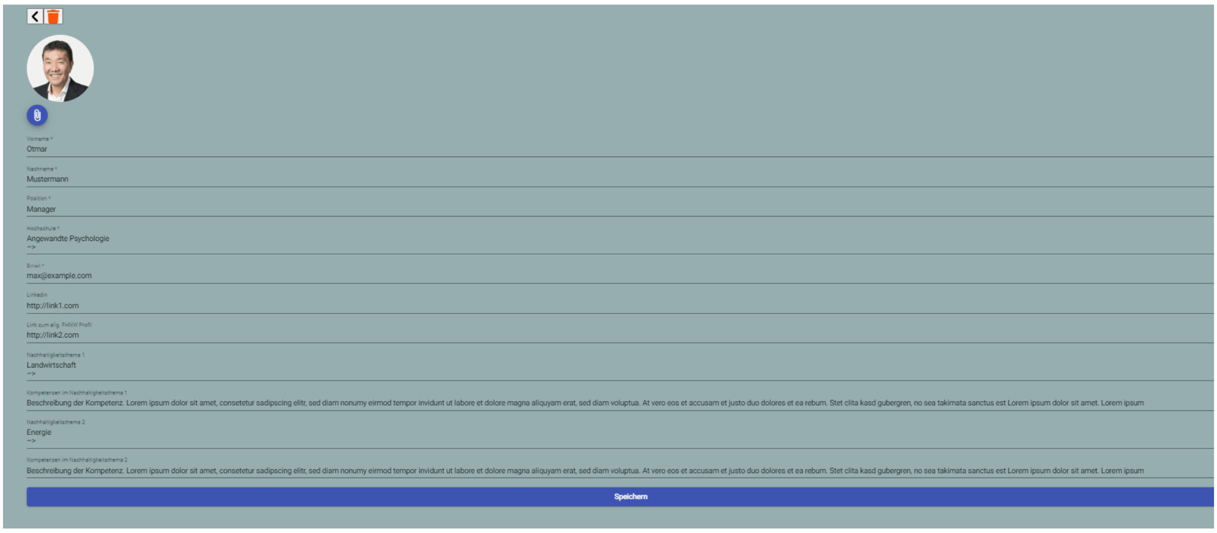
Energie

Beschreibung der Kompetenz. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. Lorem ipsum

Figure 43: profile detail view

Profile Edit Screen

In the profile edit screen (Figure 44), users have the capability to modify their public profile. Additionally, this interface allows for the uploading of images. Currently, these uploads can only be done in the edit screen, not during the initial creation of the profile. This is due to the requirement that a profile must already exist in the system to associate images with it. However, this limitation should be easily addressable by future developers. In the meantime, images can be uploaded and updated at any time.



Vorname *
Otmar

Nachname *
Mustermann

Position *
Manager

Hochschule *
Angewandte Psychologie
-->

Email *
max@example.com

Linkedin
http://link1.com

Link zum allg. FHNW Profil
http://link2.com

Nachhaltigkeitsthema 1
Landwirtschaft
-->

Kompetenzen im Nachhaltigkeitsthema 1
Beschreibung der Kompetenz. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. Lorem ipsum

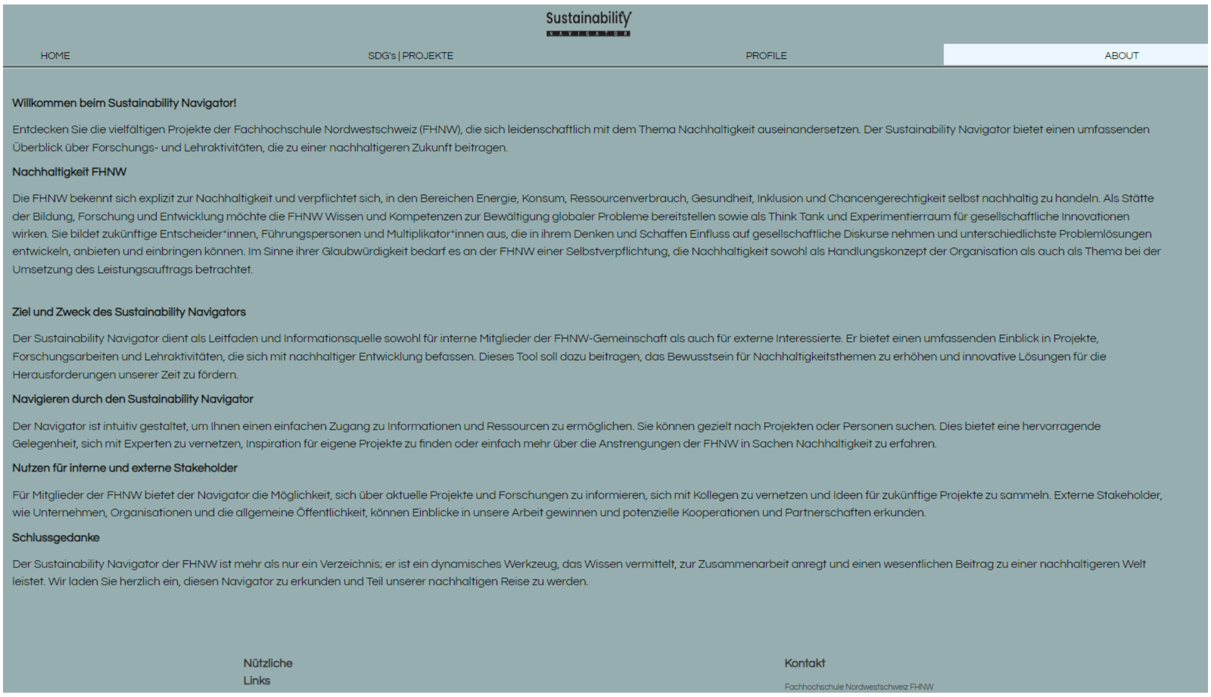
Nachhaltigkeitsthema 2
Energie
-->

Kompetenzen im Nachhaltigkeitsthema 2
Beschreibung der Kompetenz. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. Lorem ipsum

Figure 44: profile edit view

About Page

The About-page (Figure 45) offers a comprehensive overview of the platform, its objectives, and primarily delves into the current state of sustainability initiatives at FHNW. This section aims to provide users with a clear understanding of the platform's purpose and the broader context of FHNW's commitment to sustainability. Additionally, the page features numerous helpful links directing users to the main page. These links facilitate easy navigation and access to further information, enriching the user experience by connecting them with additional resources and relevant content.



Willkommen beim Sustainability Navigator!

Entdecken Sie die vielfältigen Projekte der Fachhochschule Nordwestschweiz (FHNW), die sich leidenschaftlich mit dem Thema Nachhaltigkeit auseinandersetzen. Der Sustainability Navigator bietet einen umfassenden Überblick über Forschungs- und Lehraktivitäten, die zu einer nachhaltigeren Zukunft beitragen.

Nachhaltigkeit FHNW

Die FHNW bekennt sich explizit zur Nachhaltigkeit und verpflichtet sich, in den Bereichen Energie, Konsum, Ressourcenverbrauch, Gesundheit, Inklusion und Chancengerechtigkeit selbst nachhaltig zu handeln. Als Stätte der Bildung, Forschung und Entwicklung möchte die FHNW Wissen und Kompetenzen zur Bewältigung globaler Probleme bereitstellen sowie als Think Tank und Experimentierraum für gesellschaftliche Innovationen wirken. Sie bildet zukünftige Entscheider*innen, Führungspersonen und Multiplikator*innen aus, die in ihrem Denken und Schaffen Einfluss auf gesellschaftliche Diskurse nehmen und unterschiedlichste Problemlösungen entwickeln, anbieten und einbringen können. Im Sinne ihrer Glaubwürdigkeit bedarf es an der FHNW einer Selbstverpflichtung, die Nachhaltigkeit sowohl als Handlungskonzept der Organisation als auch als Thema bei der Umsetzung des Leistungsauftrags betrachtet.

Ziel und Zweck des Sustainability Navigators

Der Sustainability Navigator dient als Leitfaden und Informationsquelle sowohl für interne Mitglieder der FHNW-Gemeinschaft als auch für externe Interessierte. Er bietet einen umfassenden Einblick in Projekte, Forschungsarbeiten und Lehraktivitäten, die sich mit nachhaltiger Entwicklung befassen. Dieses Tool soll dazu beitragen, das Bewusstsein für Nachhaltigkeitsthemen zu erhöhen und innovative Lösungen für die Herausforderungen unserer Zeit zu fördern.

Navigieren durch den Sustainability Navigator

Der Navigator ist intuitiv gestaltet, um Ihnen einen einfachen Zugang zu Informationen und Ressourcen zu ermöglichen. Sie können gezielt nach Projekten oder Personen suchen. Dies bietet eine hervorragende Gelegenheit, sich mit Experten zu vernetzen, Inspiration für eigene Projekte zu finden oder einfach mehr über die Anstrengungen der FHNW in Sachen Nachhaltigkeit zu erfahren.

Nutzen für interne und externe Stakeholder

Für Mitglieder der FHNW bietet der Navigator die Möglichkeit, sich über aktuelle Projekte und Forschungen zu informieren, sich mit Kollegen zu vernetzen und Ideen für zukünftige Projekte zu sammeln. Externe Stakeholder, wie Unternehmen, Organisationen und die allgemeine Öffentlichkeit, können Einblicke in unsere Arbeit gewinnen und potenzielle Kooperationen und Partnerschaften erkunden.

Schlussgedanke

Der Sustainability Navigator der FHNW ist mehr als nur ein Verzeichnis; er ist ein dynamisches Werkzeug, das Wissen vermittelt, zur Zusammenarbeit anregt und einen wesentlichen Beitrag zu einer nachhaltigeren Welt leistet. Wir laden Sie herzlich ein, diesen Navigator zu erkunden und Teil unserer nachhaltigen Reise zu werden.

Figure 45: about page

Search function

The Project Overview and Profile Overview screens on the platform both feature search functions (Figure 46), significantly streamlining the process of finding a specific project or person. This functionality enhances the platform's usability by reducing the effort users need to exert in their search. Even if a user only knows part of a name or project title, the Sustainability Navigator (SN) efficiently filters and displays projects and profiles containing that particular segment. This partial search capability ensures a more user-friendly and effective navigation experience, making the platform accessible and convenient for all users.

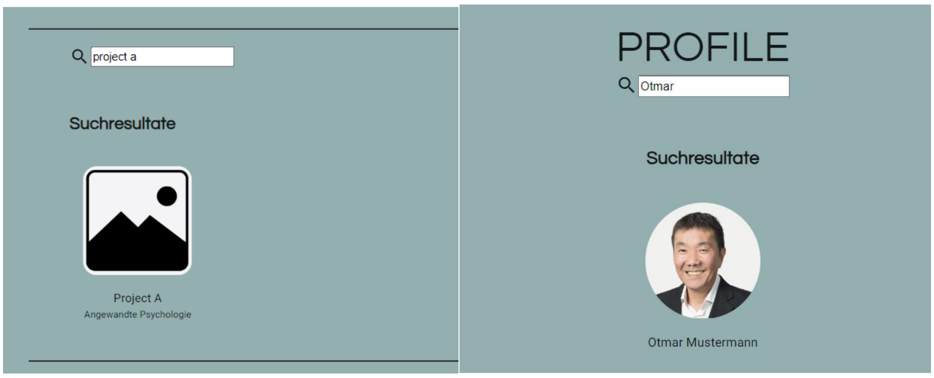


Figure 46: search function

6.1.2 Comparison current state with project goal

The primary objective of this project was to develop a functional prototype of the Sustainability Navigator for the customers to test. By using this prototype and gathering information on the subject, they will be able to make an informed decision on whether to proceed with the Sustainability Navigator.

The fact that all databases are available, and the page is accessible online means that our customers can use this tool in real-world scenarios. This practical application offers invaluable insights into the tool's necessity and effectiveness, providing a clear understanding of its potential impact and utility.

Based on these considerations, we are confident that the current state of the project meets the initial project goals.

6.1.3 What works what does not?

Drawing on our previous experience in software projects, we recognized the crucial role of effective teamwork. Therefore, we placed a strong emphasis on collaboration in this project. We held regular meetings and dedicated full days to coding together, ensuring constant communication and progress, even while working remotely. When in the home office, we stayed connected through calls. This approach guaranteed that both team members were always informed about the project's status and each other's activities, significantly reducing confusion, and enhancing coordination.

6.1.4 What could be improved?

Currently, the Sustainability Navigator (SN) is functioning effectively, though there are a few minor improvements that could enhance its usability. One such improvement is allowing the upload of images during the initial creation phase of a project or profile, rather than only in the editing stage. Additionally, incorporating a user management system would be advantageous. While this is more of an added feature than a minor tweak.

For future integration with the FHNW website, it would be helpful to modify the color scheme of the SN to white and yellow, aligning with FHNW's branding. Also, incorporating the FHNW logo into the design would further unify the platform with the institution's identity. These are simple adjustments and should be easily manageable for future developers.

6.1.5 Learnings

During this project, we gained substantial knowledge in project management and managing various stakeholders. The initial lack of information regarding the customer's requirements made it necessary to have extensive meetings and information gathering. Navigating through options for publishing and deciding on the appropriate technology also presented challenges. These experiences made us understand how important it is to gather information and utilize them correctly.

From a technical standpoint, we learned significantly about databases, Angular, and server management. While both of us had prior experience in similar projects, starting a large-scale project entirely from scratch was an entirely new experience for us. It was extremely rewarding to be involved in every aspect of creating a web application, from gathering information and deciding on the tech stack, to server setup, website management, and programming the page itself.

This project was a valuable learning experience, enhancing our skills in both project management and technical aspects. We are grateful for the opportunity to have gained such experience and are pleased with the growth and knowledge acquired through this project.

6.2 Recommendations

6.2.1 Expansion Future Developers

For any future team tasked with advancing the Sustainability Navigator project, it will be crucial to conduct updated research on the current state of the FHNW website relaunch, as this will significantly influence the project's trajectory. The relaunch is likely to introduce a new design standards and technical requirements, which the Sustainability Navigator will need to align with to ensure seamless integration.

Adhering to FHNW's corporate design guidelines is essential for the platform to gain acceptance by the main page administrators. This may necessitate some minor but crucial adjustments in the platform's design to align with the updated website aesthetics and functional norms.

Furthermore, the team must thoroughly review and incorporate the feedback documented in the 'Sustainability Test' section of our project documentation. This feedback is invaluable as it provides insights into user experiences, expectations, and areas needing improvement. Addressing this feedback will be critical in refining the platform's usability and relevance to its target audience.

Should these steps be diligently followed, and the customer opts to continue with this initiative, the Sustainability Navigator stands a strong chance of being successfully integrated into the FHNW website. This integration would not only enhance the visibility and accessibility of sustainability projects but also demonstrate FHNW's commitment to promoting sustainable practices and collaborations within and beyond its community.

6.2.2 Keeping it up to date

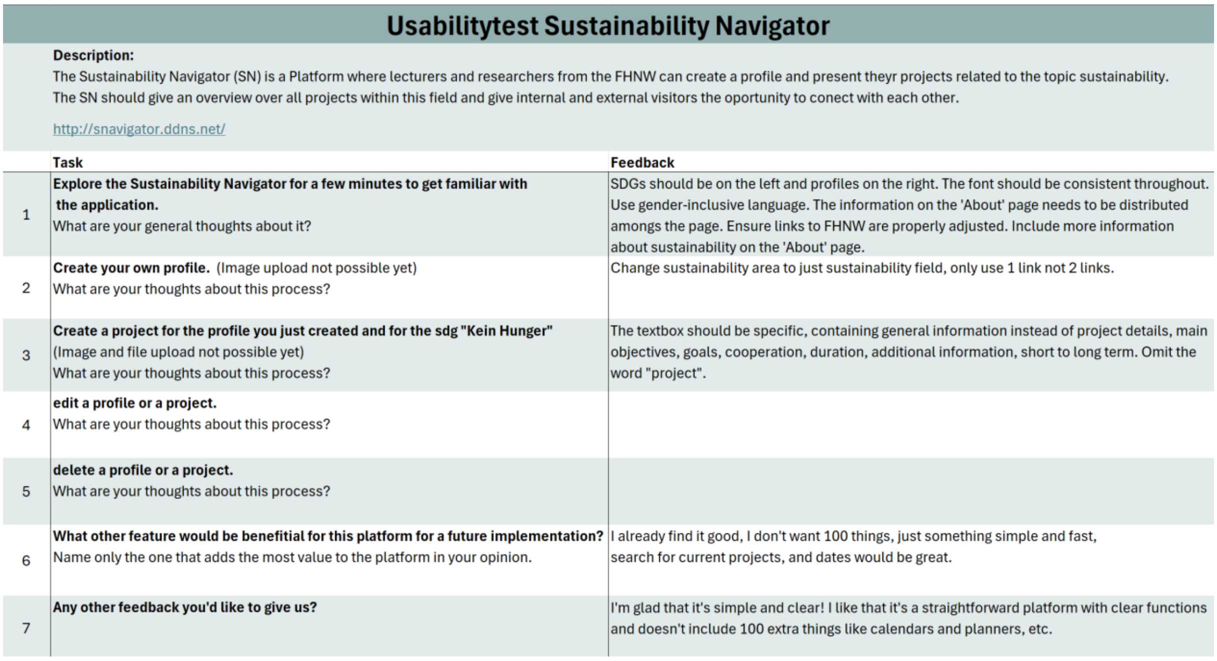
This serves as a small reminder that every system interacting with the web must be kept up to date, primarily for security reasons but also for performance. When this project is resumed, it is essential that the server, as well as all configurations for Nginx, CI/CD, Docker, and technologies like Angular, Node.js, and Sequelize, be updated.

These updates should be conducted at the start of the new project iteration. Completing them early on will facilitate a clean and efficient continuation of the project. Given that Angular often undergoes significant updates within short periods, it would be best to start the updating process with Angular.

6.3 Usability Tests

6.3.1 Usability test

This is the first Usability test (Figure 47) we conducted with Andrea Bauer, the others are in the appendix:



Usabilitytest Sustainability Navigator

Description:
The Sustainability Navigator (SN) is a Platform where lecturers and researchers from the FHNW can create a profile and present theyr projects related to the topic sustainability.
The SN should give an overview over all projects within this field and give internal and external visitors the oportunity to conect with each other.

http://snavigator.ddns.net/

	Task	Feedback
1	**Explore the Sustainability Navigator for a few minutes to get familiar with the application.** What are your general thoughts about it?	SDGs should be on the left and profiles on the right. The font should be consistent throughout. Use gender-inclusive language. The information on the 'About' page needs to be distributed amongs the page. Ensure links to FHNW are properly adjusted. Include more information about sustainability on the 'About' page.
2	**Create your own profile.** (Image upload not possible yet) What are your thoughts about this process?	Change sustainability area to just sustainability field, only use 1 link not 2 links.
3	**Create a project for the profile you just created and for the sdg "Kein Hunger"** (Image and file upload not possible yet) What are your thoughts about this process?	The textbox should be specific, containing general information instead of project details, main objectives, goals, cooperation, duration, additional information, short to long term. Omit the word "project".
4	**edit a profile or a project.** What are your thoughts about this process?	
5	**delete a profile or a project.** What are your thoughts about this process?	
6	**What other feature would be benefitial for this platform for a future implementation?** Name only the one that adds the most value to the platform in your opinion.	I already find it good, I don't want 100 things, just something simple and fast, search for current projects, and dates would be great.
7	**Any other feedback you'd like to give us?**	I'm glad that it's simple and clear! I like that it's a straightforward platform with clear functions and doesn't include 100 extra things like calendars and planners, etc.

Figure 47: usability test

6.3.2 Recommendations according to Usability Tests

During the usability tests the testers were asked which feature they would like to have in a future version of the sustainability navigator. This could be the starting point for the next team to go on with the development.

- Filter projects by “actually in progress”.
- Filter based on the date in general.
- Page with an explanation how it works.
- Bigger “edit” and “create” button.
- Function to review stats of projects.

6.4 Limitation and Next Stepps

This document comprehensively compiles all necessary information for future developers to seamlessly continue the evolution of this project. The immediate next step involves our current customers and stakeholders engaging with the existing prototype of the Sustainability Navigator. This prototype is highly functional, offering compatibility across both PC and mobile platforms, and is capable of handling real data and actual projects. This functionality allows all involved parties to interact with the product as though it were fully operational, thereby enabling them to make well-informed decisions. These decisions will be based on the insights gained from testing the product, potentially in real-world scenarios.

Once this testing phase is completed and feedback is collected, it will be time for a new team to delve into this document. Their task will be to build upon the existing foundation, with initial efforts likely focusing on minor design modifications and the development of a user management system.

The user management system was not part of the current project iterations scope since it would have exceeded the scope by far. However, it is currently the biggest limitation since it prevents the Sustainability Navigator from being implemented into the FHNW page.

These enhancements are mainly from a development standpoint and, once completed, would make the Sustainability Navigator technically ready for integration into a future iteration of the FHNW website.

This process highlights the project's dedication to ongoing refinement and a focus on user needs. It ensures that the final product will meet the changing requirements of its users and will be in line with the FHNW’s corporate identity.

7 References

Communication, S. E.-F. (2024, Octobre 01). *admin.ch*. Retrieved from admin.ch: https://www.eda.admin.ch/agenda2030/en/home/agenda-2030/die-17-ziele-fuer-eine-nachhaltige-entwicklung.html

8 Links

Sustainability Navigator	http://snavigator.ddns.net/home
Repositories (Backend/ Frontend/ Management Documents)	https://gitlab.fhnw.ch/ip5-sustainability-navigator
Figma	https://www.figma.com/file/YywBlS5aumLGQuygxHkUYW/Untitled?type=design&node-id=0-1&mode=design&t=ZZu6YbOCiQ0jitkH-0
Backlog & Sprint boards	https://gitlab.fhnw.ch/iit-projektschiene/hs23/ip5-sustainability-navigator/-/boards/3681
About the project	https://web0.fhnw.ch/ht/informatik/ip5/23hs/23hs_iit38/index.html

9 Declaration of Authenticity

We the undersigned declare that all material presented in this project report is our own work and written independently only using the indicated sources. We declare that all statements and information contained herein are true, correct and accurate to the best of our knowledge and belief. This report or part of it have not been published to date. It has thus not been made available to other interested parties or examination boards.

Location Date: Windisch 5210, 19.01.2023

Name: Philippe Fasel

Signature: P. Fasel

Name: Kevin Würsch

Signature: K.

10 Appendix

In the Appendix we list the extra Documents and resources to this project. They all are in the same Zip Folder as this document.

10.1 Documents

10.1.1 Usability Tests

- Folder “Usability Tests”
  - usabilitytest_SustaninabilityNavigator_Andrea.xlsx
  - usabilitytest_SustaninabilityNavigator_Ariane.xlsx
  - usabilitytest_SustaninabilityNavigator_Joe.xlsx
  - usabilitytest_SustaninabilityNavigator_Reto.xlsx
  - usabilitytest_SustaninabilityNavigator_Zoe.xlsx

10.1.2 Project agreement

- IP5_projectagreement_v5.0_SustainabilityNavigator_Würsch_Fasel_signed.pdf

10.1.3 Slides

- IP5_Slides_SustainabilityNavigator_Würsch_Fasel.pptx

10.2 Logins and links

- RepositoryLinks.txt
- SN_Link_and_IPAddress.txt
- FigmaLinks.txt
- Folder “Server Connection”
  - IP5_Puttykey.ppk
  - LoginPortainer.txt
  - PuttyPassphrase.txt
  - IP5_SustainabilityNavigator_ServerConnectionGuide.pdf

10.3 Database concepts

- Folder Database
  - EntityRelationModel_First_Drawing.pdf
  - ExampleData_Script.sql
  - SustainabilityNavigatorERD.drawio
  - SustainabilityNavigatorERD.drawio.pdf
  - SustainabilityNavigator_Create_Script.sql

10.4 Repositories Downloaded

- Folder “DownloadedRepos”
  - ip5_sn_frontend.zip
  - ip5_sn_backend.zip