1. Exam Manager and Generator

Organizational and thematic responsibility

KF Artificial Intelligence & Data Analytics
Topics: Databases, GUI
Contact: Christoph Redl, redlch@technikum-wien.at

Vision

The goal of this project is the development of a tool for organizing exam questions and generating exams.

Description

For traditional paper-based exams, teachers usually assemble the exam by picking questions from previous exams and adding some (major or minor) modifications afterwards. Also completely new questions may be added. In large courses we need to create multiple exams for different groups of students.

In this project we want to develop a tool that supports this process. To this end, exam questions should be stored in a database and organized in different categories. The tool should then assemble an exam by randomly picking questions from the different categories, depending on the teacher's settings (e.g. how many questions per category, etc.). A graphical interface should then support the exchange of individual questions.

Finally, it should also be possible to edit questions manually or add completely new questions. Such changes should also be stored back in the underlying question pool to make modified/ new questions reusable in the future.

The exact features are to be discussed with the supervisor.

Requirements and Conditions

- The programming language can be freely chosen (e.g. Java, C#, etc.).
- Becaues the tool is to be used by many lecturers over a long time, it makes only sense if it works well without setup overhead. It is therefore important to make the tool easily useable without the need for active maintenance of servers, etc.
- Due to the previous point, the type of data storage should be chosen appropriately (e.g. a lightweight database such as SQLite instead of a full-fledged Oracle server).
- **Overall estimation of required skills:**
  Mostly doable with the skills you earned in your FHTW studies.

Value for our faculty

Teaching: can be used to generate exams in BIF and BWI

2. Electronic Teacher's Notebook

Organizational and thematic responsibility

KF Artificial Intelligence & Data Analytics
Topics: Databases, GUI
Contact: Christoph Redl, redlch@technikum-wien.at

Vision

The goal of this project is the development of a tool for making notes about students.

Description

Our Moodle courses contain activities that allow for adding points and grades. However, sometimes lecturers want to make notes about students without directly referring to a specific activity or without making the note directly visible to the student.

An example includes notes about participation. In some courses we assign some (bonus) points to the general participation throughout the semester. This activity can only be graded at the end of the semester, but we need to make textual comments whenever the student participates.

Currently, such comments are made in local documents, which are not linked to the Moodle course whatsoever. This has the disadvantage that formal marks in Moodle and informal comments are separated and it is difficult to keep track of the overall performance of students.

This project is about the development of an electronic notebook that automatically integrates informal notes and a student's current Moodle entries into an overall record.

The exact features are to be discussed with the supervisor.

Requirements and Conditions

- The programming language can be freely chosen (e.g. Java, C#, etc.).
- Some Web technologies (e.g. HTTP requests) will be necessary to load data from Moodle.
- Becaues the tool is to be used by many lecturers over a long time, it makes only sense if it works well without setup overhead. It is therefore important to make the tool easily useable without the need for active maintenance of servers, etc.
- Due to the previous point, the type of data storage should be chosen appropriately (e.g. a lightweight database such as SQLite instead of a full-fledged Oracle server).
- Privacy needs to be taked into account as well. That is, a student's must not be stored on external servers that are not controlled by FHTW.
- **Overall estimation of required skills:**
  Mostly doable with the skills you earned in your FHTW studies.

Value for our faculty

Teaching: can be used to generate exams in BIF and BWI

3. Visualization of Algorithms

Organizational and thematic responsibility

KF Artificial Intelligence & Data Analytics
Topics: Algorithms
Contact: Christoph Redl, redlch@technikum-wien.at

Vision

The goal of this project is the development of tools for visualization of algorithms fort he use in teaching.

Description

This project is about the development of a tool that visualizes algorithms to be used in teaching in computer science (e.g. search, sorting, trees, etc). The tool is the be used in presentations and talks in courses in order to illustrate algorithms to the participants.

Since there are already tools of this kind around, the first step is to analyze the market and identify gaps and shortcomings of existing solutions. Afterwards, a new tool that fills this gap is to be developed. Ideally, the tool should not only visualize a single algorithm but a whole family of related algorithms.

The exact topic is to be discussed with the supervisor.

Requirements and Conditions

- Interest for algorithms and programming skills are necessary.
- The programming language can be freely chosen (e.g. Java, C#, etc.).
- The topic is flexible, depending on the interests of the group.
- **Overall estimation of required skills:**
  Mostly doable with the skills you earned in your FHTW studies.

Value for our faculty

Teaching: can be used in courses, specifically in fundamental courses in BIF and BWI

4. Development of a Computer Game with AI Agent

Organizational and thematic responsibility

KF Artificial Intelligence & Data Analytics
Topics: Artificial Intelligence, Games
Contact: Christoph Redl, redlch@technikum-wien.at

Vision

Development of an AI show case in form of a computer game.

Description

The faculty is continuously looking for good AI show cases that are easy to understand also (for IT laymen). They are to be used in our AI lab, at the Open Days, and other public events. For this purpose, this project is about the development of a computer game that contains some AI capabilities.

We apire for an agent that is able to learn and improve over time. That is, the agent's strategy should not be „hard coded" within the program, but rather be learnt while the game is running. This allows it also to adopt to modified rules (e.g. in context of further development of the game).

The game concept, technologies and the AI methods to be used are flexbile depending on the group's interests.

Requirements and Conditions

- Interest for AI, ideally also with game development.
- General programming skills. The language can be freely chosen (e.g. Java, C#, etc.). The game may be developed from scratch or – if the participants have experience o rare interested - technologies such as an existing engine can be used.
- Flexible topic depending on the group's preferences. The game to be developed is to be discussed with the lecturer.
- **Overall estimation of required skills:**
  Be aware that the project requires skills beyond BWI courses. It aims at students who either have previous knowledge in gaming and/ or AI, or want to learn about it.

Value for our faculty

Representation: show case for public events to present our students' capabilities

5. Development of a Mathematics PowerPoint Plugin

Organizational and thematic responsibility

KF Artificial Intelligence & Data Analytics
Topics: MS Office, Plugin
Contact: Christoph Redl, redlch@technikum-wien.at

Vision

Easy conversion of LaTeX-based content into PowerPoint.

Description

Mathematics makes frequent use of special symbols and formulas. Therefore such content is usually created in LaTeX. While this is convenient on it's own, using such content within a WYSIWYS environment (such as PowerPoint) is cumbersome. The normal copy&paste function often corrupts the structure of formulas, and special symbols are often not available in common fonts. As an alternative, formulas are often added by making screenshots of PDFs and inserting them as images, which prevents later editing.

There are some tools that try to address this issue (e.g. pdf-to-pptx converter, combinations of WYSIWYG editors and LaTeX, etc), but they are usually standalone apps or online tools focused on converting whole documents rather than individual formulas.

The project is about developing a copy&paste plugin for mathematical content. The goal is to support the seamless insertion into PowerPoint (and ideally, also other Office apps), such that the structure and symbols are preserved and editing remains possible.

The desired features are as follows:

- Copy & paste formulas from PDFs into PowerPoint without corruption
- Insertion of LaTeX code that is seamlessly rendered in the background
- For large teams: recognition of formulas in images and transformation into editable format (using existing image recognition software)

Requirements and Conditions

- Experience with MS Office and good programming skills in a language that is suitable for implementing MS Office plugins (e.g. C#).
- Existing backends (e.g. LaTeX rendering or for image recognition) can be used.
- Focus is on good usability.
- Note: Despite the project's title, mathematical skills/ interest are not necessary! (here we just insert formulas, but don't need to understand them). Also knowledge in AI is not needed (we may call an OCR tool, but not develop it).
- **Overall estimation of required skills:**
  Be aware that the project requires skills beyond BWI courses. It aims at students who either have previous knowledge in MS Office plugin development, or want to learn about it (knowledge in mathematics or AI is not necessary!).

Value for our faculty

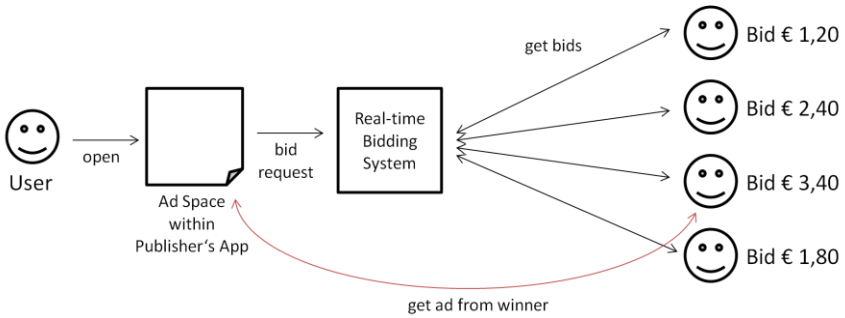
The project supports the creation of PowerPoint-based slides with mathematical content, to be used in teaching and research.

6. Web Platform for Programmatic Advertisement

KF Artificial Intelligence & Data Analytics
Topics: Web Development
Contact: Christoph Redl, redlch@technikum-wien.at

Vision

The goal of this project is to develop a simple web platform for ad exchange (ADX).



Description

In the field of programmatic advertisement, so-called *publishers* reserve space within their apps or websites to show ads from *advertisers*. Third parties bring publishers and advertisers together and make sure that ads are shown within appropriate ad spaces. The selection of an ad to be shown by an advertiser is based on a bidding system. For billing purposes, various performance indicators such as the click rate or the install rate need to be tracked as well.

In this project, we want to develop a prototype application that manages this process. It should allow for publishers and advertisers to register for the platform, and implement a basic protocol to transfer ads and collect and visualize data required for evaluation and billing. The platform is to be implemented as a web application.

Requirements and Conditions

- To be implemented as a web application.
- Ideally, it should be compatible with OpenRTB.
- Technologies (programming language, web framework) can be freely chosen, but it should be easy to install the application on a new web server.
- **Overall estimation of required skills:**
  Mostly doable with the skills you earned in your FHTW studies.

Value for our faculty

The application combines software development with a business application. It is to be used as a simple show case for BWI that can be presented to the public or new applicants during the open days.

7. Game-Based Learning Units and AI

Organizational and thematic responsibility

KF Digital Enterprise & UX
Topics: Education, Game Development, Gamification
Contact: Dominik Dolezal, dominik.dolezal@technikum-wien.at

Vision

Development of a prototype that allows learners without computer science background to playfully gain first experiences in programming and/or computational thinking

Description

The goal of the project is to develop learning units (e.g., two-hour sessions) that enable newcomers to computer science to learn fundamental concepts of computer science and/or programming (e.g., loops, if statements, etc.) in a playful and practical manner. Teachers should be able to incorporate these learning modules into their lessons with minimal overhead so that both learners and teachers can achieve quick positive experiences and success.

A possible implementation could be, for example, mini-games or a framework for them, into which learners must insert pieces of code to make the game work (e.g., increasing the score when something is collected, etc.). This should be achievable without needing extensive background information about the framework itself or the language. The goal is also for the learning modules to go beyond simple visualizations and ideally include interaction (similar to "Scratch").

An experimental integration of AI elements is desired (e.g. for generating content / levels / quizzes / visualizations ...).

The project group is welcome to bring their own ideas to the table; the exact features are to be discussed with the supervisor. If successful, the learning modules should ideally be used in courses.

Requirements and Conditions

- Interest in game development, game-based learning, AI and/or education
- General programming skills. The framework (e.g. Unity) and programming language (e.g. Python, Java, C#, etc.) can be freely chosen
- Flexible topic depending on the group's preferences. The game to be developed is to be discussed with the lecturer.
- Because the tool is to be used by many lecturers over a long time, it makes only sense if it works well without setup overhead. It is therefore important to make the tool easily useable without the need for active maintenance of servers, etc.
- Due to the previous point, the type of data storage should be chosen appropriately (e.g. a lightweight database such as SQLite instead of a full-fledged Oracle server).
- **Overall estimation of required skills:**
  Be aware that the project requires skills beyond BWI courses. It aims at students who have previous knowledge in game development or want to learn about it.

Value for our faculty

Teaching: can be used to supplement warm-up courses

8. AI-Based Learning Platform

Organizational and thematic responsibility

KF Digital Enterprise & UX
Topics: Education, Game Development, Gamification
Contact: Dominik Dolezal, dominik.dolezal@technikum-wien.at

Vision

Development of a tool or platform that fosters student learning

Description

There is no dispute that recent developments in AI have an impact on education and student learning. Hence, the idea of this project is to utilize new technologies and AI tools to foster student learning.

The project may take different directions, depending on the project team's interest. Possible features for leaners and lecturers include:

- AI-supported, automatic generation of quizzes based on provided course material (e.g., uploading a PDF file / providing full text generates a quiz with several questions and answers about the content)
- Generation of exercise descriptions for definable topics/course contents (e.g., generating an exercise to practice loops in Java)
- Generation of summaries of certain topics
- Generation of simple games based on course material
- Individualized AI-based coaching based on student performance

The features, concept, technologies and the AI methods to be used are flexible depending on the group's interests. The end product should have an interface (web, app or desktop application) and be easy to use.

Requirements and Conditions

- Interest in AI and education
- General programming skills. The language can be freely chosen (e.g. Python, Java, C#, etc.).
- Flexible topic depending on the group's preferences.
- **Overall estimation of required skills:**
  Be aware that the project requires skills beyond BWI courses. It aims at students who either have previous knowledge in AI or want to learn about it.

Value for our faculty

Representation: show case for public events to present our students‘ capabilities
Teaching: can be used in courses
Research: findings may be published

9. Audio Game Development and UX

Organizational and thematic responsibility

KF Digital Enterprise & UX
Topics: Usability, Game Development
Contact: Dominik Dolezal, dominik.dolezal@technikum-wien.at

Vision

Development of an own simple audio game with a focus on UX

Description

The aim is to create a simple audio game, i.e. a video game that relies primarily on sound for gameplay, making it accessible to both sighted and visually impaired players. Unlike traditional video games that focus on visual elements like graphics and text, audio games use auditory cues, such as music, voice narration, sound effects, and spatial audio, to create an immersive experience.

The first step would be to find an idea of an own audio game – Students are invited to bring in their own ideas for a game.

Finally, the game should be tested and evaluated with participants in usability tests. The results of this study should be summarized in a usability test report.

Requirements and Conditions

- Interest in human-centered design as well as (audio) games
- Prior knowledge of professional usability evaluation is an advantage
- Interest in professional documentation
- **Overall estimation of required skills:**
  Mostly doable with the skills you earned in your FHTW studies.

Value for our faculty

Representation: show case for public events to present our students' capabilities
Research: findings may be published

10. AI and Sustainability in Education

Organizational and thematic responsibility

KF Digital Enterprise & UX
Topics: Usability, Game Development
Contact: Dominik Dolezal, dominik.dolezal@technikum-wien.at

Vision

Development of an AI-based (web) app with a focus on sustainability.

Description

A prototype of an AI-supported web application should be developed that adapts and uses existing large language models (LLM) to the context of education, enabling reflective and responsible use in lessons. The app is all about sustainability and offers students various options for sustainable learning and learning about sustainability.

The project may take different directions, depending on the project team's interest. Possible features for leaners and lecturers include:

- Learning companion: The AI coaches young people as part of a personalized chatbot and thus helps them with sustainable learning. In addition to general learning tips, the AI should also be able to put together individualized learning plans and answer content-related questions about the subject matter.
- Collaborative learning about sustainability: The sustAInability app should be able to be used for joint activities in the class to promote social skills and at the same time address the topic of sustainability. Cooperative exercises, such as joint, interactively designed AI-generated stories on the topics of species loss, environmental pollution and climate change, should contribute to this.
- Gamified learning experience: In order to make the use of the sustAInability app as motivating as possible, playful elements should be incorporated, such as AI-generated quizzes on current learning material and important social topics such as digitalization, sustainability, data protection and artificial intelligence itself.

The project group is welcome to bring their own ideas to the table; the exact features are to be discussed with the supervisor. If successful, the learning modules should ideally be used in courses.

Requirements and Conditions

- Interest in AI and education
- General programming skills. The language can be freely chosen (e.g. Python, Java, C#, etc.).
- Flexible topic depending on the group's preferences.
- **Overall estimation of required skills:**
  Be aware that the project requires skills beyond BWI courses. It aims at students who either have previous knowledge in AI or want to learn about it.

Value for our faculty

Representation: show case for public events to present our students‘ capabilities
Teaching: can be used in courses
Research: findings may be published

11. Gamified On- and Off-Campus Quizzes

Organizational and thematic responsibility

KF Digital Enterprise & UX
Topics: Education, Game Development, Gamification
Contact: Dominik Dolezal, dominik.dolezal@technikum-wien.at

Vision

Development of a tool for gamified quizzes

Description

A prototype of a platform or app is to be developed that allows creating and playing interactive and competitive learning quizzes (similar to "Kahoot").

Users can create quizzes consisting of multiple-choice questions. A question can consist of text and/or media (images, videos, etc.) and provide multiple answers (typically: 4), of which any number can be correct. Points should be awarded for correct answers, with more points given for faster (correct) responses. Quizzes should be manageable (created, exported, imported, duplicated, etc.).

Quizzes can be played in two ways: either "live"/online (with a projector) using internet-enabled devices or offline. In both cases, there is a leaderboard (with an opt-out option). After playing quizzes, optional feedback can be provided (e.g., a questionnaire). A high emphasis is placed on the "fun factor" (stimulating music, animations, design, etc.). The group may also focus on the design- and fun-aspect by applying methods of human-centered design, which may reduce the scope of the project and features.

Requirements and Conditions

- Interest in gamification and education; optionally in user centered design
- General programming skills. The language can be freely chosen (e.g. Java, C#, etc.). Optionally prior knowledge in human-centered design.
- Flexible topic depending on the group's preferences.
- **Overall estimation of required skills:**
  Mostly doable with the skills you earned in your FHTW studies.

Value for our faculty

Teaching: can be used in courses

12. Smart Data Explorer

Organizational and thematic responsibility

KF: Software-Engineering and Architecture
Topics: Open-Data, Data-Models, SmartData Models, FIWARE
Contact: Bernhard Wallisch (walliscb@technikum-wien.at)

Vision

The goal of this project is the development of a tool to support developers defining data-models for Smart Solutions based on FIWARE (https://www.fiware.org/about-us/) and SmartData Models/NGSI-LD (https://smartdatamodels.org/).

Description

Smart Solutions gather data from many different sources (including but not limited to IoT) to build a "picture" of the real world and then process and analyze that information in order to implement the desired intelligent behavior.

The Smart Data Models (SDM) initiative, led by FIWARE Foundation, has firmly established JSON Schema as the core component and single source of truth for creating exports in YAML, SQL, and soon RDF. The JSON Schema definitions are provided via GitHub (https://github.com/smart-data-models). However, using the existing search engine (https://smartdatamodels.org/index.php/ddbb-of-properties-descriptions/) it is hard to find the appropriate items and manually generate the corresponding JSON Schema definitions.

Implement a search-tool to find the matching JSON-schema definitions. Provide some "smart" search methods, like fuzzy searching (e.g. with ElasticSearch) or search by prompts (e.g. by integrating a GPT tool) to improve the developers experience. Include a button to extract the found smart data item into a JSON schema definition.

The exact features are to be discussed with the supervisor.

Requirements and Conditions

- The programming language can be freely chosen (e.g. Java, C#, etc.).
- Because the tool is to be used by different developers over a long time, it makes only sense if it works well without setup overhead.
- It is therefore important to make the tool easily useable.
- Due to the previous point, the type of data storage should be chosen appropriately
- **Overall estimation of required skills:**
  Mostly doable with the skills you earned in your FHTW studies.

Value for our faculty

Teaching: can be used to generate exams in BIF and BWI

13.SmartSearch into CodeBase

Organizational and thematic responsibility

KF: Software-Engineering and Architecture
Topics: SW-Development-Tools, Applied-AI
Contact: Bernhard Wallisch (walliscb@technikum-wien.at)

Vision

The goal of this project is the development of a tool for searching a project's codebase using prompts, resulting a list of referenced sources which are most likely appropriate to the searched text.

Description

To investigate the function of software projects and find the right places where specific behavior is implemented in a code-base can be a very time-consuming and complicated task, e.g. the question "where are new users created…" is hard to answer when using "find-in-files" or through debugging. In this project AI-technologies are applied to enable programmers asking a question, and the application will return a list of results of source-files and positions where the context applies best.

Cloud Solutions, like GitHub CoPilot would serve this, but for the companies it is often not acceptable to upload their complete code-base into the cloud and therefore need a local solution!

The implementation may be done with the help of the Haystack framework. In short it means, that in a first step the source-files needs to be indexed (Dense-Passage-Retrieval) and stored in a datastore (e.g. elastic-search, which is already supported by the Haystack framework).
In a second step - the search function, actually - the data-base will be searched (using the Extractive Question Answering Model) and the result list containing the file- and line-references is returned.
See the following article about application of the Haystack framework: https://ix.de/zy3m

For the user - the software developer - the project needs to provide two major functions:

1. A command (at least a command-line command) which will index the complete codebase and store it in a datastore (e.g. elastic-search) for later use. This command should be executable during build or along a CI/CD-pipeline (e.g. Java/Maven)
2. A command (at least a command-line command) which will take a prompt from the user as input, will execute the search, and return the result list with links to the corresponding positions in the source-files

The exact features are to be discussed with the supervisor.

Requirements and Conditions

- The supported programming language and tooling of the users can be freely defined.
- The type of the data-store may also be freely chosen (alternatives to elasticsearch)
- Pay attention, that the users will be required to have a GPU installed to enable for performant indexing and searching!

- **Overall estimation of required skills:**
  Mostly doable with the skills you earned in your FHTW studies.
  No sophisticated AI-skills/research is necessary! Turn a "feasibility sample" into a product.

Value for our faculty

Support students & lecturers in doing software development/coding projects.

14.Test Harness Proxy

Organizational and thematic responsibility

KF: SWAT & CSSEC
Topics: Client/Server, HTTP-family, CI/CD
Contact: Bernhard Wallisch (walliscb@technikum-wien.at)

Vision

To improve a software-system's stability and longevity, develop a tool acting as proxy between client and server (or service-provider and -consumer) to test the application's integration-point out-of-specs behavior.

Description

The proxy will manipulate network connections between client and server to test how resilient the system is against connection-losses, data-drops, speed limits and further failure scenarios; it will also perform automatic reporting and monitoring.

Samples/questions to be investigated could be as follows, to report how the system-under-test acts if…

- …it can't make the initial connection (between the components)?
- …it takes ten minutes to make the connection?
- …it can make the connection and then gets disconnected?
- …it can make the connection but doesn't get a response from the other end?
- …it takes two minutes to respond to my query?
- …10000 requests come in at the same time?
- …the disk is full when the application tries to log an error message?
- …the network was bogged down with a worm?

Add further failure scenarios, reporting, monitoring and automating features to the test-harness solution.

Also think about how easy the Test-Hardness-Proxy Server can be setup/used in customer-specific solutions. What has to be installed? What needs to be configured?

The exact features are to be discussed with the supervisor.

Requirements and Conditions

- The programming language can be freely chosen (e.g. Java, C#, etc.).
- Define the test-cases/rules via JSON or YAML file in order to easily adapt it to the software-under-test
- The report has also to be provided as JSON or XML, to be processable by software.
- The focussed network protocols should be HTTP (HTTPS), TCP, UDP
- **Overall estimation of required skills:**
  Mostly doable with the skills you earned in your FHTW studies.

Value for our faculty

Check and improve the resilience and security of our developed and used applications.

15.LEAN Process Viewer

Organizational and thematic responsibility

KF: Software-Engineering and Architecture
Topics: SW-Development-Tools, Applied-AI
Contact: Bernhard Wallisch (wallischb@technikum-wien.at)
Wolfgang Wallisch (PORR / pde integrale Planung GmbH,
wolfgang.wallisch@pde-porr.com)

Vision

The purpose of this project is to develop a Process-Viewer for LEAN Management to visualize the overall process chain and parts of it over time and/or process lines respectively, in 3 different zoom levels.

Description & Requirements

Due to the high level of complexity, large-scale construction projects require well-coordinated planning and construction by the project partners. PORR uses the LEAN method here, i.e. the entire planning and construction process is set up at the beginning of the project with the decisive dependencies (trade sequence = in line, preprocess = between lines). Changes during the project are problematic and require additional process steps to complete the project on time.

The project is intended to result in a software pilot that combines these two crucial functionalities, namely - process visualization and change notifications.

Requirements and Conditions

- The programming language can be freely chosen (e.g. Java, C#, etc.).
- Frontend:
  - input process steps,
  - define dependencies,
  - show change reports, visualization of all processes in 3 zoom levels (arrange processes due to dependencies),
  - calculate critical process paths and buffers (forward and backward)

  (Detailed specifications to be found in interviews with the stackeholder)
- The data should be persisted in a SQL-based database
- The solution should be running standalone, at least in form of docker-containers (docker-compose)
- **Overall estimation of required skills:**
  Mostly doable with the skills you earned in your FHTW studies.

Value for our faculty

Used as a planning tool for long term and sophisticated projects.