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Leistung mit Menschlichkeit

informatik

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Diplomarbeit

im Rahmen der Reife- und Diplomprüfung

Königskarte

informatik

Leon Edlinger
Paul Gigler
Andreas Weissl

5BHIF
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Betreuer: Prof. DI Johannes Loibner, BSc
Projektpartner: Prof. DI Robert Müllerferli
Datum: MISSING DATE

Statutory declaration

I declare under oath that I have written the present diploma thesis independently and without outside help, have not used sources and aids other than those indicated and have identified the passages taken from the sources used literally and in terms of content as such.

Ort, Datum	Leon Edlinger
Ort, Datum	Paul Gigler
Ort, Datum	Andreas Weissl

Abstract

Abstract in English

Kurzfassung

Kurzfassung in Deutsch

Thanks

It would not have been possible to carry out this thesis to this extent without the active support of a number of people. We would therefore like to thank everyone who supported us in the implementation of this thesis.
…

Table of Contents

1 Introduction

TODO: Is halt die frage ob ma den anfang einfach so schreiben, war ja eigentlich net ganz so xD
Mobile apps are utilized for virtually all aspects of daily life in the modern world. So after we noticed that there is no application that allows the efficient planning of campaigns like the "Sternsinger-Aktion" we asked ourselves why, and furthermore, how hard it is to create an App with intuitive usability with the main purpose of simplifying the process of managing such a campaign and gaining a general overview of the progress made by the groups.

The app needs to comply with specific criteria we defined in cooperation with Prof. DI Robert Müllerferli. He is the main organizer of the campaign in the parish of Lieboch and helped us to work out the key aspects our project should implement. In the finished product, every user should be able to scan a QR-Code, through which the area of this group gets assigned to the device. These areas must be dynamically adjustable, so an admin can coordinate the workload of each area more efficiently. The areas also need to be clearly visible by an outline which gets drawn through "Border" addresses. These border addresses get calculated by an algorithm implemented by us. It should be visible at a glance if there is an "specification", which can be assigned by admins, set for an address. This should be realized through the use of different icons instead of the default icon. Apart from the app itself, we also implemented a web-portal through which administrators can manage and supervise the campaign.
TODO: vielleicht noch was rein bezüglich der borders und dann unten nurmehr drauf referenzieren?

The research part of this thesis will be dedicated to how components should act and look, so that new users can use this tool without requiring a long "onboarding" phase. It should feel familiar to interact with elements and the borders of what users can and can not do need to be clearly defined. Because our application also needs a reliable data source to guarantee the consistency and accuracy of marked addresses, we researched ways to keep our database up-to-date, without the need of much manual intervention. After defining the project requirements, we noticed that we need to calculate which addresses are border addresses. So we decided to take a look into different algorithms for this task and compare them concerning their efficiency, decide on one of them and implement it.

This thesis contains an in-depth description of our thought and development process, as well as any other steps we took to achieve our goal of a functional mobile application that can be used by volunteers in course of the "Sternsinger-Aktion 2025" taking place in the parish of Lieboch.

1.1 Team

This thesis was created by three Students attending the BHIF20 at the HTBLA Kaindorf Computer Science Department.

TODO: andis bild anpassen

Leon Edlinger

Database, Admin-Panel

Paul Gigler

Deployment, Mobile App

Andreas Weissl

Backend

2 Technologies

Development would not have been possible without making use of many tools, frameworks and environments. In this chapter each tool used in the creation of our software will be described briefly.

2.1 LaTeX

Hier kommt eine Beschreibung zu Latex hin

2.2 Frontend

2.2.1 Dart

Dart is a programming language initially designed for web development, with the goal, of replacing JavaScript, in mind. Today it gets used in a variety of software products, mainly because of the flutter framework. It can be compiled for many platforms and architectures (ARM, x64, RISC-V, JavaScript or WebAssembly) and is loved for its combination of High-Level Features, with practical language features like Garbage collection and optional Type annotation. It was developed by Google and is now an open-source project.

(*Flutter for Beginners*, n.d.)

2.2.2 Flutter

Flutter is an Open-Source software development framework. It allows programmers to compile their application for different platforms including Web, macOS, IOS as well as Windows and any type of Linux-based systems, all from one code-base, written in Dart. This allows for more efficient and faster cross-platform development. Another benefit of Google's toolkit are the highly customizable predefined UI components. Developers can mix and match these components however needed which makes them an applicable choice.

We chose flutter mainly for these reasons, but also because of our previous experience with Java to which Dart is quite similar. Through it, we were able to get started quickly, learn what we need along the way. Having a design through the components was also very helpful and saved us some time.

("flutter/README.md at master · flutter/flutter", 2025) (Dagne, 2019)


Flutter

2.3 Backend

2.3.1 Java Spring

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2.3.2 PostgreSQL

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2.4 Version Control

2.4.1 Git

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2.4.2 GitHub

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2.5 Map Data

2.5.1 OpenStreetMap

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2.5.2 Graphhopper

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2.6 Development Tools

2.6.1 VS Code

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2.6.2 IntelliJ

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2.6.3 Android Studio

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2.6.4 Postman

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2.6.5 Figma

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2.7 Deployment

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2.7.2 Uberspace

2.7.3 Webmin

3 Research Questions

3.1 Leon Edlinger

3.2 Paul Gigler

3.3 Andreas Weissl

4 Spring Framework

The backend leverages the **Spring Framework**, a comprehensive framework for enterprise Java development. This section explores its key components and advantages.

4.1 Spring Boot

Spring Boot simplifies configuration and deployment with embedded servers and opinionated setups. This reduces boilerplate code and accelerates development.

4.2 Spring Data JPA

Spring Data JPA provides abstractions for database interactions, streamlining CRUD operations and custom query creation.

4.3 Lombok

Lombok reduces boilerplate code by generating getters, setters, and other methods at compile time, improving code readability and maintainability.

4.4 Advantages

Using Spring enhances productivity, reduces setup complexity, and ensures scalability, making it ideal for this project.

5 Area Borders

The area borders feature addresses the research question by implementing computational geometry algorithms for precise geographical boundary calculations.

5.1 Purpose of Area Borders in the App

Accurate area borders are essential for defining regions based on user input, supporting the app's mapping functionality.

5.2 Overview of the Convex Hull Algorithm

The convex hull algorithm identifies the smallest convex polygon enclosing a set of points, making it a suitable choice for this project.

5.3 Use Cases of the Convex Hull in Industry

Applications of convex hulls in mapping, computer graphics, and robotics highlight their importance in solving real-world problems.

5.4 Alternate Methods for Area Border Calculation

Alternative methods like Voronoi diagrams and alpha shapes were considered but found less suitable due to complexity or computational demands.

5.5 Rationale for Choosing the Convex Hull Method

The convex hull algorithm offers a balance of simplicity, efficiency, and accuracy, aligning with the project's requirements.

5.6 Integration of the Algorithm into the Backend

The algorithm is implemented in the service layer, ensuring smooth integration with other backend components.

5.7 Challenges and Adjustments

Challenges included handling edge cases like collinear points, which were resolved through specific algorithm adjustments.

6 Structure of the Backend

The backend follows a layered architecture to promote separation of concerns, scalability, and maintainability. This section outlines the roles of each layer.

6.1 Controller Layer

The controller layer acts as the interface for incoming HTTP requests, delegating them to appropriate service methods.

6.2 Service Layer

The service layer contains business logic, validating data and coordinating interactions between controllers and repositories.

6.3 Repository Layer

Repositories abstract database operations, allowing the backend to interact with the database without explicit SQL queries.

6.4 Persistence Layer (Entity Classes)

Entity classes define the data model and its mapping to the relational database, ensuring a consistent schema.

6.5 Applied Design Principles (DTOs)

Data Transfer Objects (DTOs) enhance encapsulation and optimize data transfer between layers and external clients.

7 Defining usability

Since my research question "How can user-experience principals add to an intuitive map displayment for nonprofit activities in which people of different technical know-how levels collaborate?" is all about usability, I want to introduce you to its basic concepts and challenges but also provide some examples on how usability can impact a software's revenue and perception.

Usability is a critical aspect of software and interface design, ensuring that users can efficiently and effectively interact with a product or system. Its job is to provide clear feedback and "experiences" to the user, so interactions between software and human feel smooth and straight forward. Because each human being is different in its emotional experiences, it is difficult to design a kind of "one size fits all" solution. Due to this circumstance, many studies and experiments were conducted. (Nielsen, 2024)

7.1 Why it is important

Usability ensures that users can accomplish their goals with minimal frustration and maximum efficiency. With the increasing reliance on digital tools, usability plays a key role, not only, in shaping user experiences but also accessibility of software for diverse user groups. A well-designed and thought-out usability concept can go a long way from refining a once tedious and complicated to use product, to one that can be operated even by non-familiar users or disabled people. This plays a big part in the inclusion of all age and knowledge groups as well as the general market share through mass adoption because of the easiness.

7.2 Components of Usability

According to Jakob Nielsen, usability consists of five core components. To achieve the best possible usability, each of factors must be taken into account and be improved to its maximum.

- Learnability

  How **easy** it is to accomplish basic tasks the first time

- Efficiency

  How **quickly** task can be accomplished after an initial learning period

- Memorability

  How **memorable** actions are to users so, after an extended period of not using a software

- Error handling

  How **many** errors users make while using the design and how **sever** they are

- Satisfaction

  How **pleasant** the overall experience of using the product is

(Nielsen, 2024)

Now that we know these key points, what measures can we take to reach the goal of great usability? According to Nasrullah Hamidli, human-computer-interaction relies on consistency, visibility, feedback, and simplicity. Consistency ensures users do not need to learn new interactions for each task. For example, buttons should look alike and be in a similar location. This makes for a more natural navigation across the product and an overall familiar feel. Simplicity connects directly to this. Its goal is to minimize clutter and make user interfaces easy to understand and provide one, clear way to accomplish a task, not many possible, but complicated and unintuitive ways. It also aims to reduce distractions. Visibility allows users to clearly understand their options at any given moment, this is most often achieved through visual cues, like, grayed out buttons. This goes hand in hand with the feedback aspect, which provides immediate confirmation of actions. Loading indicators, color-changes and alike get used most often.

Another important part of designing a good UI are typography and colors. These can act as parameters for the attention and emotions of users, as well as establish visual hierarchies, which, intern, contribute again to a simpler to navigate interface.
(Hamidli, 2023)

7.3 Fundamental concepts

Visual Hierarchy

Visual hierarchy is a fundamental principle in UI/UX design that dictates how users perceive and navigate content. It ensures that important elements are more visually prominent, guiding users toward essential actions and information.
A bad design lacks differentiation in text size, weight, or spacing, making it hard to distinguish between headings, body text, and interactive elements for the user. This results in cluttered interfaces, increasing cognitive load and reduced usability.

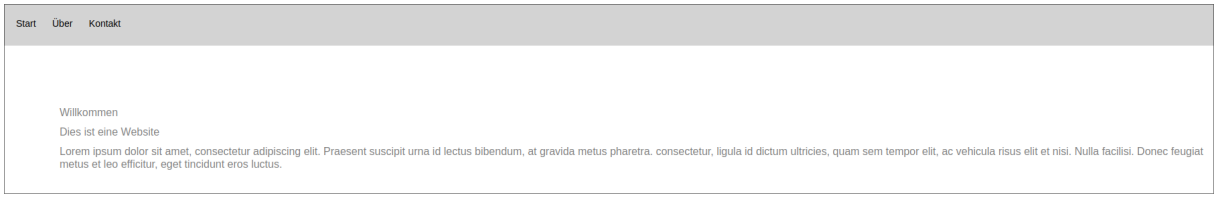

Abb. 1

A good design example effectively uses font size, color contrast, spacing, and alignment to distinguish primary content from secondary information. Headings are bold and larger, while body text is appropriately sized for readability. Proper spacing and alignment create a structured and easy-to-follow interface.
Source: FMD University - UX Visual Hierarchy

Color Theory & Contrast

Color selection plays a critical role in usability and aesthetics. High contrast improves readability, while poor color choices can make content inaccessible, especially for users with visual impairments.
A bad design example features low-contrast elements, such as light gray text on a white background, making it difficult to read, especially for users with low vision or color blindness.
A good design example follows WCAG (Web Content Accessibility Guidelines) by ensuring high contrast between text and background. Colors are chosen deliberately to create visual harmony while maintaining functionality.
Source: Atmos - Color Theory in UI Design

Consistent Layout & Interaction Patterns

Consistency in design enhances user experience by ensuring that UI elements and interactions are predictable across different screens.
A bad design example includes an inconsistent navigation bar where the position and style change across different screens, leading to confusion and frustration.
A good design example maintains a uniform layout with clearly defined navigation menus, button styles, and form elements. This consistency improves usability and allows users to develop mental models of how the system operates.
Source: Maze - UI Design Principles

Button Placement & Behavior

Buttons are critical interactive elements in UI design. Their placement and responsiveness affect usability and efficiency.
A bad design example places primary actions (e.g., "Submit") in less prominent areas, while secondary actions (e.g., "Cancel") are emphasized, leading to potential user errors.
A good design example ensures that primary actions are clearly distinguishable with appropriate sizing and positioning. Visual and tactile feedback, such as hover effects or state changes, confirm user interactions.
Source: Dribbble - Button UI Design

Feedback & Responsiveness

Providing immediate and clear feedback enhances user confidence and prevents frustration.
A bad design example lacks feedback for user actions, such as clicking a button without visual confirmation, leaving users uncertain if their action was registered.
A good design example includes real-time feedback mechanisms like loading indicators, success messages, and animations to confirm user interactions.
Source: Dribbble - Feedback UI Design

Form Design Best Practices

Forms are a crucial aspect of digital interfaces. Their usability impacts user satisfaction and data collection efficiency.
A bad design example relies solely on placeholder text without persistent labels, making it difficult for users to recall input requirements once they start typing.
A good design example includes clearly visible labels, real-time validation messages, and appropriately spaced input fields, reducing user errors and improving accessibility.
Source: Medium - Form Design Best Practices

7.4 Challenges in designing for a broad user spectrum

Designing for a diverse user base requires the addressing of varying levels of experience, prior knowledge, cognitive abilities, and accessibility needs. Failure to account for these differences can lead to usability issues, preventing certain groups from effectively using a system. Designers must implement features such as adjustable text sizes, screen reader compatibility, and intuitive navigation to ensure accessibility for all users.

Interfaces should always be tailored to the needs and expectations of the end-user. This leads to challenges when the user-group is not clearly defined or consists of people with widely different backgrounds. For example elderly people often need further guidance when interacting with digital solutions than members of younger generations. This leads back to the core components of usability-design, interfaces need to be simple and unmistakable in their functionality. Failing to provide these core concepts will sooner or later result in a frustrated and shrinking user base. (Hamidli, 2023)

TODO: wenn zu wenig inhalt dann könnte man auch noch was schreiben wieso des so is und auf welchen psychologischen dingen des basiert

8 Usability in context of maps

8.1 Basic Analysis of the Google Maps interface

8.2 Identifying Flaws in Googles Design

8.3 How could specific user groups struggle with this design

3. Usability in the Context of Maps

3.1 Basic Analysis of the Google Maps Interface

Google Maps is one of the most widely used navigation tools, offering a range of features such as real-time traffic updates, route planning, and location discovery. Its interface follows usability principles by prioritizing clarity and responsiveness. The search function is prominently displayed, while key actions, such as zooming and switching between map views, are easily accessible (Nielsen, 2012). Additionally, Google Maps leverages user feedback mechanisms, such as reporting incorrect locations, to enhance accuracy and user experience.

3.2 Identifying Flaws in Google's Design

Despite its strengths, Google Maps has usability shortcomings. Research has shown that the interface can be overwhelming due to the excessive number of icons and options displayed simultaneously (Schneiderman, 1997). Users, particularly those unfamiliar with digital tools, may struggle with distinguishing between essential and non-essential features. Additionally, the reliance on small touch targets can make navigation difficult for users with motor impairments (Nnesirr, 2023). Addressing these flaws would enhance accessibility and usability for a broader audience.

3.3 How Could Specific User Groups Struggle With This Design?

Certain user groups face greater challenges when using Google Maps. For example, older adults may find it difficult to read small text labels or interpret color-coded information. Individuals with visual impairments may struggle with low-contrast elements and a lack of alternative text for key icons (Nnesirr, 2023). Moreover, users with cognitive disabilities may become overwhelmed by the interface's complexity, necessitating a more simplified mode tailored to their needs. Incorporating user-centered design principles, such as progressive disclosure and customizable settings, could alleviate these issues and create a more inclusive experience.

4. Conclusion

Usability is essential for creating intuitive digital experiences, particularly for applications like Google Maps that serve a wide user base. By adhering to fundamental usability principles—such as consistency, feedback, and accessibility—designers can enhance user satisfaction and efficiency. However, challenges remain in designing for diverse user groups. Addressing these issues requires ongoing evaluation and adaptation, ensuring that all users, regardless of their technical proficiency or abilities, can navigate digital tools with ease.

9 Adaptive algorithms and real-time data integration

9.1 Theoretical Framework

9.1.1 Traditional Methods for Address Database Management

9.1.2 Adaptive Algorithms: Concepts and Applications

9.1.3 Real-Time Data Integration Frameworks

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9.2.3 Evaluation Metrics

9.2.3.1 Accuracy

9.2.3.2 Latency

10 Traditional Methods for Address Database Management

11 Adaptive Algorithms: Concepts and Applications

12 Real-Time Data Integration Frameworks

13 Implementation of the Backend

The backend implementation combines theoretical concepts with practical solutions to ensure functionality and scalability.

13.1 Config of Spring Boot (application.properties)

The `application.properties` file configures essential settings, including database connections, logging, and server parameters.

13.2 Entity Classes (Structure/Purpose)

Entity classes define the application's data model, using annotations to map fields to database tables.

13.3 JPA-Repositories (DB Access and CRUD Operations)

Repositories simplify database access by providing methods for CRUD operations and enabling custom queries.

13.4 Service Classes

Service classes encapsulate business logic, coordinating data flow between controllers and repositories.

13.5 Rest Controller (API Endpoints and their Functions)

REST controllers define API endpoints, processing requests and returning responses to ensure seamless interaction with the frontend.

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17.3 User Feedback

18 Final Thoughts

18.1 Leon Edlinger

18.2 Paul Gigler

18.3 Andreas Weissl

19 Meetings

Protokolle der Meetings, vielleicht auch ein zeitplan wann immer und wie lang

20 Working Hours

Arbeitspaket-Nr.	Beschreibung	Dauer
1	Einführung und Einarbeitung	8 h
2	Grundkonzept erstellen	8 h
3	Struktur der App festlegen	6 h
5	Wifi-Socket in App implementieren	39 h
6	Write-Funktionalität in App implementieren	14 h
7	Read-Funktionalität in App implementieren	19 h
8	Trim-Funktionalität in App implementieren	10 h
9	Konfigurationsmöglichkeiten für Flug in App implementieren	16 h
10	Höhenregelung-Funktionalität in App implementieren	14 h
12	Graphische Darstellung der Flugdaten	18 h
14	App testen und debuggen	19 h
26	Gesamtkonzept testen und debuggen	16 h
Summe		**187 h**

Table 1: Arbeitszeitnachweis

21 Source code directory

Source Code directory, kein plan was des is

22 List of figures

23 List of tables

24 Bibliography

Dagne, L. (2019). Flutter for cross-platform app and sdk development.

Flutter for Beginners. (n.d.). https://books.google.at/books?hl=de&lr=&id=pF6vDwAAQBAJ&oi=fnd&pg=PP1&dq=benefits+dart+language&ots=dZJWUGVs4x&sig=a196WqhXmQzuy23cmcKpEpIqn_k&redir_esc=y#v=onepage&q=benefits%20dart%20language&f=false

flutter/README.md at master · flutter/flutter [[Online; accessed 23. Jan. 2025]]. (2025, January). https://github.com/flutter/flutter/blob/master/README.md

Hamidli, N. (2023). Introduction to ui/ux design: Key concepts and principles. *Academia. URL: https://www.academia.edu/98036432/Introduction_to_UI_UX_Design_Key_Concepts_and_Principles [accessed 2024-04-27]*.

Nielsen, J. (2024). Usability 101: Introduction to Usability. *Nielsen Norman Group*. https://www.nngroup.com/articles/usability-101-introduction-to-usability

25 Abbreviation

ADC	Analog Digital Converter
API	Application Programming Interface
BLE	Bluetooth Low Energy
CPU	Central Processing Unit
DAC	Digital Analog Converter
DAVE	Digital Application Virtual Engineer
DSP	Digital Signal Processor
FPU	Floating Point Unit
FPV	First Person View, First Pilot View
GPIO	General Purpose Input/Output
GPS	Global Positioning System
GUI	Graphical User Interface
HDMI	High Definition Multimedia Interface
I^2C	Inter-Integrated Circuit
IDE	Integrated Development Environment
IP	Internet Protocol
RPI	Raspberry Pi
SD	Secure Digital
SPI	Serial Peripheral Interface
USB	Universal Serial Bus
TCP	Transmission Control Protocol
UART	Universal Asynchronous Receiver Transmitter
WLAN	Wireless Local Area Network
WPA	WiFi Protected Access
XML	Extensible Markup Language