

UNIVERSITY OF TARTU
Institute of Computer Science
Computer Science Curriculum

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**Dashify: A UX-driven Approach to Personalized
User Dashboards**
Bachelor's Thesis (9 ECTS)

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Tartu 2025

Dashify: A UX-driven Approach to Personalized User Dashboards

Abstract:

In today's tech-savvy world, dashboards are used to track and display information. The problem is that most solutions have pre-built templates and limit customization for all users, making individual personalization impossible. This study identifies common usability and dashboard issues, such as the lack of appropriate personalization options and poor User Experience (UX) design, which often lead to cognitive overload and decreased user engagement.

This bachelor's thesis aims to tackle the aforementioned problem by exploring how fundamental UX principles can enhance dashboard personalization. To illustrate the impact of UX on the usability and adoption of dashboards, a single-page web application (SPA), namely Dashify was developed that allows real-time customization of the layout, moving widgets, and customizing the appearance of the workspace. The development process emphasized accessibility and ease of use for both novice and experienced users, aiming to deliver a pleasant and intuitive experience. User testing was conducted to collect feedback on the created application.

The results show that applying UX design principles and implementing personalization significantly improve the speed and usability. This thesis is a practical demonstration of how modern UX methods can be used to create personalized dashboards that prioritize the needs and preferences of end users.

Keywords: Dashboard, SPA, User Experience, UX, Personalization

CERCS: P175 Informatics, systems theory

Dashify: UX-põhine lähenemine isikupärastatud kasutajate töölaudadele

Lühikokkuvõte:

Tänapäeva tehnikatundlikus maailmas kasutatakse teabe jälgimiseks ja kuvamiseks töölaudu. Probleem on selles, et enamikul lahendustel on eelehitatud mallid ja need piiravad kohandamist kõigi kasutajate jaoks, muutes individuaalse isikupärastamise võimatuks. See uuring tuvastab levinumad kasutatavuse ja töölauda probleemid, nagu sobivate isikupärastamisvalikute puudumine ja kehv kasutajakogemuse (*UX*) disain, mis sageli põhjustavad kognitiivset ülekoormust ja kasutajate seotuse vähenemist.

Selle bakalaureusetöö eesmärk on lahendada eelnimetatud probleemi, uurides, kuidas *UX*-i põhiprintsiibid võivad töölauda isikupärastamist tõhustada. Et illustreerida *UX*-i mõju töölaudade kasutatavusele ja kasutuselevõtule, töötati välja üheleheline veebirakendus (*SPA*) nimega *Dashify*, mis võimaldab paigutatust reaajas kohandada, vidinaid teisaldada ja tööruumi välimust kohandada. Arendusprotsessis rõhutati juurdepääsetavust ja kasutusmugavust nii algajatele, kui ka kogunud kasutajatele, eesmärgiga pakkuda meeldivat ja intuitiivset kogemust. Loodud rakenduse kohta tagasiside kogumiseks viidi läbi kasutajatestimine.

Tulemused näitavad, et *UX* disaini põhimõtete rakendamine ja isikupärastamise kasutamine parandavad oluliselt kiirust ja kasutatavust. See lõputöö on praktiline demonstratsioon selle kohta, kuidas tänapäevaste *UX*-meetodite abil saab luua isikupärastatud töölaudu, mis seavad esikohale lõppkasutajate vajadused ja eelistused.

Võtmesõnad: Töölaud, SPA, Kasutajakogemus, UX, Isikupärastamine

CERCS: P175 Informaatika, süsteemiteooria

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Introduction

In the modern digital world, dashboards have become essential tools that help users manage information, track various activities, and instantly access important information. Dashboards can be described as centralized hubs that provide vital metrics and interactive elements in one simple, low-density user interface. They can be utilized for business, education, or personal purposes [1].

According to Mir [2], a dashboard can be used to consolidate critical information and important metrics in a graphical display so that users can understand and make decisions based on the data presented. This utility is used in organizations where departments or teams need synchronized information in real time or to track goals and future objectives. This approach is much more efficient due to the almost instantaneous updating of information. However, as the amount and variety of digital content grows, so does the need to personalize dashboards so that they adapt to specific user preferences and goals.

Dashboard personalization is an enabler of usability and a cognitive overload reducer, which increases user engagement via the tailor-made content [1]. Personalization becomes especially important when users have differing goals and prioritize information in distinct ways

However, while many dashboards provide high-level overviews, they often lack effective personalization, which limits their usefulness for diverse user groups [1]. Users may find themselves overwhelmed with irrelevant information or features that do not align with their roles or preferences. Personalization, as discussed henceforward in Section 2.2, is a very important part of modern UX, which attempts to customize interfaces according to individual users' needs based on their behaviors, preferences, or goals. Personalized dashboards would then be an enhancement to the more traditional offerings in providing dynamically aligned content and layout toward a more engaging UX design.

This thesis looks at how principles of UX design can be applied to develop a more usable and engaging dashboard. To support this, a web application called Dashify was developed. The application was built based on a single-page application (SPA) paradigm, which allows for real-time customization of the layout, positioning of various widgets, and personalization of the appearance. While SPA technologies help achieve responsiveness and modularity, the focus of this project is to improve the UX by creating a more intuitive, flexible, and satisfying UX.

The primary goals of this thesis are to:

1. Study what makes a dashboard easy and enjoyable to use, contributing to better UX.
2. Investigate how prominent existing dashboards handle customization.
3. Find the most important features that can make a dashboard more personalized, useful, and usable.
4. Develop a dashboard prototype, which allows users to replace a traditional web browser home page with a modern dashboard that aims on UX improvement.

By studying existing solutions and building on previous research, this thesis will focus specifically on SPAs and show how using UX principles can create dashboards that are both personalized and easy to use. This work will also help developers understand how to create better dashboards and improve overall user satisfaction.

1. Theoretical Framework

1.1 What is UX?

UX plays a key role in how end users interact with software. It concerns not only the appearance of the application, but also the functionality and user satisfaction [3]. The success of a website or other application depends on how intuitive and pleasant the UX is. This chapter discusses the definition of UX, its importance, and the key principles of good UX.

According to Interaction Design Foundation [4] UX is about people's feelings, while using digital products, which can be websites or applications. Almost all user interaction with a product can be associated with UX. In the computer science domain, UX designers focus primarily on the relationships between users and software products.

Elmhurst public library [5] stated that UX refers to the immediate interplay with a product, evaluating how it works rather than how it looks. UX design is the process of increasing user satisfaction by improving the usability, accessibility, and pleasure in the interaction between the user and the product. UX design encompasses the entire experience a user has with a product or service — far beyond traditional human-computer interaction design.

1.1.1 The Importance of UX Design

UX Design has become a major factor in the development of applications and websites, as it determines how satisfied users are with the use of a service or product [3]. Good UX is not only about visually appealing design, but also about the functionality that meets users' expectations and needs. West [6] highlights how poor design choices can lead to user frustration, citing a case where a banking application system allowed a payment to be scheduled on a holiday, although an error later appeared that prevented further processing of the payment. The problem was not only the error message, but also the fact that this single error prevented all other payments from being processed. West emphasizes that such situations are not simply inconveniences for the user, but indicate poor system design or insufficient testing. She further emphasizes that while aesthetic preferences may vary among users, the presence of functional errors is a clear UX problem that needs to be fixed. Chomiak Orsa [3] also suggests that while not everyone may be completely pleased, with a product or service online, it is crucial consider users' behaviors and perceptions, like how familiar they are with the interface and how easily they can find what they're looking for quickly. When websites and apps are designed in a user-friendly way, it helps prevent confusion and ensures adequate UX. In essence, we can say that

a subpar UX is not about looks; it also involves issues and design flaws that can greatly impact user satisfaction.

1.1.2 UX Design Process

The process of UX design centers, around grasping the needs of users and fulfilling them through design efforts. As highlighted by Elmhurst public library, the UX design process begins with a discovery phase, where potential users and stakeholders are identified, and their needs and goals are analyzed. The importance of this phase lies in validating the problem and defining the project goals, which are based on user research through interviews and questionnaires, task analysis, and analysis of similar products. For example, the creation of empathy maps and service diagrams is used here to create a clear overview [5].

Next, according to the Elmhurst public library material, the idea generation phase takes place, which is aimed at developing solutions, considering both technological possibilities and company goals. Tools such as sketching, prototyping, and user journey mapping are used here to iteratively find solutions. It is important that ideas are tested quickly with members of the target group, which allows for changes in direction if necessary. The result is the exploration of solutions and low-resolution prototypes, which are then developed [5].

The process ends with a validation phase, where prototypes are tested with users to ensure their intuitiveness and functionality. Methods used in this phase include usability testing, feedback integration, and design retrospectives. The results suggest possible changes to the interface flows and design, ensuring that the final solution meets both user expectations and project goals [9].

1.1.3 UX Design Principles

Effective UX design will always be based on a set of core principles that underpin the design of easy, accessible, and effective digital experiences. These principles, by their nature, ensure that design decisions are driven toward users while aligning with broader business goals [7]. Outlined below are the core principles widely recognized as central to UX design, as discussed by Chandan, Tram, and Ali [7–9].

1. User-centricity.

Great UX design has user-centricity at its core. It is about putting users first and developing products that serve their needs. To put it simply, it is about knowing who the user is, what

he/she wants, and how the user interacts with a product. The UX design process starts with research into the user problems and then continues with testing so that the final solution will serve those users well. As a UX designer you should always keep user-centricity in mind; however, strike a balance between what is best for the users against what is good for the business in building experiences that are meaningful and effective.

2. Consistency.

Consistency is the second principle of UX design, which ensures that products feel familiar and function predictably for users. This coherence includes the visual elements like buttons, icons, etc., as well as an appropriate tone across the various pages and products of a single brand. Consistency also incorporates user expectations: if a user books flights through an application, he or she expects this application interface to follow a structure already known from other similar applications. While change is good, unnecessary variations can be confusing. This incorporation of consistency by the designer will help users in using the product easily and with less learning, thus fostering a pleasant experience.

3. Hierarchy.

Hierarchy is another important principle of UX that affects the way a user navigates through a product and how easily they find their needs. It can be defined as the information architecture—that is, the entire skeleton of a site or application, whereas visual hierarchy refers to the placement of elements on a page or screen. With information architecture, the flow is logical, with the major pages and menu items being placed where users expect them. Visual hierarchy draws attention through size, color, and placement. For example, large fonts to emphasize headlines and contrasting colors to make buttons stand out. A proper information hierarchy enhances usability and makes navigation intuitive and user-friendly.

4. Context.

Context is the fourth important principle on which UX is founded, and it involves situating the user with respect to product interaction. Ever since the dawn of design, the context has been studied to include such factors as the system used, the user's environment, and anything else with the possibility to affect his experience with the product. A case in point is that the increased usage of people browsing on mobile websites must be optimized for small screens. Other contextual factors affecting usability include things like background noises or limited hand use while driving. By gaining a better perspective on real-world circumstances

surrounding user interactions with their products, designers will be in a position to foresee obstacles, hence allowing for the design of more effective UX.

5. User control.

Another core UX principle is user control, bestowing upon the user the power to control and manage the interaction with a product. According to Nielsen's principles, allowing users an easy way to rectify errors becomes a necessity that implies the clear provision of emergency exits to cancel unwanted actions without much fuss. This importance escalates in interactions with the AI doing the decision-making, as in the case of autocorrection, where by virtue of user control, they should be allowed to correct or override potential mistakes caused by the autocorrect AI. Giving users access to undoing or canceling actions would give users confidence and a sense of control, enabling them to rectify errors in a flow without disturbing the complete experience.

6. Accessibility.

Accessibility is a sixth basic UX design principle that guarantees that products may be used by the greatest number of people, including people with disabilities. Designing for inclusivity includes things like visual impairments or different environmental situations. For example, one way to assist people with visual disabilities is to have high color contrast to improve legibility. UX designers should consider accessibility throughout the design process so that all users can interact with and benefit from the product regardless of their abilities or circumstances.

7. Usability.

Usability is the last UX principle that measures how easily and efficiently a product can be utilized; hence, a product that ranks low on usability will not count toward a good UX. Usability can be divided into five major areas:

1. **Learnability:** What is the time taken for users to first understand and use the product?
2. **Efficiency:** Can users perform tasks with ease and speed using the product?
3. **Memorability:** After an absence, how easily can users recover their knowledge of the use of the product?
4. **Errors:** How likely are users to make mistakes, and how readily can they recover from those?
5. **Satisfaction:** Is the product pleasant and rewarding to use?

It is important to focus on usability over aesthetics, while usability testing is conducted throughout the design phase to catch the issues and rectify them for ensuring a smooth experience and effective use.

1.2 Personalization in Digital Interfaces

In the era of technology and digital interfaces, users want their needs and preferences to be satisfied by the services they use. This concept is called personalized experience [10]. The essence of personalization in UX design is to provide each user with an individual approach based on their preferences. This approach can be based on the user's interests, goals, and design preferences [11].

The goal of personalization is not only to satisfy the end user, but also to improve their engagement, retention, and conversion.

1.2.1 Importance of User Experience Personalization

Paying attention to the personalization of UX is a very important aspect, thanks to which the UX itself improves. As highlighted by Nivelics digital agency [11], adaptation of content and consideration of user preferences contribute to faster and more convenient interaction with content and search for information. Also, sites personalized for specific users increase the likelihood that the user will continue to interact with them and will return in the future, thereby increasing customer loyalty and engagement. An equally important advantage of personalization is an increase in the conversion rate and sales. Since, due to personalization, users will see products relevant to their preferences, the likelihood that they will make a purchase increases. The rating of the service in search engines can also improve thanks to personalization, as search engines value content and experience that is focused on users. Users will spend more time on the site, thereby recommending it to others, increasing the rating of the resource [11].

1.2.2 Process for User Experience Personalization

As outlined by Devoq Design [10], the data collection process is the first step in personalizing the UX, which involves obtaining information about the user and their preferences. Data refers to behavioral data, which includes clicks, time spent on the site, and the paths they take. The next subdivision of data is demographic data, which includes the user's age and location. This type of data allows us to divide the audience into segments. Language preferences, the user's

choice of template or site theme, allow for customize personalization more precisely. It is important to remember that data collection must be agreed upon with the user so as not to violate their privacy.

According to Devoq Design [10], after the process of collecting user data, it is necessary to divide it into segments and groups to create a basis for personalization. It is necessary to separate new and regular users so that new users can navigate and get acquainted with the resources more easily. While regular users can be offered personalization opportunities based on their time on the site. Users can also be divided based on their interests and preferences, showing relevant content. Dividing users by region also allows you to personalize content for large groups at once, showing events or services that are taking place in that region. Adaptive user interfaces are tailored to specific tasks and user skills. New users may see a simplified interface without specific settings. Advanced users, on the other hand, can customize the interface themselves and choose different templates or move elements around. Although personalization based on user data is an effective method, in some cases it may not be enough, and it is necessary to give the user the opportunity to be responsible for their own experience.

To implement this method, it is necessary to give the user the ability to customize the interface, choose the font and its size, as well as the color scheme [12]. You can also give users the right to independently select content that matches their interests [10]. The final stage of personalization is continuous testing. It is necessary to conduct testing to identify which methods work more effectively. It is also necessary to collect feedback from users and analyze it to further improve the UX [10]. A simplified view of UX personalization process is shown on Figure 1.

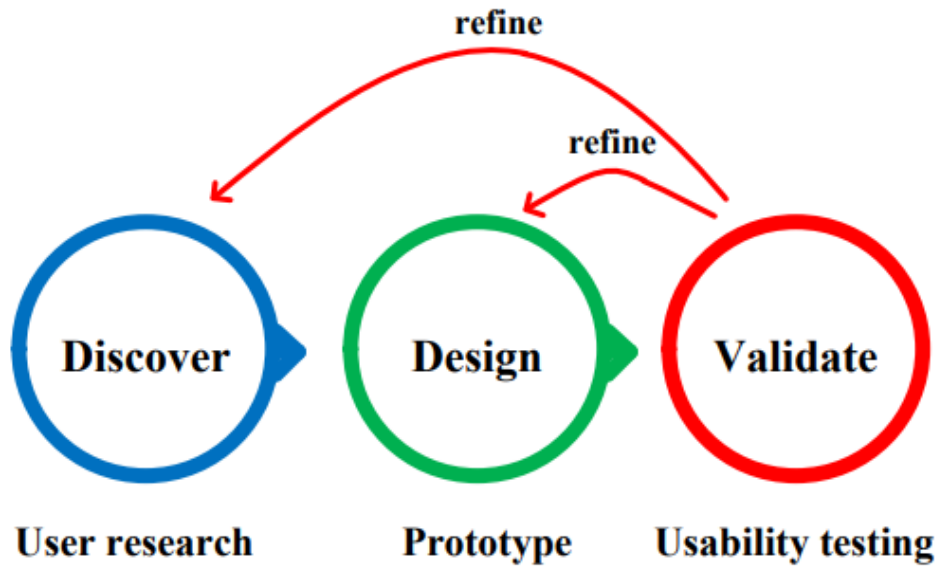


Figure 1. Process of UX personalization [13].

2. Analysis of existing solutions

There are many applications that allow users to manage their personalization experience using different options on UX aspects. This thesis covers three of the most prominent of such services: Protopage, and Start.me.

2.1 Protopage

Protopage [14] is a web page that offers users a customizable personal page that can be accessed from any device. It allows users to organize bookmarks, follow news, weather, and add various widgets such as notes, to-do lists, and more. Protopage users can personalize their page by customizing themes, colors, and widget layouts. Also, there is an option to customize the number of columns in the layout or use free positioning to organize content on the page.

Although Protopage allows users to create personalized start pages with widgets, it has several shortcomings that make it feel outdated and unintuitive. Despite the fact that Protopage allows customization, its user interface feels old-fashioned and lacks modern design principles. The page is overwhelmed, and changing the size or position of widgets is not intuitive or smooth. There are also no modern themes or visual effects, which makes the service unattractive. Even though Protopage provides basic customization options, it does not meet modern standards. Its outdated interface and unintuitive functionality make the service limited and unfriendly to users.

2.2 Start.me

Start.me [15] is a web application that is a replacement for the standard web browser home page, which is designed to improve the UX by centralizing and organizing online activities. Users can manage bookmarks, access the latest news, add notes, and integrate various widgets. The key advantage of Start.me is that it is available on several devices, allowing it to be platform-independent. Users are given the opportunity to classify bookmarks into tabs, thereby reducing cognitive load and simplifying access to information of interest. The presence of various widgets such as weather forecast, calendars, and notes adds a personalized experience, allowing the user to fine-tune the home page.

Although Start.me provides more flexible and modern options for creating home web pages than Protopage, it also has some drawbacks. The positioning of widgets is limited, which does not allow users to freely place elements on the page. Also, the menu for adding and configuring

widgets is not very intuitive. The buttons are in inconvenient places, and users have to spend time to find the necessary setting.

3. Application Requirements

This section will discuss the key requirements of the application, which were defined before the development process, focusing on key aspects that were absent in Start.me and Protopage.

3.1 Functional Requirements (FR)

FR1: The application must allow users to freely position widgets.

This requirement allows the user to arrange their workspace in a fully manageable and creative way to fit exactly the user's needs.

FR2: The application must allow the users to place widgets in a column layout.

Column-based layout allows a user to group widgets between columns and organize the workspace orderly, improving clarity and usability.

FR3: The system must allow the user to choose a number of columns in a column-based layout.

This requirement will allow user to balance space distribution according to the number of widgets and their placement.

FR4: A user must be able to control the width of each column.

This allows for making the application responsive on different screens and adjusting widget sizes to satisfy user preferences.

FR5: A User must be able to use drag and drop functionality to handle widget movements.

Drag and drop functionality provides a modern and easy-to-use method for content movement, offering a fast and efficient way to organize the dashboard.

FR6: The application must allow the user to rearrange widget placement between columns.

This will allow a user to swap widgets between columns which will make content organization more comfortable and exclude unnecessary widget deletion and adding again.

FR7: The application must provide light and dark modes for interface.

Light and dark modes will allow user to work comfortably in various environments whether in bright daylight or low-light conditions.

FR8: The application must allow a user to change the workspace background color and image.

Color and image customization enhance visual ergonomics, allowing users to match their workspace with their mood or accessibility needs and create a comfortable and aesthetic workspace.

FR9: The application must save all user changes automatically.

Automatic saving prevents data loss and ensures a smooth and consistent UX across sessions.

3.2 Non-Functional Requirements (NFR)

NFR1: The application's interface must look clean and modern.

One of the most important requirements for this application, as the idea of the whole thesis is to create an app that will follow core UX principles.

NFR2: All interactions like drag and drop and layout adjustments must be smooth and animated.

Animations improve the visual feedback loop, helping users feel more in control and engaged with the interface.

NFR3: The application must load dashboard layouts within 2 seconds.

Fast loading improves overall UX and reduces frustration and the chances that the user will return to the resource are higher.

4. The Dashify Application

This section provides a detailed description of the development process and application itself that was developed for this thesis. The application's source code and installation instructions can be found on GitHub:

- Front-end: https://github.com/NFilin10/dashify_frontend
- Back-end: https://github.com/NFilin10/dashify_backend

4.1 Development Platforms

Dashify is a web-based dashboard that allows users to replace a traditional web browser home page with a modern dashboard that focuses on UX improvement. The Application needs front-end and back-end solutions to fully cover the requirements that were defined in the previous section. As a front-end solution the React was chosen as it allows to create modern and clear user interfaces. Express and PostgreSQL were used as a back-end for the application to manage user accounts and their preferences for dashboard management.

React

React [16] is an open-source JavaScript based framework, which is maintained by Meta for developing single-page applications. React is a component-based framework, which means that the web application consists of different components, which can be a simple button or whole page.

The reason for choosing React as a front-end was that it is a powerful and at the same time easy-to-use tool. Also, the author of this thesis had experience with this framework and developed other projects using this application stack.

Express

Express [17] is the most popular Node.js framework for HTTP requests management, authentication, and session handling. Express itself is quite poor in terms of functionality, but a strong community and developers created a lot of libraries to solve almost all problems related to the back-end.

Express was chosen by the author because it perfectly aligns with React and it is the most suitable library to complete the requirements. Also, as Express is so widely used it has a lot of documentation and other resources that make the development process faster and simpler.

PostgreSQL

PostgreSQL [18] is an open source database, which uses object-relational approach and SQL language for database queries. PostgreSQL is respected for its reliable architecture, data integrity, comprehensive features and flexibility.

Docker

Docker [19] is a development platform that allows the execution and deployment of applications through containers. With Docker, infrastructure management becomes as streamlined as application management.

In this thesis, Docker was used to make the application delivery process faster and easier and avoid version conflicts between different machines. Both the front end and back end can be run in containers with a single command, enhancing consistency and ease of use.

4.2 Architecture of the Application

The application consists of a backend service, which uses PostgreSQL as a database and frontend-end. Figure 2 describes the application's basic architecture. This is a simplified view of the application that does not contain small objects like custom hooks and detailed widget components.

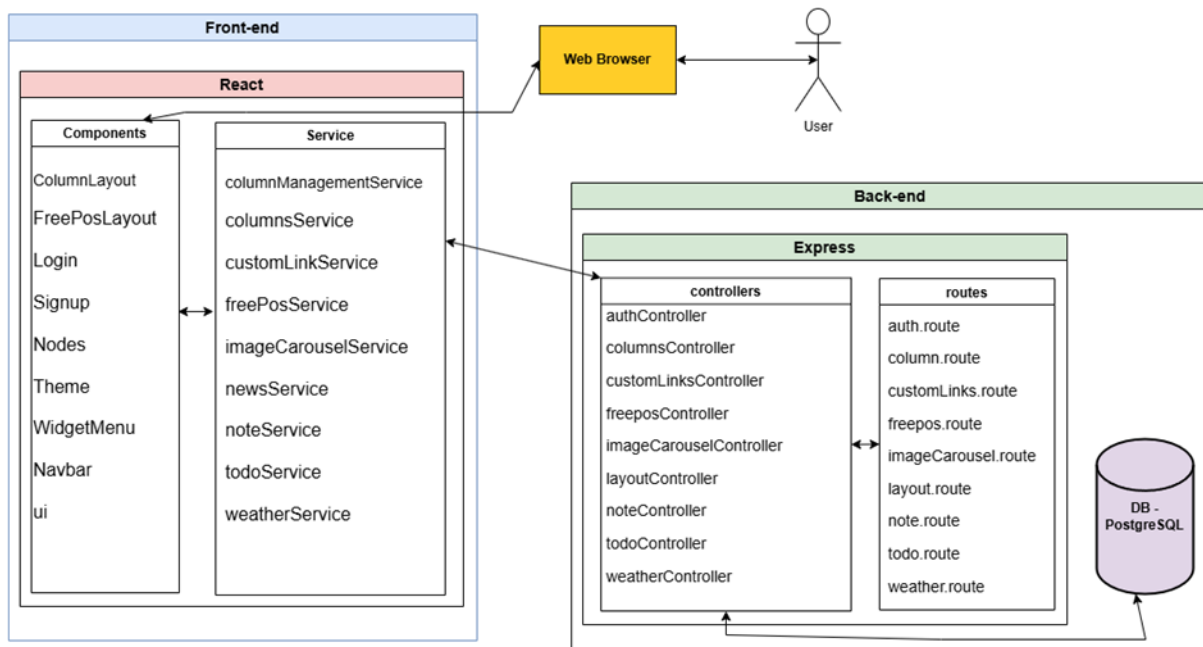


Figure 2. Application architecture.

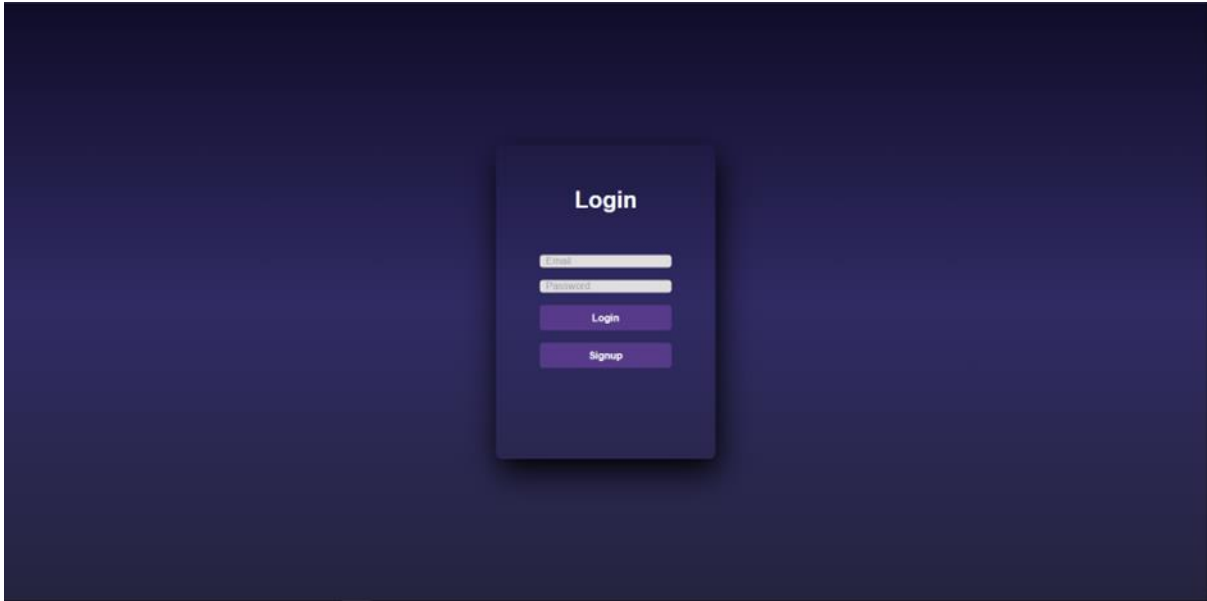


Figure 4. Login page.

In order to log in, the user must first have an account. Figure 5 shows the signup form, with first name, last name, email, and password fields that the user must fill in. Also, in this version of application there is no password confirmation and ability to reset password.

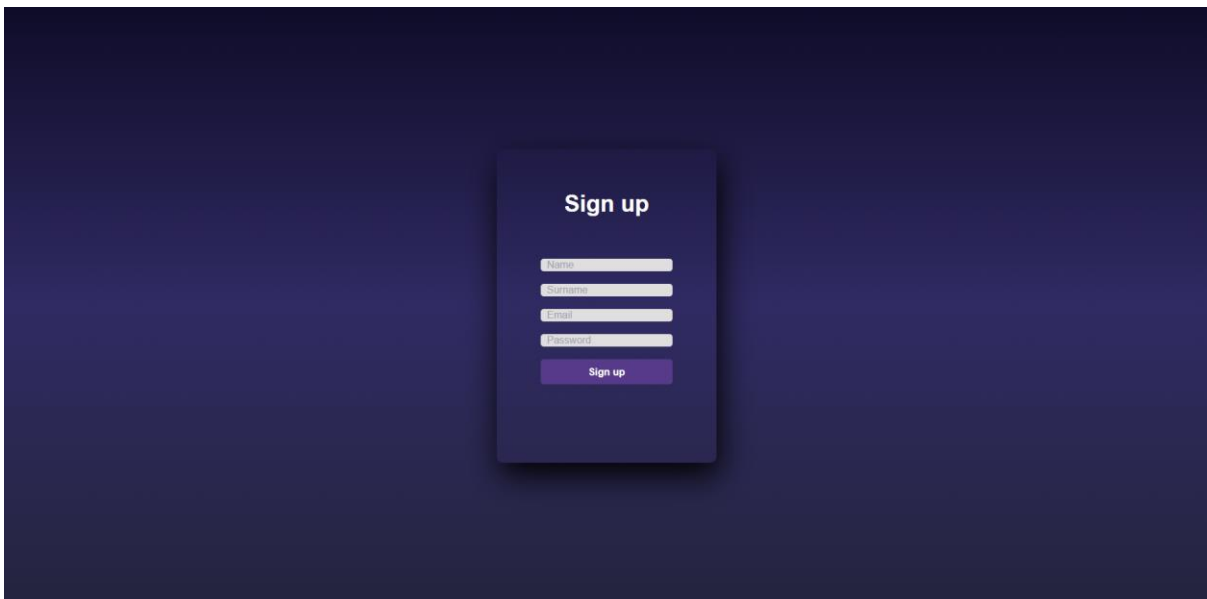


Figure 5. Sign up page.

Home page

After successful login, the user will see the view displayed in Figure 6. This consists of a navbar that includes a widgets menu on the left side, and on the right side, there are buttons for

changing layout type, theme selection, and layout preferences. Another component is a free positioning layout, which allows the user to place widgets in any place on the workspace.

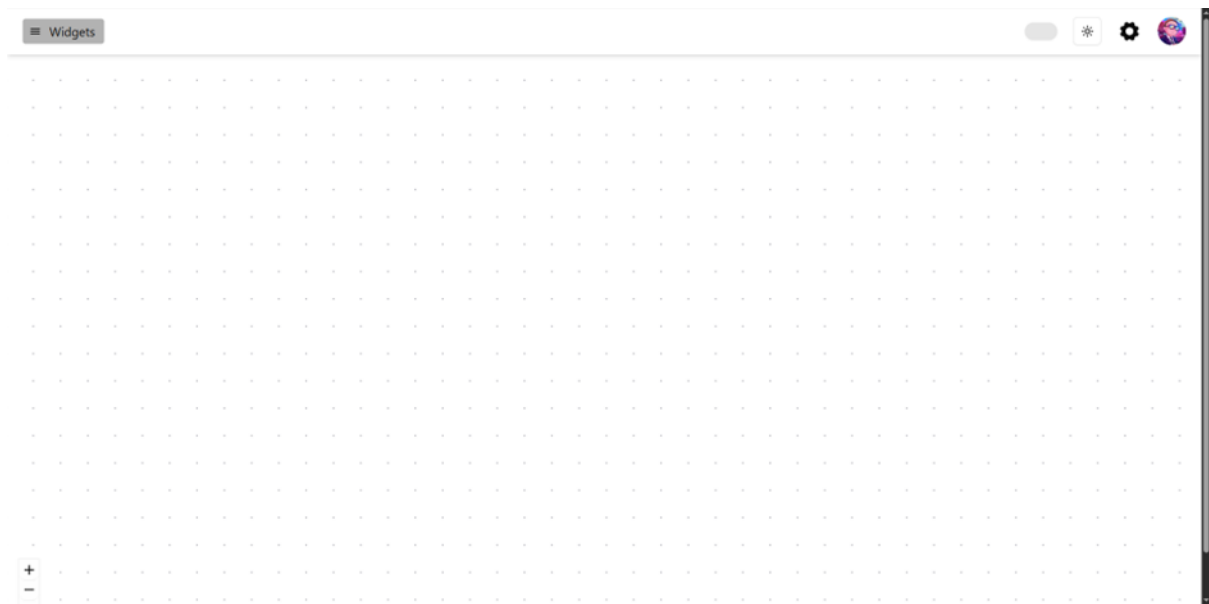


Figure 6. Home page.

Column layout

The user has the ability to change the layout and use column-based structure, which is displayed in Figure 7 for widget placement. This allows to group widgets between columns. By default, every user has 3 columns with the same width.



Figure 7. Column layout view.

Column management

Also, the user has the ability to manage columns using the dropdown menu that is shown in Figure 8. The application allows to add new columns, delete them and change the width of each column.

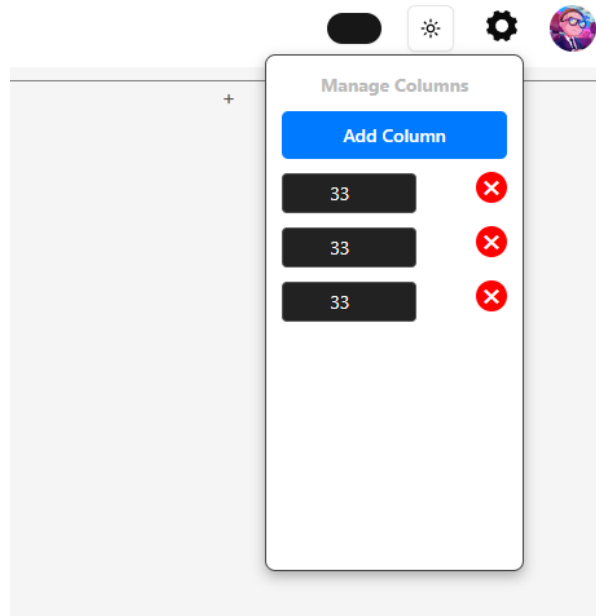


Figure 8. Column management settings.

Interface modes

Another feature that was added to make UX more comfortable is light and dark modes which are shown on Figure 9. This will allow users to switch between themes based on their personal preferences or environmental lighting conditions. The dark mode is particularly beneficial in low-light settings, as it reduces eye strain. On the other hand, the light mode offers better visibility in bright environments and may be preferred by users who find dark interfaces harder to read.

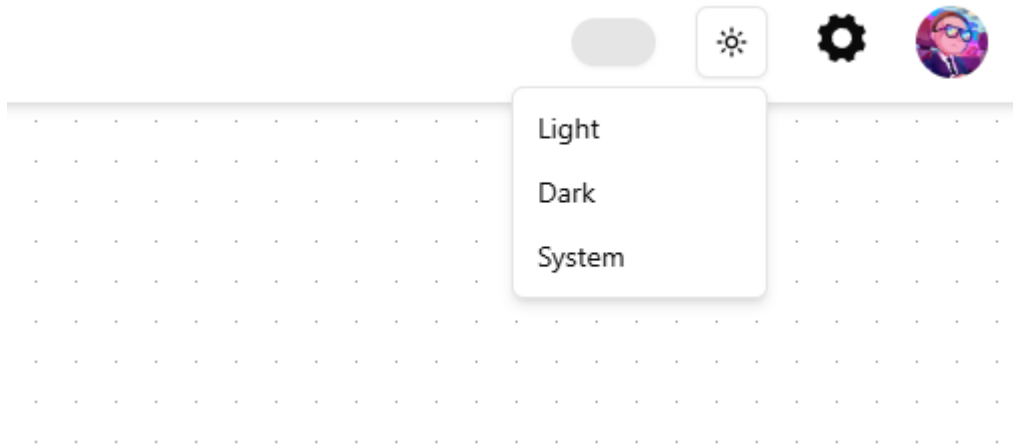


Figure 9. Interface mode settings.

Customization settings

Except for light and dark interfaces, users are also given an opportunity to customize the layout by selecting their own colors or applying any image as the background, which is shown on Figure 10. These customization options give users an ability to personalize their workspace according to individual tastes and moods.

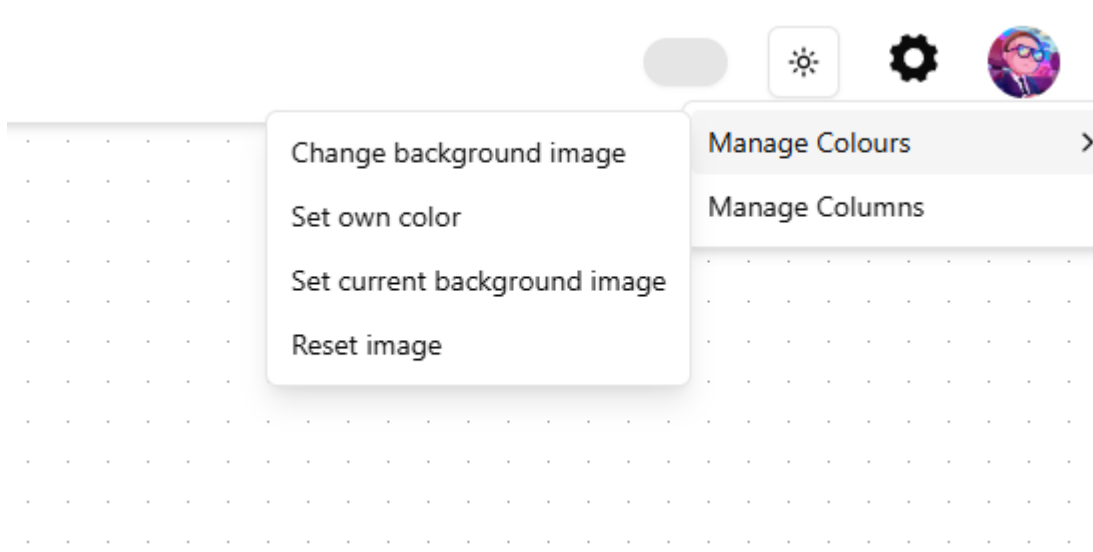


Figure 10. Customization settings.

Widget menu

Figure 11 displays the available widgets menu that the user can add on free positioning and column layouts using drag and drop functionality. In the further section each widget will be considered separately.

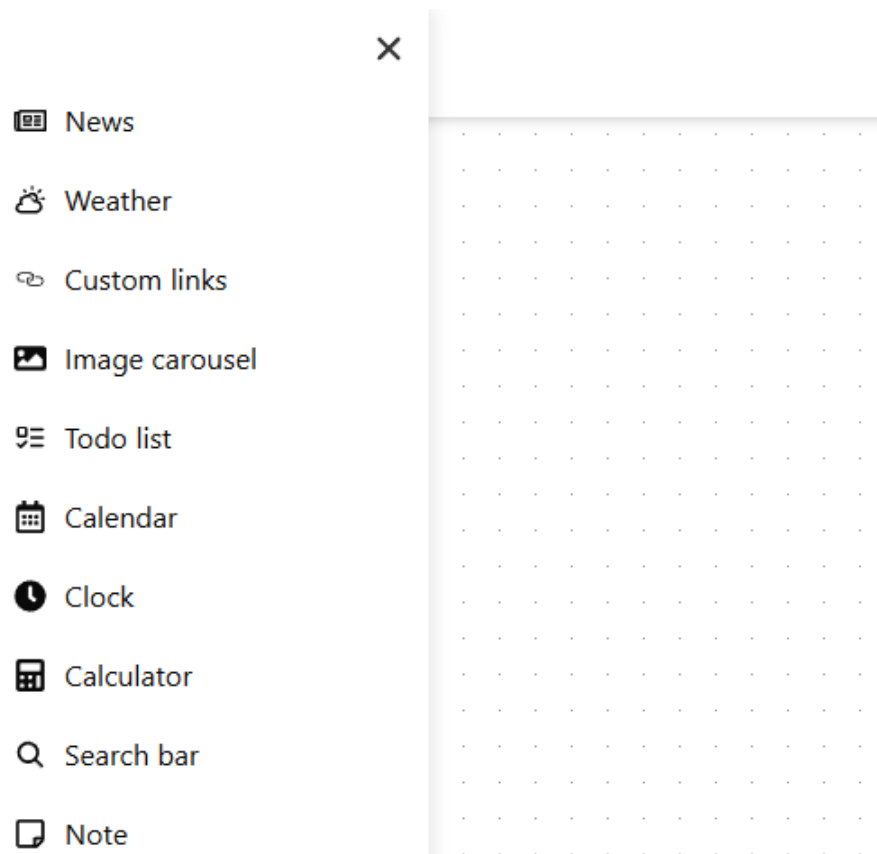


Figure 11. Widget menu view.

Free positioning layout with widgets

The layout containing all available widgets is shown in Figure 12, from which the user is free to choose and rearrange any number of widgets according to their preference. This drag-and-drop feature provides flexibility to users in designing their work environment as best suited to their workflow. The current theme mode is dark, as shown in the figure, demonstrating the interface's ability to adapt while maintaining visual clarity and consistency.

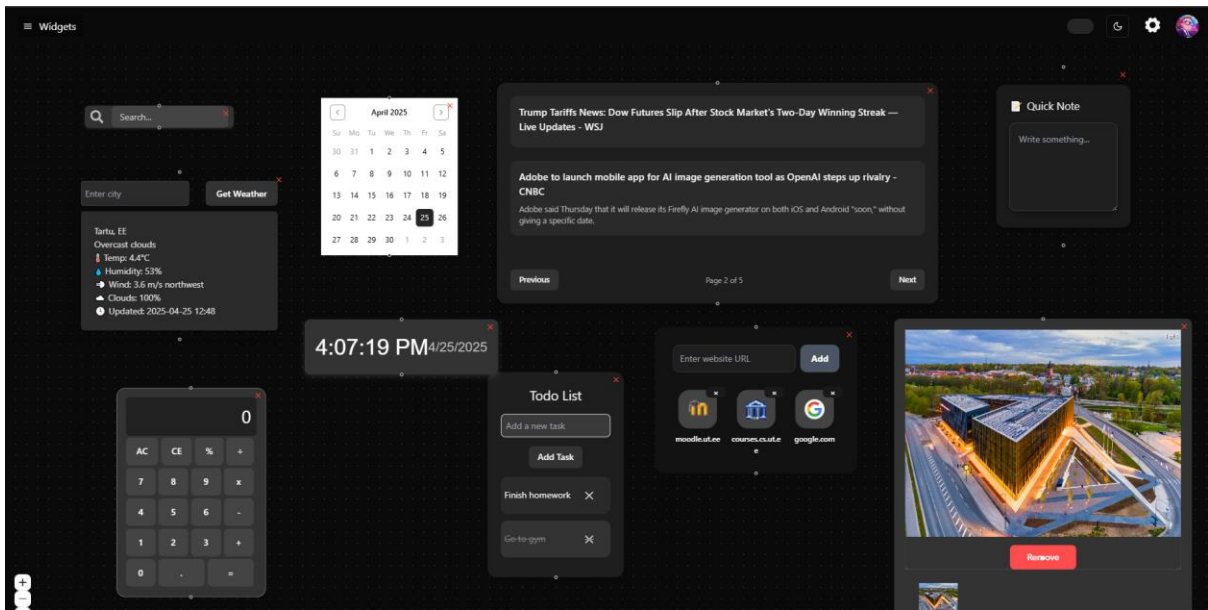


Figure 12. Free positioning layout with widgets.

Column layout with widgets

Figure 13 represents a column-based layout, which has different widgets arranged over four distinct columns. It organizes content in such a way that it is much easier for the user even to navigate among the various elements. In this example, light theme mode displays the interface, giving an idea of how the design works for readability and aesthetics across different visual presentations.

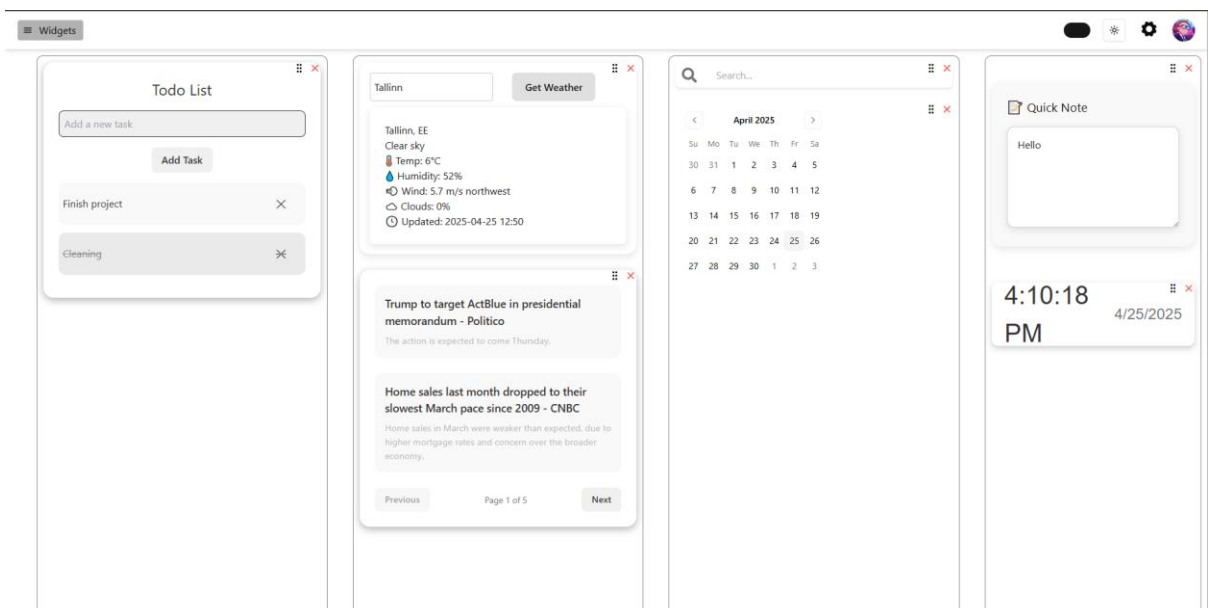


Figure 13. Column layout with widgets.

Widget description

News – This widget displays the latest news using API, also if a user is interested in reading the whole article, he can easily access it through the widget.

Weather – Before using this widget, the user must provide a city where he wants to see weather data, then the weather API is used to fetch data like temperature, humidity, wind and clouds.

Custom links – User can add any link as a shortcut, and it will be available at any time by just clicking on it. Each link is labeled and organized for quick and easy access.

Image carousel - A rotating gallery that displays a collection of user-uploaded images. It can be used to showcase memories, presentations, or motivational content in a visually engaging format.

Todo list - Enables users to create, edit, and check off daily tasks. It supports task deletion and marking tasks as done and helps users stay organized and productive.

Calendar – Shows current month dates and allows moving between months.

Clock – Displays current time and date in digital format. Clock even shows seconds.

Calculator - A basic calculator tool for performing quick arithmetic operations without needing to leave the dashboard.

Search bar - Offers a convenient way to search the web or within the dashboard content.

Note - Provides a space for users to jot down quick notes, ideas, or reminders. Notes can be saved, edited or deleted.

4.4 Validation

This section describes the validation and testing of the application in order to determine whether it satisfies the functional and non-functional requirements, is it compatible with other similar existing solutions and meets user expectations and requirements.

Methodology of testing

Validation and testing of the application took place through personal meetings with potential users, during which they had to perform various tasks to test the application, as well as answer some questions after completing them. The list of tasks and questions is in Appendix 1. During testing, the user performed the same tasks on three different resources: Protopage, Start.me,

and the Dashify application created as part of this thesis. The testing process was blind; that is, the user did not know in advance which application was developed by the author. This method helped to exclude the possibility that users would be more loyal to the author's work. During the testing, 5 people from different age groups and from different fields were interviewed to obtain more general and plausible information regarding the UX. The main goal of the testing was to find out how much time the time to complete tasks differs on different platforms and how satisfied users are with the UX and the possibilities for customizing the dashboard. The results of tasks' completion time are presented in Appendix 2.

Results from interviews

Before testing, the users were explained the essence and purpose of the presented applications so that they understood what they were dealing with. The first application that was provided to users was Protopage. The first thing that users noticed was that the website interface was overloaded, as a result of which it was difficult to even find the menu with available widgets. Also, none of the subjects could figure out the system of dragging widgets onto the work panel without the investigators' help. Problems also arose when trying to change the appearance of the work panel, since users did not see changes in real time, and the settings menu was also not intuitive and overloaded.

Next in line was Start.me. In terms of design, it was more pleasant for users than Protopage. However, users had a problem with the column management, since it was difficult for them to find the desired item in the large list of available settings. Also, users noted that despite the fact that Start.me allows you to set a background image, their choice is limited to what the resource offers.

The last of the tested applications was Dashify, created as part of this thesis. Users immediately noted the presence of two possible options for work: free positioning and column layouts. Also, through feedback, it turned out that although Start.me offers more options for personalization, Dashify does it better and more clearly, thanks to a minimalist design, which is especially focused on new users.

The structured questions after each task provided deeper insights into UX, particularly regarding ease of use and interface clarity.

After completing the first task, respondents were asked about the difficulty of finding the widget menu and the intuitiveness of adding them to the dashboard. For Protopage, 4 out of 5

users rated this process as very difficult, due to the interface being full and unintuitive. In Start.me, the process of adding widgets was clear to all users, but 3 respondents indicated that it was difficult to find the button with the widget menu. In Dashify, all respondents rated the ease of adding widgets and the convenient and clear location of the button with the widget menu.

The second task, which involved changing the color or image of the workspace, asked users to rate the difficulty of saving settings, the appearance of the settings menu, and the ease of finding the settings button. Protopage scored poorly, with 4 out of 5 users rating the settings menu as crowded and confusing, but finding the color settings menu was easy. In Start.me, 3 users also had trouble finding the desired settings menu, and they also noted the limited color settings. Dashify, on the other hand, received an average score of 4.6 out of 5 for the appearance of the color and image settings menu. Users noted that finding and changing appearance settings was clear and easy, and changes were instantly saved and displayed to users.

The third task involved interacting with three widgets: weather, notes, and a to-do list. Users rated their satisfaction with the widgets, ease of customization, and possible changes. Protopage received an average score of 3 out of 5, as difficulties arose with adding a city to the weather widget, since the initial example indicated the coordinates of the city, not its name. Start.me showed a result of 4.2 points, with the functionality described as satisfactory, but the number of widget settings was confusing. Dashify received a 4.7, due to its minimalist and clear settings. The only suggestion that came from one respondent was to make the marking of the completed task in the form of a check mark instead of just clicking on it.

After completing all the tasks, respondents answered general questions about each resource. The first step was to rate each app overall from 1 to 5. Protopage received a 1.8, Start.me 3.8, and Dashify 4.7. In terms of user friendliness, Protopage was described as confusing and outdated, Start.me was dense but clear and functional, and Dashify was intuitive and minimalist. All respondents indicated that Dashify was the easiest to complete the tasks. In terms of what they liked and didn't like about Protopage, the main issue was the clutter and outdated interface. Start.me was praised for its modern design, but users disliked the lack of the ability to move widgets around freely. Dashify was appreciated for its simplicity, usability, and openness to new users, but users would like to see more widgets that could be added in the future.

Finally, respondents answered a question regarding which app provided the most positive UX. 4 out of 5 users chose Dashify, and 1 chose Start.me, citing that it has more widgets available and is more advanced than Dashify, which is great for beginners.

In addition to collecting general UX information from survey respondents, the time it took to complete each task on all three platforms was analyzed to assess the usability and effectiveness of the resources provided. Users performed three common tasks on each site, such as basic workspace settings, workspace customization, and customization of individual widgets. The results showed significant differences in performance between the tools.

In the first task, which involved setting up a dashboard, Dashify enabled users to complete the task significantly faster, with an average completion time of 0.49 minutes. Start.me was the second fastest with an average completion time of 1.10 minutes, while Protopage took 3.18 minutes. From this, we can conclude that Dashify reflects an intuitive experience and clever placement and functionality of widget additions, eliminating the overloaded interface of Protopage.

The second task, which involved changing the appearance of the workspace, Dashify again outperformed other platforms, showing an average time of 0.33 minutes. Protopage also showed itself relatively well in this task (0.56 minutes), which suggests that, after getting used to the interface, specific actions become more understandable for users. Start.me showed a result of 0.67 minutes.

The third task, which involved customizing individual widgets, showed similar trends. Dashify still came in first place in terms of completion speed with an average time of 0.73 minutes, followed by Start.me (1.08 minutes) and Protopage (2.22 minutes). This shows that Dashify provides a smoother UX by minimizing time and causing no frustration.

Summing up the testing, we can say that all the requirements set by the author for the application were met. Not only did 4 out of 5 respondents prefer Dashify (the remaining respondent chose Start.me), but the task completion data also confirmed that Dashify provided the fastest and most efficient task completion. The goal of this application was to focus on UX and personalization, and the interview and time-testing results showed that these goals were achieved.

4.5 Limitations and Possible Future Developments

There are several features that were not added to the final application due to time constraints and the complexity of implementation. However, despite these limitations, the described features will be added in the future to continue the project.

One of the features that was not implemented is the ability for users to share their dashboards with other users. To implement this feature, it is necessary to significantly expand the database structure and add new functions that will handle the distribution and permissions of shared dashboards between users. This will open a lot of new collaboration opportunities and make the application more social.

Additionally, in the future, it is planned to enhance the dashboard system itself. Currently, users are limited to creating one dashboard in a free positioning layout and another one in column-based layout. This limits users in creating working spaces for different needs.

Another improvement is to offer users more control over individual widgets. At the moment, resizing affects all widgets, which can harm personalization. It is planned to add an ability to resize each widget independently. This will allow users to create their dashboards that fully suit their personal needs.

Finally, the feedback system can be added, as communication with end users is a key in such applications, which are focused firstly to users. In the future users will have an ability to suggest ideas for new widgets, since the number of widgets are theoretically unlimited as long as they fit the dashboard layout.

Conclusion

Due to the large number of web applications that provide users with the ability to personalize dashboards that do not follow the rules of UX design, there is a need for an application that will be developed and aimed specifically at a pleasant UX. The goal of this thesis is to create an application called Dashify, which will have a modern design and follow the basic principles of UX design.

Before starting the development, an analysis was made of how important the UX is and what principles need to be applied to improve it. Similar solutions were also analyzed to identify aspects in them that do not meet the requirements of UX design and personalization in order to avoid the same mistakes when developing the application. The created application allows users to add various widgets to their dashboard, such as weather, notes, news, etc., while providing various personalization options, such as changing the color and background image of the dashboard, various themes and templates.

The created solution turned out to be successful and fulfilled its goal. During testing, most users chose Dashify over other available applications that were considered in this work. Users said the app looked modern and minimalist, making it easy to find the features they needed.

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Appendix 1: Application Testing Sheet

Description: The purpose of the Dashify web application is to provide a modern and user-centered dashboard that will allow users to replace their default start browser page with the ability to fully personalize it according to user needs and preferences.

This survey is aimed at gathering feedback on the use of the application and see how comparable it is to other solutions available on the Internet. We will ask you to complete some tasks in three different applications and answer the questions. The testing is going to be blind, which means that you would not know which is the application that was developed by the author of this thesis.

Task list

You are already logged by the investigator, so you start on the home screen that is available after login.

Task 1: Find the widget menu and add 4 different widgets on your own choice. After the task, please answer the following questions.

- How difficult was it to find the widget menu?
- Was the widget adding process user-friendly and intuitive?

Task 2: Find settings and change the background color or image of the workspace. After the task, please answer the following questions.

- How difficult was it to save your color/image choice?
- On a scale 1 to 5, how would you rate the overall view of the settings?
- How difficult was it to find the settings button?

Task 3: Add the following widgets to the workspace: weather, notes, and to-do list. After that, in the weather widget, find the weather in Tartu, write 1 note, add 2 tasks, then mark 1 task as done, and delete one task from to-do list. After the task, please answer the following questions.

- On scale 1 to 5, how would you rate the overall satisfaction with these 3 widgets?
- How difficult was it to find out how to edit widgets (enter city, save note, add and manage to-do list tasks)?
- What improvements would you suggest for the weather, notes, and to-do list widgets to enhance their usability?

Finishing questions for each application

- How would you rate the application on a scale from 1 to 5?
- How user-friendly was the application?
- Was it difficult or clear to complete tasks?
- What did you like and did not like in the experience with the application?

Interview end questions

- Which of the three tested applications had the best user experience?

Appendix 2: Task Completion Time

Table 1. Task completion time on Protopage.

Participant	Task 1 (min)	Task 2 (min)	Task 3 (min)
Participant 1	4.22	0.5	1.5
Participant 2	1.18	0.21	1
Participant 3	4	0.28	2
Participant 4	3	0.55	2.17
Participant 5	3.5	1.27	3.45

Table 2. Task completion time on Start.me.

Participant	Task 1 (min)	Task 2 (min)	Task 3 (min)
Participant 1	1	0.17	0.87
Participant 2	1	1	1
Participant 3	0.83	0.88	0.62
Participant 4	0.75	0.35	1.63
Participant 5	1.9	0.94	1.28

Table 3. Task completion time on Dashify

Participant	Task 1 (min)	Task 2 (min)	Task 3 (min)
Participant 1	0.25	0.28	0.58
Participant 2	0.75	0.13	0.43
Participant 3	0.35	0.17	0.92
Participant 4	0.58	0.33	0.7
Participant 5	0.5	0.76	1

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