TimeWise - Transforming Chaos into Coordinated Bliss

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Technical Report

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Abstract

Effective time management is crucial for balancing professional, academic and personal commitments in modern life. However, many face challenges in organizing and coordinating these activities due to a lack of efficient tools. This project proposes an innovative solution to facilitate time management, both at an individual and group level. Using heuristics and computational methods, the solution will automate appointment scheduling, identifying compatible periods between users and suggesting complementary activities. Additionally, it will offer personalized notifications to keep users organized and motivated. This approach promises not only to save time and effort but also to promote better use of available time, contributing to the general well-being of users. The project is poised to evolve dynamically, ensuring its continued relevance in the future.

Keywords: Time management, Efficiency, Automated Scheduling, Custom notifications, Time optimization, Productivity

Acknowledgments

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Chapter 1

Introduction

Anxiety arising from the need to balance professional commitments, leisure time, and personal life is a common reality for many individuals. A clear example is a student who faces multiple assessments in the same week and needs to invest time and effort into planning their study period and concentration while trying to balance it with other commitments.

Another relevant aspect is the social pressure for greater organization and productivity in everyday life, making it essential to optimize every minute for efficient time management. The ability to maximize the use of available time can have a significant impact on productivity while considering the general well-being of individuals.

However, effective time management is often a challenge, especially due to the difficulties in scheduling individual and group meetings, as well as the need to handle multiple applications simultaneously to organize multiple types of events. The tools currently available require a considerable investment to coordinate schedules and availability efficiently, making the process complex and demotivating. Therefore, there is a strong need for fresh solutions that can assist users in managing time in an uncomplicated way, automating some of the most common steps or those that are most difficult to manage manually, providing an effective answer for those who face these challenges daily.

In line with the challenges identified above, this project aims to provide an innovative solution for time management in a simplified and efficient way. To achieve this, we adopted a User-Centered Design (UCD) approach, which included carrying out initial interviews, collecting input, establishing requirements, creating a prototype and, more recently, evaluating with potential users.

The purpose of this technical report is to present TimeWise, a web system that aims to **saving time, in managing time**. The user can see their entire calendar, mark events that will be categorized automatically and intelligently, and schedule events with several people without an endless exchange of emails or messages.

The TimeWise project yielded promising results, demonstrating the effectiveness of the proposed solution in streamlining time management. Noteworthy outcomes include the following:

- Users expressed high satisfaction with TimeWise, lauding its usability and functionality, and acknowledging the reduced time spent organizing their schedules.
- The automatic categorization of events was well-received, simplifying organization without manual intervention.
- The feature enabling the scheduling of events with multiple participants, minimizing prolonged email exchanges, received high praise.
- TimeWise effectively integrated with other calendars and applications, ensuring synchronization of all commitments.

1.1 Report Structure

This report is divided into five main chapters:

- **State-of-the-Art:** The context of the project is explained, and an overview of recent trends and advances in time management and the main applications used in this area are also shown, and which features fit into our context.

- **Conceptual Modeling of TimeWise:** Here is made a definition of the problem, it shows how the requirements gathering was carried out, as well as details of the Actors, Use Cases, and Requirements, both functional and non-functional, are given.

- **Procedure:** The procedure illustrates the evolution of the system's architecture and provides detailed explanations for each service and the front end.

- **User Study:** The User Study shows how users were necessary and influenced the evolution of our project

- **Concluding Remarks and Future work:** Here we show the result of the work done throughout the project and what we would like to do with it in the future

Chapter 2

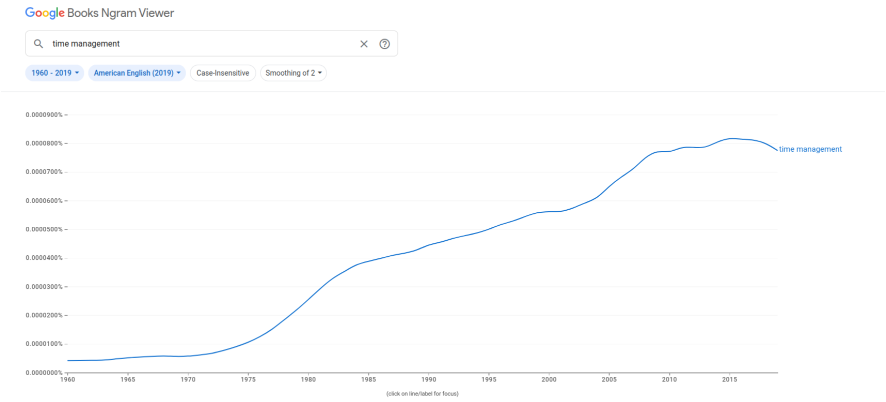
State-of-the-art

2.1 Context

Effective time management is a growing concern in a world where personal and professional demands compete for individuals' attention. 2.1

Time management strategies generally address three aspects: structuring, protecting, and adapting to changing circumstances. Structuring refers to the way people organize their activities over time, using tools such as a schedule, a planner, or other devices that represent time systematically. Protection concerns setting limits on time to avoid unwanted interruptions. For example, some people say "no" to time-consuming requests from colleagues or friends or turn off the phone during family time. Lastly, adapting time to changing circumstances means being flexible and responsive regarding time management. Furthermore, time management strategies usually examine behaviors related to these three dimensions (such as using a schedule to organize the day or taking advantage of downtime). However, they sometimes also assess people's attitudes towards their control over time.

Employers, educators, parents, and politicians urge employees, students, children, and citizens to adopt more efficient ways of using their time. Considering this, it is not surprising that from 1960 to 2008, the frequency of books mentioning time management increased by more than 2,700% (Books Ngram Viewer). [1]



time management

1960 - 2019 ▾ | American English (2019) ▾ | Case-Insensitive | Smoothing of 2 ▾

Figure 2.1: Relative frequency of the words "time management" about the total number of words in the digitized books for the selected time

Studies show that the link between time management and work performance appears to become stronger over the years, reflecting the need to manage time in more autonomous and flexible jobs. [6]

In a study carried out by specialists in professional software services, a group of 300 industrial employees were asked what the benefits of good time management would be, and the answers led to the Bar chart represented in Figure 2.2:

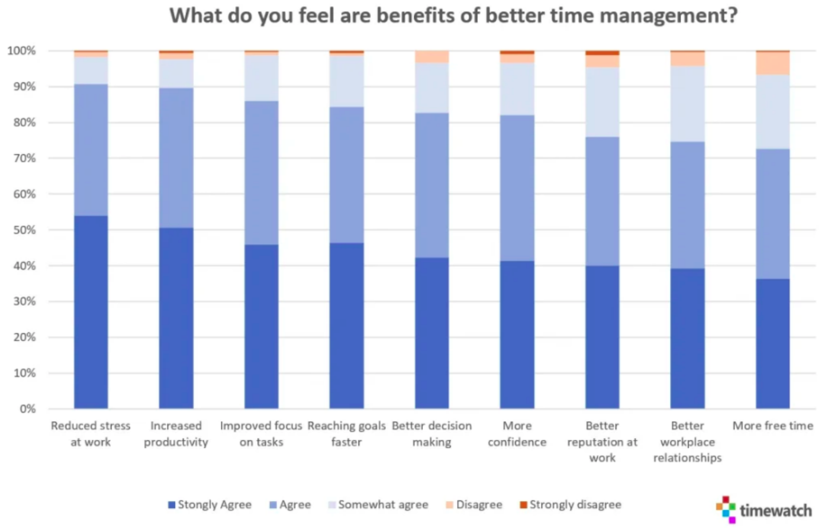


Figure 2.2: Bar chart showing agreement on the benefits of time management. [6]

We can then see that the vast majority of employees agree that the main benefits of good time management are reduced stress at work, an increase in productivity, and greater focus on tasks, among many other benefits.

They were also asked “If better time management saved 90 minutes a day, reduced stress, and improved reputation at work, what would be the maximum time you would spend per day to achieve this gain”, to which the majority responded that they would be willing to spend between 15 to 30 minutes. 2.3

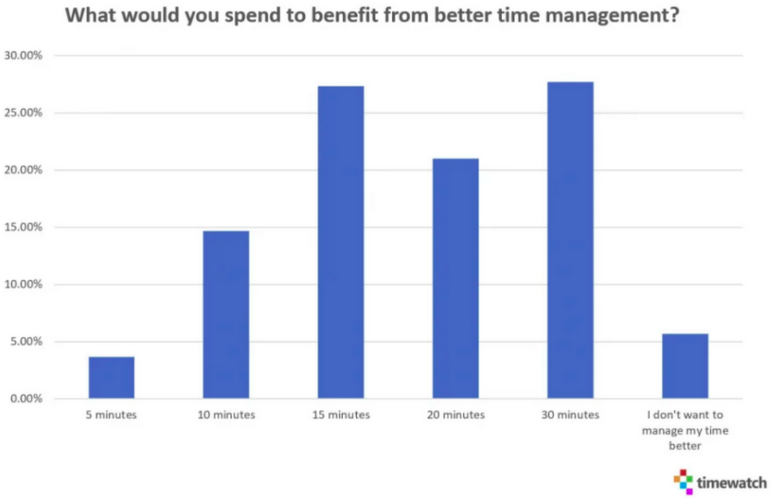


Figure 2.3: Bar chart showing the time employees would be willing to spend on their time management. [6]

Moving from a more global context on time management to the academic world, where our system fits, it is possible to see that existing research indicates that students who actively participate in academic activities, extracurricular and jobs on campus tend to achieve greater success at university due to their alleged higher level of time management skills. Furthermore, it is suggested that success at university does not depend solely on students’ time management behavior, but rather on their perception of control over their time, regardless of their involvement in academic and extracurricular activities. [7]

It is also this group of people that tends to have a greater use of technologies both in their personal and academic/professional lives.

For example, in education, students and teachers can take advantage of time management tools to improve study organization, academic work deadlines, class schedules, and exam revisions. This helps students to better manage their study time and achieve better academic results.

On the other hand, when we talk about health and well-being, individuals concerned about their health and well-being can use time management tools to schedule and track physical activities, meditation, adequate sleep, and regular breaks during the day. This contributes to a more balanced and healthier lifestyle.

Finally, people looking to improve their productivity, set goals, develop positive habits, and find a balance between personal and professional life can benefit from time management tools. These tools provide resources for planning, organizing, and self-assessment.

2.2 Recent Trends on Temporal Management

This section outlines recent developments in time management applications and tools, with a focus on platforms that optimize time for both individuals and groups. Notable calendar applications such as Google Calendar, Apple Calendar, and Notion offer a wide array of features for effectively organizing appointments and syncing schedules across multiple devices. Additionally, productivity tools like Google Keep, Siri, and Alexa facilitate the setting of customizable reminders. Furthermore, applications like Forest and Freedom are designed to enhance focus by limiting distractions. It is also worth noting that most smartphones now come equipped with built-in ”Modes” that enable users to tailor focus settings according to different scenarios.

In recent times, a notable trend has been the incorporation of task management and personal goal-tracking features within these applications. This integration allows users to oversee and manage all their commitments and objectives from a centralized location, thereby fostering a more comprehensive approach to time management.

Furthermore, there have been significant advancements in collaboration, particularly in the realm of calendar synchronization and collaborative tools. Platforms like Calendly, Doodle, and Lettuce Meet have streamlined the process of scheduling meetings and events for multiple participants. Through the automatic synchronization of availability, these tools eliminate the need for prolonged email exchanges. Their seamless integration with calendar applications also contributes to efficient time management, especially in collaborative work environments and distributed teams.

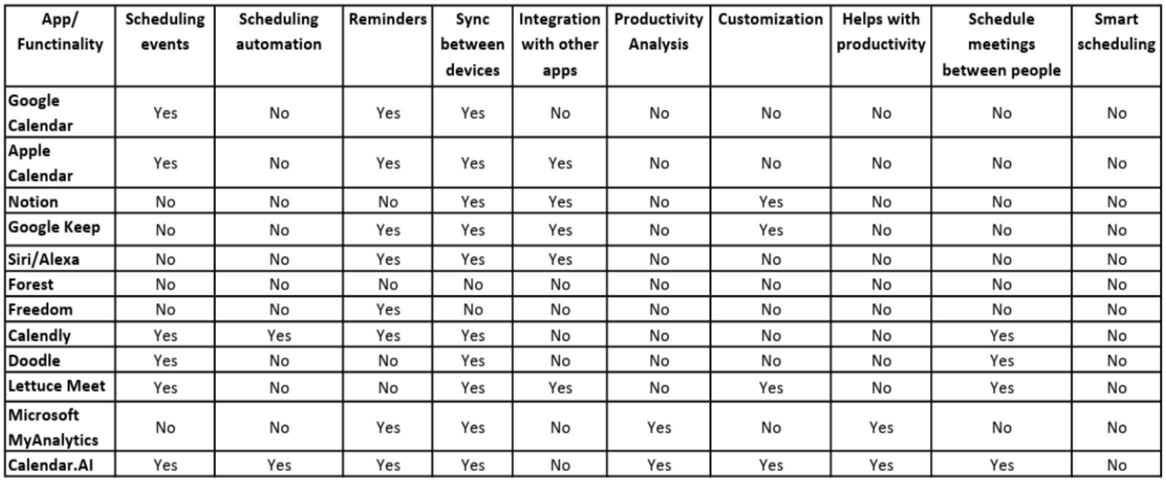
In addition to basic scheduling, some applications employ advanced algorithms and heuristics to propose optimal timings for diverse activities. These suggestions take into consideration user productivity, personal preferences, and time constraints. A prominent example of this approach is demonstrated by Microsoft MyAnalytics, which analyzes user data to recommend adjustments aimed at enhancing efficiency. Ongoing research endeavors aim to further harness machine learning and artificial intelligence to advance the capability of these systems in predicting user behavior patterns and offering customized recommendations.

There is a growing demand for applications that surpass basic time management capabilities and advocate a proactive approach. These applications provide insights into user productivity habits and offer recommendations for enhancement. A critical upcoming challenge involves seamlessly integrating data and functionality across various applications and platforms. Additionally, ensuring the utmost privacy and security of user data remains a top priority. Finally, the continuous adaptation to evolving user needs and expectations is essential for the ongoing success of temporal management tools.

2.3 Analysis of Current Systems and Functionalities

Based on a review of recent and widely used tools, Table 2.4 showcases functionalities offered by a selection of representative temporal management systems. As you can see, a user who needs all the features presented to organize themselves must use several systems.

Of the 12 systems presented, half allow the scheduling of events and their subsequent visualization, only 4 allow the scheduling of events between several people and none can categorize an event automatically and intelligently (Smart Scheduling). It should be noted that the 3 features mentioned above are some of the main requirements that our system intends to apply, showing that our main objective is to ensure that the user does not need to balance several systems to achieve their objectives.



App/ Functinality	Scheduling events	Scheduling automation	Reminders	Sync between devices	Integration with other apps	Productivity Analysis	Customization	Helps with productivity	Schedule meetings between people	Smart scheduling
Google Calendar	Yes	No	Yes	Yes	No	No	No	No	No	No
Apple Calendar	Yes	No	Yes	Yes	Yes	No	No	No	No	No
Notion	No	No	No	Yes	Yes	No	Yes	No	No	No
Google Keep	No	No	Yes	Yes	Yes	No	Yes	No	No	No
Siri/Alexa	No	No	Yes	Yes	Yes	No	No	No	No	No
Forest	No	No	No	No	No	No	No	No	No	No
Freedom	No	No	Yes	No	No	No	No	No	No	No
Calendly	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No
Doodle	Yes	No	No	Yes	No	No	No	No	Yes	No
Lettuce Meet	Yes	No	No	Yes	Yes	No	Yes	No	Yes	No
Microsoft MyAnalytics	No	No	Yes	Yes	No	Yes	No	Yes	No	No
Calendar.AI	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No

Figure 2.4: Summary of most relevant features for a set of recent and widely used applications for time management and event scheduling

2.3.1 Google Calendar

Google Calendar is an online calendar application that allows users to organize and manage events. It offers scheduling features, automatic reminders and synchronization across different devices, making planning and collaboration easier.

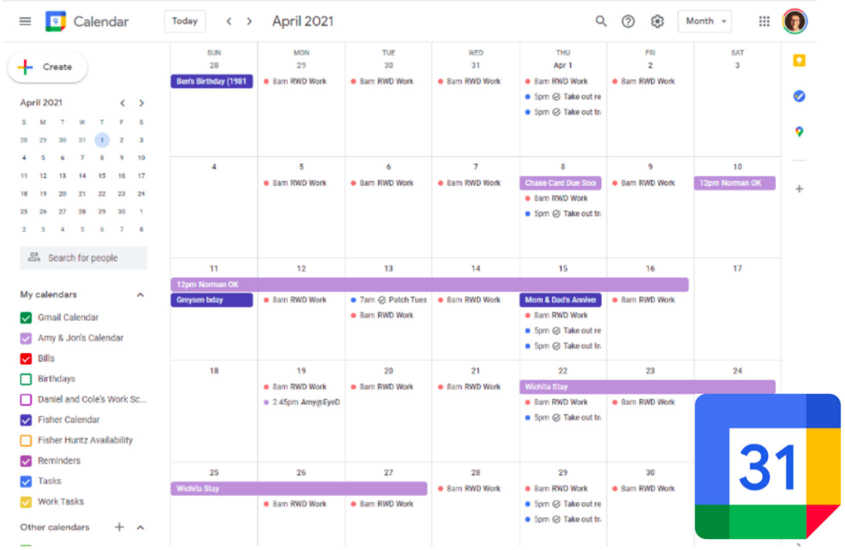


Figure 2.5: Google Calendar interface and logo

2.3.2 Apple Calendar

Apple Calendar is a calendar app built into Apple devices such as iPhones, iPads and Macs. It allows users to organize events, appointments and reminders intuitively, with synchronization between devices and integration with other Apple apps, such as Mail and iCloud.

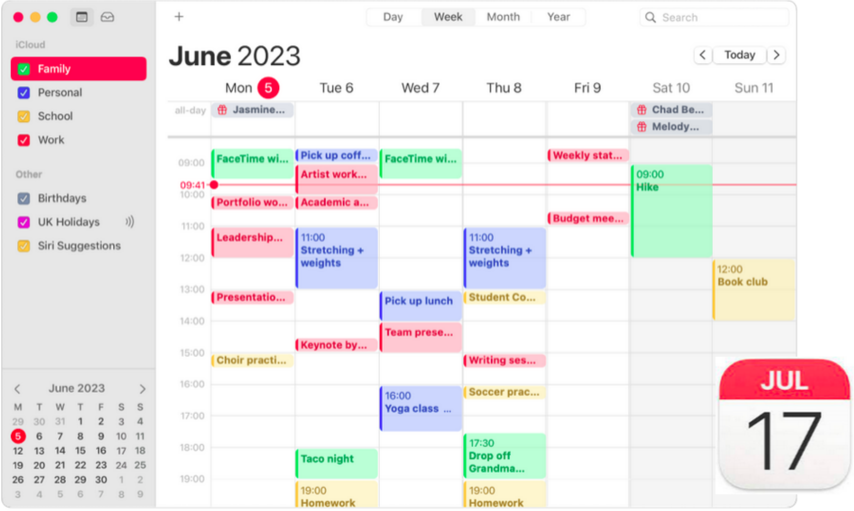


Figure 2.6: Apple Calendar interface and logo

2.3.3 Notion

Notion is a versatile productivity app that combines notes, tasks, databases and project management into a single platform. Users can flexibly create and organize documents, tables, task lists and collaboration boards. Notion offers advanced customization, cross-device syncing, and real-time collaboration, adapting to individual and group needs.

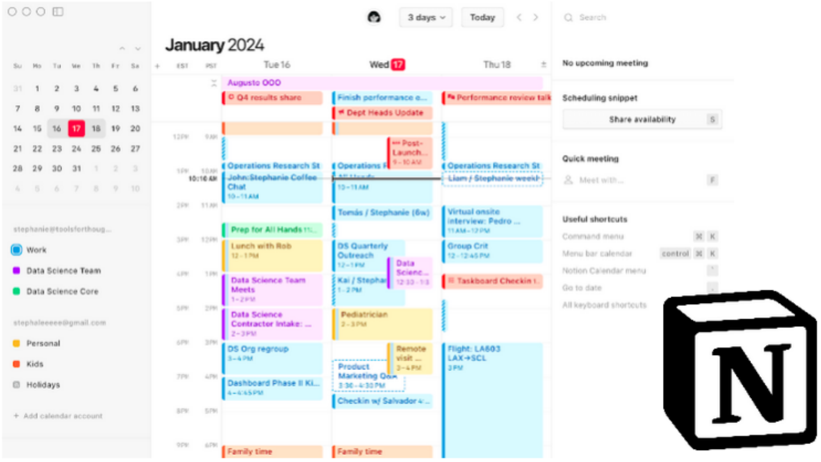
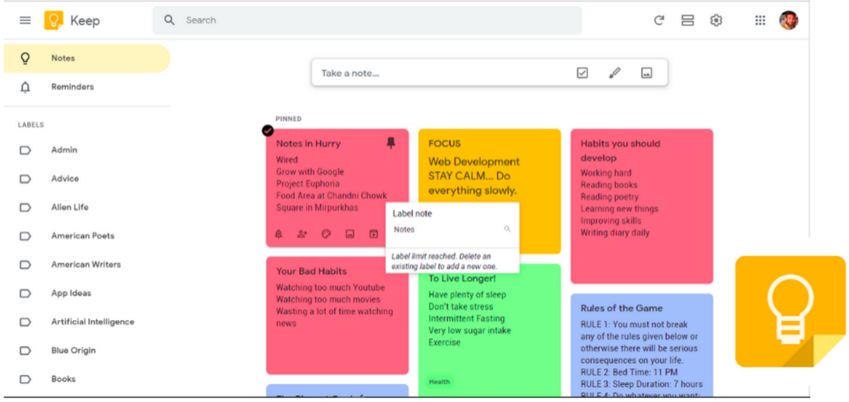


Figure 2.7: Notion interface and logo

2.3.4 Google Keep

Google Keep is a note-taking application that allows users to easily create, organize and share notes, lists and reminders. Offers simple idea capture capabilities such as text, checklists, images and audio, with real-time synchronization between devices. Keep also allows you to categorize notes by color, add labels, and set reminders based on location or time, making it easier to organize and manage information.



Notes in Hurry
Wired
Grow with Google
Project Euphoria
Food Area at Chandni Chowk
Square in Mirpurkhas

FOCUS
Web Development
STAY CALM... Do
everything slowly.

Habits you should develop
Working hard
Reading books
Reading poetry
Learning new things
Improving skills
Writing diary daily

Label limit reached. Delete an existing label to add a new one.

Your Bad Habits
Watching too much Youtube
Watching too much movies
Wasting a lot of time watching news

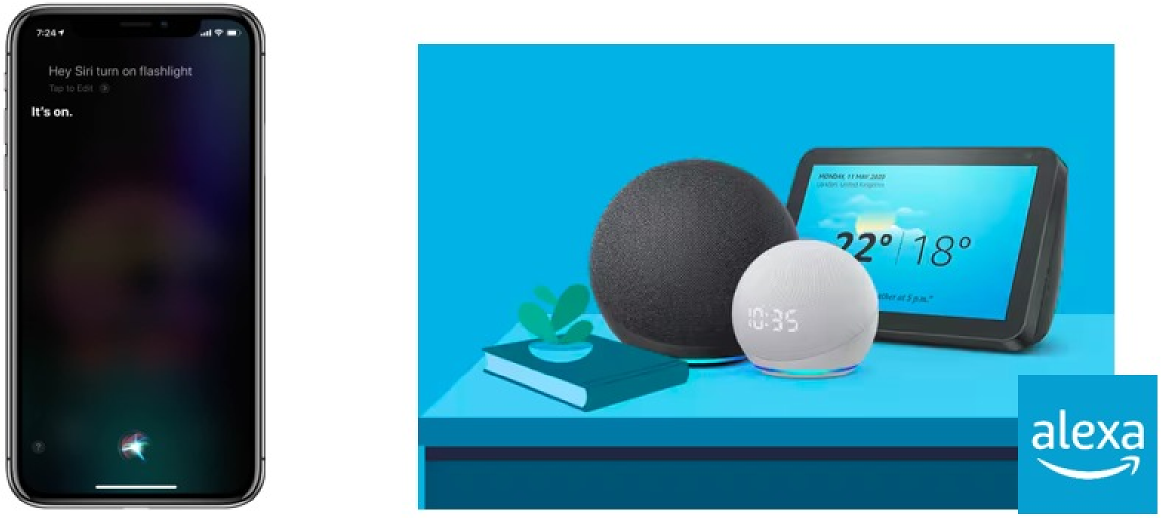
To Live Longer!
Have plenty of sleep
Don't take stress
Intermittent Fasting
Very low sugar intake
Exercise

Rules of the Game
RULE 1: You must not break any of the rules given below or otherwise there will be serious consequences on your life.
RULE 2: Bed Time: 11 PM
RULE 3: Sleep Duration: 7 hours
RULE 4: Do whatever you want:

Figure 2.8: Google Keep interface and logo

2.3.5 Siri and Alexa

Siri and Alexa are virtual assistants developed by Apple and Amazon, respectively. Both offer a wide range of features, including performing tasks by voice command, such as setting reminders, creating lists and even scheduling appointments. These assistants are designed to make interaction with technological devices more intuitive and efficient, allowing users to perform various activities with just voice commands.



Hey Siri turn on flashlight

It's on.

Figure 2.9: Siri and Alexa interfaces and logos

2.3.6 Forest

Forest is a productivity app that encourages concentration by planting virtual trees, helping users avoid distractions while working or studying. It uses a gamified approach, where the user must remain within the app so that the tree continues to grow.

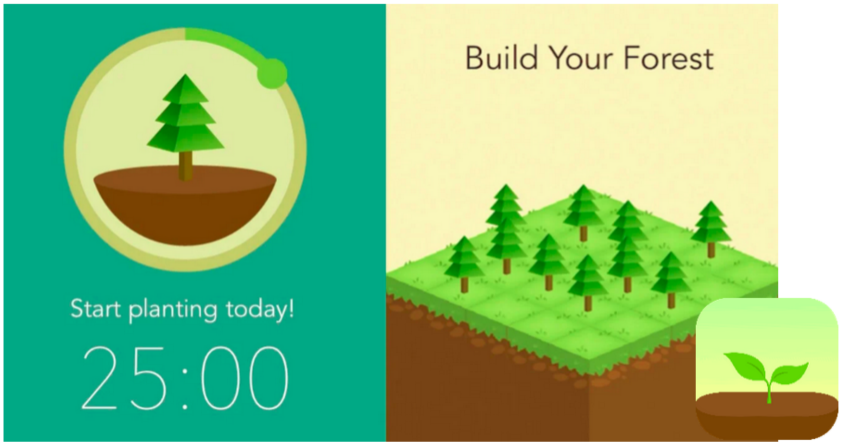


Figure 2.10: Forest interface and logo

2.3.7 Freedom

Freedom is a distraction-blocking app that helps users focus on their tasks by limiting access to websites, apps and notifications that can cause distractions. Users can set specific periods during which they want to focus, temporarily blocking access to selected websites and apps. Freedom offers the flexibility to customize blocking settings and helps users increase their productivity by minimizing digital interruptions.

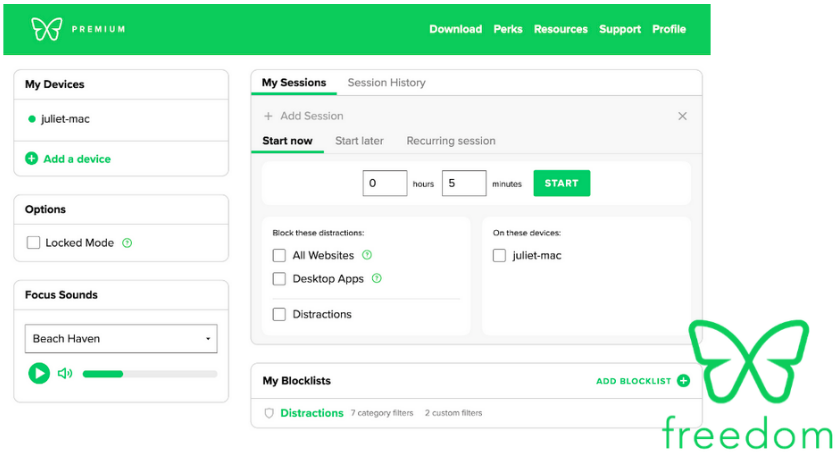


Figure 2.11: Freedom interface and logo

2.3.8 Calendly

Calendly is an online scheduling app that allows users to schedule meetings, interviews and events efficiently. Users can share their available calendars and participants can select suitable times, eliminating manual scheduling work. Calendly syncs with popular calendars and sends automatic reminders, making appointment management simple. It also takes time zones into account.

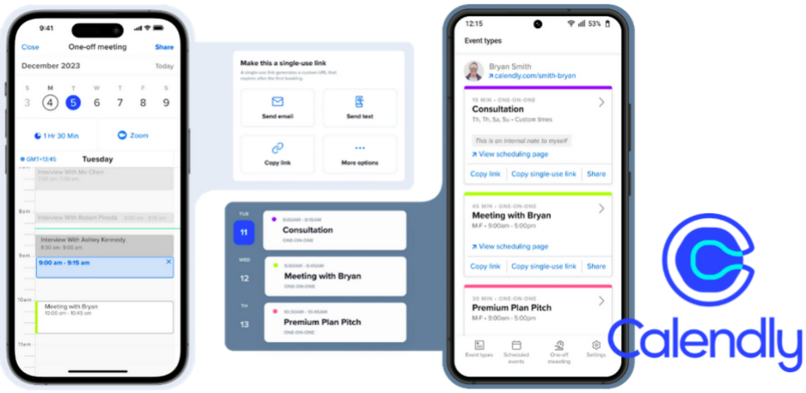
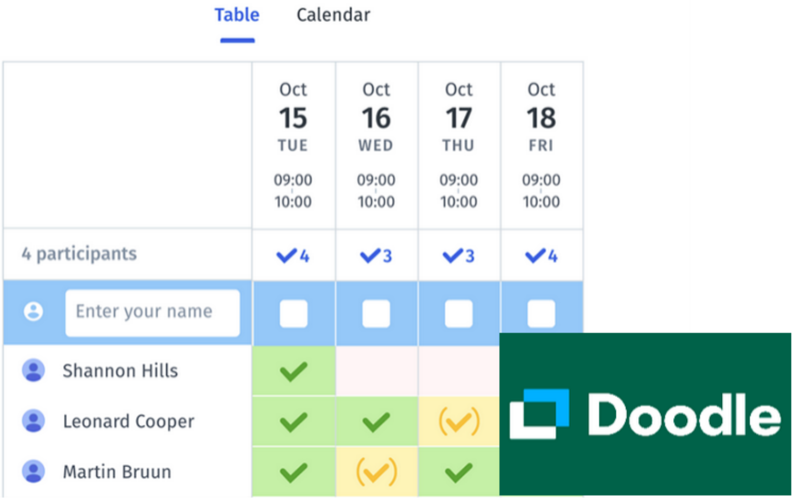


Figure 2.12: Calendly interface and logo

2.3.9 Doodle

Doodle is a scheduling application that simplifies scheduling appointments and meetings, allowing users to propose different times and dates and for participants to vote on the options that best suit their schedules. With an intuitive interface, Doodle makes it easy to coordinate schedules between multiple people and helps find the best time for events, minimizing communication and planning efforts.



	Oct 15 TUE 09:00 10:00	Oct 16 WED 09:00 10:00	Oct 17 THU 09:00 10:00	Oct 18 FRI 09:00 10:00
4 participants	✓4	✓3	✓3	✓4
Enter your name	□	□	□	□
Shannon Hills	✓			
Leonard Cooper	✓	✓	(✓)	
Martin Bruun	✓	(✓)	✓	

Figure 2.13: Doodle interface and logo

2.3.10 Lettuce Meet

Lettuce Meet is a meeting scheduling platform that makes it simple to coordinate schedules between multiple people. Allows users to create personalized availability polls and invite participants to vote for times that best suit their schedules. With customization features and calendar integration, Lettuce Meet makes the meeting scheduling process more efficient and collaborative.

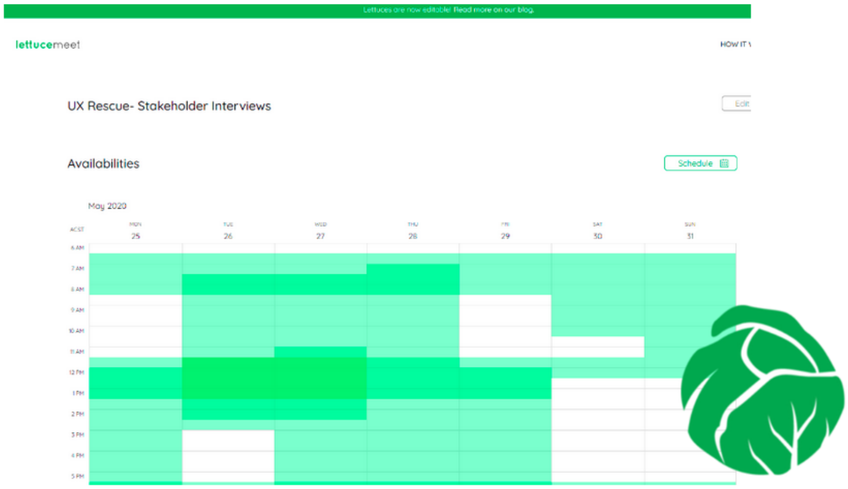
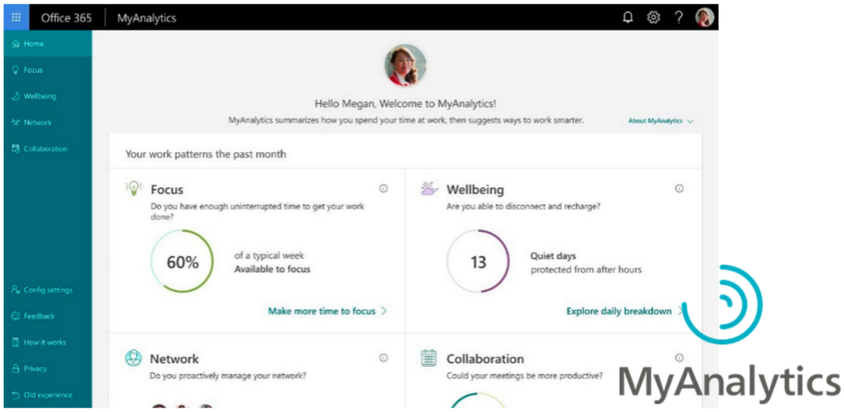


Figure 2.14: Lettuce Meet interface and logo

2.3.11 Microsoft MyAnalytics

Microsoft MyAnalytics is a productivity analytics tool that provides personalized insights into how users spend their time at work. It analyzes Office 365 activity data, such as emails, meetings, and focus time, to identify patterns and offer suggestions to improve efficiency and well-being at work. With charts and metrics, MyAnalytics helps users understand their work habits and make more informed decisions to increase productivity and work-life balance.



Hello Megan, Welcome to MyAnalytics!

MyAnalytics summarizes how you spend your time at work, then suggests ways to work smarter.

Your work patterns the past month

Do you have enough uninterrupted time to get your work done?

of a typical week Available to focus

Are you able to disconnect and recharge?

Quiet days protected from after hours

Do you proactively manage your network?

Could your meetings be more productive?

Figure 2.15: Microsoft MyAnalytics interface and logo

2.3.12 Calendar.AI

Calendar.AI is a smart calendar mobile app that offers advanced scheduling and organization features. It integrates with popular calendar platforms such as Google Calendar and Outlook, providing detailed analytics on how users spend their time and making it easy to automatically schedule meetings by analyzing participants' calendars (analysis done in the Doodle model). With features such as reminders, notifications and contextual information about participants, Calendar.AI helps users better manage their appointments and maximize their productivity.

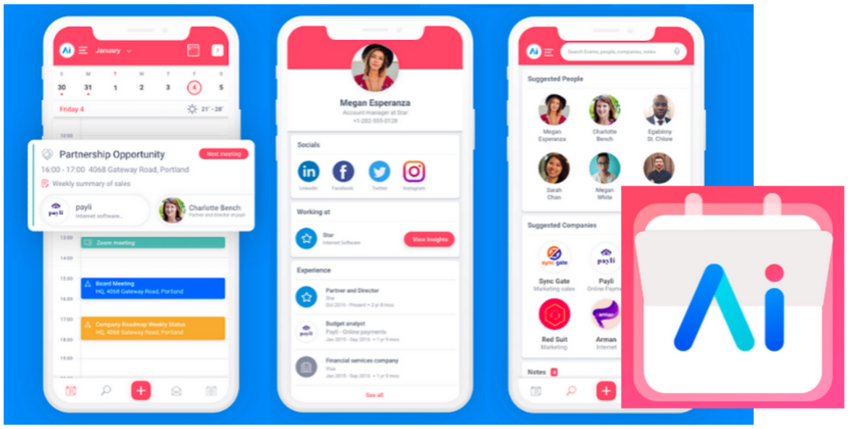


Figure 2.16: Calendar.AI interface and logo

In short, the current state of time and calendar management applications and tools is evolving rapidly to meet increasingly complex user demands, with a growing emphasis on automation, personalization and collaboration. Future research will continue to explore new approaches and technologies to further improve the efficiency and effectiveness of these solutions.

Chapter 3

Conceptual Modeling

3.1 Problem Definition

In today's fast-paced society, people constantly strive to maintain a well-organized schedule and establish effective routines. As a result, they seek out simple and efficient tools to help them achieve this objective. Unfortunately, in the present market scenario, users have to resort to the use of multiple applications and platforms to efficiently manage their time across various dimensions. For example, scheduling events with a calendar app and coordinating meetings with two or more people using Doodle can be time-consuming and laborious. This can make planning one's day-to-day activities an inconvenient and tedious task. TimeWise aims to address these issues by providing a seamless user experience.

3.2 Understanding the Context and User Needs

First and foremost, it is important to acknowledge that the intended audience for this project is the academic community. However, it should be noted that the platform's main functionalities have the potential to cater to other audiences in the future. This decision was made since the academic community provides us with the opportunity to explore the majority of the functionalities we wish to implement, as well as our direct accessibility to this audience.

To ensure that our project meets the needs of our future users, our team has engaged in weekly meetings with advisors and brainstorming sessions between the members. Additionally, we conducted a questionnaire to gain insight into the time management skills and habits of students and teachers. This valuable information helped guide the direction of our project since it allowed us to come to crucial conclusions regarding the requirements for this platform – what it should do, what are its priorities, and how it should work.

From this set of questions, various results, that would help us make decisions concerning our system, arise, being the ones that stand out the most:

1. Most participants have "busy" days (level 4, on a scale of 1 (Not busy at all) to 5 (Very busy)).

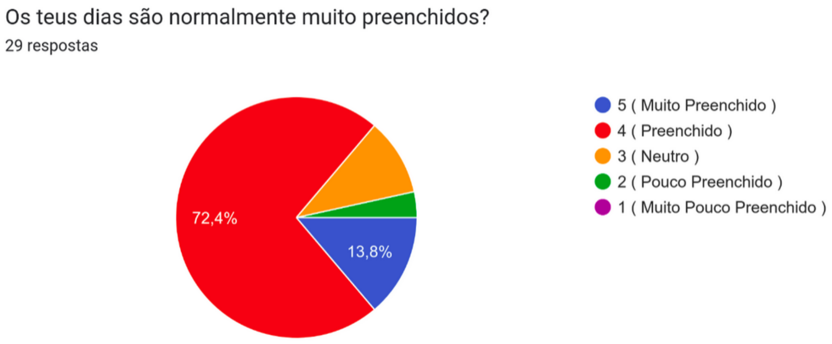


Figure 3.1: Results for user questionnaire: How busy is your day?

2. A little more than half of the participants showed some difficulty in managing their time (level 4, on a scale of 1 (Don't have any difficulties) to 5 (Have a lot of difficulties)).

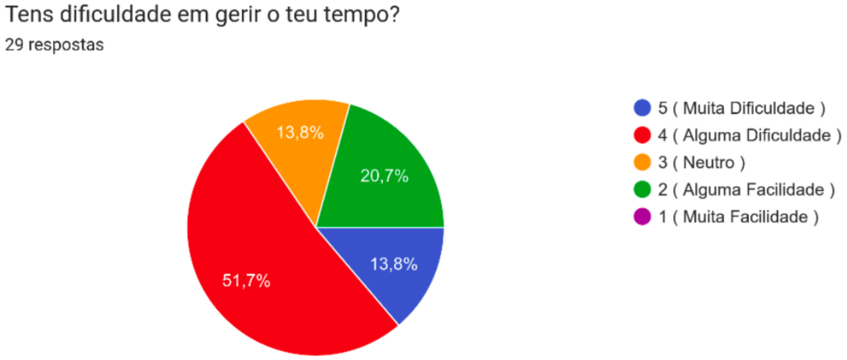


Figure 3.2: Results for user questionnaire: You have difficulty managing your time?

3. The participants use, mostly, Google Calendar, a physical journal, or their smartphone's calendar app.

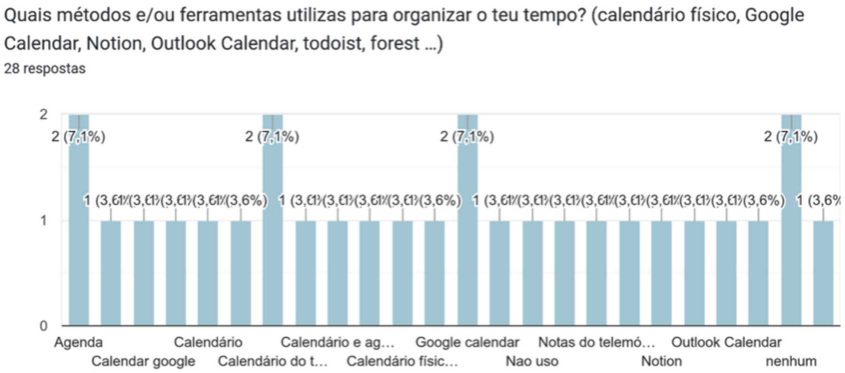


Figure 3.3: Results for user questionnaire: What tools do you use to organize your time?

4. The opinion of the participants about these methods is divided between "Neutral" and "Some efficiency" (levels 3 and 4, respectively, on a scale of 1 (Not efficient at all) to 5 (Very efficient))

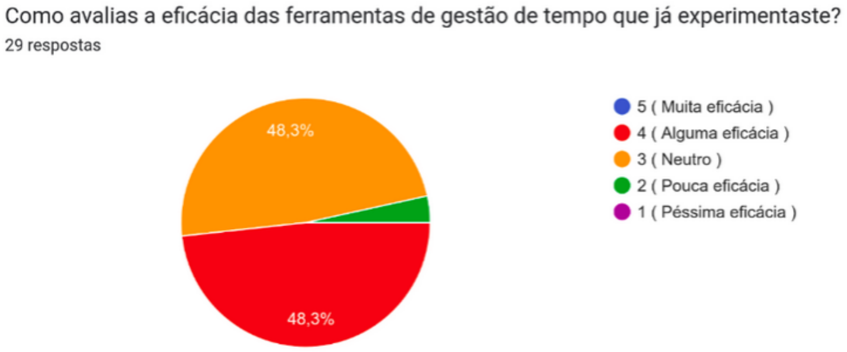
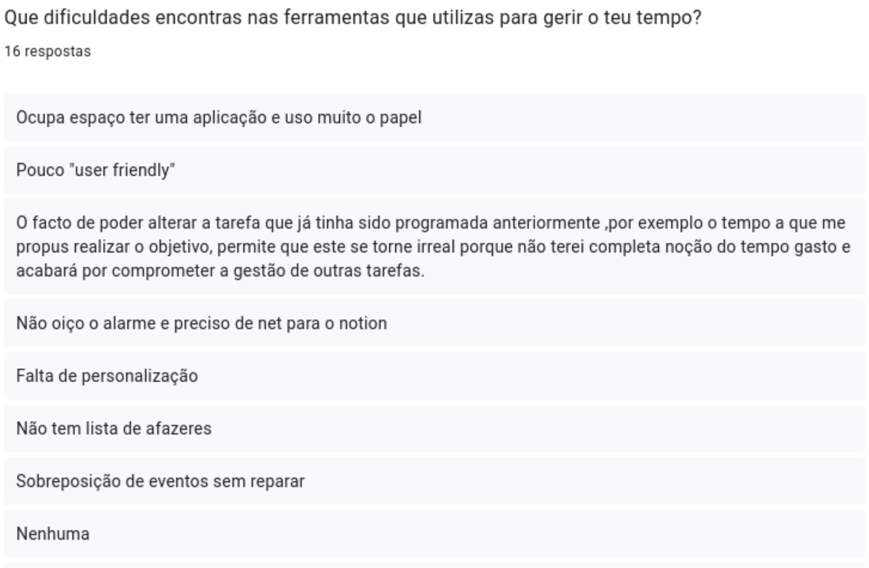


Figure 3.4: Results for user questionnaire: How do you evaluate the effectiveness of the tools you use?

5. Different problems were pointed out by the participants, from lack of customization to lack of a

"to-do list" to the occurrence of overlap of tasks that go unnoticed, alongside others.



Que dificuldades encontras nas ferramentas que utilizas para gerir o teu tempo?

16 respostas

Ocupa espaço ter uma aplicação e uso muito o papel

Pouco "user friendly"

O facto de poder alterar a tarefa que já tinha sido programada anteriormente ,por exemplo o tempo a que me propus realizar o objetivo, permite que este se torne irreal porque não terei completa noção do tempo gasto e acabará por comprometer a gestão de outras tarefas.

Não oiço o alarme e preciso de net para o notion

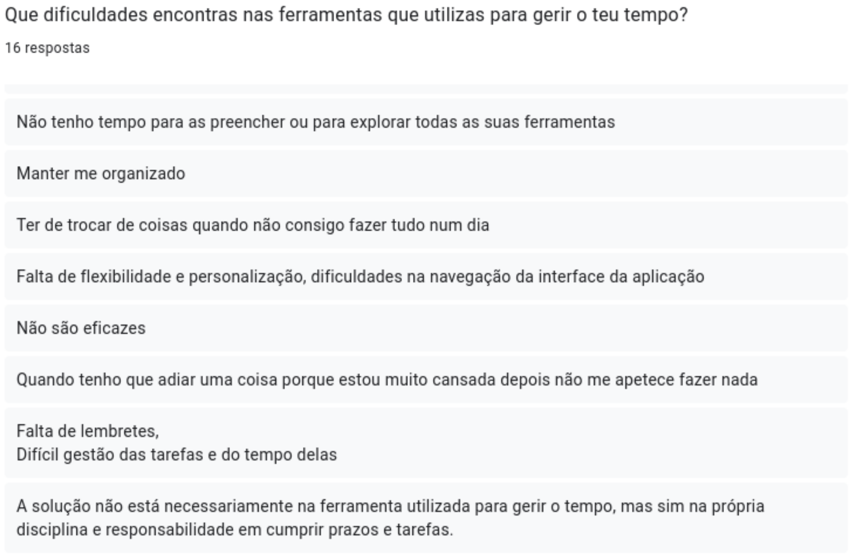
Falta de personalização

Não tem lista de afazeres

Sobreposição de eventos sem reparar

Nenhuma

Figure 3.5: Results for user questionnaire: What difficulties do you encounter with the tools you use? (part 1)



Que dificuldades encontras nas ferramentas que utilizas para gerir o teu tempo?

16 respostas

Não tenho tempo para as preencher ou para explorar todas as suas ferramentas

Manter me organizado

Ter de trocar de coisas quando não consigo fazer tudo num dia

Falta de flexibilidade e personalização, dificuldades na navegação da interface da aplicação

Não são eficazes

Quando tenho que adiar uma coisa porque estou muito cansada depois não me apetece fazer nada

Falta de lembretes,
Difícil gestão das tarefas e do tempo delas

A solução não está necessariamente na ferramenta utilizada para gerir o tempo, mas sim na própria disciplina e responsabilidade em cumprir prazos e tarefas.

Figure 3.6: Results for user questionnaire: What difficulties do you encounter with the tools you use? (part 2)

3.3 Actors

After analyzing our target audience, we identified two primary platform actors and created a representative persona for each. This process helped us understand these users' motivations and needs and tailor the platform accordingly.

- **Student:** uses the platform to organize and schedule his daily and weekly activities and to create routines (i.e. study routines, workout routines...)
  Represented by: Mateus Silva

Figure 3.7: Student Mateus Silva

Mateus Silva is a 21-year-old student who is currently pursuing his master's degree in mechanical engineering. He hails from Leiria and is currently studying at the School of Engineering of the University of Porto (FEUP). He has a scholarship that requires him to work every Monday and Wednesday from 9 am to 5 pm. As part of his scholarship, Mateus has to manage meetings, adhere to tight schedules, prepare presentations, deliver deliverables, and execute other tasks.

He faces some trouble managing his time, between classes from five different subjects, trips, gym sessions, and "praxe". Mateus feels like he lacks time management skills and that he gets lost in time when he's working on some task. Also, he never really knows how much time it takes to finish a certain task or prepare one.

The person usually uses social media to stay updated on news, keep in touch with friends, and for fun. They use Google Calendar and the phone's calendar app to plan and schedule daily tasks, errands, and appointments.

They tend to be quite disorganized and lack study routines, often ending up only studying a few days before an assessment. Even when it comes to working for your scholarship, you tend to do planned tasks with little advance notice, which leads you to do many hours of exhausting work and even give up your nights to be able to complete them on time. In this way, Mateus often ends up feeling tired, stressed, and anxious.

Mateus would like to find a simple way to manage the time that would help him follow and complete the tasks he needs to carry out on a given day, thus being able to follow a more harmonious routine.

- **Teacher:** uses the platform to schedule meetings with students and other teachers (meetings with two or more people) and to be aware of deadlines
  Represented by: Cláudia Mendes

Figure 3.8: Teacher Cláudia Mendes

Cláudia Mendes is a 40-year-old assistant teacher at the University of Aveiro and a researcher at the “Instituto de Engenharia Eletrónica e Telemática de Aveiro” (IEETA). **She faces difficulties with managing her busy schedule due to her responsibilities as a teacher and researcher. Her tasks include managing scientific projects, supervising dissertation/doctoral students, writing scientific articles, preparing classes, and more.**

Despite trying to use traditional methods of organization such as physical diaries, post-its on different surfaces, and alarms on her cell phone, Cláudia often forgets important dates and leaves tasks until the last minute. She finds scheduling meetings with her students particularly challenging as they too have very busy schedules.

Cláudia wishes to schedule meetings in the most efficient way possible and receive automatic notifications about planned events to manage her time properly. Cláudia Mendes is a 40-year-old assistant teacher at the University of Aveiro and a researcher at the Institute of Electronics and Informatics Engineering of Aveiro” (IEETA). She faces difficulties managing her busy schedule due to her responsibilities as a teacher/researcher, namely managing scientific projects, supervising dissertation/doctoral students, writing scientific articles, preparing classes, etc.

Despite trying to use traditional methods of organization, such as physical diaries, post-its on different surfaces and alarms on her cell phone, Cláudia often forgets important dates and leaves tasks until the last minute.

She feels that scheduling meetings with her students is a particularly difficult task, as they, like herself, generally have very busy schedules.

Cláudia would therefore like to be able to schedule meetings in the most efficient way possible, as well as automatically schedule notifications about planned events.

Both users have access to the same features, although used for different things and with different frequencies.

3.4 Use Cases

After all the research done and understanding the user’s needs, we came up with the following Use Cases, represented in the diagram 3.9.

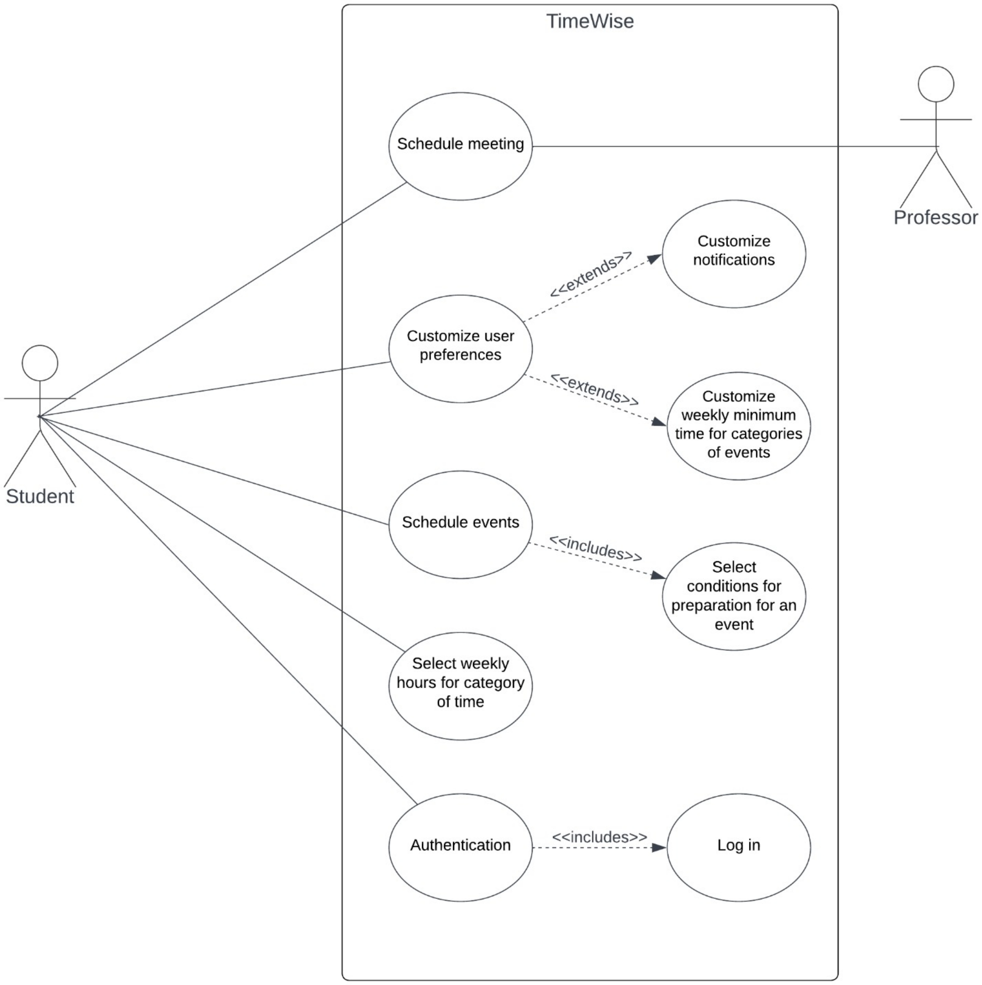

TimeWise
Schedule meeting
Professor
Customize notifications
<<extends>>
Customize user preferences
<<extends>>
Customize weekly minimum time for categories of events
Student
Schedule events
<<includes>>
Select conditions for preparation for an event
Select weekly hours for category of time
Authentication
<<includes>>
Log in

Figure 3.9: UML Diagram Depicting the Use Cases

Schedule a Meeting with Two or More People: This use case describes the process of scheduling a meeting involving two or more participants, where our application facilitates schedule coordination and sending invitations. The actors involved are the Student and the Advisor. The goal is to allow the Student to schedule a meeting with their Advisor quickly and easily. In the basic flow, the Student selects "schedule a new appointment," enters the title of the meeting, receives suggestions for dates and times, which he can adjust and selects preferred slots, and sends invitations. Upon confirmation, the Advisor receives the invitation, selects available dates, and confirms their availability. When the scheduled date arrives, the Student receives a notification of the meeting and can confirm the best slot suggested by the application.

Schedule an Event and Preparation Time: This use case describes the process of scheduling an event and allocating preparation time. The actor involved is the Student. The goal is to enable the Student to quickly schedule preparation time for an event. In the basic flow, the Student selects a slot to mark a new event, optionally chooses preparation time, and the system proposes available slots based on the specified number of hours and days. Upon confirmation of the slot/slots, the preparation time is automatically added to the schedule.

Define Weekly Hours for Each Event Category: This use case describes the process of defining the number of hours a user wants to allocate to different event categories weekly. The actors involved are users (Teachers or Students). The goal is to enable users to set weekly time allocations for various activities. In the basic flow, the user accesses customization settings, sets reserved times (maximum or minimum) for each event category, and saves preferences.

Set Rest Hours: This use case allows users to select a period during which they do not wish to be disturbed, such as sleeping hours. The actor involved is the user. The goal is to enable users to define periods of rest to avoid scheduling events. In the basic flow, the user accesses customization settings, sets rest time, confirms settings and the application updates their preferences accordingly.

Customize Notifications: This use case involves customizing notifications according to user preferences. The actors involved are users (Teachers or Students). The goal is to allow users to personalize notification settings. In the basic flow, the user accesses notification settings, adjusts preferences, and confirms the settings.

3.5 Requirements

Next, the primary functional and non-functional requirements are outlined. These requirements were instrumental in guiding the conceptualization and development of the proposed solution.

3.5.1 Functional Requirements

Reference	**Functional Requirements**
FR-1	The user must be able to view their agenda.
FR-2	The application must allow users to log in via a Google account.
FR-3	The application must be able to categorize an event automatically and intelligently
FR-4	The user should be able to schedule meetings with two or more people.
FR-5	The user must have the ability to schedule events.
FR-6	All accounts must be authenticated.
FR-7	The user can personalize meeting conditions if needed.
FR-8	The user must have the option to accept or reject scheduled meetings.
FR-9	The user must be able to remove participants from meetings.
FR-10	When scheduling an event requiring preparation, the user should customize the time and slots for this preparation.
FR-11	The user can modify event tags suggested by the application.
FR-12	The application must send alerts for unmet goals.
FR-13	The application should include a to-do list for scheduling events/tasks.
FR-14	The user should be able to view their calendar based on preferences (daily, weekly, 24h, 48h).
FR-15	The application must send calendar event notifications to users.
FR-16	The system allows non-users to select slots for joint meetings upon receiving invitations.
FR-17	The user can define rest time.
FR-18	The user can set weekly hours for work, free time, exercise, rest, etc.
FR-19	The user should be able to customize their notifications.
FR-20	The application should suggest time slots for tasks from the user's to-do list.
FR-21	The system must notify the user of their weekly schedule status (busy, quiet).
FR-22	The system should categorize events by priority level based on notifications.
FR-23	The system must create pending slots while waiting for participant selections.
FR-24	The user can check the number of selections for pending slots.
FR-25	The user should be able to schedule new events in unchosen pending slots.
FR-26	The application should suggest breaks during long study/work sessions.

Table 3.1: Functional Requirements

3.5.2 Non-Functional Requirements

Reference	**Functional Requirements**
NFR-1	The application must find a compatible time among up to 100 people within 5 seconds.
NFR-2	When creating an event on the user's calendar, the application must be able to categorize the event in less than 2 seconds.
NFR-3	The error rate when timing an event must be less than 10%.
NFR-4	The application must function correctly on both desktop and smartphone platforms.
NFR-5	The application must integrate an NLP model.
NFR-6	The application must be a web app.
NFR-7	The application's interface must be user-friendly.
NFR-8	The application must follow secure scheduling flows to prevent tampering by third parties.
NFR-9	The application must maintain good performance with increasing user numbers and accommodate new features easily.
NFR-10	The application's source code must adhere to good software development practices for modularity, readability, and comments to facilitate maintenance and collaboration.

Table 3.2: Non-Functional Requirements

Chapter 4

Procedure

4.1 Overall Concept

Our solution is designed to tackle the challenge of effectively managing user schedules and events. It encompasses an integrated, user-friendly platform that consolidates multiple services into a cohesive system. The crux of our strategy lies in providing a streamlined user experience for calendar management, offering intelligent event recommendations, and facilitating effortless meeting coordination.

Our system enables users to:

- **Manage Calendars:** Users can create, modify, and remove events within their calendars, with seamless synchronization to Google Calendar.
- **Receive Event Suggestions:** The system utilizes user preferences and availability to recommend ideal event times, enabling efficient scheduling of meetings and activities.
- **Coordinate Meetings:** The platform facilitates the scheduling of meetings between multiple users, finding commonly available slots, and sending out invitations.
- **Secure Authentication:** Ensuring user data security and privacy through robust authentication mechanisms using Firebase and OAuth 2.0.

By leveraging modern web technologies and a microservices architecture, our solution is designed to be scalable, flexible, and easy to maintain, providing a high-quality user experience.

4.2 Early System Architectures

Throughout the **Elaboration** and **Construction** phases, our architecture underwent an evolution, caused by the beginning of the project development and the perception that things could be done more simply.

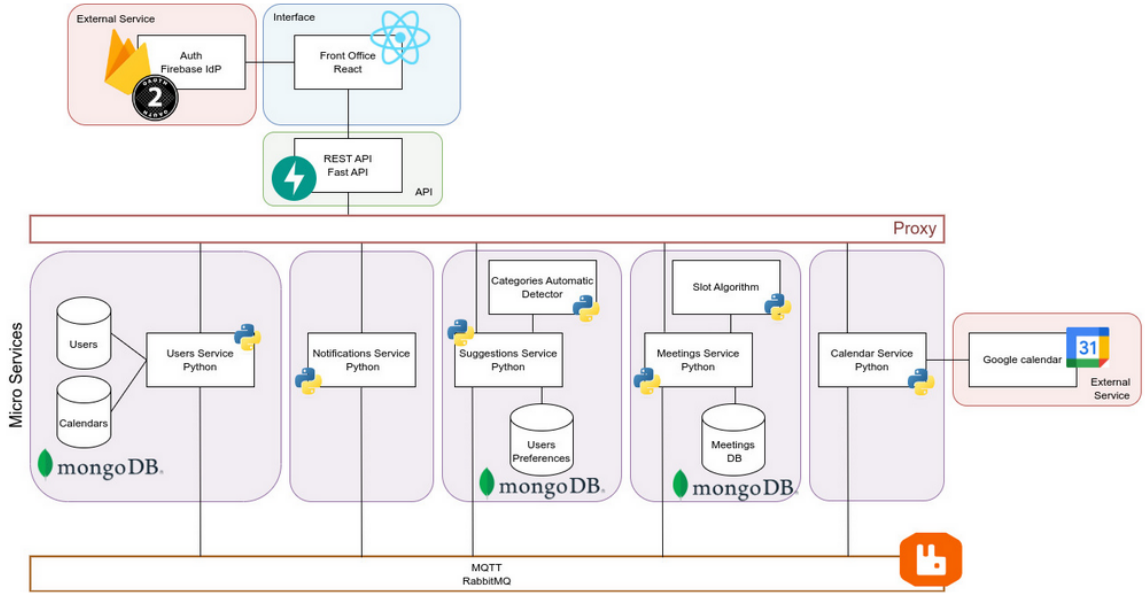


Figure 4.1: Architecture first's version

In this first version, we had the front end with authentication linked to a proxy that communicated with the services. In total, we had 5 services: **User Service**, **Notification Service**, **Suggestions Service**, **Meetings Service**, and, finally, **Calendar Service**, linked to the external Google Calendar service. Communication between services was then done using a message broker, Rabbit MQ.

Later, we realized that the User and Calendar services would always have to be in communication, which led to the decision to merge these two services. This merger made it possible to simplify the system architecture, offering a more integrated experience for users. By having a single service to manage both user information and their calendars, we can improve the user experience and facilitate access and manipulation of calendar-related details within the context of user profiles. Finally, the merger contributed to improving the scalability and performance of the system, reducing the communication overhead between services and optimizing the use of computing resources.

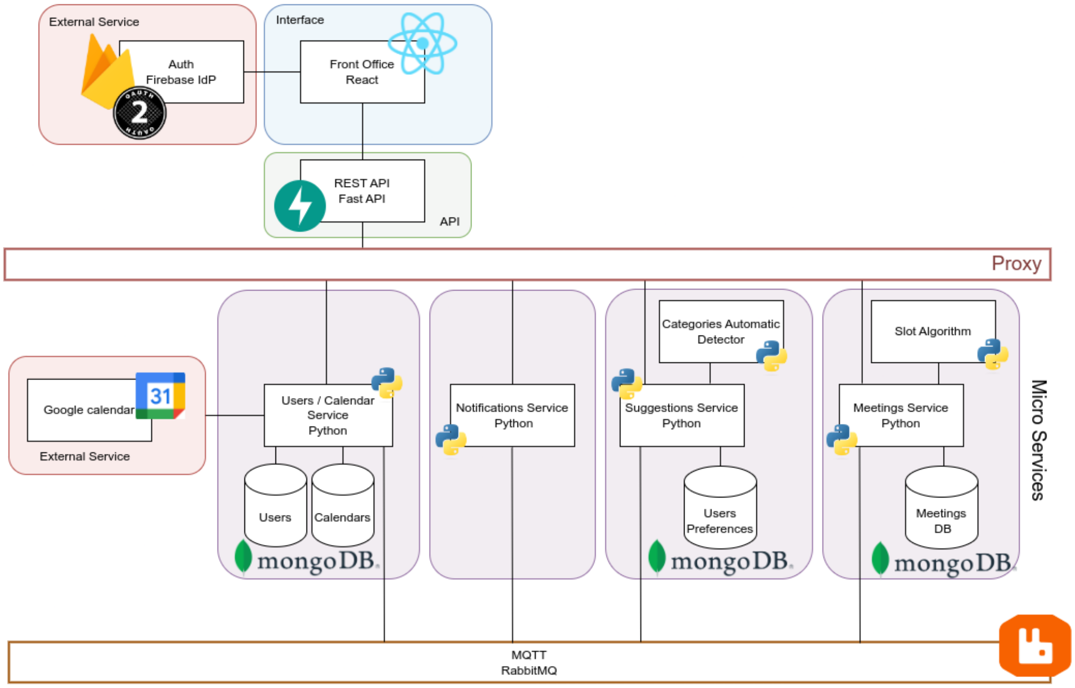


Figure 4.2: Second version of the architecture

Finally, we decided to remove the REST API from the front end, since if communication is done through the Proxy, the API would not be doing anything there. Additionally, we have also decided to remove the Notifications service for engineering reasons.

4.3 Adopted System Architecture

Figure 4.3 shows the final adopted architecture.

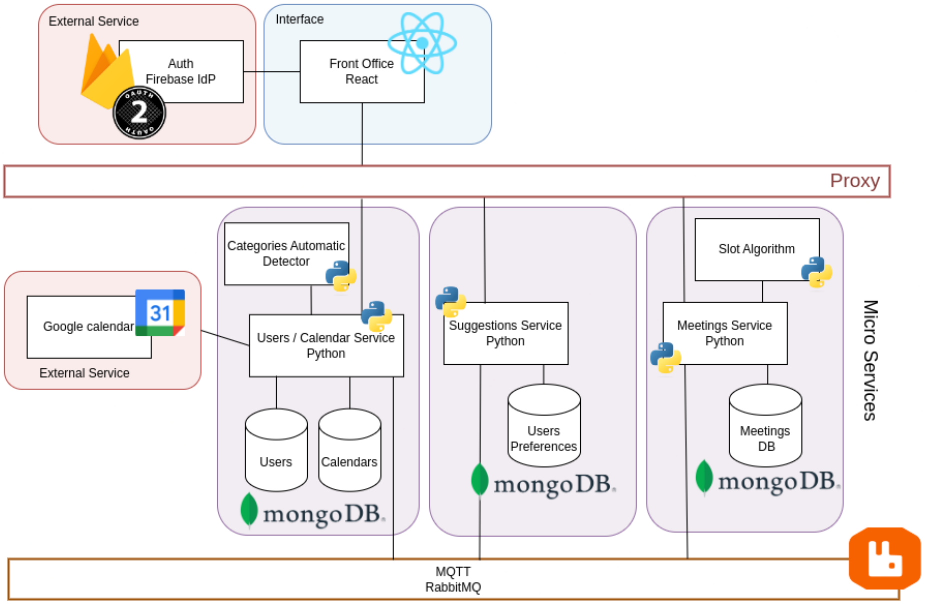


Figure 4.3: Final version of the architecture

The presented architecture adopts a layered approach to the organization and functioning of the system. At the most external level, we have the **Front-end** Layer, built as a web application developed in React. This layer offers an interactive and friendly interface for users, allowing them to interact with the system intuitively. Additionally, security and authentication are guaranteed by Firebase and Oauth2.0, providing a secure and reliable login experience.

Just below, we have the **Proxy**, which acts as a bridge between the front end and the back end. It directs customer requests to corresponding services on the backend, ensuring efficient communication between system layers.

In the Services Layer (**Back-end**), we find several specialized services that perform specific functions in the system. The **User/Calendar Service** is responsible for processing user data and their calendar, including integration with the external Google Calendar service. This service uses MongoDB as a database to manage all operations related to the user's calendar.

The **Suggestions Service** performs the event suggestions logic, calculating available slots based on the user's preferences. It maintains a database to store users' preferences, facilitating personalized and relevant suggestions.

Finally, the **Meeting Service** manages all the logic related to the intelligent scheduling of events between multiple users, from creation to scheduling and participation. All services are written in Python and communicate with each other using Rabbit MQ for asynchronous communication, ensuring efficient and reliable integration between system components.

We use MongoDB for all the databases, FastAPI for creating the API endpoints, and Swagger for documenting and testing the endpoints. This combination ensures efficient data handling, rapid API development, and an easy-to-use interface for exploring the available endpoints.

This layered architecture offers a robust and scalable solution for distributed systems, promoting easy maintenance, extensibility, and source code organization. Each layer plays a fundamental role in the system's functioning, ensuring a clear separation of responsibilities and an integrated and efficient user experience.

4.4 User Interface

4.4.1 Used Technologies

The front-end layer of this project uses the React framework to build the user interface. React, a JavaScript library developed by Facebook stands out for its ability to create interactive and responsive interfaces. React's component-based structure allows the interface to be decomposed into modular units, which promotes reuse and simplified code maintenance. JSX (JavaScript XML) is a fundamental feature of React, which facilitates the declarative description of the interface within JavaScript code, promoting clarity and cohesion in development. In addition to efficient application state management, React offers an ecosystem rich in complementary tools and libraries. The Syncfusion, Vite, DaisyUI, and Tailwind libraries were integrated into the development environment to expand the application's functionality and styling. Syncfusion offers various components and widgets to create rich, dynamic interfaces. Vite is a fast and configurable build tool, providing an agile and efficient development experience. DaisyUI and Tailwind are style libraries that simplify the interface styling process, offering a utility-first approach and reusable components. The choice of React as the main framework for the front end of this project was motivated by its popularity, its active community, and its proven performance in large-scale projects.

4.4.2 Organization

Following good component programming practices for interface design, we have larger directories with all files of a certain type and/or function, grouped into subfolders when necessary. Initially, we have the *App.jsx* file which is the root of every project, it contains two context providers (application and authentication, respectively), and influenced by these, we have the router that receives a layout and routes for all pages accessible; As we do not use different simultaneous versions of the same project, this base always remains unchanged. Finally, we have two optional directories, however, with significant impact on the project: the services folder, containing all the functions necessary to search and change server information, and the *assets* directory, that is, all multimedia content required for quick and better interface perception. When a page is built, it is made available for access behind the routes, its interface is initially filled with layout settings and completed with components. If interactions with the user are necessary, it searches for functionalities in the services and multimedia previously required in the *assets*. If necessary, access to the page can be limited or blocked by the router, requiring you to log in or be in a different situation to have its content freely accessible. Using the *Home* page as an example, we observed that on the same page, we used almost the entire project tree: available only after context authentication, the page searches for user information by services, exposes such information based on components, and has intuitive navigation with the use of easy-to-perceive icons.

4.4.3 State Management

Although the number of screens required to apply Timewise is not plentiful, the project presents complexity in transferring and using data. To help with this structuring and manipulation of states, we mainly use libraries from React itself, whether using *ContextAPI* for creating contexts providing communication between unrelated components and other internal *hooks* of the technology, such as *useNavigate*, responsible for safe navigation between routes and their pages; *useState*, ensuring the component renders whenever a fundamental internal state change; *useEffect*, being able to activate and deactivate key resources during the user's start and use of a page, *ReactRouterDom*, making it possible to create secure routes; between others. Also noteworthy is the use of conditional rendering, using the technology's ability to render only components with changed states and thus creating SPA (single page applications) where users can interact, change, and receive information without leaving the same page or route. In addition to React's internal libraries, we also had access to other external ones, examples of which are: *HeroIconsReact*, responsible for providing more than 250 free icons for a better perception of the project; Axios, facilitating services by simplifying requests; ReHooks/LocalStorage, allowing the use and modification of variable states from the page's local storage as if it were an internal state of useState; UUID (*Universal Unique Identifier*), making it easier to identify tags when creating an identifier.

4.4.4 Security and Authentication

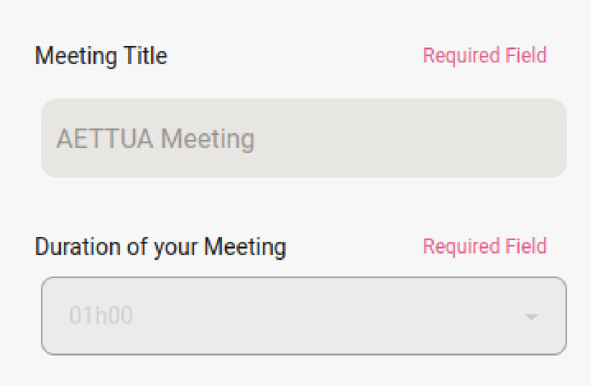
Security and authentication on the front end are implemented robustly and effectively, especially considering using services like Firebase and Auth2.0. In the case of login, integration with Firebase allows users to authenticate through their Google accounts. This significantly simplifies the login process by providing a fluid and familiar experience. Auth2.0, in turn, plays an essential role in managing user identity and access. It offers advanced authentication features such as two-factor authentication, email verification, and password recovery. The integration of these authentication services with the front end is done transparently and securely. Firebase provides a JavaScript library that enables user authentication directly on the front end, while Auth2.0 offers a simple and intuitive API for user identity management. When users try to access the application, they are redirected to the login page, where they log in with their Google account. After successful login, the user is authenticated and can access the application's resources.

4.4.5 User Experience

Our system has always aimed to bring the user the smoothest experience possible, taking into account that organizing life's tasks can often be stressful.

One of our bets was the Gestalt principles. Gestalt principles are a set of fundamental theories and concepts in the psychology of perception, developed by German psychologists Max Wertheimer, Kurt Koffka, and Wolfgang Köhler at the beginning of the 20th century. The word ”Gestalt” comes from German and can be translated as ”form” or ”configuration”. These principles aim to understand how humans perceive and organize the world around them, highlighting underlying patterns and structures in visual perception. They provide valuable insights into how individual elements are perceived about the whole and how our minds tend to organize information in a meaningful and coherent way. Gestalt principles are widely applied in a variety of areas, including graphic design, interface design, architecture, psychology, and art, helping to create more effective and engaging visual and perceptual experiences. [2]

Just giving reference to some of the principles, let's start with the **Proximity Principle**. In this principle, we are told that closer elements are more related to each other than elements that are further away.[3] An example in our interface is filling in the fields in “Meetings”. Each field has a label that is next to it, which makes the user understand that they are related.



Meeting Title Required Field

AETTUA Meeting

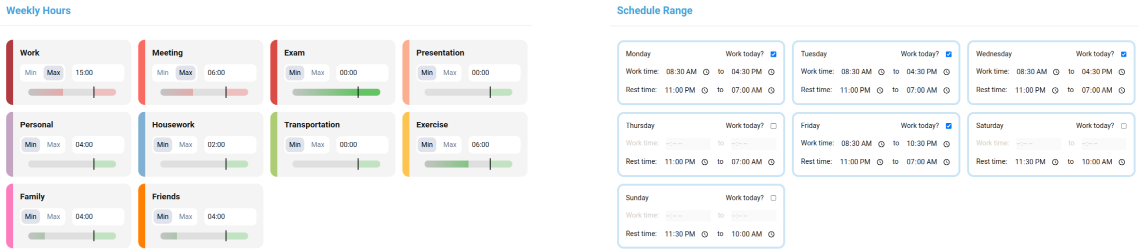
Duration of your Meeting Required Field

01h00

Figure 4.4: Proximity Principle in TimeWise's Interface

Moving on to the **Principle of Similarity**, similar elements are understood as part of a group with the same functionality. [3] In our interface we have two examples that illustrate this principle very well, namely the “Weekly Hours” tab and the “Schedule Range” tab. As the cards are similar to each other, the user can understand that they have the same function, but for different tags. Here we can also associate the Common Region Principle, since these elements are positioned within a closed region, which makes the user realize that they belong to the same group.

The **Continuity Principle** is also present in our system, showing that elements organized in a line or curve are more likely to be related than elements organized randomly. [5] A very simple example



Weekly Hours

Work: Min [✓ Max] 15:00

Meeting: Min [✓ Max] 06:00

Exam: [✓ Min] Max 00:00

Presentation: [✓ Min] Max 00:00

Personal: [✓ Min] Max 04:00

Housework: [✓ Min] Max 02:00

Transportation: [✓ Min] Max 00:00

Exercise: [✓ Min] Max 06:00

Family: [✓ Min] Max 04:00

Friends: [✓ Min] Max 04:00

Schedule Range

Monday — Work today? ☑ — Work time: 08:30 AM to 04:30 PM — Rest time: 11:00 PM to 07:00 AM

Tuesday — Work today? ☑ — Work time: 08:30 AM to 04:30 PM — Rest time: 11:00 PM to 07:00 AM

Wednesday — Work today? ☑ — Work time: 08:30 AM to 04:30 PM — Rest time: 11:00 PM to 07:00 AM

Thursday — Work today? □ — Work time: --:-- -- to --:-- -- — Rest time: 11:00 PM to 07:00 AM

Friday — Work today? ☑ — Work time: 08:30 AM to 10:30 PM — Rest time: 11:00 PM to 07:00 AM

Saturday — Work today? □ — Work time: --:-- -- to --:-- -- — Rest time: 11:30 PM to 10:00 AM

Sunday — Work today? □ — Work time: --:-- -- to --:-- -- — Rest time: 11:30 PM to 10:00 AM

Figure 4.5: Similarity Principles in TimeWise's Interface

of this principle in our interface takes us back to "Meetings", but this time in the steps. Here, from these points, the user can understand what comes next, hence the continuity.

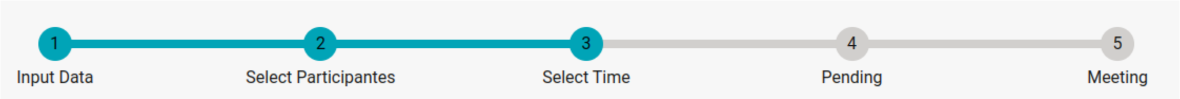


Figure 4.6: Continuity Principle in TimeWise's Interface

One of the greatest examples of the **Closure Principle** is the use of icons, "where simplicity helps with communicating meaning, swiftly and clearly". [2]This happens because most icons seem incomplete, but our mind quickly fills in what is missing and we can quickly understand the intention or meaning of the icon. In the "navbar" of our interface, we find three icons that despite seeming "incomplete", you can easily understand what they are for. Here the user can understand that the icons mean "meeting", "settings", and "logout", respectively.

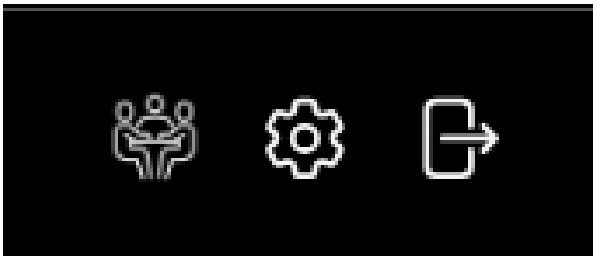
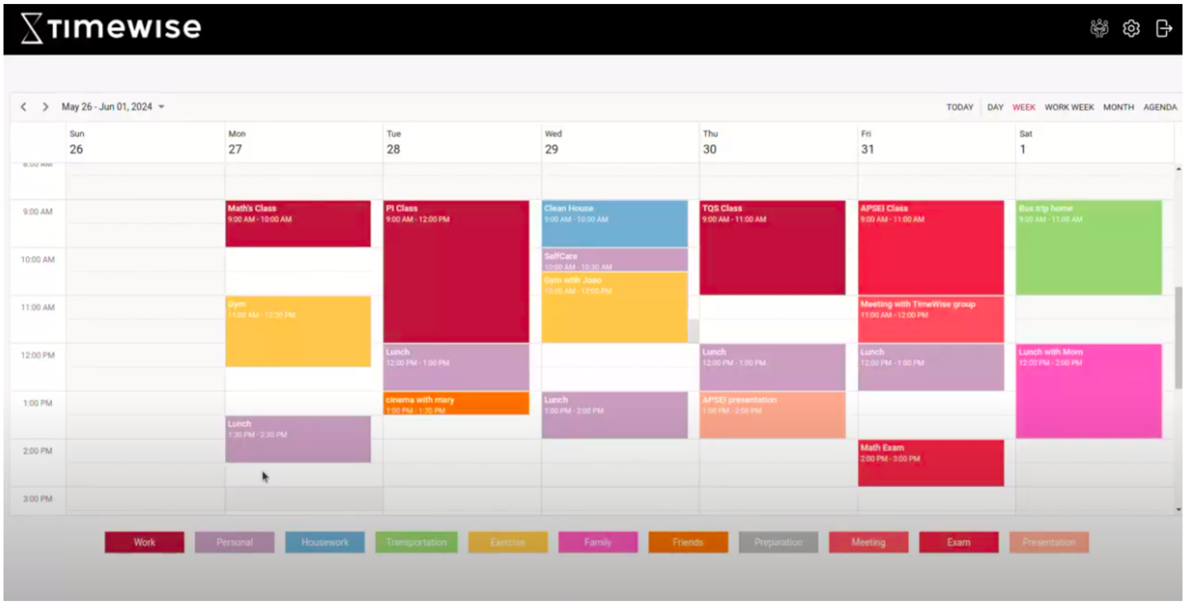


Figure 4.7: Closure Principle in TimeWise's Interface

Finally, we have the **Focal Point Principle**, which states that any element that stands out visually will more easily capture the user's attention. [3] In our interface we can see this principle applied to the calendar on the main page. It is large and colorful, which captures the user's attention.



Math's Class 9:00 AM - 10:00 AM
Gym 11:00 AM - 12:30 PM
Lunch 1:30 PM - 2:30 PM
PI Class 9:00 AM - 12:00 PM
Lunch 12:00 PM - 1:00 PM
cinema with mary 1:00 PM - 1:30 PM
Clean House 9:00 AM - 10:00 AM
SelfCare 10:00 AM - 10:30 AM
Gym with Joao 10:30 AM - 12:00 PM
Lunch 1:00 PM - 2:00 PM
TQS Class 9:00 AM - 11:00 AM
Lunch 12:00 PM - 1:00 PM
APSEI presentation 1:00 PM - 2:00 PM
APSEI Class 9:00 AM - 11:00 AM
Meeting with TimeWise group 11:00 AM - 12:00 PM
Lunch 12:00 PM - 1:00 PM
Math Exam 2:00 PM - 3:00 PM
Bus trip home 9:00 AM - 11:00 AM
Lunch with Mom 12:00 PM - 2:00 PM

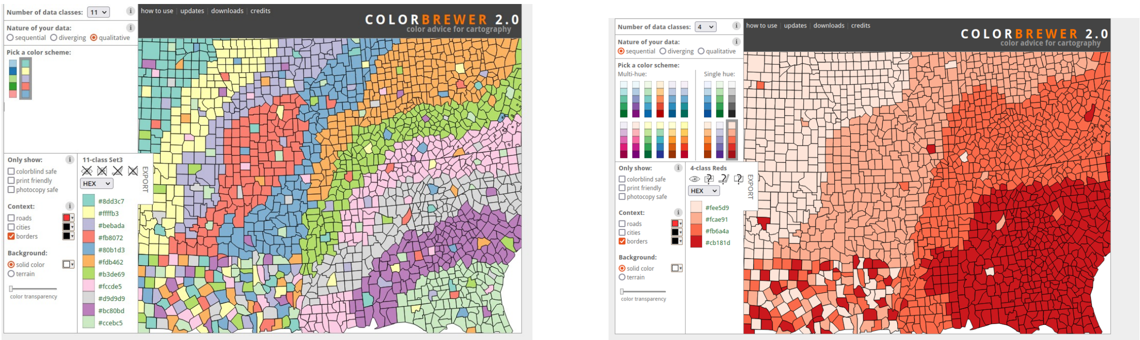
Figure 4.8: Focal Point Principle in TimeWise's Interface

Leaving the Gestalt principles aside, we will now talk about choosing colors for event tags.

Data visualization aims to graphically represent, manipulate, and explore data and information to gain understanding and insight. In this context, color mapping is a crucial technique, but choosing the most appropriate color scale is not just about a colorful and visually appealing representation. Adding color that does not contribute to insight can confuse users when trying to understand its meaning and should therefore be avoided. When selecting a color scale to highlight specific features in data, it is important to consider the linear separability of colors and the perception of similar groups of tones as part of the same group.[4]

From extensive research into the psychology of colors and their impact on the user, we arrived at the colors of tags. Our goal was to select a set of colors that would be highly distinguishable from each other to enhance user experience and usability. To aid in choosing these colors, we turned to the COLOR BREWER website.

Color Brewer provides an environment and a set of color scales designed to help users select the best color options for various applications, such as maps. It offers resources that enable choosing color scales with colors that are optimized for maximum distinguishability. We made only the necessary adjustments to these recommendations to ensure they fit our specific requirements, aiming to create a visually appealing and functional color scheme for our tags.



Number of data classes: 11
Nature of your data: ○ sequential ○ diverging ● qualitative
Only show: □ colorblind safe □ print friendly □ photocopy safe
Context: □ roads □ cities ☑ borders
Background: ● solid color ○ terrain
11-class Set3
HEX
#8dd3c7
#ffffb3
#bebada
#fb8072
#80b1d3
#fdb462
#b3de69
#fccde5
#d9d9d9
#bc80bd
#ccebc5

Number of data classes: 4
Nature of your data: ● sequential ○ diverging ○ qualitative
Only show: □ colorblind safe □ print friendly □ photocopy safe
Context: □ roads □ cities ☑ borders
Background: ● solid color ○ terrain
4-class Reds
HEX
#fee5d9
#fcae91
#fb6a4a
#cb181d

Figure 4.9: Color Brewer's website showing how different color mappings work over mapping data.

We then have the following colors that correspond to each tag:

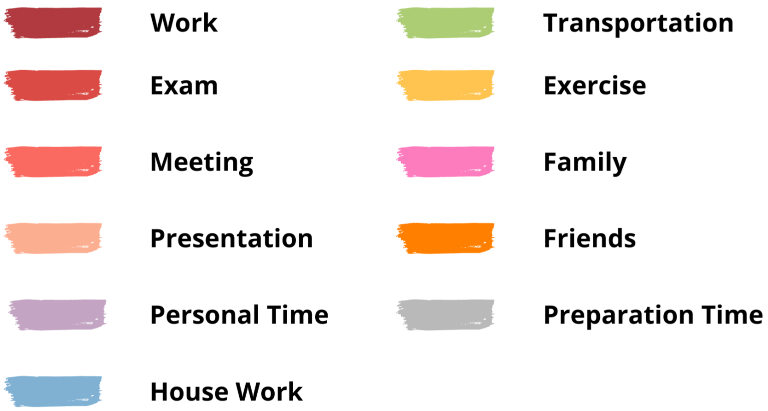


Figure 4.10: Colors associated with each tag

- **Work**: Red was chosen because it is generally associated with something intense or important. (#b03a3f)
- **Exam, Meeting, and Presentation**: As they are variations of the Work tag, they are presented in lighter shades of red. (#da4b45, #fb6a60 and #fcae91 respectively)
- **Personal Time**: The color purple is generally associated with luxury. Unfortunately in today's world, time dedicated to ourselves seems to be a luxury, because many demands are competing for our time and attention. Other sources also suggest that purple can be associated with spirituality, calm, and even inner peace. (#c3a5c3)
- **House Work**: The color blue also has several associated meanings, some of which are organization, efficiency, peace, and even tranquility. We chose blue to represent housework because by organizing our home, we are not only promoting efficiency and organization, but we are also creating an environment of peace and tranquility in our home. (#80b1d3)
- **Transportation**: Often, when traveling, whether by bus, bicycle, or even plane, we tend to look out the window and appreciate what is around us, especially nature. For this same reason, we chose green for this type of activity. (#adcd75)
- **Exercise**: Yellow is a color associated with something optimistic and positive, often used when trying to captivate younger audiences. Here we decided to use yellow as something energetic, not only to captivate the user into wanting to exercise but also to give them an optimistic feeling about what they are going to exercise. (#fec44f)
- **Family**: Pink is a color associated with love and affection and that's why we decided to associate it with family events. (#fc7cbe)
- **Friends**: As for friends, we decided to associate the color orange, a happy color, which also represents the adventurous, creative, and fun spirit that events between friends tend to become. (#ff7f00)
- **Preparation Time**: Finally, for the preparation times, we decided to choose the color gray, so as not to overshadow the other events. (#b9b9b9)

4.5 User/Calendar Service

The User/Calendar Service is responsible for processing user data and their calendar, including integration with the external Google Calendar service. This service uses MongoDB as a database to manage all operations related to the user's calendar.

4.5.1 Functions and Responsibilities

This service offers a range of robust features, focused on managing user data and organizing events. To ensure the security and privacy of users, a symmetric cipher is presented that uses the Fernet cipher algorithm. This was the chosen cipher as it is strong, secure, and widely used to protect confidential data in software applications. The *generate_key* function is responsible for generating secure cipher keys, while *encrypt_token* and *decrypt_token* are responsible for encrypting and decrypting access tokens for the user's Google calendar, respectively. This approach ensures that sensitive user data remains protected during transmission and storage.

In addition to these security functions, the service includes essential functionalities related to calendar management. The *seeEvents* function allows you to view all events related to a specific user, while *get_free_slots* helps to identify available times, within a given time interval, to schedule new appointments. The *create_event*, *create_preparation_event*, *edit_event*, and *delete_event* functions enable users to create, modify, and delete events as needed, offering flexibility and control over their schedule.

To manage and update user data, the service includes the *save_token* function, which stores the encrypted access token in the database, avoiding duplication and guaranteeing the security of the tokens. The *getToken* function retrieves and decrypts the Google Calendar access token, using the user's encryption key to ensure that only the authorized user can access the token. The *save_user* function saves a new user in the database, generating a unique ID and a new encryption key to ensure data integrity. Furthermore, the *get_user_email* and *get_user_id* functions allow you to obtain the user's email and ID, respectively, facilitating the association of events and preferences with the correct user in the system.

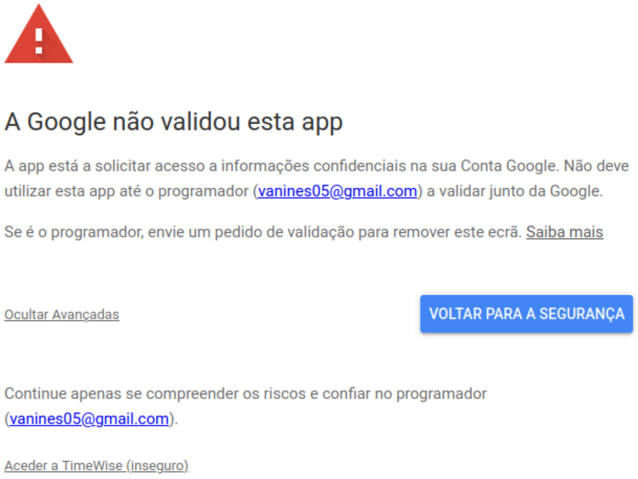
The service also offers specific functionalities for managing hours associated with event tags. The *format_minutes_to_hours* and *parse_hours_to_minutes* functions help with time conversion, allowing you to transform minutes into "hours" format and vice versa. The *get_tag_hours* function retrieves and formats the tag hours associated with events, while *update_tag_hours* updates the hours by adding the duration of new events to the hours already recorded. The *reset_tag_hours* function resets the times of all tags to "00:00", essential for weekly reset times.

To maintain the integrity of event data, the *update_event_tag* function checks whether an event has extended properties and, if so, updates the times associated with the event tag. Finally, the *run_weekly_update* function performs a weekly update, resetting tag hours and recalculating hours based on the current week's events, ensuring that the system is always up to date with the user's time distribution. These features together provide a robust and secure approach to managing calendars and user data, ensuring strict control over data integrity and privacy, as well as offering valuable insights into time spent on different activities.

4.5.2 Integration with Google Calendar

Integration with Google Calendar is a crucial feature of the service, although it has presented specific challenges due to the strict restrictions and requirements of the Google platform. Working with the Google Calendar API was initially complex due to Google's restrictive policies regarding user data security and privacy. To avoid Google's lengthy approval process and simplify integration, the service uses an OAuth2.0 client ID configured as "Desktop" and an API key. This configuration implies that, for users to be able to view their Google calendar within our application, it is necessary to make their Google calendar public. While this may limit users' privacy, it is a pragmatic solution to bypass Google's verification requirements.

An additional challenge arises during the login process, where the page is identified as "dangerous" due to the lack of verification of the application by Google. This results in a warning to the user, requiring forced input to continue, as you can see in Figure 4.11.



A Google não validou esta app

A app está a solicitar acesso a informações confidenciais na sua Conta Google. Não deve utilizar esta app até o programador (vanines05@gmail.com) a validar junto da Google.

Se é o programador, envie um pedido de validação para remover este ecrã. Saiba mais

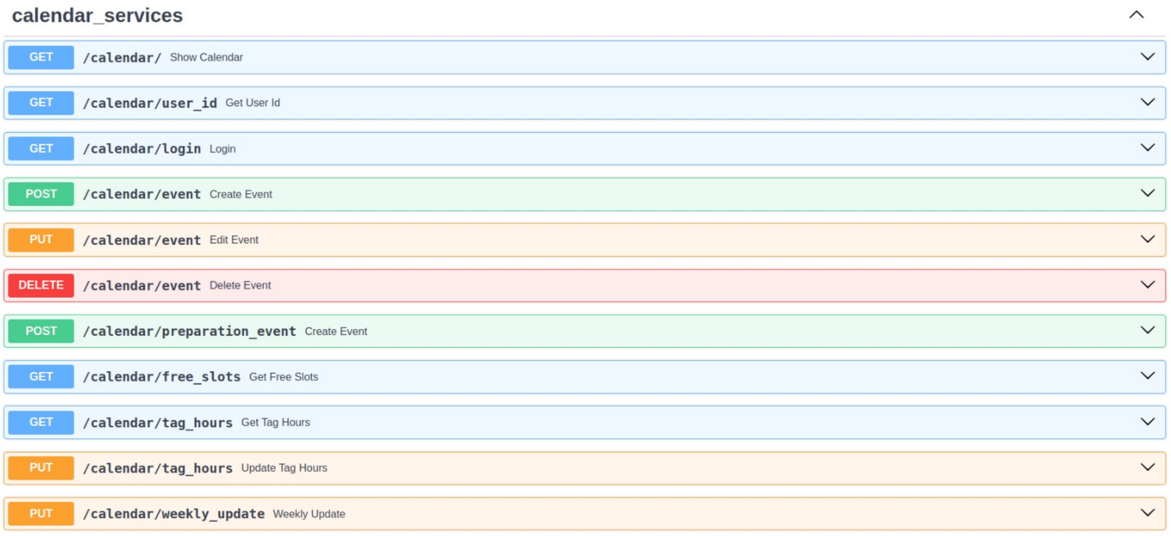
Continue apenas se compreender os riscos e confiar no programador (vanines05@gmail.com).

Figure 4.11: Page presented to the user that says our app is ”dangerous”

While this may cause initial concern, it is an inevitable consequence of Google’s lack of app verification. Despite these obstacles, integration with Google Calendar allows users to access and manage their calendars directly within our app, providing a convenient and seamless experience. Users can view, create, edit, and delete events on their Google Calendar.

4.5.3 Data Storage

For data storage, this module uses MongoDB as a database to manage all operations related to the user’s calendar. It is in this database that all information about the user and their calendar is stored, presenting the following endpoints:



calendar_services

GET /calendar/ Show Calendar
GET /calendar/user_id Get User Id
GET /calendar/login Login
POST /calendar/event Create Event
PUT /calendar/event Edit Event
DELETE /calendar/event Delete Event
POST /calendar/preparation_event Create Event
GET /calendar/free_slots Get Free Slots
GET /calendar/tag_hours Get Tag Hours
PUT /calendar/tag_hours Update Tag Hours
PUT /calendar/weekly_update Weekly Update

Figure 4.12: Endpoints in User/Calendar database

- **GET /calendar/** - Show Calendar
  - Input parameters: user_id
  - Answer: List of events
- **GET /calendar/user_id** - Get User ID

  - Input parameters: email
  - Answer: user ID

- **GET /calendar/login** - Login
  - Input parameters: None
  - Answer: User ID and email

- **POST /calendar/event** - Create Event
  - Input parameters: user_id, event_data (which includes summary, start_time, end_time, description, location, recurrence)
  - Answer: New event ID and event tag

- **POST /calendar/preparation_event** - Create Preparation Event
  - Input parameters: user_id, event_data (which includes summary, start_time, end_time, description, location, recurrence)
  - Answer: New event ID

- **PUT /calendar/event** - Edit Event
  - Input parameters: user_id, event_id, event_data (which includes summary, start_time, end_time, description, location, recurrence)
  - Answer: Edited event ID and event tag

- **DELETE /calendar/event** - Delete Event
  - Input parameters: user_id, event_id
  - Answer: Confirmation that the event has been deleted

- **GET /calendar/free_slots** - Get Free Slots
  - Input parameters: user_id, start_time, end_time
  - Answer: List of free slots in the specified time range

- **GET /calendar/tag_hours** - Get the number of hours the user has spent in the week for each Tag
  - Input parameters: user_id
  - Answer: Tag hours

- **PUT /calendar/tag_hours** - Update hours spent for each Tag
  - Input parameters: user_id, tag_update
  - Answer: Confirmation that tag hours have been updated successfully

- **PUT /calendar/weekly_update** - Weekly update of hours spent for each tag
  - Input parameters: user_id
  - Answer: Confirmation that the weekly update was done successfully

4.5.4 Model

Choosing the model to associate tags with events was an iterative process guided by the desired results. Our primary goal was to implement a robust and accurate system for classifying events based solely on their titles. This classification was essential for organizing events into relevant categories, such as work, personal time, housework, transportation, exercise, and time with family and friends.

Initially, we considered using the *BERT* and *RoBERTa* models, two widely recognized pre-trained language models. However, we realized that these models were not a good fit for our specific use case. *BERT* and *RoBERTa* are more effective in handling longer and more complex contexts, such as full texts, whereas our requirement was to classify events using only their titles, which are typically short and concise.

After exploring other models and pipelines that could provide the desired features, we identified Hugging Face as a valuable resource. Hugging Face is a platform known for offering a variety of cutting-edge language models as well as open-source implementations for the machine-learning community. From the wide range of models provided on the platform, an overall analysis allowed the identification of the *bart-large-mnli* model as an optimal choice for our needs.

The *bart-large-mnli* model is trained on the *MultiNLI* (Natural Language Inference) dataset and focuses on natural language generation, translation, and comprehension tasks. It also offers additional text classification functionality based on natural language inference (NLI), which was particularly relevant for our use case. This zero-shot text classification method works by formulating hypotheses from the event title and analyzing the probability of each hypothesis concerning possible tags.

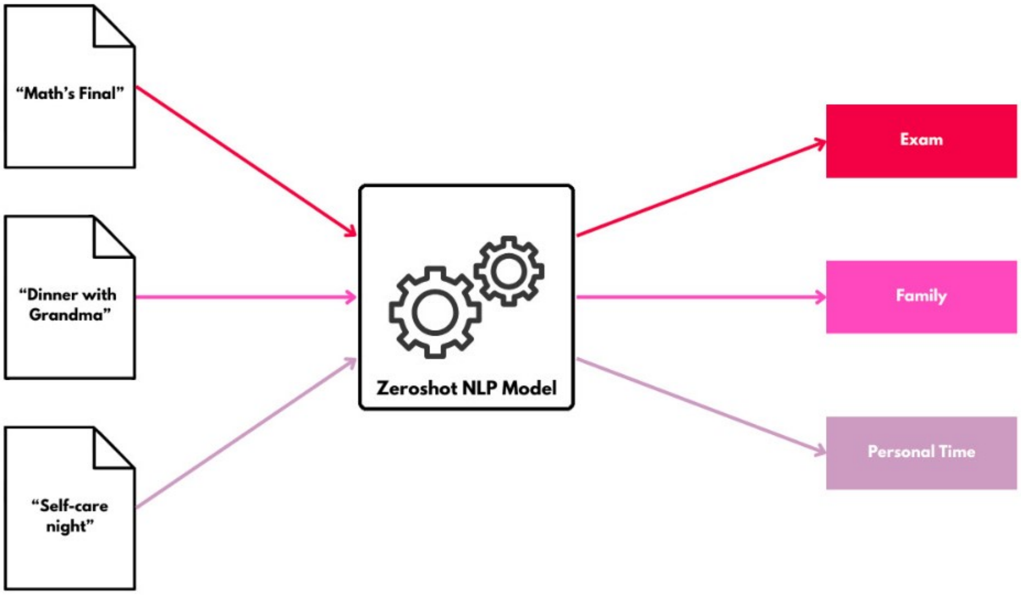


Figure 4.13: Illustration of how the *bart-large-mnli* model works

We chose *bart-large-mnli* as our final model due to its ability to distinguish between our 10 specific tags, 3 of which are subtags related to the "work" tag. This model provided the best balance of accuracy and performance for our specific classification needs. The tags we implemented were carefully chosen to cover a variety of event categories, ensuring comprehensive organization and easy retrieval of events.

This thorough and methodical approach ensured that we selected the most appropriate model to meet our objectives, leveraging the strengths of Hugging Face's offerings to enhance the functionality and user experience of our system.

4.6 Meetings Service

The Meeting Service manages all the logic related to the intelligent scheduling of events between multiple users, from creation to scheduling and participation.

4.6.1 Functions and Responsibilities

The meeting management service is a robust, multi-faceted system that makes it easy to create, organize, schedule, and participate in meetings.

The *create_meeting* function allows you to create a new meeting. The data associated with a meeting is then the meeting ID, the creator's email, the duration of the meeting, title, description, location, time interval in which the meeting can be scheduled, the deadline to respond, and a list of participants. The meeting creator must also provide the time slots in which you can have the meeting, initially suggested by our application based on your preferences and the free slots in that time slot in which the meeting can be scheduled. He can add, remove, or change these slots as needed to schedule the meeting.

The meeting creator can add or remove participants using the *add_participant* and *delete_participant* functions and, when they respond to the request, their status changes, according to the logic of the *participant_decision* function. A user's status can be pending (while not responding), accepted (if they respond to the request and fill in the necessary fields), and declined (if the person, after entering the link, rejects the meeting).

The request is made via an email that is sent to all participants with the creator's email and the link that leads to our app. When entering the link, the user sees all the meeting data where they can or cannot accept joining the meeting. After confirming the data and agreeing to join the meeting, you must select the available times for the meeting, provided by our application, according to your preferences, as given to the organizer. You can add, remove, or change these slots.

When all participants respond, the compatibility of all slots is evaluated by the *slots_compatibility* function, which calculates the compatibility of the participants' slots with those of the meeting creator so that the slots with greater compatibility have higher priority to be chosen. The *get_best_slot* function calculates the best slot for everyone, taking into account the creator's slots, their compatibility with those of other participants, and the duration of the meeting. It is also checked here if users have scheduled any other event in any of the slots they initially had informed that he was available for the meeting, using the *slot_availability* function.

Then, using the *schedule_meeting* function, the best slot chosen by our system is marked on the calendar of the creator and all participants, and all meeting information is deleted from the database.

4.6.2 Integration with Other Services

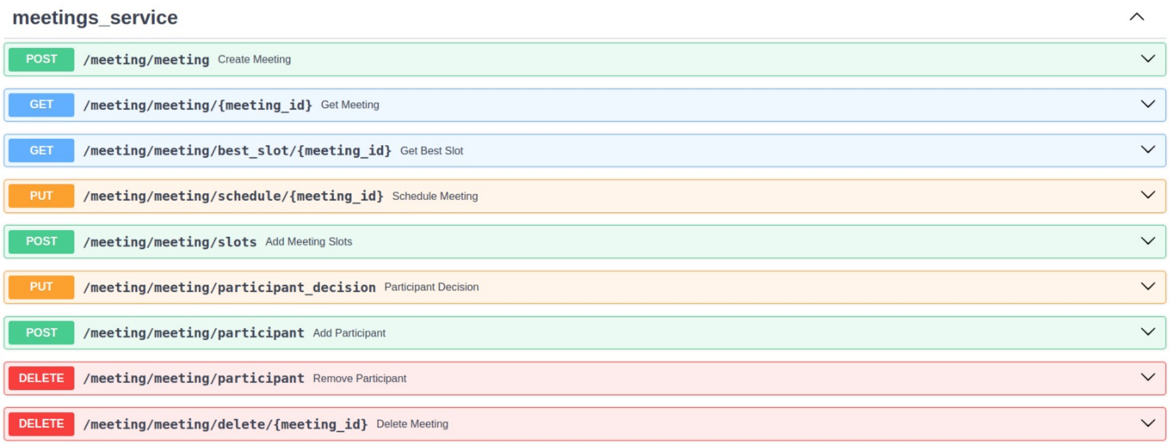
Integration of the meeting management service with other services, such as the User/Calendar Service, is essential to provide an integrated and efficient user experience. Connecting to the user-related part of the database, which manages user information such as emails and IDs, allows obtaining essential user IDs for functions such as *schedule_meeting* and *slot_availability*. It is thanks to this that participants can be validated and verified.

Integration with the part of the database related to calendars, which manages users' calendars and availability, allows checking availability and scheduling events. The *slot_availability* function makes calls to the User/Calendar Service to obtain free slots from participants and the meeting creator, while the *schedule_meeting* function uses the User/Calendar Service to create events on participants' calendars. This is where we can check whether the meeting was scheduled and the availability of participants.

Automatic availability checking reduces the likelihood of conflicting schedules by ensuring meetings are scheduled only when all participants are available, and most operations are automated, from meeting creation to participant notification, increasing efficiency and reducing administrative burden.

4.6.3 Data Storage

For data storage, this module uses MongoDB as a database to manage all meeting data, until it is schedule, as we can see in the following endpoints:



meetings_service

POST `/meeting/meeting` Create Meeting

GET `/meeting/meeting/{meeting_id}` Get Meeting

GET `/meeting/meeting/best_slot/{meeting_id}` Get Best Slot

PUT `/meeting/meeting/schedule/{meeting_id}` Schedule Meeting

POST `/meeting/meeting/slots` Add Meeting Slots

PUT `/meeting/meeting/participant_decision` Participant Decision

POST `/meeting/meeting/participant` Add Participant

DELETE `/meeting/meeting/participant` Remove Participant

DELETE `/meeting/meeting/delete/{meeting_id}` Delete Meeting

Figure 4.14: Endpoints in meetings database

- **POST /meeting/meeting** - Create Meetings
  - Input parameters: meeting (which includes meeting_id, creator_email, meeting_time, summary, description, location, start_day, end_day, deadline, participants, and slots where the creator intends to have the meeting)
  - Answer: Confirmation that the meeting was created
- **GET /meeting/meeting/{meeting_id}** - Get Meeting Details
  - Input parameters: meeting_id
  - Answer: Meeting details
- **GET /meeting/meeting/best_slot/{meeting_id}** - Get Best Slot
  - Input parameters: meeting_id
  - Answer: Best slot found according to the compatibility of the participants' slots with those of the creator and the duration of the meeting
- **PUT /meeting/meeting/schedule/{meeting_id}** - Schedule meeting
  - Input parameters: meeting_id, event(which includes, summary, description, location, start_time, end_time)
  - Answer: Confirmation that the meeting has been scheduled on all participants' calendars
- **POST /meeting/meeting/slots** - Add Participant Slots to the Meeting
  - Input parameters: meeting_id, email, slots (in which the participant intends to have the meeting)
  - Answer: Confirmation that slots have been added
- **PUT /meeting/meeting/participant_decision** - Declare the Participant's Decision
  - Input parameters: meeting_id, email

  - Answer: Confirmation that the participant's status has been updated

- **POST /meeting/meeting/participant** - Add Participant Email
  - Input parameters: meeting_id, email
  - Answer: Confirmation that the participant has been added

- **DELETE /meeting/meeting/participant** - Remove Participant
  - Input parameters: meeting_id, email
  - Answer: Confirmation that the participant has been removed

- **DELETE /meeting/meeting/delete/{meeting_id}** - Delete Meeting
  - Input parameters: meeting_id
  - Answer: Confirmation that the meeting has been deleted

4.6.4 Access Control and Security

Our system allows users to only see meeting details and confirmation responses from other participants. No user, including the organizer, can see the available slots selected by other participants. Meeting scheduling is exclusive to the organizer, who can only see the slot with the best compatibility, without access to specific slots chosen by other users.

4.7 Suggestions Service

The Suggestions Service performs the event suggestions logic, calculating available slots based on the user's preferences. It maintains a database to store users' preferences, facilitating personalized and relevant suggestions.

4.7.1 Functions and Responsibilities

It is in this service that all the logic behind suggesting event preparation slots is made.

Among the main features, slot management and scheduling stand out. The *get_free_slots_from_calendar* function retrieves the free time slots in the user's calendar, while *generate_daily_slots* generates daily time slots based on the user's preferences. The *adjust_slot_boundaries* function adjusts slot boundaries to avoid overlapping with user-defined rest periods. Additionally, *filter_slots* filters available slots according to the specific event tag, ensuring that events are scheduled at appropriate times. The *divide_hours_into_slots* function divides the available hours into smaller slots, since the Google Calendar API provides time slots and not divided slots, making it easier to schedule multiple events, and *schedule_slots_in_calendar* schedules the filtered slots in the user's calendar, ensuring that appointments be added without conflicts.

Event suggestion is an essential feature of the service. The *get_suggestions* function generates event suggestions, in this case, the preparation of other events, based on the working and rest hours of users' preferences, the available slots in their calendar, and the time required for the event tag to be prepared to propose ideal times for new preparation events. The *get_tag_infos* function retrieves information about tags, such as the preparation hours each one requires. The *number_of_days_between* function calculates the number of days between the current date and the event date, assisting in the preparation and planning of events that require preparation. User preferences are another central aspect of the service. It is the *add_user_preferences* function that inserts the default preferences into the user database. The *update_all_user_preferences* function updates all user preferences, facilitating complete reconfiguration. The *update_weekly_hours* function adjusts the weekly hours that the user wants to allocate to each type of event.

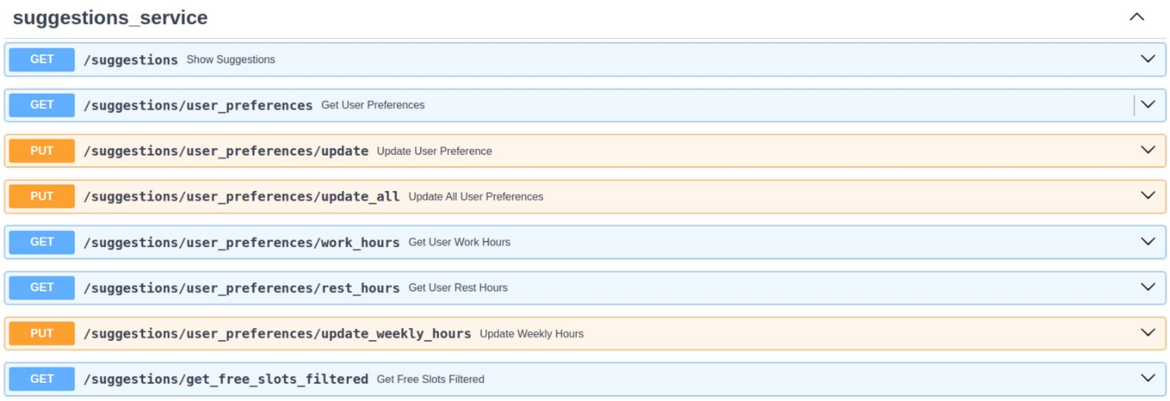
Additionally, *get_user_preferences* shows the user's preferences, while *get_user_work_hours* and *get_user_rest_hours* get the user-defined work and rest hours for each day, respectively.

Event suggestion logic allows you to personalize the scheduling experience for each user. This functionality uses a set of user preferences, including work and rest hours. Initially, user preferences are collected and stored, including work and rest hours for each day of the week. Based on these preferences and the user's current calendar, the system generates available time slots. If the event is work-related, the app will only suggest slots within user-defined working hours. Likewise, for non-work related events, only slots outside of working hours will be suggested. Using information about available slots and user preferences, the service generates suggestions for preparation events, depending on the preparation hours required for each type of event (tag), optimizing the use of the user's time and respecting their rest periods and work.

These features and the implemented business logic ensure that users can manage their events in an efficient and personalized way. The integration of detailed preferences allows the service to offer event suggestions that align with each user's individual goals and needs, optimizing their time and improving their productivity.

4.7.2 Data Storage

For data storage, this module uses MongoDB as a database to manage all the user's preferences, as we can see in the following endpoints:



suggestions_service

GET /suggestions Show Suggestions

GET /suggestions/user_preferences Get User Preferences

PUT /suggestions/user_preferences/update Update User Preference

PUT /suggestions/user_preferences/update_all Update All User Preferences

GET /suggestions/user_preferences/work_hours Get User Work Hours

GET /suggestions/user_preferences/rest_hours Get User Rest Hours

PUT /suggestions/user_preferences/update_weekly_hours Update Weekly Hours

GET /suggestions/get_free_slots_filtered Get Free Slots Filtered

Figure 4.15: Endpoints in user's preferences database

- **GET /suggestions** - Show Suggested Preparation Times
  - Input parameters: user_id, summary, end_time, tag
  - Answer: List of preparation slots
- **GET /suggestions/user_preferences** - Get User Preferences
  - Input parameters: user_id
  - Answer: User preferences such as work time, rest time, and weekly hours
- **PUT /suggestions/user_preferences/update** - Update User work and rest time
  - Input parameters: user_id, type, day, start_time, end_time
  - Answer: Confirmation that the user preference has been updated successfully
- **PUT /suggestions/user_preferences/update_all** - Update All User Preferences
  - Input parameters: user_id, preferences
  - Answer: Confirmation that the user preference has been updated successfully
- **GET /suggestions/user_preferences/work_hours** - Get User Work Hours

  - Input parameters: user_id
  - Answer: User's work hours

- **GET /suggestions/user_preferences/rest_hours -** Get User Rest Hours
  - Input parameters: user_id
  - Answer: User's rest hours

- **PUT /suggestions/user_preferences/update_weekly_hours -** Update Weekly Hours for each Tag that the User intends to spend
  - Input parameters: user_id, weekly_hours(tag, min or max, horas)
  - Answer: Confirmation that weekly hours were updated successfully

- **GET /suggestions/get_free_slots_filtered -** Get Free Slots Filtered by User Work and Rest Hours
  - Input parameters: user_id, start_time, end_time
  - Answer: List of filtered free slots

Chapter 5

User Study

In developing our application, we have always prioritized user experience, creating a user-centric platform. We have aimed to simplify the user's interactions, making the app not only functional but also intuitive. We attribute these qualities to our application, Timewise, making it uniquely tailored to efficient time management. Recognizing the significance of user experience, we conducted usability studies and tests to pinpoint both the strengths and the challenges faced by users, allowing us to continually refine and enhance our application.

5.1 Experimental Design

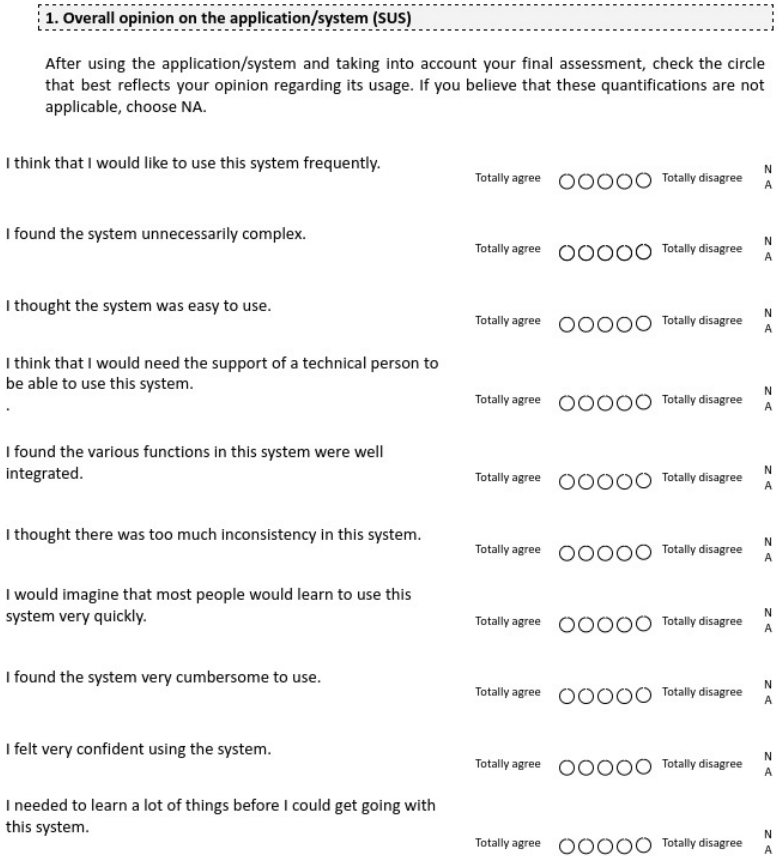
Designing an experiment is a fundamental aspect of scientific research, aimed at testing hypotheses and establishing causal relationships. In defining our experimental design, we meticulously followed a structured approach, which involved several critical steps: defining variables, formulating hypotheses, and outlining experimental procedures.

5.1.1 Define Variables and Measures

First, we started with our independent variables, these are the functionalities of the app, which included scheduling simple events, scheduling events with preparation time, setting work and rest hours, setting goals, and scheduling meetings. These features were manipulated during the experiments to observe their effects.

Having the independent variables defined we conclude that our primary dependent variable was the efficiency of time management as experienced by the users. To evaluate this, we asked participants to describe how they would typically perform tasks such as scheduling study sessions, tracking gym hours, and organizing meetings before using our app. We then compared these processes to the steps required when these users, doing the same tasks, were using Timewise, aiming to quantify any improvements.

As a secondary measure of our app's impact on this dependent variable, participants completed a brief questionnaire post-experiment,as shown in Figure 5.1, providing feedback on their experience using Timewise and their satisfaction with its features for organizing their time.



1. Overall opinion on the application/system (SUS)

After using the application/system and taking into account your final assessment, check the circle that best reflects your opinion regarding its usage. If you believe that these quantifications are not applicable, choose NA.

I think that I would like to use this system frequently.	Totally agree	○○○○○	Totally disagree	NA
I found the system unnecessarily complex.	Totally agree	○○○○○	Totally disagree	NA
I thought the system was easy to use.	Totally agree	○○○○○	Totally disagree	NA
I think that I would need the support of a technical person to be able to use this system. .	Totally agree	○○○○○	Totally disagree	NA
I found the various functions in this system were well integrated.	Totally agree	○○○○○	Totally disagree	NA
I thought there was too much inconsistency in this system.	Totally agree	○○○○○	Totally disagree	NA
I would imagine that most people would learn to use this system very quickly.	Totally agree	○○○○○	Totally disagree	NA
I found the system very cumbersome to use.	Totally agree	○○○○○	Totally disagree	NA
I felt very confident using the system.	Totally agree	○○○○○	Totally disagree	NA
I needed to learn a lot of things before I could get going with this system.	Totally agree	○○○○○	Totally disagree	NA

Figure 5.1: Questionnaire Post-Experiment

To ensure the reliability of our results, we defined some control variables: the participants were provided with the same computing equipment and conducted the tests in a similar informal environment. This controlled setting helped eliminate external factors that could influence the outcomes of the study. Additionally, we actively engaged with participants, encouraging them to voice their questions and suggestions, thereby fostering an open dialogue that enriched our insights.

5.1.2 Hypothesis Formulation

A crucial step in experimental design is the formulation of hypotheses. This process involves creating a clear and testable prediction based on the expected relationship between the independent and dependent variables under study. For our study, the main hypothesis was formulated as follows:

Hypothesis: ”The implementation of specific features in the Timewise app, such as scheduling simple events, configuring work and rest hours, and organizing meetings, will significantly increase the efficiency of time management for users compared to the traditional methods they previously used.”

This hypothesis is based on the assumption that tools and features designed to facilitate organization and planning will help users complete their tasks more quickly and effectively. By testing this hypothesis, we seek concrete evidence to confirm or refute our prediction, using data collected from experimental activities and questionnaire responses.

5.1.3 Develop Experimental Procedures

To initiate the experiment, we introduced participants to the concept of TimeWise. We began with a brief explanation to ensure all users understood the context of TimeWise: “TimeWise is a smart calendar manager designed to simplify the process of managing your schedule, making it easier to plan your week and keep track of your appointments, tasks and goals, alongside an easier way to schedule meetings between multiple people. “

Following this introduction, we presented a promotional video of our app. This video not only detailed the features of our app through high-level explanations but also included practical applications and a touch of comedy to engage the participants and ensure they paid close attention to the TimeWise features. This step was crucial to guarantee that users understood how to operate the app effectively, ensuring that their user experience would not be hindered by unfamiliarity with the system.

Monitoring and data collection were conducted in two primary ways:

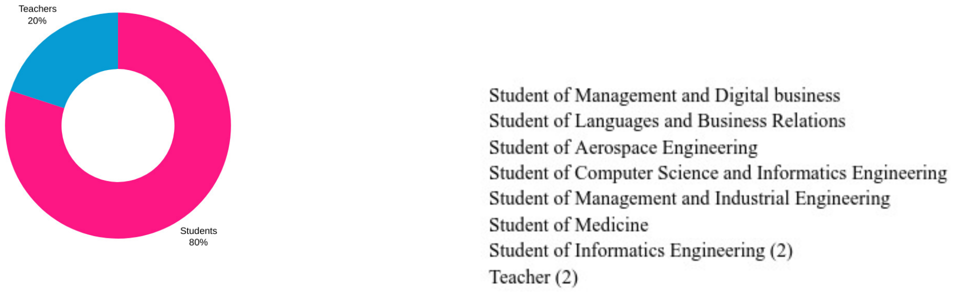
1. Throughout the experiment, one researcher was responsible for administering tasks, responding to participants’ questions, and providing necessary assistance. Concurrently, another researcher observed the test sessions, specifically noting the steps taken by participants. This observer focused on documenting any difficulties, suggestions, and questions raised by the participants, which were crucial for understanding user interaction and challenges.

2. After completing the tasks, participants were asked to fill out a questionnaire. This survey was designed to gather feedback on their experience using TimeWise, including their level of satisfaction with the app’s features and the overall ease of use.

These combined methods of monitoring and data collection allowed us to gather comprehensive insights into how participants interacted with TimeWise and their perceptions of its effectiveness. This data is instrumental in further refining the app to better meet the needs of its users.

5.1.4 Participants Selection

In selecting participants for this research, we focused on assembling a diverse group from our target audience, considering the main factors that could influence the use of our app. We selected 10 individuals in total, composed of 8 students and 2 teachers. The students were chosen from a variety of academic degrees to cover different needs and calendar requirements. For instance, a student from the Computer Science area typically focuses on projects throughout the year, on the other side a Management student is more concerned with preparing reports and studying for multiple exams.



Student of Management and Digital business
Student of Languages and Business Relations
Student of Aerospace Engineering
Student of Computer Science and Informatics Engineering
Student of Management and Industrial Engineering
Student of Medicine
Student of Informatics Engineering (2)
Teacher (2)

Figure 5.2: Diversity of Participants and their Degrees

We also considered the participants’ levels of informatization to ensure that TimeWise is accessible to both tech-knowledge individuals and those with limited exposure to technology.

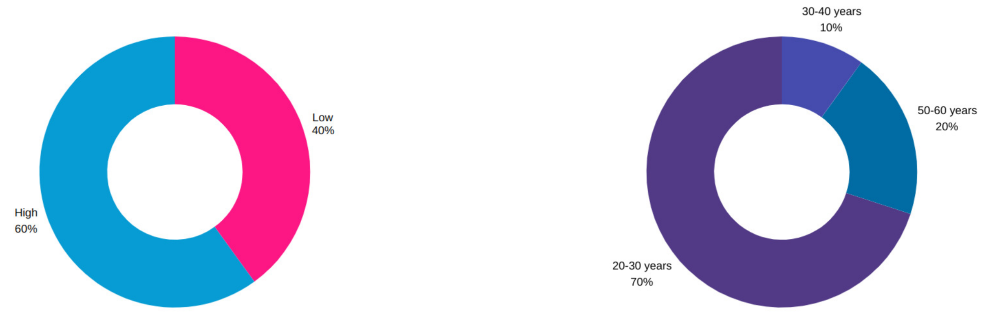


Figure 5.3: Participants' Informatization Level and Age Diversity

Another aspect we evaluated was the participants' familiarity with similar systems. We asked how much they knew about this type of system, categorizing their responses into three levels: none, some, and a lot. Those who reported 'some' or 'a lot' of familiarity were also asked which systems they had experience with, Google Calendar and Motion were the most commonly mentioned.

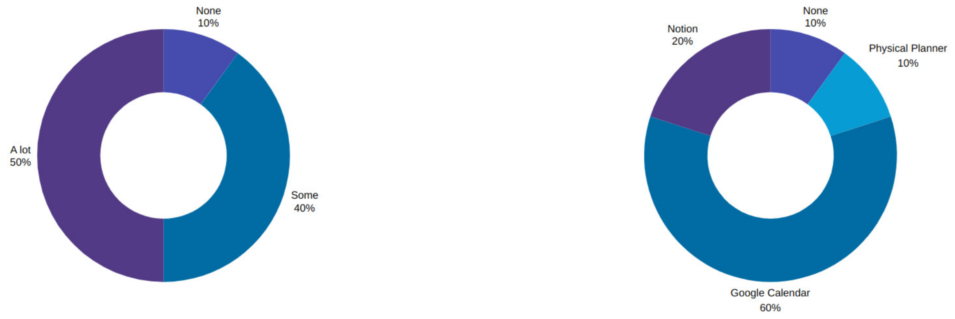


Figure 5.4: Participants' Confort with Technologies and which ones

All these considerations have led to a well-rounded and diverse sample, providing us with reliable data that accurately reflects the reality of our app's usage. This approach significantly reduces the likelihood of data bias.

5.2 Tasks

The tasks assigned to the users served as practical examples of various use cases. Each task included a specific scenario requiring the users to perform actions that demonstrated the applicability and effectiveness of the system in real-world settings. Following the completion of each task, we posed a question to the user. This question was designed to assess whether the user understood the impact and outcome of the action they had just performed. Here is an outline of the tasks provided:

"Task 1: Schedule a simple example "

1. Schedule a Math class for Monday, May 27th, at 10 AM. The location of the class is at DETI, and the description is "Geometry lesson."
   What tag was assigned to the class?

"Task 2: Schedule an event with preparation time "

1. Schedule a Math exam for Monday, June 3rd, at 9 AM, with preparation times.
   What days were set for preparation times?
2. Add two hours to the closest schedule to the exam.
3. Confirm the action.

“Task 3: Update Rest and Work hours ”

1. Access the settings.
2. Update your Thursday schedule to take the day off.
3. Update your Friday rest schedule to start at 10 AM.

“Task 4: Update Goals “

1. Still on the settings page, update your Weekly Hours (Goals) to exercise for at least 3 hours per week.
   With the change, have you already achieved your weekly exercise goal?

“Task 5: Create a Meeting “

1. Go to the meeting creation page.
2. Create a meeting for the Science Project, lasting one hour, with possible dates from the 29th to the 31st. The location is at DETI. The last possible date for participants to respond is the 28th.
3. Proceed to the next step.
4. Add the email lilianapcribeiro@gmail.com.
5. Proceed to the next step. *What do the slots in front of you represent?*
6. Remove the schedule for Wednesday, the 29th, from 12 PM to 1 PM.
7. Proceed to the next step. *What else is needed to finalize the meeting?*

5.3 Data Collection and Analysis

The data collected from the post-task questionnaire included responses where each participant indicated their level of agreement by selecting one of five options, ranging from ”Totally Agree” to ”Totally Disagree.” For our analysis, a rating of 1 corresponds to ”Totally Agree,” and a rating of 5 corresponds to ”Totally Disagree.” The intermediate ratings are distributed accordingly within this range.

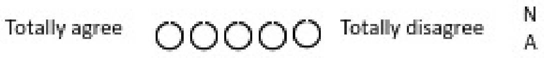


Figure 5.5: Ratings Range

- **I think that I would like to use this system frequently.**

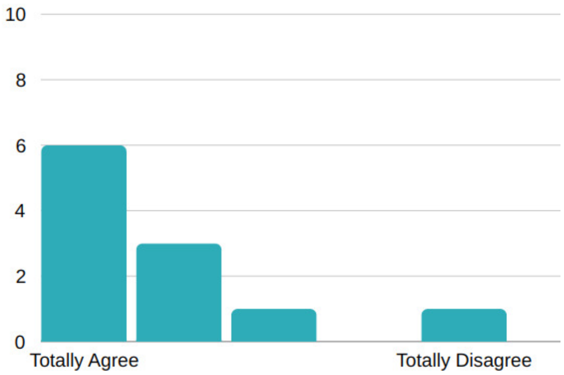


Figure 5.6: Answers to the question: ”I think that I would like to use this system frequently.”

A majority of participants indicated a strong preference for frequent use of the system (60% agree). This suggests a general approval of the system’s capabilities and potential value to users. There was one response of totally disagreed, which was justified by the participant as not wanting to change from a physical calendar to an online calendar.

- **I found the system unnecessarily complex.**

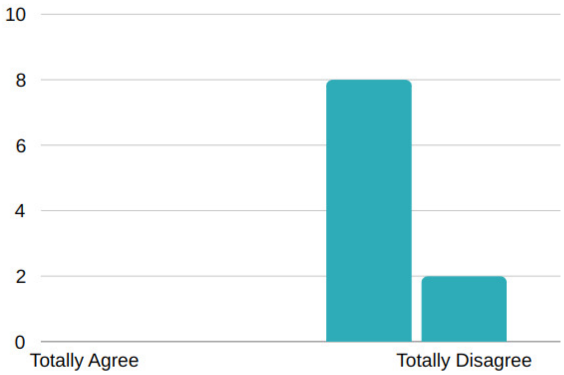


Figure 5.7: Answers to the question: ”I found the system unnecessarily complex.”

The system was perceived as not being overly complex, which is indicated by most ratings being 4 or 5 (disagree to totally disagree). This suggests that users find the system reasonably straightforward, which is a positive aspect of usability.

- **I thought the system was easy to use.**

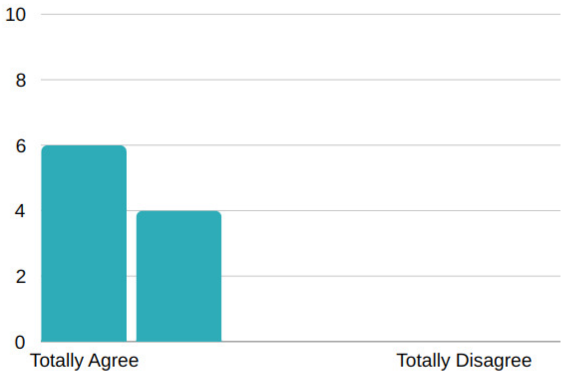


Figure 5.8: Answers to the question: ”I thought the system was easy to use.”

Participants generally found the system easy to use, with a majority giving ratings of 1 or 2 (agree to totally agree). This is encouraging, as it indicates that the system is user-friendly and accessible.

- **I think that I would need the support of a technical person to be able to use this system.**

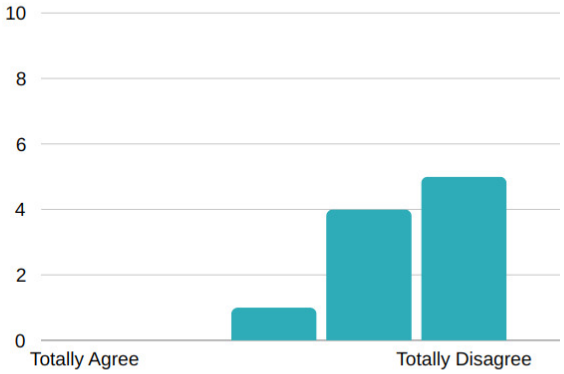


Figure 5.9: Answers to the question: ”I think that I would need the support of a technical person to be able to use this system.”

The feedback suggests that most users feel confident using the system without the need for technical support, as evidenced by high ratings of 4 or 5.

- **I found the various functions in this system were well integrated.**

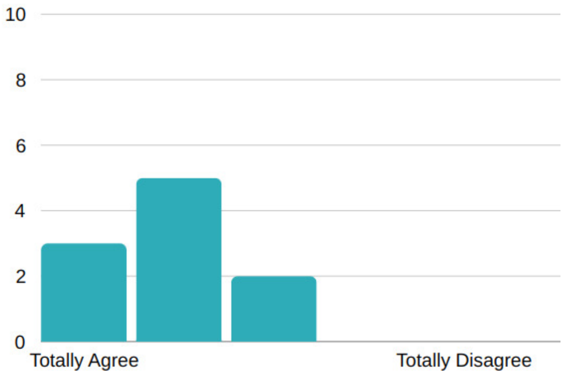


Figure 5.10: Answers to the question: "I found the various functions in this system were well integrated."

The integration of functions within the system is generally well-received, with most responses indicating agreement (ratings of 1 and 2) that the functions are well integrated.

- **I thought there was too much inconsistency in this system.**

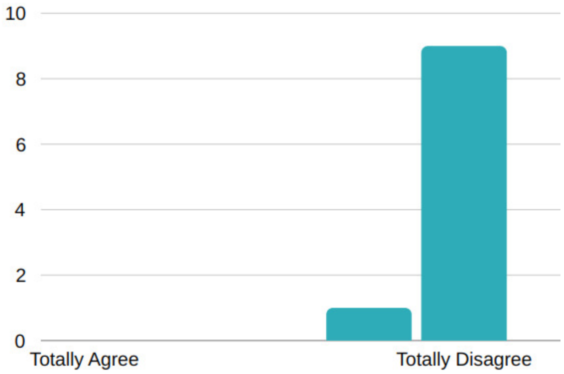


Figure 5.11: Answers to the question: "I thought there was too much inconsistency in this system."

The consistency of the system was highly rated, with the majority giving a rating of 4 or 5, indicating that users found the system to be consistent and reliable. Some users also expressed appreciation for the feature that suggests preparation time slots and meeting slots, which are differentiated by color (blue and pink, respectively) to maintain clarity and coherence.

- **I would imagine that most people would learn to use this system very quickly.**

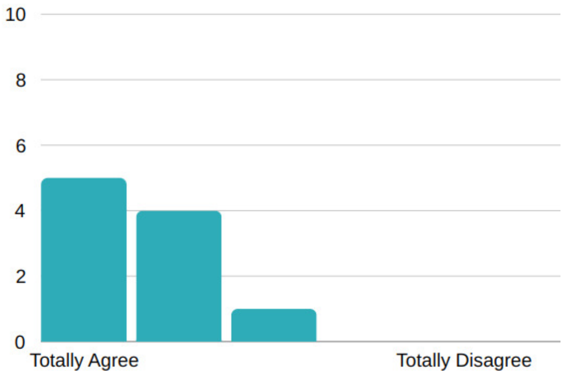


Figure 5.12: Answers to the question: ”I would imagine that most people would learn to use this system very quickly.”

The responses indicate that users feel the system is easy to learn quickly, with the majority giving ratings of 1 and 2. This is beneficial for new user adoption and overall user experience.

- **I found the system very cumbersome to use.**

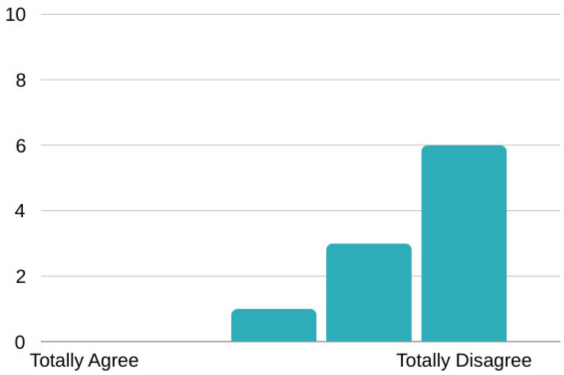


Figure 5.13: Answers to the question: ”I found the system very cumbersome to use.”

Most participants disagreed that the system is cumbersome to use, as indicated by ratings of 4 and 5. This suggests that the system is considered manageable and user-friendly.

- **I felt very confident using the system.**

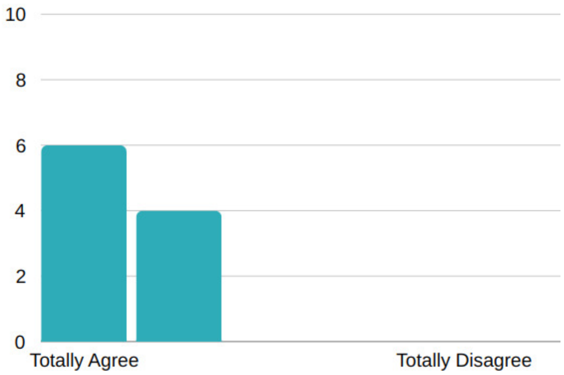


Figure 5.14: Answers to the question: ”I felt very confident using the system.”

Confidence among users is high, with most indicating they felt very confident using the system (ratings of 1 and 2). This confidence is likely due to the system’s ease of use and intuitive design.

- **I needed to learn a lot of things before I could get going with this system.**

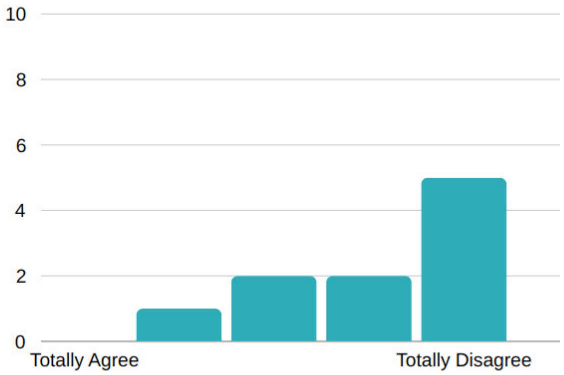


Figure 5.15: Answers to the question: ”I needed to learn a lot of things before I could get going with this system.”

Among students, there is a consensus that the system does not require extensive learning before use, as evidenced by the predominance of ratings of 4 and 5. However, all teachers rated this aspect with a grade of 3, indicating a moderate perception that for teachers and persons with less tech knowledge, some initial learning is necessary.

5.4 Results and Discussion

The feedback collected from the post-task questionnaire underscores the system’s strengths in usability and user engagement, demonstrating its effectiveness in meeting diverse user needs. However, the responses also revealed a slight learning curve among less tech-knowledge users, such as teachers, suggesting the need for targeted training or simplified features to enhance accessibility and ease of use.

Additional feedback from users outside the questionnaire highlighted several areas for further improvement:

Language and Terminology: Many users experienced difficulties understanding the application’s language. To address this, we plan to implement an onboarding process during the first use, which will guide users through the app’s functionalities and terminology.

Goal Functionality: There is a need to better motivate users to utilize the goal-setting features. We plan to implement weekly notifications to help users achieve their goals.

Meeting Participant Selection: Users suggested adding the ability to create groups for selecting meeting participants, which could streamline the process and enhance functionality.

Meeting Scheduling Process: The method used for scheduling meetings was noted to be unconventional and uncommon during initial use. We aim to clarify this process through enhanced instructions and a detailed walkthrough in the first use.

While the system's design and functionalities were generally well-received, the feedback indicates that ongoing adjustments and enhancements are necessary to further refine the user experience and ensure the system remains adaptable and inclusive for all user groups.

Chapter 6

Concluding Remarks and Future Work

Timewise stands out as an innovative solution to the problem of time management, described at the beginning of the document, offering several benefits and differences that distinguish it from other solutions on the market.

The system provides an easy transition from the already existing calendar in the user's Google account, with no need to reschedule events.

The user can track their weekly goals and define their rest and work hours for a more accurate experience in the application. This then takes us to the features that most differentiate us from other systems on the market and help users solve the problem of time management. Firstly, we automatically mark preparation events, which reduces the time a user spends marking less relevant events. Then we have the scheduling of meetings between several people, which also reduces a lot of the time that used to be spent on other ways of scheduling meetings.

In our **future plans** for the system, we aim to carefully consider the insights derived from user feedback obtained through usability tests, particularly about the front end. Additionally, we plan to implement an onboarding process to facilitate users' initial interaction with our application, making it more user-friendly and intuitive.

To enhance users' organizational capabilities, we are considering the incorporation of a TODO list and weekly feedback feature, enabling users to track their progress toward their objectives and monitor time spent on various activities.

Moreover, to further improve the user experience, we would like to explore the integration of artificial intelligence for scheduling preparation events. This would allow the system to adapt to users' routines and recommend optimal time slots.

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