SAPIENZA
UNIVERSITÀ DI ROMA

FUH: Future University Hub

Human Computer Interaction

Engineering in Computer Science Sapienza, Rome, Italy

Presented By:

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Academic Year 2022/2023

1. ABSTRACT

Now more than ever, university students from all over the world need technical support increasingly sophisticated in order to successfully overcome academic obstacles. Indeed, it is crucial to develop an application that can help students to overcome nowadays university challenges. Indeed, **FUH: Future University Hub** is designed to provide a hub for enrolled and future students, offering a wide range of useful features in order to support them during their entire university careers.

The app is developed to be a centralised platform for students, providing them with all the information, resources and services for their university needs. It includes a map of the university, highlighting all relevant locations. This feature alone can save students a lot of time and hassle as they navigate the sprawling university grounds.

The app also includes a map of the main libraries of the university, which can be a huge help for students who need to access resources for their exams or for students who want to focus. Additionally, the app has a news section that will keep students updated with the latest developments at university, ensuring that they do not miss any important events or deadlines.

Another key feature of the app is the tuition fees section, where students can easily check their payment status for the semester. The app also includes an exam section, where students can view upcoming exam dates and book them.

The personalised calendar feature is another major benefit of the app, which helps students keep track of their schedule based on their registered classes. The app also has a section for every course that includes detailed descriptions, syllabuses, exam modes, and class material only for registered users, as well as a lesson log to track their progress. For unregistered students, the app provides sample material to give an overview of the course.

Moreover, there is the section related to the virtual card that displays a digital version of their student ID card. The card contains the student's photo, name, ID number, and other relevant information such as their course of study, enrollment status, and expiration date.

Overall, this application is a must-have for any university student looking to streamline their experience and take their studies to the next level.

2. REQUIREMENT ANALYSIS

2.1 Competitors analysis

As for the competitors for our application, we looked at the apps which already provided some of the features of our project, with their strengths and weaknesses.

The main competitors of the application are, regarding ***private apps***:

1) **My Libretto**

Pros:

- You can register your lesson hours
- There is a tuition fees functionality, which allows you to register the fees to pay and the ones already paid
- There is a news section for your university
- You can see statistics and graphs regarding your marks

The main disadvantage of the app is that it is not integrated with the university internal system, so all lesson hours, tuition fees, marks and grades must be personally added to the app by the user.

2) **UniWhere**

Pros:

- It offers a partial synchronisation with the university site, having an exam page with marks and upcoming exams
- There is a section for class reviews
- It has a section dedicated to tuition fees, showing both paid and unpaid ones

The main disadvantage is that offering only a partial synchronisation with the university site and it is limited in many features, for example in handling all the administrative matters, or the lack of any feature regarding single courses, like info or material.

While the competitors as ***university apps*** are:

1) **Infostud**

The main advantage is that it is good for handling all the administrative matters.

Cons:

- It does not feature anything about courses, all the information and material have to be taken from other sites or apps
- The official app of the website has many issues and does not feature all the functionalities of it.

2) **Classroom, Piazza, Moodle, Professors personal sites**

All these other sites are used by professors to share course materials and information. Each site has their own personal style, but they all share some features like an info section for the description of the course and the exam, a place to share the material for the class and a news section.

Despite the personal preferences of students and professors regarding these sites, the main disadvantage is that having different courses scattered all around, there is neither a unique place to retrieve information and material nor the possibility to have a calendar feature that puts together all the lesson hours of the different courses. Moreover, each time a student needs to look up anything about the course he has to remember where to go to retrieve the information, and some of these sites, while they may be intuitive for the professors to upload news or material, are sometimes badly designed for the students' use.

2.2 User Profile, personas and scenarios

2.2.1 User Profile

Our user profile has the following characteristics:

Age	**18-25 years**
Gender	**Any**
Profession	**University student**
Education	**High School**
Technology	**Smartphone with internet connection**
Location	**Italy**

2.2.2 Personas and scenarios

Persona: Phoebe

Phoebe, a 21-year-old foreign student, hails from the city of Louisville, nestled in the state of Kentucky. While pursuing her education, she selflessly devotes her spare time to assisting her family on their farm back home.

She is a bright and curious student who has always been interested in biology and computer science and a lovely friend. Her passion for science and technology was sparked at a young age, and she has always been fascinated by the ways in which computational methods can be used to better understand and analyse biological systems.

She has recently decided to pursue a degree in Bioinformatics in Rome at la Sapienza University of Rome. Outside of the classroom, Phoebe is an active member of several academic and research communities about green economy.

In her spare time, Phoebe enjoys exploring the outdoors and going on hikes with her dog. She loves the feeling of being surrounded by nature and finds it helps to clear her mind after long hours of studying and research.

Scenario

Phoebe is preparing for an exam in her bioinformatics course and needs to review key concepts and materials, so she sets out on a mission to gather all the necessary resources to aid her study. To begin her review, Phoebe first gathers her lecture notes from each class. These notes serve as her primary source of information, capturing the main ideas, definitions, and explanations discussed during the lectures. Phoebe knows that revisiting these notes will help refresh her memory and reinforce her understanding of the subject matter. But she doesn't have all the materials that she needs so Phoebe seeks out the lecture slides provided by her instructor. These slides often contain representations, diagrams, and important points discussed in class. By analysing the slides, Phoebe can gain a deeper insight into complex concepts and visualise the relationships between different topics, facilitating a more comprehensive review.

Persona: Evaristo

Evaristo is a 24-year-old student from Rimini enrolled in the Faculty of Economics at La Sapienza University in Rome. He has two loving mums: Gianna and Rita.

He spends his days at the university, attending lectures, studying with friends, and chatting during breaks. Whether it's participating in student activity, conducting research in the lab, or attending workshops and seminars, he immerses himself in the vibrant academic environment.

He chose to study Economics and communication for management and innovation for his master degree because he believes that innovation, environmental sustainability and integration should be an important part of the education of the economists of the future.

Evaristo is a very generous and smart person that loves to work as a volunteer, helping people that live in poor condition.

In his spare time, he works as a dog trainer in an education centre in Rome with his dog Ettore, a beautiful Bernese that is 4 years old.

Scenario

Today Evaristo woke up with a great sense of relief and with a smile on his face, and after kissing goodbye to his moms he went to the university.
As a matter of fact, classes started a few days ago, and throughout the summer, Evaristo has been grappling with uncertainty regarding his academic path and which courses to follow in the upcoming academic year. To make a definitive decision, he

attended the first lectures of each course in the first days of the semester. Finally yesterday evening he made up his mind, solidified his choices and sent his study plan. So now he feels much more relaxed about what to expect in the next months.
While commuting on the tram Evaristo cannot remember the room in which he has to attend today's lectures and also exactly in which order the courses are scheduled for the day. So he opens his smartphone and searches on google for the lesson hours of his university course. He has to go through a couple of pages before finding what he's looking for and he's finally able to find his answers. Also the following day Evaristo goes again through this process. But at lunch while talking with his friends he finds out about the introduction of FUH in his university, he downloads the app, and he's able to see his schedule directly on the calendar, which is synchronised with the courses of his study plan.

Persona: Sandro

Sandro grew up in Fiumicino with two sisters and one brother in a small flat. He has always been interested in understanding human behaviour so he decided to pursue a degree in Psychology because he has a strong desire to understand the complexities of the mind and how they impact our daily lives.

Despite being 35, Sandro is determined to succeed in his new field of study. He is a charismatic and sensible guy that is able to speak four languages: Italian, English, German and Spanish.

Sandro is currently in his third year of studies but in his previous career he worked as a freelance photographer for low-cost and private airlines.

In his spare time he spends a lot of time reading fantasy books and playing board games with his family. He is very appreciated in the Rome D&D Community as a master.

Scenario

Sandro prefers studying in a quiet and peaceful environment. He finds that the library or a spare class is the perfect place to focus on his studies without any distractions. On the first day of the exam session, he decides to wake up early and go to the university library to study, skimming through his notes to have a general feeling on how to organise his study schedule. As Sandro enters the library, he realises that there are no seats available, he starts wandering through the University to look for another spot where he can study without any interruptions. He finally finds a small library and settles in, taking out his laptop and textbooks. Sandro starts

to read through his notes, but soon realises that the room is not lit enough for his liking, which is making him drowsy.
Feeling frustrated, Sandro decides to try a spare classroom instead. He heads to one of the empty classrooms he saw on his way to the library. He finds a well-lit and quiet room and sets up his study materials once again. This time, he's able to focus much better without the distractions of other students and the dim lighting.
At lunch Sandro takes out his packed lunch and, while eating, he starts to feel frustrated for wasting time in the morning in looking for a place to study,so he decides to finally download the FUH app, like he was advised to do by many of his colleagues. Here thanks to the “library” feature he discovers all the libraries placed throughout his university that he had no idea even existed.

2.3 Questionnaire analysis

In this section there are the questionnaire results used to better understand the limits and the point of the power of existing platforms that help students every day to do all their academic actions.
We successfully contacted 65 students, and these statistics helped us to both confirm and enhance our presumptions and concepts.

Section 1

General information

In the following graphics we present preliminary information on the user samples we have collected. The analysis of these samples provides valuable insights into the diversity of users within the scope of our application highlighting the heterogeneity of our data.

Our primary focus, as mentioned earlier, centres around college students (Figure G2), recognizing their importance as a target audience for our application, and younger than 27 years (Figure G1). Interestingly, the data we have gathered emphasises a considerable number of users from Sapienza University (Figure G4). The presence of a substantial user representation from this well-known institution holds promising implications for the relevance and applicability of our application within academic environments.

By exploring other aspects such as demographic information (e.g., age, gender, field of study (Figure G3)), we can gain a more comprehensive understanding of the user base. This deeper analysis will enable us to identify any patterns, preferences, or distinctive features associated with users from Sapienza University or other educational institutions.

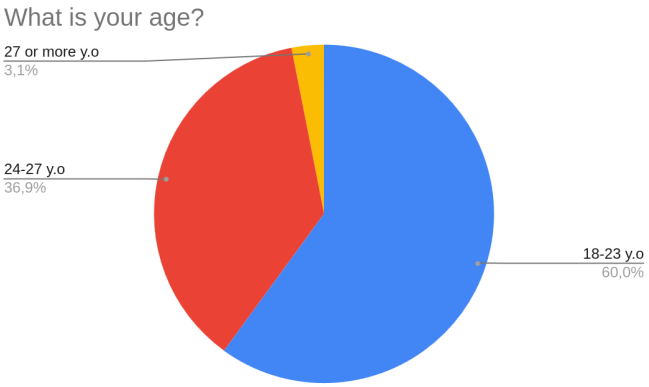

Figure G1 Age of the Questionnaire participants

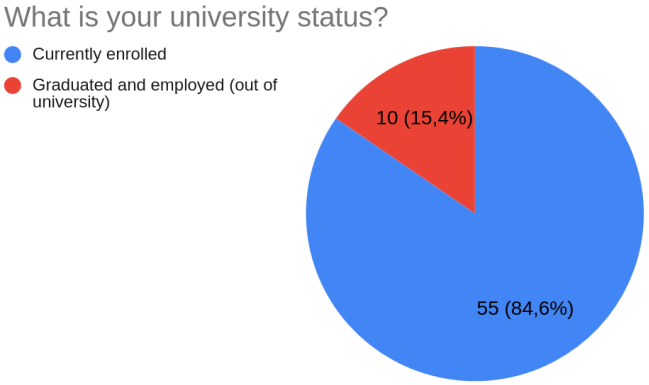

Figure G2: University status of Questionnaire participants

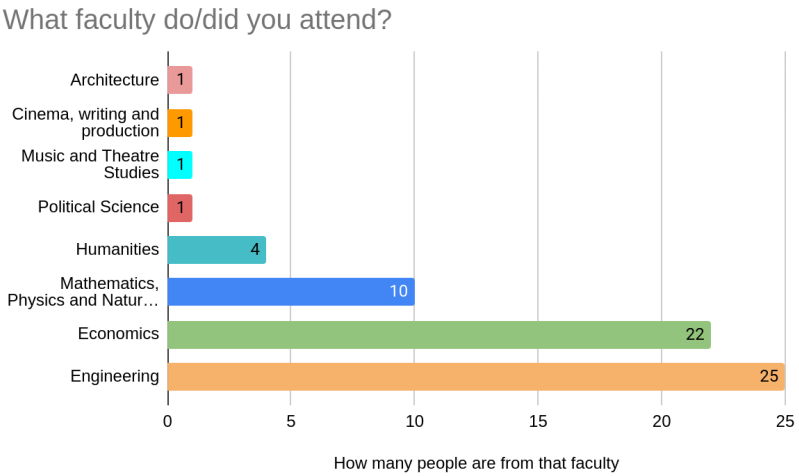

Figure G3: Faculty of Questionnaire participants

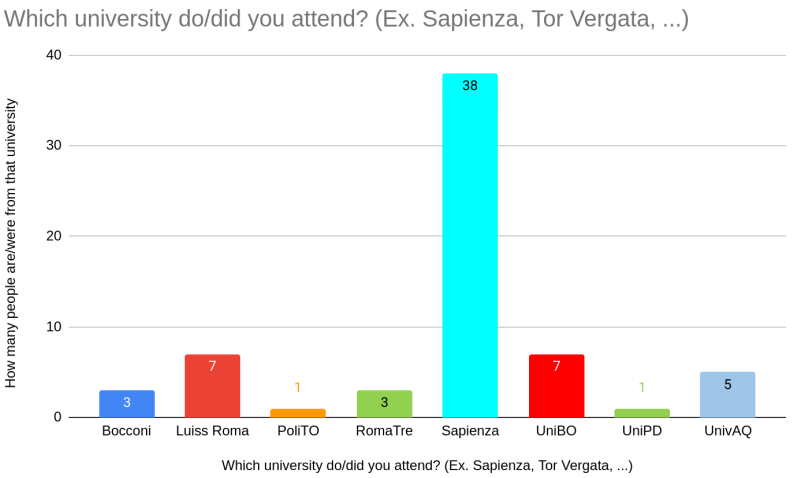

Figure G4: University attended by Questionnaire participants

Section 2

Validation of the idea

With the data we collected, we set out to assess whether the app presented a valid service such as the one we conceived. Through our questionnaires, we sought to understand students' habits and universities' attitudes toward existing platforms.

The results of the surveys were very positive. It turned out that the vast majority of students, as well as universities, make use of more than one platform (Figure G5). This suggests that there is room for new solutions that can consolidate the student experience on a single platform, thereby simplifying their daily use of applications.

An interesting finding we noted is that the majority of users would prefer to use a single platform (Figure G6). This indicates a potential demand for a service that can integrate different features and meet the diverse needs of students in a single solution. By offering a comprehensive and versatile platform, we would be able to reduce the inconvenience and confusion caused by using multiple separate applications.

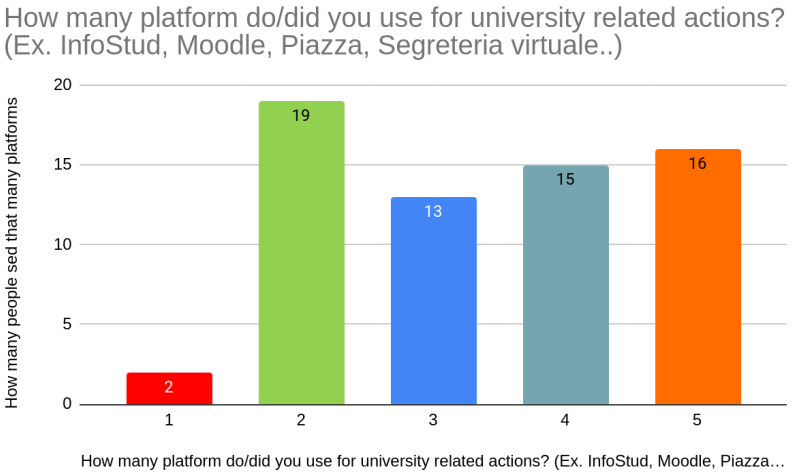

Figure G5: Number of platforms used by Questionnaire participants

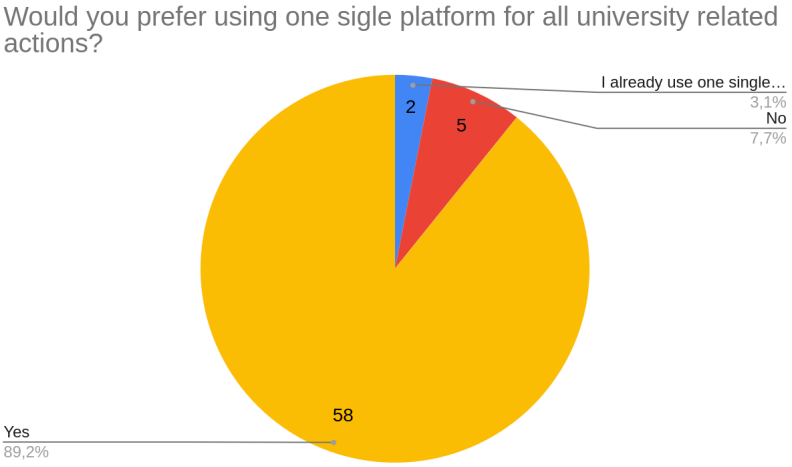

Figure G6: Preference on platform usage of Questionnaire participants

Section 3

Level of satisfaction of the various university sites

The data below confirm our expectations and support an interesting correlation between the number of platforms used by universities and the collective satisfaction level of students. As shown in the graphs (Figure G8), it clearly emerges that students who use a small number of platforms show a higher level of satisfaction on average than students who have to manage a larger number of platforms.

In addition, it is interesting to note that students' dissatisfaction focuses more on the search for "quick" information rather than static information. This refers to the need for real-time information, such as the latest news or updates, rather than

information that once searched and found remains stable over time, such as the course syllabus.

In light of these considerations, we have focused our efforts on providing a quick access to university information, allowing students to centralise all resources in a single platform. This solution can obviously facilitate access to crucial information by giving an efficient and user-friendly service.

It is important to note that although the public does not show unbridled enthusiasm toward current platforms (Figure G9), they seem to be willing to accept them as an integral part of their university journey. In the graph (Fig. G8) we want to show how in private universities, where fewer platforms are used, the level of student satisfaction is higher in all the categories in which we surveyed users. We have also taken Sapienza as an example, since it is the university where most of the users come from, which is known to use many platforms, and in the graph we can see how the level of student satisfaction is lower than average, and lower than users at private universities.

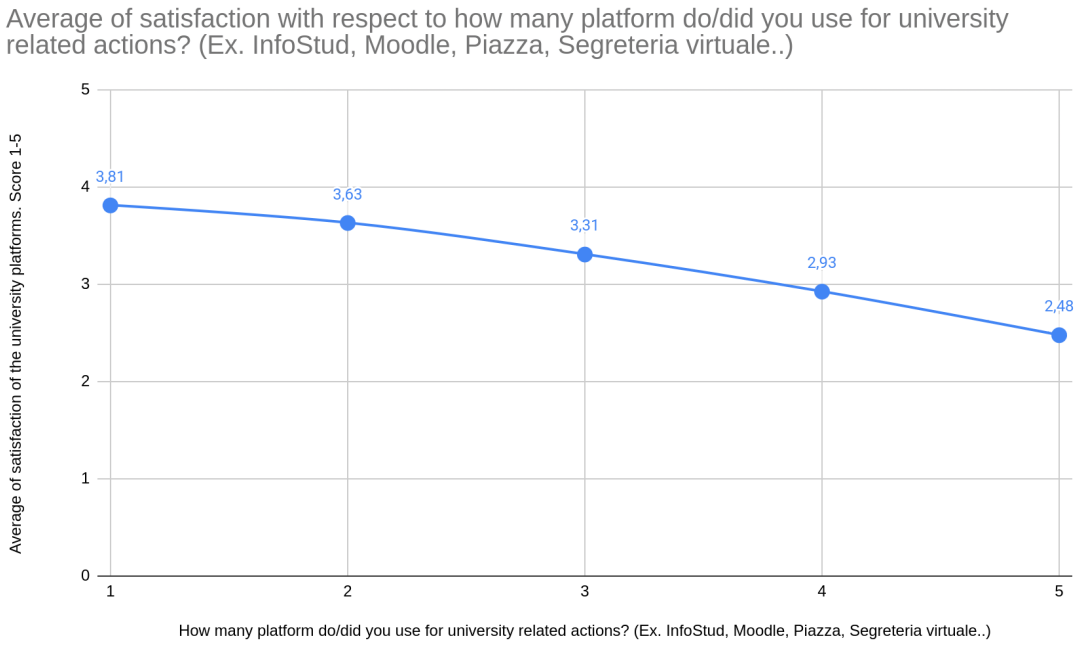

Figure G8: Level of satisfaction with respect to number of platform used

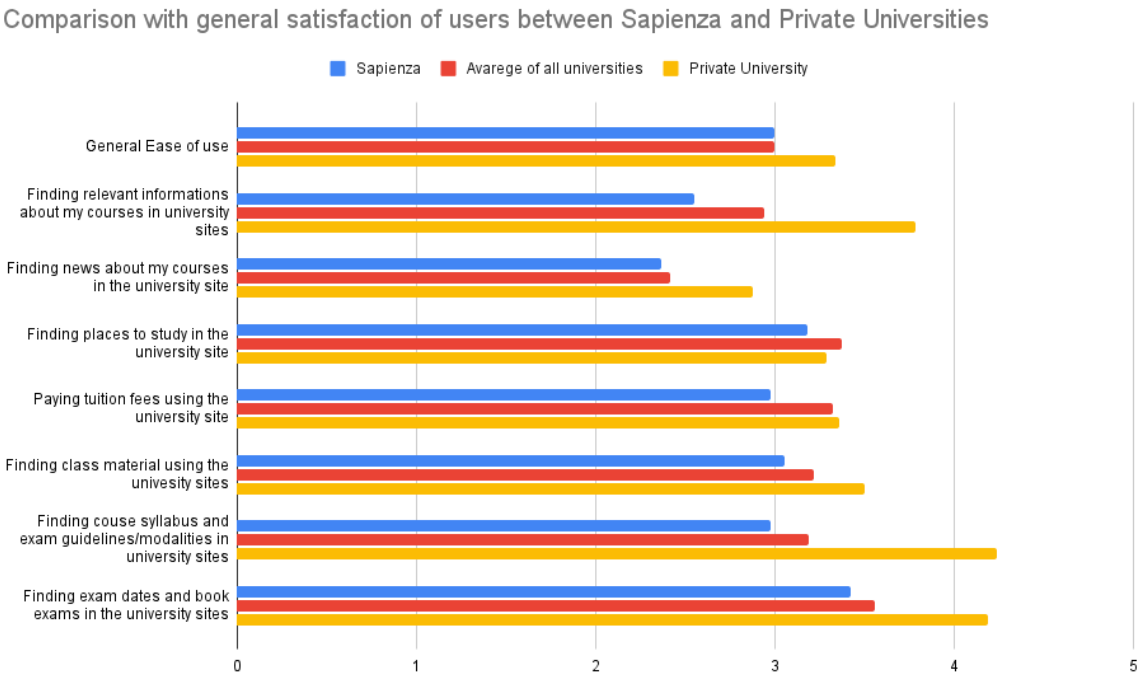

Figure G8: Level of satisfaction

Section 4

Analysis of competitors

Through the data below, an interesting scenario emerges in which the majority of users do not make use of third-party applications (Figure G9), despite harboring some dissatisfaction with the service offered by official university platforms. During data collection, we set out to identify the main reasons why users do not use third-party applications (Figure G10).

We begin by analysing the least selected reason, namely "I don't trust them with my data." This response, along with the mention of finding such applications tedious, raised the importance of developing a native platform rather than relying on external solutions guaranteeing security and reliability.

The second least selected reason is "I don't find them useful," confirming the assumptions we made earlier. In other words, the average user may be content with the service provided by official applications, even if he or she does not find them particularly intuitive or easy to use. This finding suggests that there is room for improving the user experience by designing a more intuitive interface and simplified usability to provide a service that is truly appreciated by users.

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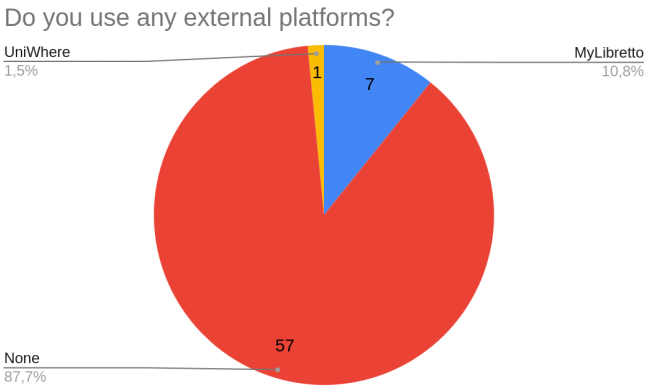


Figure G9: Usage of third party platforms

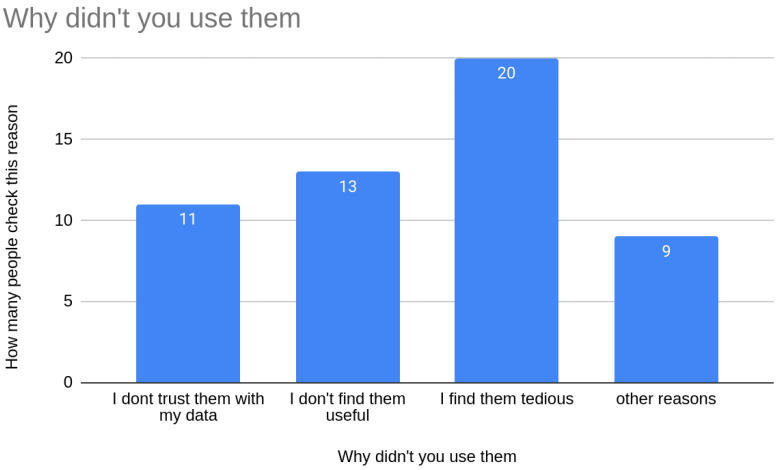


Figure G10: Reasons why users didn't use third party platforms

2.4 Interview

In order to ensure that the application would be highly useful and provide an excellent user experience, we carried out an unstructured interview with our target consumers to gain a better understanding of their requirements.

Interviewee:

- Ivan, 23 years old
- born in Melfi, Potenza
- lives in Rome

Ivan is one of the top students of his course, while talking with us he explained the main difficulties he had to face during his academic journey by having to use so many

platforms. He told us that it is not only about retrieving course material, but also being up to date with news about the class, homeworks or last minute notices.
He told how he often found himself early for classes that were postponed, or even attending cancelled classes, as the alert of the news didn't pop-up on his smartphone or the email arrived with too much delay.
Ivan really liked our idea of having a single app to feature all university related matters, and was sure that having all the courses sections in one single place would ease his university life.
He also gave us some suggestions about the app, for example he would really appreciate the possibility to have a section in the app providing all the relevant places, like the main locations or the libraries, as he really feels comfortable in studying in libraries, but being in San Pietro in Vincoli's location for the first time in his university career, he doesn't know neither how many libraries there are nor where they are located.

3. TASK ANALYSIS

Task models refer to representations or descriptions of the activities and steps that users need to perform in order to achieve their goals when interacting with a computer system or interface. Task models provide a structured and systematic way to understand and analyse user tasks, helping designers and researchers in the process of designing and evaluating user interfaces.

Hierarchical Task Analysis (**HTA**) is a cognitive psychology in which the main task is decomposed into smaller, more manageable subtasks, which are further decomposed into sub-subtasks, creating a hierarchical structure. It provides a systematic approach to understanding and representing the steps required to accomplish a particular goal or activity.

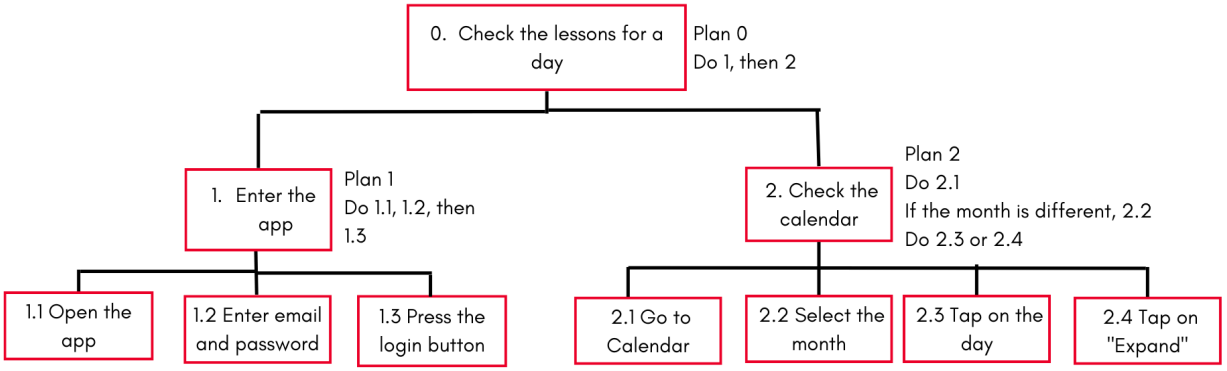
State Transition Networks (**STN**) are graphical representations or diagrams used in human-computer interaction to model and describe the behaviour and interactions of a system or software application. Each state represents a specific condition or mode of the system, and the transitions depict the possible paths or changes between states.

The HTA and STN presented are related to the main tasks of our application:

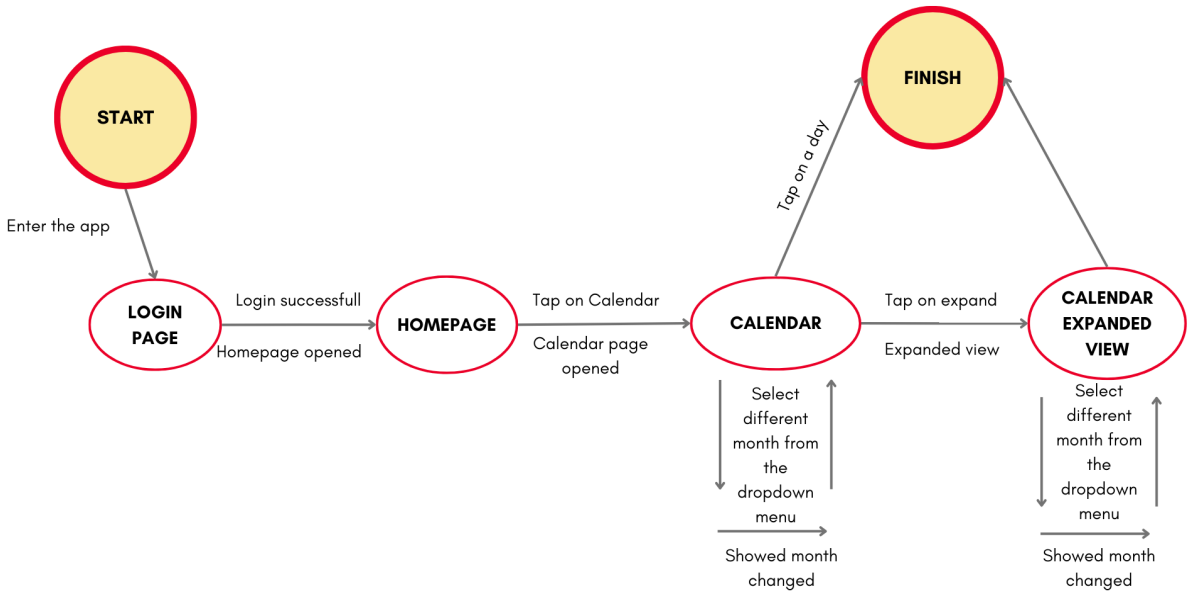
- Check the lessons for a day
- Book an exam
- Check the average of the exam
- Check the libraries in the university
- Read the material of a course

3.1 Check the lessons for a day

HTA

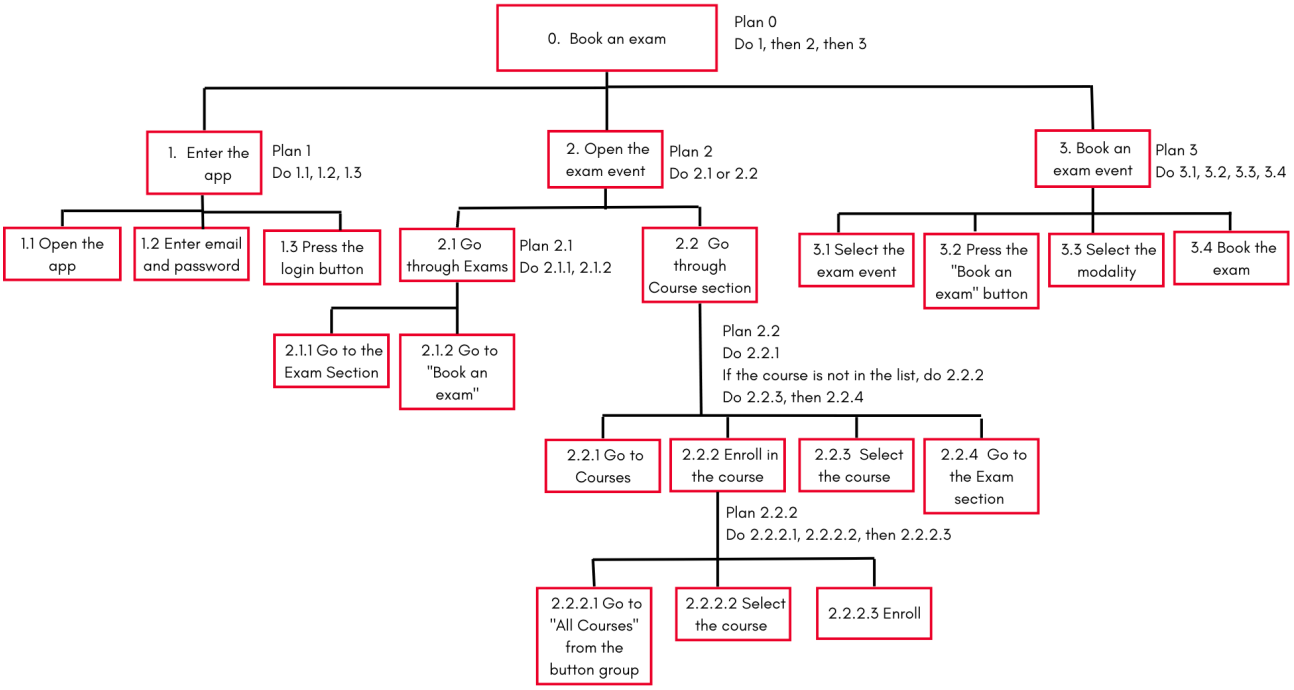


STN

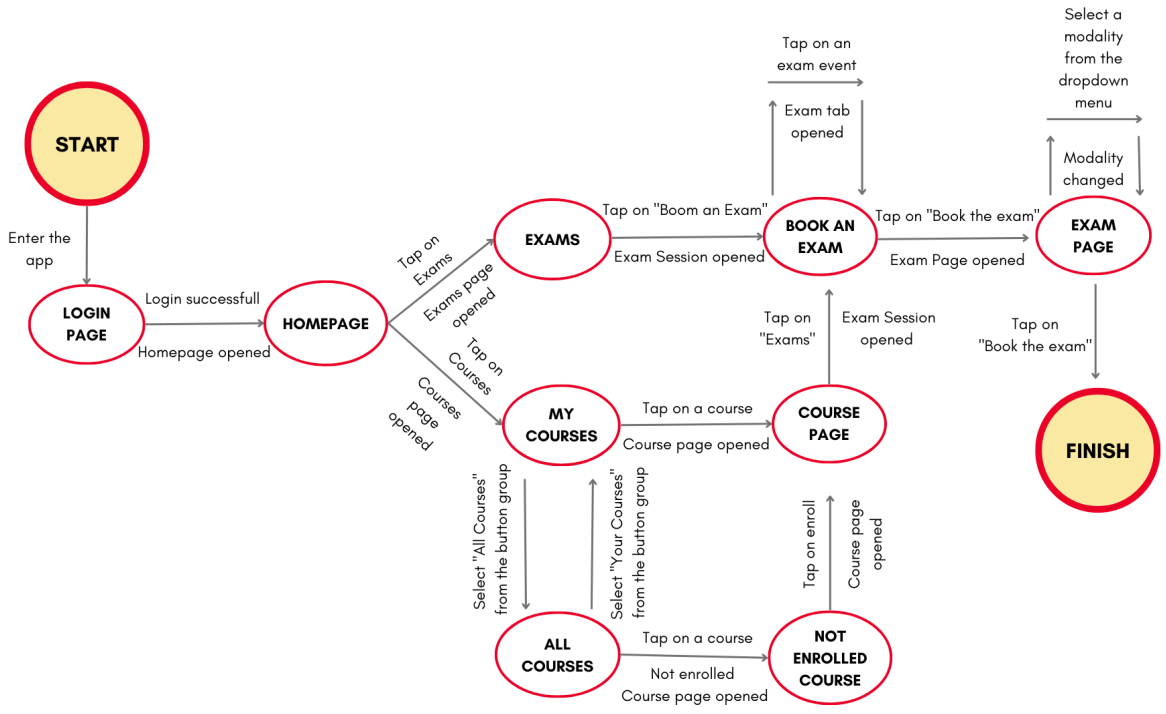


3.2 Book an exam

HTA

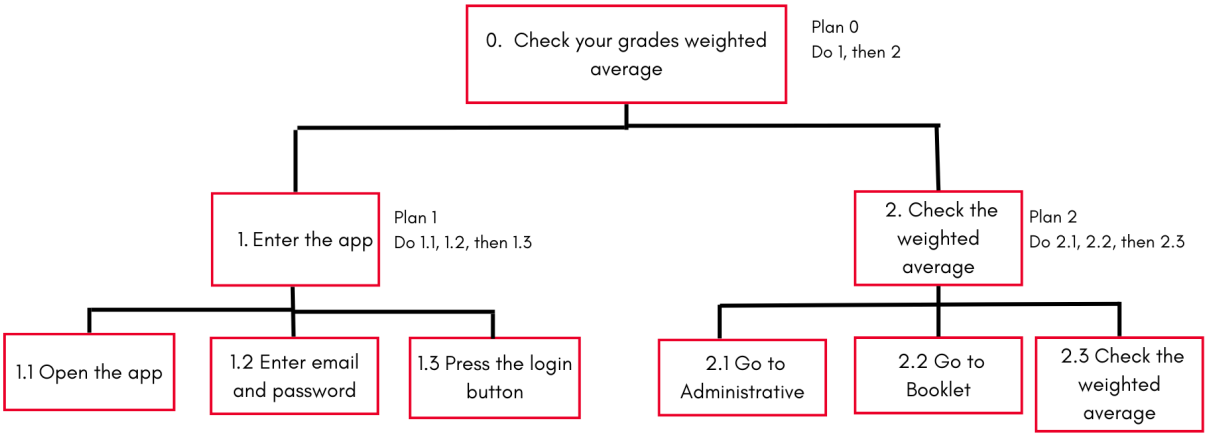


STN

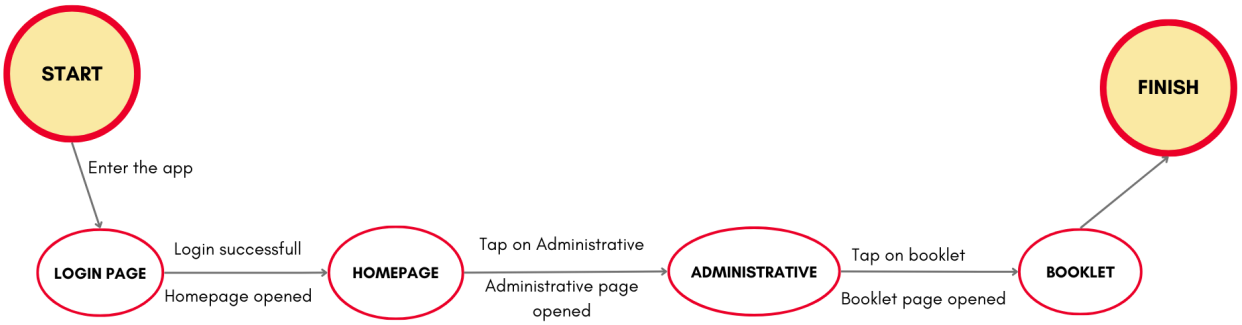


3.3 Check the average of the exam

HTA

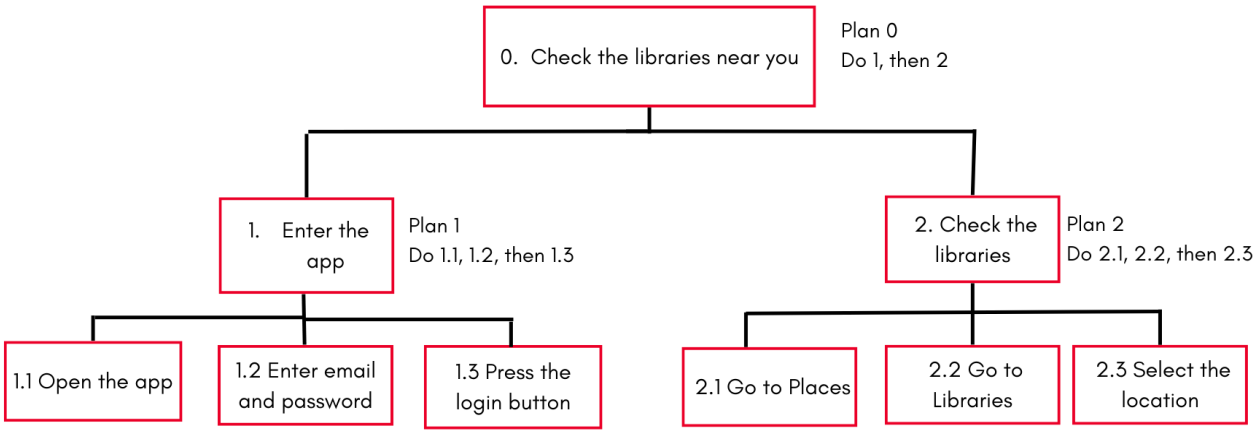


STN

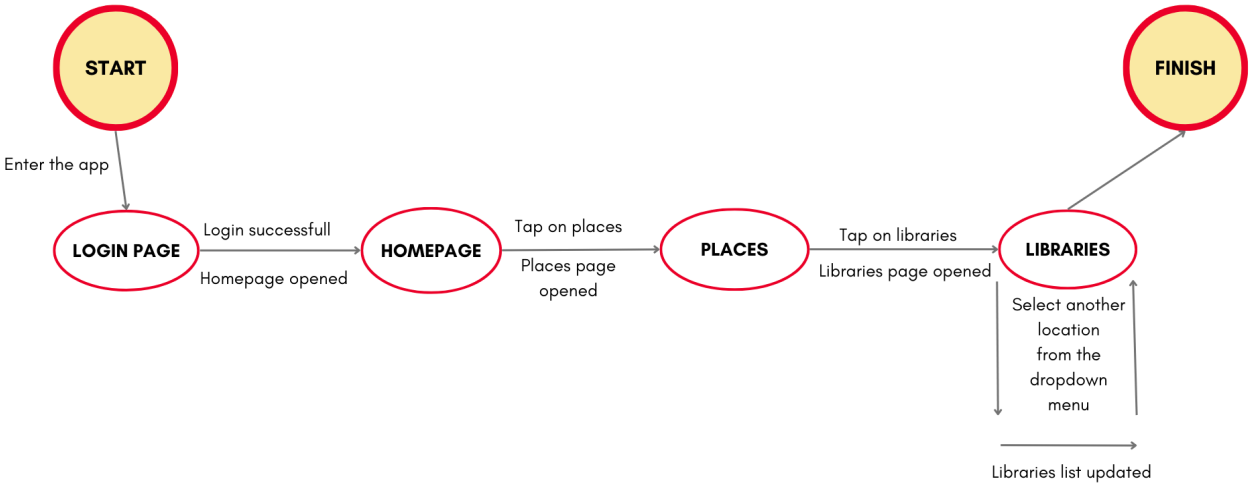


3.4 Check the libraries in the university

HTA

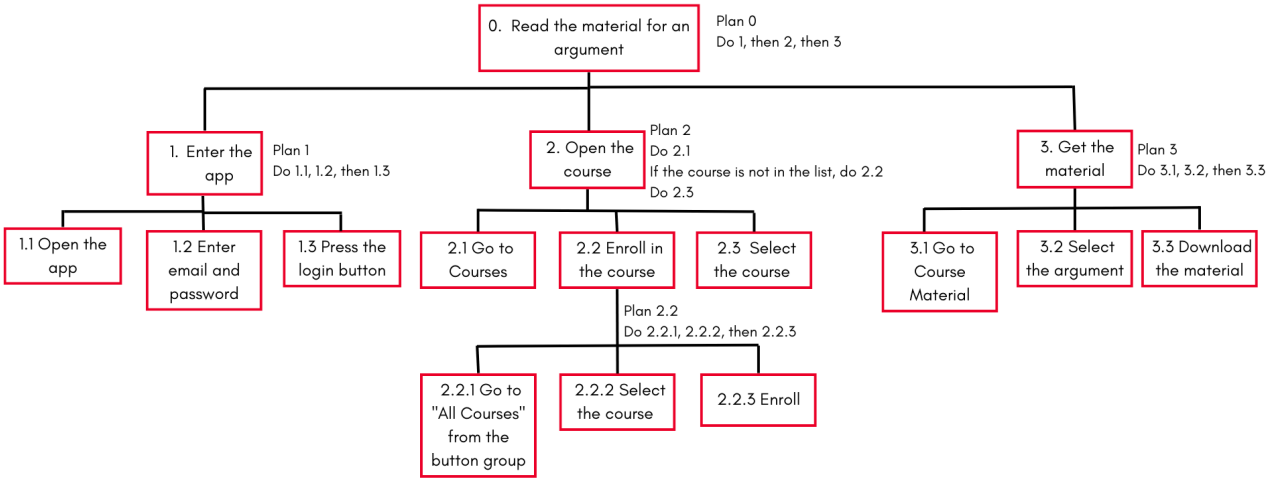


STN

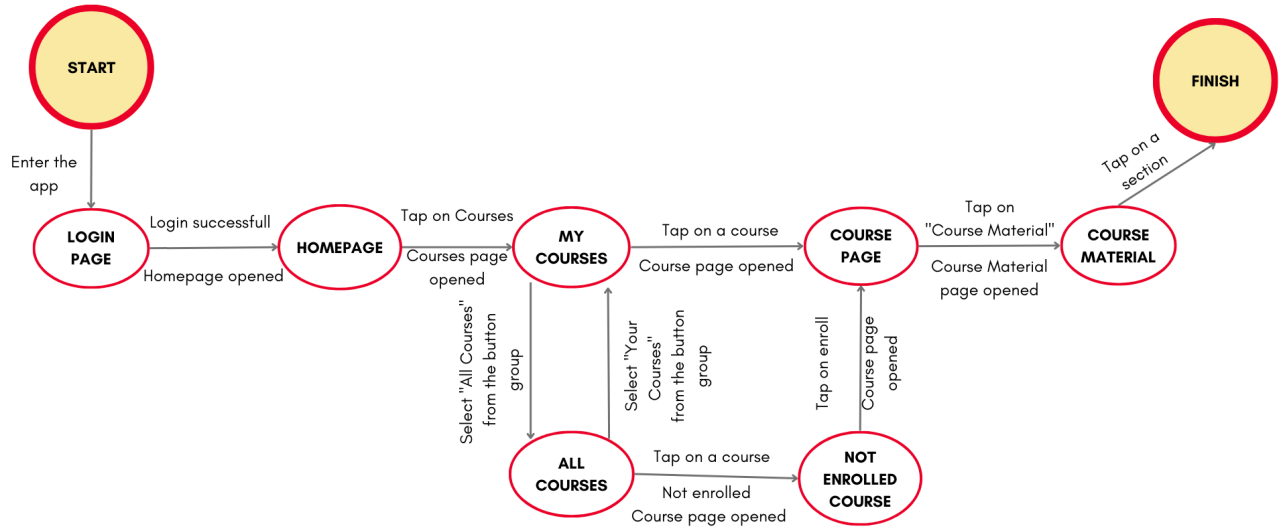


3.5 Read the material of a course

HTA



STN



4. PROTOTYPE 1

4.1 Main functionalities

Our first prototype is designed to give to the user the best experience thanks to the user friendly design and the easy interaction. The mockups of our prototype are presented above.

The main features are selected on the basis of the most common actions that a student does when he wants to interact with the university website. For the graphic user interface we followed an intuitive design with big buttons and clear drop list.

Our mobile application main functionalities are:

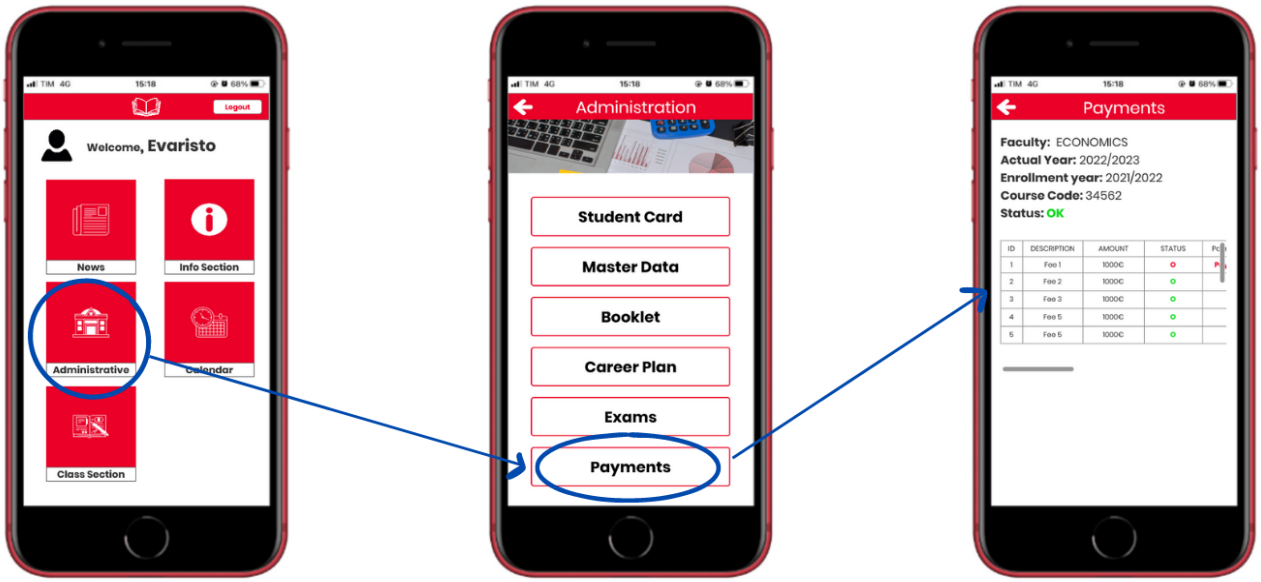
- Explore the university map
- Stay up to date with the latest university news
- Check the status of tuition fees
- Book and view upcoming exam
- Keep track of schedule
- View the course material
- View the virtual card

The following mockups have been done using **Axure RP 10**.

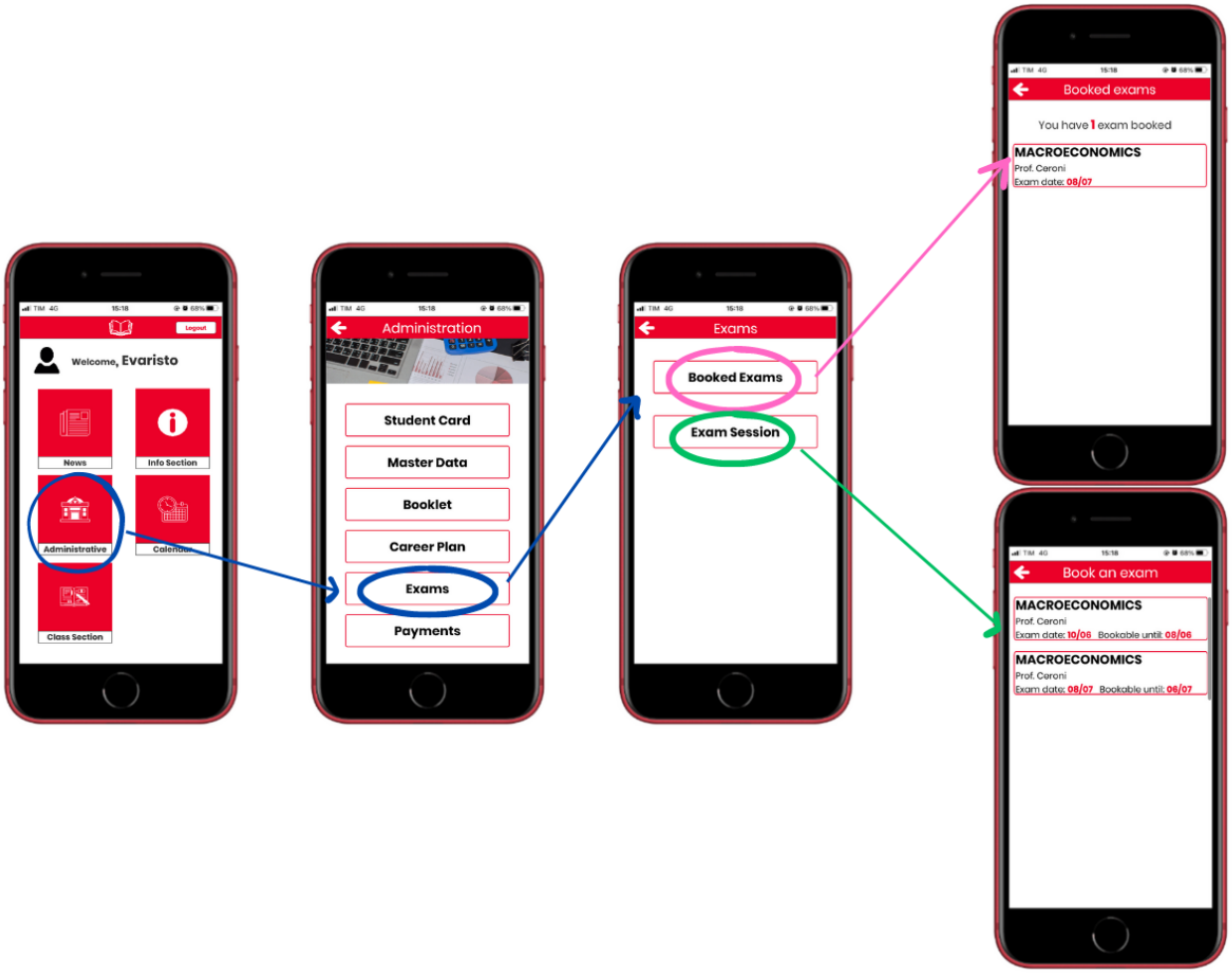
- Explore the university map

- Stay up to date with the latest university news

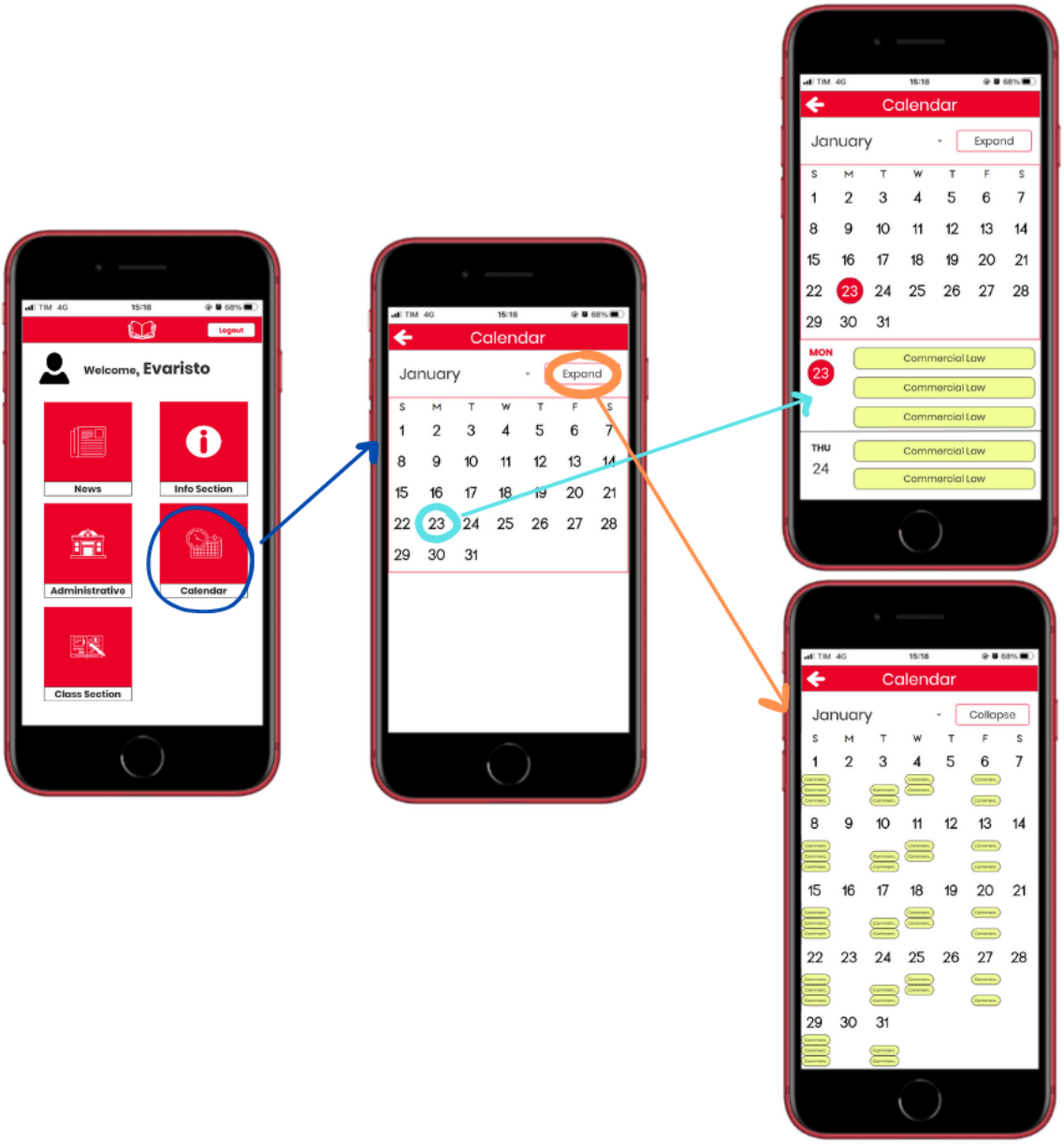
- Check the status of tuition fees



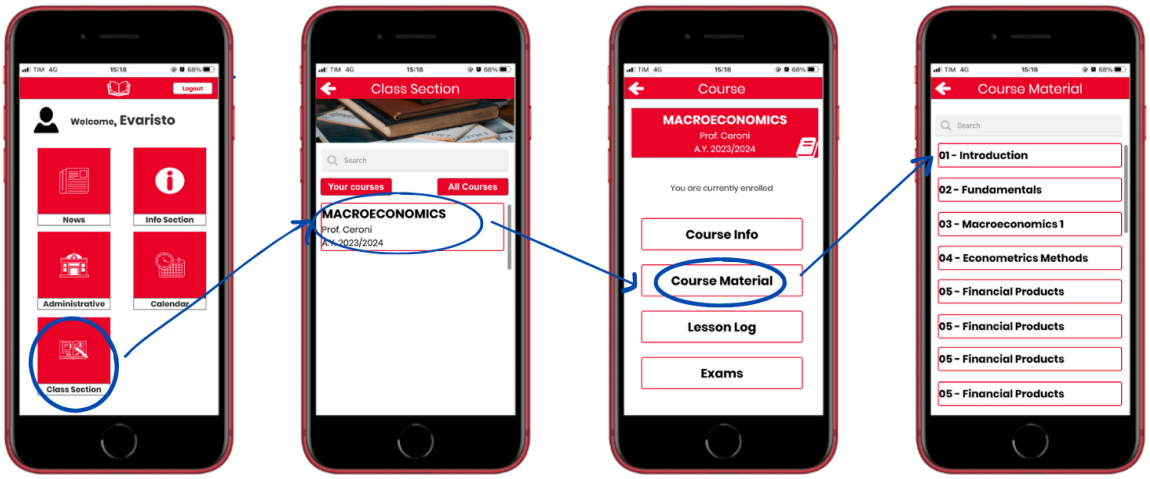
- Book and view upcoming exam



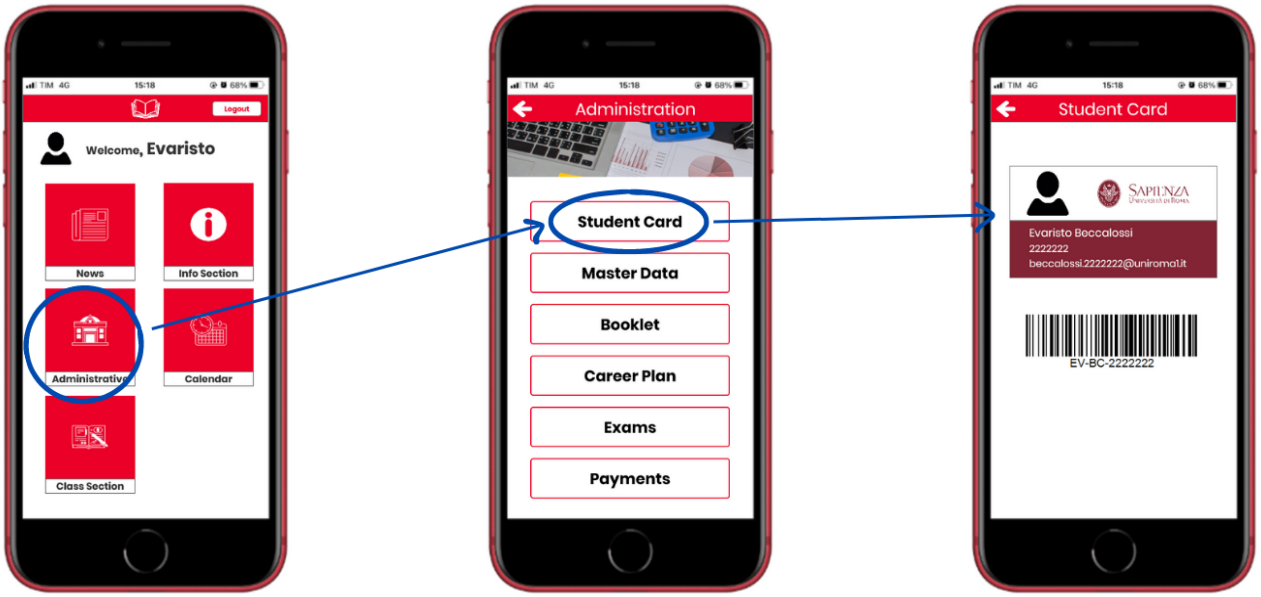
- Keep track of schedule



- View the course material



- View the virtual card



5. EXPERT BASED EVALUATION

Expert-based evaluation in human-computer interaction refers to a method of assessing the usability and effectiveness of a computer system or interface by involving experts in the field. It involves gathering feedback and insights from individuals who have specialised knowledge and experience in HCI principles, design guidelines, and user-centred approaches.

In expert-based evaluation, the experts examine the interface or system under evaluation and provide their professional judgement and analysis based on their expertise. They evaluate various aspects such as the interface layout, navigation, interaction design, visual aesthetics, information architecture, and overall user experience.

Expert-based evaluation is often conducted in the early stages of the design process to identify usability problems and make informed design decisions. This evaluation is typically conducted using a predefined set of evaluation criteria or heuristics that reflect best practices and industry standards.

5.1 Heuristic Evaluation

Heuristic evaluation is a usability evaluation method in human-computer interaction (HCI) that involves expert evaluators systematically examining a user interface based on a set of predefined heuristics or guidelines. It aims to identify usability issues and potential areas for improvement in the design. The expert who performed the Heuristic Evaluation is Dott.ssa Alba Bisante.

Here are some commonly used criteria in heuristic evaluation:

- Visibility of system status
- Match between system and the real world
- User control and freedom
- Consistency and standards
- Error prevention
- Recognition rather than recall
- Aesthetic and minimalist design
- Help and documentation:
- Error recovery

In our first prototype, we have violated 10 different heuristics criteria. The violated items can be seen in the table below.

5.1.1 Expert Report

Evaluator: **Alba Bisante**

Prototype: **FUH**

Date: **15/06/23**

Page	**Heuristic violated**	**Severity (1-5)**	**Description/comment**
Login	Help users recognize, diagnose, and recover from errors	4	Include a “Forgot password” link
Homepage	Aesthetic and minimalist design, Flexibility and efficiency of use	2	Are all the sections of equal importance? For example, if the most common use of the app is to check today's classes, maybe the calendar section should have more relevance in the page
Homepage	Aesthetic and minimalist design	1	It is not necessary to add “section” near the section name (Info section, class section)
Homepage	Match between the system and the real world, Recognition rather than recall	3	The “Info section” contains info regarding the university places (map, libraries, administration offices). I suggest choosing a more representative section name. Note: having clear labels helps the user navigate the contents easily, and in this case is especially relevant because the app is providing a lot of information so it’s easy to get lost
Homepage	Match between the system and the real world, Recognition rather than recall	3	The “Class section” contains the list of courses, I suggest using the same word (“Courses”)
Class section	Visibility of system status, Consistency and standards, Recognition rather than	4	It is not clear which of the two filters (if any) are selected. The default selection is “Your

	recall		courses" or "all courses"? By clicking all courses it is understandable that the right guess is the former (as the list expands), but it should be clear from the beginning
Class section	Recognition rather than recall, Flexibility and efficiency of use	4	The feature of enrolling to a course is too hidden (class section > all courses > select a course > enrol me). I suggest simplifying this flow
Administration section	Match between the system and the real world	2	What does "Master Data" stand for? Also "Persona" is a little bit unusual (e.g, maybe something like "your profile" is more common)
Administration section	Flexibility and efficiency of use, User control and freedom	3	I suggest separating the exams stuff from the administration one, as I believe it is something especially important for the final user (a student). However, the homepage already has a lot of sections, so in this case I suggest to try and test different arrangement versions
Booklet	Flexibility and efficiency of use, User control and freedom	3	Exams statistics are a little bit too hidden, I feel this is a feature that students usually find useful

Severity legend:

• 0 = I don't agree that this is a usability problem at all

• 1 = Cosmetic problem only

• 2 = Minor usability problem

• 3 = Major usability problem

• 4 = Usability catastrophe

5.2 Cognitive Walkthrough

The **cognitive walkthrough** is a method to evaluate the usability of a user interface design. It focuses on understanding how easily users can accomplish tasks and make effective use of an interface based on their cognitive processes and mental models.

During a cognitive walkthrough, a group of evaluators systematically analyse the design of an interface, step-by-step, to identify any potential usability issues. The evaluation is carried out from the perspective of a typical user, considering their goals, knowledge, and expectations.

By performing a cognitive walkthrough, experts gain insights into the strengths and weaknesses of an interface design from a usability perspective and help in improving the overall user experience by identifying potential obstacles.

The process of a cognitive walkthrough typically involves the following steps:

- Define the user and their goals
- Identify tasks
- Walk through the interface
- Analyse the interface
- Identify potential usability issues
- Document findings
- Iterative improvement

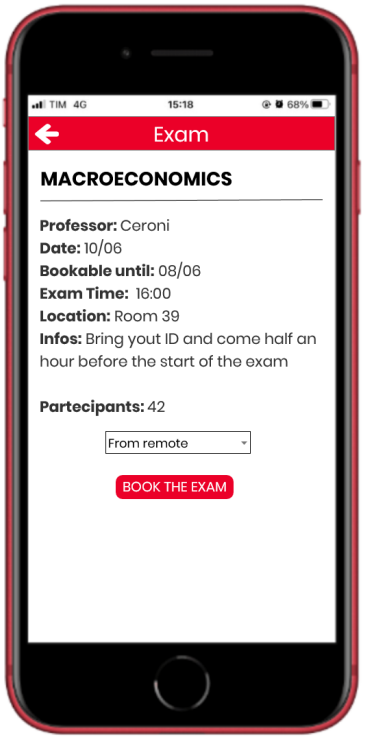
The task analysed by the expert Dott.ssa Alba Bisante is: ***"Book an exam for the Macroeconomics course on date 10/06 in presence"*** and she has answered to this question:

Q1: Is the effect of the action the same as the user's goal at that point? (Does the user understand that this subtask is needed to reach the goal?)

Q2: Will users see the action is available?

Q3: Once users find the correct action, will they know it is the one they need?

Q4: After the action is taken, will users understand the feedback they get?



Action 1: Tap on Exams button
Response 1: Exam page opened

Action 2: Tap on "Exam Session" button
Response 2: Exam Session page opened

Action 3: Tap on the exam event
Response 3: The system displays the exam details

Action 4: Tap on the "Book the exam" button
Response 4: Exam Page opened

Action 5: Select in presence from the dropdown form
Response 5: The system shows the selected option

Action 6: Tap on the "Book the exam" button
Response 6: The system shows if the exam is booked successfully or not

5.1.2 Expert Report

Evaluator: **Alba Bisante**
Prototype: **FUH**
Date: **22/06/23**

Action 1: Tap on Exams button

Response 1: Exam page opened

Q1	Yes
Q2	Yes
Q3	Yes
Q4	Yes
Note: The two buttons are wasting useful space - why not display immediately interesting information instead of requiring the user to explore the app with a sequence of buttons? For example, I suggest displaying the booked exams, as they are probably less than those already taken / those the student still needs to do. Another idea could be to display the exams of the current session (e.g. "Sessione	

estiva 2023 (giugno/luglio)"..), and then a button to link other (probably less interesting) sessions…

Action 2: Tap on "Exam Session" button

Response 2: Exam Session page opened

Q1	Yes
Q2	Yes
Q3	Yes
Q4	Yes

Action 3: Tap on the exam event

Response 3: The system displays the exam details

Q1	Yes
Q2	Yes
Q3	Yes
Q4	Yes

Action 4: Tap on the "Book the exam" button

Response 4: Exam Page opened

Q1	Yes
Q2	Yes
Q3	Yes
Q4	Yes

Action 5: Select in presence from the dropdown form

Response 5: The system shows the selected option

Q1	Yes
Q2	Yes

Q3	Yes
Q4	Yes

Action 6: Tap on the “Book the exam” button

Response 6: The system shows if the exam is booked successfully or not

Q1	Yes
Q2	Yes
Q3	Yes
Q4	Yes
Note: to get out of this task, the user has to click on the back arrow button, which may cause confusion/insecurity: as the back arrow usually means “get back / cancel”, it may indicate that if you click there, you are cancelling your action (as an example, think of a payment form. At the end of the payment, do you get back with a back arrow? Or do you click the back arrow only before the actual payment, when you are changing your mind about something in the cart?). In case of important tasks (such as booking an exam), take extra care in being clear about what the buttons/labels mean.	

5.3 Errors correction and Prototype 2

According to the result of the **heuristic evaluation**, we have made the right improvements considering the 10 violated heuristic criteria.

1. The first violation was “Help users recognize, diagnose, and recover from errors”, with severity equal to “4”, regarding the login page. The “Forgot password” link was included (Figure 1).

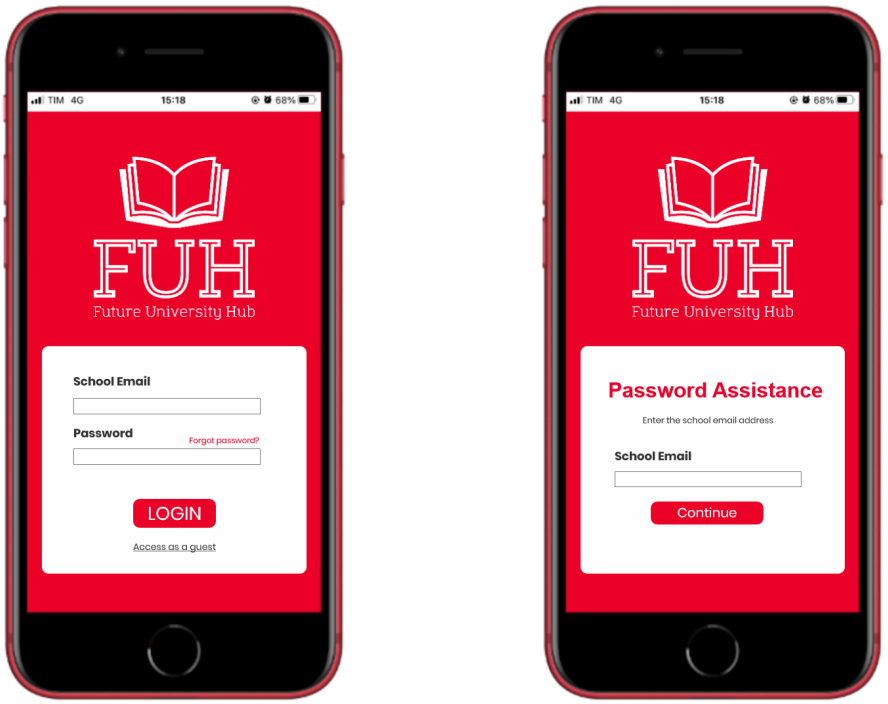


Figure 1: Login page

2. The second violation was “Aesthetic and minimalist design, Flexibility and efficiency of use”, with severity equal to “2”, regarding the homepage. Now, the calendar and the courses sections have more relevance in the homepage.

   The third violation was “Aesthetic and minimalist design”, with severity equal to “1”, regarding the homepage. The “section” near the section name was removed (Course section, Administrative section, ...).

   The fourth violation was “Match between the system and the real world, Recognition rather than recall”, with severity equal to “3”, regarding the homepage. The “Info section” was renamed with “Places” to have a more clear label.

   The fifth violation was “Match between the system and the real world, Recognition rather than recall”, with severity equal to “3”, regarding the homepage. Every “class” was renamed to “course” (Figure 2).

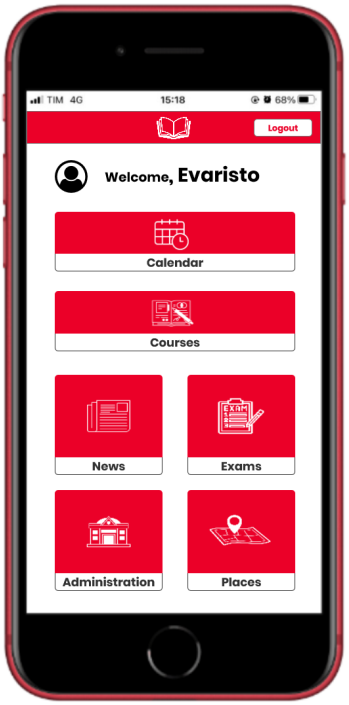


Figure 2: Homepage

3. The sixth violation was “Visibility of system status, Consistency and standards, Recognition rather than recall”, with severity equal to “4”, regarding the class section page. The "your courses" and "all courses" buttons have become a button group that clarifies the selected section (Figure 3).

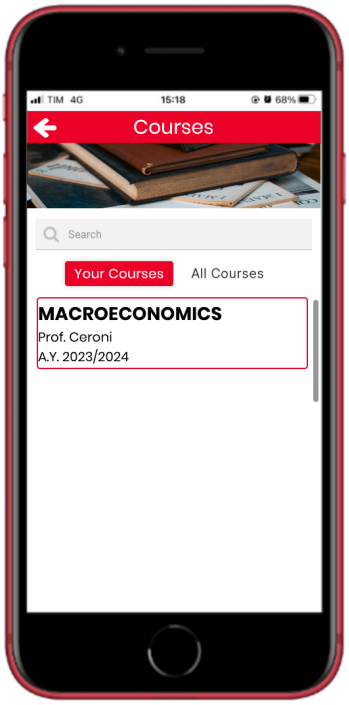


Figure 3: Courses page

4. The seventh violation was “Recognition rather than recall, Flexibility and efficiency of use”, with severity equal to “4”, regarding the class section page.

The suggestion is to simplify the process of enrolling in a course by streamlining the flow rate and reducing unnecessary steps. Currently, the enrollment option is too hidden and requires navigating through multiple sections (class section > all courses > select a course > enrol me).

After conducting a brainstorming session with numerous potential users, it was discovered that the current navigation system is coherent and easily understandable. This is because the mechanism is similar to a university platform that is currently in use. Other proposed designs were rejected by the users as they were deemed less intuitive.

5. The eight violation was “Match between the system and the real world”, with severity equal to “2”, regarding the administration section page. The button “Master Data” was renamed to “Your Profile” to have a more clear label (Figure 4).

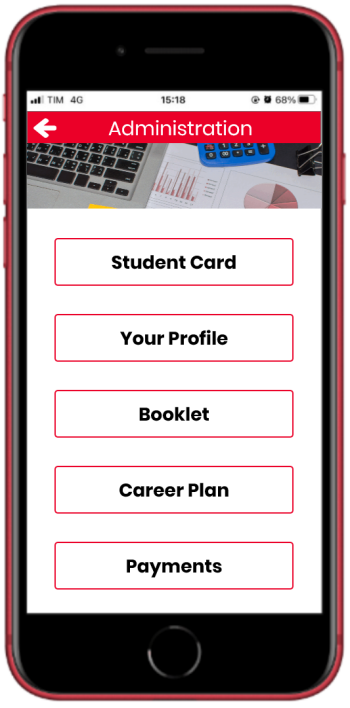


Figure 4: Administration page

6. The ninth violation was “Flexibility and efficiency of use, User control and freedom”, with severity equal to “3”, regarding the administration section page. Now the “exams section” is separated from the “administration section” to get an easy interaction with this important part (Figure 5).

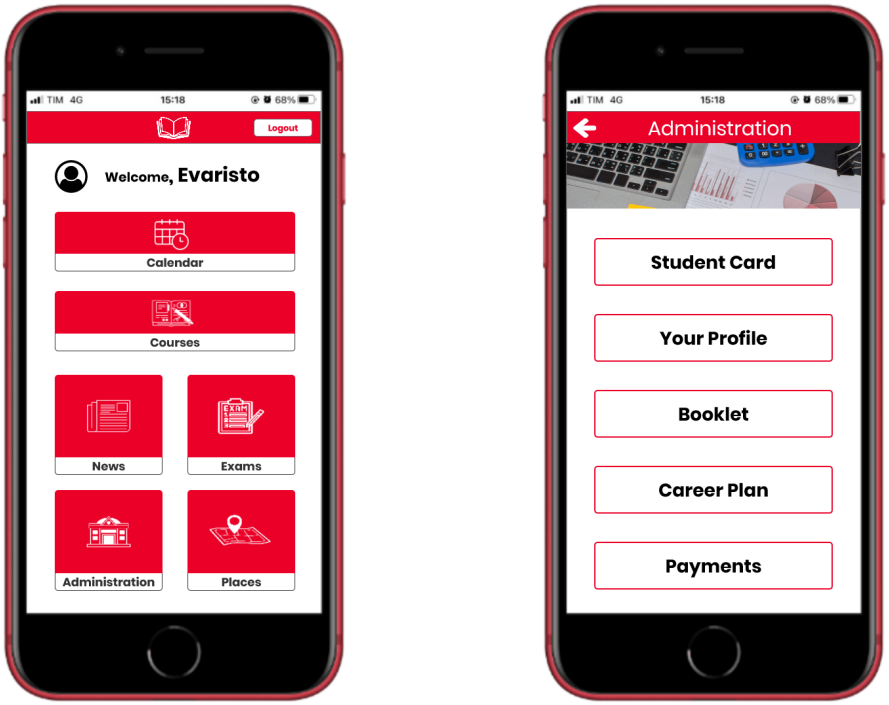


Figure 5: Homepage and administration section page

7. The tenth violation was “Flexibility and efficiency of use, User control and freedom”, with severity equal to “3”, regarding the booklet page. The exam statistics are highlighted on the top of the page (Figure 6).

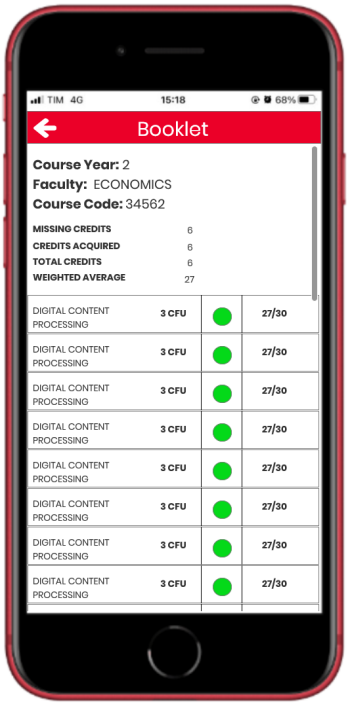


Figure 6: Booklet page

According to the result of the **cognitive walkthrough**, we have made the right improvements considering the 2 notes.

The **first note** is: “Instead of two buttons taking up space, it is better to display instantly engaging information like booked exams or exams for the current session, with a button for other sessions.” while the **second note** is**:** “Ensure clarity by avoiding confusion-inducing back arrow buttons for critical tasks like booking exams. It is better to use clear labels and consider alternative options to avoid potential cancellation misunderstandings.”

So we have the solved the Cognitive Walkthrough issue as show below:

1. After conducting multiple evaluations with potential users, it was determined that both of the proposed approaches were less intuitive and ultimately confusing. The first modified prototype (Figure 7) was evaluated as not immediately understandable since users struggled to differentiate between booked exams and exams that needed to be booked.

   The second modified prototype (Figure 8) was assessed to be comparatively more intuitive than the first one, but it still fared worse than the basic version. Additionally, there was no clear differentiation between booked exams and the option to book an exam.

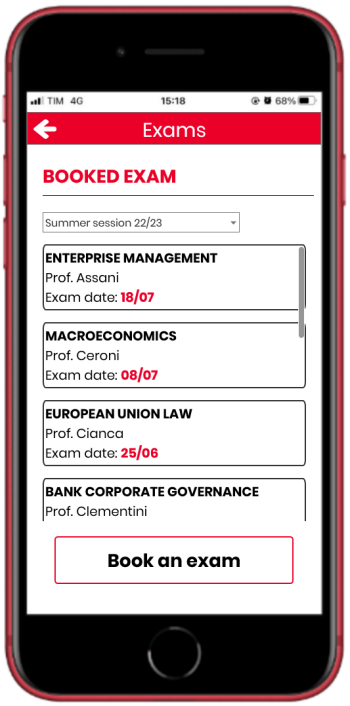


Figure 7: First modified prototype of exam page

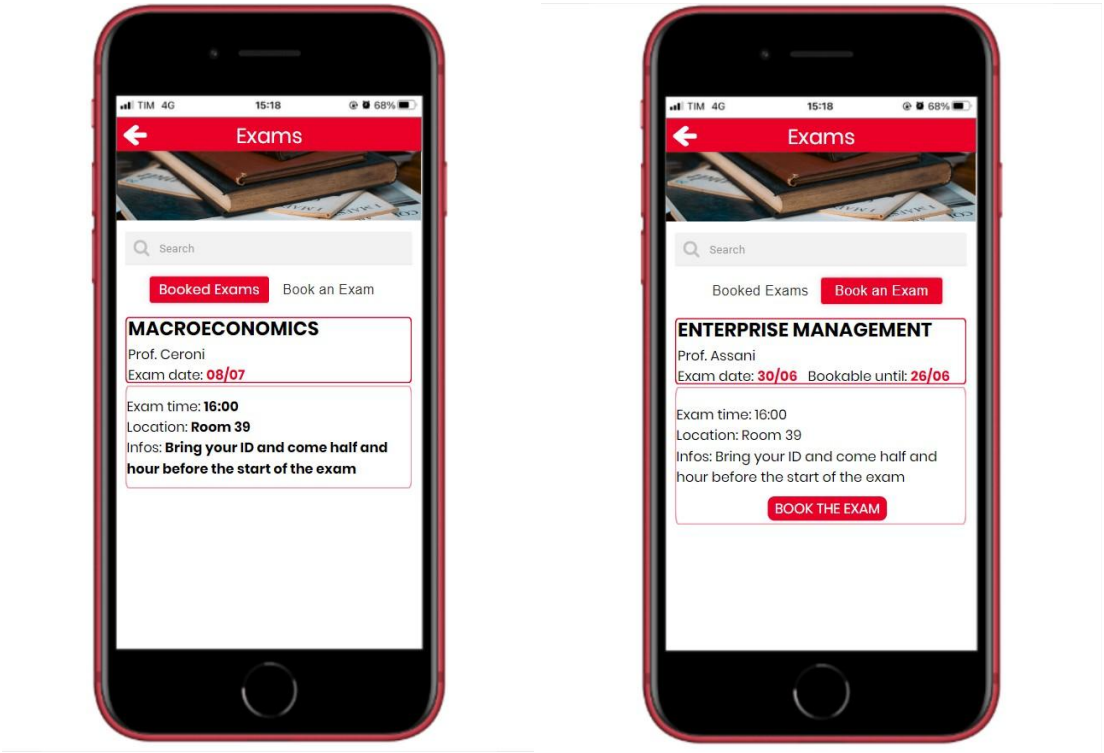


Figure 8: Second modified prototype of exam page

As it shown in the Figure 9, the final version of the exam page is the following one:

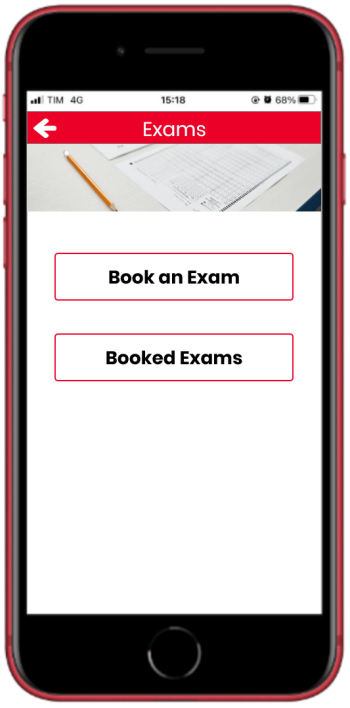


Figure 9: Final version of exam page

2. A new button, labelled "Back to Homepage," has been added to prevent user confusion and provide confirmation that the action has been completed correctly (Figure 10).

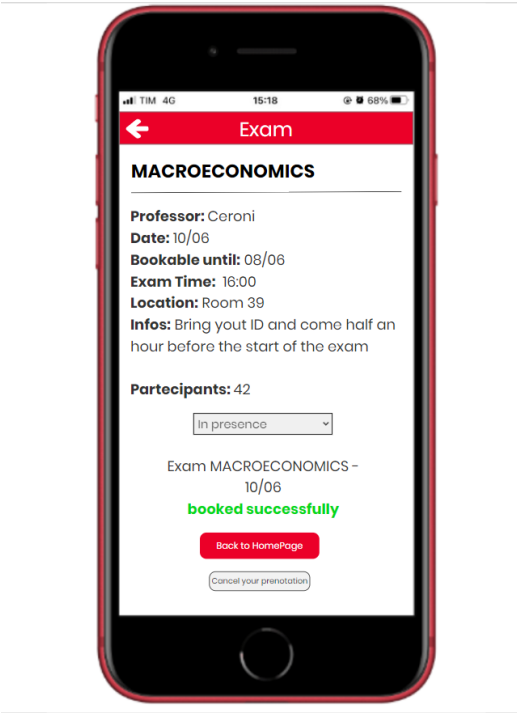


Figure 10: Modified 'Book an exam' page

6. THINK ALOUD

The **think-aloud** technique is employed to evaluate the usability of a product or system by having participants articulate their thoughts and actions while interacting with it. The main objective is to gain an understanding of the user's experience, identify any issues or challenges they encounter, and gather insights into their decision-making and overall satisfaction.
In a usability test using the think-aloud technique, participants are instructed to verbalise their thoughts, opinions, and reactions as they complete specific tasks or scenarios, without any help from the interviewer . They are encouraged to express their impressions, frustrations, successes, and any other relevant observations throughout the testing session.
By actively listening to participants' verbalizations, usability researchers acquire valuable insights into the user's cognitive processes, including their expectations, assumptions, and problem-solving strategies. This approach aids in uncovering usability problems such as confusing interfaces, unclear instructions, or functional issues that may not be readily apparent through purely observational or quantitative data.

6.1 TA session

The **think-aloud** experiment was conducted on the second prototype of the application.
Seven people were evaluated to perform some tasks, each of them was a target of our user profile, so they were all students between the ages of 18 and 25, and enrolled in different courses and universities, both public and private. The session was conducted by both recording the participants while they “spoke aloud” and by taking notes.

The participants were assigned 5 tasks:

- Book an exam
- Find the study material of a course
- Find the the paid university fees
- Find out today’s schedule
- Find a library to study in a specific university location

6.2 Results

Most of the subjects appreciated the plain and intuitive aspects of the app, and especially of the Homepage. All of them were able to move pretty easily throughout the app and despite using it for the first time they were able to perform at the first attempt most of the tasks we gave them.

We had a little problem with the fifth task, probably also given by the fact that it was given last after the users had already accustomed a little to the app, where one the the subjects took a little too long to find the bar to change the university location on top of the page, and for some time didn't know how to move forward, so initially wasn't able to see all the libraries. Thanks to that we were able to add a sign over the search bar, reporting "select a location" which made the bar more visible and easy to find (Figure 11).

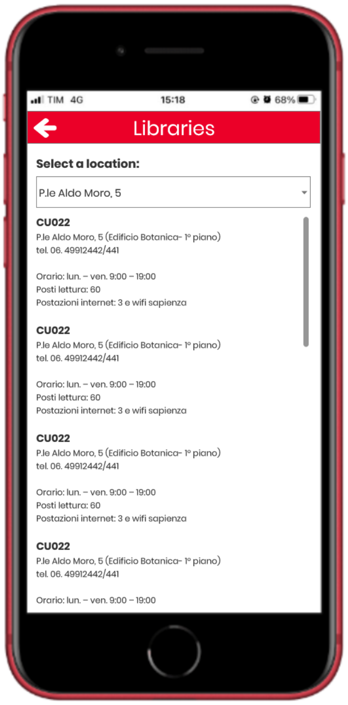


Figure 11: Modified libraries page

7. CONTROLLED EXPERIMENT

A **controlled experiment** evaluates the effectiveness of application design elements. Independent variables (design variations) are manipulated, while dependent variables (user behaviour, satisfaction, performance) are measured. The experiment begins with a research question and hypothesis. Design variations are identified, such as interface layouts or colour schemes. Participants are randomly assigned to control and experimental groups. Tasks are assigned, and metrics like completion time or subjective ratings are measured. Data is collected and statistically analysed using the **ANOVA** method. The results provide insights into effective design elements. Factors influencing reliability include sample size, randomization, controlling extraneous variables, valid measurements, minimising researcher bias, and ecological validity. A well-controlled experiment yields reliable insights for iterative design improvements.

In our prototype, the user can access the exam events from two paths:

- From the homepage, he/she goes to the exam section, selects a class and then books an event
- From the course section, he/she selects a course and books the exam from there

In this experiment we want to see if this two-way approach enhances the usability of the interface or reduces the understandability of the application. We also want to verify the frequency in the usage of the two paths.

We designed three experiments to understand the user approach to our application:

1. Differences in time to book an exam using one path or the other
2. Which path is used by a new user to book an exam
3. Differences in time to book an exam starting the course path from the course page

Our hypothesis is that users that access the application only to book an exam will follow the exam section path, because it's faster and accessible from the homepage. A new user will take the exam section path too, because it's clearly accessible from the homepage. We think that the average user spends most of the time on the application in the class section, so they should have access to the exam of a course from the course page, without the need of going back to the homepage.

7.1 Experiment 1

We asked 20 different people to perform the task. We divided the users into 2 groups, each one of 10 users, and each user performed the task only under one condition, with no transfer of learning.

Users: People that match our user profile (university students between 18-25 y.o.)

Variables:

- Independent: the constraint of following the exam section path or the course section path
- Dependent: The time in seconds to complete the task

Hypothesis:

- NULL: Booking an exam from the exam section or from the course section takes the same time
- OUR: Booking an exam from the exam section takes less time than booking it from the course section

Experiment:

- Task: Book the exam of Macroeconomics with professor Ceroni for the 10th of June in presence
- Assumptions: user is already logged and in the homepage

Results:

EXAM SECTION	COURSE SECTION
15	20
12	16
19	17
11	11
15	26
20	17
7	19
12	17
9	19

11	16
7	14
7	18
22	16
15	14
15	21
15	17
8	23
20	12
15	10
10	21

This is the **ANOVA** analysis of the data:

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Going by Exams	20	265	13,25	21,35526316
Going By course	20	344	17,2	15,64210526

ANOVA

Source of Variatio	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	156,025	1	156,025	8,434383669	0,006103910598	4,005238727
Within Groups	702,95	38	18,49868421			
Total	858,975	39				

The results of the experiment indicate a statistically significant difference in the time taken to complete the task between the two conditions (exam section and course section). With an **F = 8.434 > F-crit = 4.005**, we reject the null hypothesis and accept the alternative hypothesis. Our alpha value is **0.05**, smaller than the P-value, rejecting the null hypothesis too. The mean times confirm the results. Therefore, we can conclude that booking an exam from the exam section takes significantly less time compared to booking it from the course section.

7.2 Experiment 2

We asked 10 different people to perform the task.

Users: People that match our user profile (university students between 18-25 y.o.)

Variables:

- Independent: none
- Dependent: The path chosen by the user

Hypothesis:

- NULL: The users choose the exam path or the course path with a comparable frequency
- OUR: The vast majority chooses the exam path

Experiment:

- Task: Book the exam of Macroeconomics with professor Ceroni for the 10th of June in presence
- Assumptions: user is already logged and in the homepage

Results:

	EXAM SECTION PATH	COURSE SECTION PATH
# OF USERS	10	0

All 10 users chose the exam section path, while none of them opted for the course section path. This overwhelming majority in favour of the exam section path supports the hypothesis that the vast majority of users would choose this path.

Therefore, we can confidently conclude that the exam section path is the preferred choice for users when performing the task right after they access the application.

7.3 Experiment 3

We asked 20 different people to perform the task. We divided the users into 2 groups, each one of 10 users, and each user performed the task only under one condition, with no transfer of learning.

Users: People that match our user profile (university students between 18-25 y.o.)

Variables:

- Independent: the constraint of following the exam section path or the course path
- Dependent: The time in seconds to complete the task

Hypothesis:

- NULL: Booking an exam starting from the home page via the exam section or starting from the course page via the course section takes the same time
- OUR: Booking an exam starting from the homepage via the exam section takes more time than starting from the course page via the course section

Experiment:

- Task: Book the exam of Macroeconomics with professor Ceroni for the 10th of June in presence
- Assumptions: user is already logged

GOING BY EXAMS	GOING BY COURSE
20	12
7	7
14	10
13	9
13	8
15	13
21	9
12	13
9	10
14	15
20	7
13	10
13	9
15	10
7	7
17	9
17	14
15	12
16	7
14	12

This is the **ANOVA** analysis of the data:

Groups	*Count*	*Sum*	*Average*	*Variance*		
Going by Exams	20	285	14,25	14,51315789		
Going By course	20	203	10,15	6,028947368		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	168,1	1	168,1	16,36638483	0,000246641003	4,098171661
Within Groups	390,3	38	10,27105263			
Total	558,4	39				

The **ANOVA** analysis resulted in a p-value of 0.000246, which is significantly lower than our alpha of 0.05. Additionally, the calculated F-value of 16.366 exceeds the critical F-value of 4.09817.

Based on these results, we can reject the null hypothesis and conclude that there is a significant difference in the time taken to complete the task between the two paths.

7.4 Conclusions on the experiments

The results of the experiments certifies our hypothesis: the idea of booking an exam from the two paths is valuable. A poll conducted on potential users shows they would spend most of the time on the app in the course section. While a user that accesses the app to book an exam will surely take the “exam section” path if the user is already using the application he/she will probably be in the course section. Having a direct way to book the exam from the course page will enhance the application's usability.

8. FINAL PRODUCT

8.1 Overview of the final product

The ultimate version of the application was brought to life using Axure RP. This involved making direct modifications to the first prototype developing a front-end interface and using the program variables feature it was possible to simulate a back-end functionality. The final version of the application successfully incorporated all the essential characteristics of a mobile application. It prioritised user-friendliness, intuitive navigation, and clear labelling, as determined through comprehensive evaluation and user experience analysis.

8.2 Story Boards

The application was thinked for two types of users: “Student enrolled at the university” and “Guest student”.

8.2.1 Student enrolled at the university

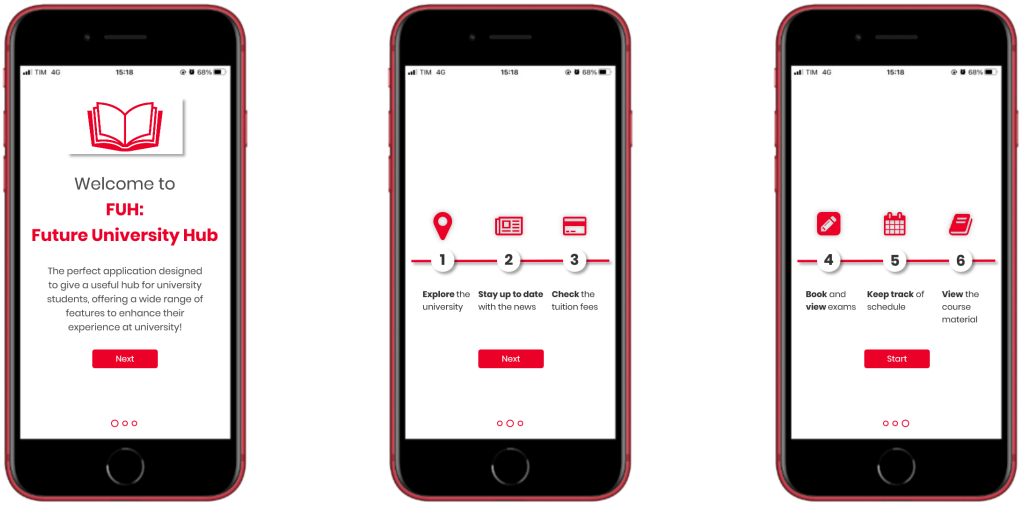


Figure 12: Tour

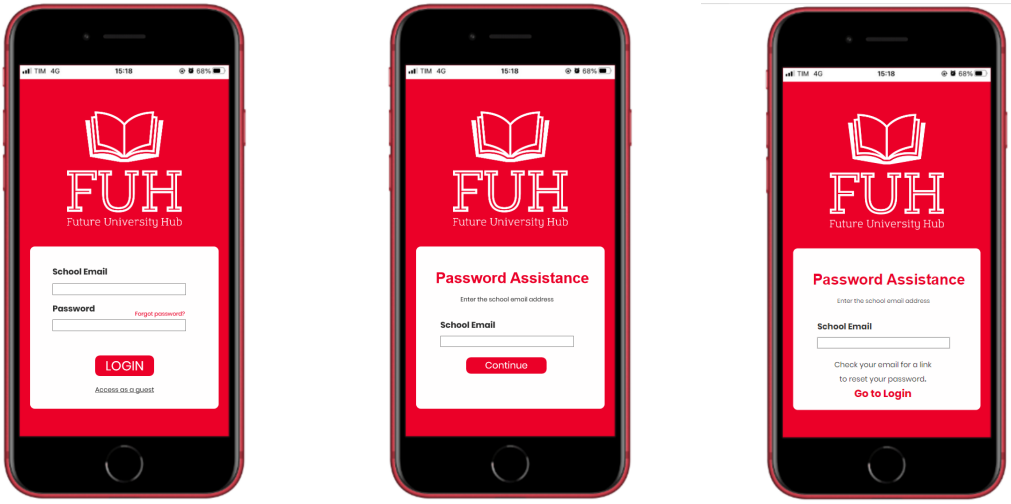


Figure 13: Login and 'Forgot Password' page

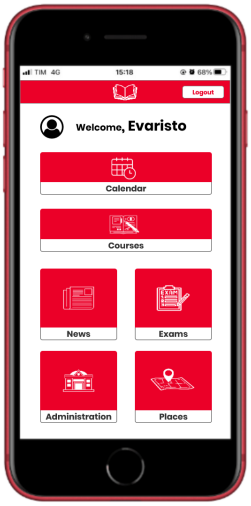


Figure 14: Homepage

Figure 15: Calendar

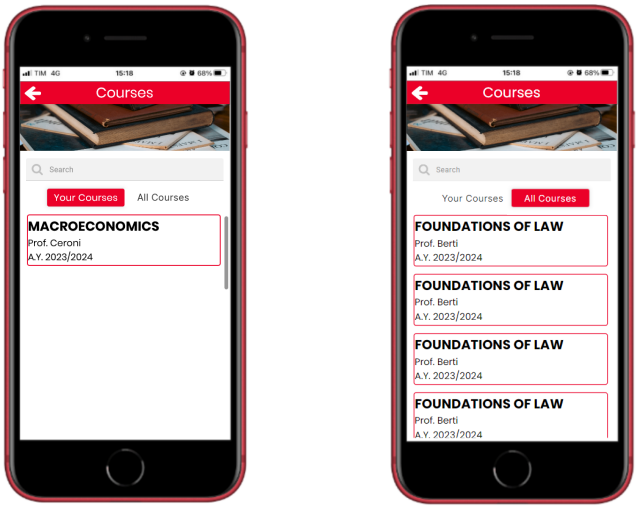


Figure 16: Course page

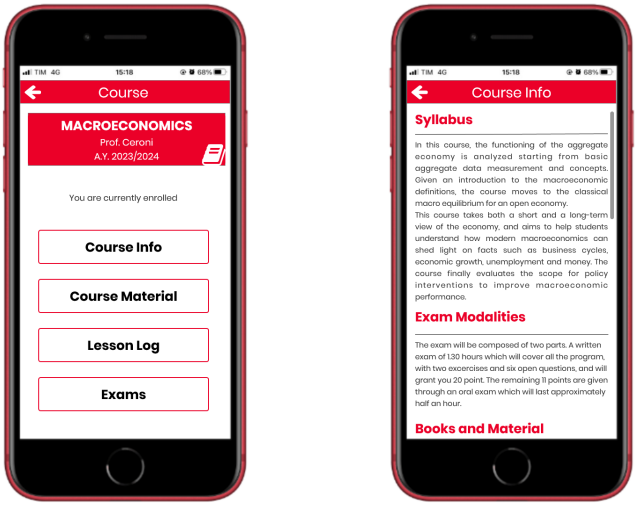


Figure 17: “Enrolled” course page and course info

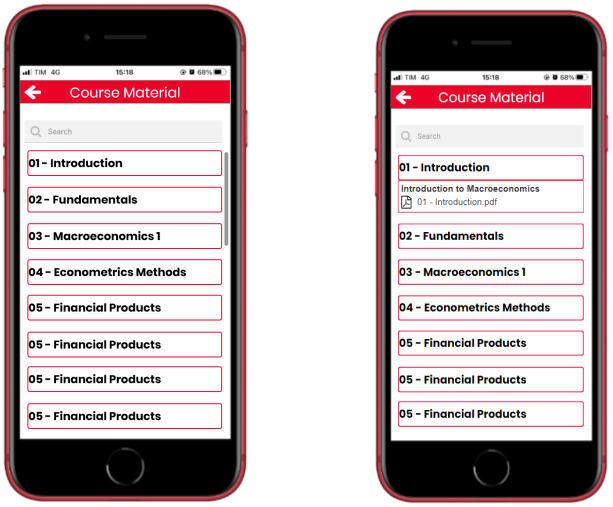


Figure 18: Course material

Figure 19: Lesson log

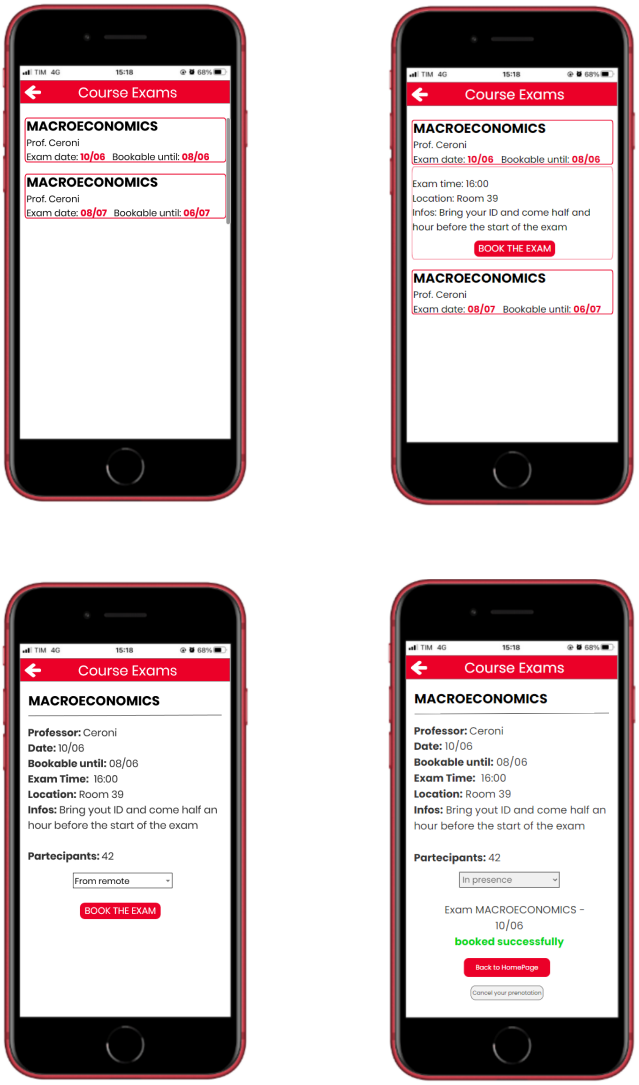


Figure 20: Overview of exams and “Book an exam”

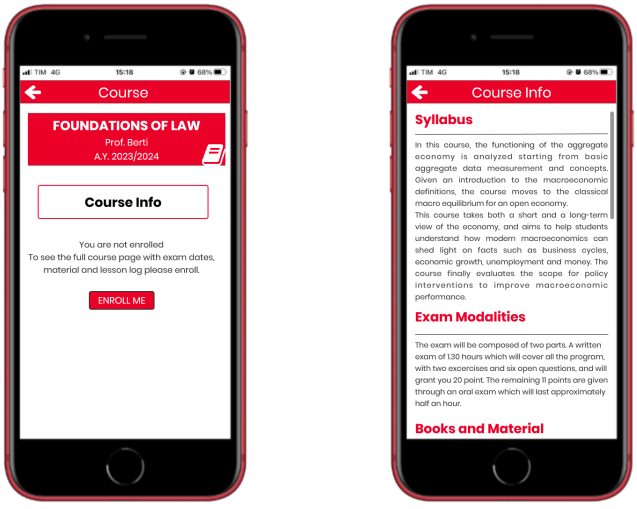


Figure 21: “Not enrolled” course page and course info

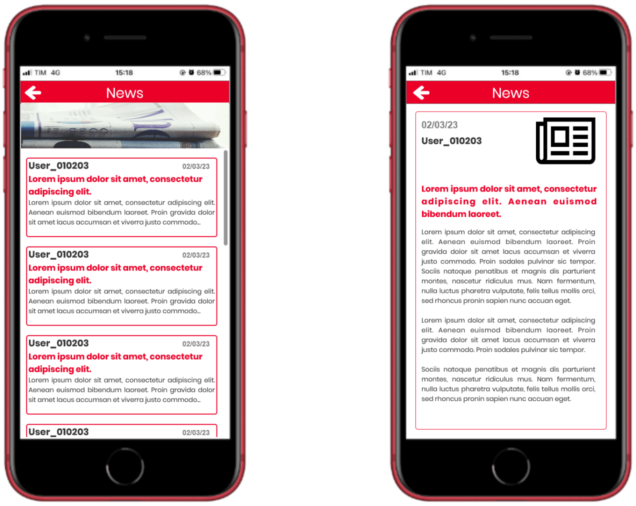


Figure 22: News page

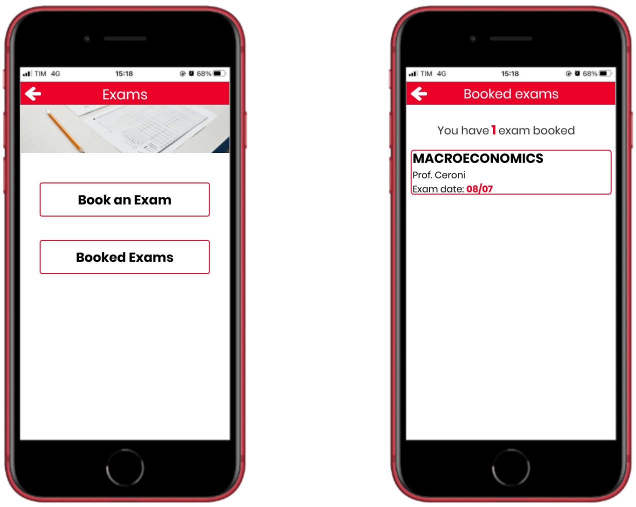


Figure 23: Exam page and “Booked Exams”

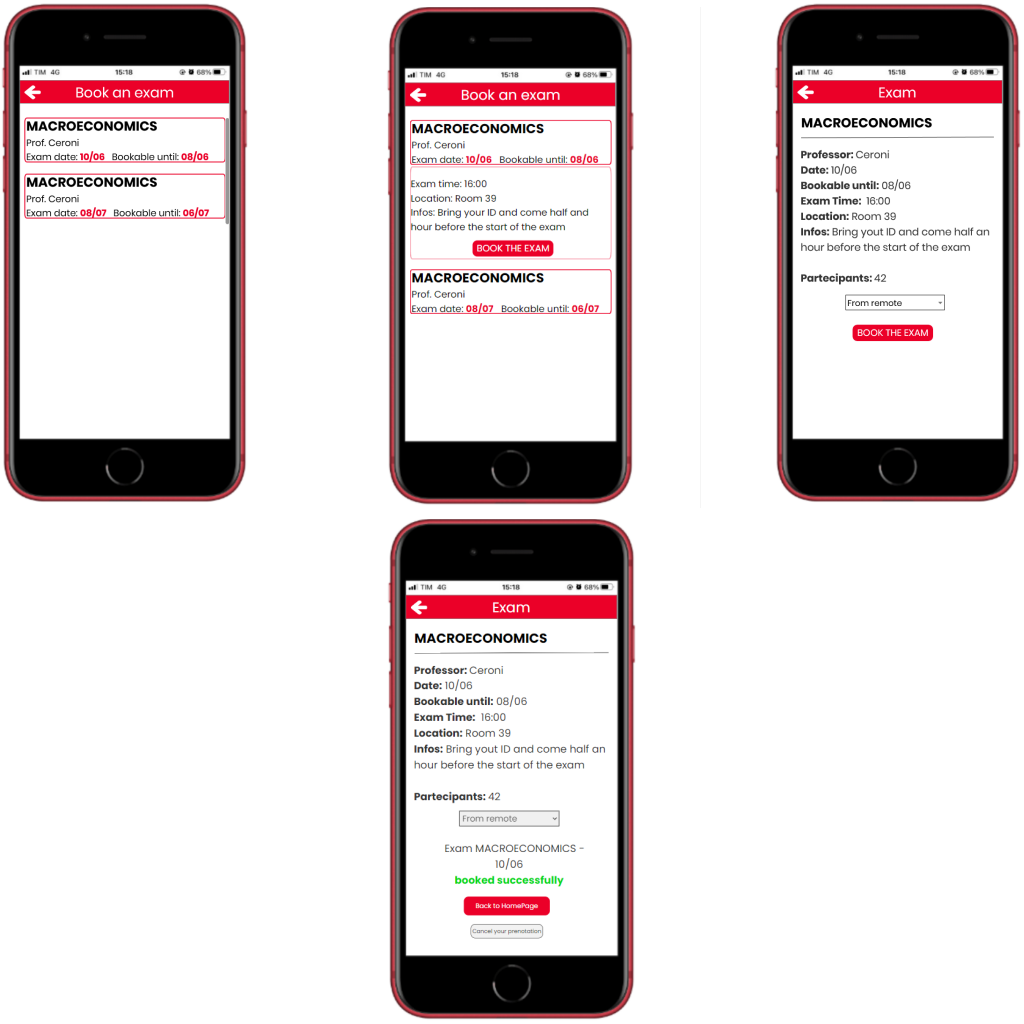


Figure 24: “Book an exam” page

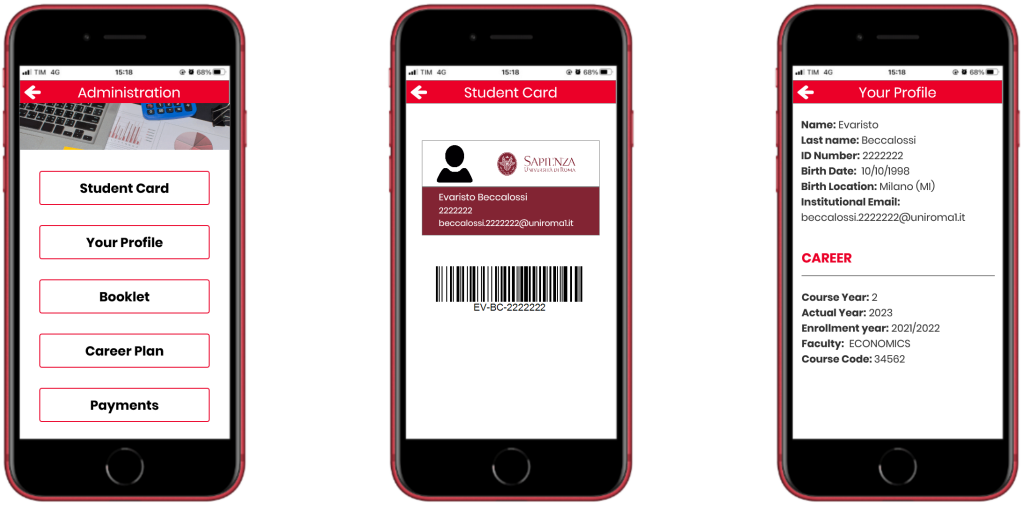


Figure 25: Administration, “Student Card” and “Your Profile” pages

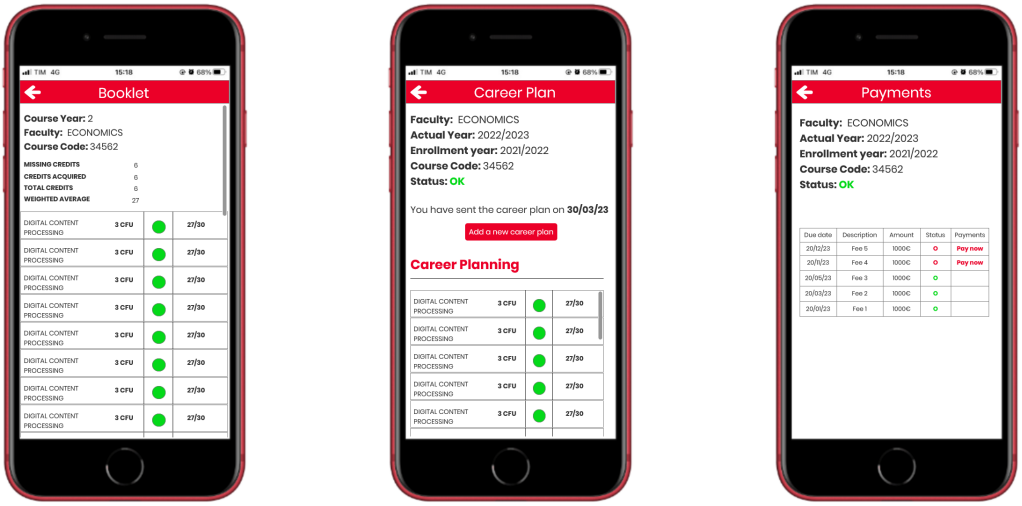


Figure 26: “Booklet”, “Career Plan” and “Payments” pages

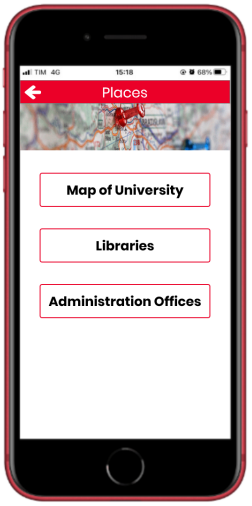


Figure 27: Places page

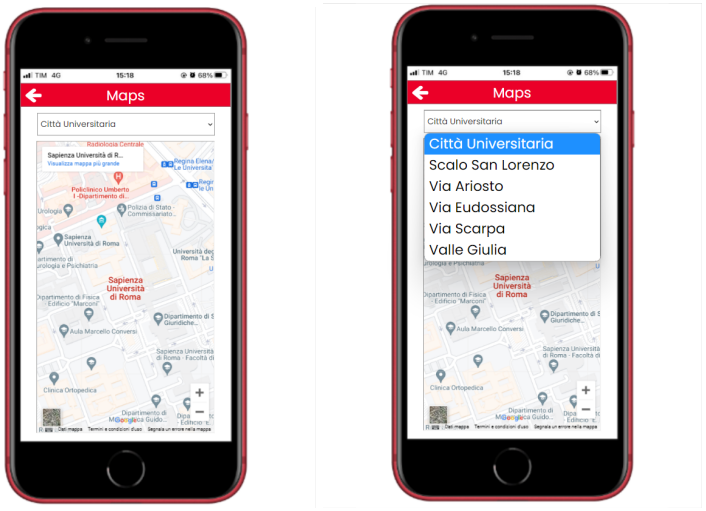


Figure 28: Maps of university

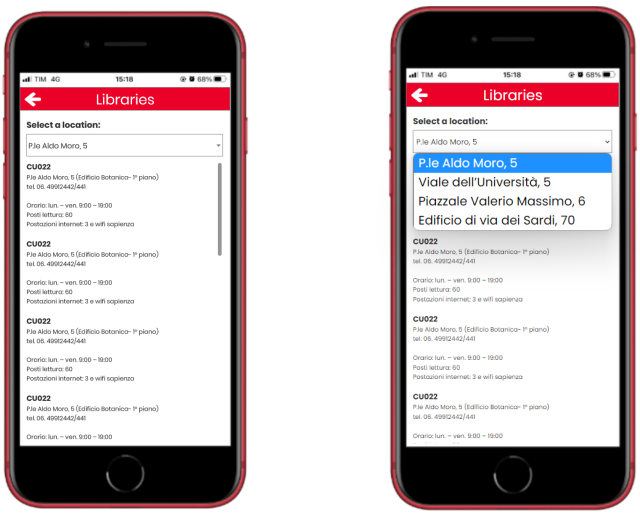


Figure 29: Libraries

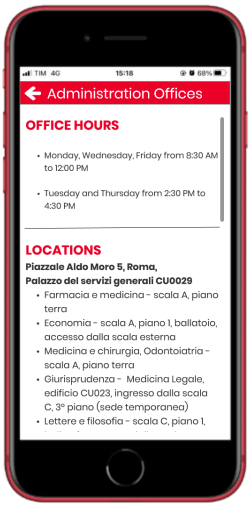


Figure 30: Administration offices

8.2.1 Guest student

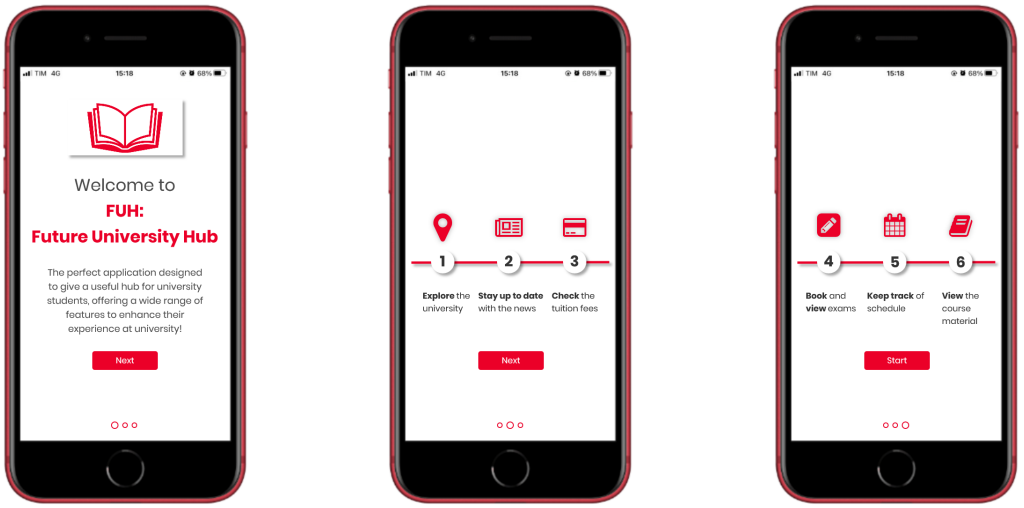


Figure 31: Tour

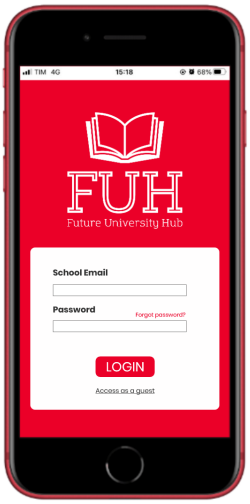


Figure 32: “Access as a guest”

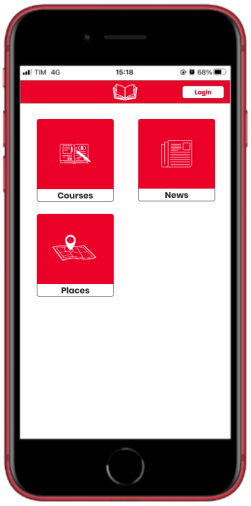


Figure 33: Homepage

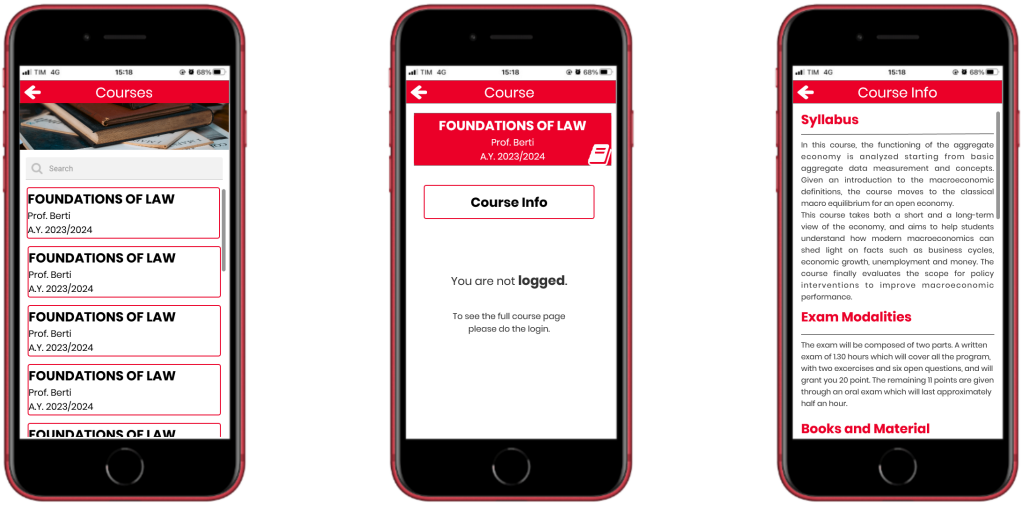


Figure 34: Course page

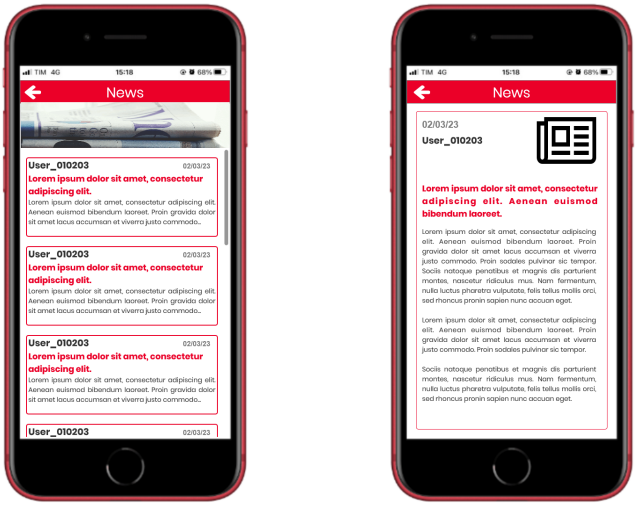


Figure 35: News page

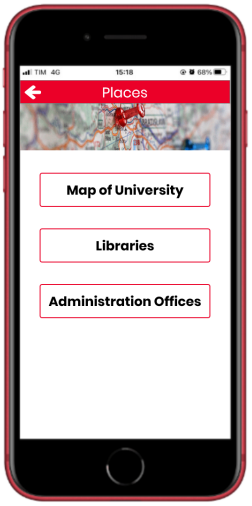


Figure 36: Places page

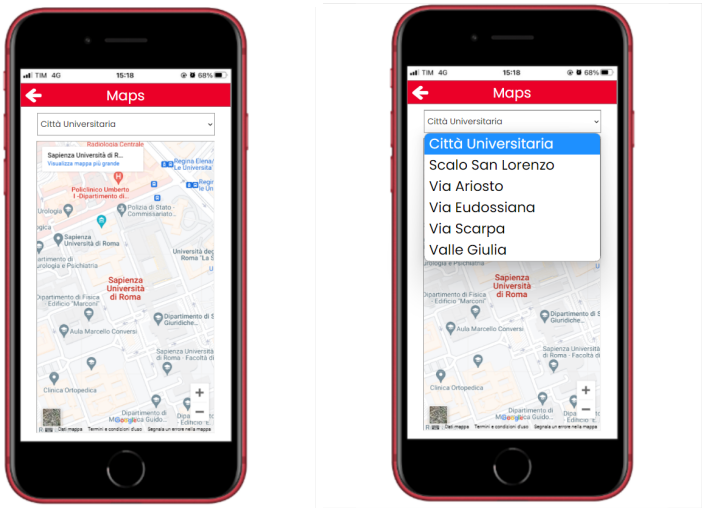


Figure 37: Maps of university

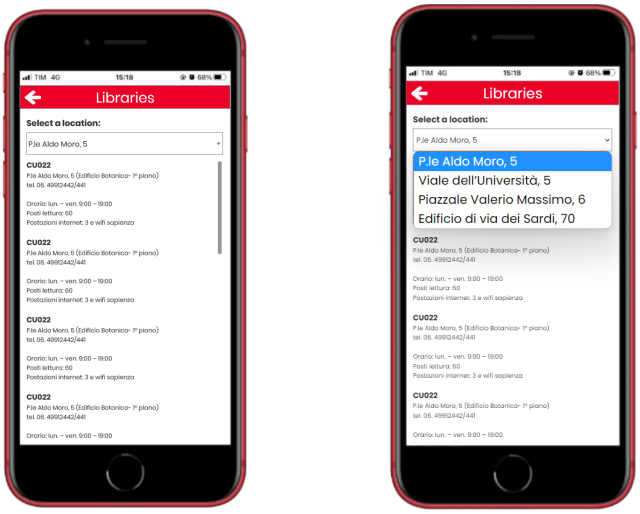


Figure 38: Libraries

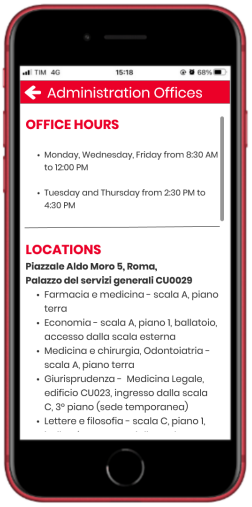


Figure 39: Administration offices

9. CONCLUSION

The idea behind this application rises from the confusion generated by the multiple platforms used in the university environment to provide needed services to students. At present, students, in order to complete any university-related task, must first figure out which platform to interface with, and then find the necessary resource in user interfaces that are often counterintuitive and full of features not inherent to the specific field. Our application aims to present a new way for students to interface with the most common tasks in the university environment, with an intuitive and understandable interface.

Working on this project using a User-Centred Design approach has been a valuable experience that has significantly enhanced our understanding of user needs and the importance of designing applications with users in mind. It marked the first time we directly engaged with users to gather requirements, receive suggestions, and gather feedback on general usage concepts. This direct interaction provided us with invaluable insights and guided us in crafting a useful and user-friendly application.

Throughout the project, we not only learned new ways of working but also honed our technical skills in developing mobile interfaces. By focusing on the users' needs and preferences, we were able to improve our overall development process and deliver a high-quality product.

However, while the application has been developed to work locally on a machine, further work is required to ensure its distribution to users. This additional effort will involve making the necessary adjustments and enhancements to make the application accessible and available to a wider audience.

Overall, this project has allowed us to solve our doubts involved in creating user-centred applications. From gathering user information through questionnaires to implementing the final product, we recognized the significance of each step in the development process. By embracing the challenges encountered along the way, we have refined our working methods and problem-solving approaches.

As we conclude this project, we look back with a sense of achievement and growth. The knowledge and skills gained will undoubtedly contribute to our future endeavours in creating user-centric and impactful applications.