

Individual Diploma Thesis

**MYEHEALTHAPPCY TELECONSULTATION MODULE**

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**DEPARTMENT OF COMPUTER SCIENCE**

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**MYeHealthAppCY Teleconsultation module**

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The Diploma project was submitted for partial fulfilment of the requirements for the acquisition of the Bachelor's Degree from the Department of Computer Science of the University of Cyprus

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## **Abstract**

This project aims to improve access to quality healthcare for patients and providers through the development of a teleconsultation module for the MYeHealthAppCY mobile eHealth application in Cyprus. In addition to teleconsultation, the solution includes features such as integrated prescription and dispensing management and patient summary views to streamline the delivery of care and enhance patient engagement. The teleconsultation module was implemented using the open-source Jitsi Meet videoconferencing software and the application was developed using React Native. The backend of the solution was implemented using C# and the eHealth Laboratory at the University of Cyprus provided the development server for the backend API.

One key aspect of this project was the focus on modularity, with the goal of making the solution easily reusable by other countries and organizations. To achieve this, the code was designed with the intention of packaging and distributing key components as reusable React Native components. The application was also designed to be interoperable using the FHIR (Fast Healthcare Interoperability Resources) standard for data processing and storage, ensuring that it can be easily integrated with other systems through a well-defined and still improving health-related protocol.

Overall, the project aims to contribute to the development of a more robust and comprehensive eHealth system in Cyprus, with the goal of improving the quality of healthcare for all stakeholders. While the project serves as a proof of concept, there is potential for further development and improvement in the future, particularly as part of a master's program. The teleconsultation module has the potential to significantly improve access to healthcare for patients in remote areas and to reduce the risk of transmission of infectious diseases, while also improving the efficiency and effectiveness of care delivery for healthcare professionals.

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# Chapter 1

## Introduction

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### 1.1 Motivation

Modern technology and methods of patient care are continually being introduced, which leads to continuous change in the healthcare sector. The utilization of mobile electronic health (eHealth) technologies to increase access to care and improve the patient experience is one area that has attracted lot of interest recently [1]. Teleconsultation has become a viable option in this situation for enhancing the provision of healthcare services, particularly in poor or remote places. Teleconsultation refers to the use of electronic communication technologies, such as video conferencing, to facilitate consultations between healthcare providers and patients. This approach has the potential to overcome barriers such as distance, time, and cost, allowing patients to receive care from the comfort of their own homes. Teleconsultation can also help to reduce the burden on traditional healthcare systems, which may be overwhelmed by demand, especially during times of crisis or pandemic [2].



*Figure 1 - Mock-up of doctor having a teleconsultation with his patient.*

In Cyprus, the eHealth ecosystem is still in its preliminary stages of development, with significant opportunities for growth and improvement. By implementing a teleconsultation solution for a mobile eHealth platform, this project aims to contribute to the development of a more comprehensive and accessible healthcare system in the country. The solution will include features such as integrated prescription management and patient summary views, which aim to streamline the delivery of care and enhance patient engagement. Overall, the project aims to improve the quality of healthcare for patients and providers in Cyprus and serves as a proof of concept for the potential use of teleconsultation in other contexts.



*Figure 2 - Mock-up of MYeHealthAppCY application highlighting the 'My Health' screen.*

## **1.2 Background and Context**

The eHealth Laboratory at the University of Cyprus is a research group dedicated to the development and implementation of innovative technologies and solutions in the field of healthcare. With a focus on the use of the FHIR (Fast Healthcare Interoperability Resources) standard [3], the laboratory aims to improve the interoperability and exchange of data between different healthcare systems and stakeholders. As a result, patients can benefit from more comprehensive and efficient care, while healthcare providers can access and use relevant information in a timely manner.

The use of FHIR has the potential to transform the way healthcare is delivered, by enabling the integration of different systems and enabling data sharing between stakeholders. This can lead to more efficient and effective healthcare delivery, as well as improved patient outcomes.

The eHealth Laboratory is actively involved in several projects and initiatives aimed at promoting the development of the eHealth ecosystem in Cyprus. These include the development of eHealth services and applications, the implementation of interoperability solutions, and the establishment of partnerships with industry and academic institutions. Through its work, the eHealth Laboratory plays a key role in driving the adoption and implementation of eHealth solutions in Cyprus, with the goal of improving the quality of healthcare for all stakeholders.

As part of the eHealth Laboratory's efforts to develop a comprehensive and effective eHealth ecosystem in Cyprus, the team has been working closely with the Simplifier platform. Simplifier is a tool that allows healthcare organizations to define and manage their own profiles based on national requirements and specific needs. By using Simplifier, the eHealth Laboratory has been able to create national profiles that reflect the specific needs of the Cyprus healthcare system, including the use of the Cyprus General Healthcare Service beneficiary code and other national requirements.

I, the author of this thesis, have had the opportunity to work as a member of the eHealth Laboratory at the University of Cyprus on the development of the backend API, EHR Engine and FHIR Client which are still on 'early' development stages. Through my work at the eHealth Laboratory, I have gained valuable experience in the development of eHealth solutions and have become proficient in the use of the FHIR (Fast Healthcare Interoperability Resources) standard, which is a key enabler for interoperability in healthcare.

### 1.3 Objectives and Research Questions

The primary objective of the project was to design and implement a teleconsultation module for a mobile eHealth application, MYeHealthAppCY, with a focus on improving access to quality healthcare for patients and providers.

To achieve this goal, the following research questions were addressed:

1. How can teleconsultation be integrated into a mobile eHealth platform to improve the delivery of healthcare services in Cyprus?
2. Which features and functions can be included in the teleconsultation module to enhance the patient experience and engagement?
3. How can the teleconsultation module be designed to be modular and reusable in other contexts?
4. How can the teleconsultation module be integrated with other systems using the FHIR standard?
5. How can the teleconsultation module be assessed and evaluated to ensure its effectiveness and usability?

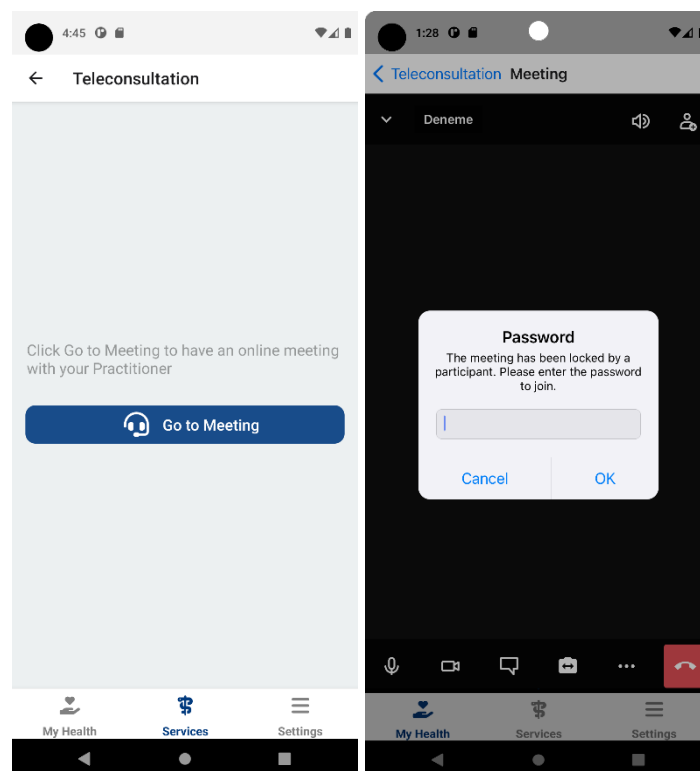


Figure 3 - (a) Screen of Teleconsultation service, (b) Password requirement to join the teleconsultation.



Summarizing, the scope of the project included the design and implementation of a teleconsultation module for a mobile eHealth application in Cyprus using React Native and integrating the Jitsi Meet open-source videoconferencing solution. The backend was implemented using C#, and the eHealth Laboratory at the University of Cyprus provided the development server for the backend API [4], as shown in Figure 4. The project also included the development of features such as authentication and authorization of the user, integrated prescription management and patient summary views.

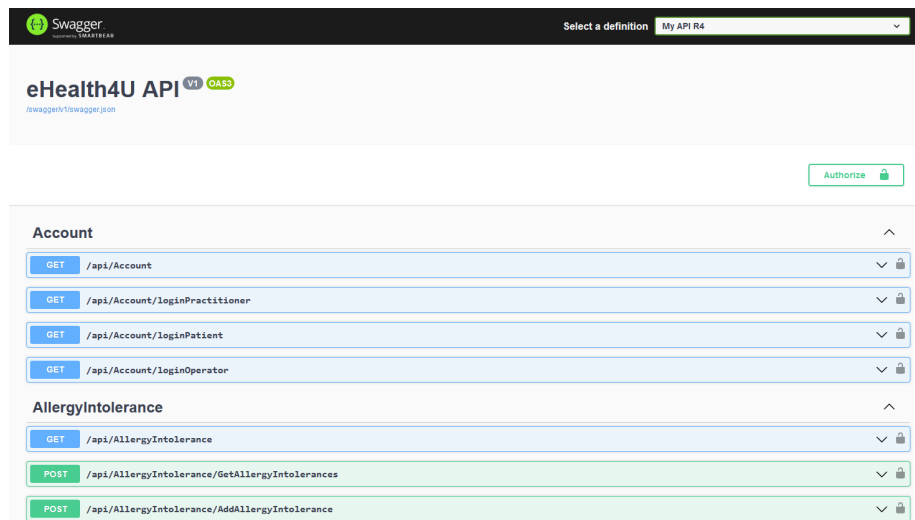


Figure 4 - Screenshot of development API of eHealth4u.

There were a few limitations and assumptions that were made in the scope of the project. One limitation was that the solution was only developed for the Android and iOS operating systems. However, due to Apple iOS operating system limitations, which restrain iOS development to only Mac users, I was only able to contribute through the Android emulation to develop the app for the Android users. Additionally, the project assumed that users of the app would have access to a stable internet connection, as teleconsultation requires a reliable internet connection to function properly. Another assumption was that the app would be used primarily by healthcare professionals and patients in Cyprus and may not be applicable to other countries or regions with different healthcare systems and regulations. Finally, the project assumed that the FHIR standard would continue to be used as the primary means of interoperability in the healthcare industry.

## **1.4 Guide to Thesis contents**

The thesis is organized into seven chapters, in which the process of implementing and evaluating the teleconsultation module and other related communication channels are thoroughly documented. The teleconsultation module is designed to be integrated into the MYeHealthAppCY mobile application, which aims to provide remote healthcare services to patients in Cyprus. Chapter 1 serves as an introduction, and it provides a background on the need for teleconsultation services in the current healthcare landscape. It also lays out the research objectives and the scope of the study. Chapter 2 reviews existing teleconsultation and telecommunication software solutions, analysing the pros and cons of both open-source and paid options. The chosen solution, Jitsi Meet, is open-source and has good documentation. The chapter also covers the requirements analysis process, which helped in identifying the necessary features and functionalities of the teleconsultation module. In chapter 3, the various technologies utilized during the implementation process are discussed, providing a brief introduction to each. The focus of the thesis is not on specific technologies such as React Native, C#, FHIR protocol, or Keycloak, but these were deemed necessary for the project and are well-documented on the open Internet for anyone to access. Chapter 4 introduces the chosen Software Development Life Cycle (SDLC) for the MYeHealthAppCY mobile application, which employs the Waterfall Software Development Model. The chapter also covers the project management aspects of the development process, including the project planning, scheduling, and resource allocation. The general architecture of the system and application are discussed in chapter 5, and the SDLC is examined to determine how each stage contributed to the final solution. The chapter also covers the deployment and maintenance of the teleconsultation module, including the necessary infrastructure and support systems. Chapter 6 covers testing and evaluation of the application, including both functional and non-functional testing. The chapter also covers the user acceptance testing process, in which real users were asked to test the teleconsultation module and provide feedback. Finally, chapter 7 concludes the thesis by summarizing the limitations, difficulties encountered, and recommendations for future work on the application. This chapter also covers the potential impact of the teleconsultation module on the healthcare system in Cyprus and the potential for further research in this area.

## Chapter 2

### Reviewing teleconsultation software

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#### 2.1 Introduction

The reviewing teleconsultation software chapter aims to provide an overview of the current state of teleconsultation solutions in the healthcare industry, as well as the research and software that has been used as a foundation for the development of the teleconsultation module in this project. This chapter will explore the various teleconsultation solutions that are available on the market, including both open-source and commercial options, and will also review the relevant research on teleconsultation and its potential benefits and challenges. Additionally, this chapter will detail the software that was used in the development of the teleconsultation module, including the programming languages, frameworks, and libraries that were utilized. By understanding the landscape of teleconsultation solutions and the tools that were used to develop the module, readers will be able to gain insight into the design and implementation of the teleconsultation module in this project.



*Figure 5 - Elderly people having a teleconsultation with their doctor.*

## **2.2 Requirements Analysis**

The requirements analysis is a critical step in the software development process, as it helps to define the scope and goals of the project, and to identify the stakeholders and their needs. This process involves gathering and analysing information about the users, the business context, and the technical environment in which the software will be used. The requirements analysis helps to ensure that the software is aligned with the needs of the users and the business, and that it will meet the required performance, reliability, and usability standards.

To perform the requirements analysis for this project, a variety of techniques were used, including interviews with stakeholders, focus groups with users, and online surveys. The information gathered during the requirements analysis was used to create user stories, use cases, and acceptance criteria, which helped to define the functional and non-functional requirements of the teleconsultation module. The requirements analysis also helped to identify any constraints or assumptions that would need to be considered during the design and development of the solution. Overall, the requirements analysis was an essential step in ensuring that the teleconsultation module would meet the needs and expectations of the users and stakeholders.

As a member of the eHealth Laboratory, I was constantly involved in the development of various sections of this application, both directly and indirectly. For example, to fetch the patient profile, we needed to retrieve various resources such as the patient, practitioner, and organization records. These resources are provided by the FHIR HAPI server and are essential for the proper functioning of the application. In addition to teleconsultation, the application includes features such as integrated prescription management and patient summary views, which aim to streamline the delivery of care and enhance patient engagement. Overall, my contributions to the development of this application have been focused on improving the accessibility and quality of healthcare for patients and providers in Cyprus.

### **2.3 Technologies background**

To develop a teleconsultation solution for the mobile eHealth application, extensive research was conducted on existing software in the market. This included evaluating both open-source and paid options, as well as assessing the specific requirements for the project, such as video conferencing capabilities, interoperability with other systems, and user experience.

To integrate the application with the existing system under development, research was also conducted on the server and database components of the solution. The server was running a Swagger API with REST calls, and it was necessary to understand how to make connections to the database and retrieve data. Additionally, the eHealth Laboratory provided Keycloak [5] as the User Identity Provider for the application. It was necessary to research how to use Keycloak and how to store and use tokens to implement the login functionality. Overall, a significant amount of research was conducted to ensure that the teleconsultation module was properly integrated with the existing system and met the requirements of the project.

In addition to researching the teleconsultation software available on the market, research was conducted on mobile development tools and techniques [6]. It was decided to use React Native Cli [7] for the development of the application, as it is an open-source framework that offers a wide range of packages and is well maintained. While React Native Expo [8] may be easier to deploy it does not offer the same level of customization

as React Native Cli, which allows developers to extend the functionality of the application with custom native modules and device specific configurations. I also found that React Native Cli allows for the creation of native Android or iOS modules using languages such as Java/Kotlin for Android and Swift for iOS which was beneficial for the specific requirements of the project. During the research process, I gained familiarity with tools such as the Android emulator [9], Android Studio [10] and various debugging tools, which were essential for the development and testing of the application.

Figure 6 - Android Studio Screen with embedded Android Emulator.

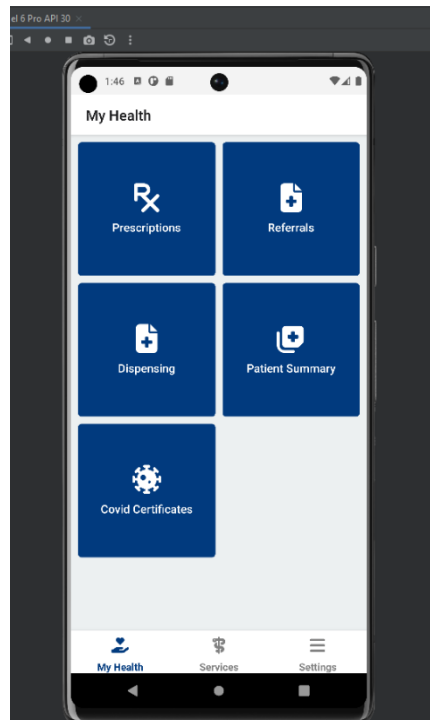


Figure 7 - Android Emulator.

## 2.4 Existing Software

In the "Existing Software" section, it is worth mentioning that there are many teleconsultation software options available on the market, such as “Google Meet [11]”, “Microsoft Teams [12]”, “Jitsi [13]”, “Webex [14]”, “AnyMeeting [15]”, “Zoom [16]”, “Join.me [17]”, “8x8 [18]”, “Rocket.Chat [19]” and many more. Each of these solutions has its own unique features and pricing plans, and it was important to carefully consider which one would best meet the needs of the teleconsultation module being developed. Also, there were a lot of limitations, such as Google Meet's one-hour free call limitation. Jitsi stands out as a particularly attractive option due to its open-source nature and the fact that any developer or organization can host their own server. This gives users the flexibility to customize and tailor the software to their specific needs and requirements.

As a result of the research conducted on existing solutions, it was determined that the teleconsultation module for the mobile eHealth application in Cyprus would require the use of Keycloak [5] for authentication and authorization, C# for the backend implementation, and the FHIR standard for interoperability. In addition, it was determined that the use of REST APIs [20] would be necessary for communication with the server and accessing healthcare-related data. Overall, the findings from the research indicated that there would be a significant amount of work required to integrate these various components and ensure the smooth operation of the teleconsultation module within the broader eHealth platform.

As part of the research for this project, I also needed to gain a deeper understanding of the FHIR protocol [21] and how to write and map profiles using this standard and how to create and use the REST APIs providing the data. This was especially important as the application was being built upon the Simplifier project of the eHealth4u project, which relies heavily on FHIR for interoperability. To effectively implement the authorization and healthcare data channels of the application, it was necessary to thoroughly research the capabilities and best practices for working with FHIR. Additionally, I also needed to familiarize themselves with the various tools and resources available for working with FHIR, such as the HAPI FHIR [22] and the FHIR specification. Overall, the research on FHIR and the Simplifier project played a crucial

role in the development of the teleconsultation module and the MYeHealthAppCY application.

The screenshot shows the 'eHealth4U' project page. At the top, it says 'PROJECT eHealth4U' and provides a description: 'The eHealth4U is a research project that undertakes the challenge of designing and developing a prototype of the national integrated EHR system in Cyprus. More information: <http://ehealth4u.cs.ucy.ac.cy/>'. Below this is a green banner that reads 'Prototype of the National Integrated EHR System in Cyprus'. To the right of the banner are tags: 'PUBLIC PROJECT', 'FHIR R4', 'Scope National CY', and 'Subscriptions 3'. Below the banner is a navigation bar with links: 'Introduction', 'Resources', 'Guides', 'Team', 'Log', 'Dependencies', and 'Packages'. The 'Resources' link is selected. On the left side, there is a search bar and a 'Resource Categories' section with a list of categories: 'Profiles' (checked), 'ValueSets', 'CodeSystems', 'Extensions', 'SearchParameters', 'CompartmentDefinitions', 'CapabilityStatements', 'OperationDefinitions', 'NamingSystems', 'ConceptMaps', 'StructureMaps', 'ImplementationGuides', 'TestScripts', and 'DataElements'. On the right side, there is a list of draft profiles: 'Cyprus EHR Address datatype' (Profile on Address, 8/12/2022), 'Cyprus EHR Allergy Intolerance profile' (Profile on AllergyIntolerance, 12/19/2022), 'Cyprus EHR Body Blood Pressure profile' (Profile on Observation, 9/19/2022), and 'Cyprus EHR Body Mass Index profile' (Profile on Observation, 9/1/2022). Each profile has a 'Draft' label and a date.

Figure 8 - Simplifier of the Cyprus eHealth4u showing some draft profiles.

The screenshot shows the 'Cyprus EHR Patient profile' page. At the top, it says 'PROJECT eHealth4U' and 'Cyprus EHR Patient profile'. Below this is a green banner that reads 'Prototype of the National Integrated EHR System in Cyprus'. To the right of the banner are tags: 'type Profile on Patient', 'FHIR R4', 'status Draft', and 'version 1.0'. Below the banner is a navigation bar with links: 'Overview', 'Details', 'Mappings', 'Table', 'XML', 'JSON', 'Related', 'History', and 'Narrative'. The 'Overview' link is selected. On the right side, there is a search bar and a 'Patient' section. Below the 'Patient' section is a table with columns: 'Element Id', 'Short description', 'Definition', 'Requirements', and 'Data Type'. The table contains the following data:

Element Id	Short description	Definition	Requirements	Data Type
Patient.Identifier	An identifier for this patient	An identifier for this patient.	CyprusEHR: Identifiers can be provided for every person registered in national integrated EHR system of Cyprus but it is not mandatory, e.g.: a patient in some specific cases can remain anonymous. There are three possible identifiers that can be used: (1) the national identity and the issuing country (2) the passport and the issuing country (3) the Alien Resident Card (in Cyprus) and (4) the Social Insurance Services.	Identifier

Figure 9 - Cyprus eHealth4u FHIR patient profile.



### **2.4.1 Paid Solutions**

Paid teleconsultation solutions often offer a range of benefits that may not be available with free or open-source options. These benefits can include:

- **Advanced features:** Paid solutions may offer a wider range of features and functionality, such as screen sharing, document collaboration, and integration with other tools and systems.
- **Support:** Paid solutions often provide access to resolute support teams, who can help users troubleshoot issues and provide guidance on how to use the software.
- **Security:** Many paid solutions offer enhanced security features, such as end-to-end encryption and secure data storage, which can be particularly important for sensitive medical information.
- **Customization:** Some paid solutions allow users to customize the appearance and functionality of the software to meet the specific needs of their organization.

Overall, paid teleconsultation solutions can be a good choice for organizations that require advanced features and support, or that need to ensure the security and privacy of their data. However, it is important to carefully consider the cost and feature set of any paid solution before deciding.

### **2.4.2 Open-Source Solutions**

There are several key benefits to using open-source software in the development of teleconsultation solutions:

- **Cost:** One of the main advantages of open-source software is that it is generally free to use, which can be a significant cost saving for organizations or individuals looking to develop teleconsultation solutions.
- **Customization:** Open-source software is often highly customizable, allowing developers to modify and adapt the software to meet their specific needs and requirements.
- **Community support:** Open-source software often has a large and active community of developers and users, who can provide support and assistance in the development and maintenance of the software.

- Collaboration: Open-source software promotes collaboration and sharing, which can lead to faster development and a more robust solution.
- Innovation: The open-source model encourages innovation and allows developers to build upon and improve existing solutions, leading to the development of new and innovative technologies.

### **2.4.3 Comparison of Paid vs Open-Source Solutions**

There are both paid and open-source solutions available for teleconsultation. Paid solutions often offer a range of features and support options that can be attractive to organizations or individuals with specific needs or resources. These solutions may offer features such as advanced security measures, integrations with other healthcare systems, and technical support. However, they can also be expensive, especially for organizations with limited budgets or for individuals who may only need teleconsultation on a sporadic basis.

On the other hand, open-source solutions offer several benefits that may make them a more attractive option for some users. For example, open-source solutions are often free to use and can be modified or customized according to the needs of the user. They also often have a strong community of developers and users who contribute to their development and support. However, open-source solutions may not offer the same level of features or support as paid solutions, and users may need to be more technically proficient to set them up and use them effectively. Ultimately, the choice between paid and open-source solutions will depend on the needs and resources of the user.

### **2.4.4 Pros and Cons of each approach**

Using paid teleconsultation solutions can have several benefits, including:

Pros of paid teleconsultation solutions:

- Reliability: Paid solutions often come with dedicated support teams and are more likely to have a higher uptime and fewer technical issues.
- Customization: Many paid solutions offer a range of customization options, allowing users to tailor the platform to their specific needs.

- **Advanced features:** Paid solutions often come with a wider range of features and functionality, such as the ability to record consultations or integrate with other healthcare systems.

However, there are also some potential drawbacks to using paid teleconsultation solutions:

Cons of paid teleconsultation solutions:

- **Cost:** The main disadvantage of paid solutions is the cost, which can be significant depending on the size and needs of the organization.
- **Dependency:** Using a paid solution means that the organization is dependent on the vendor to provide updates and support, which can be a risk if the vendor goes out of business or experiences technical issues.
- **Limited flexibility:** Paid solutions may not offer the same level of flexibility as open-source solutions, as users are limited to the features and functionality provided by the vendor.

On the other hand, using open-source teleconsultation solutions can have the following benefits:

Pros of open-source teleconsultation solutions:

- **Cost:** Open-source solutions are typically free to use, which can be a major advantage for organizations with limited budgets.
- **Flexibility:** Open-source solutions offer more flexibility and customization options, as users can modify the code to meet their specific needs.
- **Community support:** Many open-source solutions have large communities of users and developers who contribute to the project and provide support, which can be a valuable resource for users.

However, there are also some potential drawbacks to using open-source teleconsultation solutions:

Cons of open-source teleconsultation solutions:

- Limited support: Open-source solutions often have limited support options, as users are reliant on the community for help and guidance.
- Dependency: Using an open-source solution means that the organization is dependent on the community to maintain and update the project, which can be a risk if the community becomes inactive or the project is abandoned.
- Limited features: Open-source solutions may not have the same range of advanced features as paid solutions, as users are limited to what has been developed by the community.

## **2.5 Summary of Research Conclusions**

In summary, the research conducted for this project has provided valuable insights into the various teleconsultation software solutions available on the market. The decision to use a paid solution, such as Webex or Zoom, may offer a more comprehensive set of features and potentially better support, but it may also come with a higher cost. On the other hand, using an open-source solution like Jitsi allows for greater customization and the ability to host the platform on one's own servers, but it may require more technical expertise and potentially less support. Ultimately, the choice of teleconsultation software will depend on the specific needs and resources of the organization or project. In the case of this project, the decision was made to use Jitsi due to its open-source nature and ability to meet the project's requirements.

In terms of the overall eHealth solution, the integration of a teleconsultation module has the potential to greatly improve access to care and enhance the patient experience. By allowing patients to receive consultations from the comfort of their own homes, teleconsultation can help to overcome barriers such as distance, time, and cost. It can also help to reduce the burden on traditional healthcare systems, especially during times of crisis or high demand. Overall, the use of teleconsultation has the potential to greatly benefit both patients and healthcare providers in Cyprus and beyond.

## Chapter 3

### Technologies

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#### 3.1 Introduction

In the Technologies Introduction section, it is important to mention that the development of the teleconsultation solution for the mobile eHealth platform involved the use of several key technologies. Based on the research conducted, the following five technologies were identified as being central to the project:

- React Native: This is a JavaScript framework used for building native mobile applications for Android and iOS [23]. It allows developers to use a single codebase to create applications that can run on multiple platforms, making it a cost-effective and efficient solution for mobile development.
- Jitsi Meet: This is an open-source videoconferencing solution that was used to enable teleconsultation in the mobile eHealth platform. It offers a range of features such as screen sharing, chat, and file sharing, making it an ideal solution for virtual consultations.
- FHIR Protocol: The Fast Healthcare Interoperability Resources (FHIR) protocol is a widely used standard for exchanging healthcare information electronically. It was used to facilitate interoperability between the teleconsultation solution and other healthcare systems.
- Keycloak: This open-source authentication and authorization platform was used to provide secure access to the teleconsultation solution. It was used to manage user

identities and permissions, ensuring that only authorized users could access the application.

- C#: This is a popular programming language used for building a wide range of applications, including those for the web, mobile, and desktop. It was used to implement the backend of the teleconsultation solution, including the API and database integration.

### **3.2 React Native**

React Native is a popular open source [24] framework for developing mobile applications that was developed by Facebook. It is based on the React JavaScript library and is designed to allow developers to build native mobile applications using the same principles and concepts that they would use for mobile development.

React Native is backed by a strong community of developers and is constantly being updated and improved. There is a wealth of documentation and resources available online for developers to learn about React Native and get started with building their own applications [25].

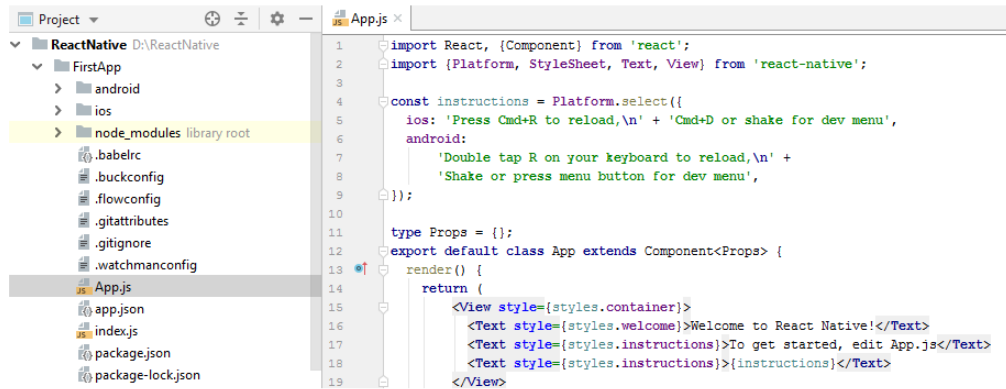
As a member of the eHealth Laboratory, I, the author of this thesis had the opportunity to work with React Native in the past, including completing a course on the framework and interning for three months at a company that used React in its development process. Through this experience, I gained familiarity with concepts such as hooks, state management, and the benefits of responsive design.

One of the major advantages of React Native is its ability to allow developers to code once and run their applications on multiple platforms, including both Android, iOS, desktop, TVs, and tablets. This means that developers can write their code once and have it work on multiple platforms, rather than having to create separate versions of their applications for each operating system.

Another benefit of React Native is its Hot Reload feature, which allows developers to make changes to their code and see those changes reflected instantly in the app. This

can greatly speed up the development process and allow developers to iterate quickly on their designs and features.

Overall, React Native is a powerful and widely used framework for developing mobile and other applications, and I am confident in the ability to utilize it effectively in the development of the teleconsultation module for the eHealth application.



Code of default React Native first app

Figure 10 - React Native Hello World example.

### 3.3 Jitsi Meet

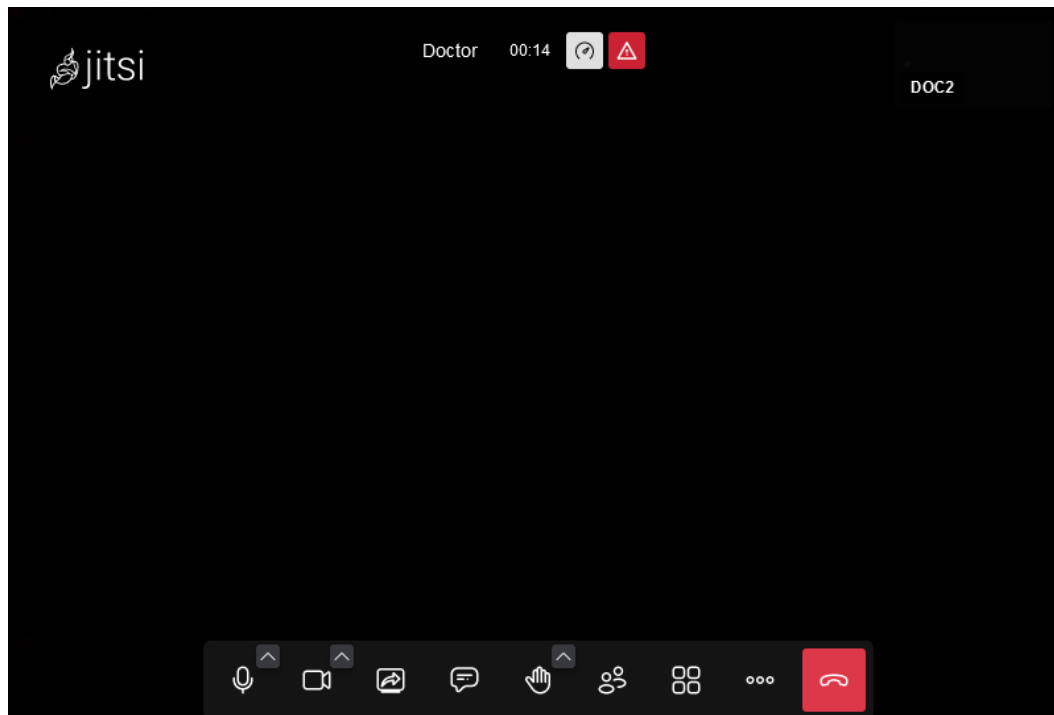
Jitsi Meet is a fully featured video conferencing application that allows users to participate in high-quality audio and video calls from their web, [26] Android, or iOS devices.<sup>i</sup> The application includes features such as the ability to mute and turn off the microphone and camera, as well as the ability to share screens and collaborate on documents in real-time. Jitsi Meet is open-source and multiplatform, meaning that it can be used on a variety of different devices and operating systems.

One of the key benefits of Jitsi Meet is its ease of use. It requires no downloads or installations, at least on the desktop version, and users can join a call simply by clicking a link. Jitsi Meet is also fully encrypted, ensuring the privacy and security of teleconsultation sessions. In addition, it is highly scalable, allowing it to support large numbers of participants in a single call.

Other notable features of Jitsi Meet include the ability to record calls, the integration of a chat function, and the support for multiple languages. It is also possible to customize the appearance of Jitsi Meet, including the ability to add a logo and change the

background colour. Overall, the features of Jitsi Meet make it a powerful and user-friendly solution for teleconsultation.

Overall, Jitsi Meet is a powerful and reliable video conferencing application that is suitable for a wide range of use cases. Whether for personal or professional use, Jitsi Meet is an excellent choice for anyone looking to stay connected and collaborate with others remotely.



*Figure 11 - Jitsi Meet example of active call.*

### **3.4 FHIR Protocol**

FHIR, or Fast Healthcare Interoperability Resources, is a healthcare data standard that enables the exchange of healthcare information between systems and organizations. The FHIR protocol is designed to be flexible, easy to implement, and able to support a wide range of healthcare use cases. The FHIR was developed by Graham Grieve and a team at HL7 in 2012. The goal of the standard was to make it easier to share and access healthcare information, addressing the fragmentation and inefficiencies in the healthcare system. FHIR was made available for free and went through several iterations before being published as a Draft Standard for Trial Use in 2014. The standard has been



successful in connecting healthcare data using online standards and has the support of a dedicated community of developers [3].

FHIR is based on the concept of "resources," which are individual pieces of healthcare information such as patient records, medication lists, and diagnostic reports. These resources are structured according to a set of defined data types and are transmitted between systems using a RESTful API [20].

One of the key benefits of FHIR is its ability to support interoperability between different healthcare systems and organizations. This allows for the exchange of information in a standardized format, making it easier to share data and improve the delivery of care.

In addition to its use in data exchange, FHIR is also commonly used to define national profiles, which reflect the specific needs and requirements of a particular country or region. For example, the eHealth Laboratory at the University of Cyprus has used FHIR to define national profiles that include the Cyprus GHS [27] beneficiary code and other national requirements.

Overall, FHIR is a powerful tool for improving interoperability in healthcare and enabling the exchange of information between systems and organizations.

## 0 Welcome to FHIR®

FHIR is a standard for health care data exchange, published by HL7®. This is Release R4B - see the [explanation about R4B](#).

### First time here?

See the [executive summary](#), the [developer's introduction](#), [clinical introduction](#), or [architect's introduction](#), and then the [FHIR overview / roadmap & Timelines](#). See also the [open license](#) (and don't miss the full [Table of Contents](#) and the [Community Credits](#) or you can [search this specification](#)).

See also the [Known Issues](#) that are not yet addressed.

### Level 1 Basic framework on which the specification is built



#### Foundation

Base Documentation, XML, JSON, Data Types, Extensions

### Level 2 Supporting implementation and binding to external specifications



#### Implementer Support

Downloads,  
Version Mgmt,  
Use Cases,  
Testing



#### Security & Privacy

Security,  
Consent,  
Provenance,  
AuditEvent



#### Conformance

StructureDefinition,  
CapabilityStatement,  
ImplementationGuide,  
Profiling



#### Terminology

CodeSystem,  
ValueSet,  
ConceptMap,  
Terminology Svc



#### Exchange

REST API +  
Search  
Documents  
Messaging  
Services  
Databases

### Level 3 Linking to real world concepts in the healthcare system



#### Administration

Patient, Practitioner, CareTeam, Device, Organization, Location,  
Healthcare Service

### Level 4 Record-keeping and Data Exchange for the healthcare process



#### Clinical

Allergy, Problem,  
Procedure,  
CarePlan/Goal,  
ServiceRequest,  
Family History,  
RiskAssessment,  
etc.



#### Diagnostics

Observation,  
Report,  
Specimen,  
ImagingStudy,  
Genomics,  
Specimen,  
ImagingStudy,  
etc.



#### Medications

Medication,  
Request,  
Dispense,  
Administration,  
Statement,  
Immunization,  
etc.



#### Workflow

Introduction +  
Task,  
Appointment,  
Schedule,  
Referral,  
PlanDefinition,  
etc



#### Financial

Claim, Account,  
Invoice, ChargeItem,  
Coverage + Eligibility  
Request & Response,  
ExplanationOfBenefit,  
etc.

### Level 5 Providing the ability to reason about the healthcare process



#### Clinical Reasoning

Library, PlanDefinition & GuidanceResponse,  
Measure/MeasureReport, etc.



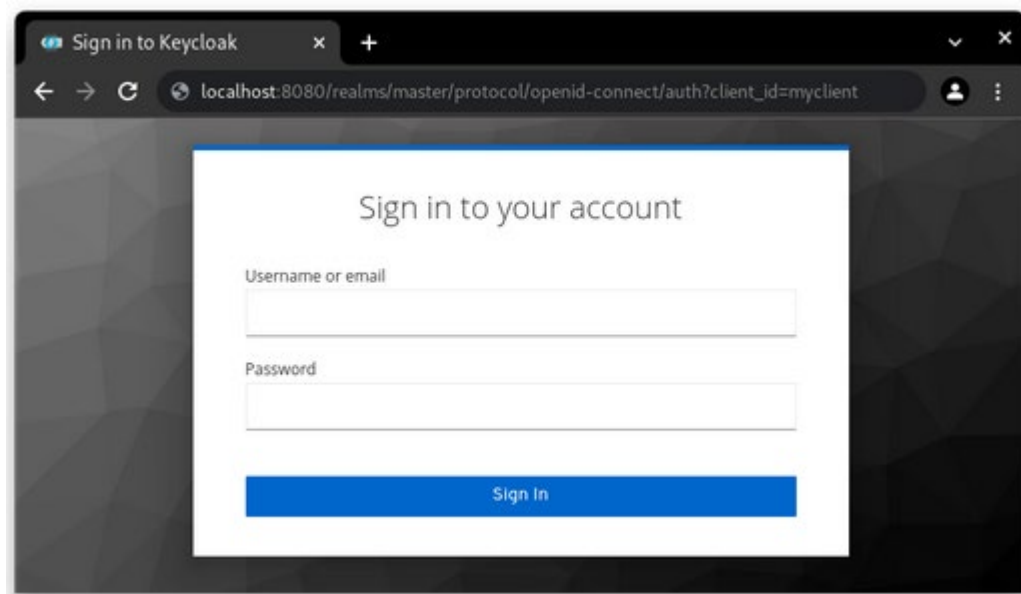
#### Medication Definition

Medicinal, Packaged & Administrable product  
definitions, Regulated Authorization, etc.

Figure 12 - FHIR protocol homepage with various modules.

### 3.5 Keycloak

Keycloak [5] is an open-source identity and access management solution developed by Red Hat. It is designed to be easy to use and customize and provides a range of features including single sign-on, user and role management, and integration with external identity providers such as Google and Facebook. Keycloak is based on the popular WildFly application server and is available in both standalone and cluster modes. It can be used to secure applications and services in a variety of contexts, including web, mobile, and API-based applications. Keycloak supports multiple authentication protocols, including SAML, OAuth, and OpenID Connect, and can be easily integrated with a wide range of applications and services.



*Figure 13 - Keycloak login prompt.*

### 3.6 C#

C# (pronounced "C-sharp") [28] is a modern, object-oriented programming language developed by Microsoft in the early 2000s. It was designed to be a high-level language that is easy to read and write, while also being efficient and powerful enough to handle a wide range of programming tasks. C# is often used for building Windows applications, web applications, and mobile apps, as well as for creating games and other types of interactive software. It has a strong emphasis on object-oriented programming principles and is built on top of the .NET framework, which provides a rich set of libraries and tools for developing software. C# has a large and active community of developers, with many resources and tools available for learning and working with the language.

```

public partial record Person<T> : IState<T>
    where T : Enum
{
    [JsonPropertyName("dataName")]
    public string FirstName { get; init; }
    [JsonPropertyName("dataCity")]
    public string LastName { get; init; }
    [JsonPropertyName("dataState")]
    public T State { get; init; }
}

```

Figure 14 - C# example of code with field for Person resource.

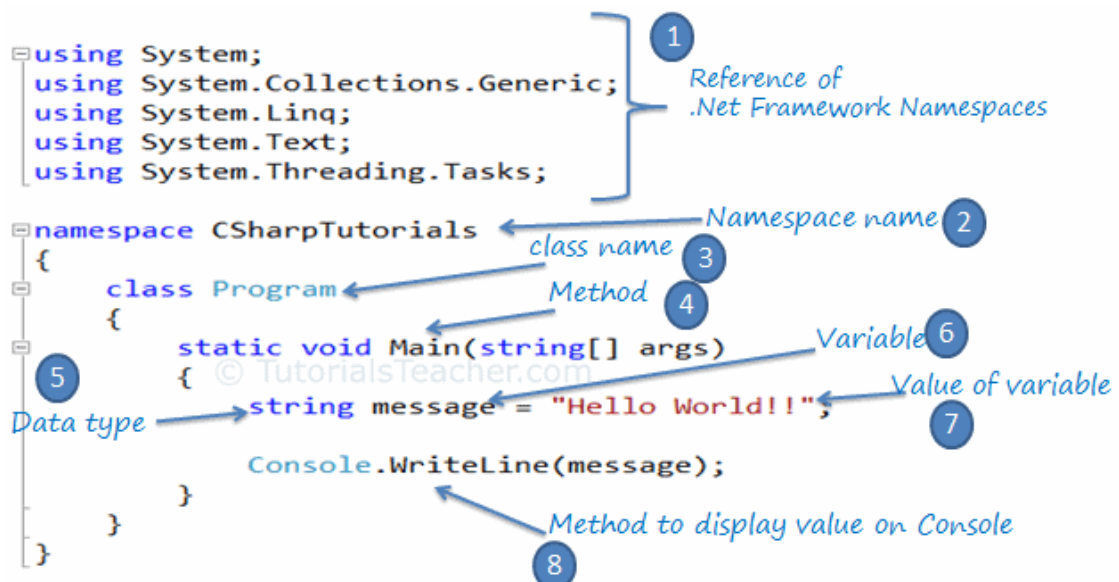


Figure 15 - C# explanation of various syntax used.

## Chapter 4

### Software Development Life Cycle

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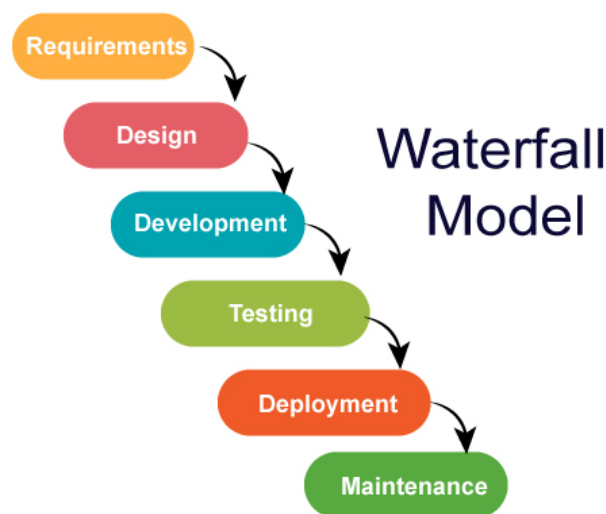
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4.2 Logo Selection Poll	27
4.3 Requirements and Planning	28
4.4 Waterfall Software Development Model	29

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#### 4.1 Introduction / Methodology

The purpose of this chapter is to provide an overview of the software development life cycle (SDLC) [29] followed in the development of the teleconsultation module for the eHealth mobile application. The SDLC is a systematic approach to the creation, testing, and deployment of software, and it is a critical part of the software development process.

The methodology chosen for this project was the Waterfall model [30], which is a linear and sequential approach to software development. This model involves a series of distinct phases, each with its own set of deliverables, and progress moves in a forward direction through each phase. The Waterfall model was chosen because it is well-suited to projects with clear and well-defined requirements, and it provides a structured and orderly approach to software development.



*Figure 16 - Waterfall Model of Software Development Life Cycle*

In the first phase of the Waterfall model, the requirements and planning phase, the scope and objectives of the project were defined, and the necessary resources were identified and allocated. This phase also involved the selection of the logo for the application, which was done through a logo selection poll.

The second phase of the Waterfall model was the design phase, in which the overall architecture of the application was determined, as well as the design of the various components and modules of the application.

The third phase, the implementation phase, involved the actual coding and development of the application, as well as the integration of the various components and modules.

The fourth phase, the testing phase, involved the testing and debugging of the application to ensure that it met the requirements and specifications defined in the planning phase.

Finally, in the deployment phase, the application was packaged and distributed to users.

Throughout the SDLC, it was important to ensure that the project was on track and that any issues or challenges were addressed in a timely manner. The project was also subject to ongoing maintenance and updates to ensure its continued functionality and effectiveness. The whole process was monitored with the help of Microsoft Azure DevOps platform provided by the eHealth4u Laboratory.

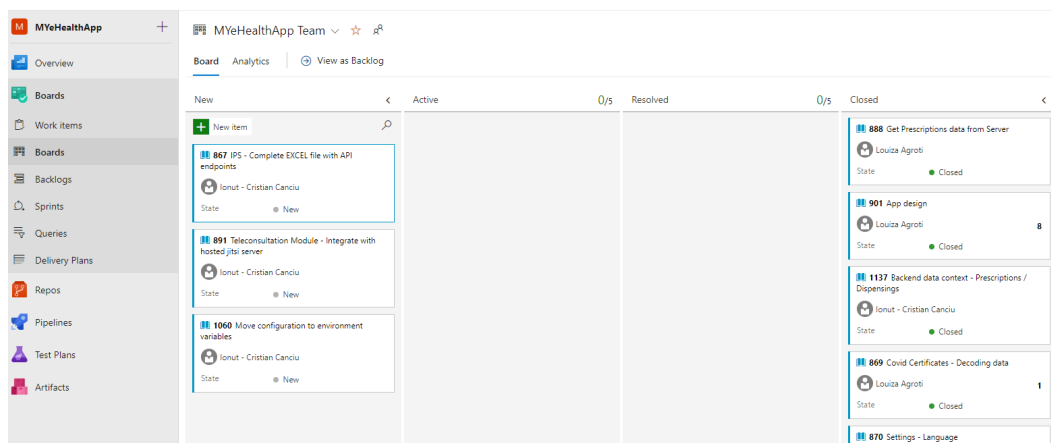


Figure 17 - Azure DevOps project of the MYeHealthAppCY project showing the Boards section.

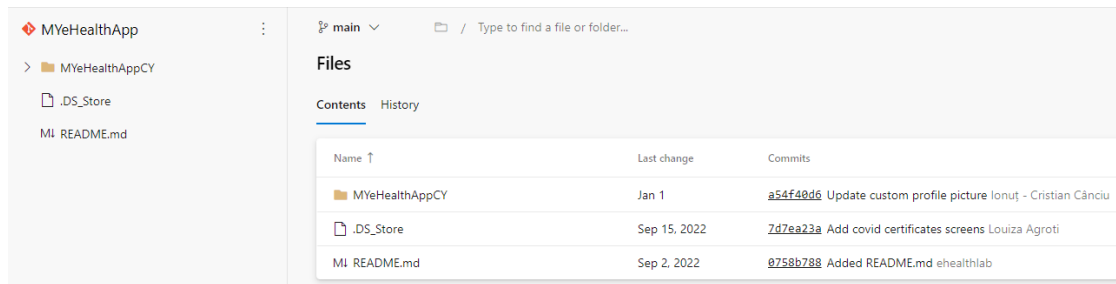


Figure 18 - Azure DevOps of the MYeHealthAppCY showing the repository of the application.

## 4.2 Logo Selection Poll

To determine the most suitable logo for the teleconsultation application, a poll was conducted among a group of healthcare professionals, medical informatics and technical personal and obviously patients and citizens. A total of 6 logo options were presented, and participants were asked to rate each logo on a scale of 1 to 6 in terms of how well it reflected the values and goals of the application. The results of the poll were then analysed and the logo with the highest overall rating was selected. The results and in-depth analysis about the poll are shown in APPENDIX B.



Figure 19 - Logo option provided for selection from the UI designer, ordered based on votes received.



Figure 20 - Logo Selection Results from 80 responses.

Distribution of 'What is your role/expertise?' for each 'Select the logo you think is best suited for the mobile health application.'

Count of What is your role/expertise?	Column Labels							
Row Labels	Logo 1	Logo 2	Logo 3	Logo 4	Logo 5	Logo 6	Grand Total	
Citizen / Patient	16	10	8	1	1	16	52	
Healthcare Professional	1	2	2				5	
Medical Informatics - Technical	8	5	4	3		3	23	
<b>Grand Total</b>	<b>25</b>	<b>17</b>	<b>14</b>	<b>4</b>	<b>1</b>	<b>19</b>	<b>80</b>	

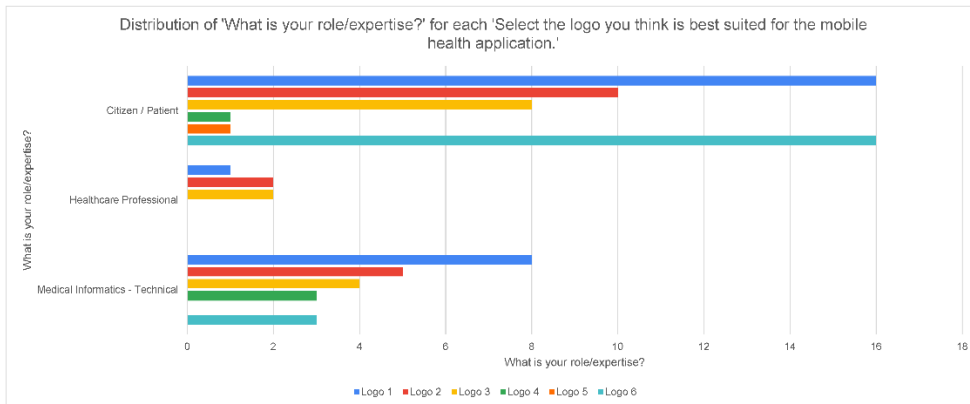


Figure 21 - Logo Selection Results sorted based on the responders category.

### 4.3 Requirements and Planning

The requirements and planning phase of the project involved the identification and definition of the project's objectives and scope. This included the identification of the target audience, the functional and non-functional requirements of the application, and the constraints and assumptions that would impact the development process. During this phase, I also conducted a logo selection poll to gather feedback and input from stakeholders on the design of the application's logo. The poll results were then analysed and used to inform the final logo selection. In addition to these activities, me my supervisor and Louiza Agroti also developed a detailed project plan that outlined the tasks and milestones for the development of the application. This plan served as a roadmap for the project and helped to ensure that the project was completed on time.

In the planning phase, we identified 4 major milestones for the project. The first milestone was the implementation of the authorization process, which involved integrating the Keycloak platform and setting up the necessary protocols for user authentication and authorization. The second milestone was the implementation of the teleconsultation module, which involved integrating the Jitsi Meet videoconferencing solution and developing the necessary features for teleconsultation. The third milestone was the integration of the FHIR healthcare data protocol, which involved developing the necessary APIs and algorithms to request and receive healthcare data from the development server. The final milestone was the evaluation of the app, which involved conducting user testing and gathering feedback to make any necessary improvements.



#### 4.4 Waterfall Software Development Model

The Waterfall software development model [31] is a linear, sequential approach to software development. It is named after the way that each phase of the process flows, with each phase building on the previous one, like water flowing down a waterfall. In this model, the development process is divided into distinct phases, each with its own specific goals and deliverables. These phases include requirements gathering and analysis, design, implementation, testing, deployment, and maintenance. The Waterfall model is a traditional approach to software development, and it is characterized by its rigidity and lack of flexibility. However, it can be useful in cases where the requirements are well-defined, and the project has clear goals and deliverables. It is also a good choice for projects where the development team has a high level of expertise and experience, as it allows for precise planning and execution.

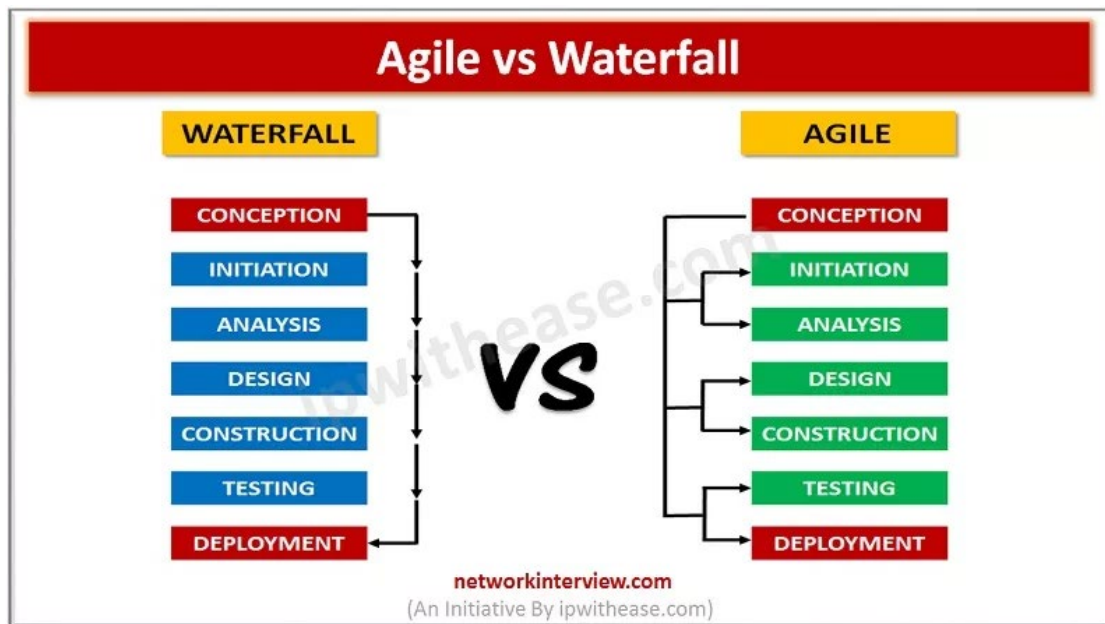


Figure 22 - Waterfall vs Agile Model.

## Chapter 5

### Implementation

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#### 5.1 General Architecture

The general architecture of the project involves the design and implementation of a teleconsultation module for a mobile eHealth application in Cyprus. The solution will be developed using React Native and will integrate the Jitsi Meet open-source videoconferencing solution for teleconsultation. The backend of the solution will be implemented using C#, and the eHealth Laboratory at the University of Cyprus will provide the development server for the backend API. The project will also include the development of features such as integrated prescription management and patient summary views, which aim to streamline the delivery of care and enhance patient engagement. The mobile application will be developed for the Android and iOS operating systems and will rely on a stable internet connection for proper functioning. The application will be used primarily by healthcare professionals and patients in Cyprus and will adhere to the FHIR standard for interoperability in the healthcare industry.

More details about the architecture can be found under the APPENDIX A, page A-1.

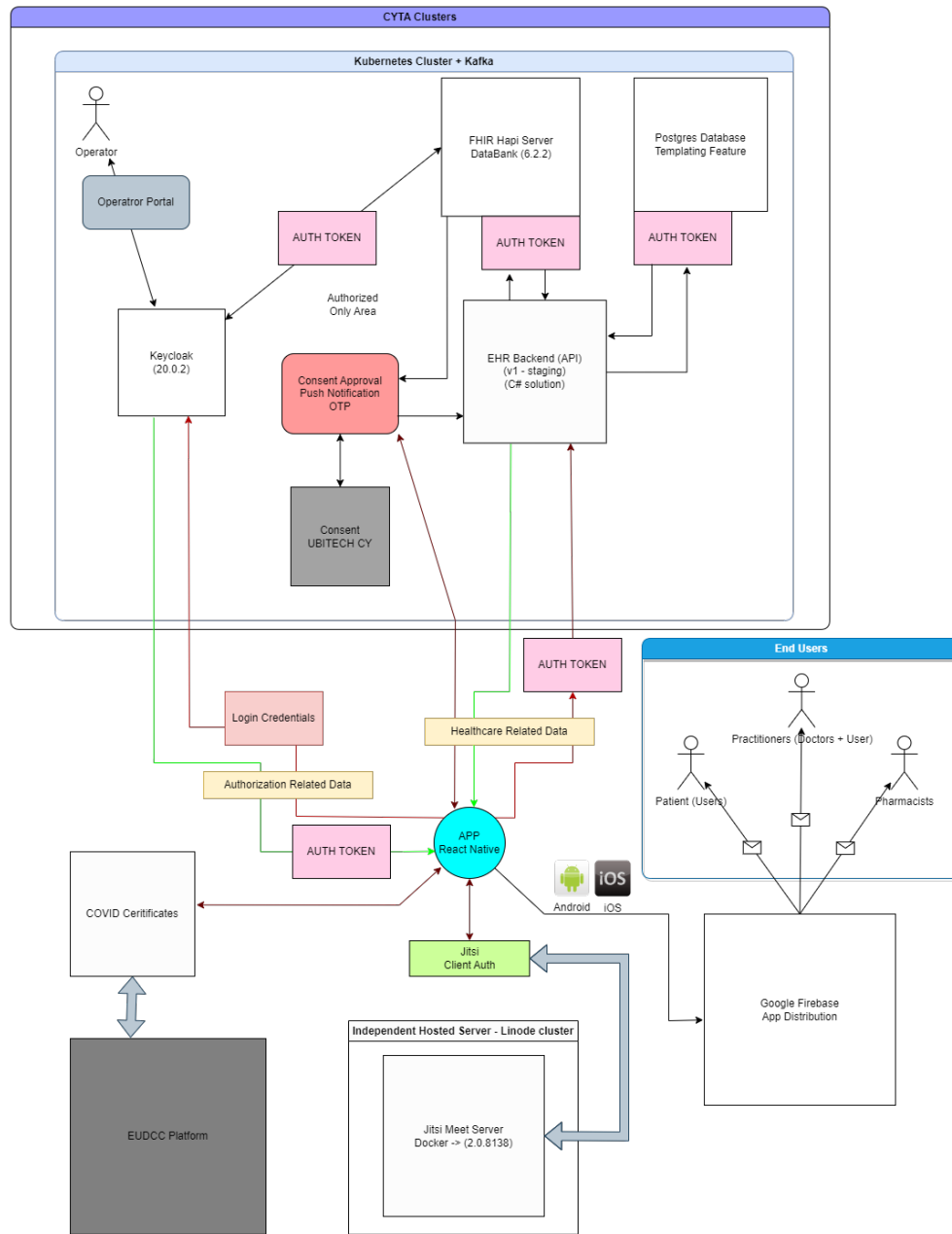


Figure 23 - General Architecture of the solution.

## 5.2 Mobile Application Architecture

The mobile application architecture for the teleconsultation module of the eHealth application was designed to ensure that the application was easy to use and maintain, while also providing the necessary functionality for teleconsultation. The architecture consisted of three main layers: the presentation layer, the business logic layer, and the data access layer.

The presentation layer was responsible for handling user input and displaying the appropriate information to the user. This layer was implemented using React Native and included the user interface for the teleconsultation module.

The business logic layer was responsible for handling the processing of data and the communication with the backend API. This layer was implemented using C# and made use of the FHIR protocol to communicate with the backend API.

The data access layer was responsible for accessing and storing data in the database. This layer was implemented using C# and made use of RESTful API calls to communicate with the backend API.

Overall, the mobile application architecture was designed to ensure that the teleconsultation module was easy to use and maintain, while also providing the necessary functionality for teleconsultation.

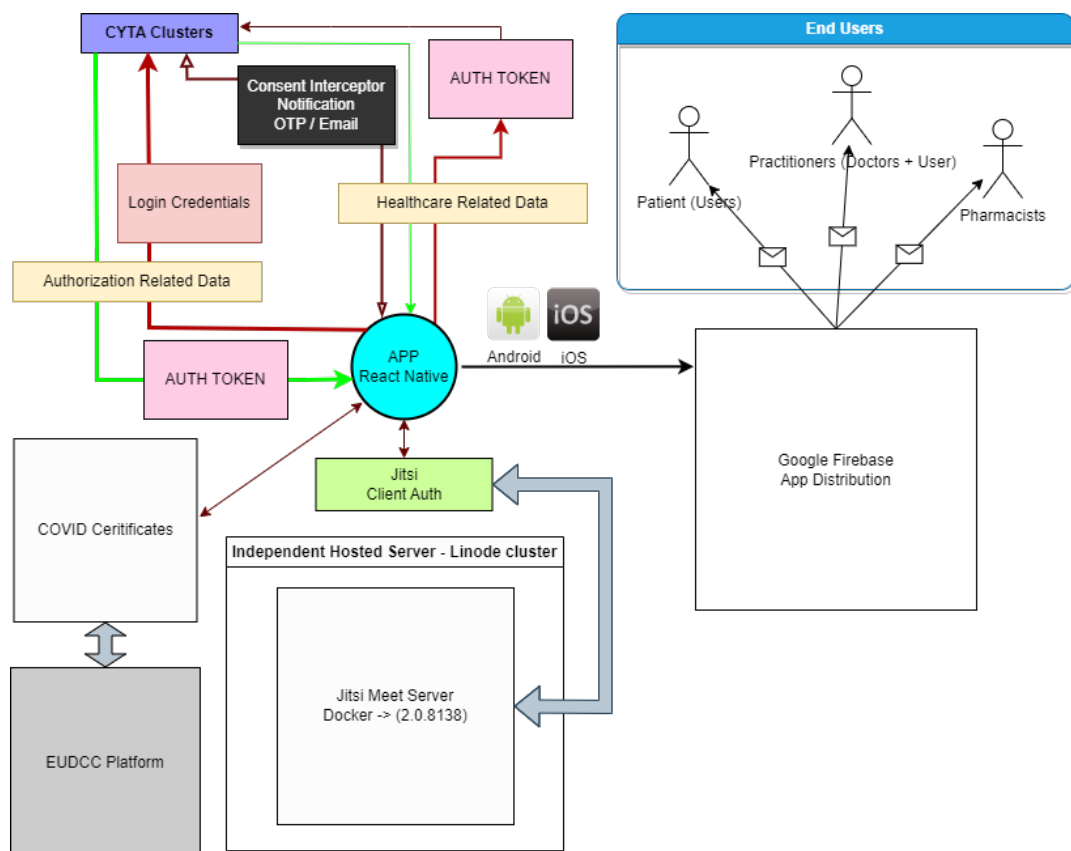


Figure 24 - Detailed section of the mobile application architecture.

### **5.3 Waterfall Software Development Model**

The Waterfall Software Development Model is a linear approach to software development that follows a specific sequence of steps. The model consists of six phases: Requirements Analysis, Design, Implementation, Testing, and Deployment. The Requirements Analysis phase involves gathering and analysing user requirements to define the scope of the project. The Design phase involves creating a detailed design plan for the software, including its architecture and user interface. The Implementation phase involves coding and testing the individual components of the software. The Testing phase involves verifying that the software meets the specified requirements and functions correctly. Finally, the Deployment phase involves releasing the software to users. Each phase of the Waterfall model [30] must be completed before moving on to the next phase, and it is not possible to return to a previous phase once it has been completed. The Waterfall model is typically used for projects with well-defined and stable requirements, where it is possible to plan out the entire development process in advance.

#### **5.3.1 Requirement Analysis**

In the requirement analysis phase, we gathered and analysed the requirements for the teleconsultation module. This involved discussing the needs of the stakeholders and determining the functional and non-functional requirements for the application. We also identified any constraints or limitations that would impact the development of the module. Once the requirements were identified and documented, we used them to guide the design and implementation phases.

#### **5.3.2 Design**

During the design phase, we focused on creating a user-friendly interface that would be intuitive and easy to use for both healthcare professionals and patients. We also designed the overall architecture of the application, including the interactions between the frontend, backend, and external services such as the Jitsi Meet videoconferencing solution and the Keycloak [5] authentication platform.

To ensure that the application met the requirements specified in the planning phase, we created detailed wireframes and user flows that outlined the different screens and

interactions within the application. We also defined the data model and API endpoints that would be used to retrieve and store data from the backend.

In addition to the functional design of the application, we also focused on creating a visually appealing design that would be consistent with the values of the eHealth application. We selected colours and fonts that would be easy to read and navigate, and we created a logo that represented the values of accessibility and reliability.

Overall, the design phase was crucial in ensuring that the development phase would run smoothly, and that the final product would be intuitive and easy to use for users.

### **5.3.3 Implementation**

The implementation phase of the project involved the actual coding and development of the teleconsultation module for the mobile eHealth application. This phase involved the use of React Native for the front-end development, C# for the backend API, and the integration of the Jitsi Meet videoconferencing solution for teleconsultation. The project also included the development of features such as integrated prescription management and patient summary views. These features were designed to streamline the delivery of care and enhance patient engagement. The development process followed the waterfall software development model, with each phase of the model being completed before moving on to the next. The implementation phase was completed in a timely manner and met all the project's requirements and objectives.

### **5.3.4 Testing**

The testing phase was an important part of the development process for the teleconsultation app. Me and Louiza Agroti were primarily responsible for testing the app and identifying any issues or bugs that needed to be addressed. In order to gather more comprehensive feedback, we also planned an evaluation and created a user manual, which we sent to a number of people. We conducted the evaluation using physical means, where people were using the application on our personal phones and using teleconferencing means, where we showcased the app to participants and asked them to answer a questionnaire. While the survey is still ongoing, we have received a few responses so far and have been able to fix some of the small issues that were

identified. The results of the evaluation and user feedback can be found in the APPENDIX D. Also, more details are discussed in Chapter 6 about the application testing and evaluation.

### **5.3.5 Deployment**

During the deployment phase, the app was first deployed to Firebase [32] for debugging purposes. Once the debugging was complete, a release version of the app was prepared and submitted for testing. However, some building errors were encountered during this process and efforts are ongoing to fix these issues before the app is released to a wider audience.

### **5.3.6 Maintenance**

The maintenance phase is ongoing, and we are constantly fixing bugs and adding new features to the application. We also plan to regularly update the application to ensure that it remains up to date with the latest technologies and standards in the healthcare industry. This includes regularly updating the FHIR implementation and ensuring that the application remains compliant with relevant regulations and standards. Additionally, we will continue to gather feedback from users and incorporate their suggestions into future updates of the application.

## **5.4 Implementation of Teleconsultation Module**

During the implementation of the teleconsultation module, I utilized the react-native-jitsi-meet package [33] to integrate the Jitsi Meet functionality into the mobile application. This required configuring the build.gradle files and following the package's documentation on GitHub. I imported the package and used its various components within the app, such as the JitsiMeetView component which allows the user to join or host a video conference. I also implemented functionality to retrieve the current logged in user's details and use them to start or request a meeting. Overall, the integration of the teleconsultation module was a significant part of the development process and required careful planning and consideration of the various features and requirements of the module. Screenshot of the implementations are provided within the APPENDIX E under section Implementation, pages E34-E35.

```

7   const MeetingScreen = ({ navigation }) => {
8     const { state: userState } = useContext(UserContext);
9
10    let user = userState.user;
11
12    const { t } = useTranslation();
13
14    var timeStampUserJoinedMeeting = 0;
15    var timeStampUserTerminated = 0;
16
17    useEffect(() => {
18      setTimeout(() => {
19        const url = 'https://meet.jit.si/deneme'; // can also be only room name and will connect to
20        const userInfo = {
21          displayName: user.name?.givenName[0] + ' ' + user.name?.familyName,
22          email: user.telecom[0]?.value,
23          avatar: 'https://gravatar.com/avatar/abc123',
24        }; // You, 2 months ago * Added teleconsultation implementation ...
25        const options = { ...
31        };
32        const meetFeatureFlags = { ...
54        };
55        JitsiMeet.call(url, userInfo, options);
56        /* You can also use JitsiMeet.audioCall(url) for audio only call */
57        /* You can programmatically end the call with JitsiMeet.endCall() */
58      }, 1000);
59    }, []);
60
61    // useEffect(() => {

```

Figure 25 - Jitsi Meet implementation in React Native.

```

67  function onConferenceTerminated(nativeEvent) {
68    timeStampUserTerminated = nativeEvent.timeStamp;
69    const diff = (timeStampUserTerminated - timeStampUserJoinedMeeting) / 1000;
70    navigation.navigate(t('teleconsultation'), { meetingKey: diff });
71  }
72
73  function onConferenceJoined(nativeEvent) {
74    timeStampUserJoinedMeeting = nativeEvent.timeStamp;
75  }
76
77  function onConferenceWillJoin(nativeEvent) {}
78
79  return (
80    <View style={{ backgroundColor: 'black', flex: 1 }}>
81      <JitsiMeetView
82        onConferenceTerminated={onConferenceTerminated}
83        onConferenceJoined={onConferenceJoined}
84        onConferenceWillJoin={onConferenceWillJoin}
85        style={{ flex: 1, height: '100%', width: '100%' }}
86      />
87    </View>
88  );
89  };
90
91  export default MeetingScreen;
92

```

Figure 26 - Jitsi Meet return the JitsiMeetView component in React Native.

## 5.5 Implementation Authorization Channel

The implementation of the authorization channel involved using the react-native-keycloak-plugin package [34] to integrate Keycloak into the application. This included implementing the login and logout functionality, as well as the refresh token mechanism



to allow for seamless authentication without requiring the user to continuously enter their credentials. In addition, a partial registration process was implemented, as well as the ability to reset a forgotten password and change an existing password. To ensure the security of the user's credentials, they are stored in the EncryptedStorage [35], while a copy of the active username and token is saved in the Keychain [36] for easy access. This allows for a secure and convenient way to manage user authentication within the application. APPENDIX E under section Implementation, pages E17-E32.

```
76  const signin = () => {
77    return async (username: string, password: string, callback: any) => {
78      try {
79        Keycloak.login(
80          keycloakConfig,
81          username,
82          password,
83          'openid profile fhir email offline_access',
84        )
85      }
86      .then(async (response: IKeycloakResponse) => {
87        // User can be either patient or practitioner
88        let user = jwt_decode<IKeycloakUser>(response.access_token);
89
90        // Save the credentials in the keychain
91        await Keychain.setGenericPassword(username, response.access_token);
92
93        if (user.resource_access.fhir.roles.includes('Patients')) {
94          // load the patient profile using IPatient interface
95          let patientRequest = await loadPatientProfile()
96          .then((userProfile: any) => {
97            return userProfile;
98          })
99          .catch((error: any) => {
100            console.error(`API Profile Error: ${JSON.stringify(error)}`);
101          });
102
103          console.log(
104            `API Profile Request Results: ${JSON.stringify(patientRequest)}`,
105          );
106
107          callback(patientRequest);
108        } else if (
109          user.resource_access.fhir.roles.includes('Practitioners')
110        ) {
111          let practitionerRequest = await loadPractitionerProfile()
112          .then((userProfile: any) => {
113            return userProfile;
114          })
115          .catch((error: any) => {
116            console.error(`API Profile Error: ${JSON.stringify(error)}`);
117          });
118        }
119      })
120    }
121  }
```

Figure 27 - Keycloak authorization implementation using react-native-keycloak-plugin in React Native.

```

You, 2 months ago | 1 author (You)
1  export const config: any = {           You, 3 months ago • mo
2      'auth-server-url': 'https://access.ehealth4u.eu/',
3      realm: 'ehealth4u',
4      resource: 'ehealth4umobile',
5      responseType: 'code',
6      appsiteUri: 'MYeHealthAppCY',
7      redirectUri: 'MYeHealthAppCY://Home',
8  };
9

```

Figure 28 - Keycloak configuration file.

```

164  const refreshToken = (dispatch: any) => {
165  return async (callback: any) => {
166  try {
167      // Get the credentials from the keychain
168      const credentials = await Keychain.getGenericPassword();
169      if (credentials) {
170          // Get the access token from the credentials
171          let user = jwt_decode<ITokens>(credentials.password);
172
173          Keycloak.refreshToken({
174              keycloakConfig,
175              refreshToken: user.refresh_token,
176          })
177          .then((response: any) => {
178              console.log(
179                  `Keycloak.refreshToken Response: ${JSON.stringify(response)}`,
180              );
181              callback(response);
182          })
183          .then((newCredentials: any) => {
184              // Save the credentials in the keychain
185              Keychain.setGenericPassword(
186                  credentials.username,
187                  newCredentials.access_token,
188              );
189          })
190          .catch((error: any) => {
191              console.error(
192                  `Keycloak.refreshToken Error: ${JSON.stringify(error)}`,
193              );
194              // clear the credentials
195              cleanCredentials();
196              dispatch({ type: 'signout' });
197          });
198      }
199  } catch (error) {
200      console.error('RefreshToken error: ' + error);
201  }
202  };
203  };

```

Figure 29 - Keycloak refresh token implementation in React Native.

```

const signout = (dispatch: any) => {
  return async () => {
    await cleanCredentials();

    dispatch({ type: 'signout' });
  };
};

```

Figure 30 - Keycloak sign out implementation in React Native.

```

18
19 // Define a function to clean the credentials
20 async function cleanCredentials() {
21   await Keychain.resetGenericPassword()
22     .then(() => {
23       console.log('Credentials successfully deleted');
24     })
25     .catch((error: any) => {
26       console.error("Keychain couldn't be accessed!", error);
27     });
28 }
29

```

Figure 31 - Keycloak clean credentials function after sign out.

## 5.6 Implementation Healthcare Related Data Channel

In order to implement the healthcare related data channel, we used the axios library to make HTTP requests to the server. We also implemented a context provider within React Native to manage the user data and ensure that it is only accessible with proper authorization and a valid token. This helps to maintain the security and privacy of the user's healthcare information. To ensure a smooth and efficient flow of data within the application, we carefully designed and implemented the data fetching and storage processes to make sure that the right data was available at the right time. More details can be found under the APPENDIX E, under section Implementation, pages E33.

```

91  export const { Provider, Context } = createDataContext(
92    userReducer,
93    {
94      getPatient,
95      setPatient,
96      getPractitioner,
97      setPractitioner,
98      getPrescriptions,
99      setPrescriptions,
100     getDispensations,
101     setDispensations,
102     getAllergies,
103     setAllergies,
104     getConditionProblems,
105     setConditionProblems,
106     getConditionDiagnosis,
107     setConditionDiagnosis,
108     getImmunizations,
109     setImmunizations,
110   },

```

Figure 32 - UserContext reducer functions to fetch resources from HAPI FHIR server.

```

111  {
112    patient: null,
113    practitioner: null,
114    currentPrescriptions: [],
115    previousPrescriptions: [],
116    currentDispensations: [],
117    previousDispensations: [],
118    allergies: [],
119    conditionsProblems: [],
120    conditionsDiagnosis: [],
121    immunizations: [],
122    observations: [],
123    socialHistories: [],
124    procedures: [],
125    devices: [],
126    pregnancies: [],
127    travelHistories: [],
128    functionalStatus: [],
129    episodesOfCare: [],
130    carePlans: [],
131    medicationStatementSummaries: [],
132  },
133 );

```

Figure 33 - Various UserContext state of resources.

In addition to implementing the data channel, we also had to research and understand the FHIR protocol to correctly map and write the MedicationRequest [37] and MedicationDispense [38]. We utilized the core FHIR structure definitions.

```

81 usage More...
private MedicationRequest ToMedicationRequestFHIR(MedicationRequestDto record)
{
    var result = new MedicationRequest();

    result.Meta = AppendProfileMeta(result.Meta, cCanonicalProfileUrls.MEDICATION_REQUEST_PROFILE);

    // Id
    if (!string.IsNullOrEmpty(record.Id))
        result.Id = record.Id;

    // Identifier
    if (record.Identifier != null && record.Identifier.Any())
        result.Identifier.AddRange(record.Identifier.Select(ToIdentifierFHIR));

    // Status
    if (!string.IsNullOrEmpty(record.Status))
        result.Status = Enum.Parse<MedicationRequest.MedicationRequestStatus>(record.Status);

    // Status Reason
    if (record.StatusReason != null)
        result.StatusReason = ToCodeableConceptFHIR(record.StatusReason);

    // Intent
    if (!string.IsNullOrEmpty(record.Intent))
        result.Intent = Enum.Parse<MedicationRequest.MedicationRequestIntent>(record.Intent);

    // Category
    if (record.Category != null)
        result.Category = ToListCodeableConceptFHIR(record.Category);

    // Priority
    if (!string.IsNullOrEmpty(record.Priority))
        result.Priority = Enum.Parse<RequestPriority>(record.Priority);

    // Do Not Perform
    if (record.DoNotPerform.HasValue)
        result.DoNotPerform = record.DoNotPerform.Value;
}

```

Figure 34 - Sample of mapping of the MedicationRequest resource in the backend solution.

```

private MedicationDispense ToMedicationDispenseFHIR(MedicationDispenseDto record)
{
    var result = new MedicationDispense();

    result.Meta = AppendProfileMeta(result.Meta, cCanonicalProfileUrls.MEDICATION_DISPENSE_PROFILE);

    // Id
    if (!string.IsNullOrEmpty(record.Id))
        result.Id = record.Id;

    // Identifier
    if (record.Identifier != null && record.Identifier.Any())
        result.Identifier.AddRange(record.Identifier.Select(ToIdentifierFHIR));

    // PartOf
    if (record.PartOf != null && record.PartOf.Any())
        result.PartOf.AddRange(record.PartOf.Select(ToResourceReferenceFHIR));

    // Status
    if (!string.IsNullOrEmpty(record.Status))
        result.Status = Enum.Parse<MedicationDispense.MedicationDispenseStatusCodes>(record.Status);

    // StatusReason
    if (record.StatusReason != null)
        result.StatusReason = ToMedicationDispenseStatusReasonFHIR(record.StatusReason);

    // Category
    if (record.Category != null)
        result.Category = ToCodeableConceptFHIR(record.Category);

    // Medication
    if (record.Medication != null)
        result.Medication = ToMedicationDispenseMedicationFHIR(record.Medication);

    // Subject
}

```

Figure 35 - Sample of mapping of the MedicationDispense resource in the backend solution.



Figure 36 - Swagger controllers for ePrescriptions for patient.



Figure 37 - Swagger controllers for eDispensing for patient.

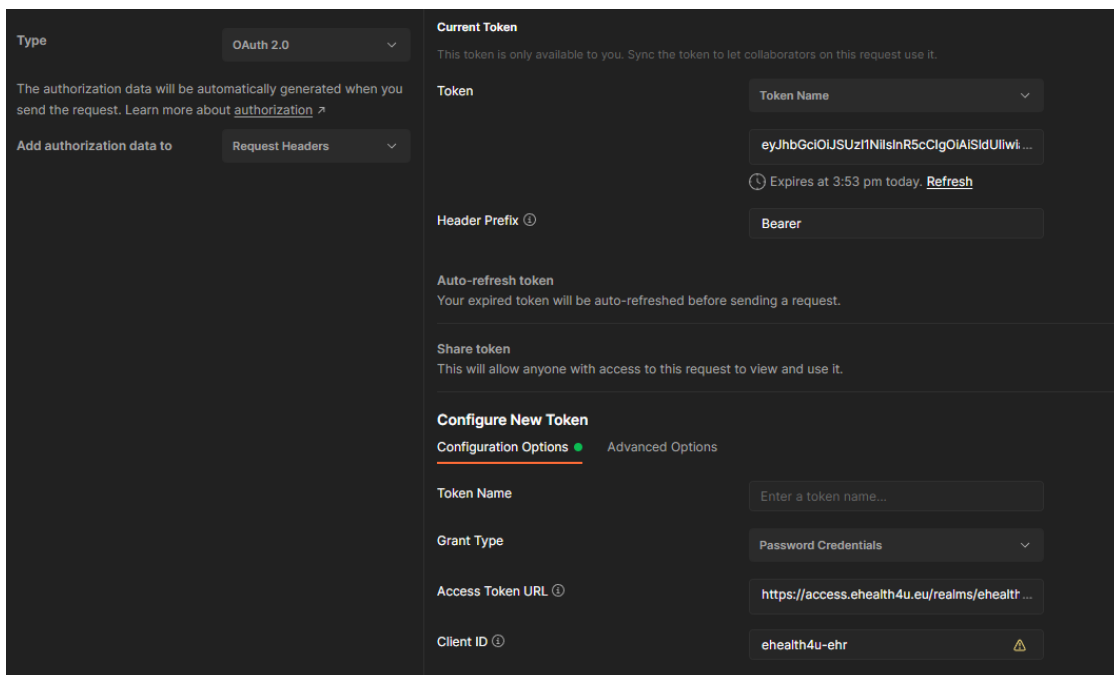


Figure 38 - Postman example of token retrieval using OAuth2.0 type from the Keycloak Identity Provider Service.

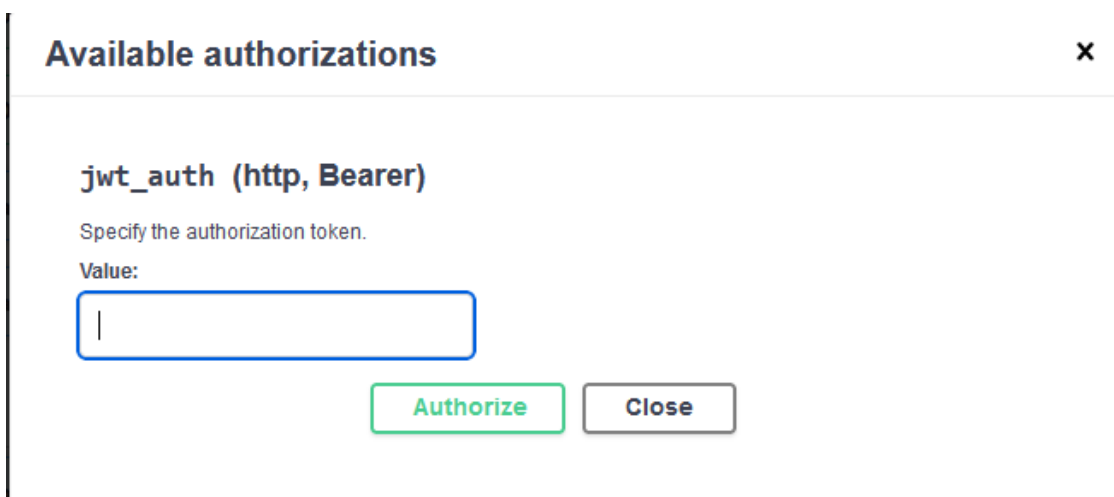


Figure 39 - Authorization within the Swagger API.

GET /api/ePrescription/GetPrescriptionsForPatient

Parameters

Name	Description
pageNumber integer(int32) (query)	pageNumber
pageSize integer(int32) (query)	pageSize
patientId string (query)	patientId

Responses

Figure 40 - Example of field needed to fetch ePrescriptions from the Swagger API.

Responses

Curl

```
curl -X 'GET' \
  'https://dev-api.ehealth4u.eu/api/ePrescription/GetPrescriptionsForPatient?pageNumber=1&pageSize=20&patientId=194315' \
  -H 'accept: text/plain'
```

Request URL

```
https://dev-api.ehealth4u.eu/api/ePrescription/GetPrescriptionsForPatient?pageNumber=1&pageSize=20&patientId=194315
```

Server response

Code	Details
401 Unauthorized	Error: Unauthorized

Response headers

Figure 41 - Example of 401 error showing that the authorization was not provided.

Overall, the implementation of the healthcare related data channel required a combination of coding skills and knowledge of healthcare data standards to ensure the proper exchange and handling of sensitive patient information.

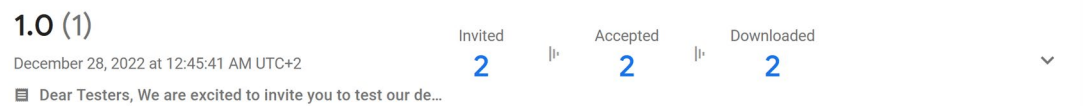
## 5.7 Packaging and Distribution

To package and distribute our teleconsultation application, we used Firebase [32]. This allowed us to easily deploy our app in a debug version for testing purposes. To use Firebase [32], we created a Firebase [32] account and connected our application to it. This enables us to deploy our app on the Google Play Store and Apple App Store once the release version is stable.

```
{
  "project_info": {
    "project_number": "754513105209",
    "project_id": "myehealthappy",
    "storage_bucket": "myehealthappy.appspot.com"
  },
  "client": [
    {
      "client_info": {
        "mobilesdk_app_id": "1:754513105209:android:71109fbb2e09003b3818e8",
        "android_client_info": {
          "package_name": "com.myehealthappy"
        }
      }
    }
  ]
}
```

Figure 42 - Section from the Firebase configuration file.

In order to package the application for distribution, I used Android Studio to bundle and sign the release APK. Since I do not have access to a Mac, I was unable to build the IPA file for iOS devices. Louiza Agroti was responsible for handling this part of the process. Packaging the application involves building the source code and all of its dependencies into a single package that can be installed on a device. The bundling process includes optimizing the code and removing unnecessary files to reduce the size of the final package. Once the bundling is complete, the package must be signed with a digital certificate in order to be installed on a device. This certificate helps to ensure the authenticity and integrity of the package, as it can be traced back to the developer who created it.



*Figure 43 - Example of app distribution using Firebase.*

In the future, we plan to release the app on the official app stores once it is stable and ready for use by the public. This will allow us to reach a larger audience and make our teleconsultation solution more accessible to citizens. Overall, the use of Firebase [32] has been beneficial in the distribution and management of our teleconsultation app.



## Chapter 6

### Application Testing and Evaluation

---

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---

#### 6.1 Introduction and Scope

The testing and evaluation phase of the teleconsultation application was a crucial step in the development process. It allowed us to gather feedback and identify any issues or areas for improvement. The scope of the testing and evaluation phase included both functional and usability testing. Functional testing was focused on ensuring that the various features and functionality of the application were working as intended, while usability testing focused on the user experience and ease of use of the application.

To gather this feedback, we developed a questionnaire and conducted evaluations with a small group of users. These evaluations took place through teleconferencing, and physical means, with the users interacting with the application and providing their feedback and responses to the questionnaire. The results of these evaluations are presented in the following chapter, along with an analysis of the findings and any actions taken based on the feedback received.

#### 6.2 Methodology

In order to evaluate the teleconsultation application, we used a combination of user testing and a questionnaire survey. The user testing was conducted through teleconferencing, where individuals were given a demonstration of the app and asked to provide feedback on their experience. The questionnaire survey was distributed to a wider group of individuals and included questions about the usability, functionality, and overall satisfaction with the app. The results of both the user testing and questionnaire

survey were analysed and used to identify any issues or areas for improvement in the app.

### 6.3 Questionnaire

During the evaluation phase, we aimed to gather feedback from a diverse group of users, more specific patients, doctors, and pharmacist, to obtain a well-rounded understanding of the strengths and weaknesses of the teleconsultation app. To do this, we distributed a questionnaire to a group of participants who were representative of the target audience for the app. The questionnaire consisted of a combination of demographic questions, operating system related question and version; and as well as questions specific to the app and its various features. Participants were asked to rate their satisfaction with the app on a scale of 1 to 5, with 5 being the highest level of satisfaction.

Language: English (United States)

## Evaluation of MyeHealthAppCY

Thank you for your participation in this questionnaire! We are interested in collecting your feedback on the MyeHealthAppCY mobile app we have developed. This app is intended to provide convenient and accessible health services to users via their mobile phones. We would like to know your opinions about the features, ease of use and your overall satisfaction with the app. Your feedback is valuable to us as we strive to continuously improve and expand the app to further meet the needs of our users.

*The questionnaire is available both in [English](#) and in [Greek](#).*

\* Required

### Demographic questions and questions about your mobile operating system

In this section, we'll ask you a few questions about your personal characteristics and the device and operating system you use to access the app. This information will help us to better understand our user base and identify any issues or trends that may affect specific groups.

**Your answers to these questions will remain strictly confidential and will only be used for**

1. What is your gender? \*

- ☐ Male
- ☐ Woman
- ☐ Other

*Figure 44 - Evaluation Questionnaire.*

2. What is your age? \*

- ☐ 18-25
- ☐ 26-35
- ☐ 36-45
- ☐ 46-55
- ☐ 56-64
- ☐ 65+

3. Which user group do you belong to? \*

- ☐ Doctor
- ☐ Pharmacist
- ☐ Patient

4. What is the operating system of your mobile phone? \*

- ☐ Android
- ☐ iOS

*Figure 45- Evaluation Questionnaire.*

5. If you know, what is the version of your Android phone? \*

- ☐ Android 10 - Quince Tart
- ☐ Android 11 - Red Velvet Cake
- ☐ Android 12 - Snow Cone
- ☐ Android 12L - Snow Cone v2
- ☐ Android 13 - Tiramisu
- ☐ I don't know

6. If you know, what is the version of your iOS mobile? \*

- ☐ iOS 13
- ☐ iOS 14
- ☐ iOS 15
- ☐ iOS 16
- ☐ I don't know

*Figure 46- Evaluation Questionnaire.*

Questions concerning the application

7. How easy was it to navigate through the app? \*

- ☐ Very easy
- ☐ Somewhat easy
- ☐ Neither easy nor difficult
- ☐ Somewhat difficult
- ☐ Very difficult

8. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with the Prescriptions? \*

1	2	3	4	5
---	---	---	---	---

9. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with Dispensing? \*

1	2	3	4	5
---	---	---	---	---

10. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with the Patient Summary? \*

1	2	3	4	5
---	---	---	---	---

Figure 47- Evaluation Questionnaire.

12. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with Covid Certificates? \*

1	2	3	4	5
---	---	---	---	---

13. Did you encounter any problems when issuing the COVID European Digital Certificate? \*

- ☐ No  
☐ Yes

14. If yes, please select one of the options below \*

- ☐ Incorrect personal information (e.g. identity card, telephone number, date of birth)

15. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with Teleconsultation? \*

1	2	3	4	5
---	---	---	---	---

*Figure 48- Evaluation Questionnaire.*

16. Did you encounter any problems while browsing Teleconsultation? \*

- ☐ No  
☐ Yes

17. If yes, please select one of the options below \*

- ☐ Long response time of the videoconference  
☐ Difficulty in setting up a new videoconference

18. How satisfied are you with the design of the application? \*

- ☐ Very satisfied  
☐ Somewhat satisfied  
☐ Neutral  
☐ Somewhat dissatisfied  
☐ Very dissatisfied

*Figure 49- Evaluation Questionnaire.*

16. Did you encounter any problems while browsing Teleconsultation? \*

- ☐ No
- ☐ Yes

17. If yes, please select one of the options below \*

- ☐ Long response time of the videoconference
- ☐ Difficulty in setting up a new videoconference

18. How satisfied are you with the design of the application? \*

- ☐ Very satisfied
- ☐ Somewhat satisfied
- ☐ Neutral
- ☐ Somewhat dissatisfied
- ☐ Very dissatisfied

*Figure 50- Evaluation Questionnaire.*

19. How satisfied are you with your overall experience with the app? \*

- ☐ Very satisfied
- ☐ Somewhat satisfied
- ☐ Neutral
- ☐ Somewhat dissatisfied
- ☐ Very dissatisfied

20. Do you want to add any comments and/or suggestions to help us improve the app? \*

21. On a scale of 1 to 5 (where 1 is "not at all likely" and 5 is "very likely"), how likely are you to recommend the app to a friend or colleague? \*

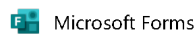
1	2	3	4	5
---	---	---	---	---

22. What overall rating would you give the app? \*



---

This content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.



*Figure 51- Evaluation Questionnaire.*

### **6.3.1 Evaluation Scenario**

During the evaluation of the teleconsultation app, users were asked to perform a series of tasks to assess the app's functionality and usability. The tasks included logging into the app, viewing their profile, accessing their healthcare data (such as prescriptions and patient summary), scanning, and saving a COVID certificate, and using the teleconsultation feature. Throughout the evaluation process, users were asked to provide feedback on their experience with the app, including any difficulties or issues they encountered. This feedback was then used to identify areas for improvement and to make updates to the app to enhance the user experience.

### **6.4 Questionnaire Results**

The results of the questionnaire showed that the majority of participants were satisfied with the teleconsultation app, with high levels of satisfaction reported for its usability and effectiveness in facilitating teleconsultations. However, a few participants did encounter issues such as difficulty navigating certain features or encountering bugs during use. These issues will be addressed in future updates to improve the overall user experience. Android users also reported some crashes, which may be due to versioning compatibility issues. We will continue to monitor and address any issues that arise in order to ensure a smooth and efficient teleconsultation experience for all users.

Based on the feedback from the questionnaire, it seems that participants had some suggestions for improving the teleconsultation app. Some participants mentioned the need for a more user-friendly design, with clearer information and better organization of data. Others suggested adding features such as notifications and a weekly habit schedule to help users track and manage their health. In order to improve the user experience, these suggestions will be taken into consideration in future updates to the app.



## Αξιολόγηση εφαρμογής MyeHealthAppCY

12

Responses

20:52

Average time to complete

Active

Status

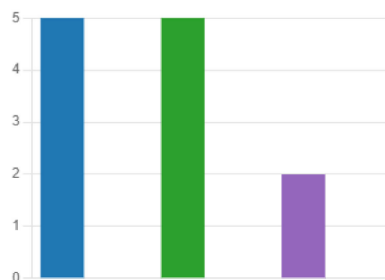
1. Ποιο είναι το φύλο σας;

● Άνδρας	8
● Γυναίκα	4
● Άλλο	0



2. Ποια είναι η ηλικία σας;

● 18-25	5
● 26-35	0
● 36-45	5
● 46-55	0
● 56-64	2
● 65+	0



3. Σε ποια ομάδα χρηστών ανήκετε;

● Ιατρός	0
● Φαρμακοποιός	0
● Ασθενής	12



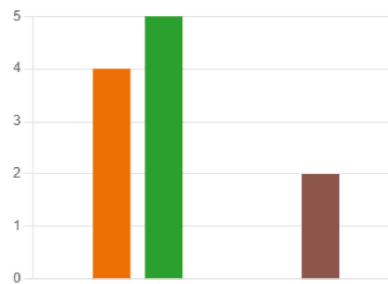
4. Ποιο είναι το λειτουργικό σύστημα του κινητού τηλεφώνου σας;

Android	11
iOS	1
Other	0



5. Αν γνωρίζετε, ποια είναι η έκδοση του Android κινητού σας;

Android 10 - Quince Tart	0
Android 11 - Red Velvet Cake	4
Android 12 - Snow Cone	5
Android 12L - Snow Cone v2	0
Android 13 - Tiramisu	0
Δεν γνωρίζω	2
Other	0



6. Αν γνωρίζετε, ποια είναι η έκδοση του iOS κινητού σας;

iOS 13	0
iOS 14	0
iOS 15	0
iOS 16	1
Δεν γνωρίζω	0
Other	0



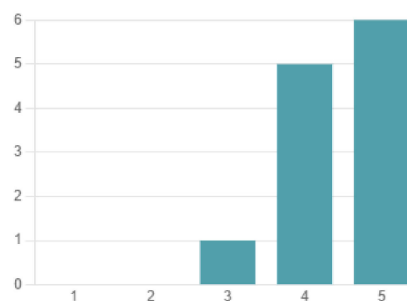
7. Πόσο εύκολη ήταν η πλοήγηση στην εφαρμογή;

Πολύ εύκολη	7
Κάπως εύκολη	3
Ούτε εύκολη ούτε δύσκολη	1
Κάπως δύσκολη	1
Πολύ δύσκολη	0



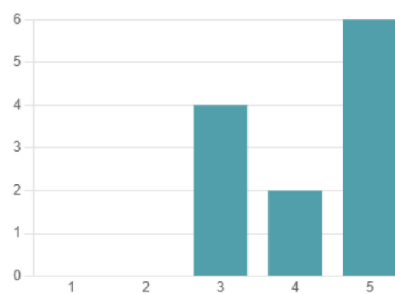
8. Σε κλίμακα από 1 έως 5 (όπου το 1 είναι «καθόλου ικανοποιημένος/η» και το 5 είναι «πολύ ικανοποιημένος/η»), ποιο είναι το επίπεδο ικανοποίησης σας από τις Συνταγές (Prescriptions);

**4.42**  
Average Rating



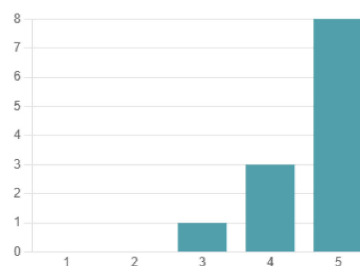
9. Σε κλίμακα από 1 έως 5 (όπου το 1 είναι «καθόλου ικανοποιημένος/η» και το 5 είναι «πολύ ικανοποιημένος/η»), ποιο είναι το επίπεδο ικανοποίησης σας από την Χορήγηση (Dispensing);

**4.17**  
Average Rating



10. Σε κλίμακα από 1 έως 5 (όπου το 1 είναι «καθόλου ικανοποιημένος/η» και το 5 είναι «πολύ ικανοποιημένος/η»), ποιο είναι το επίπεδο ικανοποίησης σας από την Περίληψη Ασθενούς (Patient Summary);

**4.58**  
Average Rating



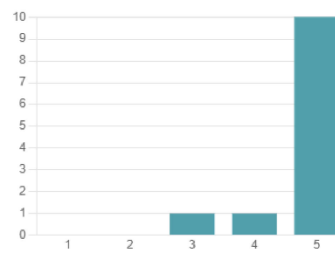
11. Στην Περίληψη Ασθενούς (Patient Summary) θα θέλατε να προστεθεί κάποια άλλη πληροφορία που θεωρείται ότι θα ήταν χρήσιμη να υπάρχει;

4  
Responses

Latest Responses

12. Σε κλίμακα από 1 έως 5 (όπου το 1 είναι «καθόλου ικανοποιημένος/η» και το 5 είναι «πολύ ικανοποιημένος/η»), ποιο είναι το επίπεδο ικανοποίησης σας από τα Πιστοποιητικά Covid (Covid Certificates);

4.75  
Average Rating



13. Αντιμετωπίσατε τυχόν προβλήματα κατά την έκδοση του Ευρωπαϊκού Ψηφιακού Πιστοποιητικού COVID;

● Όχι 11  
● Ναι 1



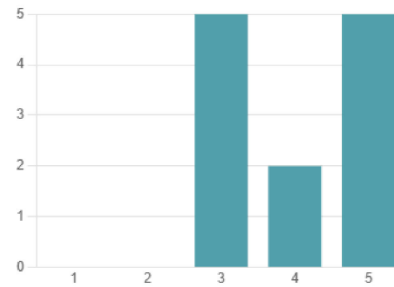
14. Παρακαλώ επιλέξτε μία από τις πιο κάτω επιλογές

● Λανθασμένα προσωπικά στοιχ... 0  
● Other 1



15. Σε κλίμακα από 1 έως 5 (όπου το 1 είναι «καθόλου ικανοποιημένος/η» και το 5 είναι «πολύ ικανοποιημένος/η»), ποιο είναι το επίπεδο ικανοποίησης σας από την Τηλεσύσκεψη (Teleconsultation);

4.00  
Average Rating



16. Αντιμετωπίσατε τυχόν προβλήματα κατά την πλοήγηση σας στην Τηλεσύσκεψη (Teleconsultation);

● Όχι 5  
● Ναι 7



17. Παρακαλώ επιλέξτε μία από τις πιο κάτω επιλογές

● Μεγάλος χρόνος ανταποκρίσε... 0  
● Δυσκολία στην δημιουργία νέα... 3  
● Other 5



18. Πόσο ικανοποιημένος/η είστε από τον σχεδιασμό της εφαρμογής;

● Πολύ ικανοποιημένος/η 4  
● Κάπως ικανοποιημένος/η 7  
● Ουδέτερος/η 1  
● Κάπως δυσαρεστημένος/η 0  
● Πολύ δυσαρεστημένος/η 0



19. Πόσο ικανοποιημένος/η είστε από την συνολική εμπειρία σας με την εφαρμογή;

● Πολύ ικανοποιημένος/η 8  
● Κάπως ικανοποιημένος/η 4  
● Ουδέτερος/η 0  
● Κάπως δυσαρεστημένος/η 0  
● Πολύ δυσαρεστημένος/η 0



20. Θέλετε να προσθέσετε τυχόν σχόλια ή/και εισηγήσεις που θα μας βοηθήσουν να βελτιώσουμε την εφαρμογή;

12  
Responses

Latest Responses

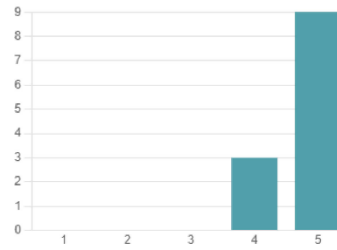
"Τρόπο να "

"Όχι"

"Very nice app, it would be amazing to incorporate maybe a weekly habit s...

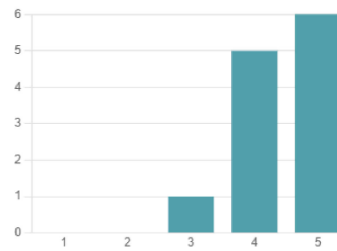
21. Σε μια κλίμακα από το 1 έως το 5 (όπου το 1 είναι "καθόλου πιθανό" και το 5 είναι "πολύ πιθανό"), πόσο πιθανό είναι να συστήσετε την εφαρμογή σε έναν φίλο ή συνάδελφο;

4.75  
Average Rating



22. Ποια συνολική βαθμολογία θα δίνατε στην εφαρμογή;

4.42  
Average Rating



## Chapter 7

### Conclusions

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#### 7.1 Conclusions

In this project, we aimed to develop a teleconsultation mobile app for citizens, using React Native as the main technology for the frontend and Keycloak [5] for the authorization. Additionally, we implemented the FHIR protocol for handling healthcare data and Jitsi Meet for the videoconferencing functionality.

Overall, the app was successful in achieving its objectives and received positive feedback from the participants of the evaluation questionnaire. The app's usability and effectiveness in facilitating teleconsultations were particularly praised. However, there were also some issues reported by participants, such as difficulty navigating certain features and encountering bugs. These issues will be addressed in future updates to the app.

In conclusion, the teleconsultation app developed in this project has the potential to improve access to healthcare services for citizens, especially in the current context of the COVID-19 pandemic where in-person consultations may not be feasible. However, there is still room for improvement and further development of the app to enhance the user experience and address any remaining issues.

#### 7.2 Limitations and Challenges

During the development of the teleconsultation app, there were several limitations and challenges that we faced. One of the main challenges was debugging and fixing errors in the code. As with any software development project, there were instances where the code did not behave as expected and we had to troubleshoot and fix the issues. Another

challenge was the complexity of the system, with multiple technologies and components being integrated together. This required careful planning and coordination to ensure that everything worked seamlessly.

Another limitation was the time available to implement all the desired features. While we were able to include a wide range of functionality in the app, there were still some additional features that we would have liked to include if we had more time. Additionally, this was the first time that I had developed a mobile application, so there was a learning curve involved in becoming familiar with the tools and technologies required for this type of development. Despite these challenges, we were able to successfully develop and deploy the teleconsultation app, and it is already being used to facilitate teleconsultations between healthcare professionals and patients.

### **7.3 Future Work**

There are several areas where the teleconsultation app could be improved in the future. One suggestion that was made by reviewers was to implement biometric login [39], such as using a fingerprint or facial recognition, to increase security and convenience for users. Another suggestion was to enable two-factor authentication (2FA) [40] to further protect user accounts.

Integrating the app with smart devices, such as wearable fitness trackers or home monitoring devices, could allow for real-time monitoring of patients' health data and allow healthcare professionals to track and address any changes or concerns more easily. This could be particularly useful for patients with chronic conditions or for those who are at higher risk for certain health issues.

Enabling a more streamlined workflow for dispensing pharmacy products and scheduling appointments could also be a useful addition to the app. This could involve incorporating features such as calendars and appointment slots to allow for more efficient teleconsultations. Additionally, implementing notifications could help to keep users informed about upcoming appointments or any changes to their healthcare data.



Finally, adding the ability to customize the app's theme or appearance could enhance the user experience and make the app more visually appealing. Overall, there are many potential areas for improvement and development that could make the teleconsultation app an even more valuable tool for healthcare professionals and patients alike.

Going forward, I would really like to continue working on the application and improving its functionality during my masters' studies. This project has been a valuable learning experience and has allowed me to apply my knowledge of software development to a real-world problem. I hope that the teleconsultation app will continue to be used and refined in the future, and I am excited to see the impact it will have on healthcare delivery.

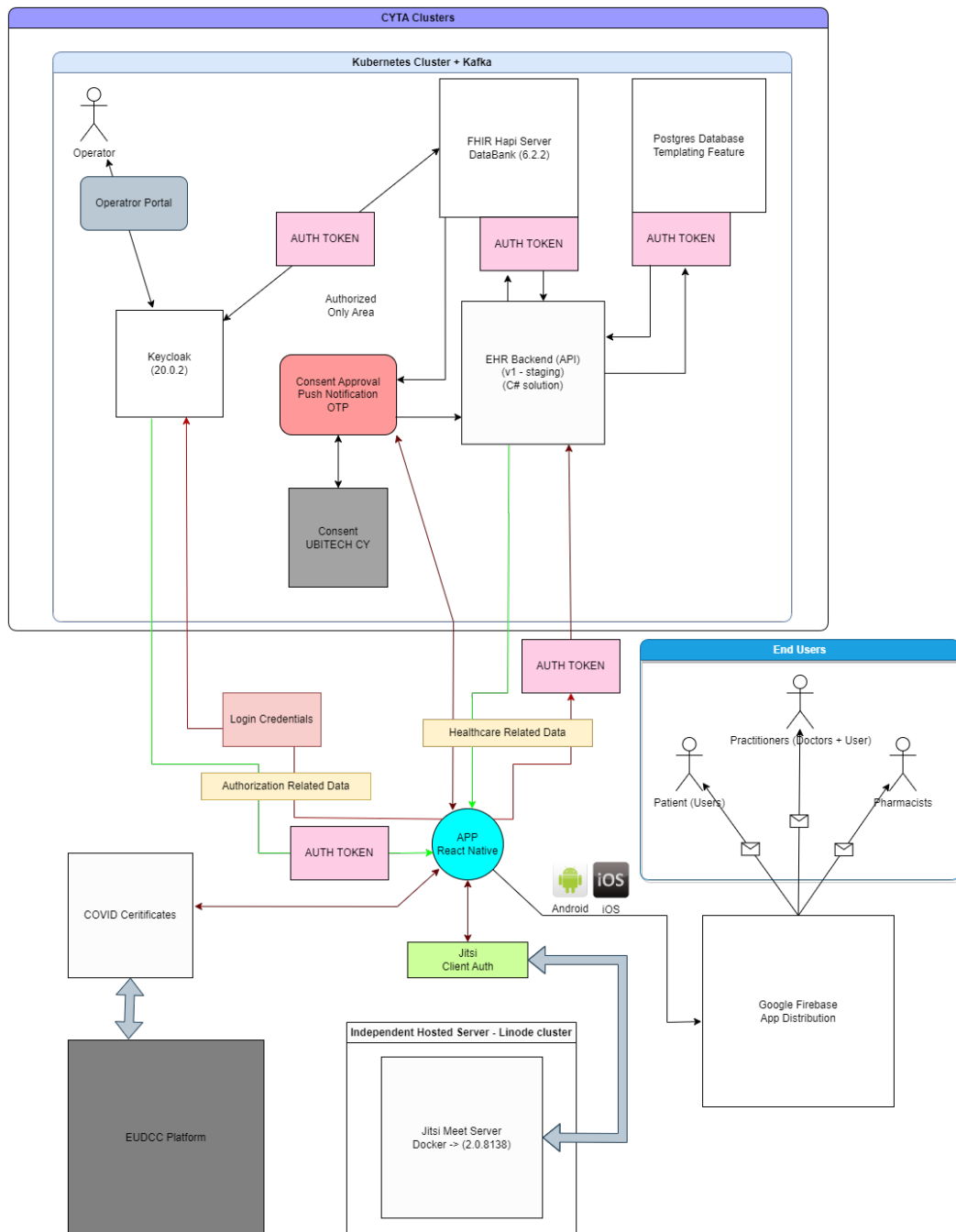
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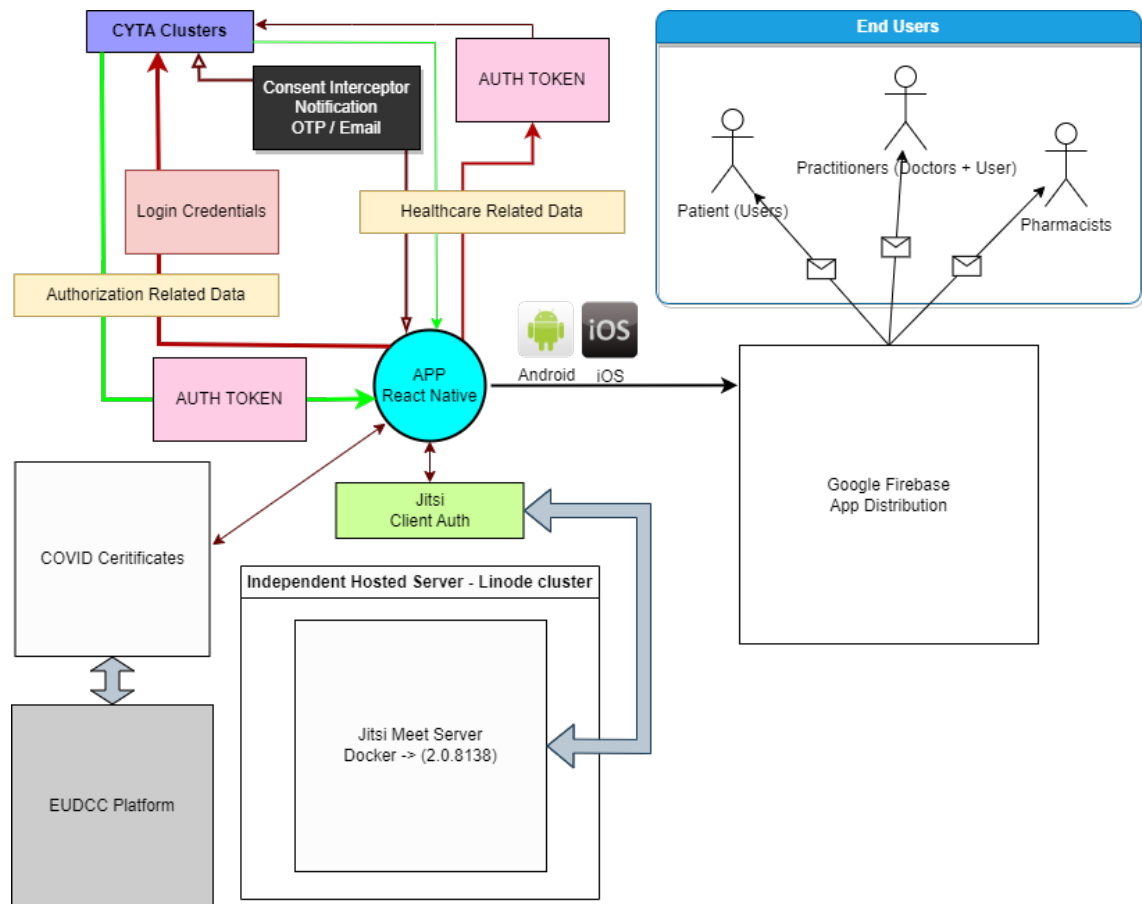
- [1] T. G. W. U. -. S. o. Business, “Are Electronics Improving Healthcare?,” 5 November 2020. [Online]. Available: <https://healthcaremba.gwu.edu/blog/are-electronics-improving-healthcare/>.
- [2] C. Gali, “Telemedicine in Rural Areas,” 8 February 2022. [Online]. Available: <https://blog.curogram.com/telemedicine-in-rural-areas>.
- [3] “History of FHIR,” [Online]. Available: <https://prolifics.com/history-of-fhir/>.
- [4] e. L. U. o. Cyprus, “Backend development API of eHealth4u,” 2022. [Online]. Available: <https://dev-api.ehealth4u.eu/index.html>.
- [5] “Keycloak Documentation,” [Online]. Available: <https://www.keycloak.org/documentation>.
- [6] O. Software, “Mobile App Development Technologies,” [Online]. Available: <https://www.orientsoftware.com/technologies/mobile-technologies/>.
- [7] R. Native, “React Native Getting Started,” [Online]. Available: <https://reactnative.dev/docs/getting-started>.
- [8] “React Native Expo Homepage,” [Online]. Available: <https://expo.dev/>.
- [9] “Running an Android Emulator,” [Online]. Available: <https://developer.android.com/studio/run/emulator>.
- [10] “Android Studio Overview,” [Online]. Available: [https://developer.android.com/studio/intro/?gclid=Cj0KCQiAiJSeBhCCARIsAHnAzT8uk3B7VELETla-oc1QyEfBB3Y0jz2mP16SqvE1ZKpLOIPcu6AdKhYaAj9qEALw\\_wcB&gclsrc=aw.ds](https://developer.android.com/studio/intro/?gclid=Cj0KCQiAiJSeBhCCARIsAHnAzT8uk3B7VELETla-oc1QyEfBB3Y0jz2mP16SqvE1ZKpLOIPcu6AdKhYaAj9qEALw_wcB&gclsrc=aw.ds).
- [11] Google, “Google Meet,” [Online]. Available: <https://meet.google.com/>.
- [12] Microsoft, “Microsoft Teams,” [Online]. Available: <https://www.microsoft.com/en-us/microsoft-teams/group-chat-software>.
- [13] Jitsi, “Jitsi Meet Homepage,” [Online]. Available: <https://jitsi.org/>.
- [14] Cisco, “Webex Homepage,” [Online]. Available: <https://www.webex.com/>.

- [15] I. C. Communications, “Anymeeting Video Conferencing,” [Online]. Available: <https://www.intermedia.com/products/anymeeting-video-conferencing>.
- [16] Zoom, “Zoom Homepage,” [Online]. Available: <https://zoom.us/>.
- [17] I. LogMeIn, “Join.me Homepage,” [Online]. Available: <https://www.join.me/apps>.
- [18] I. 8x8, “8x8 Homepage,” [Online]. Available: <https://www.8x8.com/>.
- [19] Rocket, “Rocket.chat Homepage,” [Online]. Available: <https://rocket.chat/>.
- [20] “About REST Apis,” [Online]. Available: <https://www.techtarget.com/searchapparchitecture/definition/RESTful-API>.
- [21] HL7, “HL7 FHIR Release 4B Homepage,” [Online]. Available: <https://www.hl7.org/fhir/overview.html>.
- [22] S. CDR, “HAPI FHIR,” [Online]. Available: <https://hapifhir.io/>.
- [23] “Choosing React Native For Your Mobile Tech Stack,” [Online]. Available: <https://www.ideamotive.co/react-native/guide>.
- [24] “React Native GitHub Repository,” [Online]. Available: <https://github.com/facebook/react-native>.
- [25] R. Native, “React Native Documentation,” [Online]. Available: <https://reactnative.dev/docs/getting-started>.
- [26] “Jitsi Meet Online Meeting,” [Online]. Available: <https://meet.jit.si/>.
- [27] “GHS Cyprus Homepage,” [Online]. Available: <https://www.gesy.org.cy>.
- [28] “C# Documentation,” [Online]. Available: <https://learn.microsoft.com/en-us/dotnet/csharp/>.
- [29] A. Velimirovic, “What is SDLC? Understand the Software Development Life Cycle,” 17 November 2022. [Online]. Available: <https://phoenixnap.com/blog/software-development-life-cycle>.
- [30] TutorialsPoint, “SDLC - Waterfall Model,” [Online]. Available: [https://www.tutorialspoint.com/sdlc/sdlc\\_waterfall\\_model.htm](https://www.tutorialspoint.com/sdlc/sdlc_waterfall_model.htm).
- [31] TechTarget, “What is the Waterfall Model? - Definition and Guide,” [Online]. Available: <https://www.techtarget.com/searchsoftwarequality/definition/waterfall-model>.

- [32] Google, “Firebase Docs,” [Online]. Available: <https://firebase.google.com/docs>.
- [33] “Jitsi Meet React Package, Github Repo,” [Online]. Available: <https://github.com/skrafft/react-native-jitsi-meet>.
- [34] “React Native Keycloak Plugin, GitHub Repo,” [Online]. Available: <https://github.com/react-keycloak/react-native-keycloak>.
- [35] “React Native EncryptedStorage, GitHub Repo,” [Online]. Available: <https://github.com/emeraldsanto/react-native-encrypted-storage>.
- [36] “React Native Keychain, GitHub Repo,” [Online]. Available: <https://github.com/oblador/react-native-keychain>.
- [37] “FHIR MedicationRequest Structure Definition,” [Online]. Available: <http://hl7.org/fhir/medicationrequest.html>.
- [38] “FHIR MedicationDispense Structure Definition,” [Online]. Available: <http://hl7.org/fhir/medicationdispense.html>.
- [39] “React Native Biometric Login,” [Online]. Available: <https://medium.com/@strv/iintegrating-biometric-authentication-in-react-native-22a393e075be>.
- [40] “Two-Factor Authentication (2FA) Documentation,” [Online]. Available: <https://www.microsoft.com/en-us/security/business/security-101/what-is-two-factor-authentication-2fa>.

## Appendix A – General Architecture





## Appendix B – Logo Selection Poll

### Mobile Health Application - Logo Selection

Those are the logo designs created by our graphic designer. Please go ahead and select which logo you think is best suited for the eHealth4U mobile health application.

**\* Required**

1. What is your role/expertise? \*

*Mark only one oval.*

- ☐ Healthcare Professional
- ☐ Medical Informatics - Technical
- ☐ Citizen / Patient

2. Select the logo you think is best suited for the mobile health application. \*

Logos are ordered from left to right.



*Mark only one oval.*

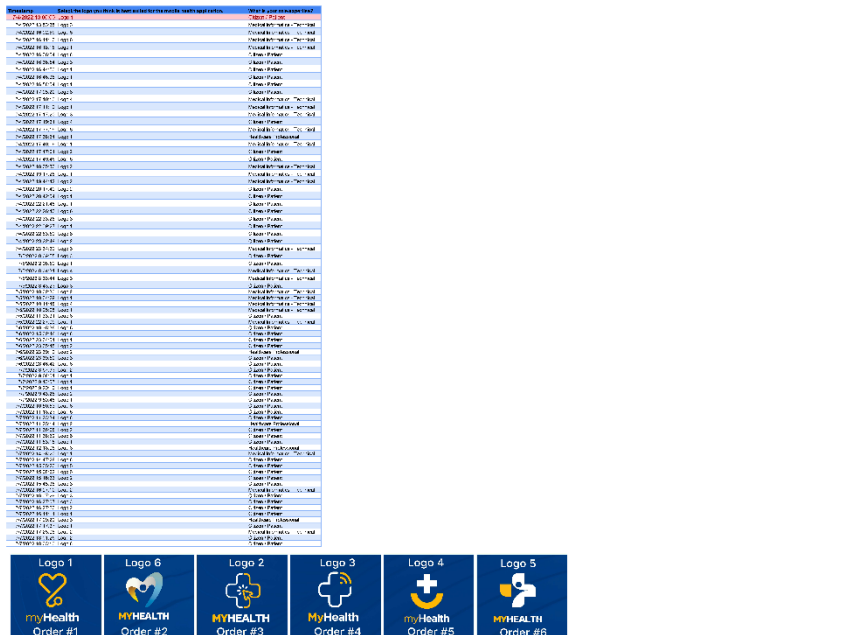
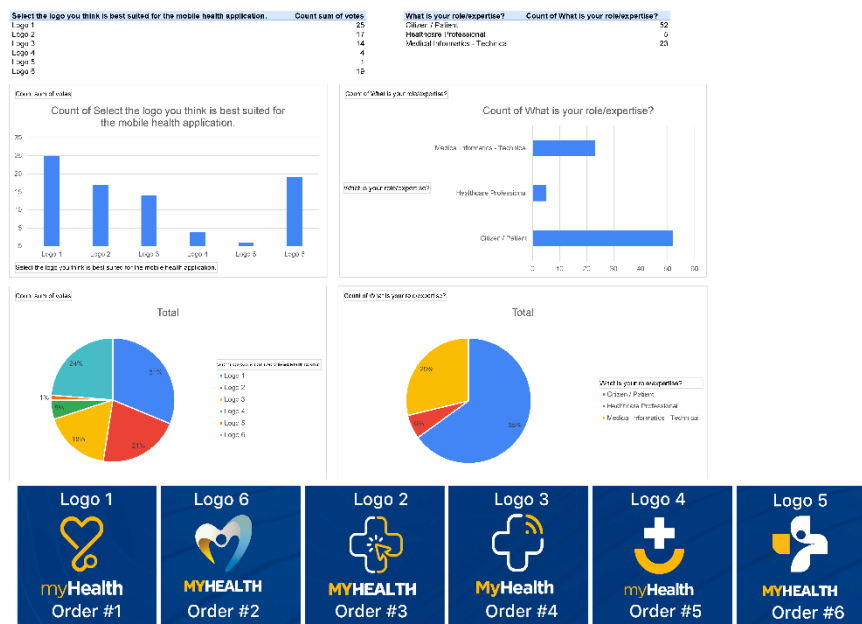
- ☐ Logo 1
- ☐ Logo 2
- ☐ Logo 3
- ☐ Logo 4
- ☐ Logo 5
- ☐ Logo 6

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**Google** Forms

## Results



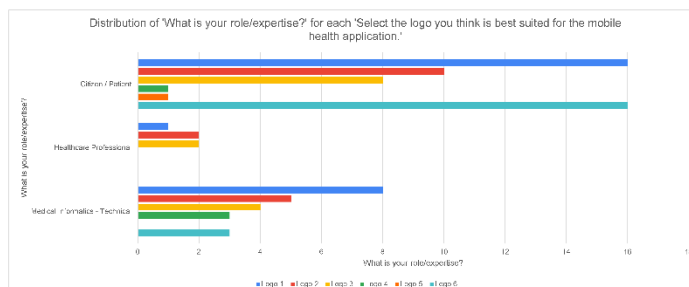


Logo Selections	Count of Select the logo you think is best suited for the mobile health application.
<b>Logo 1</b>	26
Citizen / Patient:	10
Medical informatics - Technical	9
Healthcare Professional	7
<b>Logo 2</b>	17
Citizen / Patient:	10
Medical informatics - Technical	5
Healthcare Professional	2
<b>Logo 3</b>	14
Citizen / Patient:	8
Medical informatics - Technical	4
Healthcare Professional	2
<b>Logo 4</b>	4
Medical informatics - Technical	3
Citizen / Patient:	1
<b>Logo 5</b>	1
Citizen / Patient:	1
<b>Logo 6</b>	19
Citizen / Patient:	10
Medical informatics - Technical	9
<b>Grand Total</b>	80



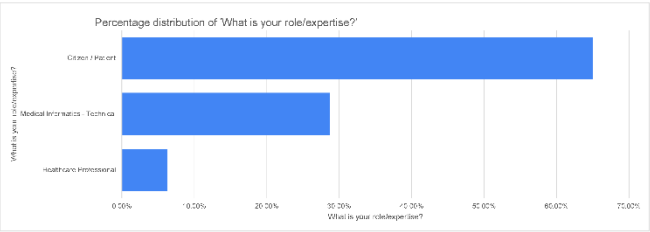
Distribution of "What is your role/expertise?" for each "Select the logo you think is best suited for the mobile health application."

Count of What is your role/expertise?	Column Labels	Logo 1	Logo 2	Logo 3	Logo 4	Logo 5	Logo 6	Grand Total
Citizen / Patient		10	10	8	1	1	16	52
Healthcare Professional		1	2	2				5
Medical informatics - Technical		9	5	4	3		3	23
<b>Grand Total</b>		26	17	14	4	1	19	80



X Distribution of 'What is your role/expertise?'

Row Labels	Count of What is your role/expertise?
Citizen / Patient	65.00%
Medical Informatics Technical	26.75%
Healthcare Professional	8.25%
Grand Total	100.00%



## Appendix C – Application User Manual

2022



### USER'S GUIDE MYEHEALTHAPPCY FOR MOBILE DEVICES

**For Citizens**

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## GENERAL

## ABOUT THE MYEHEALTHAPPCY APPLICATION

The MYeHealthAppCY is an electronic health solution designed to improve access to quality healthcare for patients and providers in Cyprus. The app includes features such as **integrated prescription management**, **patient summary views**, and the ability to **connect with healthcare providers through video conferencing/teleconsultation**, enabling consultations from the comfort of their own homes. It also includes the ability to **save and access European Digital COVID certificates**, enabling users to easily access and share their health information as needed. Developed under the thesis project of Ionut – Cristian Canciu and master's project of Louiza Agroti of the University of Cyprus, the MYeHealthAppCY is available for download on the App Store for iOS devices and Google Play for Android devices. This user manual provides instructions on how to install, set up, navigate, and use the MYeHealthAppCY application, as well as troubleshooting advice for common issues and problems.

**Please note that the MYeHealthAppCY application is still under development and some features may not be enabled yet. In the future, the application will use a templating method to provide specific user groups with access to specific views based on their needs/privileges and consents. For example, patients may have access to different screens than healthcare providers, and each group may have access to different information and functionality. We appreciate your understanding and patience as we continue to develop and improve the app. Thank you for your support and we look forward to your feedback as we work to bring the best possible experience to our users. [Check last page of this manual]**

We hope that the MYeHealthAppCY application will be a useful and convenient tool for both patients and healthcare providers in Cyprus. The app is available in both Greek and English.



Picture 1: Illustration showing the application integrated features.



## SYSTEM REQUIREMENT

The System Requirements section lists the minimum hardware and software requirements that must be met to use the app. It is important to ensure that users' device meets these requirements to ensure optimal performance and usability. Please review the system requirements carefully to ensure that the device is compatible with the app.

To ensure optimal performance and functionality, it is necessary that the device on which the app is installed meets the minimum system requirements of **iOS 13 or newer** or **Android 10.0 (API 29) or newer**. In addition, the app requires access to the device's **camera**, **microphone**, and **internet connection** to function properly.<sup>1</sup>

Please make sure that the device meets these requirements and has the necessary permissions before installing and using the app.

## NAVIGATION

The Navigation section provides an overview of how to move around within the app and access its various features and functions. Whether users are new to the app or simply need a refresher, this section will help users navigate through the app with ease. Please carefully review the navigation instructions provided below to ensure that users can fully utilize the app's capabilities.

- The app features a tab navigation bar located at the bottom of the screen, which allows users to easily access the different sections of the app.
- To navigate to a different section, simply tap on the corresponding tab.
- Within each section, users can use the app's various features and functions by pressing on the corresponding buttons or links.
- Some sections may also include a back button or breadcrumb trail that allows users to return to a previous screen or section. Users can also return to the previous section or screen by clicking the back button.

A description of the main features/functions and how to navigate is available in each section of the app, including any specific actions that users can take.

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<sup>1</sup> It is important to note that the camera and microphone are used only for specific functions within the app, namely teleconsultation and scanning COVID certificates. These features are essential to the app's core functionality and are not used for any other purposes. Rest assured that the app does not include any spyware or malware, and we take the privacy and security of the users very seriously.

## GLOSSARY

**Account:** This refers to the user's personal profile and account within the MYeHealthAppCY app.

**Alien Resident Card (ARC):** The Alien Resident Card (ARC) is a document issued by the Cyprus Department of Immigration to non-EU citizens who are legally residing in Cyprus.

**Appointments:** This refers to the process of scheduling and attending appointments with healthcare providers through the app.

**Clinical Data:** This refers to medical information about a patient, including their medical history, diagnoses, treatments, and other relevant details.

**COVID Certificate:** This refers to the digital certificate issued by the government or other authorized body to certify that an individual has been vaccinated, recovered, or tested negative for COVID-19.

**Dashboard/Home Screen:** This refers to the main screen or home page of the app, which displays a selection of actions the user can make.

**Dispensing:** This refers to the process of a pharmacy providing a patient with the medication that has been prescribed by their healthcare provider.

**Electronic Health Record (EHR):** This is a digital record of a patient's health information that is stored and shared electronically, allowing healthcare providers to access and update the information as needed.

**General Health System (GHS):** This refers to the General Health System of Cyprus and the term is used under the identifications section.

**Health Information Exchange (HIE):** This refers to the electronic exchange of healthcare information between different healthcare organizations, allowing for more efficient communication and data sharing.

**Health Record:** This refers to the collection of medical information about an individual, including their medical history, diagnoses, treatments, and test results.

**Medication:** This refers to the drugs or other substances that are prescribed by a healthcare provider to treat or prevent a medical condition.

**Medication Adherence:** This refers to a patient's ability to follow their prescribed treatment plan, including taking their medications as directed and following any other recommendations from their healthcare provider.

**Patient Summary:** This refers to a summary of a patient's medical information, including their current medications, allergies, diagnoses, and other relevant data.

**Personal Health Record (PHR):** This is a digital record of a patient's health information that is maintained and controlled by the patient themselves, rather than a healthcare provider.

**Prescription:** This refers to a written order from a healthcare provider for a specific medication or treatment.

**Referrals:** This refers to the process of a healthcare provider recommending that a patient see a specialist or receive treatment from another healthcare provider. This may be necessary if the patient's condition requires a higher level of care or specialized treatment that the primary healthcare provider is not equipped to provide.

**Teleconsultation:** This refers to the process of consulting with a healthcare provider remotely through video conferencing or other electronic means.

**Transaction Authentication Number (TAN):** This is a security code that is used to authenticate and authorize a transaction. It is typically sent to the user via email or SMS and must be entered to complete the transaction. In the context of the MYeHealthAppCY app, a TAN may be required for certain actions, such as verifying a COVID certificate.

**User Interface (UI):** This refers to the way that the app is designed and laid out, including the layout, colours, and fonts used.

#### PRIVACY AND SECURITY

To ensure the security and privacy of the users' data, the MYeHealthAppCY app employs several measures to protect user data. These measures include:

- **Encryption:** All data transmitted to and from the app is encrypted using secure protocols to prevent unauthorized access.
- **Secure servers:** The app uses secure servers to store user data, which are protected by firewalls and other security measures.
- **Other security measures:** In addition to encryption and secure servers, the app employs other security measures to protect user data, such as regular security updates and assessments to identify and address any vulnerabilities.

In addition to the measures described above, the MYeHealthAppCY app also includes a feature that **wipes all data saved on the device or in the memory cache when the user logs out**. This means that no data is maintained between sessions, and all data is

deleted when the user logs out. This feature is designed to protect the privacy of users by ensuring that **no data is left behind on the device after the user logs out.**

Please note that this feature does not apply to data stored on the app's servers, authentication and consent service and the cloud database.

*If users have more questions about how their data is stored, encrypted, and protected on the cloud, they shall contact the support team for more information.*

By employing these and other security measures, the MYeHealthAppCY app aims to ensure the security and privacy of user data and provide users with a secure and reliable experience.

As a user of the MYeHealthAppCY app, user have certain rights regarding their personal data. These rights include:

- **The right to access:** Users have the right to request a copy of the personal data that the app holds about them, as well as information about how that data is used and shared.
- **The right to correct:** If users believe that any of the personal data that the app holds about them is incorrect, users have the right to request that it be corrected.
- **The right to delete:** In certain circumstances, users have the right to request that the app delete any personal data it holds about them.

*To exercise any of these rights, please contact the support team. They will be happy to assist users in understanding and exercising their rights regarding their personal data.*

The MYeHealthAppCY app takes the privacy and security of user data very seriously and has policies in place to ensure that user data is only shared with third parties in accordance with relevant laws and regulations.

In general, the app will only share user data with third parties in the following circumstances:

- **For research purposes:** The app may share anonymized user data with research institutions or other organizations for the purpose of conducting research or analysis. This data will be stripped of any identifying information and used solely for research purposes.
- **For server performance and user activity at peaks:** The app may share anonymized user data with service providers or other third parties for the purpose of monitoring and improving server performance or analysing user activity at peak times. This data will be stripped of any identifying information and used solely for these purposes.

In all cases, the app will only share user data with third parties in accordance with relevant laws and regulations and will take steps to ensure that the data is handled securely and in accordance with the app's privacy policies.

*If users have any questions about the app's policies on sharing user data with third parties, they shall contact the support team for more information.*

The MYeHealthAppCY app includes a feature that **automatically captures and reports crash data** if the app crashes or experiences an error. This crash data includes information about the **device, operating system, and app state at the time of the crash**, as well as **a log of the events leading up to the crash**.

Crash reports are used to help the app developers identify and fix issues that may be causing the app to crash. They are also used to improve the overall stability and performance of the app.

Crash data is collected and processed in accordance with the app's privacy policies and relevant laws and regulations.

User data is retained by the MYeHealthAppCY app for **as long as the user's account is active**. If a user decides to delete their account, their data will be deleted as well. In cases where a user has not accessed their account **for an extended period**, their login may be blocked as a measure to protect their data. If a user wishes to regain access to their account, they can request activation of their login by following the instructions provided in the app. Once their login has been activated, they will be required to create a new password to access their account. This helps to ensure that user data is protected and that users have control over their data.

The MYeHealthAppCY app **is not intended for children under the age of 13**, and we do not knowingly collect or process personal data from children under the age of 13. If we become aware that we have collected personal data from a child under the age of 13, we will take steps to delete that data in accordance with applicable laws and regulations.

*If user is a parent or guardian and they believe that their child under the age of 13 has provided personal data to us through the app, they shall contact the support team so that the needed steps are taken to delete the data and deactivate the child's account.*

We encourage parents and guardians to monitor their children's online activity and to educate them about safe and responsible online behaviour.

*If users have any questions or concerns about children's privacy in connection with the MYeHealthAppCY app, please contact the support team for more information.*

## LEGAL INFORMATION

The MYeHealthAppCY app is provided "as is" and the developers make no representations or warranties of any kind, express or implied, as to the operation of the app or the information, content, materials, or products included on the app. The developers are not responsible for any errors or omissions in the app or for any damages of any kind that may result from the use of the app, including but not limited to direct, indirect, incidental, punitive, and consequential damages. The user assumes full responsibility for using the app and any reliance on the information and materials contained within it. The developers reserve the right to change or modify the app or its content at any time without notice. *[Check last page of this manual]*

Additionally, the app handles user health related data and personal information according to the laws and regulations of Cyprus. Please refer to the Cyprus electronic health system (eHealth) framework and the General Data Protection Regulation (GDPR) for more information on the protection and use of personal data in the healthcare sector. The app developers are committed to ensuring the privacy and security of user data and will take appropriate measures to protect user data in accordance with these laws and regulations.

The MYeHealthAppCY app and its content are protected by copyright and may not be reproduced or distributed without permission. Unauthorized reproduction or distribution of the app or its content is strictly prohibited and may result in legal action.

The MYeHealthAppCY application is governed by the laws of the Republic of Cyprus. Any disputes arising in relation to the use of the app, or its content will be resolved in accordance with the laws of the **Republic of Cyprus**.

## USER'S GUIDE

The User's Guide section of the app offers instructions and information about the various features and functions available within the app. This includes details about specific actions that users can take, such as logging in to their account, accessing and managing their personal health record, making teleconsultations with healthcare providers, and more. Each section of the guide provides step-by-step instructions and explanations to help users navigate and utilize the app's capabilities effectively.

## WHERE TO DOWNLOAD

Users with **mobile** devices can download and install the **MYeHealthAppCY** application from Google Play for Android devices and from App Store for iOS devices.

**DISCLAIMER:** At the current stage of development the access can be only granted using a firebase account upon beta testing request. The default username and password are patient/patient. Some features like "Reset your password" or "Registration" are disabled.

(Android: <https://appdistribution.firebase.dev/i/23ca9dd7936d6525>).<sup>2</sup>

(iOS: <https://appdistribution.firebase.dev/i/xxxxxxxxxx>).<sup>3</sup>

The MYeHealthAppCY app is a comprehensive **Electronic Health Record (EHR)** solution designed to improve access to quality healthcare for patients and providers in Cyprus. Currently, the app provides users with the ability to access and manage their personal health record, connect with healthcare providers through teleconsultation or video conferencing, and scan and save COVID certificates for easy access and verification. In the future, the app will also include features such as the ability to schedule appointments, view and track medication usage, access educational resources and information about various health topics and conditions; and use a symptom checker and self-assessment tool to help identify potential health concerns and determine whether medical attention is needed.

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<sup>2</sup> Android invitation link to install the app from Google Firebase. User will need to download and install **App Tester** on their Android device and allow installation from unknown sources. On most Android devices the App Tester is installed by default when trying to install a Firebase distribution application.

<sup>3</sup> iOS invitation link to install the app from Google Firebase. Users will need to download and install **Test Flight** on their iOS device. On most iOS devices the **Test Flight** is installed by default when trying to install a Firebase distribution application.

Following successful installation of the MYeHealthAppCY application on their smart device, users can view/use one of the following features:

#### FEATURE 1: VIEW PRESCRIPTIONS

1	2	3
View personal prescriptions.	View current or previous prescriptions.	View medications and details about the medications.

#### FEATURE 2: VIEW DISPENSINGS

1	2	3
View personal dispensing.	View current or previous dispensing.	View medications and details about the medications.

#### FEATURE 3: VIEW REFERRALS

1	2	3
View personal referrals.	View current or previous referrals.	View details about the examination plan/results.

#### FEATURE 4: VIEW PATIENT SUMMARY

1	2	3	4
View personal patient summary.	View administrative data.	View patient specific clinical data.	Track medical history and events.

#### FEATURE 5: STORE AND VIEW COVID CERTIFICATES

1	2	3	4
Scan the QR code with the <b>MYeHealthAppCY</b> application.	Insert the TAN code found under the QR code.	Check if the certificate details are correct.	Save the certificate for future use.

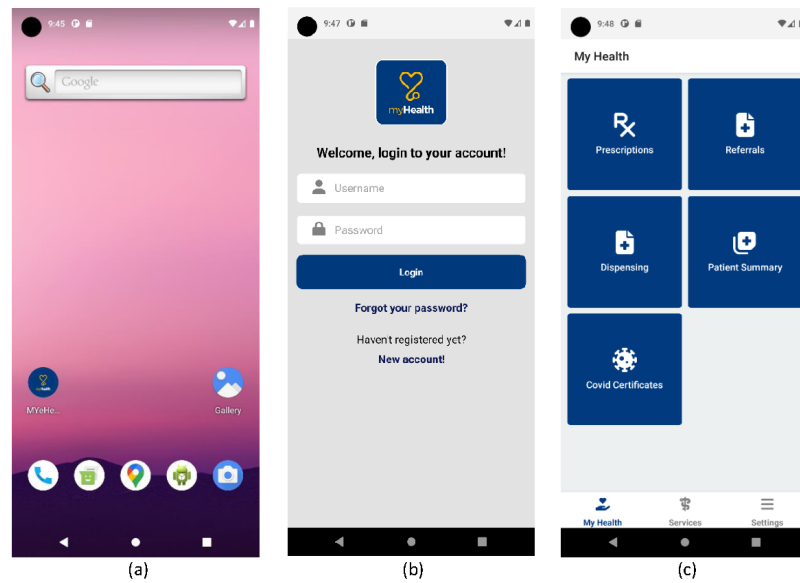
#### FEATURE 6: MAKE A TELECONSULTATION

1	2	3	4
Upon request, join the teleconsultation	A provider will be ready to pick up the call.	Once connected, insert the passcode received.	The consultation is ready from the comfort of the user's home.



Make sure that entry to the smart device is protected by some security setting (personal code, fingerprint, or other method of users' choice) and which is necessary to enter the MYeHealthAppCY application.

**Important security information:** If users' device is not protected by any security setting, they will not be able to use the MYeHealthAppCY.



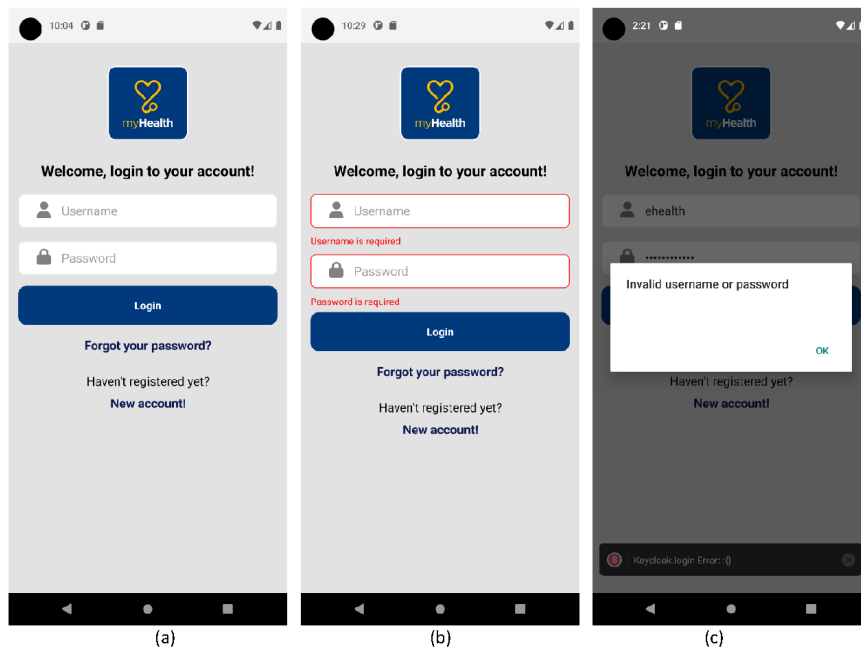
Picture 2: (a) Icon of the MYeHealthAppCY application, (b) Upon activation of the application enter user credentials, (c) Initial home screen of the MYeHealthAppCY application after inserting correct login credentials.

## SECTION A: USER LOGIN

The “**User Login**” section of the MYeHealthAppCY app is designed to help users access their personal health record and other important features and functions within the app. Users can log in to the app using their unique username and password, and if they forget their password, they can follow the instructions on how to reset it. It is essential for users to log in *into* the app to access their personal health record and other features.

### USER LOGIN

To log in to the MYeHealthAppCY app, users will need to enter their **username** and **password** and press “**Login**”. If the username or password is not provided, users will see a red error message saying “Username/Password is required.” If the credentials provided are incorrect, users will see a pop-up alert saying, “Invalid username or password.” To try again, simply press “**OK**” and re-enter the login credentials. If the credentials provided are correct, users will be redirected to the home screen of the application, as shown in [Picture 2 \(c\).](#)”



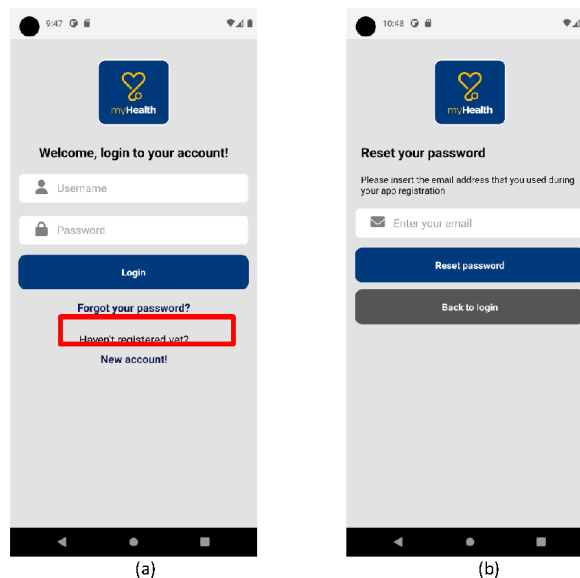
Picture 3: (a) Initial login screen of the MYeHealthAppCY application, (b) Error showing that the username and password are required for login, (c) Alert indicating that an invalid username and password combination was used.

## FORGOT PASSWORD

To reset their password in the MYeHealthAppCY app, users will need to follow this step:

- Click on the **"Forgot your password?"** link in the login screen of the app.
- Enter the email address in the designated field and press **"Reset password."**
- Check the email for a message from MYeHealthAppCY with a **password reset code**.
- If the password reset code is not received, check the spam or junk email folder.
- Follow the **instructions in the email** to enter the password reset code and create a new password.
- Once the new password is entered, press **"Continue"** to complete the password reset process.

By following these steps, users will be able to reset their password and regain access to their account. **It is important for users to keep their password secure and to choose a strong and unique password to protect their personal information.**



Picture 4: (a) Selection for "Forgot your password?", (b) Reset your password screen with field for email

*If users have any trouble resetting their password, they shall check the troubleshooting section or contact the support team for assistance.*

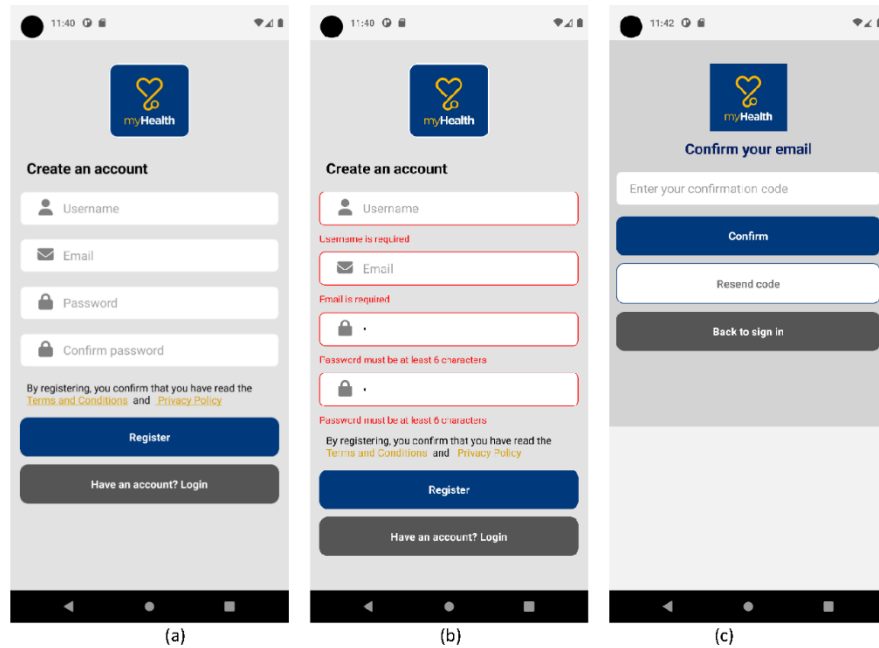
## SECTION B: USER REGISTRATION

The registration section of the MYeHealthAppCY app is designed to help users create a new account and access their personal health record and other features and functions of the app. In this section, users will find instructions on **how to create a new account** and provide the **necessary information to set up their profile**. It is important for users to complete the registration process to access their personal health record and other features and functions of the app. *Please carefully follow the instructions provided in this section to create your account and begin using the app.*

To register for a new account in the MYeHealthAppCY app, follow these steps:

- Press the **"New Account!"** link at the bottom of the login screen.
- In the registration screen enter the desired **username** in the designated field.
- Enter the **email address** in the designated field and **create a password** in the designated field.
- **Re-enter the password** in the designated **"Confirm Password"** field to confirm that it is correct.
- Press the **"Register"** button to submit the registration information.
- **Check the email** for a message from MYeHealthAppCY with a confirmation code.
- Follow the instructions in the email to enter the **confirmation code** and complete the registration process.

By following these steps, users will be able to create a new account and access the features and functions of the MYeHealthAppCY app. **It is important for users to choose a strong and unique password to protect their personal information and to keep their email address up to date to receive important notifications and updates from the app.**

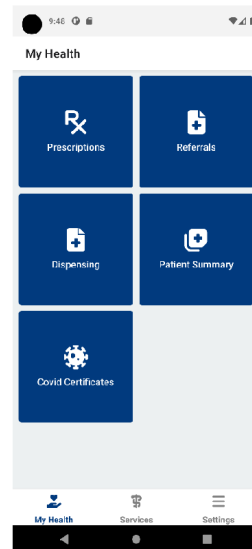


**Picture 5: (a) User registration screen, (b) User registration screen with required fields, (c) Post registration screen with confirmation code sent to email.**

*If users have any trouble with the registration process, they shall check the troubleshooting section or contact the support team for assistance.*

## SECTION C: MY HEALTH SCREEN

The **"My Health"** screen is the main hub for accessing and managing users' personal health information within the MYeHealthAppCY app. From this screen, patients can view and manage their prescriptions and dispensings, view their referrals, access their patient summary, and view and scan their COVID certificates. The app's intuitive design and user-friendly interface make it easy for patients to quickly access and manage their health information, helping them to stay organized and on top of their health needs.



Picture 6: "My Health" screen of the MYeHealthAppCY application.

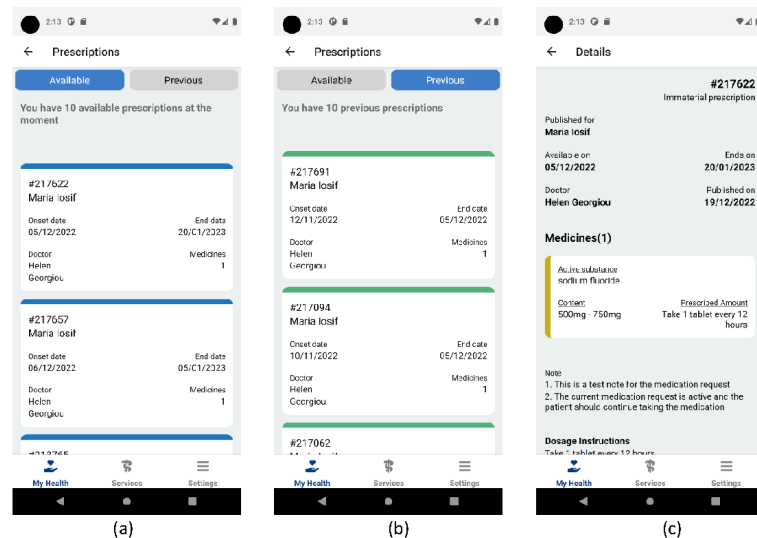
The **"My Health"** screen in the MYeHealthAppCY app provides users with access to several important features and functions:

- **Prescriptions:** Users can view their current and past prescriptions, as well as request refills or renewals as needed.
- **Dispensings:** Users can view their dispensed medications, including details about the prescribed dosage and frequency.
- **Referrals:** Users can view and manage their referrals to specialists or other healthcare providers.
- **Patient Summary:** Users can view a summary of their administrative data and medical history, current health status, including any diagnoses, allergies, or other important health information.
- **COVID Certificates:** Users can scan and save COVID certificates for easy access and verification.

## PRESCRIPTIONS

The screen includes a list of the patient's available prescriptions. The user has the possibility to select one of the preceding prescriptions. From the list, the user can see **the number of the prescription, the patient's name, the patient's name for whom the prescription has been written, the start and end dates of the prescription, the doctor who wrote the prescription and the number of drugs listed in the prescription.**

By clicking on a prescription and scrolling down, the user can see more details about the prescription chosen. In particular, the same information that was on the previous screen is displayed, together with **information about the medication, doctor's notes, dosage instructions, instructions for the patient, the time when the medication will be taken, the dose and analogy and the time when it will be taken.**



Picture 7: (a) Screen with “Available” prescription shown as list, (b) Screen with “Previous” prescription shown as list, (c) Details of the prescription.

### AVAILABLE PRESCRIPTIONS

The **"Available Prescriptions"** category displays any prescriptions that are currently available for the user to refill or renew.

### PREVIOUS PRESCRIPTIONS

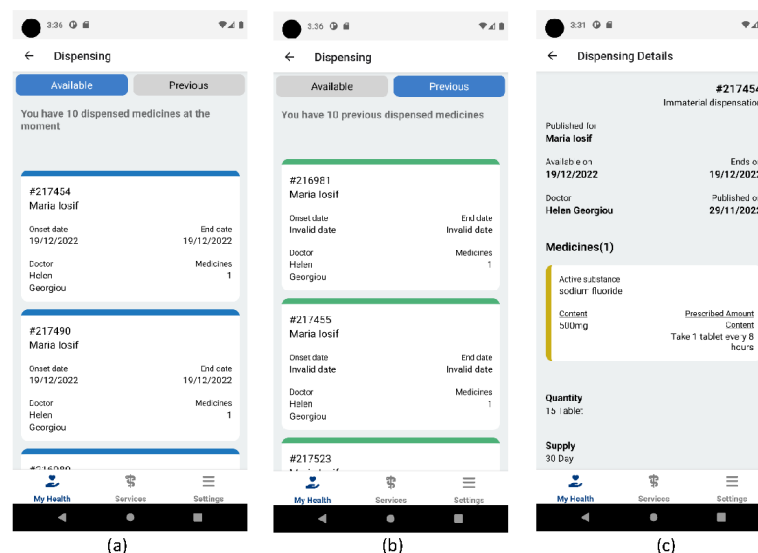
The **"Previous Prescriptions"** category displays a history of prescriptions that have been fulfilled or expired.

## DISPENSING

This screen contains a list of available dispensing for the patient. The user has the possibility to choose from among the previously dispensed medicines.

By looking at the list of medicines, the user can see **the number of the dispensed medicine, the patient's name, the patient for whom the medicine has been dispensed, the start and expiry dates and the doctor who prescribed it.**

By clicking on a medicine and scrolling down, the user can see more details about the medicine chosen. In particular, the same information that was on the previous screen is displayed, together with information **about the drug, its quantity, its supply, the doctor's notes, dosage instructions, the time taken to take the drugs, the period of time during which the medicine is taken, dose and analogy, information on which medicine has been replaced, and information on the source from which the patient received the medicine administered.**



Picture 8: (a) Screen with “Available” dispensings shown as list, (b) Screen with “Previous” dispensings shown as list, (c) Details of the dispensing.

## AVAILABLE DISPENSINGS

The “Available Dispensings” category displays any dispensings that are currently available for the user to pick up or request a delivery.

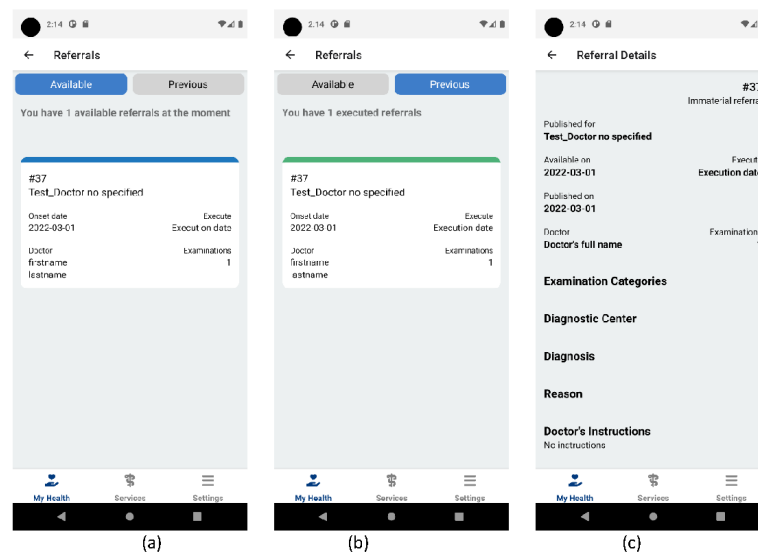


## PREVIOUS DISPENSINGS

The **"Previous Dispensings"** category displays a history of dispensings that have been picked up or delivered.

## REFERRALS

The screen includes a list of the patient's referrals. The user has the possibility to view and review their previous referrals as well as any current referrals that are still active. From the list, the user can see the details of each referral, including **the referral date**, **the referring healthcare provider**, **the specialist**, or **facility being referred to**, and **any notes or details provided about the referral**.



Picture 9: (a) Screen with "Available" referrals shown as list, (b) Screen with "Previous" referrals shown as list, (c) Details of the referral.

## AVAILABLE REFERRALS

The **"Available Referrals"** category displays any referrals that are currently available for the user to follow up on.

## PREVIOUS REFERRALS

The **"Previous Referrals"** category displays a history of referrals that have been completed or expired.

## PATIENT SUMMARY

The **"Patient Summary"** screen displays a summary of the patient's medical information, including their personal details, medical history, and current health status. The screen is divided into two categories: **"Patient Administrative Data"** and **"Patient Clinical Data"**.

The first category, **"Patient Administrative Data"**, refers to the patient's administrative data and includes screens with information related to the patient's identification, personal information, contact details and information related to the patient's insurance.

The second category, **"Patient Clinical Data"**, refers to the patient's clinical data and includes screens relating to alerts, medical history, any medical problems, summary of medications, social history, pregnancy history, data provided by the patient, results, and care plans.

*Each button is shown based on what applies to the user, so if a button is missing, it may be because the user does not have any information in that category, or it might not apply to the specific patient. For example, the "Pregnancy History" clinical data button will not be shown for male patients.*



Picture 10: (a) Administrative Data section of the Patient Summary,  
(b) Patient Clinical Data section of the Patient Summary

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#### PATIENT ADMINISTRATIVE DATA

The "**Patient Administrative Data**" section of the "**Patient Summary**" screen allows users to view and manage their personal and administrative information.

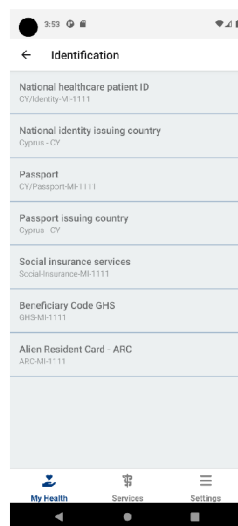
This includes the following options:

- **Identification:** This section displays the user's identification details, such as their name, gender, date of birth, and identification number.
- **Personal Information:** This section displays the user's personal details, such as their nationality, marital status, and occupation.
- **Contact Information:** This section displays the user's contact details, such as their address, phone number, and email address.
- **Insurance Information:** This section displays the user's insurance details, such as their policy number, insurer, and coverage limits.

*If any of this information is incorrect or needs to be updated, users can contact the support team for assistance.*

## IDENTIFICATION

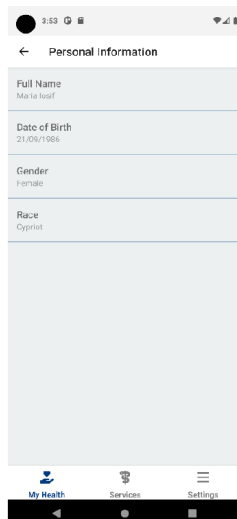
This screen includes data relating to the patient's identification. It displays information concerning **the national identity of the patient, patient's passport, social security number, general health system (GHS) beneficiary code** and the **alien resident card (ARC) number** in case the patient is a foreigner.



**Picture 11: Patient's identification details in the "Administrative Data" category of "Patient Summary"**

## PERSONAL INFORMATION

It includes data related to the patient's personal information, such as the **patient's full name, date of birth, sex, and race.**

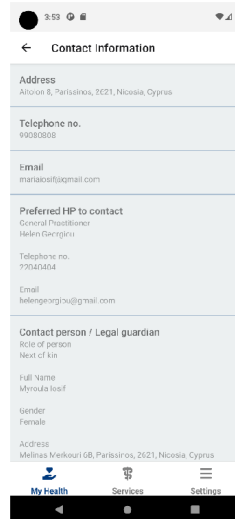


Personal Information	
Full Name	Maria Ioannidou
Date of Birth	21/06/1986
Gender	Female
Race	Cypriot

**Picture 12: Patient's personal information details in the "Administrative Data" category of "Patient Summary"**

## CONTACT INFORMATION

It includes data related to the patient's contact details. Those are the **telephone number of the patient**, the **address of the patient**, and the **personal e-mail address**. Also shown is information relating to the **healthcare provider that the patient prefers to contact in case of an incident**. Apart from this, there is information about the **patient's legal guardian or a close emergency contact**.

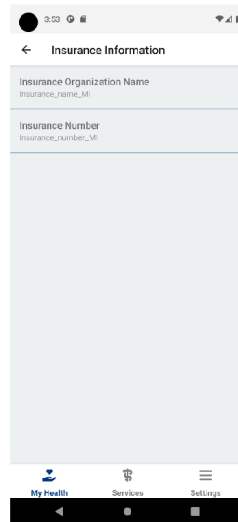


Contact Information	
<b>Address</b>	Alfonsi 8, Parissinos, 2021, Nicosia, Cyprus
<b>Telephone no.</b>	99380808
<b>Email</b>	maraisoff@gmail.com
<b>Preferred HP to contact</b>	General Practitioner: Helen Georgiou Telephone no.: 99040404 Email: helengeorgiou@gmail.com
<b>Contact person / Legal guardian</b>	Role of person: Next of kin Full Name: Myroula Iosif Gender: Female Address: Melina Merkouri 6B, Parissinos, 2021, Nicosia, Cyprus

**Picture 13: Patient's contact information details in the "Administrative Data" category of "Patient Summary"**

## INSURANCE INFORMATION

Includes data related to the patient's insurance, such as the **insurance organisation's name** and the **insurance number of the patient** and **coverage limits of the patient's insurance**.<sup>4</sup>



Picture 14: Patient's insurance details in the "Administrative Data" category of "Patient Summary"

<sup>4</sup> In the above screen there is no coverage limits since this data is not provided yet.

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## PATIENT CLINICAL DATA

The "**Patient Clinical Data**" section of the "**Patient Summary**" screen allows users to view and manage their personal clinical data.

This includes the following options:

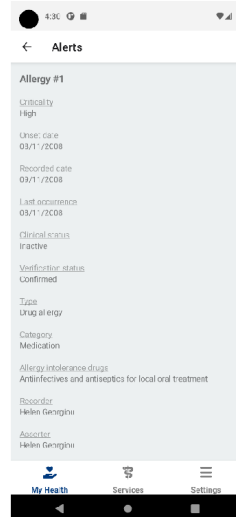
- **Alerts:** This section displays any important medical alerts or warnings that apply to the user, such as allergies or sensitivities to certain medications.
- **Medical History:** This section displays the user's past medical history, including any previous surgeries, hospitalizations, or medical conditions.
- **Medical Problems:** This section displays any current or ongoing medical problems or conditions that the user is experiencing.
- **Medication Summary:** This section displays a summary of the user's current and past medications, including the medication name, dosage, and prescribing healthcare provider.
- **Social History:** This section displays information about the user's social life, including their exercise habits, sleeping habits, tobacco use, drug use, alcohol consumption, and diet.
- **Pregnancy History:** This section displays the user's pregnancy history, including any past pregnancies and childbirths.
- **Patient Provided Data:** This section displays any additional information or data that the user has provided, such as travel history to other countries and the period spent in each country.
- **Results:** This section displays the results of any laboratory or imaging tests that the user has undergone, including any abnormal or notable findings.
- **Plan of Care:** This section displays the user's current care plan, including any treatment recommendations or follow-up appointments.

*If any of this information is incorrect or needs to be updated, users can contact the support team for assistance.*



## ALERTS

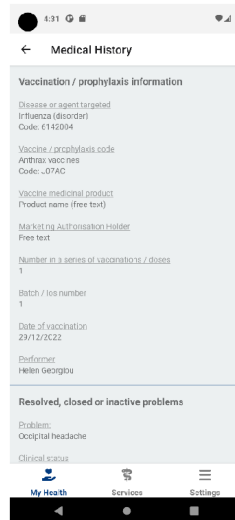
This screen refers to any allergies the patient may have. More specifically, it includes information such as the **severity of the allergy**, the **date of recording**, **when it last occurred**, the **patient's clinical case**, the **type of allergy**, **intolerance medications** and which **physician recorded the allergy**. Also, **the reaction the patient had along with the severity of the reaction** is mentioned.



Picture 15: Patient's alerts details in the "Clinical Data" category of "Patient Summary"

## MEDICAL HISTORY

This screen contains data concerning the patient's **medical history of past vaccinations** with information such as the **disease or target agent for which the vaccination was given**, the **vaccine code**, the **pharmaceutical product**, the **marketing authorization holder**, and the **date of vaccination**. Also, on the same screen we find information about the patient's **resolved or inactive medical problems**, **current clinical status**, **date of onset** and **date of remission of the problem**. At the end of the screen, **information is given on diagnoses** related to the patient, the **period of diagnosis**, **clinical condition**, **severity**, **body site**, **evidence**, and the **various stages of diagnosis**.



4:31

← Medical History

**Vaccination / prophylaxis information**

Disease or agent targeted  
Influenza (disorder)  
Code: E142004

Vaccine / prophylaxis code  
Anthrax vaccines  
Code: ..07AC

Vaccine medicinal product  
Product name (free text)

Marketing Authorization Holder  
Free text

Number in a series of vaccinations / doses  
1

Batch / lot number  
1

Date of vaccination  
23/12/2022

Practitioner  
Helen Georgiou

**Resolved, closed or inactive problems**

Problem:  
Occipital headache

Clinical status

My Health Services Settings

Picture 16: Patient's medical history details in the "Clinical Data" category of "Patient Summary"

## MEDICAL PROBLEMS

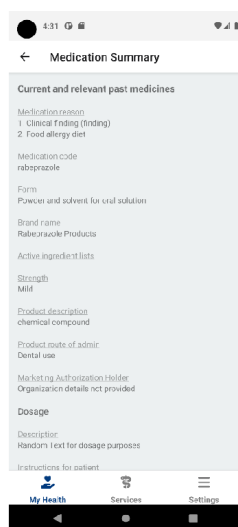
On this screen, the patient's **current medical problems** are listed along with their **clinical status** and the **date of onset**. The next information displayed is a list of any **medical devices or implants** that the patient has, including the **device identifier**, **implantation date**, **manufacturer**, and **production date**. This is followed by information on **any procedures the patient has undergone**, including the **date of the procedure**, the **performing physician**, and any **relevant details about the device or implant**. Finally, the screen includes information about the patient's **functional status**.



Picture 17: Patient's medical problems details in the "Clinical Data" category of "Patient Summary"

## MEDICATION SUMMARY

This screen displays a list of the patient's **current and past medications**. It includes **details about each medication**, such as the **reason for taking it**, the **medication code**, the **form**, the **brand**, the **strength**, the **route of administration**, and the **marketing authorization holder**. It also includes information about the **dosage**, **instructions for the patient**, the **duration of treatment**, and the **healthcare provider who prescribed the medication**. More details about those medications can also be found under the “Prescriptions” or “Dispensings” section.



Picture 18: Patient’s medication summary details in the “Clinical Data” category of “Patient Summary”

## SOCIAL HISTORY

This screen displays information about the patient's social history, including their **tobacco and alcohol use, drug use, exercise habits, sleeping habits, and diet**. It may also include information about their **exposure to infectious diseases**.

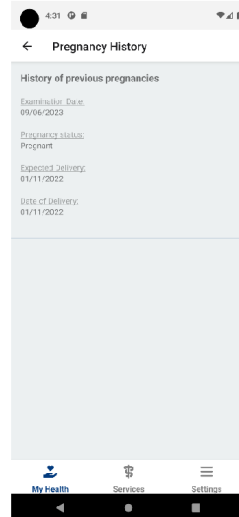


Picture 19: Patient's social history details in the "Clinical Data" category of "Patient Summary"

## PREGNANCY HISTORY

This screen displays information about the patient's **pregnancy history**, including details about **past and current pregnancies** such as **dates of tests** and **expected delivery**, as well as the **outcome of each pregnancy**.

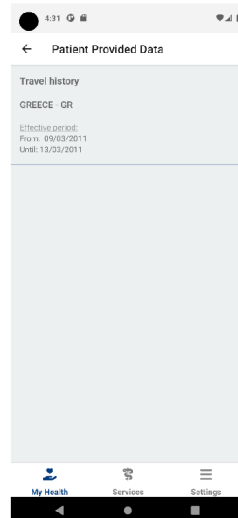
This information is only applicable to female patients.



Picture 20: Patient's pregnancy history details in the "Clinical Data" category of "Patient Summary"

## PATIENT PROVIDED DATA

This screen includes data provided by the patient themselves, such as **travel history**, including **countries visited** and **the duration of time spent in each country**.

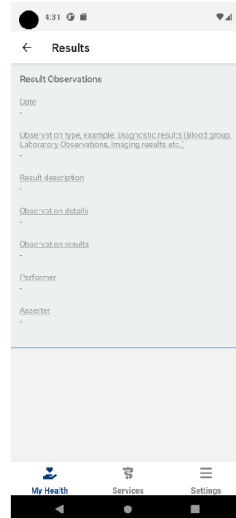


Picture 21: Patient's provided data details in the "Clinical Data" category of "Patient Summary"

## RESULTS

On this screen, there is a list of the patient's **laboratory results**, **imaging results**, or **other observations results**. The results are **organized by date**, with the most recent results displayed first. Each result includes information about the **type of test**, the **date the test was performed**, and the **result of the test**.

*Please note that at this time, this information is not provided.*

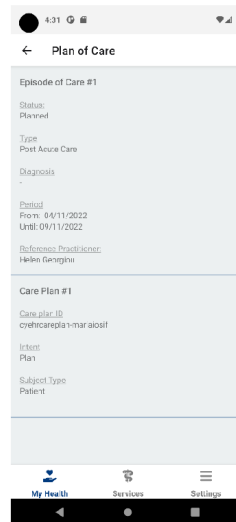


**Picture 22: Patient's results details in the "Clinical Data" category of "Patient Summary"**



## PLAN OF CARE

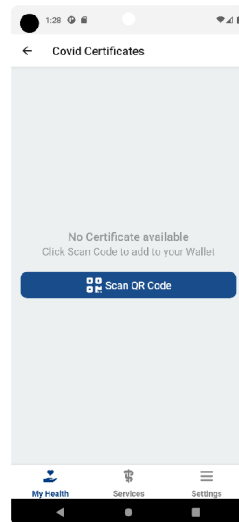
This screen displays information about the patient's **episodes of care**, including the **condition, type**, and **duration of the episode**, as well as the **referring physician**. It also includes information about the **patient's overall plan of care**.



**Picture 23: Patient's plan of care details in the "Clinical Data" category of "Patient Summary"**

## COVID CERTIFICATES

The "**COVID Certificates**" section of the "**My Health**" screen allows users to view and manage their COVID-related certificates and documents, such as **vaccination and recovery records** and **test results**. Users can scan and save their certificates for easy access and verification and can also share them with healthcare providers or other authorized parties as needed. This feature helps users to keep track of their COVID-related information and ensure that they have the necessary documents for travel, work, or other activities. To begin the process of scanning and saving a Covid Certificates, press the "**Scan QR Code**" button.



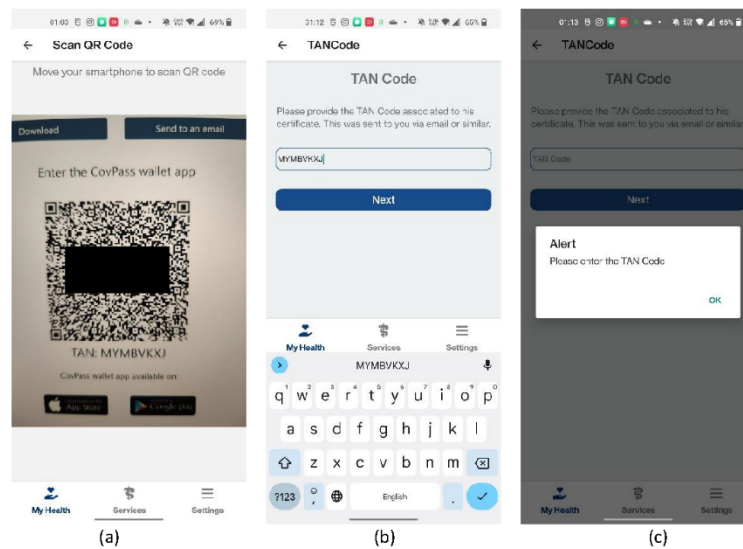
**Picture 24: Covid Certificates screen of the MYeHealthAppCY application.**

*Please note that if this is the first time using the camera within the app, users may be prompted to grant permission for the app to access the device camera. This is necessary for scanning the QR code on their COVID certificate. If used do not grant permission, they will not be able to use this feature.*

## SCAN QR CODE

The **"Scan QR Code"** section of the Covid Certificates screen allows users to scan the QR code of their Covid certificate using their device's camera. Once the QR code is scanned, the user may be prompted to enter a **TAN (Transaction Authentication Number)** code for verification. If the TAN code is incorrect, an error message will be displayed, and the user will need to try again. Once the TAN code is successfully entered, the user's Covid certificate will be displayed on the screen.

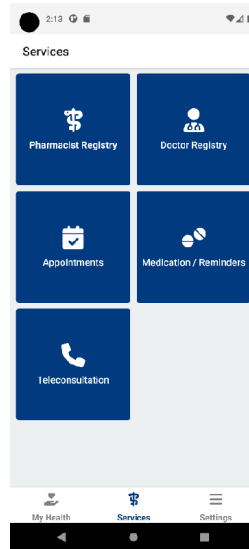
Once the certificate has been verified and saved, the user can access it at any time from within the **"Covid Certificates"** screen. The user also has the option to remove any saved certificates as needed.



Picture 25: (a) Scanning the QR code of the Covid certificate, (b) Insert TAN code when requested, (c) Error message in case the TAN code is incorrect.

#### SECTION D: SERVICES SCREEN

The **"Services"** section of the MYeHealthAppCY app provides users with access to a range of helpful tools and resources to manage their healthcare needs.



**Picture 26: Services screen of the MYeHealthAppCY application.**

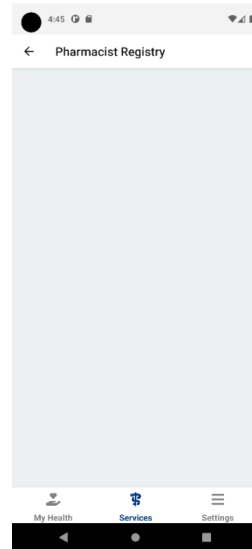
The **"Services"** section of the MYeHealthAppCY app provides users with access to several important features and functions:

- **Pharmacist Registry:** Users can search for and locate nearby pharmacies, as well as view their contact information and hours of operation.
- **Doctor Registry:** Users can search for and locate healthcare providers, including doctors, specialists, and other healthcare professionals, as well as view their contact information and specialties.
- **Appointments:** Users can schedule appointments with healthcare providers, view their upcoming appointments, and cancel or reschedule appointments as needed.
- **Medications/Reminders:** Users can view and manage their current medications, including details about dosage and frequency, and set reminders to help them stay on track with their medication regimen.
- **Teleconsultation:** Users can connect with healthcare providers through video conferencing or teleconsultation, allowing them to receive medical care remotely.

## PHARMACIST REGISTRY

The "**Pharmacist Registry**" section of the MYeHealthAppCY app allows users to access information about registered pharmacists in Cyprus. This includes the **pharmacist's name, contact information, and location**. Users can **search for pharmacists by name or location** and can also view **details about the pharmacy** where the pharmacist works.

*Please note that at this time, this information is not provided.*

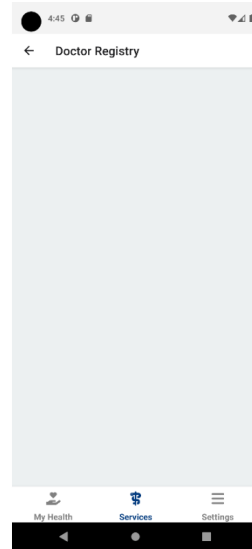


**Picture 27: Pharmacist registry screen of the MYeHealthAppCY application.**

## DOCTOR REGISTRY

The "**Doctor Registry**" feature of the MYeHealthAppCY app allows users to **search for and view information about healthcare providers in their area**. This includes details such as the **provider's name, specialty, location, and contact information**. Users can also **view ratings and reviews** from other patients to help them choose the best provider for their needs.

*Please note that at this time, this information is not provided.*

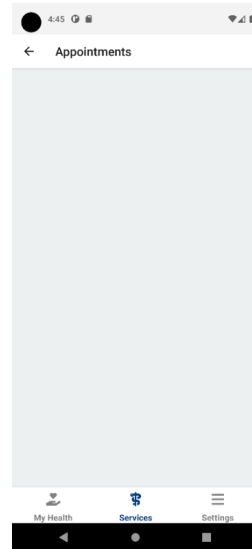


Picture 28: Doctor registry screen of the MYeHealthAppCY application.

## APPOINTMENTS

The "**Appointments**" section of the MYeHealthAppCY app allows users to view and manage their appointments with healthcare providers. Users can view the details of their **upcoming appointments**, such as the **date**, **time**, and **location**, and can also **request cancellations or rescheduling** as needed.

*Please note that at this time, this information is not provided.*

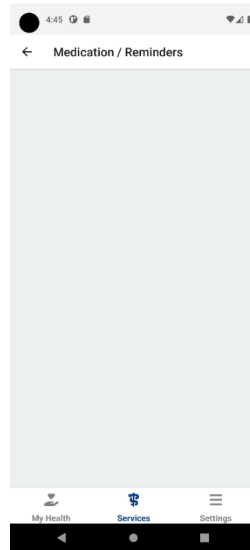


Picture 29: Appointments screen of the MYeHealthAppCY application.

## MEDICATIONS / REMINDERS

The "**Medication/Reminders**" section in the MYeHealthAppCY app allows users to view and manage their medication regimen. Users can see a list of their **prescribed medications**, including details about the **dosage, frequency**, and other important instructions. The app also includes a **reminder function** to help users remember to **take their medications on time**.

*Please note that at this time, this information is not provided.*



Picture 30: Medication / Reminders screen of the MYeHealthAppCY application.

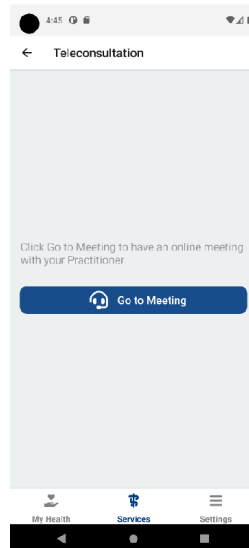


## TELECONSULTATION

The **"Teleconsultation"** feature in the MYeHealthAppCY app allows users to connect with healthcare providers through video conferencing or other remote communication methods. This feature is particularly useful for patients who are unable to visit a healthcare facility in person, or who prefer to avoid in-person visits due to COVID-19 or other reasons.

With the teleconsultation feature, users can schedule appointments with healthcare providers, discuss their health concerns, and receive medical advice and treatment recommendations without the need to physically visit a clinic or hospital.

To use this feature, users simply need to click the **"Go to Meeting"** button and wait for a provider to pick up the call. Once the teleconsultation is underway, users can communicate with their provider using audio and video and can also share documents or other relevant information as needed.

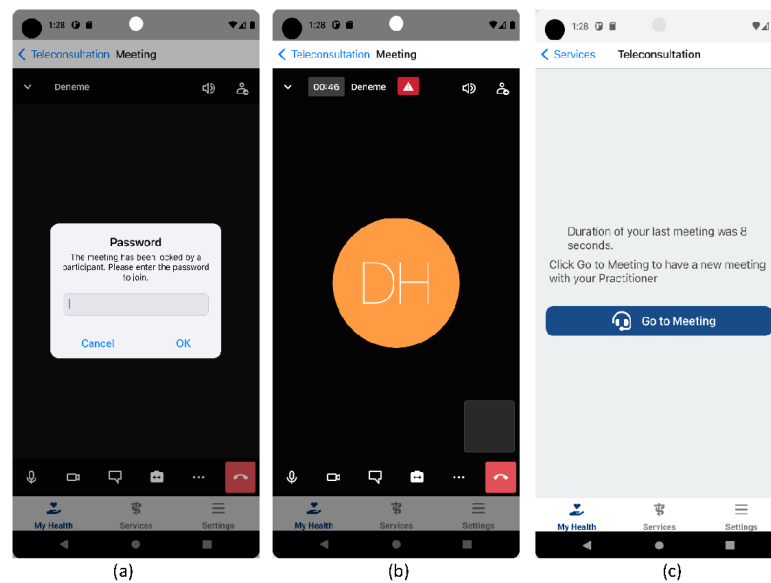


**Picture 31: Teleconsultation screen of the MYeHealthAppCY application.**

*Please note that if this is the first time the user is accessing the camera or microphone within the app, they may be prompted to grant the app permission to use these features. The user must accept these permissions to continue using the Teleconsultation feature.*

## GO TO MEETING

To initiate a teleconsultation, the user simply needs to click the **"Go to Meeting"** button on the **"Teleconsultation"** screen. Once connected, the user will be asked to enter a password, which will be sent via email or SMS. During the teleconsultation, the user can end the call at any time by clicking the red button on the bottom right corner of the screen. Once the call is ended, the user will return to the **"Teleconsultation"** screen, and the duration of the meeting will be displayed in the centre of the screen.



**Picture 32: (a) Teleconsultation password requirement before the teleconsultation starts, (b) View from within the teleconsultation, (c) Duration of the last meeting shown in the centre of the screen.**

The teleconsultation feature allows users to connect with healthcare providers for virtual appointments. It includes options to **change audio** and **video settings**, **invite additional participants**, use the **chat function to communicate with the provider**, and **view details about the call**. Users can also end the call at any time by pressing the red button.

*At the current stage, it is possible to end the call also by trying to press the back button.*

---

#### TELECONSULTATION FEATURES

At the top of the screen, starting from left to right the user can find the following:

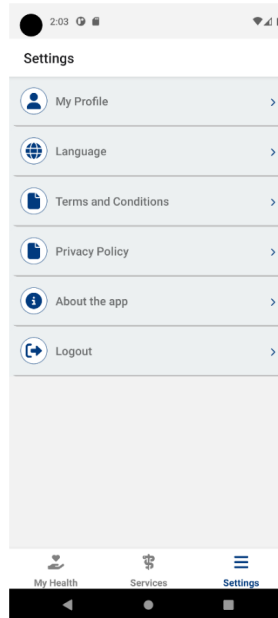
- **Duration:** The duration of the teleconsultation.
- **Audio output options:** The user can change the audio output (speaker/headphones).
- **Invite participants:** The user may invite other participants to the teleconsultation, such as other providers or a related person.

The bottom bar, starting from left to right, includes several tools for managing the call:

- **Mute microphone:** The microphone can be muted by clicking the microphone icon.
- **Turn camera on/off:** The camera can be turned on or off by clicking the camera icon.
- **Chat function:** The user can send messages or documents to the provider using the chat function.
- **Switch cameras:** The user can switch between the front and back cameras by clicking the camera switch icon.
- **View call details:** The user can view details about the call by clicking the information icon.
- **End call:** The user can end the call by clicking the red button.

## SECTION E: SETTINGS SCREEN

The "**Settings**" screen in the MYeHealthAppCY app allows users to customize and manage their app experience.



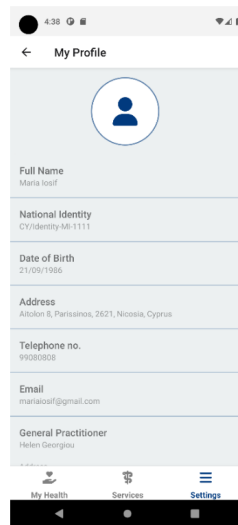
Picture 33: Settings screen of the MYeHealthAppCY application.

The "**Settings**" screen in the MYeHealthAppCY app provides users with the following options:

- **My Profile:** Users can view their personal information, such as their name, contact details, and insurance information.
- **Language:** Users can select their preferred language for the app.
- **Terms and Conditions:** Users can view the app's terms and conditions.
- **Privacy Policy:** Users can view the app's privacy policy.
- **About the App:** Users can view information about the app, including its version number and contact details for the developers.
- **Logout:** Users can log out of the app.

## MY PROFILE

It includes all the most important information about the user's profile. There is a **photo of the user**, **patient's full name**, the **number of the personal National Identity document**, **date of birth**, **address of residence**, **personal identification numbers**, the **user's personal telephone number** and **user's e-mail address**. At the end, there are the **personal details of the preferred doctor** (full name, work address, telephone number and e-mail address his/her e-mail address).

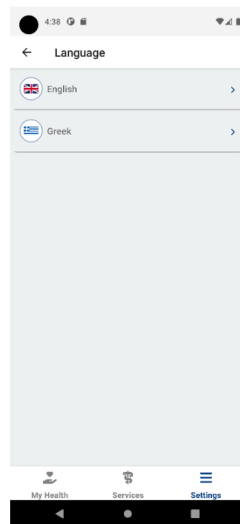


**Picture 34: My profile screen of the MYeHealthAppCY application.**

*In the context of the development stage, it is not possible to make any changes to the data.*

## LANGUAGE

This screen has two options as to the language of the application the user wants, the **English** and **Greek**. **The default language is English**. If the user chooses to change the language of the application, they will be taken to the home page of the application, which is the **"My Health"** tab.



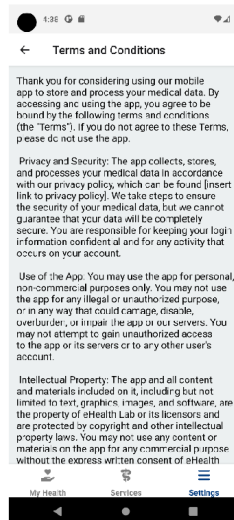
Picture 35: Language screen of the MYeHealthAppCY application.

## TERMS AND CONDITIONS

The **"Terms and Conditions"** section of the MYeHealthAppCY app provides users with access to the terms and conditions governing the use of the app. These terms and conditions **outline the rights and responsibilities of users and developers**, as well as any **limitations on the use of the app**.

It is important for users to review and understand these terms and conditions before using the app.

*Please note that much of the information contained in the terms and conditions can also be found in the general section of the user manual under the "Privacy and Security" and "Legal Information" sections.*

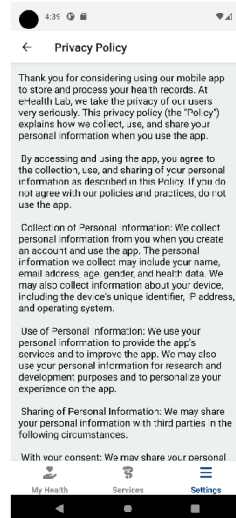


**Picture 36: Terms and conditions screen of the MYeHealthAppCY application.**

## PRIVACY POLICY

The **"Privacy Policy"** section of the MYeHealthAppCY app provides users with information about **how their personal data is collected, used, and protected within the app**. This includes details about the **types of data that are collected**, the **purposes for which it is used**, and the **steps that are taken to ensure its security and confidentiality**.

*Most of this information is also present within the general section of the user manual under "Privacy Policy" and "Legal Information."*

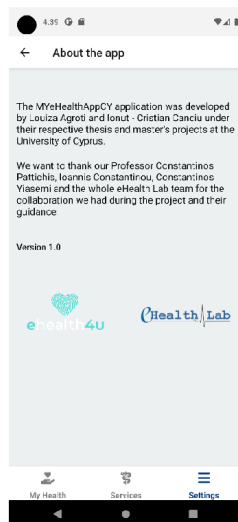


Picture 37: Privacy policy screen of the MYeHealthAppCY application.



## ABOUT THE APP

This screen includes information about the developers of the application, the purpose for which the app was developed, and acknowledgments to the people who helped with their cooperation and guidance in the development and implementation stage of the application. The current version of the application is also mentioned.

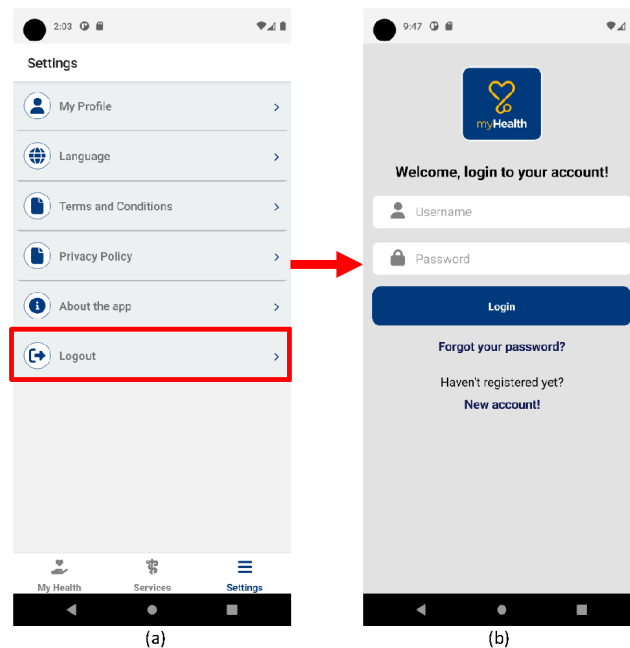


Picture 38: About the app screen of the MYeHealthAppCY application.

## LOGOUT

The logout functionality allows users to sign out of their account and end their current session within the app. This is a useful feature if users need to switch accounts or if they want to log out for security reasons.

Please note that after logging out, any data saved on the device or in the memory cache will be wiped and no data will be maintained between sessions. If users want to keep their data available between sessions, they can choose to stay logged in.



**Picture 39: (a) Logout functionality under the settings screen, (b) After logging out from the application, users will be redirected to the login screen.**

*It is important to note that COVID certificates are also deleted after logging out of the app. These certificates are not stored in the cloud or on any external servers, but rather are stored in the encrypted memory of the device. This means that they will be wiped after logging out and will need to be added again if users want to access them in a future session. Please make sure to re-enter the COVID certificates after logging back into the app to ensure that are available when needed. The app's encryption ensures that the COVID certificates always remain secure.*

#### Frequently asked questions (FAQ)

The **"FAQ" (Frequently Asked Questions)** section of the MYeHealthAppCY User Manual is designed to provide users with answers to common questions and concerns about the app and its features.

- **Q: How do I log in to the app?**  
**A:** To log in to the app, you will need to enter your registered email address and password. If you have forgotten your password, you can use the "Forgot Password" feature to reset it.
- **Q: How do I reset my password?**  
**A:** To reset your password, you can use the "Forgot Password" feature on the login screen of the MYeHealthAppCY app. Enter your email address and follow the instructions provided to reset your password.
- **Q: Can I change the language of the app?**  
**A:** Yes, you can change the language of the app by going to the "Settings" screen and selecting "Language." From there, you can choose from a list of available languages. Your selection will be applied immediately and all text within the app will be displayed in the selected language.
- **Q: How do I view my medical records in the app?**  
**A:** To view your medical records in the app, you will need to go to the "My Health" screen and select the "Patient Summary" option. From there, you can view your administrative data and clinical data.
- **Q: How do I log out of the MYeHealthAppCY app?**  
**A:** To log out of the MYeHealthAppCY app, go to the "Settings" screen and select the "Logout" button. This will end your current session and you will need to enter your login credentials to access the app again.

## TROUBLESHOOTING

The Troubleshooting section is intended to help users resolve any issues they may encounter while using the app. If user experience a problem or error message while using the app, they can refer to this section for possible solutions. If they are unable to resolve the issue, users shall not hesitate to contact the app's support team for further assistance.

Please note that in most cases, internet connectivity issues may cause problems with the app. Make sure that the device is connected to the internet before attempting to troubleshoot any issues.

### LOGIN OR AUTHENTICATION ISSUES

If users are unable to log in to the app or access certain features, check that the correct login information was used, and that the device is connected to the internet. If the issue persists, try resetting the password or contacting the app's support team for assistance.

### APP CRASHES OR FREEZES

If the app crashes or freezes, try closing the app and reopening it. If the issue persists, try restarting the device or checking for updates to the app.

### APP NOT RESPONDING

If the app becomes unresponsive, try closing and reopening it. If the issue persists, try restarting the device or checking for updates to the app.

### PERFORMANCE ISSUES

If the app is running slowly or experiencing other performance issues, try closing other apps or restarting the device. If the issue persists, try clearing the app's cache or checking for updates to the app.

### ERROR MESSAGES

If the app displays an error message, try following the steps provided in the message to resolve the issue. If the issue persists, try restarting the app or contacting the app's support team for assistance.

#### CONTACT INFORMATION

The "**Contact Information**" section of the MYeHealthAppCY User Manual provides information about how to get in touch with the app developers or support team for assistance. If user have any questions, feedback, or need help using the app, they can contact the team through the following channels:

- **Email:** users can send an email to the support team at:  
[support@mxxxxy.com](mailto:support@mxxxxy.com)
- **Phone:** users can call the support team at:  
**+357 2222xxxx**
- **Live Chat:** users can use the live chat feature within the app to speak with a representative in real-time.

In addition to these options, users can also find helpful information and assistance in the FAQs and online resources provided by the app developers. If users have any concerns or issues related to privacy, they can refer to the Privacy Policy section of the user manual for more information.

#### INSTRUCTIONS NOT INCLUDED/NOT APPLICABLE

Thank you for using the MYeHealthAppCY app. As we are currently in the development stages of the app, some features and functions may not be available at this time. The instructions and information provided in this section pertain to features and functions that will be added to the app in the future. We appreciate your understanding and patience as we work to bring these additional features and improvements to our users. If you have any suggestions for features that you would find helpful, we encourage you to share them with us. Your feedback is always welcome and helps us to continue to develop and enhance the app. Thank you for your support and we look forward to hearing your ideas.

#### Instructions and features not applicable:

- Biometric authentication as an option for logging in, allowing users to use their fingerprint or facial recognition to securely access their account without the need to remember a separate login password.
- Instructions for using search or filter functions, if applicable, to help users quickly find specific information or items within the app.
- A description of the app's notification system and how users can customize their notification settings or view their notification history
- A description of any in-app help or support resources available to users, such as a FAQ section or access to customer support via email or chat.
- Instructions for accessing the app's settings or account information and making any necessary changes (e.g., updating personal information, changing password, etc.)
- Integration with wearable devices (e.g., fitness trackers, smartwatches) to track and display health data such as steps taken, heart rate, sleep patterns, etc.
- A symptom checker or self-assessment tool that helps users identify potential health concerns and determine whether they should seek medical attention.
- A health library or knowledge centre that provides users with access to educational resources and information about various health topics and conditions.



**Picture 40: Illustration of work in progress of the MYeHealthAppCY application.**

## Appendix D – Application Users Evaluation

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Language: English (United States)

### Evaluation of MyeHealthAppCY

Thank you for your participation in this questionnaire! We are interested in collecting your feedback on the MyeHealthAppCY mobile app we have developed. This app is intended to provide convenient and accessible health services to users via their mobile phones. We would like to know your opinions about the features, ease of use and your overall satisfaction with the app. Your feedback is valuable to us as we strive to continuously improve and expand the app to further meet the needs of our users.

*The questionnaire is available both in English and in Greek.*

\* Required

#### Demographic questions and questions about your mobile operating system

In this section, we'll ask you a few questions about your personal characteristics and the device and operating system you use to access the app. This information will help us to better understand our user base and identify any issues or trends that may affect specific groups.

**Your answers to these questions will remain strictly confidential and will only be used for**

1. What is your gender? \*

- ☐ Male
- ☐ Woman
- ☐ Other

2. What is your age? \*

- ☐ 18-25
- ☐ 26-35
- ☐ 36-45
- ☐ 46-55
- ☐ 56-64
- ☐ 65+

3. Which user group do you belong to? \*

- ☐ Doctor
- ☐ Pharmacist
- ☐ Patient

4. What is the operating system of your mobile phone? \*

- ☐ Android
- ☐ iOS



5. If you know, what is the version of your Android phone? \*

- ☐ Android 10 - Quince Tart
- ☐ Android 11 - Red Velvet Cake
- ☐ Android 12 - Snow Cone
- ☐ Android 12L - Snow Cone v2
- ☐ Android 13 - Tiramisu
- ☐ I don't know

6. If you know, what is the version of your iOS mobile \*

- ☐ iOS 13
- ☐ iOS 14
- ☐ iOS 15
- ☐ iOS 16
- ☐ I don't know

## Questions concerning the application

7. How easy was it to navigate through the app? \*

- ☐ Very easy
- ☐ Somewhat easy
- ☐ Neither easy nor difficult
- ☐ Somewhat difficult
- ☐ Very difficult

8. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with the Prescriptions? \*

1	2	3	4	5
---	---	---	---	---

9. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with Dispensing? \*

1	2	3	4	5
---	---	---	---	---

10. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with the Patient Summary? \*

1	2	3	4	5
---	---	---	---	---

12. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with Covid Certificates? \*

1	2	3	4	5
---	---	---	---	---

13. Did you encounter any problems when issuing the COVID European Digital Certificate? \*

- ☐ No
- ☐ Yes

14. If yes, please select one of the options below \*

- ☐ Incorrect personal information (e.g. identity card, telephone number, date of birth)

15. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with Teleconsultation? \*

1	2	3	4	5
---	---	---	---	---

16. Did you encounter any problems while browsing Teleconsultation? \*

- ☐ No
- ☐ Yes

17. If yes, please select one of the options below \*

- ☐ Long response time of the videoconference
- ☐ Difficulty in setting up a new videoconference

18. How satisfied are you with the design of the application? \*

- ☐ Very satisfied
- ☐ Somewhat satisfied
- ☐ Neutral
- ☐ Somewhat dissatisfied
- ☐ Very dissatisfied

19. How satisfied are you with your overall experience with the app? \*

- ☐ Very satisfied
- ☐ Somewhat satisfied
- ☐ Neutral
- ☐ Somewhat dissatisfied
- ☐ Very dissatisfied

20. Do you want to add any comments and/or suggestions to help us improve the app? \*

21. On a scale of 1 to 5 (where 1 is "not at all likely" and 5 is "very likely"), how likely are you to recommend the app to a friend or colleague? \*

1	2	3	4	5
---	---	---	---	---

22. What overall rating would you give the app? \*



---

This content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.



## Customize thank you message

Thank you for taking the time to complete our survey. Your feedback is extremely valuable to us and will help us improve our app and provide a better experience for all of our users. We appreciate your input and look forward to making any necessary changes based on your suggestions. Thank you again for your time and participation.

## Results

### Αξιολόγηση εφαρμογής MyeHealthAppCY

12

Responses

20:52

Average time to complete

Active

Status

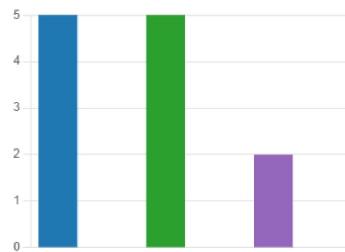
1. Ποιο είναι το φύλο σας;

● Άνδρας	8
● Γυναίκα	4
● Άλλο	0



2. Ποια είναι η ηλικία σας;

● 18-25	5
● 26-35	0
● 36-45	5
● 46-55	0
● 56-64	2
● 65+	0



3. Σε ποια ομάδα χρηστών ανήκετε;

● Ιατρός	0
● Φαρμακοποιός	0
● Ασθενής	12



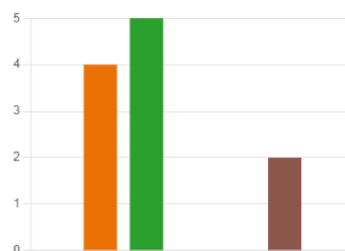
4. Ποιο είναι το λειτουργικό σύστημα του κινητού τηλεφώνου σας;

Android	11
iOS	1
Other	0



5. Αν γνωρίζετε, ποια είναι η έκδοση του Android κινητού σας;

Android 10 - Quince Tart	0
Android 11 - Red Velvet Cake	4
Android 12 - Snow Cone	5
Android 12L - Snow Cone v2	0
Android 13 - Tiramisu	0
Δεν γνωρίζω	2
Other	0



6. Αν γνωρίζετε, ποια είναι η έκδοση του iOS κινητού σας;

iOS 13	0
iOS 14	0
iOS 15	0
iOS 16	1
Δεν γνωρίζω	0
Other	0



7. Πόσο εύκολη ήταν η πλοήγηση στην εφαρμογή;

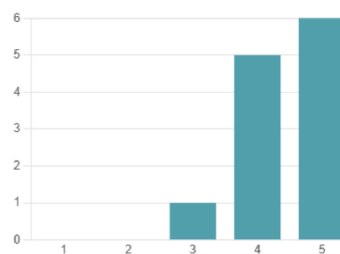
Πολύ εύκολη	7
Κάπως εύκολη	3
Ούτε εύκολη ούτε δύσκολη	1
Κάπως δύσκολη	1
Πολύ δύσκολη	0





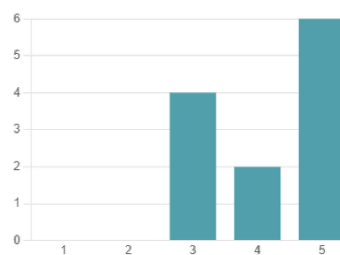
8. Σε κλίμακα από 1 έως 5 (όπου το 1 είναι «καθόλου ικανοποιημένος/η» και το 5 είναι «πολύ ικανοποιημένος/η»), ποιο είναι το επίπεδο ικανοποίησης σας από τις Συνταγές (Prescriptions);

**4.42**  
Average Rating



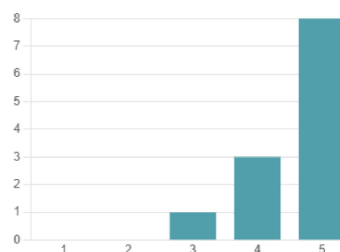
9. Σε κλίμακα από 1 έως 5 (όπου το 1 είναι «καθόλου ικανοποιημένος/η» και το 5 είναι «πολύ ικανοποιημένος/η»), ποιο είναι το επίπεδο ικανοποίησης σας από την Χορήγηση (Dispensing);

**4.17**  
Average Rating



10. Σε κλίμακα από 1 έως 5 (όπου το 1 είναι «καθόλου ικανοποιημένος/η» και το 5 είναι «πολύ ικανοποιημένος/η»), ποιο είναι το επίπεδο ικανοποίησης σας από την Περίληψη Ασθενούς (Patient Summary);

**4.58**  
Average Rating



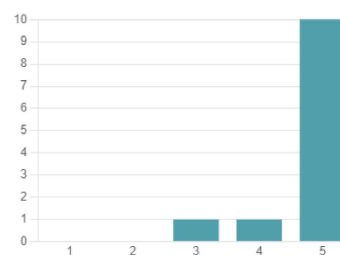
11. Στην Περίληψη Ασθενούς (Patient Summary) θα θέλατε να προστεθεί κάποια άλλη πληροφορία που θεωρείται ότι θα ήταν χρήσιμη να υπάρχει;

**4**  
Responses

Latest Responses

12. Σε κλίμακα από 1 έως 5 (όπου το 1 είναι «καθόλου ικανοποιημένος/η» και το 5 είναι «πολύ ικανοποιημένος/η»), ποιο είναι το επίπεδο ικανοποίησης σας από τα Πιστοποιητικά Covid (Covid Certificates);

**4.75**  
Average Rating



13. Αντιμετωπίσατε τυχόν προβλήματα κατά την έκδοση του Ευρωπαϊκού Ψηφιακού Πιστοποιητικού COVID;

● Όχι 11  
● Ναι 1



14. Παρακαλώ επιλέξτε μία από τις πιο κάτω επιλογές

● Λανθασμένα προσωπικά στοιχ... 0  
● Other 1



14. Παρακαλώ επιλέξτε μία από τις πιο κάτω επιλογές

1 Responses

ID ↑	Name	Responses	Language
1	anonymous	["The first time I saved the Covid certificate, it did not appear, I had to re-open the app."]	English (United States)

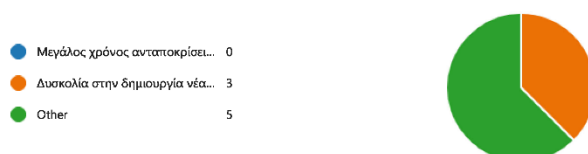
15. Σε κλίμακα από 1 έως 5 (όπου το 1 είναι «καθόλου ικανοποιημένος/η» και το 5 είναι «πολύ ικανοποιημένος/η»), ποιο είναι το επίπεδο ικανοποίησης σας από την Τηλεσύσκεψη (Teleconsultation);



16. Αντιμετωπίσατε τυχόν προβλήματα κατά την πλοήγηση σας στην Τηλεσύσκεψη (Teleconsultation);



17. Παρακαλώ επιλέξτε μία από τις πιο κάτω επιλογές



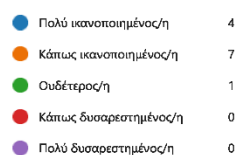


17. Παρακαλώ επιλέξτε μία από τις πιο κάτω επιλογές

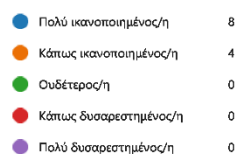
7 Responses

ID ↑	Name	Responses	Language
1	anonymous	["The app crashed"]	English (United States)
2	anonymous	["Crash"]	English (United States)
3	anonymous	["Δυσκολία στην δημιουργία νέας τηλεσύσκεψη", "Η εφαρμογή πάγωσε και έκλεισε όταν προσπάθησα να ξεκινήσω μία τηλεσύσκεψη"]	Ελληνικά
4	anonymous	["android version sometimes crashes"]	Ελληνικά
5	anonymous	["Crashed"]	English (United States)
6	anonymous	["Δυσκολία στην δημιουργία νέας τηλεσύσκεψη"]	Ελληνικά
7	anonymous	["Δυσκολία στην δημιουργία νέας τηλεσύσκεψη"]	Ελληνικά

18. Πόσο ικανοποιημένος/η είστε από τον σχεδιασμό της εφαρμογής;



19. Πόσο ικανοποιημένος/η είστε από την συνολική εμπειρία σας με την εφαρμογή;



20. Θέλετε να προσθέσετε τυχόν σχόλια ή/και εισηγήσεις που θα μας βοηθήσουν να βελτιώσουμε την εφαρμογή;

12  
Responses

Latest Responses

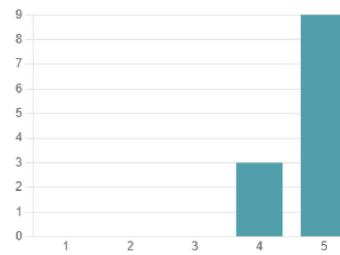
"Τρόπο να "

"Όχι"

"Very nice app, it would be amazing to incorporate maybe a weekly habit s...

21. Σε μια κλίμακα από το 1 έως το 5 (όπου το 1 είναι "καθόλου πιθανό" και το 5 είναι "πολύ πιθανό"), πόσο πιθανό είναι να συστήσετε την εφαρμογή σε έναν φίλο ή συνάδελφο;

4.75  
Average Rating





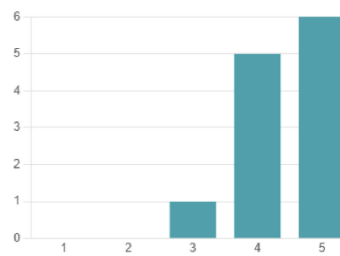
20. Θέλετε να προσθέσετε τυχόν σχόλια ή/και εισηγήσεις που θα μας βοηθήσουν να βελτιώσουμε την εφαρμογή;

## 12 Responses

ID ↑	Name	Responses	Language
1	anonymous	The design needs a lot of touches, make sections, groups and show data in a more friendly manner. Right now looks more like a log file.	English (United States)
2	anonymous	Consider the User Experience when designing the application. It should be easy to navigate the data and easy to understand it.	English (United States)
3	anonymous	Αν και φαίνεται ότι έχει γίνει αρκετή δουλειά, χρειάζεται ακόμη δουλειά το περιβάλλον. Να χωριστούν λίγο καλύτερα οι διάφορες πληροφορίες / κατηγορίες για να είναι πιο εύκολος ο εντοπισμός των πληροφοριών	Ελληνικά
4	anonymous	Προσεγγμένο design	Ελληνικά
5	anonymous	Adjustment of colors could result in better user experience, categories like allergies could have been collapsable with a brief description placed next to each title	English (United States)
6	anonymous	Πιο κατανοητές πληροφορίες στο Patient summary και πιο user friendly design	Ελληνικά
7	anonymous	no	Ελληνικά
8	anonymous	There is always room for improvement but overall this work is very good.	English (United States)
9	anonymous	Adding notifications and improve UI of health data per section.	English (United States)
10	anonymous	Very nice app, it would be amazing to incorporate maybe a weekly habit shedule in which people can write down certain activities they perform regularly like swimming every staurday or walk in the neighbourhoud everyday as an old person.	English (United States)
11	anonymous	Όχι	Ελληνικά
12	anonymous	Τρόπο να	Ελληνικά

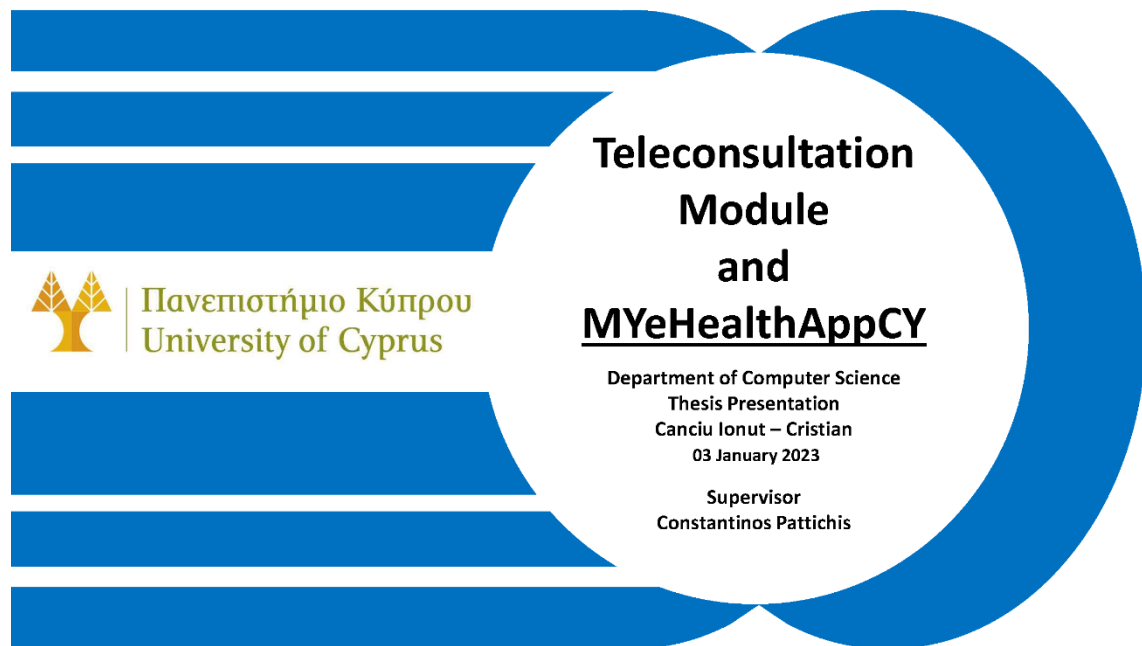
22. Ποια συνολική βαθμολογία θα δίνατε στην εφαρμογή;

**4.42**  
Average Rating



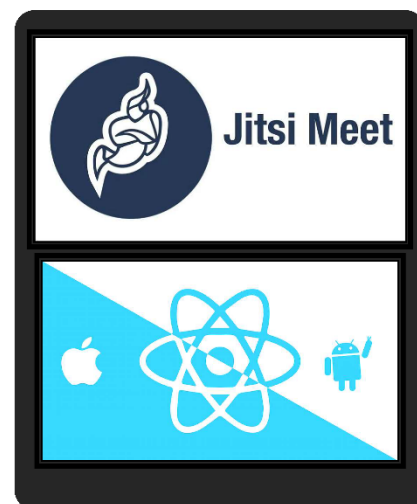


## Appendix E – Thesis Presentation



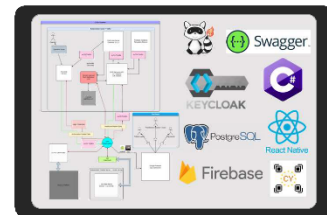
### Content

- Introduction
  - Motivation
  - Teleconsultation
- Teleconsultation and Jitsi Meet
  - Voice and Video Solutions
  - Benefits of Teleconsultation
  - Use Cases for Teleconsultation
  - FHIR Protocol and Teleconsultation
  - Open-Source vs Paid Solutions



## Content

- FHIR Protocol
  - Introduction to FHIR
  - Using FHIR in the MYeHealthAppCY app
  - FHIR and interoperability
- React Native and mobile development (Android / iOS)
  - Introduction to React Native
  - React Native in the MYeHealthAppCY
- Architecture
  - General Architecture
  - Building the MYeHealthAppCY App: A Testimony to Tenacity



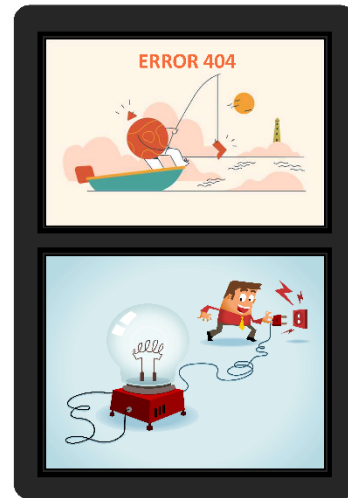
## Content

- Implementation
  - User Login and Logout using **react-native-keycloak-plugin**
  - Partial Registration and Forgot Password
  - Healthcare Data Services using ContextProvider
  - Jitsi Meet using **react-native-jitsi-meet**
  - Packaging and Distribution using Firebase
- Evaluation
  - Logo Selection Poll
  - Overall Evaluation (Patients / Doctors / Pharmacists)



## Content

- Conclusion
  - Limitations and challenges
  - Future work and application possibilities
- Demo
- Questions?



## Introduction

*Development of healthcare mobile application*

*Provide better healthcare provision to patients*

*Enable remote users or users with functional problems  
to see a doctor using teleconsultation*

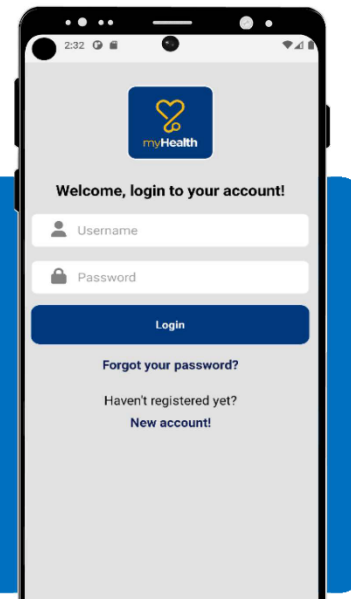
*Bring healthcare providers closer to patients*



## Introduction

### Motivation

- *Increased access to healthcare for underserved populations*
- *Greater convenience for patients*
- *Reduced need for in-person visits and potential exposure to illness*
- *Improved communication between healthcare providers and patients*
- *Potential cost savings for both patients and healthcare providers*



## Introduction

### Teleconsultation

- *Teleconsultation is a form of healthcare delivery that allows patients to consult with healthcare providers remotely, using video conferencing or other electronic means.*
- *Teleconsultation can be an effective and convenient way for patients to access healthcare services, particularly in the current COVID-19 pandemic.*



## Introduction

### Teleconsultation

- *Teleconsultation can be used for a variety of healthcare services, including primary care, mental health, and specialty care.*
- *Teleconsultation can be especially helpful for patients in rural or underserved areas, where access to healthcare can be limited.*



## Introduction

### Teleconsultation

- *Teleconsultation can also be beneficial for patients with mobility issues, as they do not need to travel to a healthcare facility in person.*
- *Teleconsultation can help to reduce the burden on traditional healthcare systems, by allowing patients to access care remotely and reducing the need for in-person visits.*



## Teleconsultation and Jitsi

Healthcare  
services closer to  
patients

Remote areas

Open Source,  
No payments

### Teleconsultation:

A general term for any consultation between doctors or between doctors and patients on a network or video link (e.g., Facetime, intranet, Internet, Skype, etc.).

- [Teleconsultation](#) | definition of teleconsultation by Medical dictionary (thefreedictionary.com)

## Teleconsultation and Jitsi

### Voice and Video Solutions

- *Webex*
- *Microsoft Teams*
- *Google Meet*
- *AnyMeeting*
- *Zoom*
- *Join.me*
- *Zoho Meeting*
- *Jitsi*
- */Daily*
- *8x8*
- *Bitrix24*
- *Rocket.Chat*

<https://filmora.wondershare.com/video-call/open-source-video-conferencing-software.html>

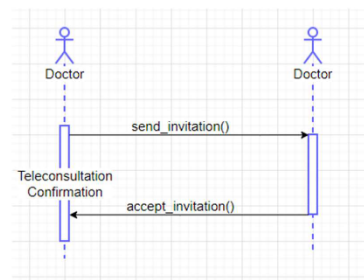
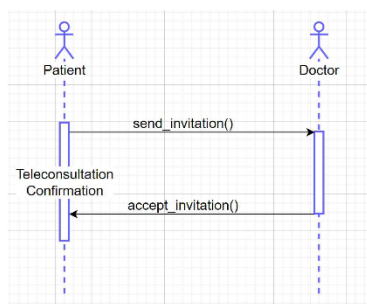
# Teleconsultation and Jitsi

## Benefits of Teleconsultation

- *Allows patients to receive healthcare remotely, increasing access to care and reducing the need for in-person visits*
- *Can improve patient outcomes by allowing healthcare providers to more easily monitor and communicate with patients*
- *Can reduce the spread of infections by minimizing in-person contact*
- *Can reduce healthcare costs by reducing the need for transportation and missed work*
- *Can improve the patient experience by offering more convenient and flexible care options*

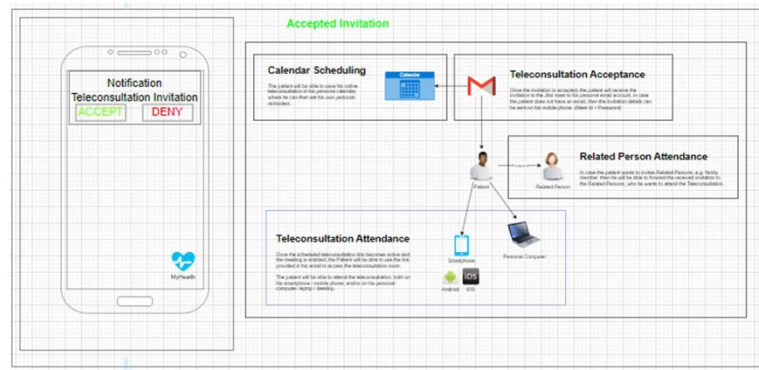
# Teleconsultation and Jitsi

## Use Cases for Teleconsultation



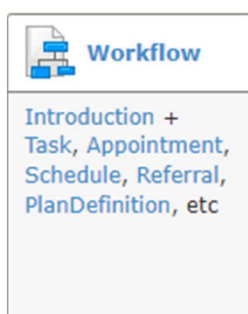
# Teleconsultation and Jitsi

## Use Cases for Teleconsultation



# Teleconsultation and Jitsi

## FHIR Protocol and Teleconsultation



### Workflow Module

*Appointment and Appointment Response*

*Schedule and Slots*



## Teleconsultation and Jitsi

## Open-Source vs Paid Solutions

- Open source teleconsultation solutions are **often free to use** and may be **customized to meet the specific needs** of a healthcare organization or individual.
- Paid teleconsultation solutions may offer **additional features** and **support**, but may come with a **higher cost**.
- Open source solutions may have a **larger user community** and may be **more actively developed and updated**.
- Paid solutions may offer **more reliable support** and a **higher level of security**.

*The choice between open source and paid solutions will depend on the specific needs and resources of the healthcare organization or individual.*

# FHIR Protocol

## Introduction to FHIR

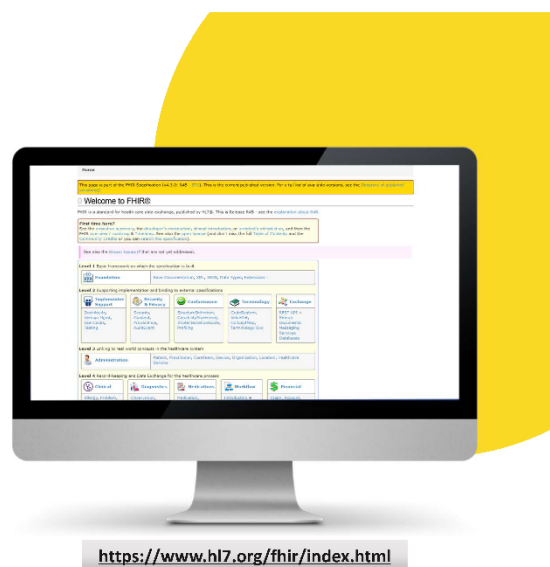
**FHIR (Fast Healthcare Interoperability Resources)** is a data standard for exchanging healthcare information electronically

FHIR is designed to be flexible and scalable, making it suitable for use in a variety of healthcare settings and situations



### Current state

## Release 4 has the First Normative Content and Trial Use Developments



# FHIR Protocol

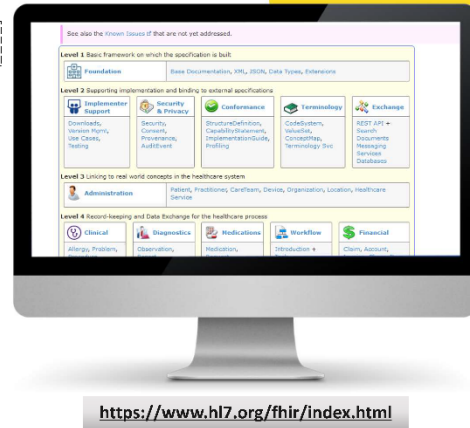
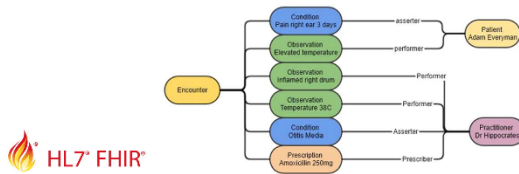
## Using FHIR in the MYeHealthAppCY app

All the resources and operations are from the FHIR protocol

FHIR implements **REST** operations (Create/Update/Read/Delete)

Prescriptions and Dispensing are implemented using the

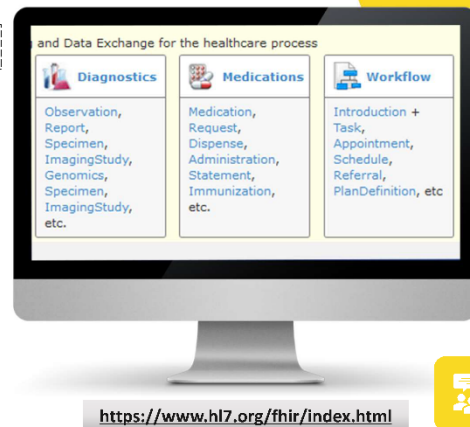
**MedicationRequest** and **MedicationDispense** Structure Definitions



# FHIR Protocol

## Using FHIR in the MYeHealthAppCY app

**Diagnostics**  
**Medications**  
**Workflows**



# FHIR Protocol

## FHIR and interoperability

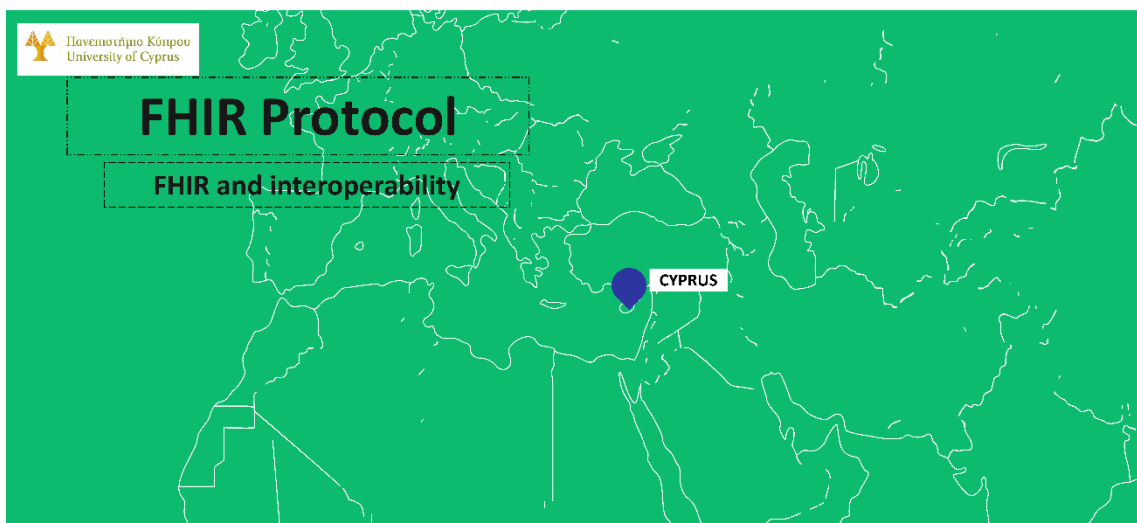
*FHIR's use of **RESTful APIs** and **standardized data** models enables easy exchange of data between different healthcare systems, improving efficiency and patient care.*

**CodeSystems and ValueSets**

**Terminology**

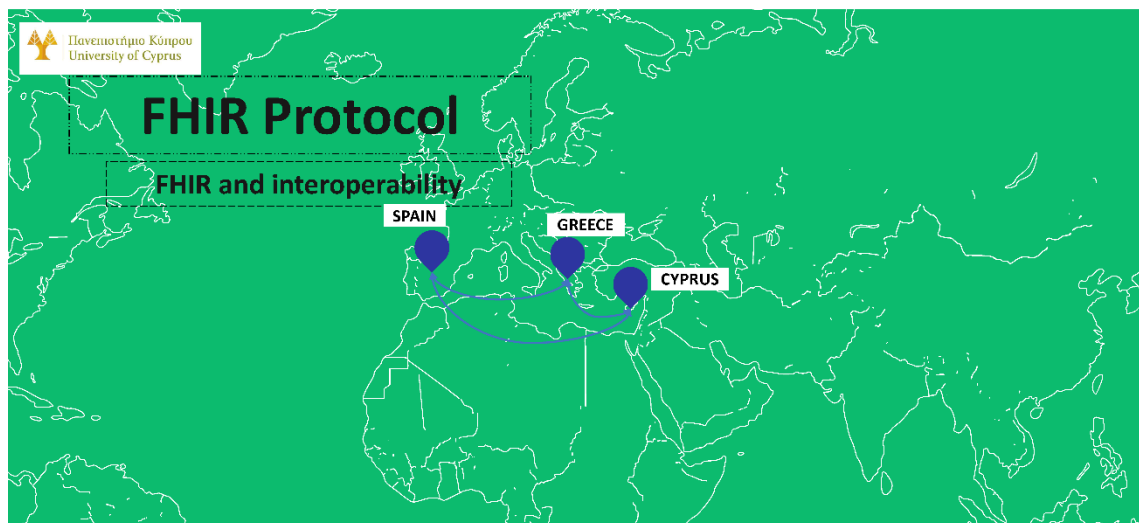


<https://www.hl7.org/fhir/index.html>



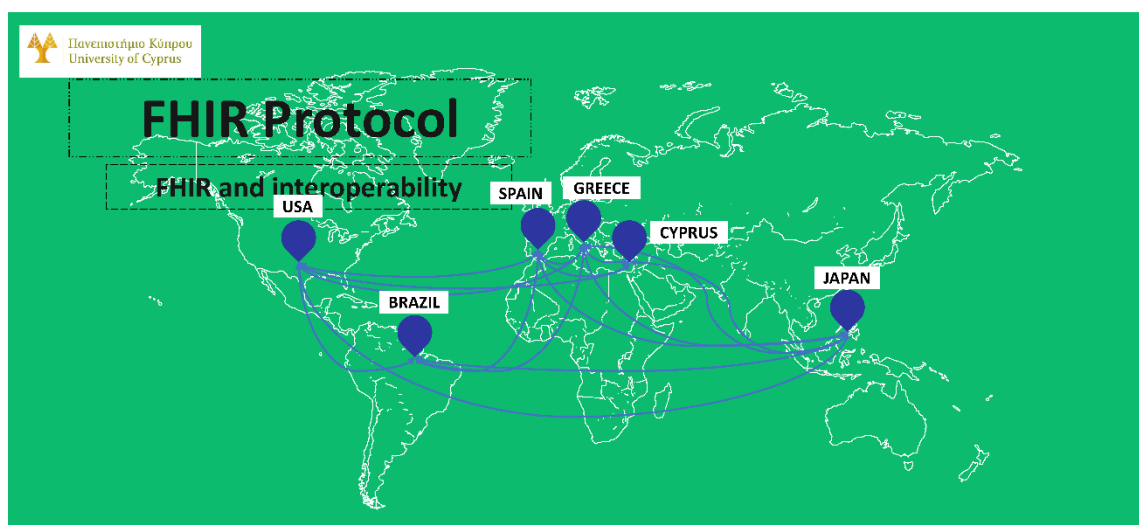
**Cross-Border Capabilities**

Cyprus is already a part of this movement, eHealth4u Lab



**Cross-Border Capabilities**

European Union countries are already implementing FHIR



**Cross-Border Capabilities**

Not only Europe, but a lot of other countries across the globe!



# React Native Framework

## Introduction to React Native

React Native is an [open-source UI software framework](#) created by [Meta Platforms, Inc.](#)

It is used to develop applications for [Android](#), [Android TV](#), [iOS](#), [macOS](#), [tvOS](#), [Web](#),

[Windows](#) and [UWP](#)

**Initial Release:** March 26, 2015; 7 years ago



# React Native Framework

## Introduction to React Native

React components **wrap existing native code** and **interact with native APIs** via React's

**declarative UI paradigm** and **JavaScript**

```
1 import { AppRegistry, Text } from 'react-native';
2 import * as React from 'react';
3
4 const HelloWorldApp = () => {
5   return <Text>Hello world!</Text>;
6 }
7
8 export default HelloWorldApp;
9
10 AppRegistry.registerComponent('HelloWorld', () => HelloWorldApp);
```

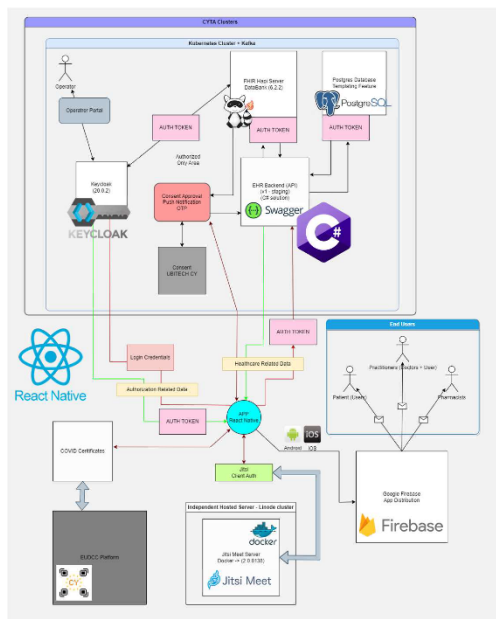


# React Native Framework

React Native in the MYeHealthAppCY

- ✓ Learn once, write anywhere
- ✓ Native Look and Feel
- ✓ Open Source
- ✓ Live Reload

One code base for both Android and iOS



# Architecture

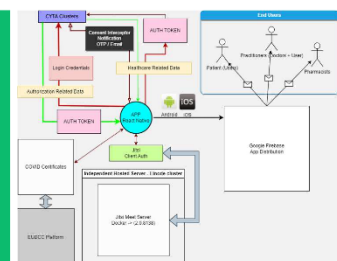
General Architecture

Development server provided by eHealth4u

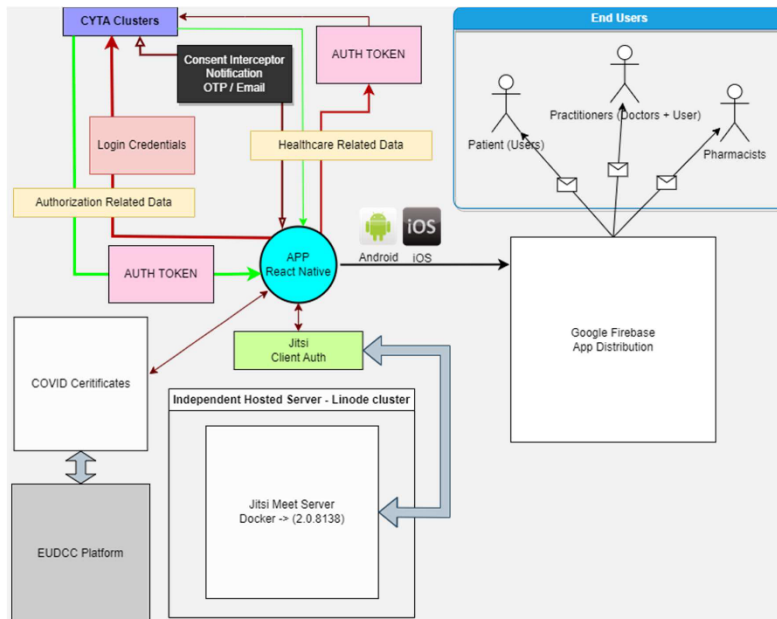
A lot of services running inside an easy scalable cluster **\*Kubernetes\***

## Mobile App Architecture

Authorization Channel  
Healthcare Data Channel  
External Services  
Distribution with Firebase



## Details



## Architecture

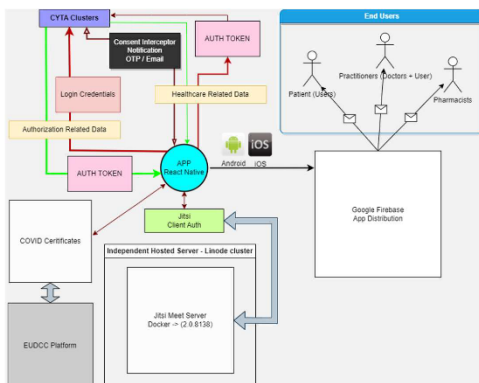
**Building the MYeHealthAppCY App:  
A Testimony to Tenacity**

*Work at eHealth4u*

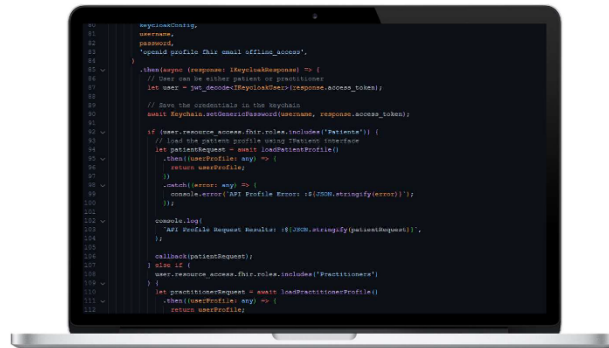
*Continuous development of the Backend*

*Continuous development engagement*

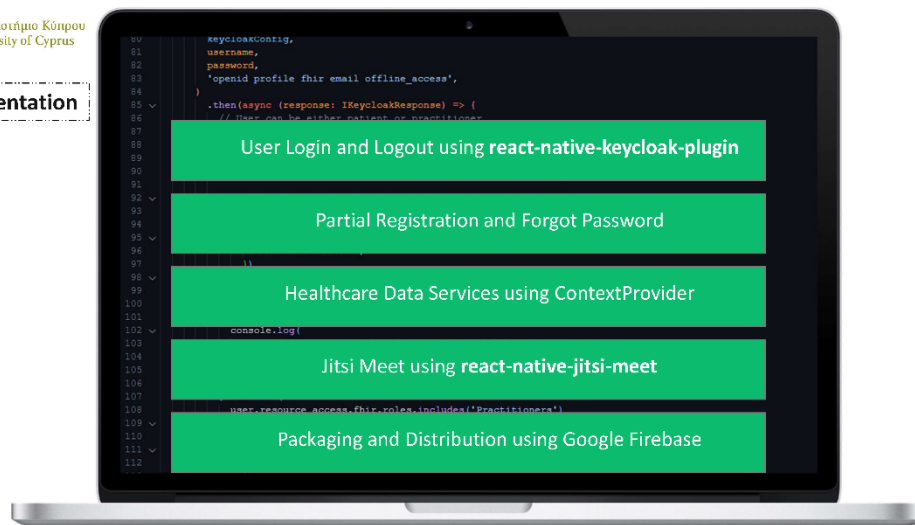
*Bringing everything together*



# Implementation



## Implementation





Implementation

Login

```
76 const signin = () => {
77   return async (username: string, password: string, callback: any) => {
78     try {
79       Keycloak.login(
80         keycloakConfig,
81         username,
82         password,
83         'openid profile fhir email offline_access',
84       )
85     }
86     .then(async (response: IKeycloakResponse) => {
87       // User can be either patient or practitioner
88       let user = jwt_decode<IKeycloakUser>(response.access_token);
89       // Save the credentials in the keychain
90       await Keychain.setGenericPassword(username, response.access_token);
91     })
92     if (user.resource_access.fhir.roles.includes('Patients')) {
93       // load the patient profile using IPatient interface
94       let patientRequest = await loadPatientProfile()
95       .then((userProfile: any) => {
96         return userProfile;
97       })
98       .catch((error: any) => {
```

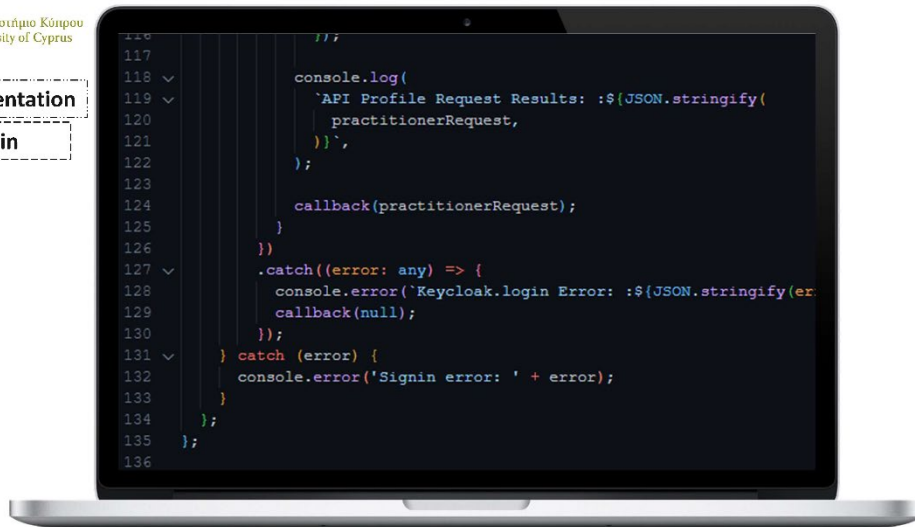
Implementation

Login

```
93 // load the patient profile using IPatient interface
94 let patientRequest = await loadPatientProfile()
95 .then((userProfile: any) => {
96   return userProfile;
97 })
98 .catch((error: any) => {
99   console.error('API Profile Error: ${JSON.stringify(error)}');
100 });
101
102 console.log(
103   'API Profile Request Results: ${JSON.stringify(patientRequest)}
104 );
105
106 callback(patientRequest);
107 } else if (
108   user.resource_access.fhir.roles.includes('Practitioners')
109 ) {
110   let practitionerRequest = await loadPractitionerProfile()
111   .then((userProfile: any) => {
112     return userProfile;
113   })
114   .catch((error: any) => {
115     console.error('API Profile Error: ${JSON.stringify(error)}');
116   });
```

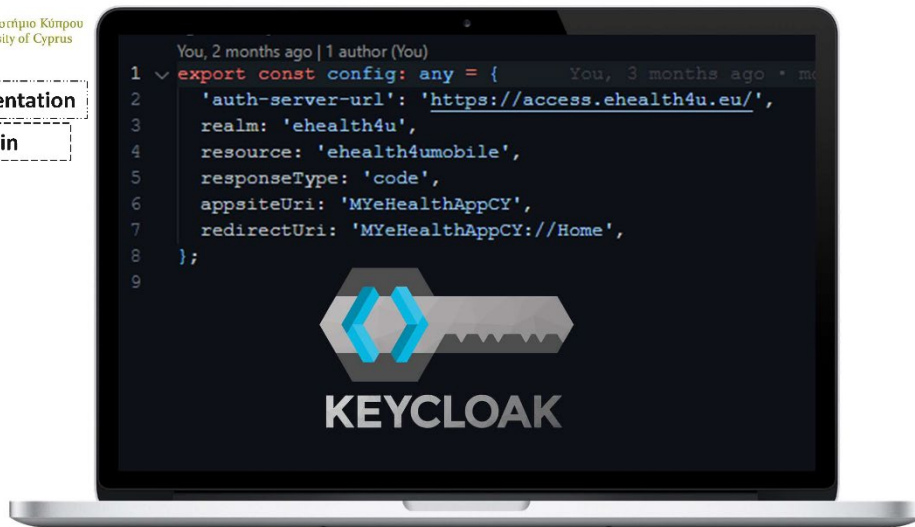
Implementation

Login



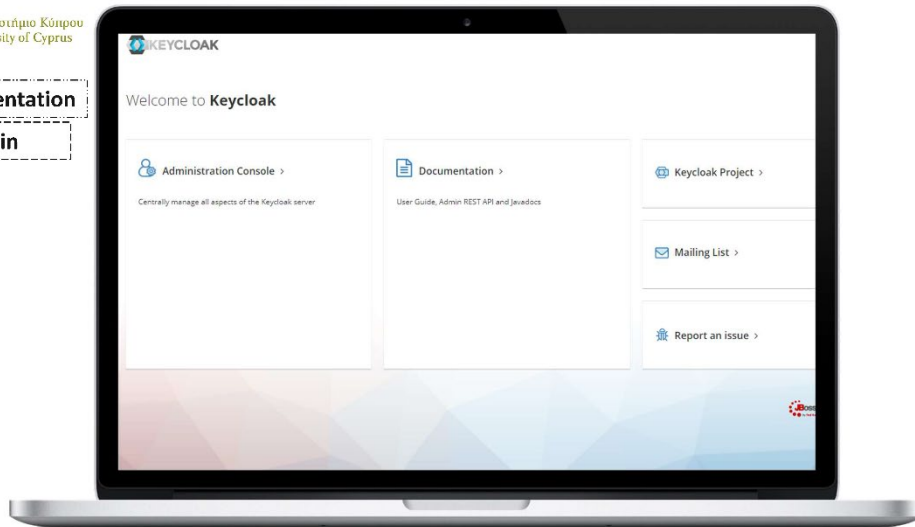
Implementation

Login



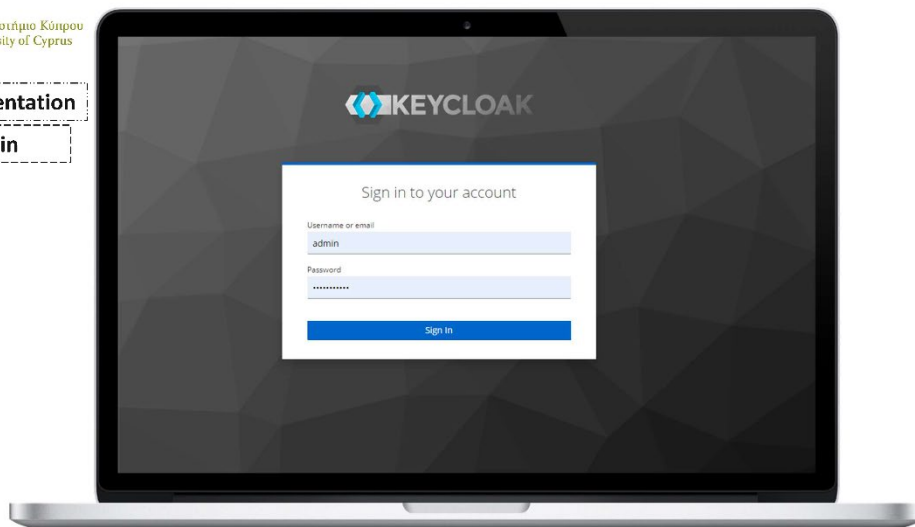
Implementation

Login



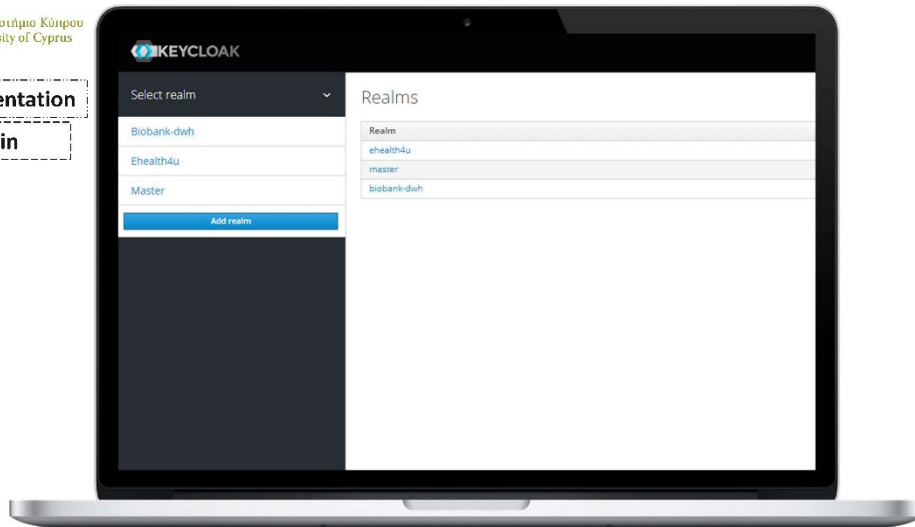
Implementation

Login



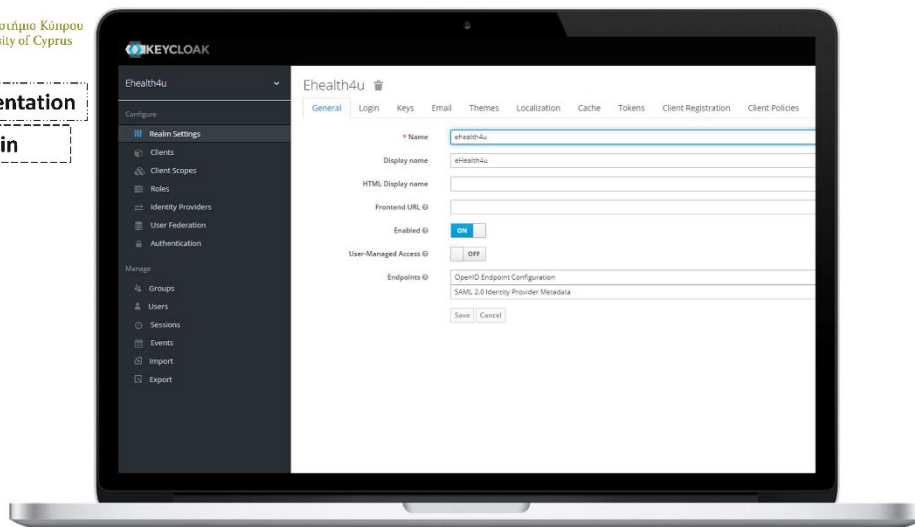
**Implementation**

**Login**

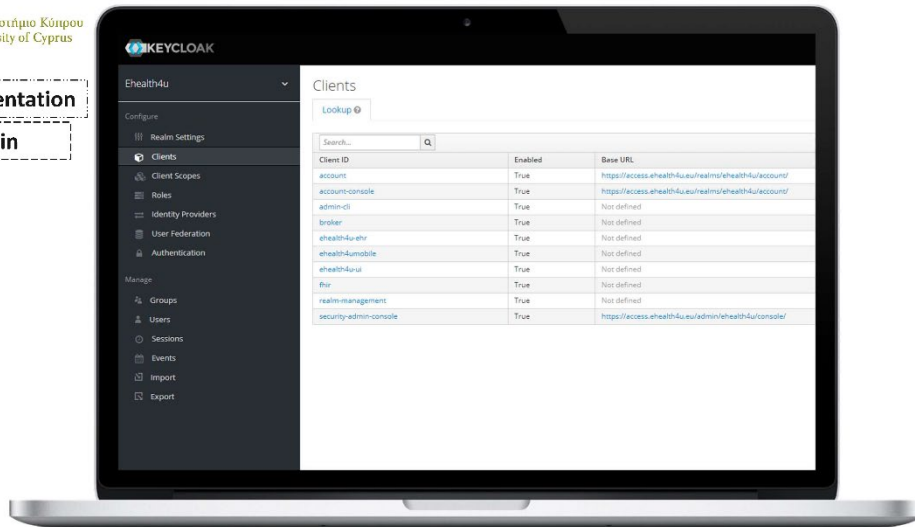


**Implementation**

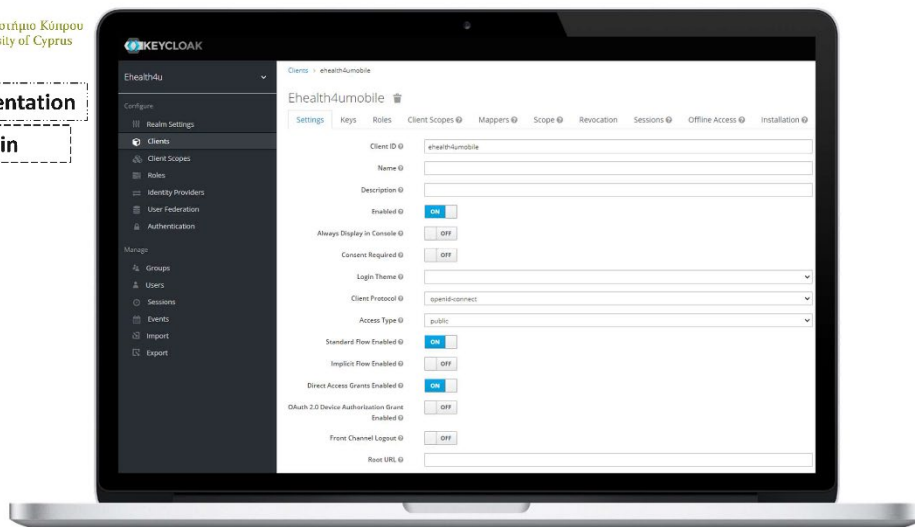
**Login**



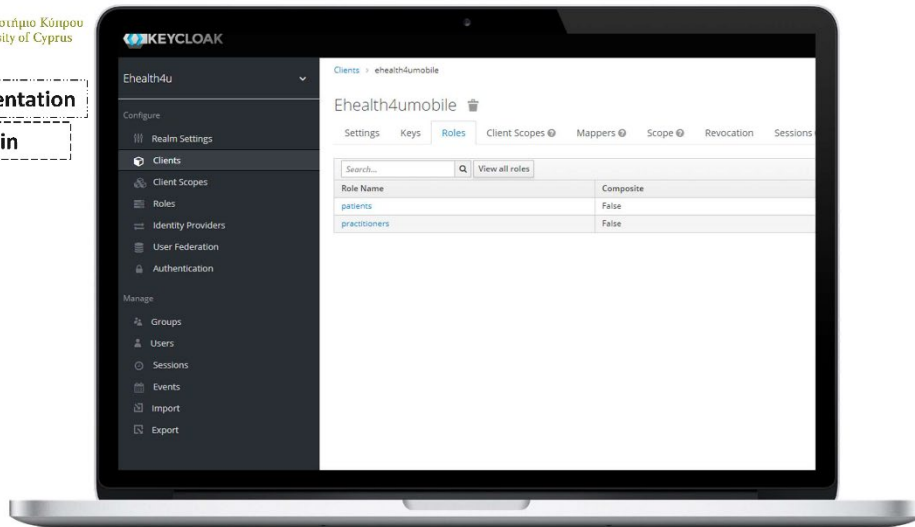
Implementation  
 Login



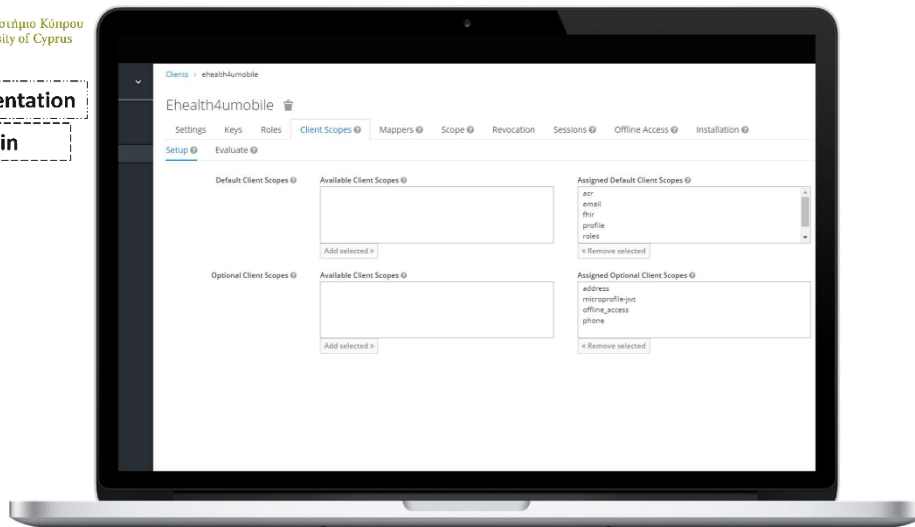
Implementation  
 Login



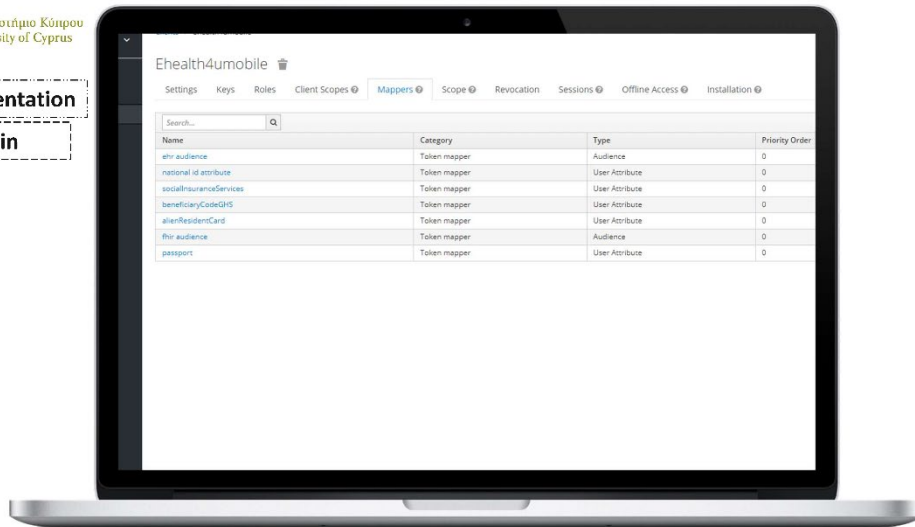
Implementation  
 Login



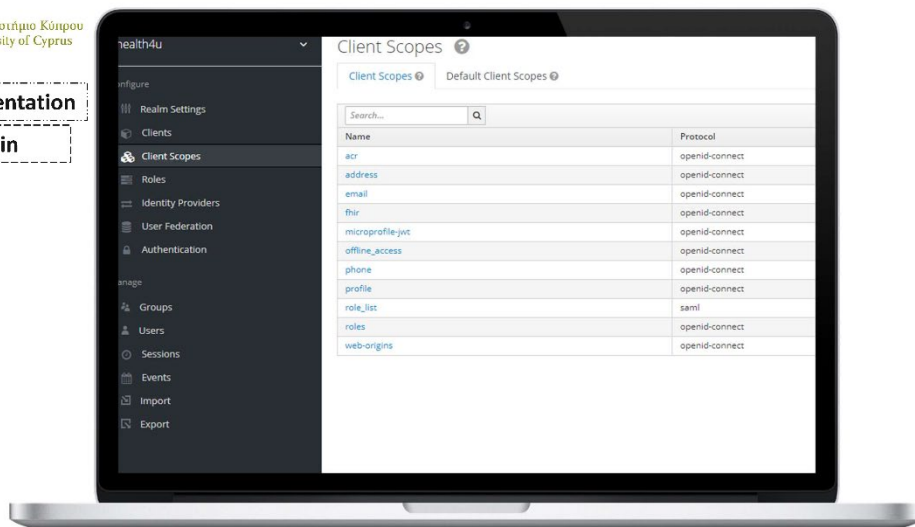
Implementation  
 Login



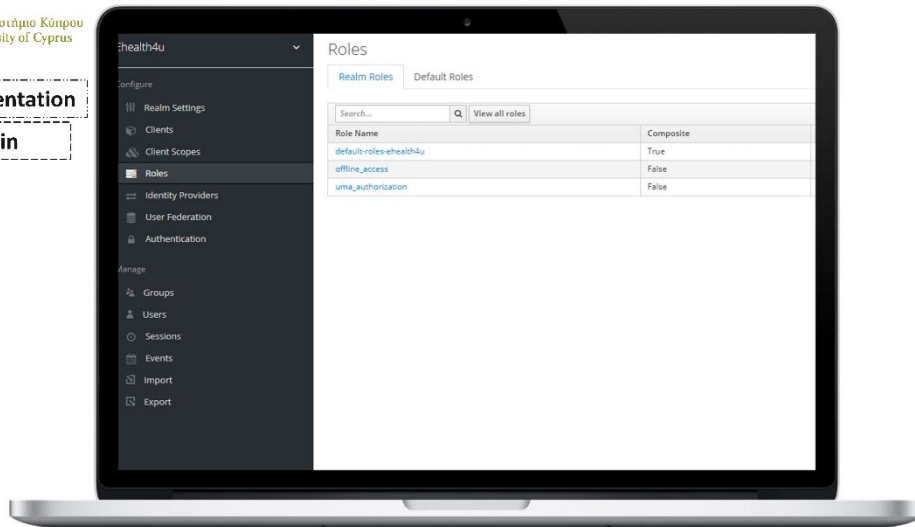
Implementation  
 Login



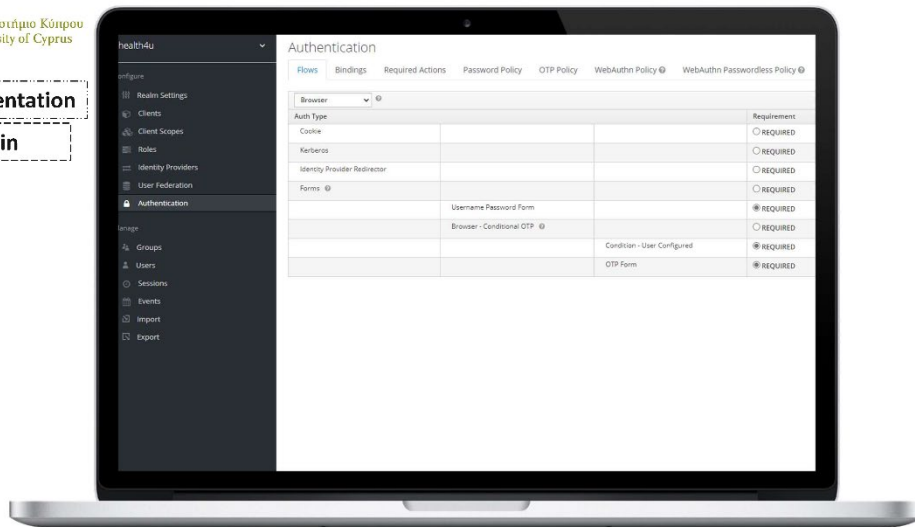
Implementation  
 Login



**Implementation**  
**Login**

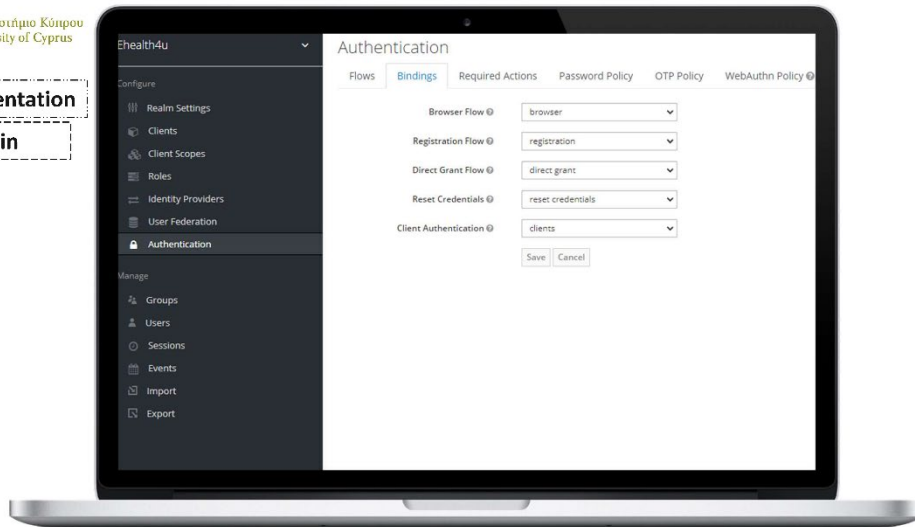


**Implementation**  
**Login**

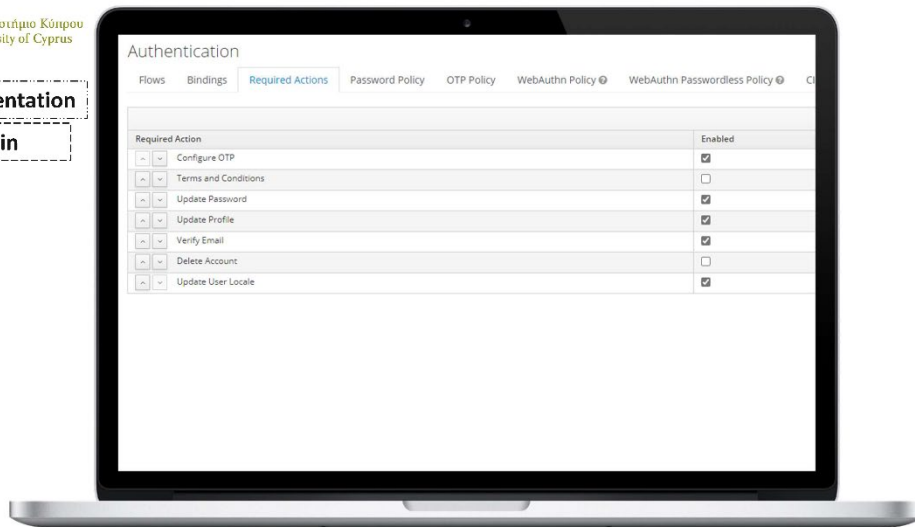




**Implementation**  
**Login**

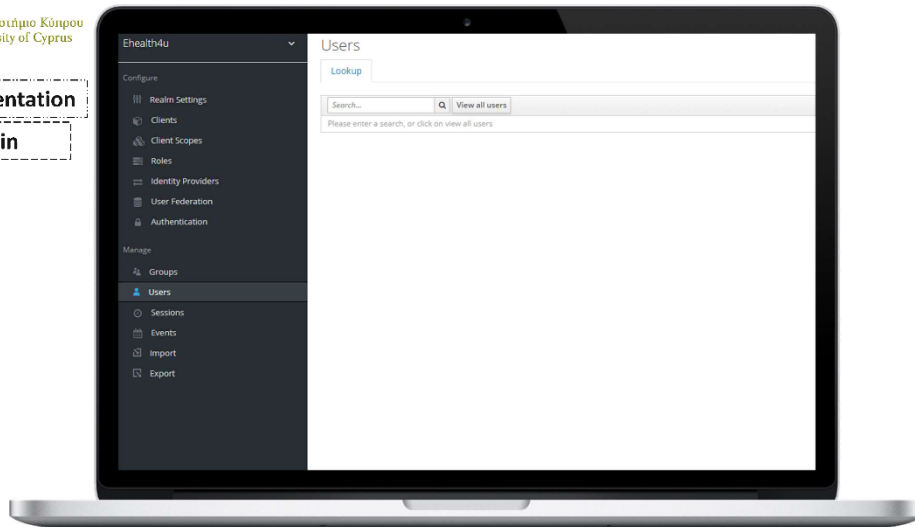


**Implementation**  
**Login**



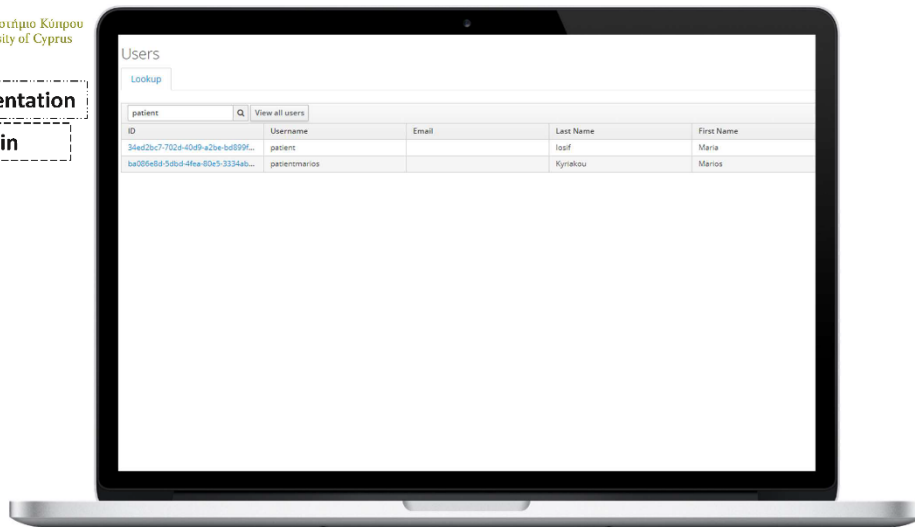
Implementation

Login



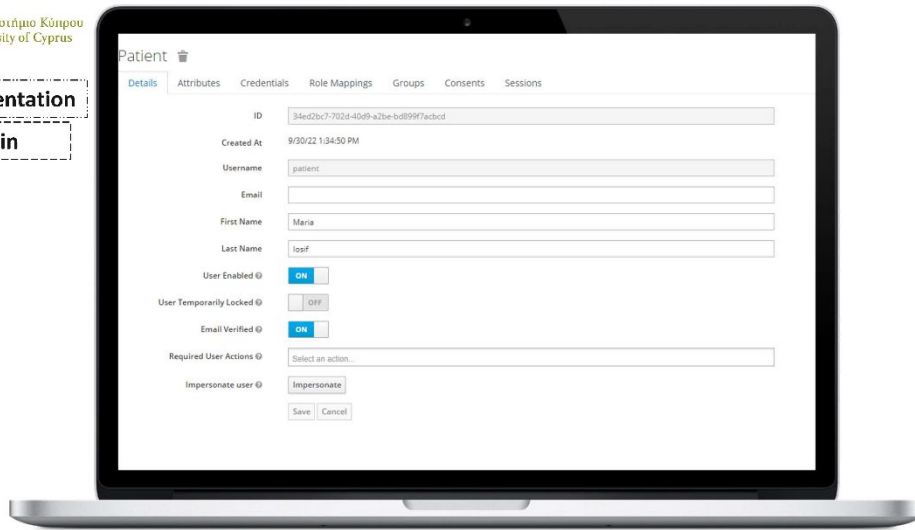
Implementation

Login



**Implementation**

**Login**



**Patient**

Details | Attributes | Credentials | Role Mappings | Groups | Consents | Sessions

ID: 34ed2bc7-702d-40d9-a2be-bd8997acbcd

Created At: 9/30/22 1:34:30 PM

Username: patient

Email:

First Name: Maria

Last Name: Ioaf

User Enabled: ☒ ON

User Temporarily Locked: ☐ OFF

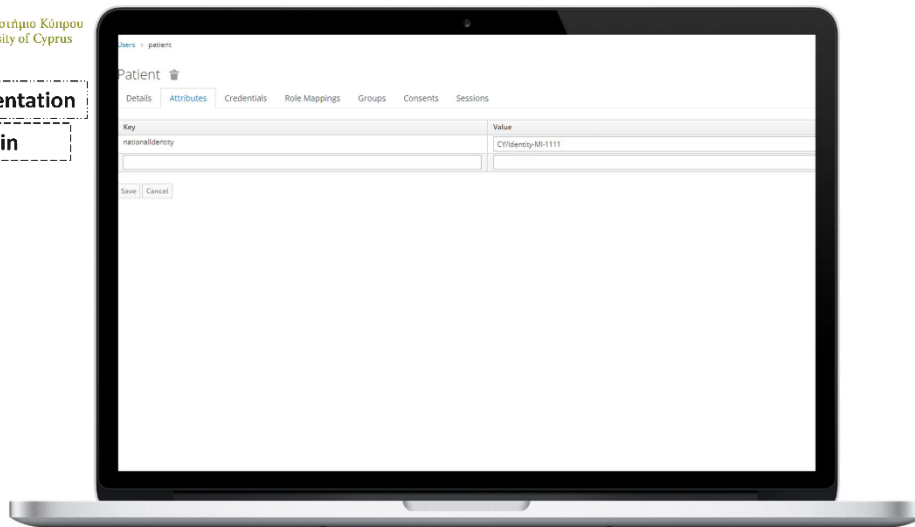
Email Verified: ☒ ON

Required User Actions: Select an action...

Impersonate user:

**Implementation**

**Login**



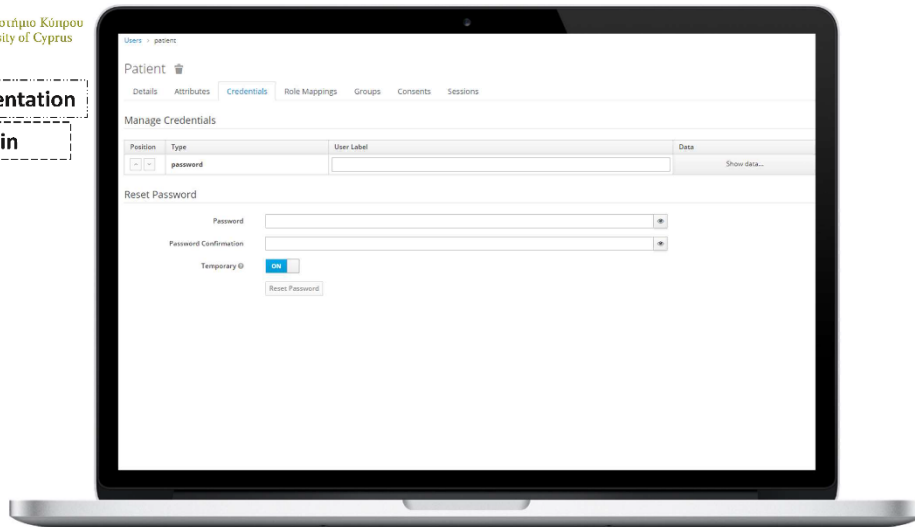
**Patient**

Details | Attributes | Credentials | Role Mappings | Groups | Consents | Sessions

Key	Value
NationalIdentity	CVIdentity-M5-1111

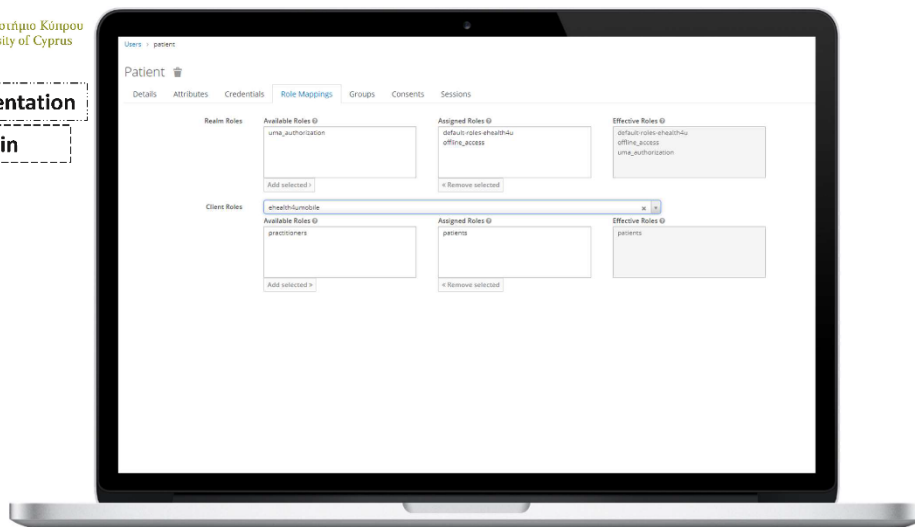
**Implementation**

**Login**



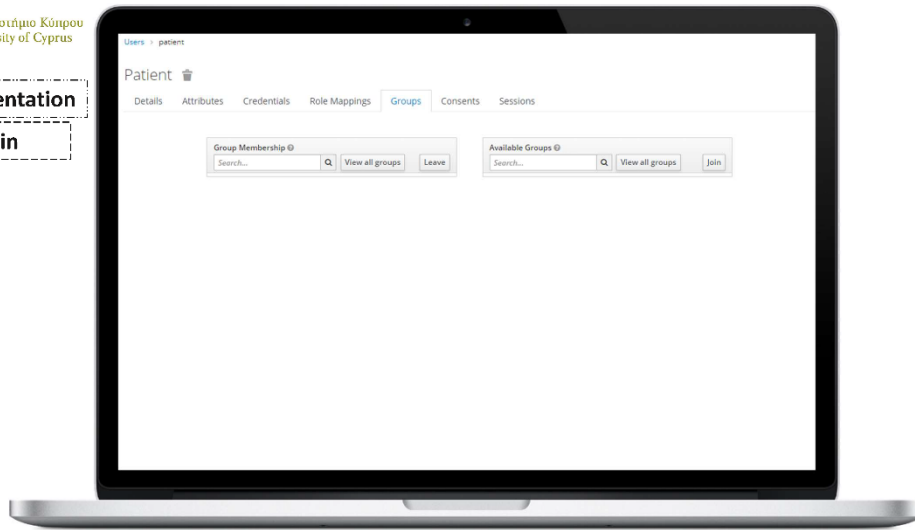
**Implementation**

**Login**



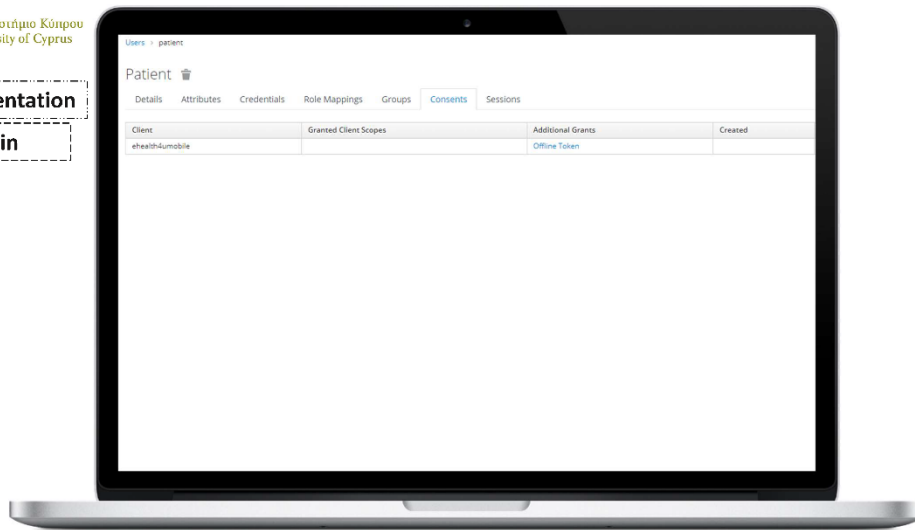
**Implementation**

Login



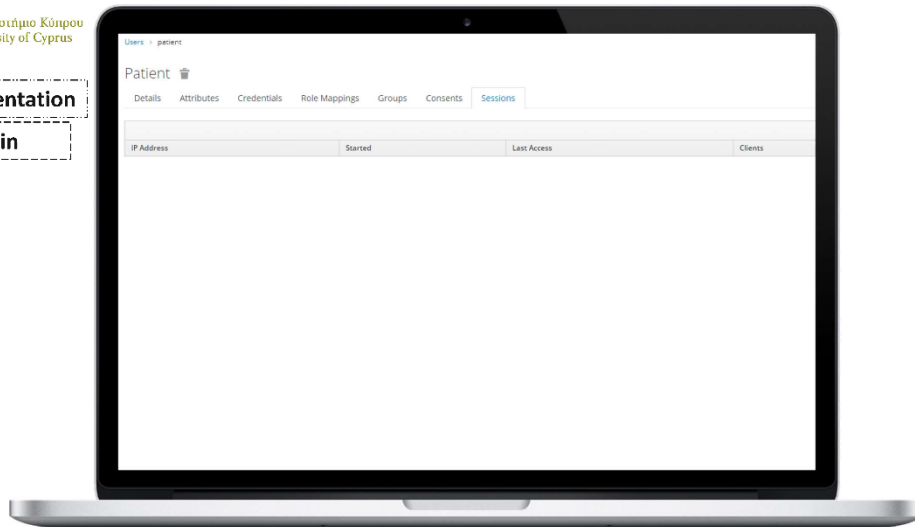
**Implementation**

Login



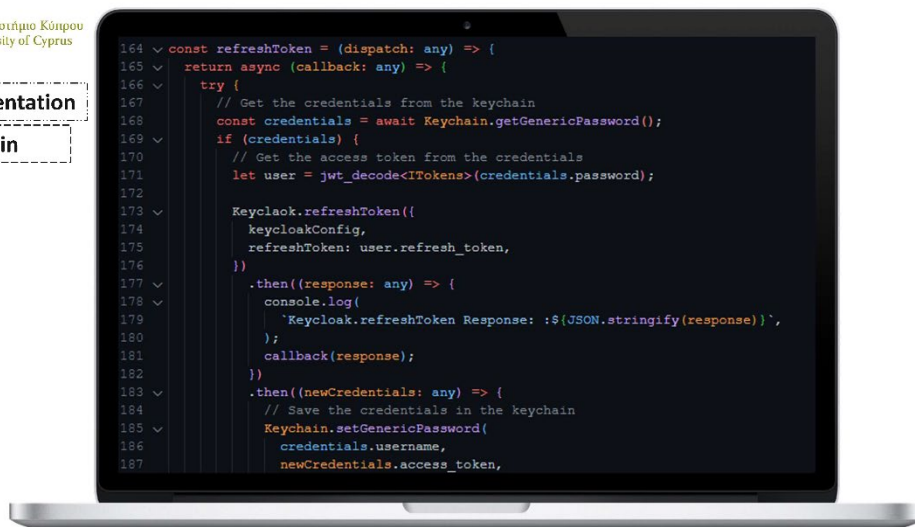
Implementation

Login



Implementation

Login



Implementation

Login

Refresh Token

```

173 ✓ Keycloak.refreshToken({
174     keycloakConfig,
175     refreshToken: user.refresh_token,
176 })
177 ✓ .then((response: any) => {
178     ✓ console.log(
179         'Keycloak.refreshToken Response: :${JSON.stringify(response)}',
180     );
181     ✓ callback(response);
182 })
183 ✓ .then((newCredentials: any) => {
184     // Save the credentials in the keychain
185     ✓ Keychain.setGenericPassword(
186         credentials.username,
187         newCredentials.access_token,
188     );
189 })
190 ✓ .catch((error: any) => {
191     ✓ console.error(
192         'Keycloak.refreshToken Error: :${JSON.stringify(error)}',
193     );
194     // clear the credentials
195     ✓ cleanCredentials();
196     ✓ dispatch({ type: 'signout' });
197 });
    
```

Implementation

Login

Refresh Token

```

180     };
181     ✓ callback(response);
182 })
183 ✓ .then((newCredentials: any) => {
184     // Save the credentials in the keychain
185     ✓ Keychain.setGenericPassword(
186         credentials.username,
187         newCredentials.access_token,
188     );
189 })
190 ✓ .catch((error: any) => {
191     ✓ console.error(
192         'Keycloak.refreshToken Error: :${JSON.stringify(error)}',
193     );
194     // clear the credentials
195     ✓ cleanCredentials();
196     ✓ dispatch({ type: 'signout' });
197 });
198 }
199 ✓ } catch (error) {
200     ✓ console.error('RefreshToken error: ' + error);
201 }
202 };
203 };
    
```

Implementation

Sign-out

```
const signout = (dispatch: an
return async () => {
  await cleanCredentials();

  dispatch({ type: 'signout
});
};
```

Implementation

Sign-out

```
19 // Define a function to clean the credentials
20 async function cleanCredentials() {
21   await Keychain.resetGenericPassword()
22   .then(() => { You, 3 months ago • added more needs
23     console.log('Credentials successfully deleted');
24   })
25   .catch((error: any) => {
26     console.error("Keychain couldn't be accessed!", error
27   });
28 }
29
30 // Define auth actions
31 type AuthAction =
32   | { type: 'signin'; payload: string }
33   | { type: 'signout' }
34   | { type: 'signup' }
35   | { type: 'refreshToken'; payload: string };
36
```



Implementation

UserContext

```
91 export const { Provider, Context } = createContext(  
92   userReducer,  
93   {  
94     getPatient,  
95     setPatient,  
96     getPractitioner,  
97     setPractitioner,  
98     getPrescriptions,  
99     setPrescriptions,  
100    getDispensations,  
101    setDispensations, // You, 4 weeks ago * added context  
102    getAllergies,  
103    setAllergies,  
104    getConditionProblems,  
105    setConditionProblems,  
106    getConditionDiagnosis,  
107    setConditionDiagnosis,  
108    getImmunizations,  
109    setImmunizations,  
110  },  
111
```

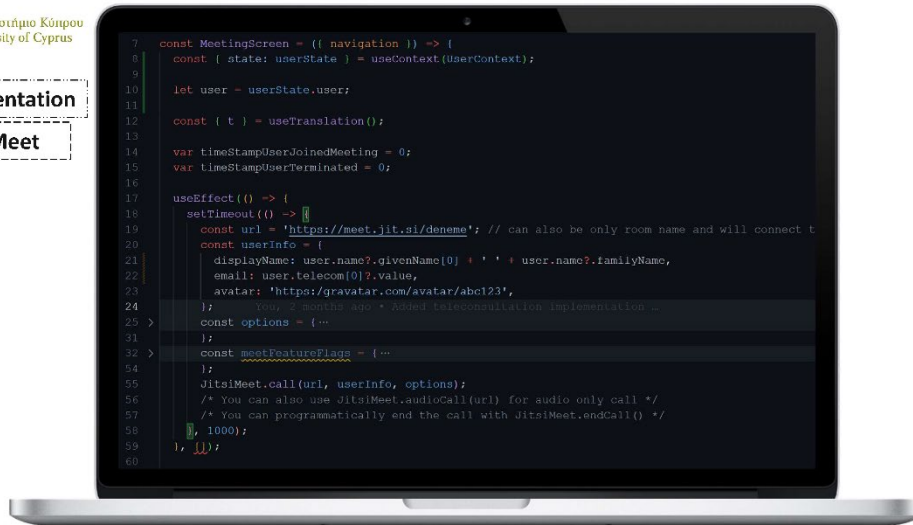
Implementation

UserContext

```
111 {  
112   patient: null,  
113   practitioner: null,  
114   currentPrescriptions: [],  
115   previousPrescriptions: [],  
116   currentDispensations: [],  
117   previousDispensations: [],  
118   allergies: [],  
119   conditionsProblems: [],  
120   conditionsDiagnosis: [],  
121   immunizations: [],  
122   observations: [],  
123   socialHistories: [],  
124   procedures: [],  
125   devices: [],  
126   pregnancies: [],  
127   travelHistories: [],  
128   functionalStatus: [],  
129   episodesOfCare: [],  
130   carePlans: [],  
131   medicationStatementSummaries: [],  
132 },  
133 );
```

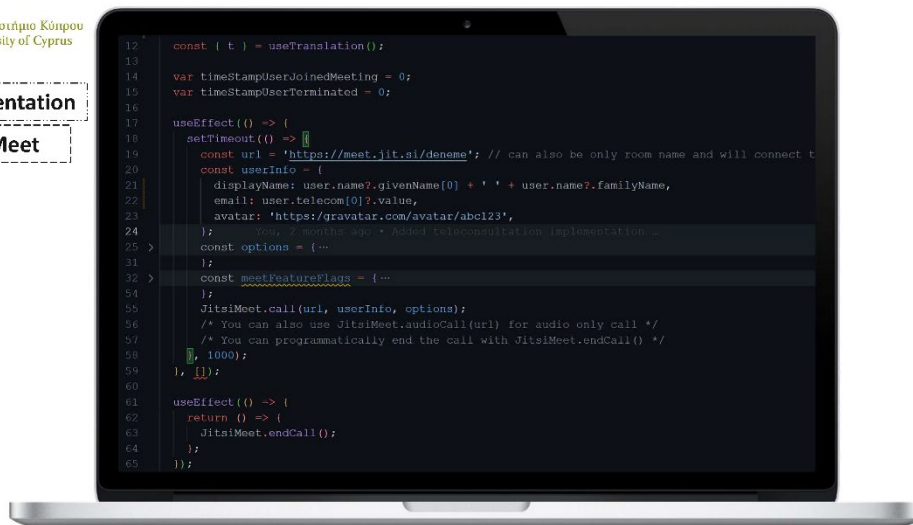
## Implementation

### Jitsi Meet



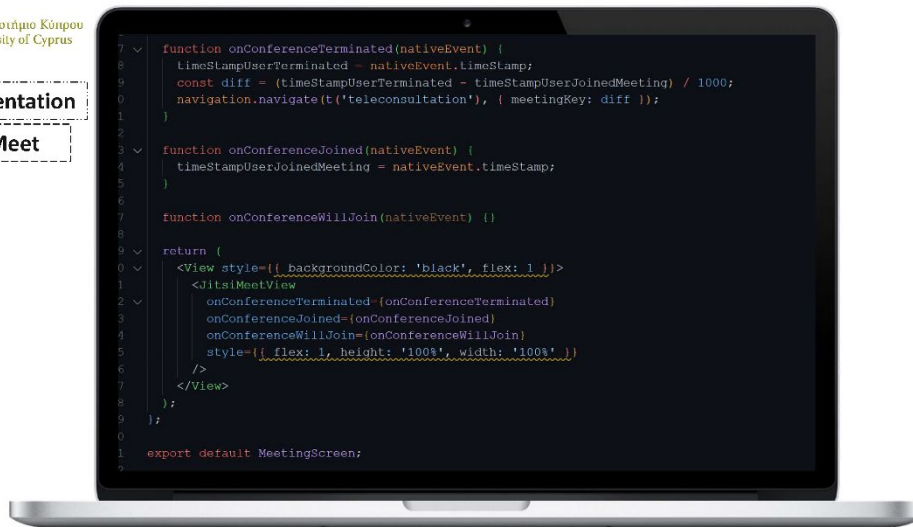
## Implementation

### Jitsi Meet



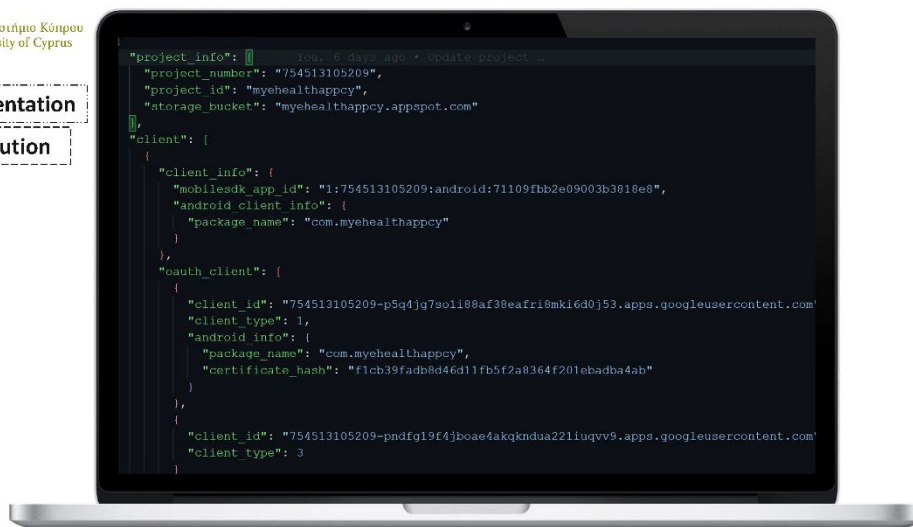
## Implementation

### Jitsi Meet



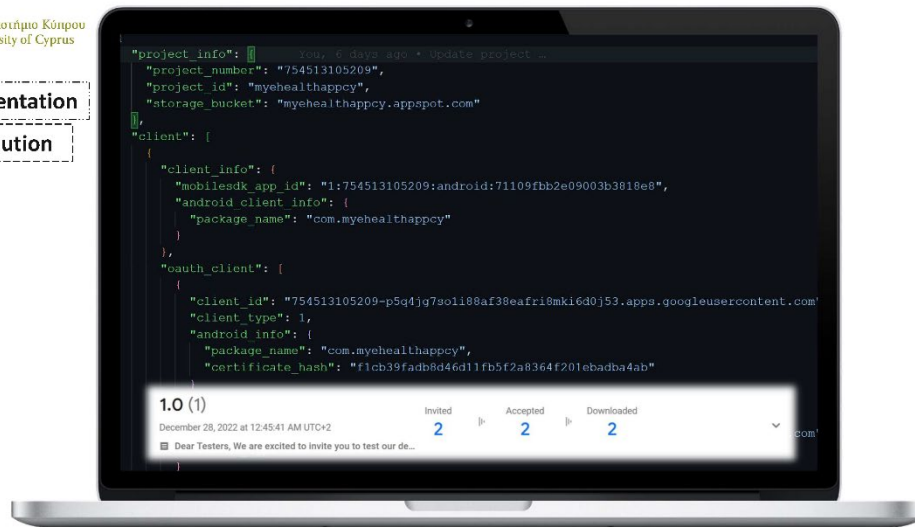
## Implementation

### Distribution



Implementation

Distribution



## Evaluation

*Logo Selection*

*Application Testing*

*Patients / Practitioners*

*Feedback*

## Logo Selection Poll

### Mobile Health Application - Logo Selection

Those are the logo designs created by our graphic designer. Please go ahead and select which logo you think is best suited for the eHealth4U mobile health application.

\* Required

#### 1. What is your role/expertise? \*

Mark only one oval.

- ☐ Healthcare Professional
- ☐ Medical Informatics - Technical
- ☐ Citizen / Patient

#### 2. Select the logo you think is best suited for the mobile health application. \*

Logos are ordered from left to right.



Mark only one oval.

- ☐ Logo 1
- ☐ Logo 2
- ☐ Logo 3
- ☐ Logo 4
- ☐ Logo 5
- ☐ Logo 6

Let potential users decide the logo

- Healthcare Professionals
- Medical Informatics – Technical
- Citizen / Patients

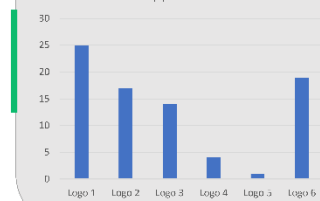
Various options created by designer

Total of 80 votes!

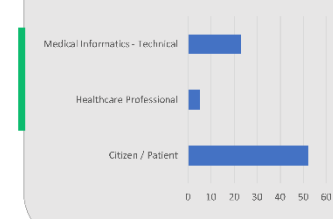
## Logo Selection Poll

### Results

Count of Select the logo you think is best suited for the mobile health application.

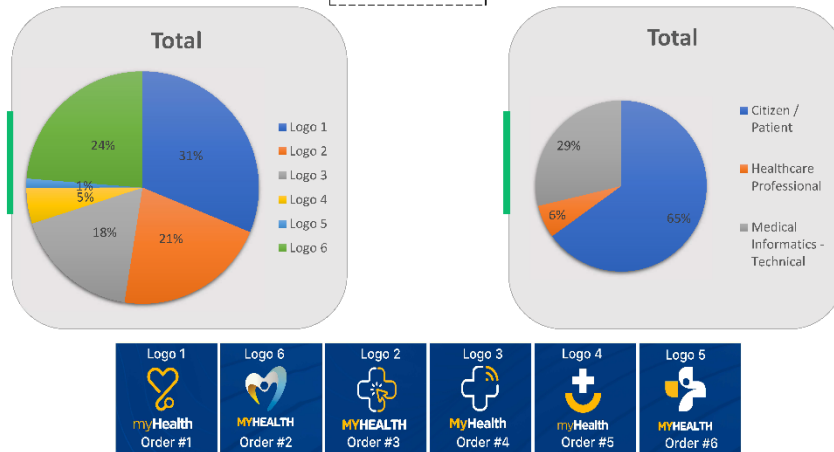


Count of What is your role/expertise?



## Logo Selection Poll

### Results



## Overall Evaluation (Patients / Doctors / Pharmacists)

The goal was to gather **feedback** from actual users

Find if there are any **issues** with the application

How to **improve** the application

Find out what people think about the **teleconsultation** feature

Get **evaluation** and **opinion** of possible users

The evaluation is still open for feedback!

**Overall  
Evaluation  
Patients  
Doctors  
Pharmacists**

**Evaluation of MyeHealthAppCY**

Thank you for your participation in this questionnaire! We are interested in collecting your feedback on the MyeHealthAppCY mobile app we have developed. This app is intended to provide convenient and accessible health services to users via their mobile phones. We would like to know your opinions about the features, ease of use and your overall satisfaction with the app. Your feedback is valuable to us as we strive to continuously improve and expand the app to further meet the needs of our users.

The questionnaire is available both in English and in Greek.

\* Required

**Demographic questions and questions about your mobile operating system**

In this section, we'll ask you a few questions about your personal characteristics and the device and operating system you use to access the app. This information will help us to better understand our user base and identify any issues or trends that may affect specific groups.  
**Your answers to these questions will remain strictly confidential and will only be used for**

1. What is your gender? \*

☐ Male  
☐ Woman  
☐ Other

**USER'S GUIDE  
MYEHEALTHAPPCY  
FOR MOBILE DEVICES**  
For Citizens

**OPEN**

**Overall  
Evaluation  
Patients  
Doctors  
Pharmacists**

2. What is your age? \*

☐ 18-25  
☐ 26-35  
☐ 36-45  
☐ 46-55  
☐ 56-64  
☐ 65+

3. Which user group do you belong to? \*

☐ Doctor  
☐ Pharmacist  
☐ Patient

4. What is the operating system of your mobile phone? \*

☐ Android  
☐ iOS

5. If you know, what is the version of your Android phone? \*

☐ Android 10 - Quince Tart  
☐ Android 11 - Red Velvet Cake  
☐ Android 12 - Snow Cone  
☐ Android 12L - Snow Cone v2  
☐ Android 13 - Tiramisu  
☐ I don't know

6. If you know, what is the version of your iOS mobile? \*

☐ iOS 13  
☐ iOS 14  
☐ iOS 15  
☐ iOS 16  
☐ I don't know

**Overall  
Evaluation  
Patients  
Doctors  
Pharmacists**

Questions concerning the application

7. How easy was it to navigate through the app? \*

☐ Very easy  
☐ Somewhat easy  
☐ Neither easy nor difficult  
☐ Somewhat difficult  
☐ Very difficult

8. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with the Prescriptions? \*

9. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with Dispensing? \*

10. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with the Patient Summary? \*

12. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with Covid Certificate? \*

13. Did you encounter any problems when issuing the COVID European Digital Certificate? \*

☐ No  
☐ Yes

14. If yes, please select one of the options below \*

☐ Incorrect personal information (e.g. identity card, telephone number, date of birth)

15. On a scale of 1 to 5 (where 1 is "not at all satisfied" and 5 is "very satisfied"), what is your level of satisfaction with Teleconsultation? \*

**Overall  
Evaluation  
Patients  
Doctors  
Pharmacists**

16. Did you encounter any problems while browsing Teleconsultation? \*

☐ No  
☐ Yes

17. If yes, please select one of the options below \*

☐ Long response time of the videoconference  
☐ Difficulty in setting up a new videoconference

18. How satisfied are you with the design of the application? \*

☐ Very satisfied  
☐ Somewhat satisfied  
☐ Neutral  
☐ Somewhat dissatisfied  
☐ Very dissatisfied

19. How satisfied are you with your overall experience with the app? \*

☐ Very satisfied  
☐ Somewhat satisfied  
☐ Neutral  
☐ Somewhat dissatisfied  
☐ Very dissatisfied

20. Do you want to add any comments and/or suggestions to help us improve the app? \*

21. On a scale of 1 to 5 (where 1 is "not at all likely" and 5 is "very likely"), how likely are you to recommend the app to a friend or colleague? \*

22. What overall rating would you give the app? \*

☆☆☆☆

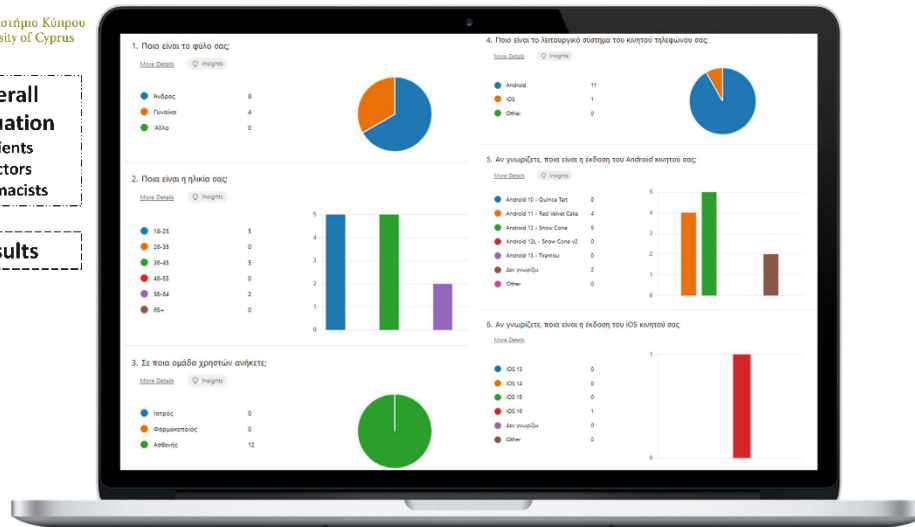
content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.

Microsoft Forms



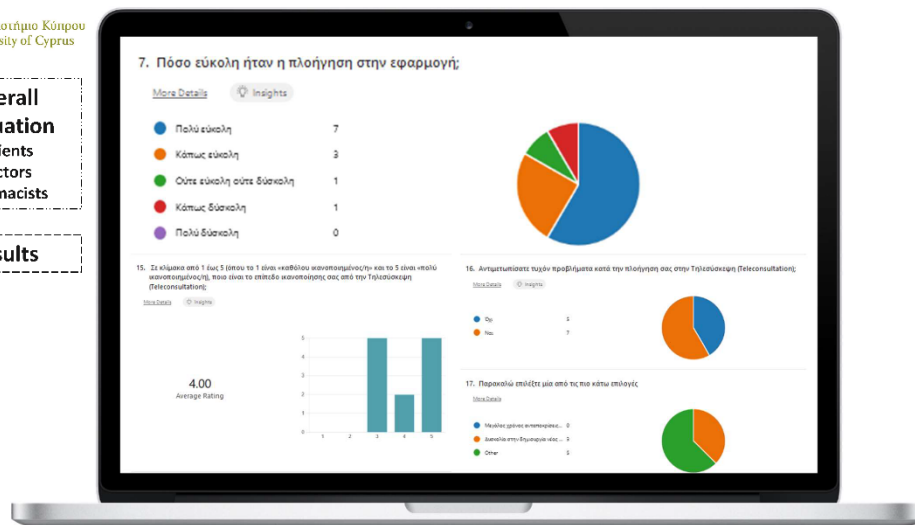
**Overall  
Evaluation  
Patients  
Doctors  
Pharmacists**

**Results**



**Overall  
Evaluation  
Patients  
Doctors  
Pharmacists**

**Results**



**Overall  
Evaluation**  
Patients  
Doctors  
Pharmacists

**Results**

ID	Name	Responses	Language
1	anonymous	["The app crashed"]	English (United States)
2	anonymous	["Crash"]	English (United States)
3	anonymous	["Δυσκολία στην δημιουργία νέας τηλεσύσκεψης"; "Η εφαρμογή πάγωσε και έκοιψε όταν προσπάθησα να ξεκινήσω μία τηλεσύσκεψη"]	Ελληνικά
4	anonymous	["android version sometimes crashes"]	Ελληνικά
5	anonymous	["Crashed"]	English (United States)
6	anonymous	["Δυσκολία στην δημιουργία νέας τηλεσύσκεψης"]	Ελληνικά
7	anonymous	["Δυσκολία στην δημιουργία νέας τηλεσύσκεψης"]	Ελληνικά

20. Θέλετε να προσθέσετε τυχόν σχόλια ή/και εισηγήσεις που θα μας βοηθήσουν να βελτιώσουμε την εφαρμογή;

[More Details](#)

12 Responses

Latest Responses

"Τρόπο να "

"Όχι"

"Very nice app. it would be amazing to incorporate maybe a weekly habit..."

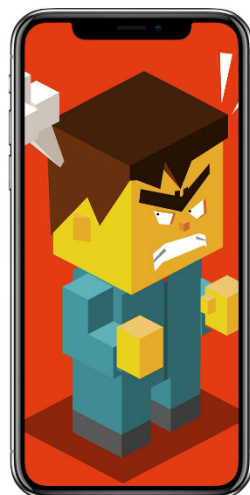
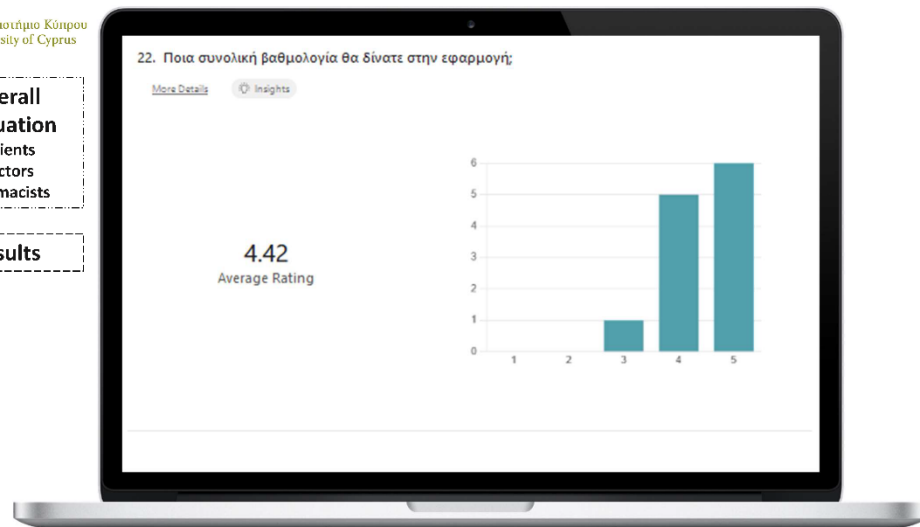
**Overall  
Evaluation**  
Patients  
Doctors  
Pharmacists

**Results**



**Overall Evaluation**  
 Patients  
 Doctors  
 Pharmacists

**Results**



**Overall Evaluation**  
 Patients - Doctors - Pharmacists

**Results**

The application crashed on a lot of occasions

Total Problems  
**58%**





### Overall Evaluation Patients - Doctors - Pharmacists

#### Results

The application crashed on a lot of occasions

Total Problems

**58%**

Overall, the results for the whole application are promising!

Average Rating

**4.42/5**

## Conclusion



### 01 – The Implementation


Due to version incompatibility and not well-maintained package selected

**The module crashes on Android**



### 02 – At least it works on iOS!!

However, a different solution might be used!

WebRTC → 

## Conclusion

Future work and application possibilities

### **Biometric Authentication & 2FA**

Enable faster login and better security

### **Prescription Management**

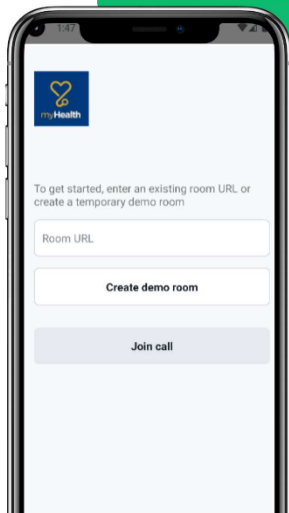
Notifications and Consents  
Dispense (At pharmacy / Delivery)

### **Appointments Management**

Schedule / Re-schedule or Cancel  
Embed with known calendars

### **Integrate with Smart Devices**

## Demo



# THANK YOU!!

## Questions?

"MYeHealthAppCY: bridging the gap between patients and providers"