

HELLENIC MEDITERRANEAN UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING



THESIS

**PLATFORM FOR ECONOMICAL DIGITAL RECORDING AND
MANAGEMENT OF THE CLINICAL ETHNOGRAPHIC INTERVIEW
(eCENI) VIA MOBILE DEVICE: IMPLEMENTATION OF BODY AND
SOCIAL NETWORK MAP**

GEORGIOS IATRAKIS

**SUPERVISOR
PROFESSOR MANOLIS TSIKNAKIS**

**HERAKLION
JUNE 2023**

Copyright

GEORGIOS IATRAKIS

2023

Responsible Declaration: we certify that we are the authors of this thesis and that any assistance we have had in its preparation is fully acknowledged and mentioned in the thesis. We have also acknowledged any sources from which we have made use of data, ideas, or words, whether quoted verbatim or paraphrased. We also certify that this thesis was personally prepared by us specifically for the requirements of the curriculum of the Department of Computer Engineering of the Technical University of Crete.

Abstract

Gender-based violence is nowadays a rapidly growing phenomenon. Even long after the experience of violence has passed, victims still face and experience physical injuries, psychological trauma, and social and cultural stigmatization.

The Clinical Ethnographic Interview (CENI) allows researchers and health and social care professionals to examine the complex interplay between pain, culture, and help-seeking. The Clinical Ethnographic Interview consists of four different sections: the Social Network Map, the Body Map, the Lifeline, and the Card Classification. Through this interview, participants can tell their stories without re-victimization, restoring personal sovereignty, empowerment, and self-understanding.

The subject of this thesis is the design and development of a platform for synchronous digital recording of Clinical Ethnographic Interviews (CENI) via a handheld device. Participants will use a handheld device to record their "story" in a natural way, simulating the typical analog paper recording process, except that in this case a stylus on a digital tablet will be used where all the user's actions will be taken into account through screen recording and not only the final answers.

Contents

Copyright.....	2
Abstract.....	3
Figures Appendix	5
1 Introduction	7
1.1 Analysis of CENI Interview Stages	7
1.2 Scope and Objective.....	8
1.3 Thesis Overview	9
2 Background.....	10
3 Methodology.....	14
3.1 Input	14
3.2 Output	14
3.3 Tools and Technologies	14
3.3.1 Flutter	14
3.3.2 Visual Studio Code.....	16
3.3.3 Android Studio Emulator	17
3.3.4 Firebase Firestore	18
3.3.5 GitLab.....	19
3.3.6 Moqups.....	20
4 Technical Description	21
4.1 Context Diagram	21
4.2 User Requirements	21
4.3 Data Flow Diagrams	22
4.4 Logical Data Model.....	27
5 Other requirements	30
5.1 Screen Size.....	30
5.2 Input Methods	30
6 ECeni Application.....	31
6.1 Log In and Authentication	31
6.2 Main Screen	32
6.3 Manage Participants	34
6.4 Manage Trainees	42
6.5 Manage Medical Professionals.....	45
6.6 Questionnaires.....	47
6.7 Statistics	50
6.8 eCeni Sessions.....	51
7 Conclusion And Future Work.....	59
8 References.....	60

Figures Appendix

Figure 1. Better-Help application	11
Figure 2. Talkspace application	11
Figure 3. Practo Application	12
Figure 4. Epocrates Application	13
Figure 5. Flutter logo	14
Figure 6. Graphs of syncfusion_flutter_charts library	16
Figure 7. Visual Studio Code logo	17
Figure 8. Android logo	17
Figure 9. Firebase logo	18
Figure 10. GitLab logo	19
Figure 11. Moqups logo.....	20
Figure 12. Context Diagram	21
Figure 13. Data Flow Diagram for login	22
Figure 14. Data Flow Diagram for Managing	23
Figure 15. Data Flow Diagram for options.....	24
Figure 16. Data Flow Diagram for Statistics	24
Figure 17. Data Flow Diagram for Questionnaires.....	25
Figure 18. Data Flow Diagram for sessions	26
Figure 19. Data Flow Diagram of eCeni stages.....	26
Figure 20. Logical Data Model.....	27
Figure 21. Samsung Galaxy Tab S8+	30
Figure 22. Login Page of eCeni application	31
Figure 23. Main Menu of the eCeni application	32
Figure 24. Navigation Bar of the eCeni application	33
Figure 25. Administrator Profile.....	34
Figure 26. Manage Participants Page	34
Figure 27. Creation of a Participant.....	35
Figure 28. Add new trauma type button	36
Figure 29. Edit page of participant	36
Figure 30. Confirmation message.....	37
Figure 31. Participant's profile page	37
Figure 32. Questionnaire statistics tab of the participant's profile	38
Figure 33. eCeni sessions tab of the participant's profile.....	39
Figure 34. Medical Professionals PDF file	40
Figure 35. Participant's PDF file.....	40
Figure 36. eCeni session video player	41
Figure 37. Manage Trainees page.....	42
Figure 38. Creating a Trainee	43
Figure 39. Editing a trainee	44
Figure 40. Trainee's profile tab.....	45
Figure 41. Manage Medical Professionals page	45
Figure 42. Creating a Medical Professional.....	46
Figure 43. Editing a medical professional	47
Figure 44. Questionnaires options	48
Figure 45. Answering a questionnaire	49
Figure 46. PDF instructions of a questionnaire	49
Figure 47. Statistics Filter Page	50
Figure 48. Statistics Results.....	51
Figure 49. Sessions list	52
Figure 50. Selecting a participant for an eCeni session	52
Figure 51. First page before starting the eCeni session	53
Figure 52. Alert Dialog for allowing sound.....	54
Figure 53. Pop-up window to start screen recording	54

Figure 54. Social Network Stage 55
Figure 55. Body Map Stage 55
Figure 56. Lifeline stage 56
Figure 57. Card Selection Stage 56
Figure 58. Entering the new emotion..... 57
Figure 59. Card Sorting stage 58
Figure 60. Card Sorting results 58

1 Introduction

Research and clinical practice with diverse populations has been challenged by the need to measure phenomena precisely and uniformly despite the recognition that existing tools are generally not culturally relevant. In the area of mental health, most studies have used Western-derived instruments to measure mental health in diverse populations. However, assessment tools do not always assess all the relevant symptoms and indicators necessary to accurately and adequately capture the phenomena of interest. The Clinical Ethnographic Narrative Interview (CENI) is a semi-structured, qualitative interview protocol that elicits a basic temporal narrative of symptom and illness experience, previous experiences with similar symptoms and illness events for the interviewee and other close persons, and the explanatory models held by the interviewee related to the illness and its treatment[1]. CENI allows researchers and practitioners a safe container to examine the complex interplay between suffering, culture, and help-seeking after trauma. The narrative is the mental activity that consciously organizes the unifying links between the self, relationships, time, and morality.

Trauma disrupts sequential processing by interfering with psychophysiological coordination, cognition, memory, emotional processing, and social connections. Trauma narratives require the persons to “recall” the traumas they experienced, thus leading to the involves the re-experiencing of distressing emotional and sensory states[2].

1.1 *Analysis of CENI Interview Stages*

CENI consists of the following sections: a) Social Network Map, b) Body Map, c) Lifeline, and d) Card Sort. The duration of CENI is expected to be around 90 min.

- a) **Social Network Map:** The social network map is an introduction to the self-in-contact process, where participants consider their relationships, level of social engagement, perception and use of social resources, and perception of negativity and stigma. This self-in-contact sets the stage for the rest of the interview, situating women within their personal, family, and community's expectations. Participants return to this picture throughout the interview, adding detail and explaining their feelings about this social context.
- b) **Body Map:** The body map is a process of personal reflection and an inwardly oriented awareness of the self. It involves the participant placing

significant events, illnesses, distresses, and joys upon the body as a way of locating their impact in the physical, material, and experiential world. The body map reveals current feelings (both positive and negative), as well as general daily life experiences, such as sleeping, eating, weakness, fatigue, and other symptoms that affect functioning. It also reminds the participant to take the body seriously.

- c) **Lifeline:** The lifeline is a "compare and contrast" activity, in which the participant references events against what is "now" as well as referencing events against each other. It depicts the highs and lows within the life of the women, revealing patterns of distress symptoms and efforts to seek help across time. Discussion of the lifeline usually develops the line with participants adding events, linking or contrasting events and feelings, and exploring similarities and differences of life events regarding meaning and context. Women examine how they dealt with stress or distress, and how they moved in and out of low times, risks and stressors, or better times where they effectively used resources. During the lifeline, participants describe how events were perceived, and how these perceptions contributed to help-seeking decisions.
- d) **Card Sort:** The participants receive a stack of cards that include emotional and physical feelings that have been gathered from previous studies[2]. They cluster these feelings into relevant groupings and explore these groupings. Most often, women appear to "climb into" or experience these feelings while doing the card sort. The interviewer does not ask about the circumstances that created the distress, but rather helps the participant "make meaning" about these experiences by examining their beliefs during them, the meanings they held at the time, and how that meaning affected their actions at that point.

1.2 *Scope and Objective*

The psychological treatment of mental health problems is beginning to undergo a fundamental change. This change is being driven by the widespread availability of "digital technology" by which we mean computers, the internet, mobile devices such as smartphones, and mobile

software applications[3]. The objective of this thesis is the design and development of a platform for synchronous digital recording of Clinical Ethnographic Interviews (CENI) via a handheld device. Participants will use a handheld device to record their "story" in a natural way, simulating the typical analog paper recording process, except that in this case a stylus on a digital tablet will be used where all the user's actions will be taken into account through screen recording and not only the final answers. The user will also have the ability to keep better track of the participants using an online database. Additionally, the clinical will have the ability to download or play the video of each participant they supervise and will be able to see a detailed PDF version of each "eCeni" interview they have done. The clinical will also be able to compile statistics based on the results of the questionnaires that the participant has completed.

1.3 Thesis Overview

The thesis is structured in the following way:

Chapter 1: A brief introduction to the Scope and Objectives of the Thesis.

Chapter 2: Explores work that is related to the "eCeni" application.

Chapter 3: Provides information about the technologies that were used to create "eCeni".

Chapter 4: Provides information about the architecture of "eCeni".

Chapter 5: Presents the hardware technologies used for testing the "eCeni" app.

Chapter 6: Detailed information about what the "eCeni" application can do.

2 Background

As was mentioned in the previous chapter, technology, and psychology have started lately to cooperate. There has been an increasing interest from academics and clinicians in harnessing smartphones as a means of delivering behavioral interventions for health[4]. The most popular "personal computer" in use today, the smartphone, has completely changed the way people communicate. Smartphones offer real-time, on-demand communication while their rich multimedia touch displays operate at increasing speeds to deliver data services and computing power to record and enhance their owners' networked lives. Psychosocial and health behavior treatments and therapies can be extended beyond traditional research or clinical settings by using mobile technology to deliver interventions to individuals as they go about their daily lives[5]. In 2011, more than 18 billion mobile apps were downloaded globally and in 2015 Health-related applications (apps) numbered more than 31,000 [6].

When you are using a Health-related application you need to know that on the other side of the phone is an expert a human that can truly help you. The Better-Help – Online Counseling can give you just that. This mobile health app is a counseling pathfinder. Patients may easily, quickly, and affordably access mental health providers thanks to BetterHelp. Online professional assistance from certified therapists and counselors is easy to access with BetterHelp. Patients benefit from specialized private care through video chat and messaging, which has received over 14,000 good evaluations[7]. The reviews point out that some patients are happier with their online treatment sessions than they were with their in-person therapy sessions in the past. Online counseling offers a secure environment for everyone. There are more than 3000 certified, licensed, and experienced counselors offering a variety of services, from family and couples counseling to depression and anxiety treatment. With the use of this mobile healthcare app, patients may personalize their experience and connect with counselors who can best match their requirements.



Figure 1. Better-Help application

Another application that helps patients through a handheld device is Talkspace. Counseling can be a crucial tool in your recovery process if you battle with mental health conditions like depression or anxiety or have trouble adjusting to major life events. There is Talkspace available for people who do not have the time or resources to receive in-person counseling. Over 2,000 certified therapists and psychiatrists provide private counseling services for individuals and couples dealing with a variety of issues on this online therapy platform. Users can receive daily assistance through limitless text, video, and audio messaging services after being matched with a therapist. Premium packages also include live online sessions. A variety of mental and behavioral health problems, including anxiety, depression, eating disorders, addiction, PTSD, LGBTQ+ concerns, and more, can be addressed by patients with the assistance of Talkspace therapists. The patient may also work with a Talkspace psychiatrist, who can write prescriptions for medication if necessary, depending on their needs[8].



Figure 2. Talkspace application

Although both of these applications were created to benefit the users, many applications were manufactured for the benefit of the doctors, to make their lives easier. Such an application is Practo. Doctors can manage their profiles, appointments, and patient feedback just by registering on the app. The online medical consultation app Practo also allows doctors to know how frequently their profile has been seen and to talk with patients online, ensuring quick

consultations. The app also gives the chance to doctors to interact with their patients through their Practo profile[9].

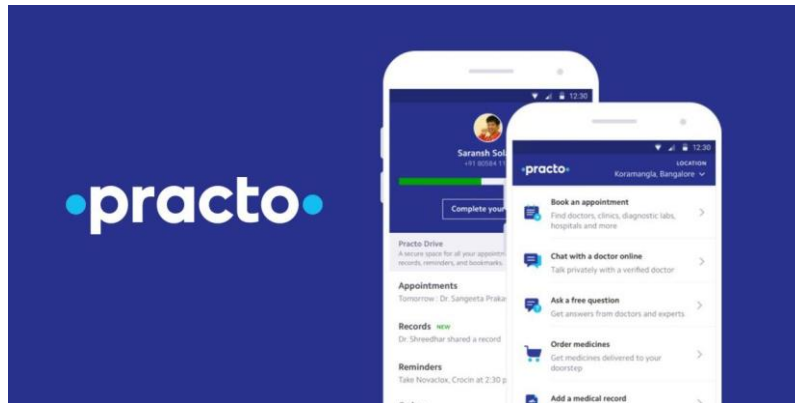


Figure 3. Practo Application

Another app like that is the one called Epocrates which holds the gold standard for medical applications. This app is used by healthcare professionals to research drugs, communicate with patients, identify colleagues for recommendations and consultations, and determine patient metrics like BMI. When treating illness, or disease, or just providing a consultation, more than a million clinicians rely on Epocrates to enhance their knowledge. Valuable tools like drug information, interaction check, and medical calculators are just a few reasons why many clinicians use our app up to 10 times a day[10]. There are also a ton of calculators for common medical equations, whose applications range from figuring out dosages that are appropriate to forecasting acute heart failure based on clinical signs. Users can access various activities, modules, and recorded lectures that cover a wide range of topics in the app's continuing medical education section. The Epocrates app offers a comprehensive reference in the palm of your hand and is a crucial tool for medical practitioners.

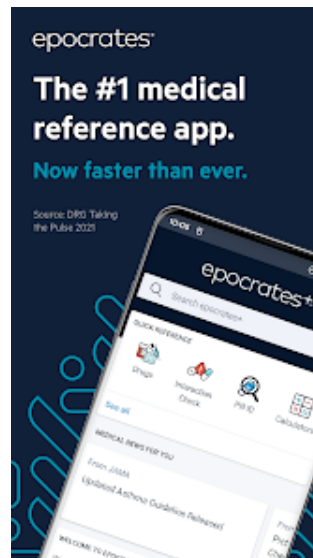


Figure 4. Epocrates Application

Although numerous apps offer the features of the “eCeni” application such an opportunity to speak with a mental health professional like Better–Help or Talkspace and allow medical professionals to have a reference application like Epocrates or have their data about the patients on the palm of their hand like Practo, CENI’s main use is for research purposes.

3 Methodology

3.1 Input

The first input of the eCENI system relates to the user's credentials. The user uses their credentials to log into the application. A second level input is the pen impression by the participant during the eCENI session. Moreover, the questionnaires to be completed by the clinical prior and/or after the eCENI sessions constitute also a second-level input of the system.

3.2 Output

The first output of the eCENI system takes place after the end of each eCENI session. The user will be able to view or download a PDF file containing screenshots of the sessions they have completed. They can also view or download the video file of each stage of the eCENI session (body map, lifeline, etc.). The individualized learning analytics is an internal output of the training tool. Evaluation results will be extracted by the testing procedure over time to reflect the user's progress.

3.3 Tools and Technologies

3.3.1 Flutter



Figure 5. Flutter logo

Flutter offers a free toolkit and is used to develop multi-platform apps for Android, iOS, Linux, macOS, and Windows as well as web and desktop applications. It was created by Google to make it faster and easier to create innovative interfaces. It is based on the Dart programming language and for this reason, the Flutter platform is not an object-oriented language. Instead, the interface consists of a set of widgets. The widgets are what the user sees on their screen and can interact with[11]. In addition to the ready-made interface components that Flutter provides

for use, it also supports a set of packages. Packages are open-source libraries created by other people that can be integrated into the application. Below are some of the libraries used:

- Library flutter_screen_recording:

This plugin can be used to record the screen on Android and iOS devices[12].

- Library flutter_foreground_task:

This plugin is used to implement a foreground service on the Android platform[13].

- Library cloud_firestore:

A Flutter plug-in to use the Cloud Firestore API[14].

- Library firebase_database:

A Flutter plug-in to use the Firebase Database API[15].

- Library open_file:

A plug-in that can call a native APP to open files with string results in Flutter[16].

- Library video_player:

A Flutter plugin for iOS, Android, and the Web for playing back video on a Widget surface[17].

- Library gallery_saver:

This plug-in saves images and videos from the network or temporary files to external storage. Both images and videos will be visible in Android Gallery and iOS Photos[18].

- Library syncfusion_flutter_charts:

Create various types of cartesian, circular, and spark charts with seamless interaction, responsiveness, and smooth animation. It has a rich set of features, and it is completely customizable and extendable[19].



Figure 6. Graphs of `syncfusion_flutter_charts` library

3.3.2 Visual Studio Code

For the implementation of this thesis, Visual Studio Code was used. Visual Studio Code is a source code editor created by Microsoft for all operating systems, Windows, Linux, and macOS [11]. In order to be able to develop the application, it was necessary to install the extensions of Dart and Flutter as well as the extension that supports the creation of a phone emulator on which it would be possible to run our application. Flutter provides faster and more flexible mobile app development than other open-source software. It provides its own library for creating and using interface components for both Android apps and iOS apps [11]. The reason why it gained popularity as an application development platform was that it supported the creation and implementation of mobile applications for both Android and iOS without adding additional code.



Figure 7. Visual Studio Code logo

Visual Studio Code is a desktop application and is available for use on Windows, Linux, and macOS. It provides built-in support for various programming languages such as JavaScript, and TypeScript and has a set of extensions for other languages such as Python, GO, and C++. Visual Studio Code with the ability to add plug-ins can very easily be used as a complete application developer containing all the appropriate tools [20].

3.3.3 Android Studio Emulator



Figure 8. Android logo

The Android Emulator simulates Android devices on your computer so that you can test your application on a variety of devices and Android API levels without needing to have each physical device[21]. The emulator enables a program using an emulator, a developer can test an Android application at various API levels without needing an actual device. An Android Virtual Device (AVD) is a device configuration that functions inside the Android emulator. It collaborates with the emulator to offer a virtual, device-specific environment in which to set up and run Android applications. The AVD Manager offers a graphical user interface where a developer may simulate various Android device configurations needed by the Android emulator.

3.3.4 Firebase Firestore



Figure 9. Firebase logo

Cloud Firestore is a flexible, scalable database for mobile, web, and server development from Firebase and Google Cloud[22]. Similar to Firebase Realtime Database, it uses real-time listeners to keep your data synchronized across client apps, provides offline support for mobile and web, and enables you to create responsive apps that function regardless of network latency or Internet connectivity. Firebase also helps to speed up the development and rollout of the app. The cloud-hosted NoSQL database provides a real-time database that helps you store and synchronize data between clients. This indeed makes it easier for the developers to access the data using any of the devices and helps to develop collaborative features. Other Firebase features such as built-in security, standard libraries for authentication, etc. also helps to develop the app faster.

3.3.5 GitLab



Figure 10. GitLab logo

GitLab is an all-inclusive DevOps platform that offers end-to-end functionality for every phase of the software development lifecycle. Teams benefit from increased productivity and cycle time reduction, which results in value being created for consumers. GitLab's use cases have recently been developing. You can arrange your work and host your codebase using GitLab projects. To manage issues, organize work, collaborate on code, and continually build, test, and deploy your app using built-in CI/CD, you may start a project. There is no restriction on the number of private projects that can be developed, and projects can be made available internally, externally, or privately.

3.3.6 Moqups



Figure 11. Moqups logo

For the design process of the eCENI system, Moqups was used. Moqups is a streamlined and intuitive web application that helps you create and collaborate on wireframes mockups, diagrams, and prototypes[23].

4 Technical Description

4.1 Context Diagram

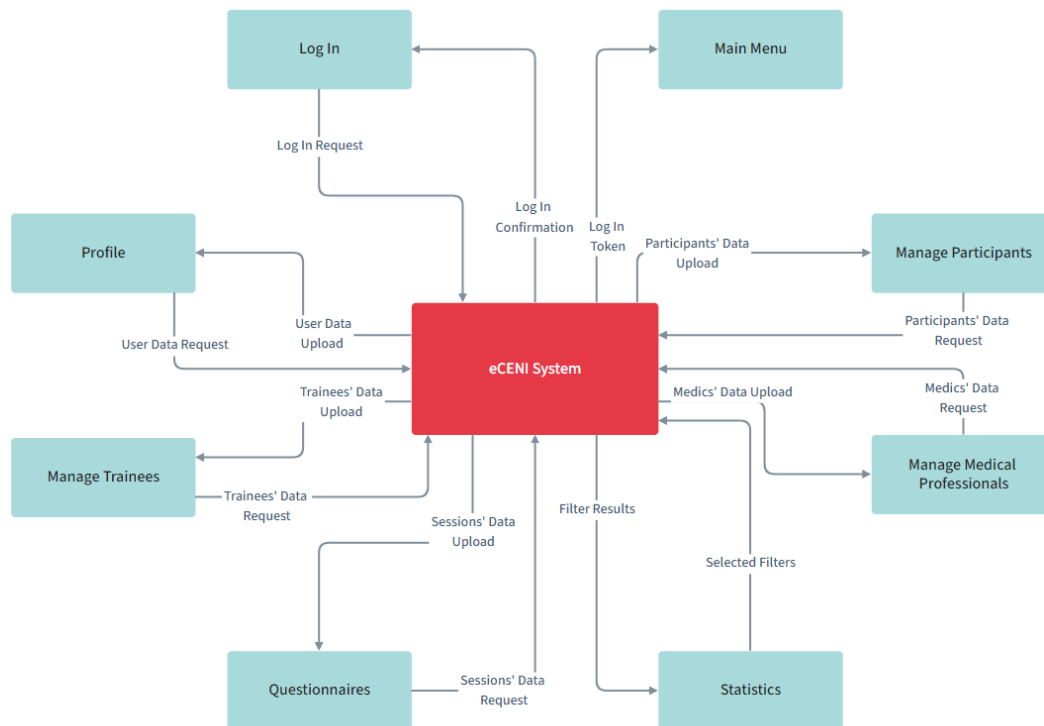


Figure 12. Context Diagram

The first step of the eCENI system is for the user to provide their login credentials so they can make the Log In Request which after the system checks the credentials gives the user the Log in Token to enter the eCENI's application's Main Menu. The user may request access to their profile data which the system will provide for them. Additionally, a clinical-level user could request access to their participants' or trainees' data and the system will upload that for them. A clinical-level user is also able to use select a variety of filters and the system will show them a chart depending on the filters the user asked for. Finally, the user can request the data of the sessions they have made and the system will upload the data for them.

4.2 User Requirements

User access levels define what information the users on the system can access and edit. In the eCeni system, there are 4 user access levels, the administrator, the medical professional, the trainee, and the participant. The administrators are at an access level above that of a normal user. In the eCeni application, the administrators are responsible for everything in the system they can see and do everything that happens in the app. The administrators are also responsible

for signing new medical professionals in the eCeni system. This user has also access to the full database of the system. The medical professional user access unlike the administrator can not sign up new medical professionals. But he can sign up participants that he will supervise and can also initiate an eCeni session only with participants that are under their supervision. They can also sign up trainees that will be under their supervision. In conclusion, the medical professional is just under the administration at the user access level category, they can do everything the administrator does except from signing up new medical professionals and have access to the whole database, they are only able to look up to the participants, eCeni sessions and trainees that they supervise. After the medical professional user access lever comes the trainees. The trainees as opposed to the two previous access levels cannot perform an eCeni session or know anything about the medical professionals or other trainees. But they can look up to the eCeni sessions their supervisor has performed and can also sign up new participants under the supervision of their supervisor. The last user access level is the participant. The participant only has access to their profile which contains the eCeni sessions they have participated in, they can also see the answers and the results of the questionnaires they have completed and lastly, they can see their demographic data.

4.3 Data Flow Diagrams

Starting the app, the login screen will appear to the user. The system will ask for the user for his credentials, once the user puts his credentials the system will check if the info that the user put was correct. If the correct info has been put the system will navigate the user onto the main screen, if the info is incorrect then the system will return him to the login screen.

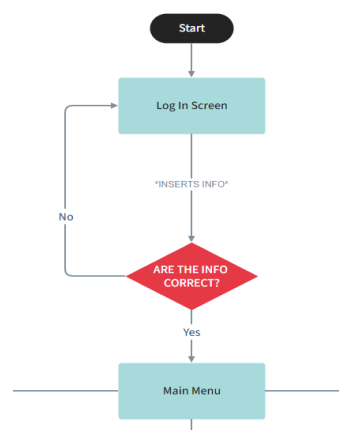


Figure 13. Data Flow Diagram for login

On the main screen, the user will be presented with 7 main components. By pressing the Manage Participants component the user will have the option to either manage an existing participant (profile, edit, delete) or create a new participant. If the user clicks the create user function the user will have to complete a create participant form and the system will check if the demographics have the correct form if they are correct the system will update the participants and the list, or if is incorrect the user will be asked to put the right form. If the user chooses to edit an existing participant, they will be presented with the edit user form and the procedure will be the same as the create new user function. By clicking the delete function the user will be asked if they are sure if they click yes, the system updates the existing participant's list and will return to the user on the manage participants list. If they choose to press the profile function, they will have 3 options for the demographic data, the questionnaire statistics, and the eCeni session. The demographic data will show the user the demographic data of the participant and if they want, they can edit a user as well by following the same procedure as before. The questionnaire statistics give access to the user to either answer questionnaires or inspect them, if they press the inspect function, they will be able to toggle between edit and inspect. The eCeni session will give access to download a PDF version of the eCeni session or download the videos that were captured or play the video on the platform. The manage trainees and the manage medical professionals have the same accesses as the manage participants component except that the profile function only has the demographic data.

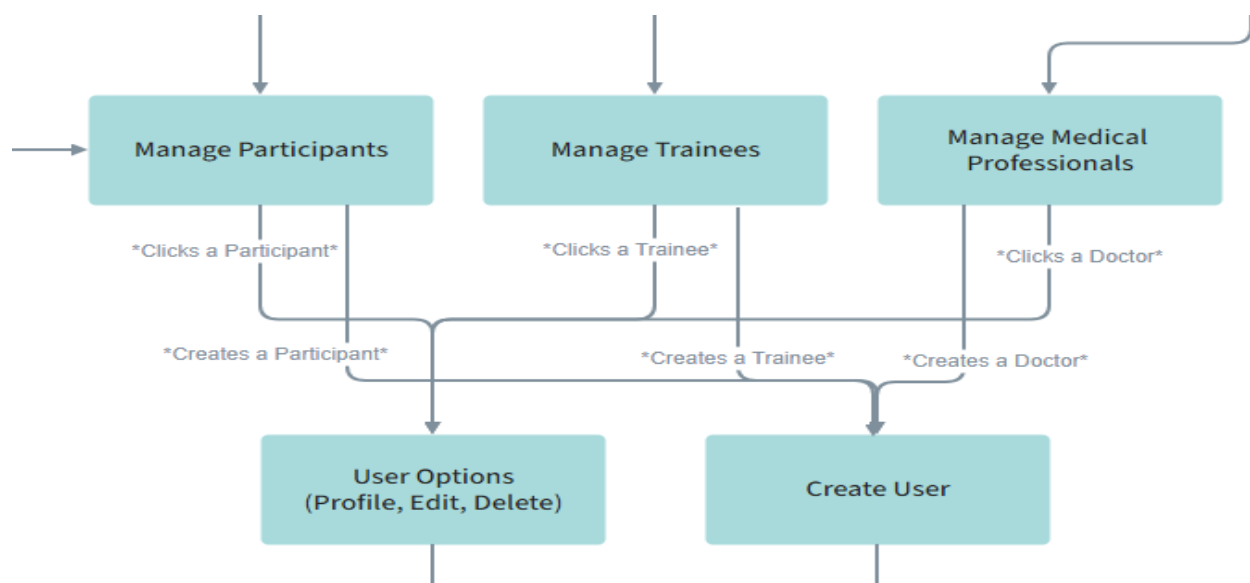


Figure 14. Data Flow Diagram for Managing

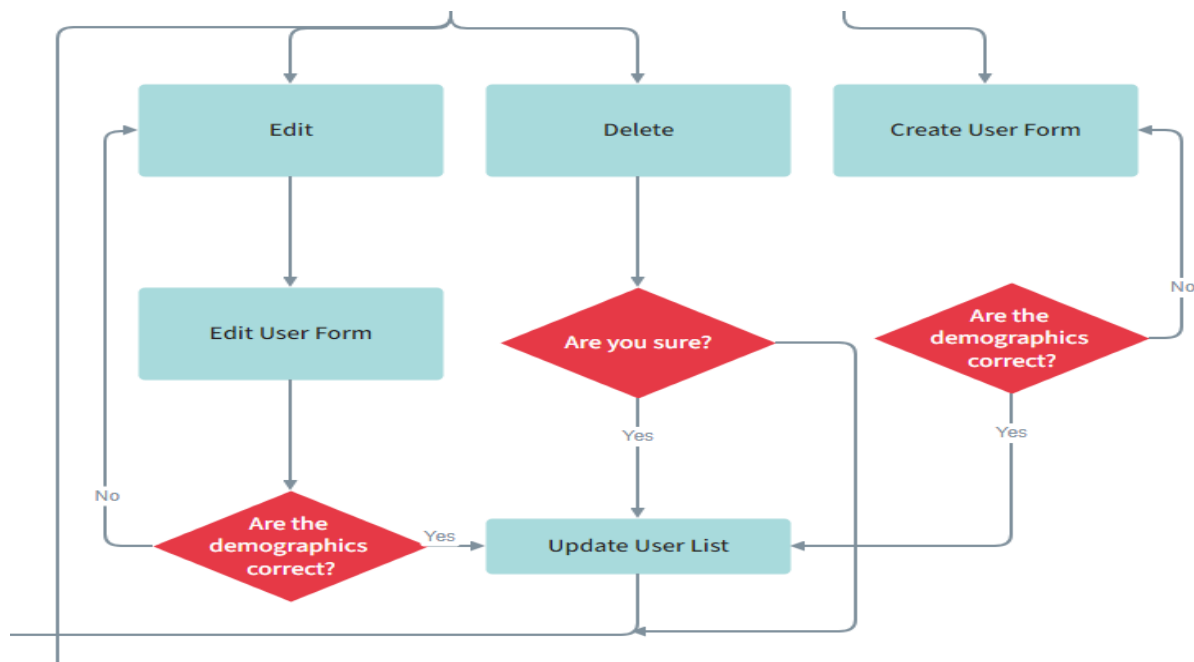


Figure 15. Data Flow Diagram for options

The statistics function will take the user into a tab with various filters. The user then will select the filters that they want, and the system will run those filters through the database and collect the information that the user requested and will present them on the screen with graphs.

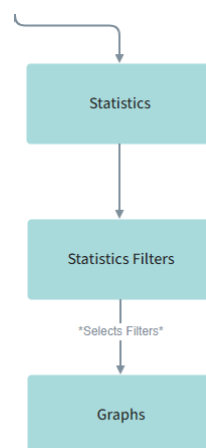


Figure 16. Data Flow Diagram for statistics

The questionnaires function navigates the user to a tab with a session list. By choosing a session from the list the user will be taken to a new tab with the available questionnaires, then by

pressing a questionnaire the list of questions will appear in front of the user so they can answer them. Once the user has completed the questionnaire the submit button will be available to them and when they press it the system will return them to the sessions list tab.

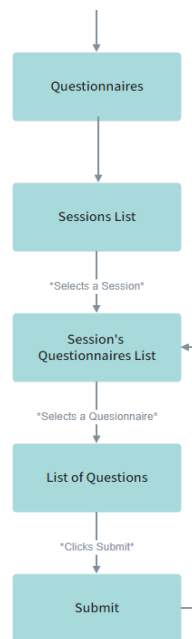


Figure 17. Data Flow Diagram for Questionnaires

The second to last component is the eCeni session. Clicking this component will take the user to the sessions list tab. There the user will have two options. The first option is to delete an existing eCeni session, if they choose to do that the system will request their confirmation, and if the user presses the yes button the session list will be updated. The second option is to create a new session. When the create button is pressed the system will navigate to the questionnaires list with an extra button that will allow the user to test the canvas. The questionnaire procedure is the same as previously explained. Once the user is done with the testing and the questionnaires and presses the start session button the system will request if the user wants to allow sound recording and then start the stages of the CENI session.

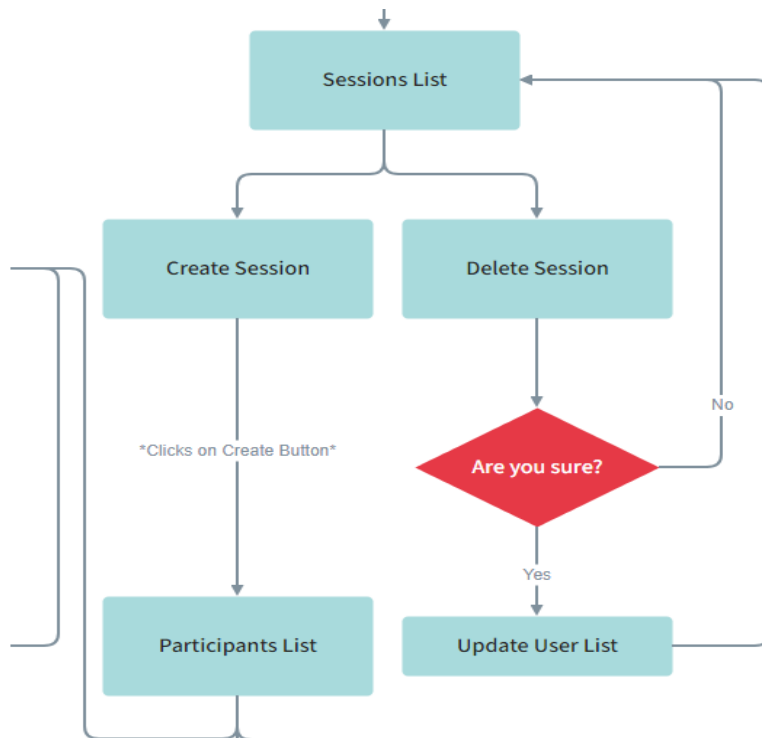


Figure 18. Data Flow Diagram for sessions

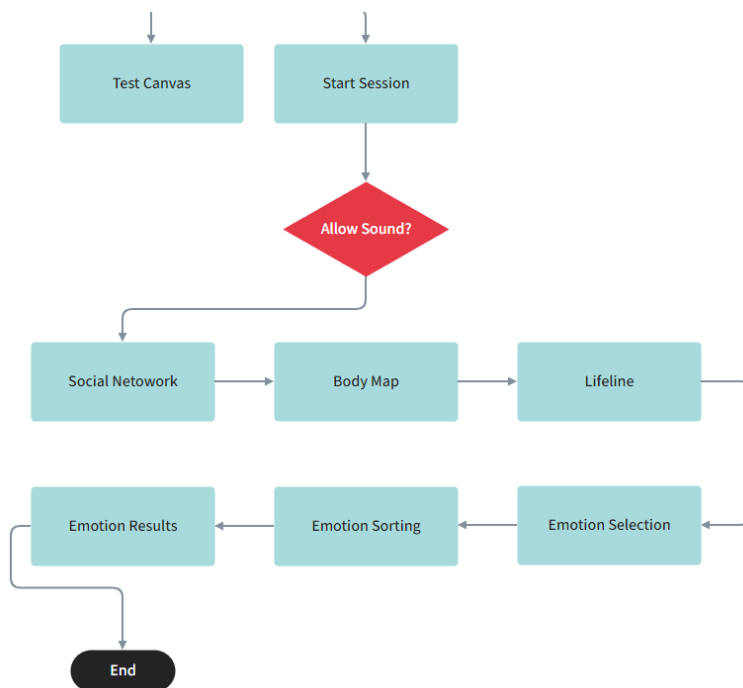


Figure 19. Data Flow Diagram of eCeni stages

4.4 Logical Data Model

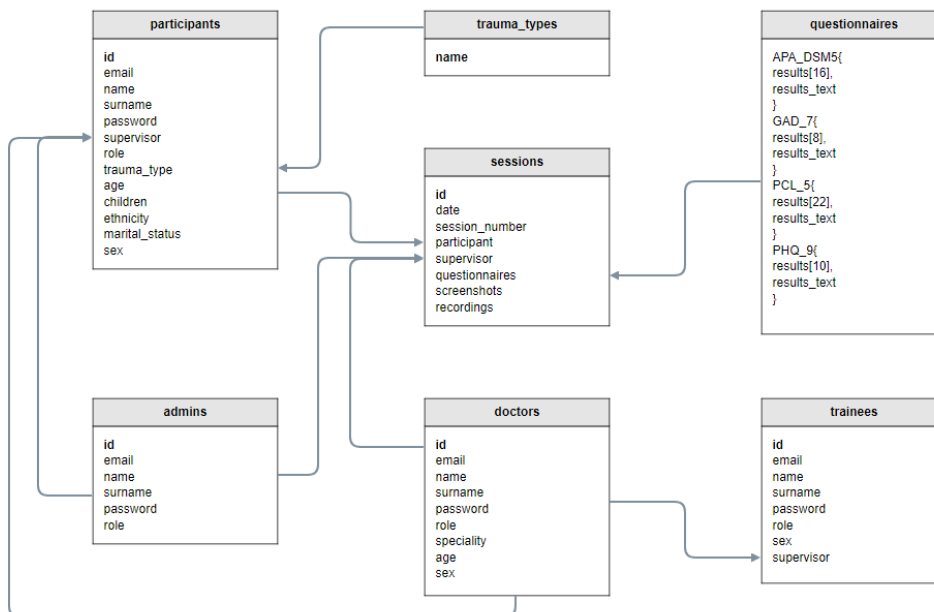


Figure 20. Logical Data Model

To store the data to be used by the application, the table is created as shown above, which consists of the following columns:

For the participants:

Id	Unique id for each user	String
Email	Email of the user for the login authorization	String
Name	Demographic data	String
Surname	Demographic data	String
Password	Hashed string of the participant's password	String
Supervisor	Reference of the medical professional	Reference
Role	Determines the user access level	String
Trauma_type	Saves the new trauma types	String
Age	Age of the user	Number
Children	Number of children of the user	Number
Ethnicity	Origins of the user	String
Marital_Status	True or false option	Boolean
Sex		String

For the Medical Professionals:

Id	Unique id for each user	String
Email	Email of the user for the login authorization	String
Name	Demographic data	String
Surname	Demographic data	String
Password	Hashed string of the user's password	String
Role	Determines the user access level	String
Specialty	The profession of the medical professional	String
Age	Age of the user	Number
Sex		Boolean

For the administrators:

Id	Unique id for each user	String
Email	Email of the user for the login authorization	String
Name	Demographic data	String
Surname	Demographic data	String
Password	Hashed string of the user's password	String
Role	Determines the user access level	String

For the trainees:

Id	Unique id for each user	String
Email	Email of the user for the login authorization	String
Name	Demographic data	String
Surname	Demographic data	String
Password	Hashed string of the user's password	String
Role	Determines the user access level	String
Sex		String
Supervisor	Reference of the medical professional id	Reference

For the questionnaires:

Name of Questionnaire	Depending on the name the system will put the results accordingly	String
Results[N]	This is where the results are saved	Number
Results_text	This is the text that will be shown depending on the results	String

For the sessions:

Id	Unique id for each user	String
Date	Timestamps the day and hour of the eCeni session creation	Timestamp
Session_number	Indicates the number of sessions the participant has participated	Number
Participant	Reference of the participant's id	Reference
Supervisor	Reference of the medical professional id	Reference
Questionnaires	Reference of the questionnaires	Reference
Screenshots	Link for the screenshot	String
Recordings	Link for the video recordings	String

5 Other requirements

5.1 Screen Size

As we stated in the first chapter until today for a typical Ceni session the participants were given a pen and pieces of paper to complete each of the stages. The size of a typical A4 paper is 11.7 inches so we had to find a device that is around the same size of a paper. After the necessary research, we concluded that the most suitable device to simulate the feeling of paper and pencil was the Samsung Galaxy Tab S8+ a 12.4-inch tablet designed and made by Samsung.



Figure 21. Samsung Galaxy Tab S8+

5.2 Input Methods

As stated before the screen size was a great matter for the selection of the right device for our project but there are a lot of tablets with a big screen that replicates the size of an actual A4 paper. So the most important part of the research was the pen. We had to find the best input method to simulate the feeling that a pen gives when writing on paper, and the Samsung Galaxy Tab S8+ gives us exactly that. The S Pen is a lightweight device that emulates the feeling of the pen or pencil, it is only 14g meaning it is easy to handle and has a latency of 2.8 milliseconds[24] so the users will get the feeling that they are just using a normal pen with a paper.

6 ECeni Application

6.1 Log In and Authentication

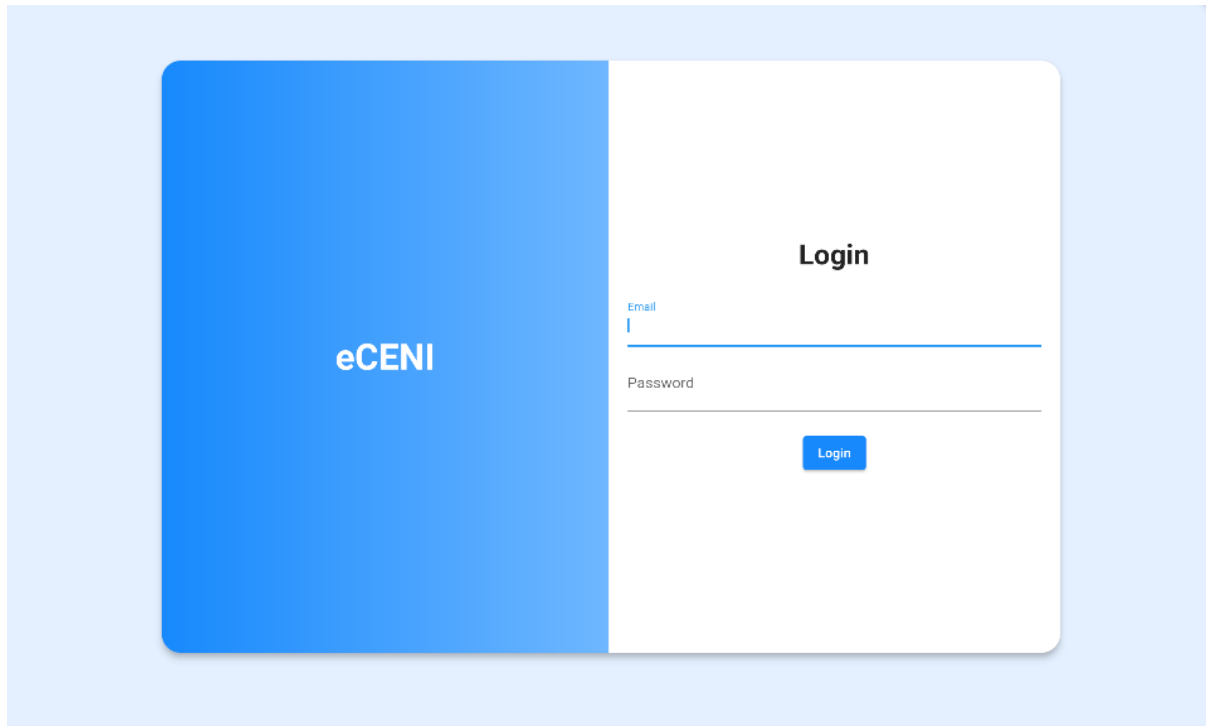


Figure 22. Login Page of eCeni application

Any system or program's first contact with a user is through a login form or registration. A login form uses the user's login information to verify their right to access. To access the application's main interface, the user must first fill out the email and password fields and then click the "Login" button. When a user clicks the "Login" button, the application looks up the user in the database to determine if the credentials match. If the user's credentials match those of an already-registered user, the program will grant them access to the main screen.

6.2 Main Screen

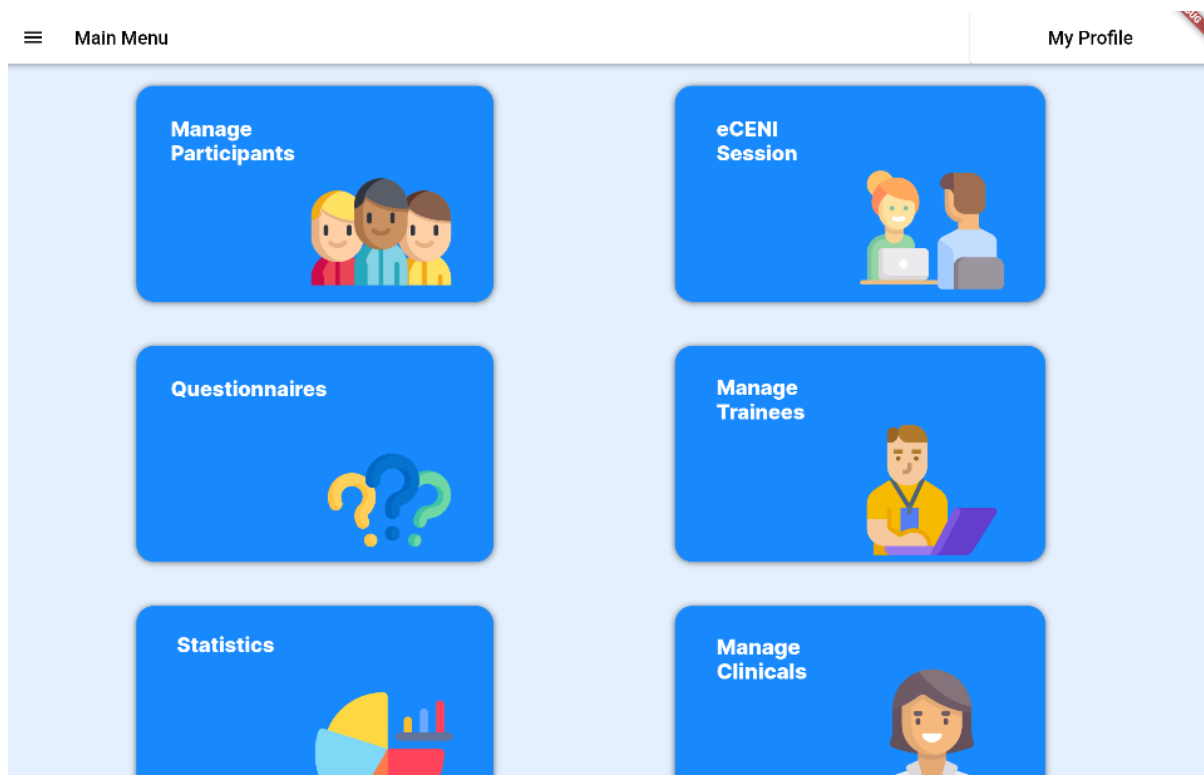


Figure 23. Main Menu of the eCeni application

The main screen of the eCeni system consists of 6 main components: Manage Participants, eCeni Session, Questionnaires, Manage Trainees, Statistics, and Manage Medical Professionals. The main screen will change depending on the user access level that has logged in. By pressing on each of these components the system will take you to the correspondent screen. Also, the main screen has a navigation bar at the top left of the screen that is used for quick navigation across the entire system.

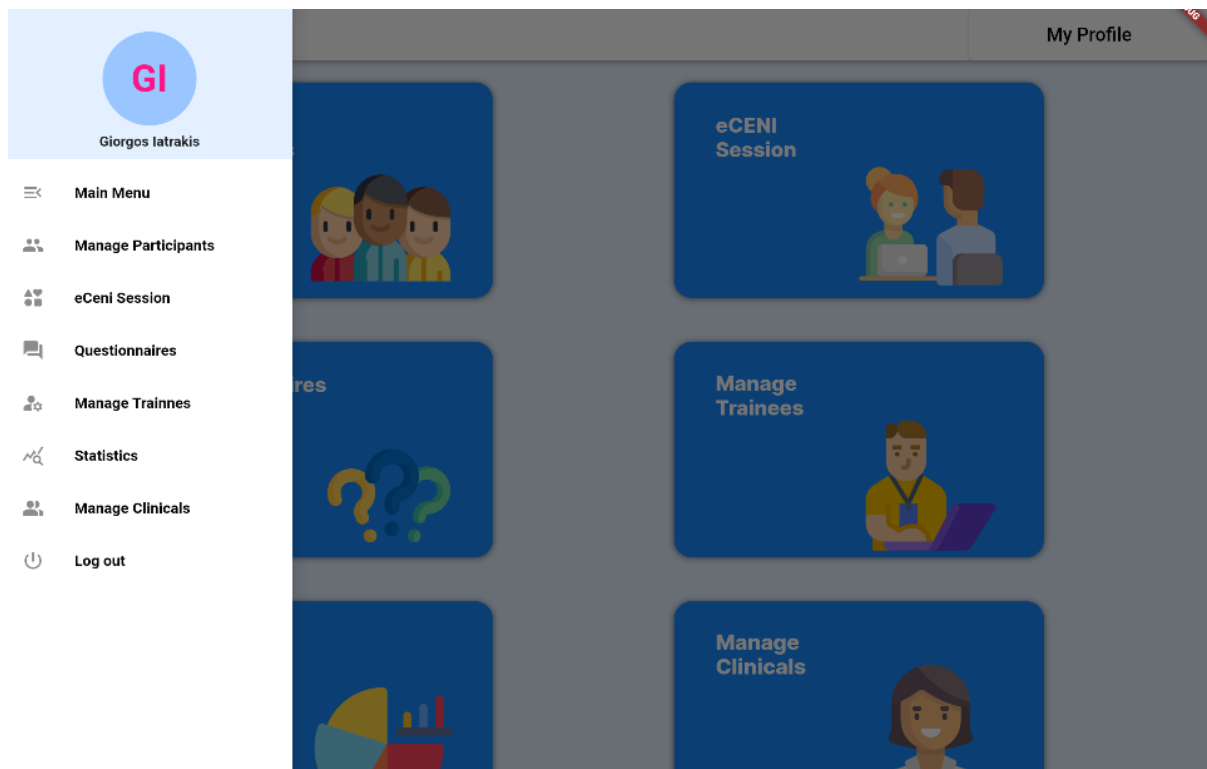


Figure 24. Navigation Bar of the eCeni application

Additionally, there is also a “My Profile” button at the top right of the screen which is used by the user so they can have access to their demographic information. The “My Profile” screen consists of a circle avatar with your initials in it and the demographic information under that.

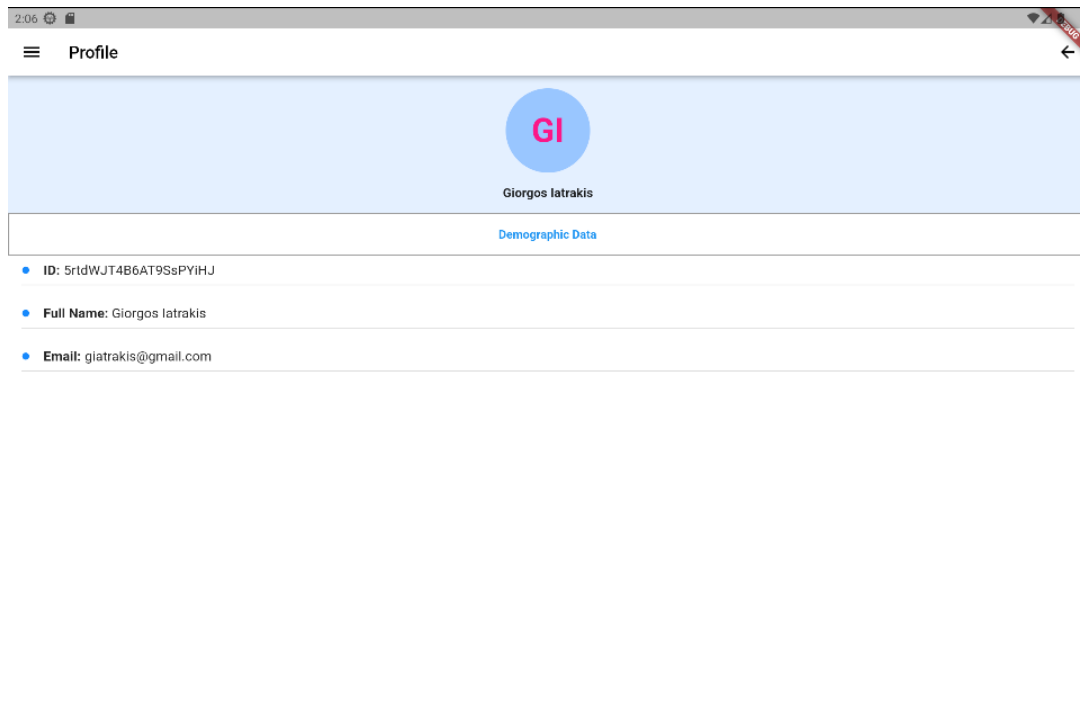


Figure 25. Administrator Profile

6.3 Manage Participants

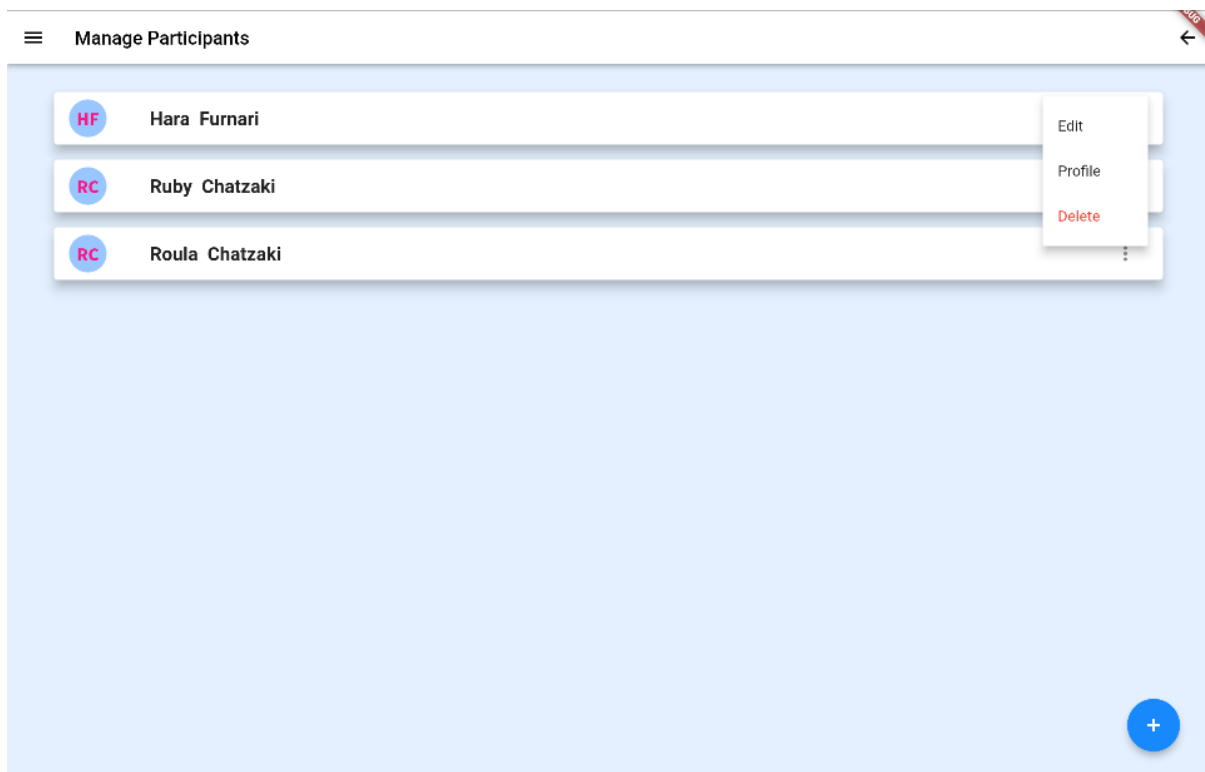
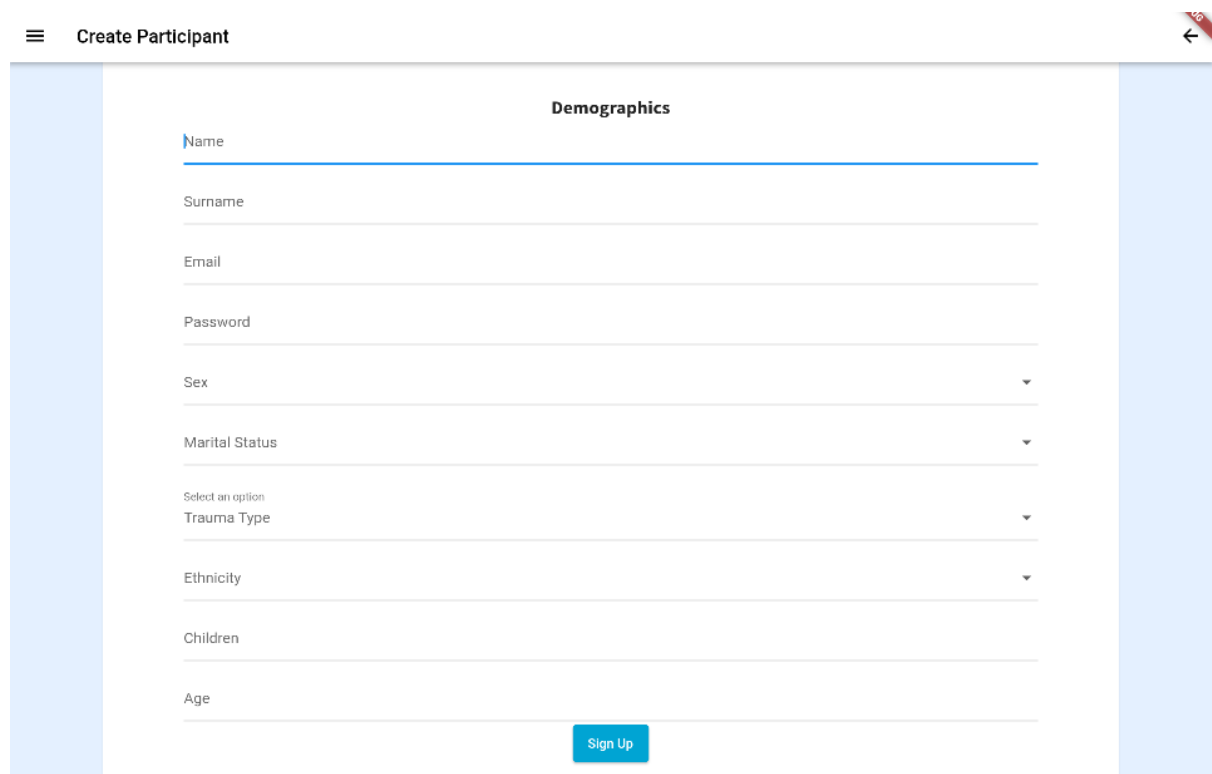


Figure 26. Manage Participants Page

By pressing the Manage Participants component the user will be presented with a new tab. The manage participants tab shows a list of participants available to the mental health professional. From this available list, the user can choose to manage the participants or have access to their profile. If they choose the manage tab, they can either add a new participant or edit or delete an existing participant.

Manage section:

When the add interactive button component is selected the medical health professional will be asked to fill a form of demographic data for the new participant. The demographic data is comprised of the Name, Surname, Password, Sex, Age, Marital Status, Kids, Nationality, and Trauma Type which has prefix options of refugees, parents of children with disabilities, gender-based violence, and trans, and the user can also add a new Trauma Type. The new trauma type that was inserted will be inserted into the eCeni system database and will be available for all medical professionals to use.

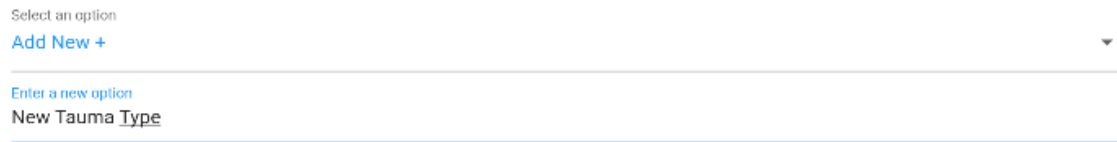


The screenshot shows a web interface for creating a new participant. At the top, there is a navigation bar with a hamburger menu icon, the text "Create Participant", and a back arrow icon. Below the navigation bar is a form titled "Demographics". The form contains the following fields:

- Name (text input)
- Surname (text input)
- Email (text input)
- Password (text input)
- Sex (dropdown menu)
- Marital Status (dropdown menu)
- Trauma Type (dropdown menu with the text "Select an option" above it)
- Ethnicity (dropdown menu)
- Children (text input)
- Age (text input)

A blue "Sign Up" button is positioned at the bottom right of the form.

Figure 27. Creation of a Participant

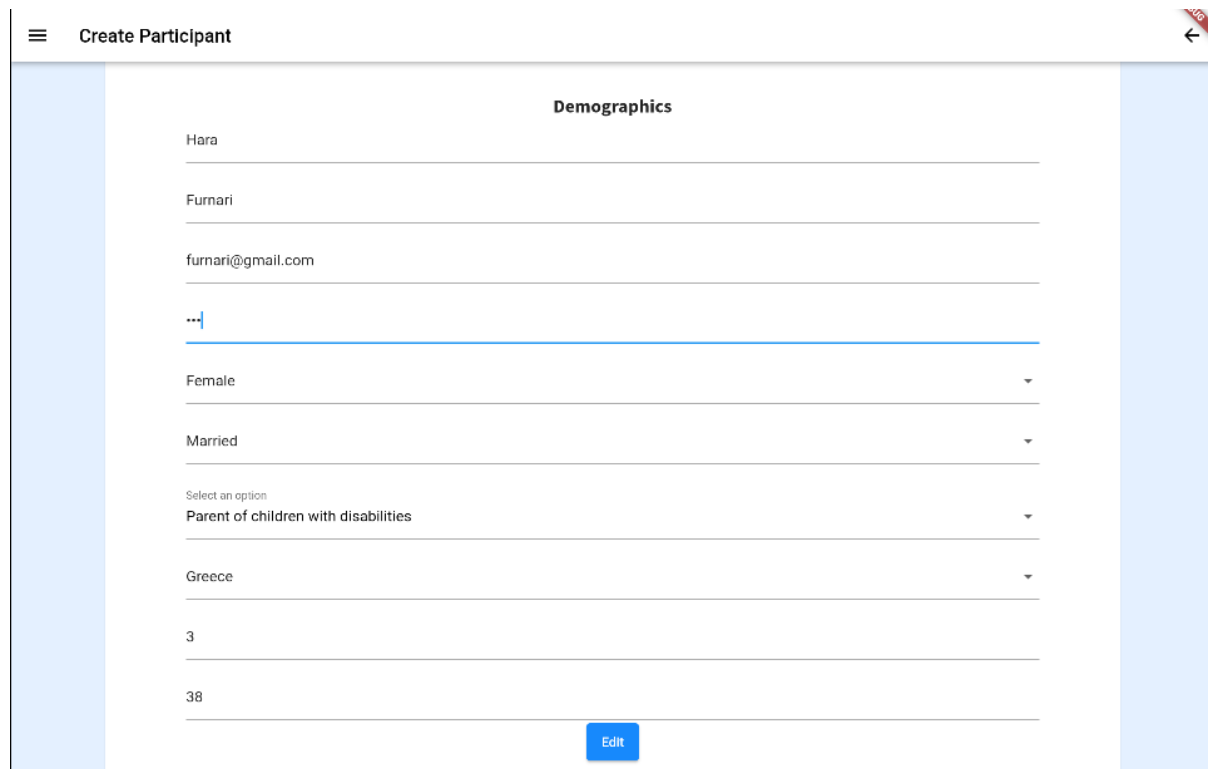


Select an option
Add New +

Enter a new option
New Trauma Type

Figure 28. Add new trauma type button

Likewise, when the edit interactive button component is selected the user will be provided with the same type of form so they can edit the existing demographic data.



☰ Create Participant ←

Demographics

Hara

Furnari

furnari@gmail.com

...

Female

Married

Select an option
Parent of children with disabilities

Greece

3

38

Edit

Figure 29. Edit page of a participant

Lastly, if the delete interactive button component is selected the user will be presented with an alert component at first that will ask the user if they are sure they want to delete the specific participant that they have selected so missclicks will be evaded. If the user pressed the “Delete” button then the specific participant that they choose will be deleted.

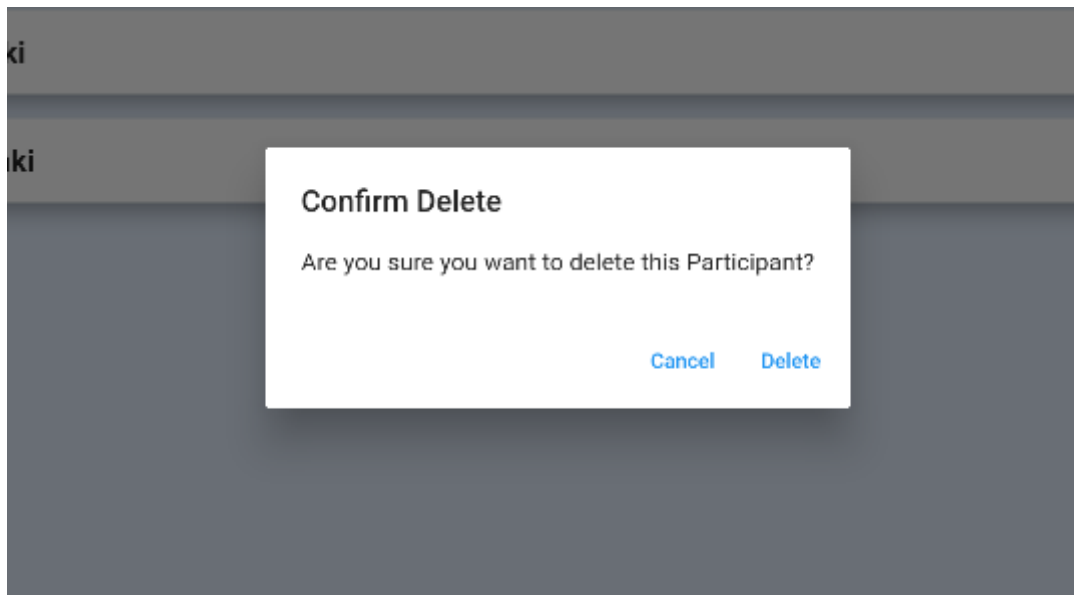


Figure 30. Confirmation message

Profile Section:

If the user selects the profile button they will be presented with the participants' demographic data, questionnaire statistics, and also the interview results of the eCeni session. The demographic data tab will show the user the demographic information of the participant that they selected to look up.

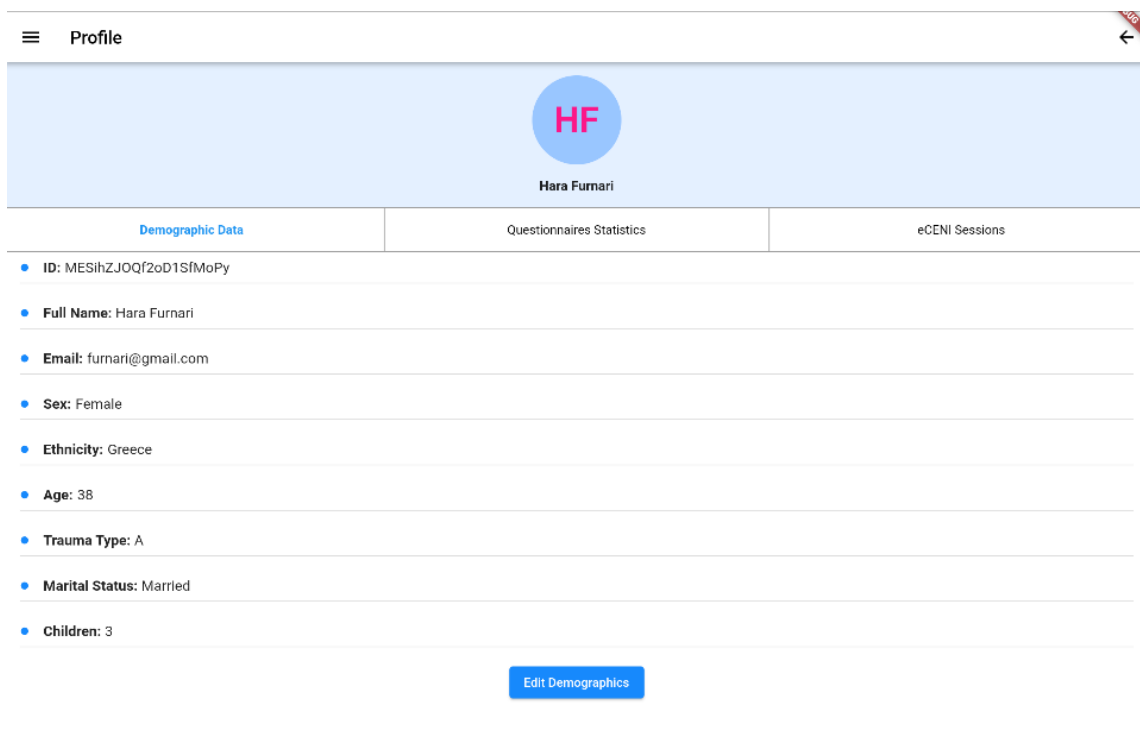
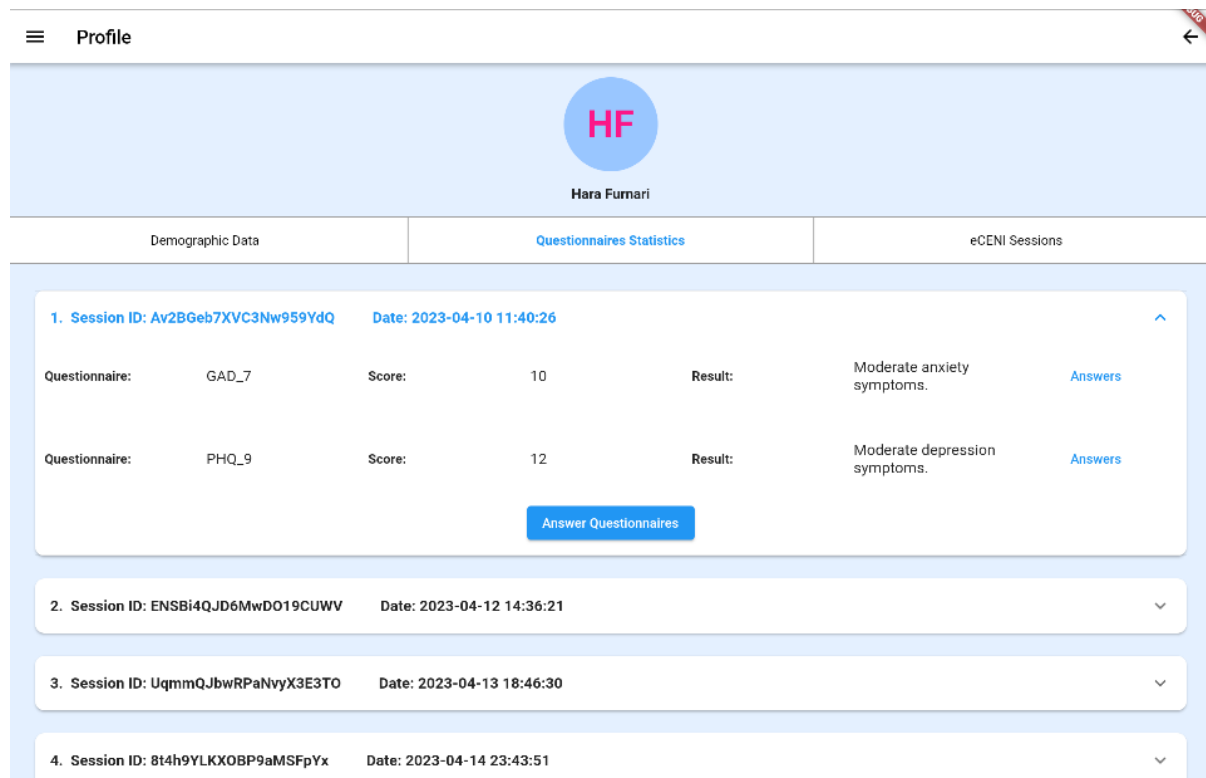


Figure 31. Participant's profile page

The questionnaire statistics tab will show the user details of the questionnaires that the participant has answered depending on the eCeni session that has been completed. From this tab, the medical professional will be able to look at the answers to each of the questionnaires and choose if they want to just view them or edit them as well. The user will be also able to answer the rest of the questionnaires that haven't been answered during the eCeni session.



The screenshot displays the 'Questionnaires Statistics' tab for a participant named Hara Furnari (HF). The interface includes a navigation bar with 'Profile' and a back arrow. Below the participant's name, there are three tabs: 'Demographic Data', 'Questionnaires Statistics' (selected), and 'eCENI Sessions'. The main content area shows a list of completed questionnaires:

Session ID	Date	Questionnaire	Score	Result	Actions
1. Av2BGeb7XVC3Nw959YdQ	2023-04-10 11:40:26	GAD_7	10	Moderate anxiety symptoms.	Answers
		PHQ_9	12	Moderate depression symptoms.	Answers

Below the list, there is a blue button labeled 'Answer Questionnaires'. The list also includes three more sessions (2, 3, and 4) which are partially visible and have expand/collapse arrows.

Figure 32. Questionnaire statistics tab of the participant's profile

The last tab of the participant's profile is the eCeni sessions tab. In this tab, the user will be able to look up past sessions of the participant. All of the sessions have a different ID and they also have the date that they were created.

The screenshot shows a user profile for Hara Furnari (HF). The profile is divided into three tabs: Demographic Data, Questionnaires Statistics, and eCeni Sessions. The eCeni Sessions tab is selected and displays a list of four sessions. Each session entry includes a session ID, a date, and two action buttons: 'Download Videos' and 'PDF Viewer'. The first session is expanded to show a list of activities: Social Network, Body Map, Lifeline, and Card Sorting, each with its own 'Download Video' and 'Play Video' buttons.

Session ID	Date	Download Videos	PDF Viewer
1. Session ID: Av2BGeb7XVC3Nw959YdQ	2023-04-10 11:40:26	Download Videos	PDF Viewer
<ul style="list-style-type: none"> Social Network: Download Video, Play Video Body Map: Download Video, Play Video Lifeline: Download Video, Play Video Card Sorting: Download Video, Play Video 			
2. Session ID: ENSBi4QJD6MwDO19CUWV	2023-04-12 14:36:21	Download Videos	PDF Viewer
3. Session ID: UqmmQJbwrPaNvyX3E3TO	2023-04-13 18:46:30	Download Videos	PDF Viewer
4. Session ID: 8t4h9YLKXOBP9aMSFpYx	2023-04-14 23:43:51	Download Videos	PDF Viewer

Figure 33. eCeni sessions tab of the participant's profile

The user can access a PDF file that contains screenshots of the session that they chose to examine. The participant and the medical professional will each have a different version of a PDF file. The medical professional will get a PDF that at the starting page will have a table of the participant's demographic data and a supervisor field. The user will also be able to download the document and save it to their device.

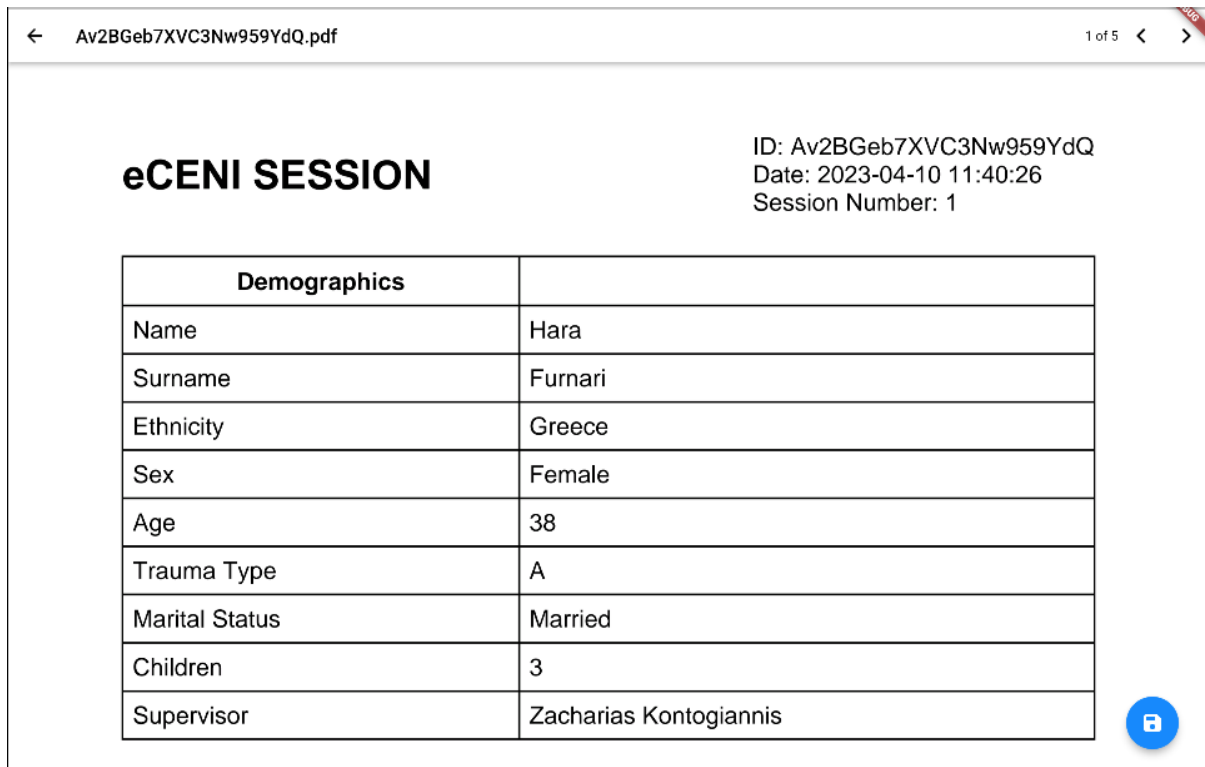


Figure 34. Medical Professionals PDF file

Instead of the front page that we saw on the participant’s first page of the document will only have the date that the session took place, the number of the session, their name, and the name of their supervisor.

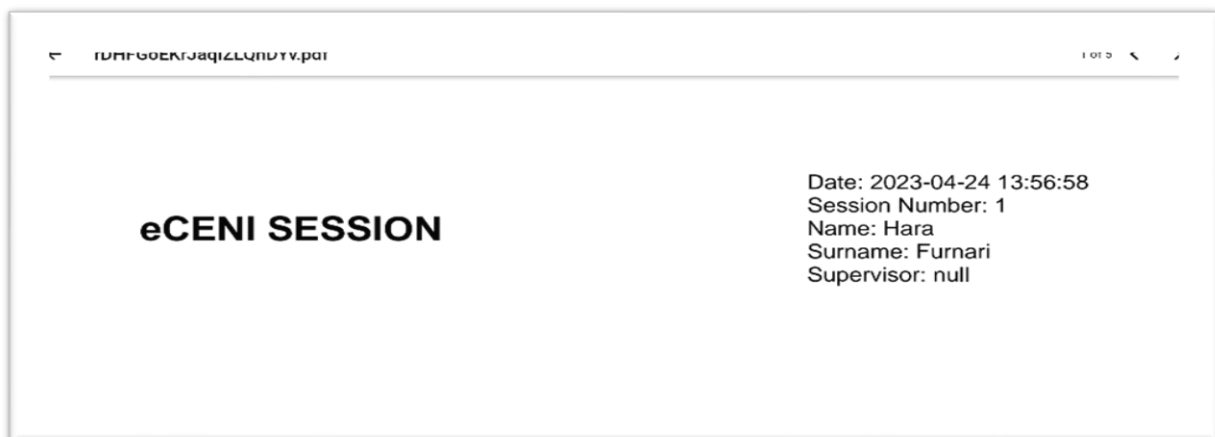


Figure 35. Participant's PDF file

Additionally, the user will be able to download and play each part of the session separately. To download all of the stages of the session the user will just have to press the “Download Videos”. If the user wants to they could play the video in the application just by pressing the “Play

Video” button. By pressing that button the application will navigate the user to the video player tab.

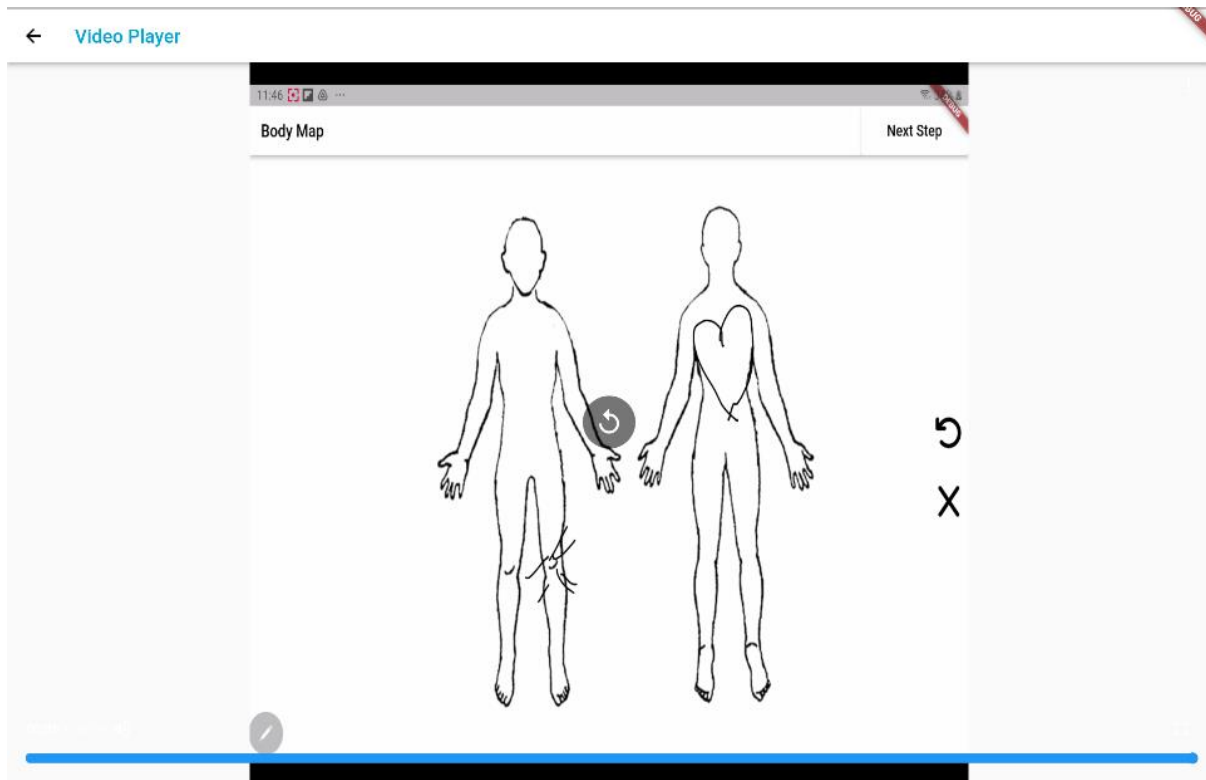


Figure 36. eCeni session video player

6.4 *Manage Trainees*

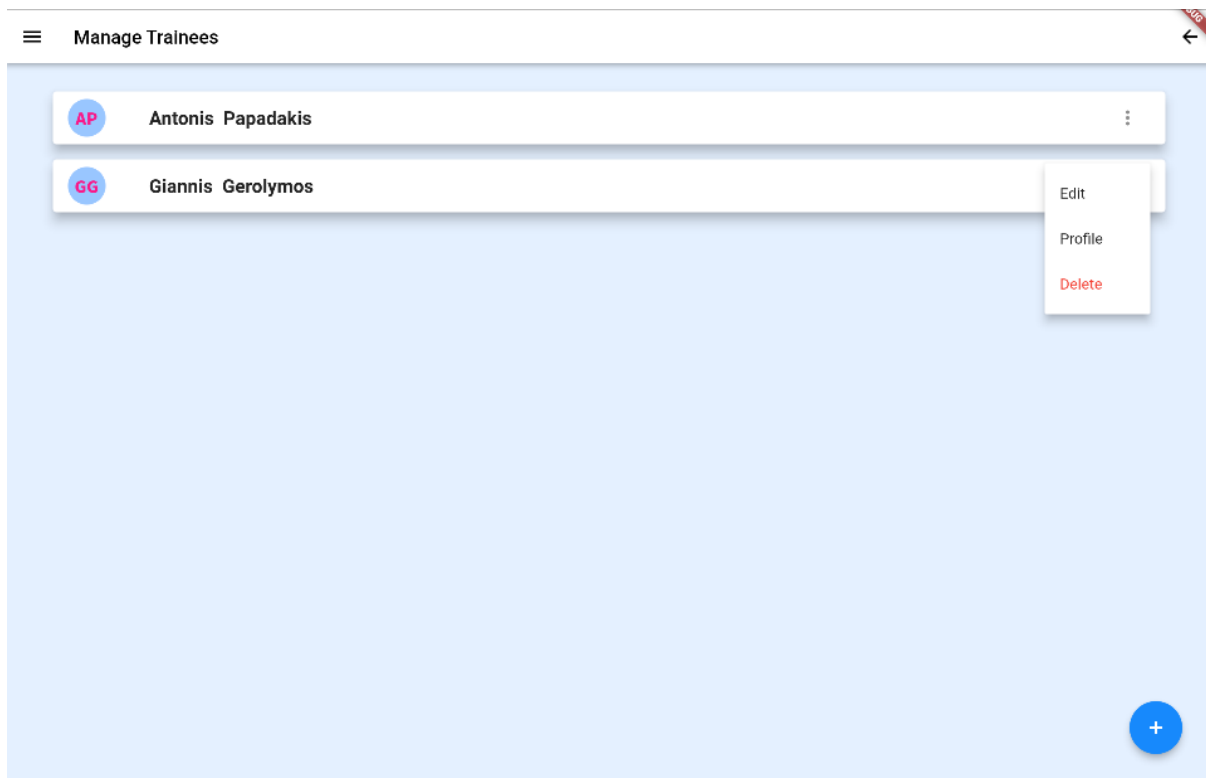
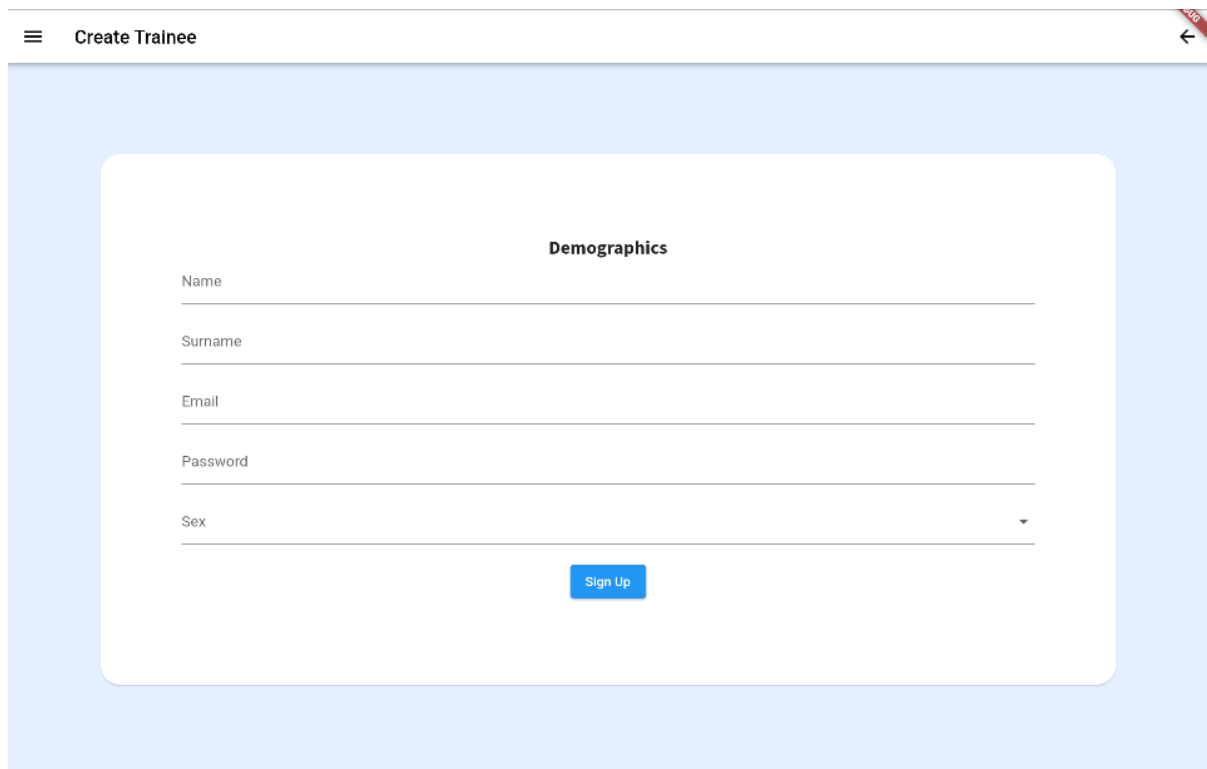


Figure 37. Manage Trainees page

A list of trainees that are available to the mental health professional is displayed on the manage trainees tab. The user may select to manage the trainees from this list. They may either add a new student, update an existing trainee, or delete an existing trainee if they select the manage option.

Manage Section:

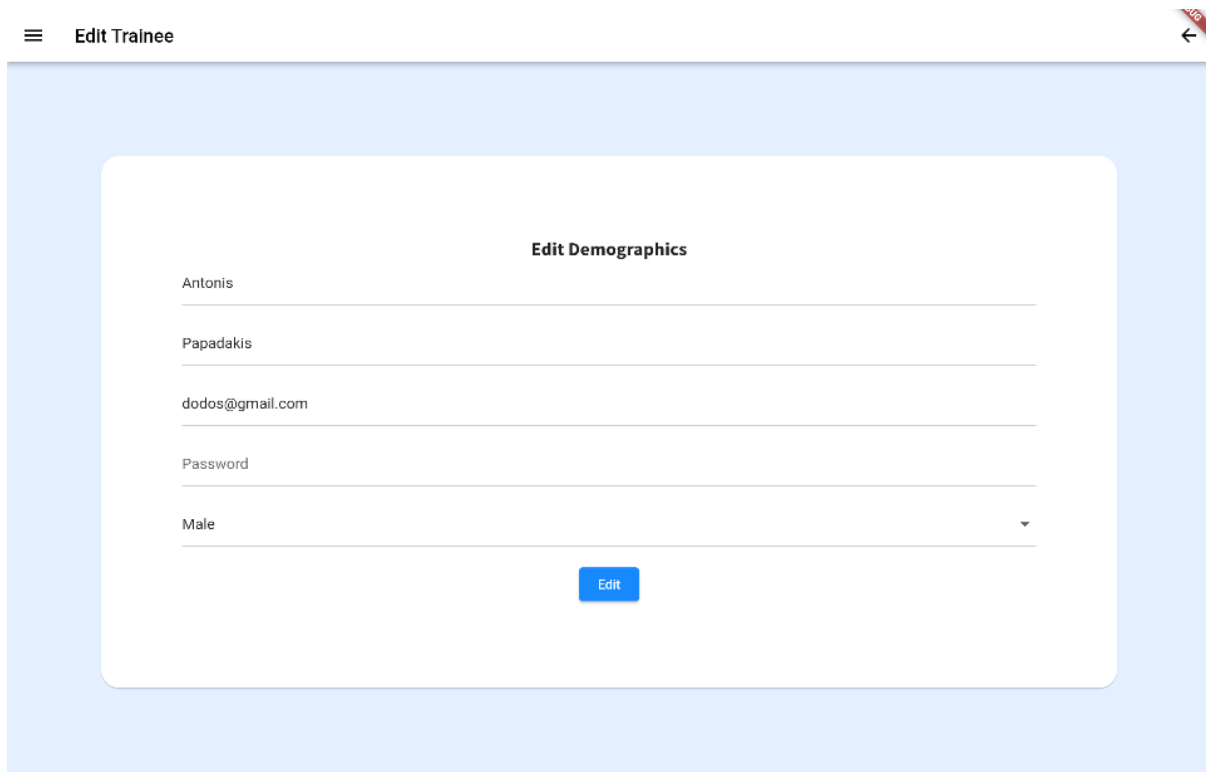
The medical health professional will be asked to complete a form of demographic information for the new trainee when the add interactive button component is chosen. Name, surname, email, sex, and password make up the demographic information.



The image shows a mobile application interface for creating a trainee. At the top, there is a header with a hamburger menu icon on the left, the text "Create Trainee" in the center, and a back arrow icon on the right. Below the header is a light blue background area containing a white rounded rectangle. Inside this rectangle, the title "Demographics" is centered. Below the title are five input fields: "Name", "Surname", "Email", "Password", and "Sex". Each field has a horizontal line for text entry. The "Sex" field has a small downward-pointing arrow on the right side, indicating it is a dropdown menu. Below the input fields is a blue button with the text "Sign Up" in white.

Figure 38. Creating a Trainee

Similar forms will be presented to the user when the edit interactive button component is chosen so they can edit the demographic data that has already been entered.



The screenshot displays a mobile application interface for editing a trainee's profile. At the top left, there is a hamburger menu icon and the text 'Edit Trainee'. At the top right, there is a back arrow icon. The main content area is a white rounded rectangle with a light blue background. Inside this rectangle, the title 'Edit Demographics' is centered. Below the title, there are five input fields: 'Antonis', 'Papadakis', 'dodos@gmail.com', 'Password', and 'Male'. The 'Male' field is a dropdown menu. At the bottom center of the form, there is a blue button labeled 'Edit'.

Figure 39. Editing a trainee

Last but not least, if the delete interactive button component is used, the user can delete the particular trainee they choose.

Profile Section:

If the user selects the profile button they will be presented with the trainee's demographic data and can also have access to the edit tab just by pressing the "Edit Demographics" button.

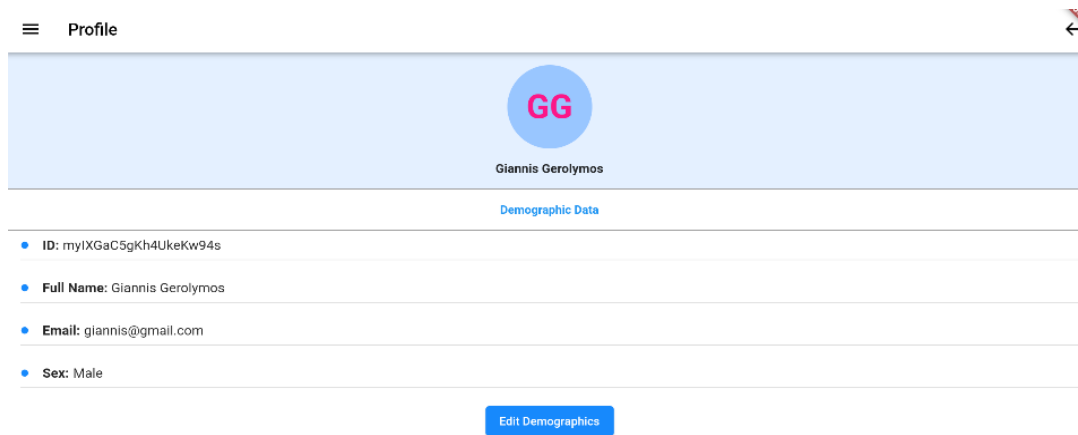


Figure 40. Trainee's profile tab

6.5 Manage Medical Professionals

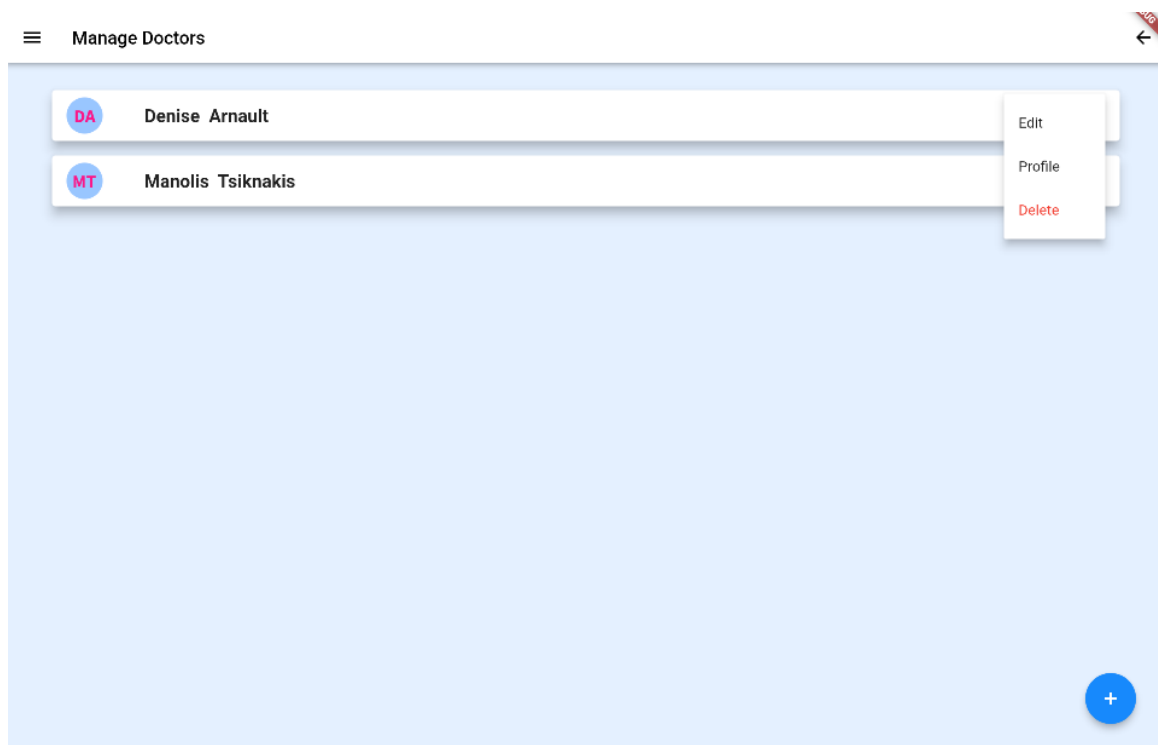
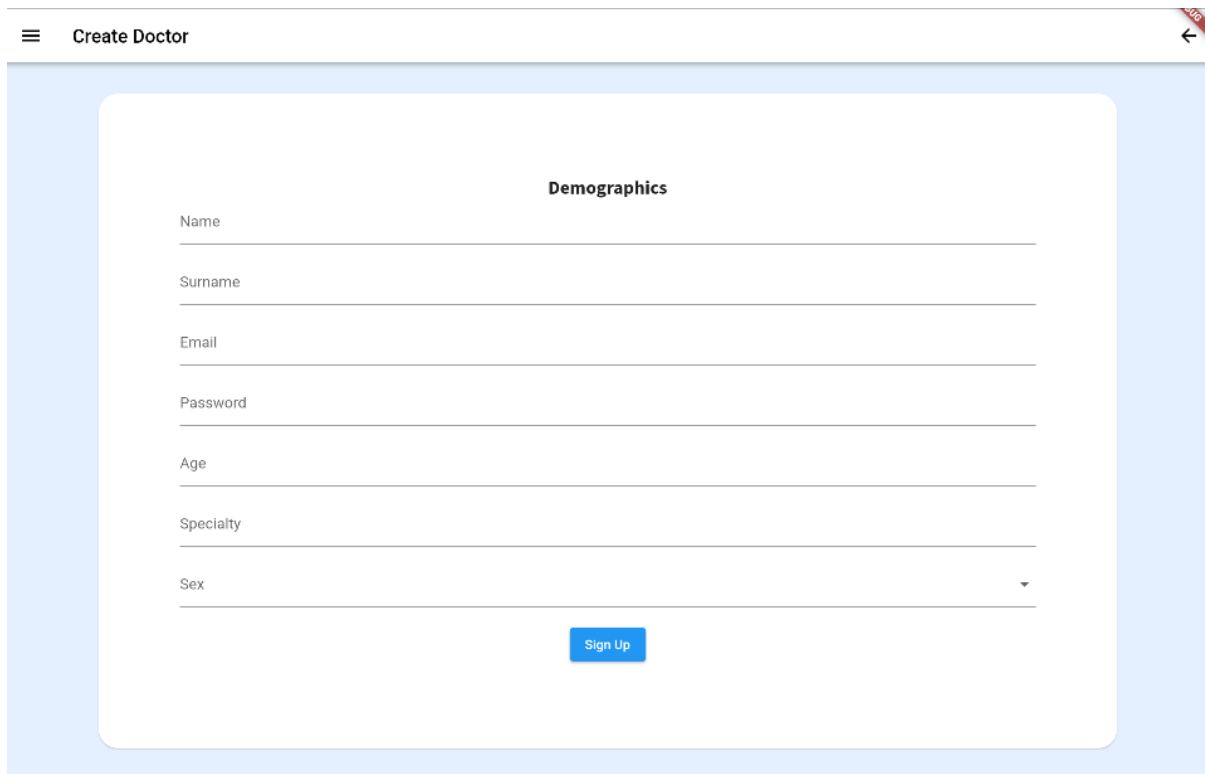


Figure 41. Manage Medical Professionals page

A list of medical professionals that are available to admin is displayed on the manage medical professionals tab. The user may select to manage the trainees from this list. They may either add a new student, update an existing trainee, or delete an existing trainee if they select the manage option.

Manage Section:

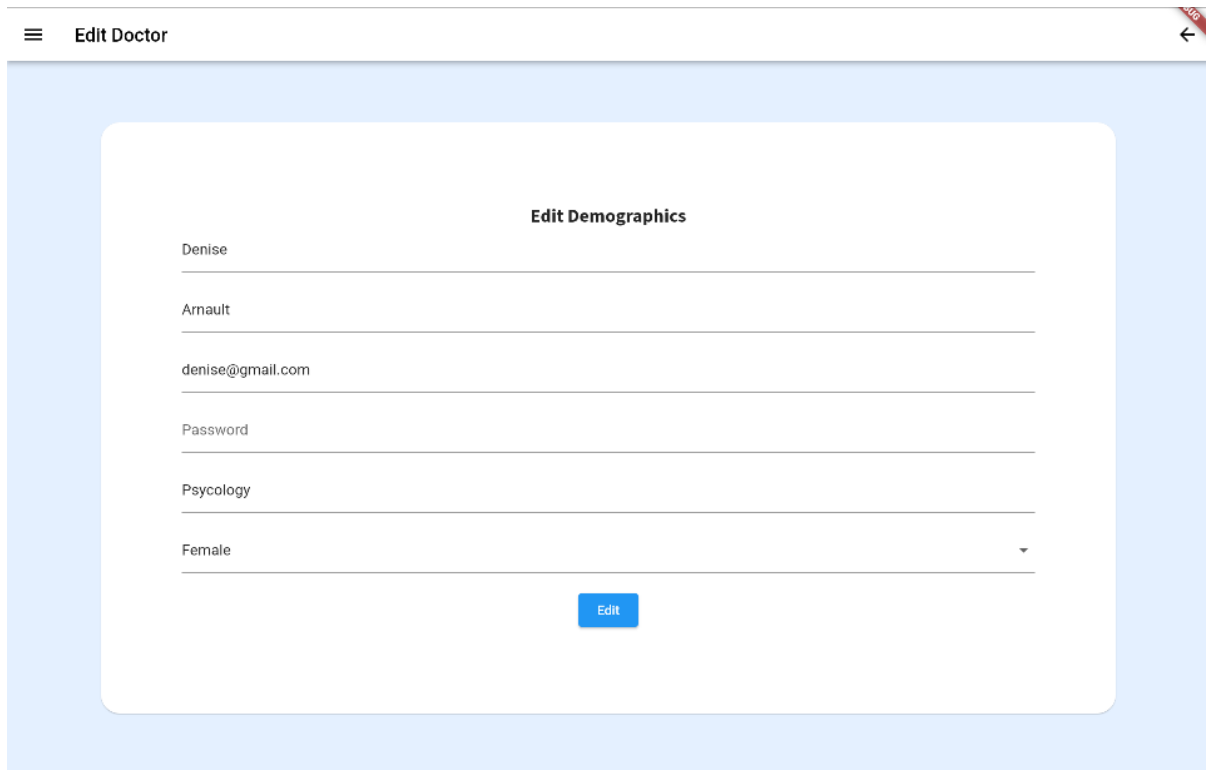
The admin will be asked to complete a form of demographic information for the new trainee when the add interactive button component is chosen. Name, surname, email, password, age, sex, and specialty make up the demographic information.



The screenshot shows a mobile application interface for creating a doctor. At the top, there is a header with a hamburger menu icon on the left, the text "Create Doctor", and a back arrow icon on the right. Below the header is a large white rounded rectangle containing the form. The form is titled "Demographics" in bold. It consists of seven input fields, each with a label to its left: "Name", "Surname", "Email", "Password", "Age", "Specialty", and "Sex". The "Sex" field is a dropdown menu. At the bottom center of the form is a blue button with the text "Sign Up".

Figure 42. Creating a Medical Professional

Similar forms will be presented to the user when the edit interactive button component is chosen so they can edit the demographic data that has already been entered.



The screenshot shows a mobile application interface for editing a doctor's profile. At the top, there is a header with a hamburger menu icon, the text "Edit Doctor", and a back arrow icon. The main content area is a white rounded rectangle with a light blue background. Inside, the title "Edit Demographics" is centered. Below the title, there are several input fields: "Denise", "Arnault", "denise@gmail.com", "Password", "Psychology", and "Female" (which is a dropdown menu). At the bottom center of the form is a blue "Edit" button.

Figure 43. Editing a medical professional

Lastly, if the delete interactive button component is used, the user can delete the particular trainee they choose.

6.6 Questionnaires

When the user presses the “Questionnaires” component they will be presented with a list of the available sessions that each of the users have supervised. Then, the user can select any of the existing sessions, and the new tab that will appear will have the available questionnaires so the user can either edit them or answer any of them that were not answered during the eCeni session.

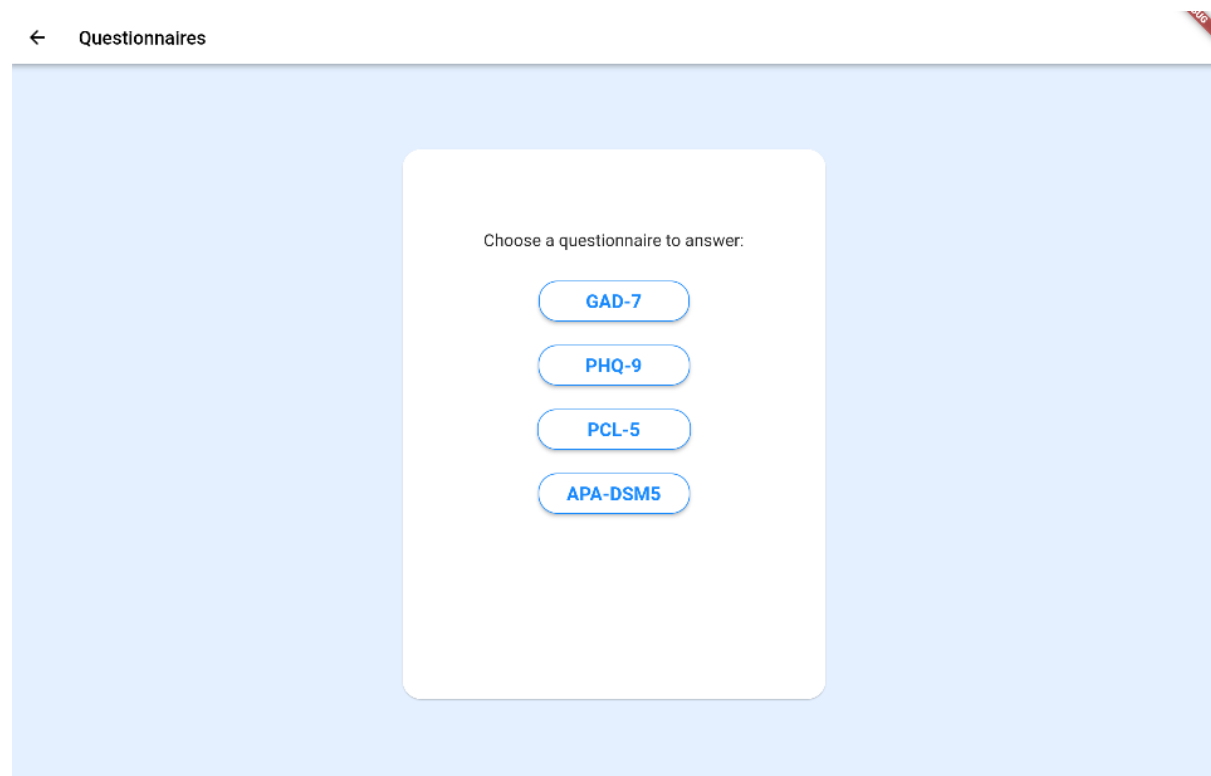


Figure 44. Questionnaires options

Once the user selects a questionnaire the system will navigate them to the digitalized version of the questionnaire that can be answered by tapping on the radio button with the answer that they want. At the bottom of the screen, a “Submit” button is located that when pressed takes the answers and inserts them into the database so they will be saved for future use.

← GAD_7 About

Question 1/7
Feeling nervous, anxious or on edge

Not at all

Several days

More than half the days

Nearly every day

Question 2/7
Not being able to stop or control worrying

Not at all

Several days

More than half the days

Nearly every day

[Submit](#)

Figure 45. Answering a questionnaire

When the "About" button in the top right corner of the screen is clicked, it will display a detailed PDF version of the existing questionnaire. The PDF will show the user the prototype questionnaire and will also provide valuable information about what the results of each questionnaire mean.

← GAD_7.pdf 1 of 1 < >

GAD-7 Anxiety

Over the last two weeks, how often have you been bothered by the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid, as if something awful might happen	0	1	2	3

Column totals ____ + ____ + ____ + ____ =

Total score ____

Figure 46. PDF instructions of a questionnaire

6.7 Statistics

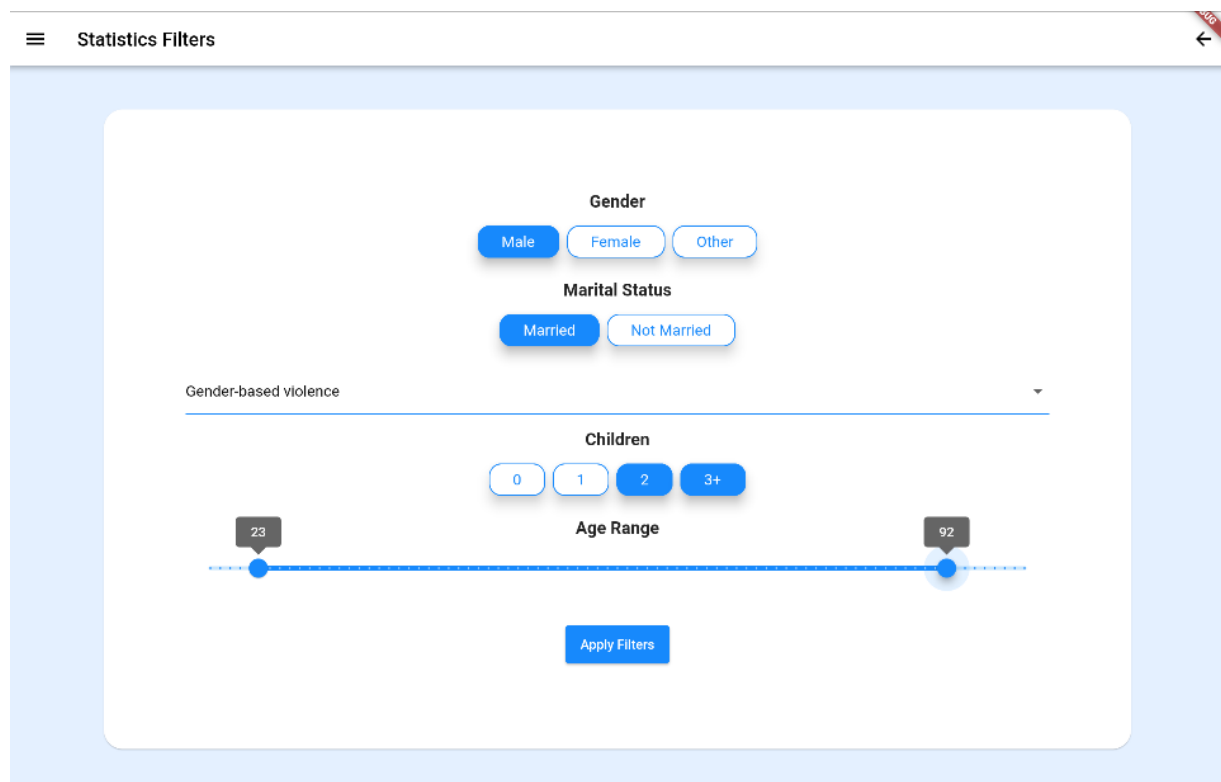


Figure 47. Statistics Filter Page

When the statistics component is pressed on the main screen the user will be redirected to the Statistics filters tab. A filter window will be shown to the medical professional, from which they can select the age group, sex, marital status, children, and trauma type that they wish to concentrate on. They can use the “Apply Filters” button component to view the statistics of their participants thus far after entering the desired information. When the button is pressed the system will meet the required filters the user requested and the application will be presented with a column chart for each of the questionnaires. The chart depends on the participants and the results of each questionnaire.



Figure 48. Statistics Results

6.8 eCeni Sessions

When the medical professional chooses this component they will be presented with two options, either see the existing list of sessions or start a new eCeni session.

Sessions Lists:

If the user selects this component they will be presented with a list of all the eCeni session results that they have completed thus far. From this tab, the user can choose to see the results of a session they have concluded.

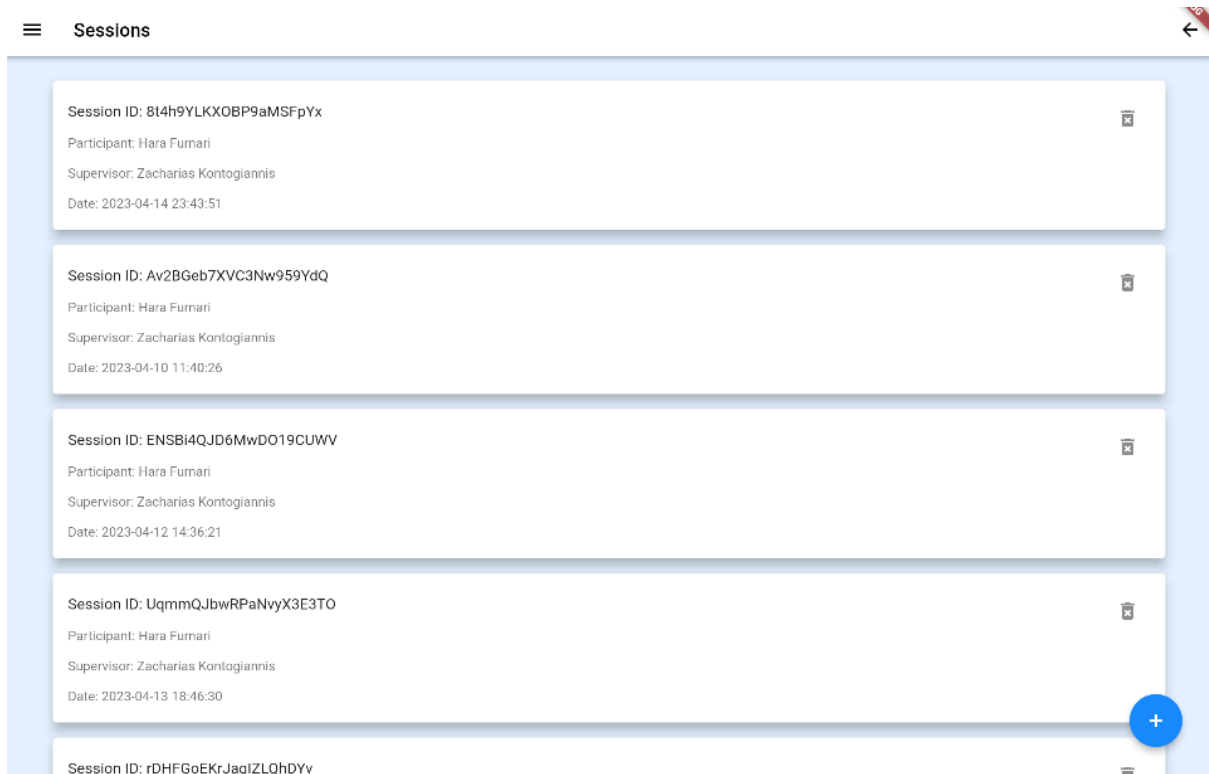


Figure 49. Sessions list

New Session:

When this button is pressed the user will see a list of the existing participants. From this list, they can choose a participant to start a new interview with.

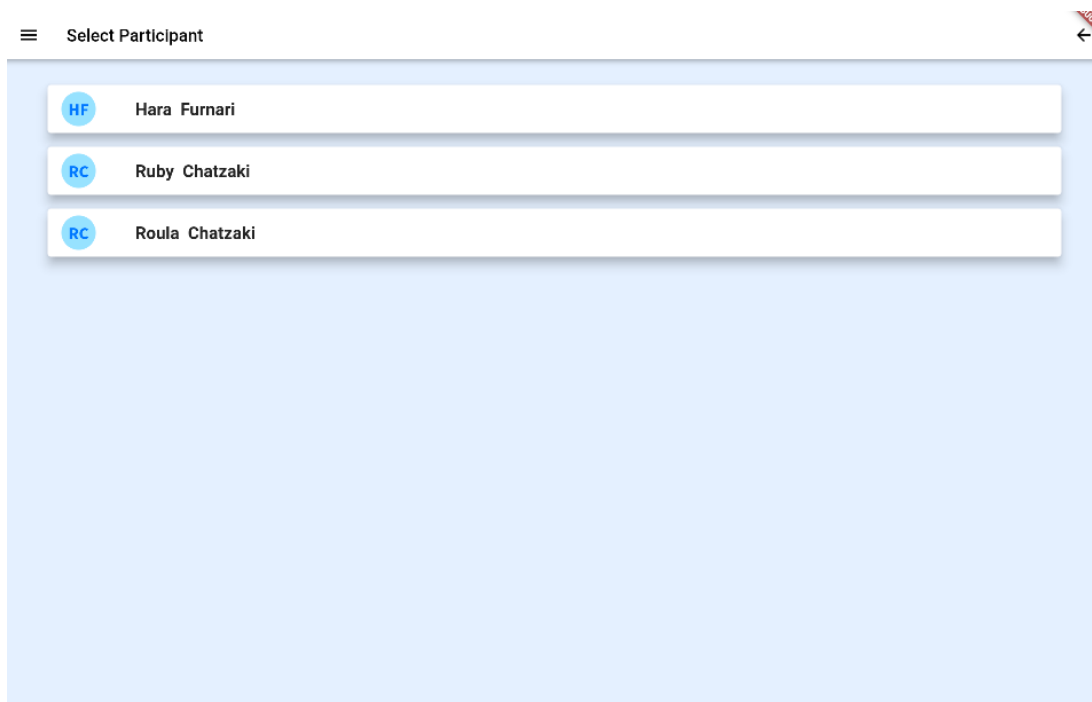


Figure 50. Selecting a participant for an eCeni session

After that, a new tab will be presented to the medical professional. In this tab, the user will have three choices. They can either complete the necessary questionnaires, start a new eCeni session or give the device to the participant so they can test the canvas and the pen to make themselves comfortable during the interview.

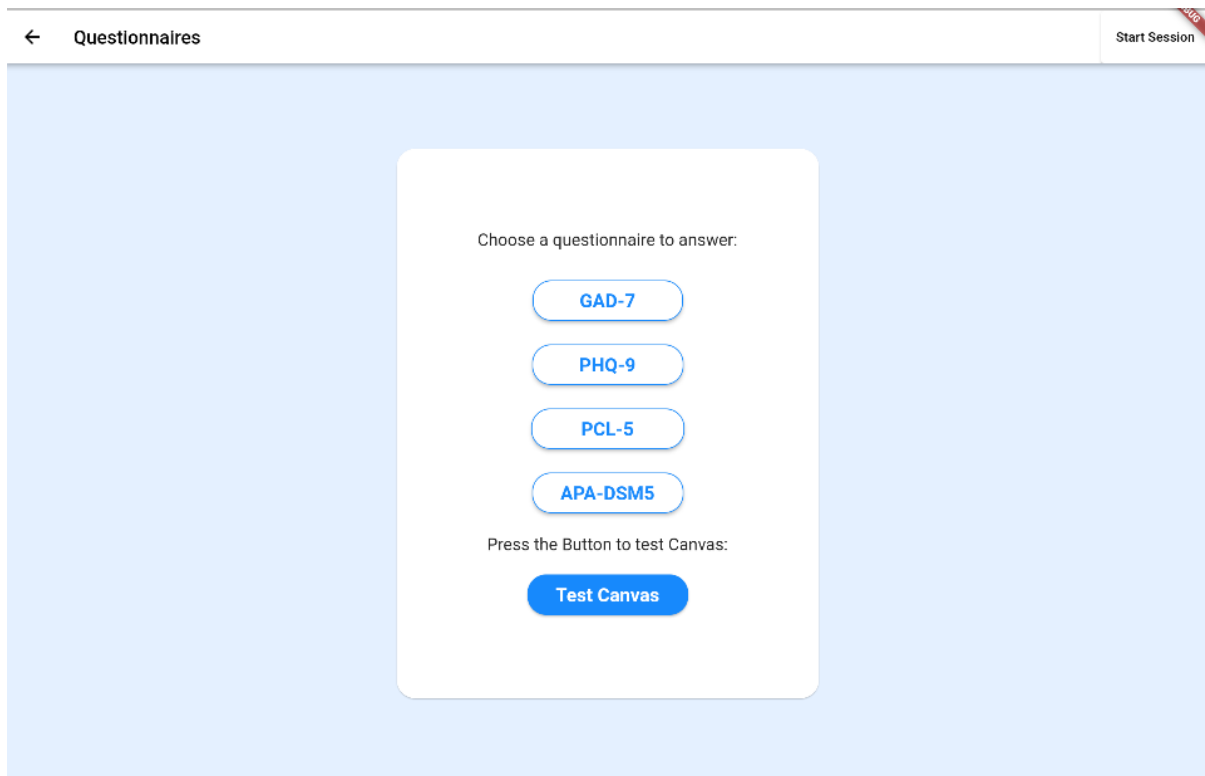


Figure 51. First page before starting the eCeni session

When the medical professional will press the “Start Session” button a new one will open with an alert dialog asking for permission to allow the device to use the microphone so the application can record sound for the video.

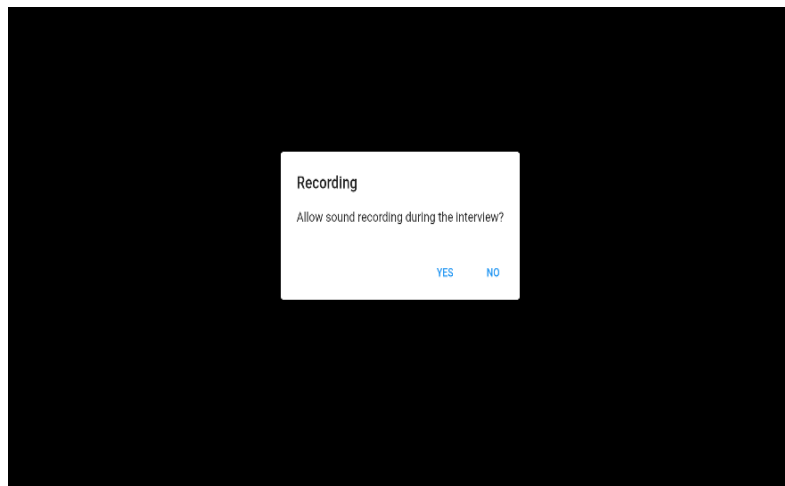


Figure 52. Alert Dialog for allowing sound

After the user pressed any button another alert dialog will appear before the user this time asking for permission to start recording the screen.

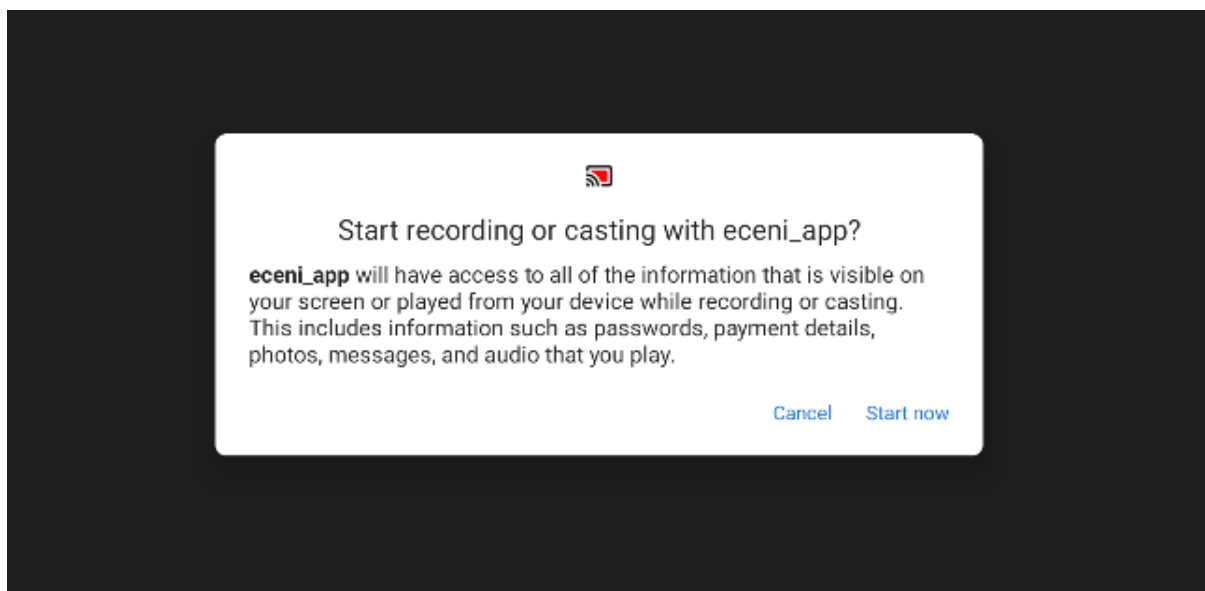


Figure 53. Pop-up window to start screen recording

After that, the first stage of the eCeni session will start. An empty canvas will appear on the screen, at the top right corner there is a “Next Step” button the user will press after they are done with the Social Network stage of the interview. Additionally, there are two extra buttons at the right center of the screen. The first button is an undo button that deletes the last move the user did in the canvas and the other one is a clear button that clears the entire canvas.

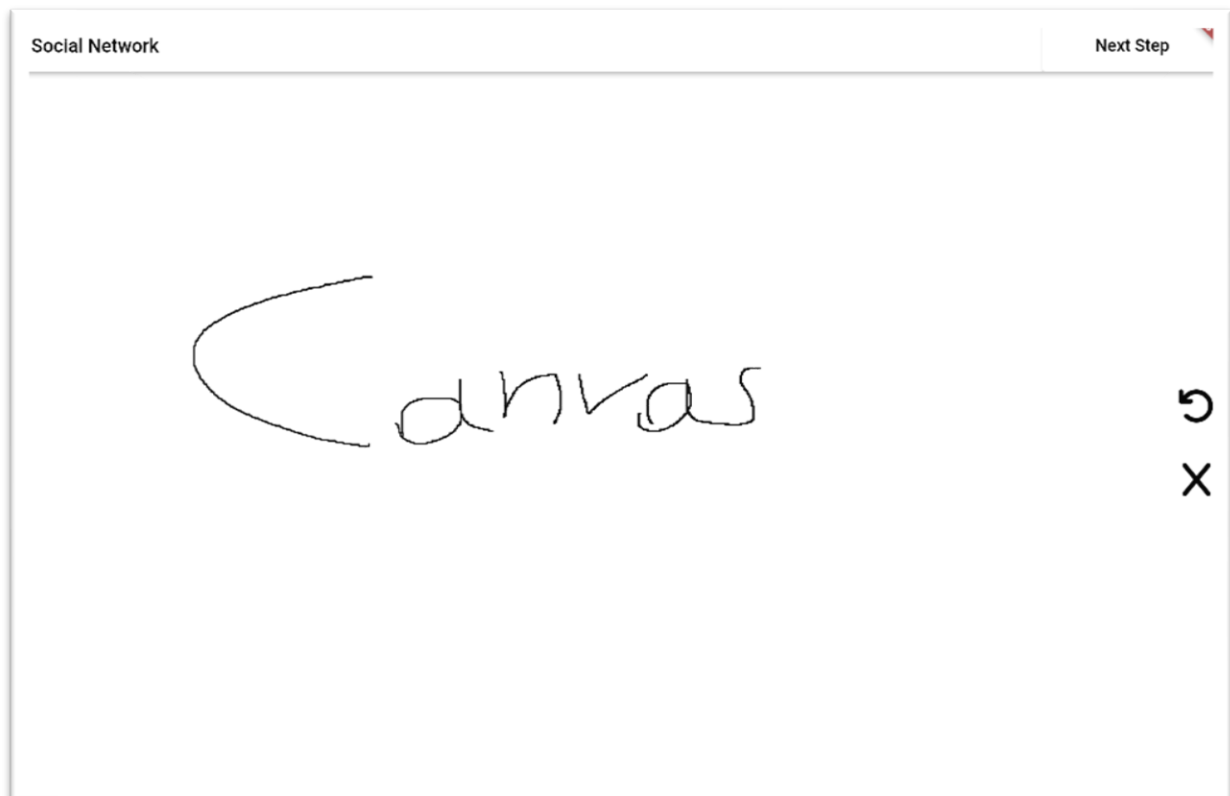


Figure 54. Social Network stage

Pressing the “Next Step” button the user will be presented again with the alert dialog asking the user for permission to record the screen. Then, the Body Map stage will appear on the screen. This stage has the same buttons as the previous stage but this time instead of an empty canvas, the user will see a canvas picture of the front and back of a human body.

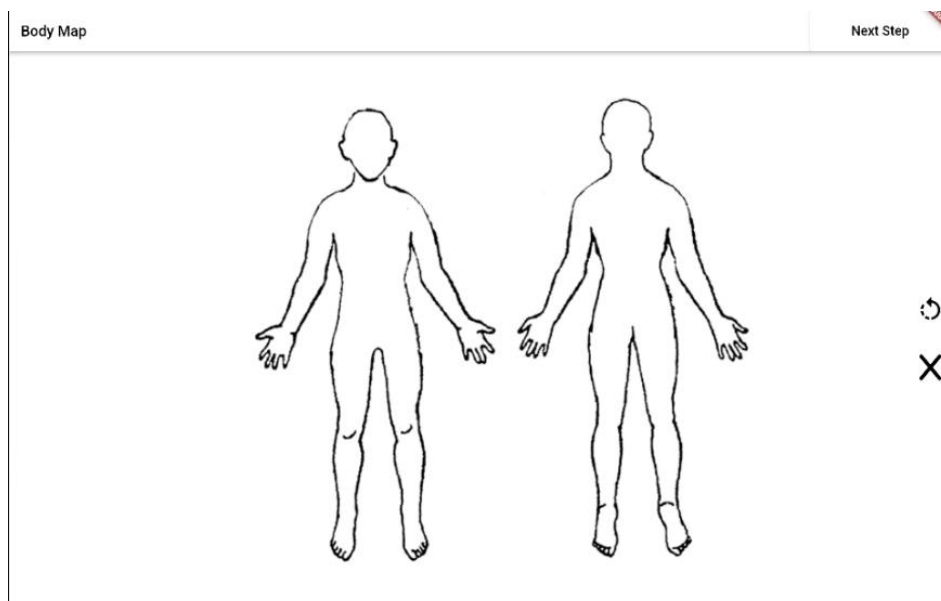


Figure 55. Body Map stage

Like before pressing the “Next Step” button will show the user the same alert dialog for the screen recording. The new screen is a Lifeline canvas with the same buttons as before. The canvas has a straight line that starts with the word “Childhood” and ends with the word “Now”.

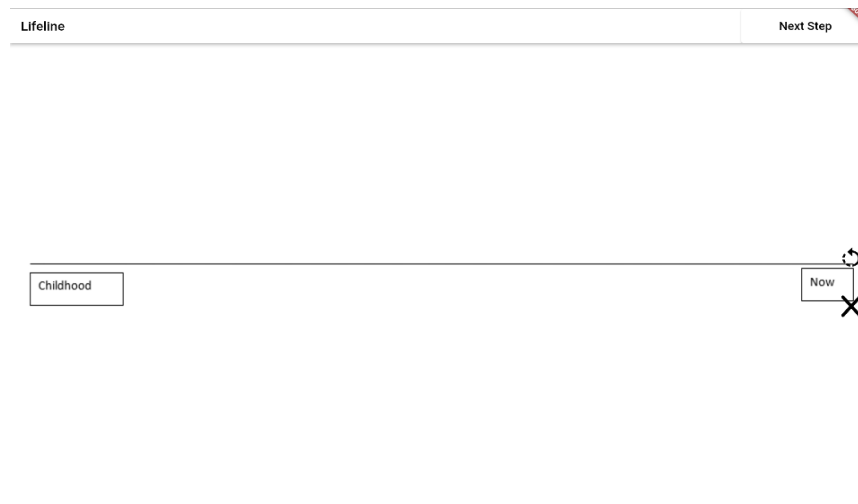


Figure 56. Lifeline stage

The next step of the eCeni session is called card selection. In this step, the participant is presented with a stack of cards with each one representing a different emotion. The participant can either swipe right to indicate that this emotion is “True” for them or swipe left to indicate that this emotion is “Not True” about them. In addition to the swiping feature, the participant can also use the two buttons at the bottom of the screen to indicate the same things.

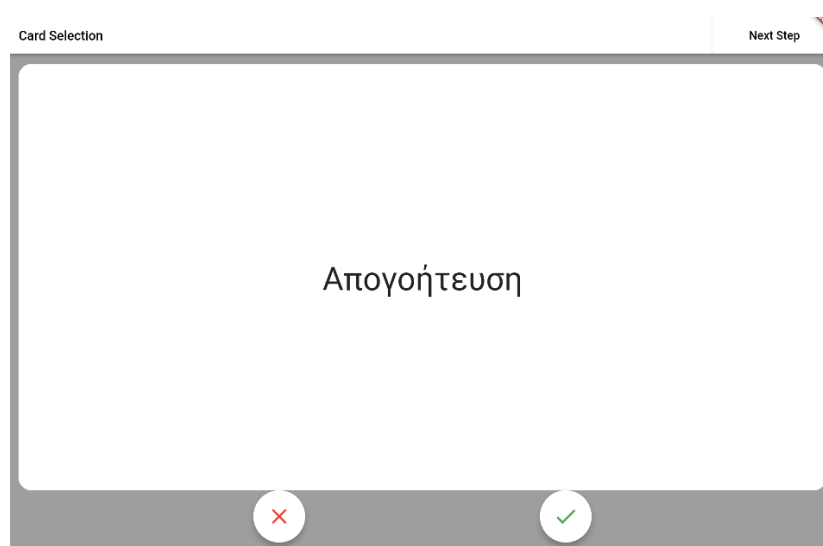


Figure 57. Card Selection stage

The last card of the stack is an empty card where the participant can write a new emotion that the other cards did not cover for him and by pressing the button “Add new emotion” the word that the participant wrote will be inserted into the stack with the “True” emotions.

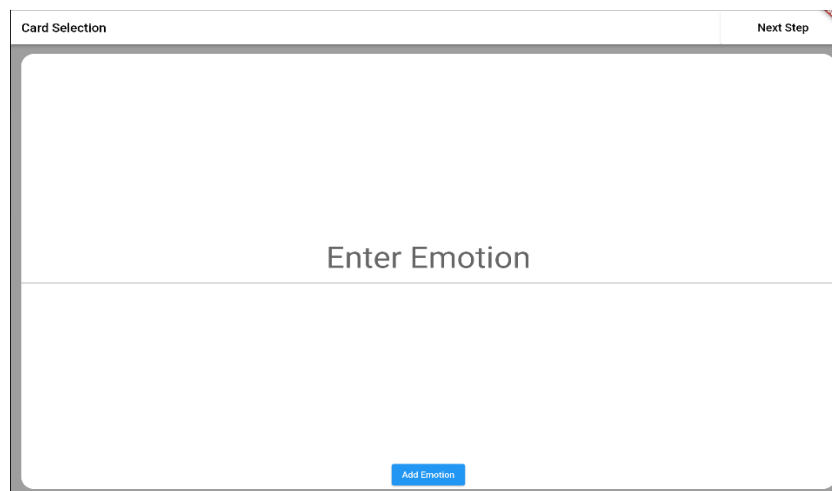
The image shows a screenshot of a web application interface. At the top left, there is a header 'Card Selection' and at the top right, a 'Next Step' button with a red arrow. The main content area is a large white rectangle with a thin grey border. Inside this rectangle, the text 'Enter Emotion' is centered. Below this text, there is a horizontal line. At the bottom center of the rectangle, there is a small blue button with the text 'Add Emotion' in white.

Figure 58. Entering the new emotion

The next stage of the interview is called Card Sorting. In this step, the participant will see two stacks of cards at the bottom of the screen one called “True” that represents the emotions that they chose in the previous stage that was “True” for them and the other called “Not True” that represents the cards that they chose in the previous stage as “Not True” for them. At the top of the screen, the participant will have one empty stack at first with an empty text field on the top of it so they can name it however they like. Next to that empty stack, there is a “+” button that when pressed creates a similar empty container. At the top right of the container, there is an “X” button that when pressed deletes the existing container. The participant can take the cards from the “True” stack and put them in any of the existing containers they want. Cards of the “Not True” stack can only be put in the “True” cards stack and from then they can put them again in the other containers. If the “X” button is pressed while the container had cards in it the system will delete the container and put the cards that were placed in it, at their starting point.



Figure 59. Card Sorting stage

When the participant is done with this stage of the interview they can press the “Check Results” button and which will take them to the last tab of the eCeni session. At this step, the participant and the medical professional will have a better understanding of the choices that the participant made during the Card Sorting part of the interview. At the top right corner of the screen is the “Finish Interview” button that when pressed stops the recording, creates the two different PDFs that we talked about in the Manage Participants subheading of the eCeni application chapter of this thesis, and uploads all of it into the database of the eCeni system.

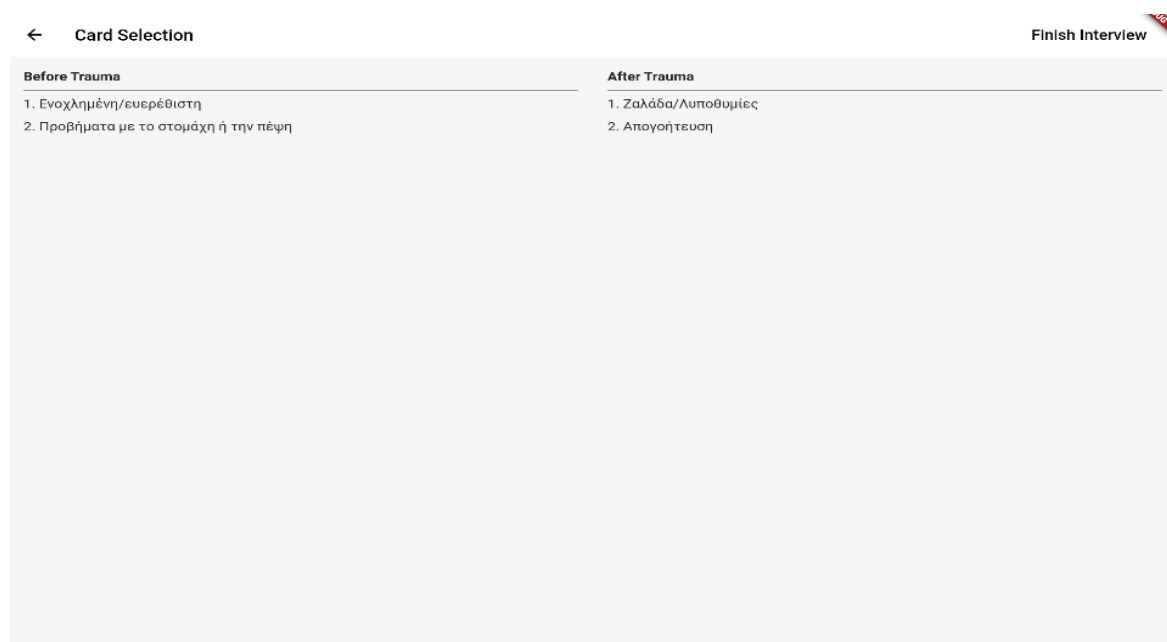


Figure 60. Card Sorting results

7 Conclusion And Future Work

In summary, the development of eHealth services is at its peak nowadays. One of the categories in which applications are classified is that of health. The Google Play Store has more than 8,000 medical apps and the Apple App Store has more than 20,000[25]. These apps are beneficial as much for doctors as are for patients.

This thesis presents the development of an application for Android devices that has as its main objective the creation of the “eCeni” which will help the medical professionals that were practicing the CENI before to have all the data of the sessions that they completed the palm of their hand whenever they need to. It will also make the goal of the CENI easier with the built-in algorithms that the system has. In addition, the application was designed following good design practices.

As the application goes forward it would also be beneficial to make the application even more user-friendly. With the recent advancements in AI technology and AI language model that OpenAI brought to our attention the implementation of an AI such as Chat-GPT would help medical health professionals do their research faster and also provide a way of communication between user and creator.

8 References

- [1] D. Saint Arnault and S. Shimabukuro, "The Clinical Ethnographic Interview: A user-friendly guide to the cultural formulation of distress and help seeking," *Transcult Psychiatry*, vol. 49, no. 2, pp. 302–322, 2012, doi: 10.1177/1363461511425877.
- [2] D. M. S. Arnault, "The use of the clinical ethnographic narrative interview to understand and support help seeking after gender-based violence," *TPM Test Psychom Methodol Appl Psychol*, vol. 24, no. 3, pp. 423–436, Sep. 2017, doi: 10.4473/TPM24.3.8.
- [3] C. G. Fairburn and V. Patel, "The impact of digital technology on psychological treatments and their dissemination," *Behaviour Research and Therapy*, vol. 88. Elsevier Ltd, pp. 19–25, Jan. 01, 2017. doi: 10.1016/j.brat.2016.08.012.
- [4] L. Dennison, L. Morrison, G. Conway, and L. Yardley, "Opportunities and challenges for smartphone applications in supporting health behavior change: Qualitative study," *J Med Internet Res*, vol. 15, no. 4, 2013, doi: 10.2196/jmir.2583.
- [5] K. E. Heron and J. M. Smyth, "Ecological momentary interventions: Incorporating mobile technology into psychosocial and health behaviour treatments," *Br J Health Psychol*, vol. 15, no. 1, pp. 1–39, Feb. 2010, doi: 10.1348/135910709X466063.
- [6] H. E. Payne, C. Lister, J. H. West, and J. M. Bernhardt, "Behavioral functionality of mobile apps in health interventions: A systematic review of the literature," *JMIR mHealth and uHealth*, vol. 3, no. 1. JMIR Publications Inc., Mar. 01, 2015. doi: 10.2196/mhealth.3335.
- [7] "Better-Help – Online Counseling ." Better-Help – Online Counseling (accessed May 25, 2023).
- [8] "Talkspace." <https://www.talkspace.com> (accessed May 25, 2023).
- [9] "Practo." <https://www.practo.com> (accessed May 25, 2023).
- [10] "Epocrates." <https://www.epocrates.com/about> (accessed May 25, 2023).
- [11] "Flutter - Build apps for any screen." <https://flutter.dev> (accessed May 11, 2023).
- [12] "Flutter Screen Recording." https://pub.dev/packages/flutter_screen_recording (accessed May 25, 2023).
- [13] "Flutter Foreground Task." https://pub.dev/packages/flutter_foreground_task (accessed May 25, 2023).
- [14] "Cloud Firestore." https://pub.dev/packages/cloud_firestore (accessed May 25, 2023).
- [15] "Flutter Firebase." https://pub.dev/packages/firebase_database (accessed May 25, 2023).
- [16] "Flutter Open File ." https://pub.dev/packages/open_file (accessed May 25, 2023).
- [17] "Flutter Video Player." https://pub.dev/packages/video_player (accessed May 25, 2023).
- [18] "Flutter Gallery Saver." https://pub.dev/packages/gallery_saver (accessed May 25, 2023).
- [19] "Flutter Syncfusion Charts." https://pub.dev/packages/syncfusion_flutter_charts (accessed May 25, 2023).

- [20] "Visual Studio Code-Code Editing Redefined." <https://code.visualstudio.com> (accessed May 11, 2023).
- [21] "Android Emulator." <https://developer.android.com/studio/run/emulator> (accessed May 11, 2023).
- [22] "Firebase-Firestore." <https://firebase.google.com/docs/firestore> (accessed May 11, 2023).
- [23] "Moqups." <https://moqups.com> (accessed May 12, 2023).
- [24] "S Pen." <https://www.xda-developers.com/galaxy-s22-ultra-s-pen-latency/> (accessed May 23, 2023).
- [25] "Apple app store still leads Android in total number of medical apps." <https://www.imedicalapps.com/2013/07/apple-android-medical-app/> (accessed May 25, 2023).