CardioLink

USER MANUAL

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1. Introduction

1.1 Project Overview

This project is aimed at the development of an application for the telemonitoring of patients with chronic conditions, enabling continuous supervision from their home environment through the use of networking algorithms and physiological sensing technology. By employing BITalino devices, which can acquire ECG (electrocardiogram) and EDA (electrodermal activity) data, the system enables early detection of physiological alterations that may indicate clinical deterioration, allowing faster response and intervention.

When the patients initialize the application, they will be asked to introduce their personal information to create an account or log into an existing one. The patient then will have the option to start recording or to see their previous recordings already checked and filled with their diagnosis by their doctor. If they choose to start a new recording, once they finish, the patient will be required to fill their symptoms from a pre-selected list. After completing all required fields and the monitoring session, the collected data is automatically transmitted to the Server, where it is processed and stored in the system's database together with the date and time of acquisition.

For doctors, after they have launched their application, they gain access to an interactive menu that offers two main functionalities. The first allows them to search for a patient in a list of all patients registered in the system to visualize the personal information of the patient and inspect their medical data in detail, including the full ECG and EDA recordings presented graphically, alongside all symptom information previously reported by the patient. The second allow them to see a list of the recently finished recordings of the patients where he needs to add a diagnosis.

The structure that allows the system to operate efficiently is composed of four independent applications, Patient, Doctor, Administrator and Server, each fulfilling a specific role within the telemedicine workflow. The Server functions as the central component, managing connections from multiple clients simultaneously, storing and retrieving data, and ensuring stable communication. An administrator interface allows authorized users to shut down the Server securely, ensuring controlled operation of the entire system.

1.2 Lists of Actions by Application

The system provides each type of user with a distinct set of actions. In the case of the patient [1], most actions are oriented toward generating or submitting new data to the application, such as creating recordings, adding symptoms, or downloading their health information. In contrast, the doctor's actions [2] are mainly focused on accessing and reviewing the information stored in the server's database, including patient profiles, diagnosis files, and physiological recordings.

Action	Description
Establish connection	Executed when the user inputs both the IP and the port
Register	User press the "register" button and introduces his username, name, surname, password, DNI, birthday, email, sex, phone number, health Insurance number and emergency contact.
Login	User press the "login" button and introduces his username and password.
Make a new recording	User press "record BITalino signal" and BITalino start recording, when stop, patient should introduce his symptoms to complete the diagnosis File creation.

View Personal Health Information	User press “View Diagnosis file” and see his birthday, sex, doctor and recordings.
View a record	User press a recording and visualize all the recording information, the symptoms, the diagnosis of the doctor and his age and sex.
Download diagnosis File	User press “Download File” button and the diagnosis File is download in his PC.
Open a recording	User press “Open recording” button and visualize the graph of the recording at the first 10 seconds
Visualize next 10 seconds of the recording	
Download recording	User press “Download recording” and the data of the ECG and EDA are download in his PC as a .csv
Log out	User press “Log out” button to exit the application.

Table 1. *Actions of Patient*

Action	**Description**
Establish a connection	Executed when the user inputs both the IP and the port
Register	User press the “ Doctor sign up” button and introduces his username, name, surname, password, DNI, birthday, email, sex, specialty and license number.
Login	User press the “login” button and introduces his username and password.

Search patient	User press “Search Patient” button and can visualize a list of all the patients.
Visualize information of a patient	User select a patient of the list to see all his information (name, date of Birth, Insurance number and sex) and his diagnosis History.
View diagnosis Files	User selects a diagnosis from the diagnosis History list to see all the information of it.
Download diagnosis File	User press “Download File” button and the diagnosis File is download in his PC.
View recording	User press “View Recording” button and visualize the graph of the recording at the first 10 seconds
Visualize next 10 seconds of the recording	User press the fragment he wants to see in the table of fragments.
Download recording	User press “Download recording” and the data of the ECG and EDA are download in his PC as a .csv
Modify recently finished recording	User press “Recently Finished” button and select the record he wants to modify (introduce a diagnosis and medication).
Log out	User press “Log out” button to exit the application

Table 2. *Actions of Doctor*

Action	**Description**
Enter IP address	User introduces the IP address of the server computer and check if it is a valid IP address.

Enter the port number	User introduces the port number of the server computer and check if it is a valid port (between 1024 and 65535 ports).
Close the server	Server is closed, so the application stops working.

Table 3. *Actions of Admin*

2. Installation

To install the applications, you need to have Java 25 installed on your computer (you can download it from here: https://www.oracle.com/es/java/technologies/downloads/). Within the project folder, navigate to the out/artifacts directory and locate the folder containing the JAR file. You will find two files: the .jar file and the run.bat file. If double-clicking the .jar file does not work, we have created an executable run.bat file that allows you to run the program without having to access the command line. Note that the run.bat file will not work unless the .jar file is also downloaded.

On the server, the database is automatically created. However, if you already have the database set up in the out/artifacts directory, the application will connect directly to it. (We highly recommend keeping our database since we have kept recordings the doctor might want to see using our View Recording feature).

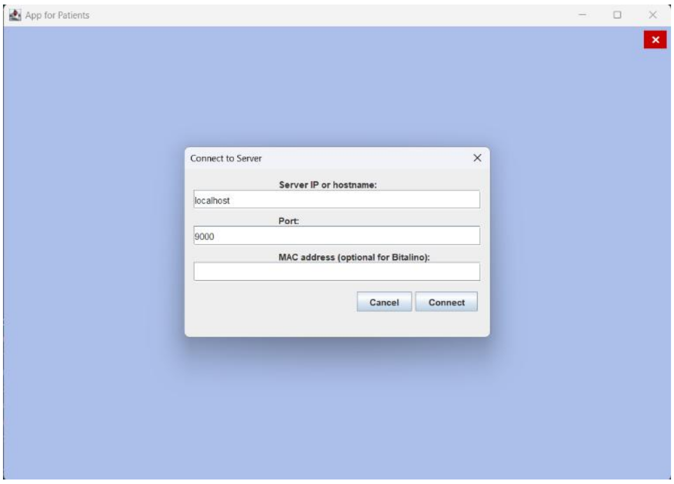
3.Individual Application Manuals

3.1 Server Manual

Server needs to be active so all the users can make their actions.

3.2 Patient Manual

Firstly, the App asks the patient to introduce the server IP, the port and the MAC address of the BITalino. To work, BITalino needs to be connected to the PC.

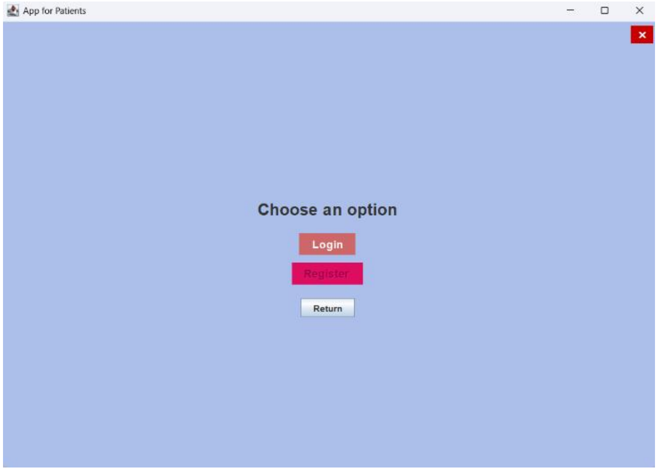


Server IP or hostname: localhost

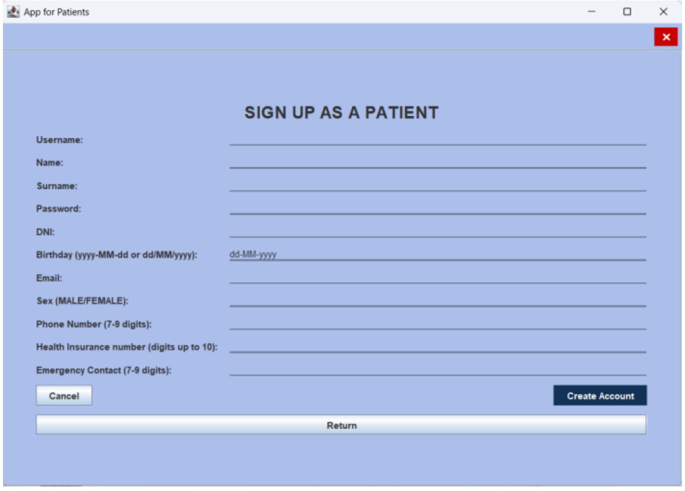
Port: 9000

MAC address (optional for Bitalino):

Then, a new window will appear where the patient has to decide to log in (if he already has an account) or register if not.



If he press to register, he will have to introduce all his data to create a new account.



SIGN UP AS A PATIENT

Username:

Name:

Surname:

Password:

DNI:

Birthday (yyyy-MM-dd or dd/MM/yyyy): dd-MM-yyyy

Email:

Sex (MALE/FEMALE):

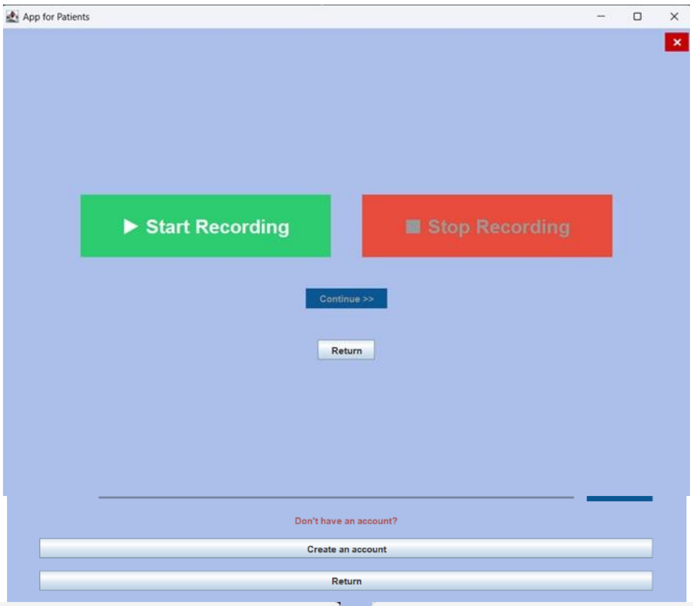
Phone Number (7-9 digits):

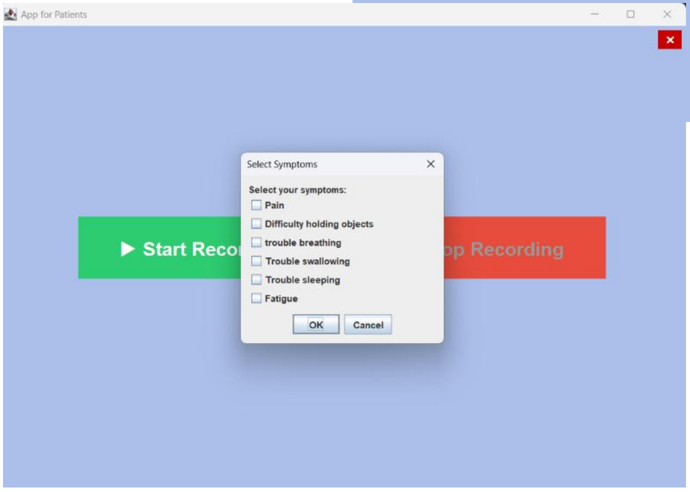
Health Insurance number (digits up to 10):

Emergency Contact (7-9 digits):

When his account is created, he has to log in by introducing his username and password.

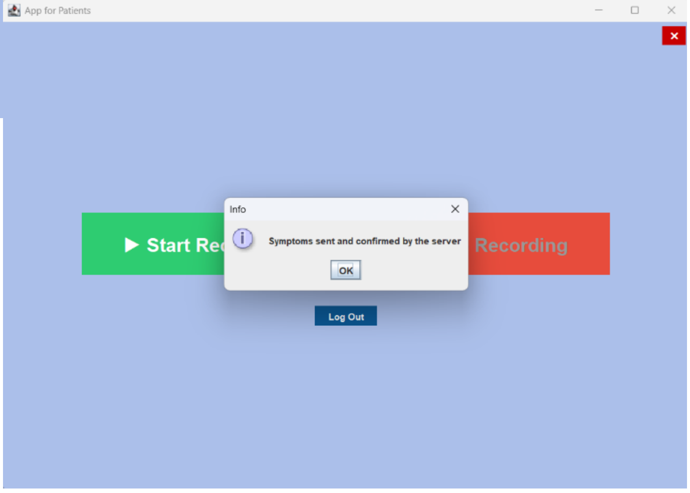
A new window appears to record the signal. To start the recording, patient need to press the green button and to finish it, the red one.





Select your symptoms:

☐ Pain
☐ Difficulty holding objects
☐ trouble breathing
☐ Trouble swallowing
☐ Trouble sleeping
☐ Fatigue

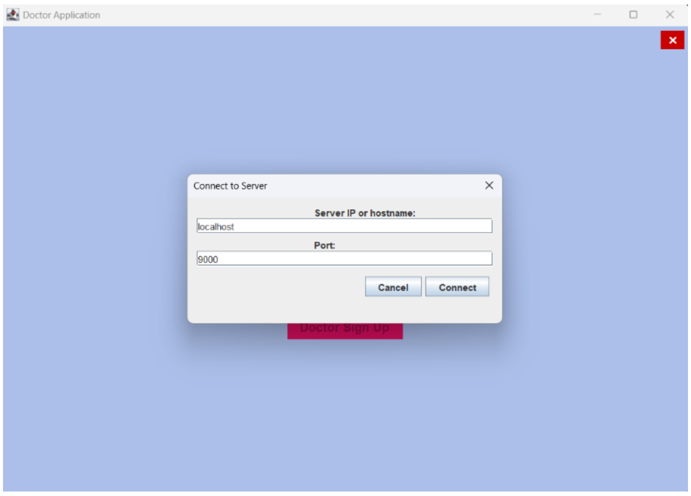


Symptoms sent and confirmed by the server

When the recording is finished, a window to select the symptoms appears. Patient need to select the ones that suffer and press “Ok” button, then a confirmation message appear.

3.3 Doctor Manual

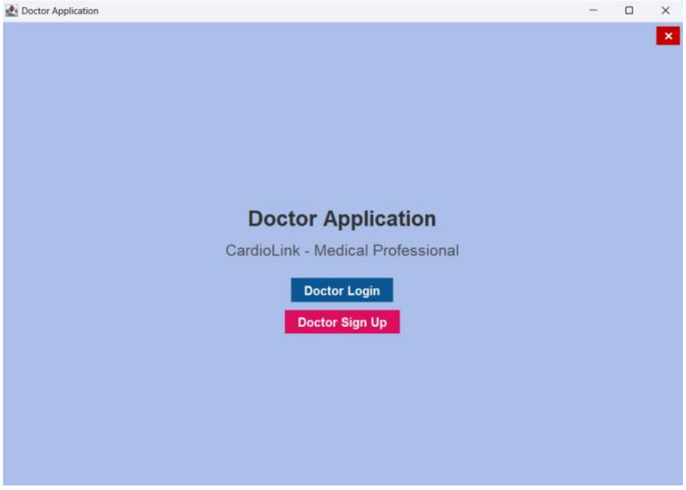
Firstly, the App asks the doctor to introduce the server IP and the port.



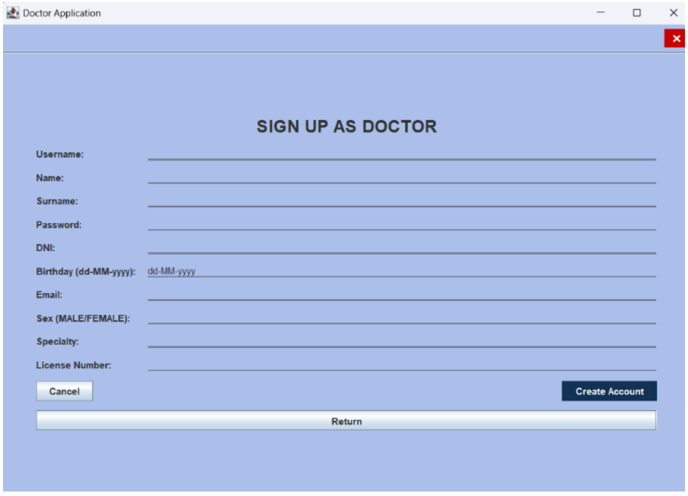
Server IP or hostname: localhost

Port: 9000

Then, a new window will appear where the doctor has to decide to log in (if he already has an account) or register if not.



If he needs to create an account, doctor should press "Doctor Sign Up" and fill all his information. The application automatically makes the log in.



Username:

Name:

Surname:

Password:

DNI:

Birthday (dd-MM-yyyy): dd-MM-yyyy

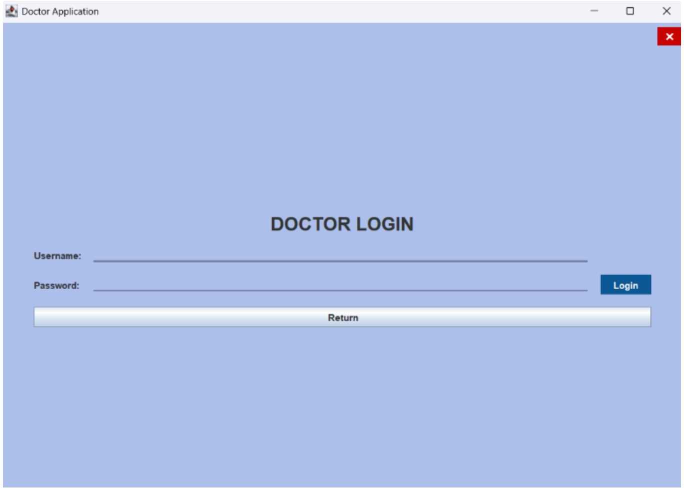
Email:

Sex (MALE/FEMALE):

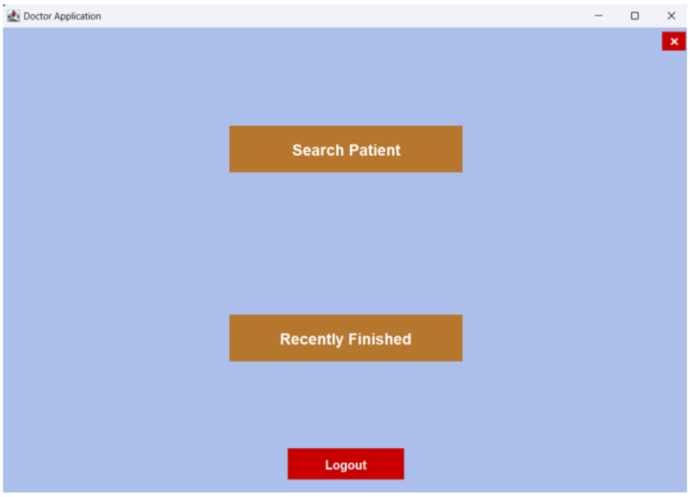
Specialty:

License Number:

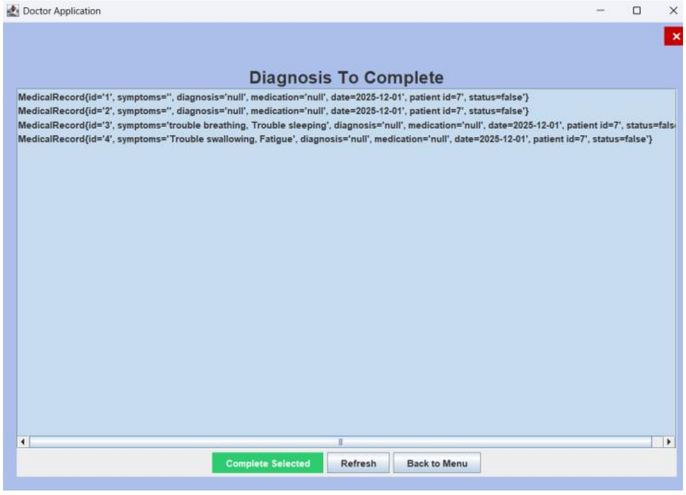
If doctor wants to login, he needs to press the "Doctor Login" button and introduce his username and password.



A new window appears; where the doctor can choose to search for a patient, see the recently finished recordings that he has to actualize with his diagnosis or log out.

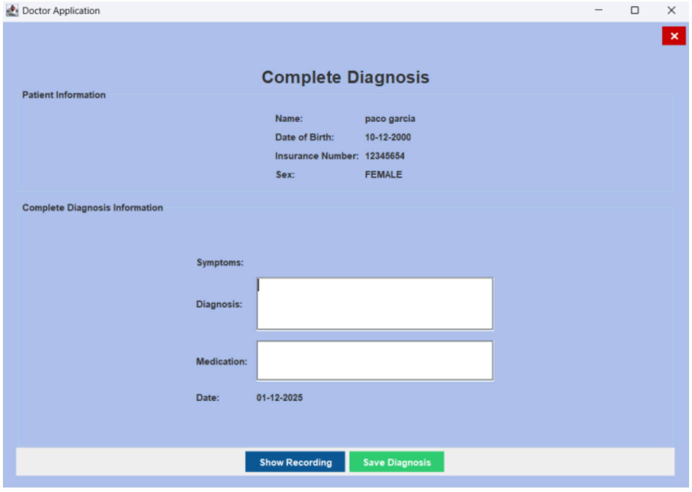


When pressing “Recently Finished” button, a list of diagnosis that need to be modified appears. The doctor needs to select the one he wants to fill and press “Complete Selected”.



```
MedicalRecord{id='1', symptoms='', diagnosis='null', medication='null', date=2025-12-01', patient id=7', status=false'}
MedicalRecord{id='2', symptoms='', diagnosis='null', medication='null', date=2025-12-01', patient id=7', status=false'}
MedicalRecord{id='3', symptoms='trouble breathing, Trouble sleeping', diagnosis='null', medication='null', date=2025-12-01', patient id=7', status=fals
MedicalRecord{id='4', symptoms='Trouble swallowing, Fatigue', diagnosis='null', medication='null', date=2025-12-01', patient id=7', status=false'}
```

Then, a window with all the patient's information appears. The doctor needs to fill the missing information (the diagnosis and the medication).



Complete Diagnosis

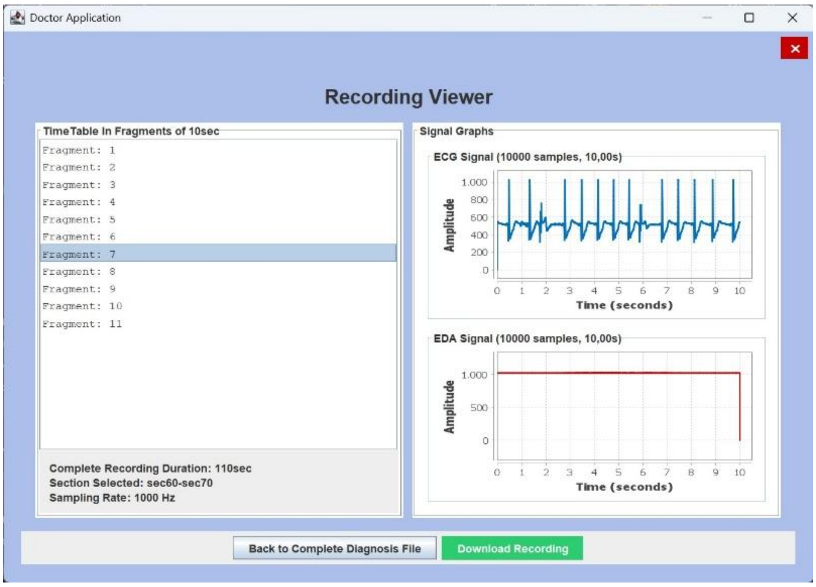
Patient Information

Name: paco garcia
Date of Birth: 10-12-2000
Insurance Number: 12345654
Sex: FEMALE

Complete Diagnosis Information

Symptoms:
Diagnosis:
Medication:
Date: 01-12-2025

Also, if he wants to see the record, he needs to press the "Show recording" button and a window with the signal graphs, a table with the fragments of 10 seconds and the rest of information of the recording. If doctor wants to see another fragment, he has to select a fragment, and the graphics and information will be actualized.



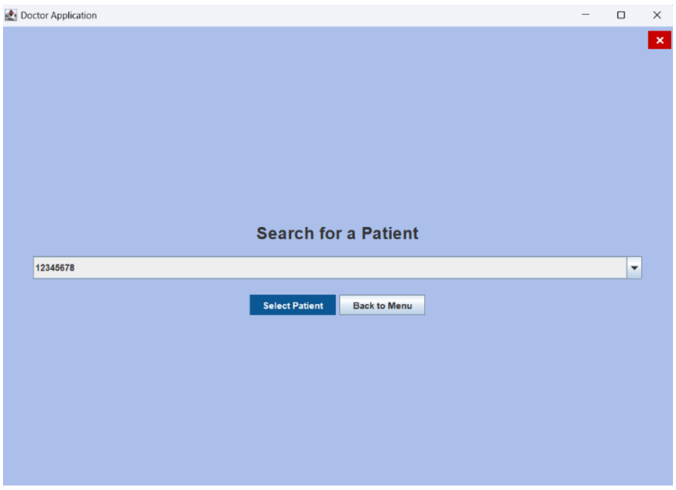
Recording Viewer

TimeTable In Fragments of 10sec

```
Fragment: 1
Fragment: 2
Fragment: 3
Fragment: 4
Fragment: 5
Fragment: 6
Fragment: 7
Fragment: 8
Fragment: 9
Fragment: 10
Fragment: 11
```

Complete Recording Duration: 110sec
Section Selected: sec60-sec70
Sampling Rate: 1000 Hz

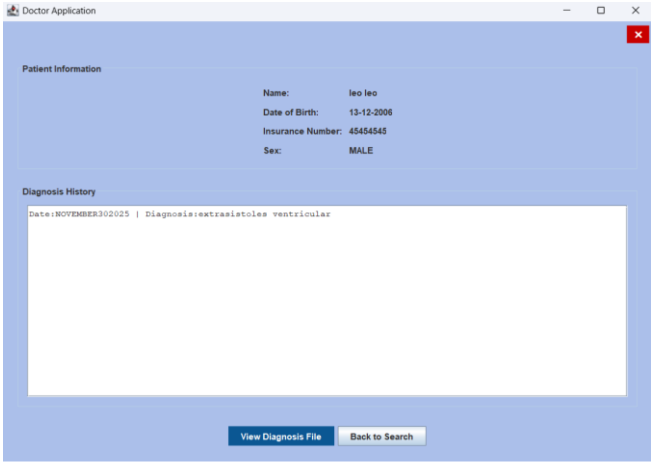
On the other hand, when pressing the “Search patient” button, a new window appears where the doctor needs to select the patient of which he wants to see the information.



Search for a Patient

12345678

Then, a window with all the information of the desired patient will appear. If doctor wants to see one of the diagnosis files, he needs select the desired one and press the “View Diagnosis Files” button.



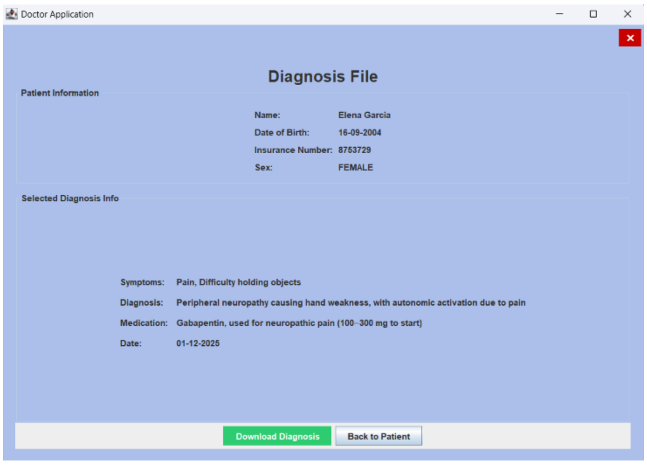
Patient Information

Name: leo leo
Date of Birth: 13-12-2006
Insurance Number: 45454545
Sex: MALE

Diagnosis History

```
Date:NOVEMBER302025 | Diagnosis:extrasistoles ventricular
```

A window with all the information of the diagnosis file selected appears. Doctor can press “Download Diagnosis” button to download it into his PC.



Diagnosis File

Patient Information

Name: Elena Garcia
Date of Birth: 16-09-2004
Insurance Number: 8753729
Sex: FEMALE

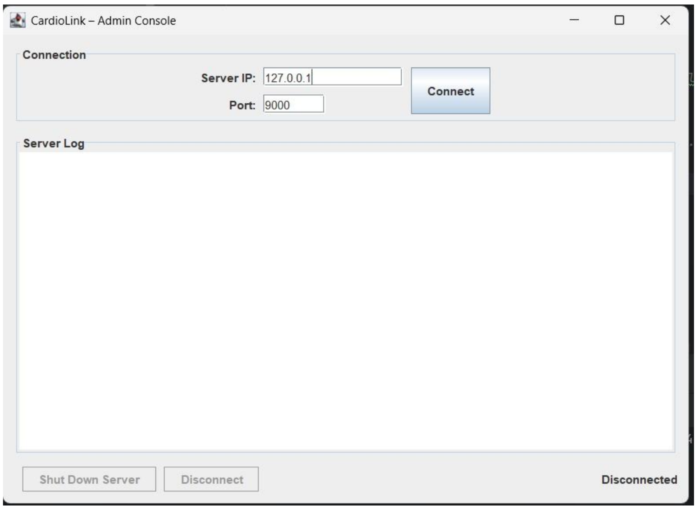
Selected Diagnosis Info

Symptoms: Pain, Difficulty holding objects
Diagnosis: Peripheral neuropathy causing hand weakness, with autonomic activation due to pain
Medication: Gabapentin, used for neuropathic pain (100–300 mg to start)
Date: 01-12-2025

3.4 Administrator’s Manual

This application is intended exclusively for server administrators, which is why no registration or authentication mechanism is required. Access is limited to users who already possess the application. Upon launching it, the administrator simply enters the server’s IP address and port number to establish the connection. Once connected, the administrator is only allowed to either shut down the server or exit the application.

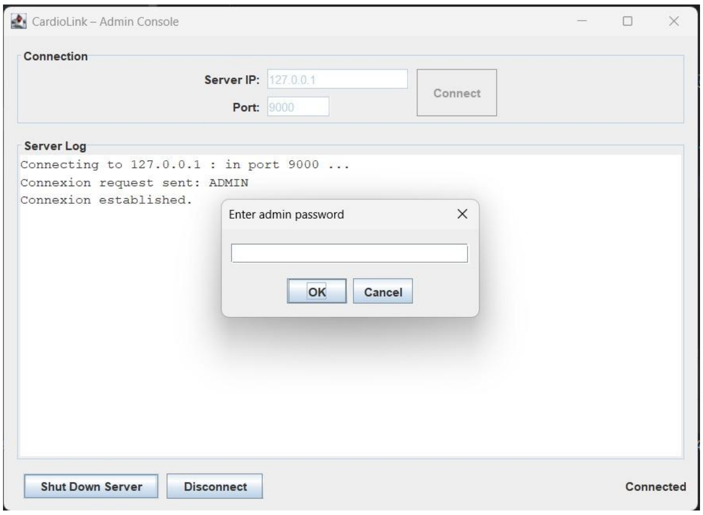
When executing the application, the administrator needs to introduce the server IP and the port and press the “Connect” button to connect. In the bottom right corner will appear “Connected”.



Server IP: 127.0.0.1

Port: 9000

If administrator press the “Shut Down Server” button, a window will appear asking for his password. To correctly shut down server, administrator have to introduce the password and press “ok” button.

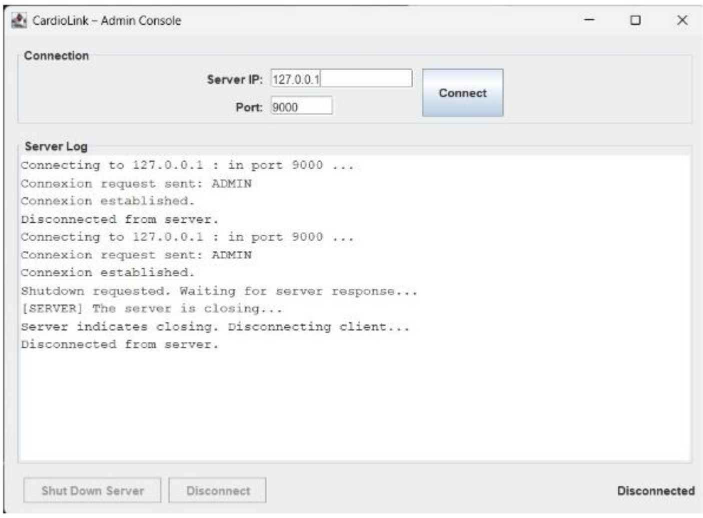


Server IP: 127.0.0.1

Port: 9000

```
Connecting to 127.0.0.1 : in port 9000 ...
Connexion request sent: ADMIN
Connexion established.
```

Then shutting down the server, it automatically disconnects from the application. If not, the administrator should press the “Disconnect” button.



Server IP: 127.0.0.1

Port: 9000

```
Connecting to 127.0.0.1 : in port 9000 ...
Connexion request sent: ADMIN
Connexion established.
Disconnected from server.
Connecting to 127.0.0.1 : in port 9000 ...
Connexion request sent: ADMIN
Connexion established.
Shutdown requested. Waiting for server response...
[SERVER] The server is closing...
Server indicates closing. Disconnecting client...
Disconnected from server.
```

4. Interface

In all three applications developed for this system, the Doctor, Patient, and Administrator interfaces, the graphical user interface was implemented using Java Swing. This framework was selected because it provides a robust, platform-independent set of components that allow us to build consistent, responsive, and easily maintainable interfaces across the different clients. Its event-driven architecture facilitated clear interaction handling between the user and the underlying network logic, ensuring reliable communication with the server in every module.