

A MONITORING APPLICATION FOR PATIENTS WITH MOOD DISORDERS

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1 INTRODUCTION

1.1 Bipolar and depressive disorders

Bipolar disorder is a chronic and complex mood disorder, that causes unusual changes in a person's mood, energy, sleep patterns, activity levels and concentration. The mood of a subject affected by bipolar disorder ranges from periods of extremely elated, irritable, energized, impulsive reckless behaviour, decreased need for sleep and increased talkativeness (called *manic episodes*) to extremely sad, indifferent and hopeless periods (known as *depressive episodes*). On the bipolar spectrum, bipolar depression is the main cause of morbidity in patients with bipolar disorder. It is often diagnosed during late adolescence (teen years) or early adulthood.

Depressive disorder (known as *depression*) is a common mental disorder. The symptoms are quite like the *depressive episodes* for people affected by bipolar disorder. Additionally, they include poor concentration, suicidal thoughts, disrupted sleep, changes in appetite or weight, feeling of excessive guilt or low self-worth, and tiredness.

Both bipolar and depressive disorders can also include *anhedonia*, which is the inability to experience pleasure and the lack of interest in almost all activities.

1.2 Aim of the work

Mood disorders, such as depression and bipolar disorder, are chronic long-term conditions that can have a significant impact on a person's daily life, affecting their mood, energy levels, and their ability to carry out even simple daily tasks. They can appear during adolescence and persist, possibly becoming more severe and disabling with aging. For these reasons it is better to start an efficient therapy as soon as possible.

While the right therapy and medication treatment are of critical importance for the management of these conditions, ongoing monitoring is often necessary to ensure that the patient is following through the therapy on a daily basis and is able to manage the symptoms in a proper way.

Our project aims to develop a monitoring system in the form of a mobile phone's application, that directly connects patients with their psychiatrist, giving them different tools to ease their interactions and facilitate the acquisition and storage of data useful for the follow-up of the disease. Since the data involved are sensible, this application should be for clinical usage only. Moreover, we considered as a possible user in the system the figure of a caregiver, who could be a family member or a key friend of the patient. The role of the caregiver is to support the patient in using the system, contribute to the continuous monitoring of their medical data and write personal observations directly to the psychiatrist.

The system provides a way to track parameters acquired at home with wearable devices or mobile phone, allowing the physician to monitor the trend of the patient's data during their daily routine, in addition to clinical exams.

Furthermore, the system provides several features that help the patient improve symptoms management, for example by compiling weekly questionnaires or writing a diary and increase treatment adherence through daily medication reminders. They will also be able to book appointments with the psychiatrist, check their therapy, read psychoeducational content, and directly call psychological support numbers.

All these features have the ambition of not only helping the patient in therapy and symptoms' management, but also of supporting the psychiatrist in making more informed therapy decisions and adjust treatment plans as needed, potentially increasing the effectiveness of the regimen. Moreover, we expect that the system can help the specialist in improving the workflow efficiency, by speeding up the communication with the patient thanks to the notes system, and by enhancing the process of appointment booking.

Lastly, a critical role in our system will be played by the technical administrator. This figure will have significant responsibilities in the maintenance and development of the system, as well as in assisting the other users with technical support, checking and registering new psychiatrists' profiles, and uploading the educational content proposed by the psychiatrist.

Ultimately, the use of a continuous monitoring system for patients affected by mood disorders has been shown to be an effective tool for improving treatment outcomes. Moreover, the system empowers patients to take a more active role in their care, providing valuable insights into their condition and enabling psychiatrists to take more effective and tailored decision on the therapy plans.

1.3 Assumptions

The app comprises three types of user profile: Psychiatrist, Patient and Caregiver.

The psychiatrist profile needs to be verified by the technical administrator to be registered on the app.

Each patient is associated with one psychiatrist and one caregiver, who is a patient's family member. Each caregiver is associated with only one patient, to improve monitoring efficiency and help the patient in relying on their caregiver. On the contrary, the psychiatrist can be in contact with more than one patient and caregiver. In order to avoid an excessive burden on the psychiatrist, the patient is allowed to send notes only to the caregiver, who will then decide if it is necessary to inform the psychiatrist. For the same reason, the patient can book a visit only after the request of the doctor.

1.4 Considered parameters

1.4.1 At home

Parameter	Mean	Insertion mode	Frequency
Heart rate	Smartwatch	Automatic	Daily
Heart rate variability	Smartwatch	Automatic	Daily
Sleep quality	Smartwatch	Automatic	Daily
Height	Meter	Manually	Monthly
Weight	Scale	Manually	Weekly
BMI		Automatic	Weekly
Activity level	Smartwatch	Automatic	Daily
Questionnaires	PHQ-9, QLESQ and MMAS-8	Manually	Weekly
Blood pressure	Blood pressure monitor	Manually	Weekly
Oxygen saturation	Smartwatch	Automatic	Daily

1.4.2 Professional measurements

Parameter	Mean	Insertion mode	Frequency
ECG parameters	Holter	Manually	Psychiatrist's decision
Blood pressure	Sphygmomanometer	Manually	During visit
Height		Manually	During visit
Weight		Manually	During visit
Cardiac Auscultation	Textual description	Manually	During visit
Medical report	Textual description	Manually	During visit
Blood exam		Manually	Every two months

2 TEXTUAL DESCRIPTIONS

2.1 General User¹

TITLE: LOG IN PROCESS	
PRECONDITION:	The user is already registered
POSTCONDITION:	The user is logged in
MAIN SUCCESS SCENARIO	
1 The user provides e-mail and password 2 The SW checks the inserted data and authenticates the user	
ALTERNATIVE SCENARIO	
2 a) Wrong password or e-mail 1. The app displays an error message; the use case ends b) The user forgot the password 1. The user clicks on "Forgot Password?" 2. The SW sends an e-mail to the user with a "Change password here" link 3. The user clicks on the link 4. The user inserts a new password twice 5. The SW verifies the two passwords are equal 6. The new password is set; the use case ends	

TITLE: LOG OUT PROCESS	
PRECONDITION:	The user is logged in
POSTCONDITION:	
MAIN SUCCESS SCENARIO	
1 The user clicks the "Log out" option 2 The SW logs the user out	
ALTERNATIVE SCENARIO	
1 a) The user exits the app 1. Return to step 2	

¹ Includes those textual descriptions which are common to patient, psychiatrist and caregiver.

TITLE:	MANAGE PROFILE
PRECONDITION:	The user is logged in
POSTCONDITION:	The SW displays the updated version of the "Personal information" section
MAIN SUCCESS SCENARIO	<ul style="list-style-type: none"> 1 The user accesses the "Personal information" section 2 The user selects the information to update 3 The user saves the changes
ALTERNATIVE SCENARIO	<ul style="list-style-type: none"> 3 a) The user exits the personal area without saving; the use case ends

TITLE:	TECHNICAL ASSISTANCE
PRECONDITION:	
POSTCONDITION:	The SW sends a notification to the technician
MAIN SUCCESS SCENARIO	<ul style="list-style-type: none"> 1 The user selects the "Chat with technician" option 2 The user selects the appropriate category (bugs/advises) and pertinence (home/calendar/list/...) 3 The user writes down a comment explaining the problem 4 The user sends the message
ALTERNATIVE SCENARIO	<ul style="list-style-type: none"> 1 a) The user directly calls the assistance; the use case ends

2.2 Patient

TITLE:	REGISTRATION PROCESS
PRECONDITION:	During the first medical visit, the psychiatrist has given the registration personal code to the patient
POSTCONDITION:	The patient is registered
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient accepts the privacy policy of the app 2 The patient chooses the account type (Psychiatrist, Caregiver, Patient) 3 The patient accepts the access request to their position in real time 4 The patient inserts a personal e-mail 5 The patient inserts the registration personal code given by the psychiatrist 6 The SW verifies the existence of the code and identifies the patient associated with it 7 The patient inserts a new password twice 8 The SW verifies the two passwords are equal 9 The SW sends a verification e-mail to the patient 10 The patient inserts the verification code 11 The SW verifies the verification code 12 The patient inserts the phone number 13 The SW sends a verification code to the patient's phone number 14 The patient inserts the verification code 15 The SW verifies the verification code 16 The patient inserts Name, Surname, Sex, Date of birth, Fiscal code and general information about their health² 17 The patient inserts current weight and height 18 The patient is registered
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 1 a) The patient does not accept the privacy policy of the app <ol style="list-style-type: none"> 1. The SW displays an error message; use case ends 3 a) The patient does not give permission to access his position <ol style="list-style-type: none"> 1. The SW displays a message explaining the utility of the position for the emergency signal (MSS "Emergency message") 2. The patient decides if accepting or not the access request; return to step 4 6 a) The code is not present in the database <ol style="list-style-type: none"> 1. The SW displays an error message; return to step 5 8 a) The two passwords inserted are different <ol style="list-style-type: none"> 1. The SW displays an error message; return to step 7 10 a) The patient does not receive any e-mail <ol style="list-style-type: none"> 1. The SW displays a message "Send Verification Code Again" 2. The patient receives the e-mail; return to step 10

² Presence of mental disorders in patient's family, current treatments and medicines, other diseases, allergies.

- b) The patient inserts a wrong verification code
 - 1. The SW displays an error message; return to step 10
 - c) The patient does not receive any e-mail
 - 1. The SW displays a message "Send Verification Code Again"
 - 2. The patient does not receive the e-mail; the use case ends
- 14 a) The patient does not receive any message
 - 1. The SW displays a message "Send Verification Code Again"
 - 2. The patient receives the message; return to step 14
- b) The patient inserts a wrong verification code
 - 1. The SW displays an error message; return to step 14
 - c) The patient does not receive any message
 - 1. The SW displays a message "Send Verification Code Again"
 - 2. The patient does not receive the message; use case ends

TITLE: VISUALIZE MEDICAL PARAMETERS³	
PRECONDITION:	The sensors have acquired the data from the patient
POSTCONDITION:	The patient visualizes the desired information
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient enters the "Medical parameters" section 2 The patient selects the parameter of interest 3 The patient selects the time period of interest 4 The SW displays the data of interest
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 4 a) The data is missing, corrupted or unintelligible <ul style="list-style-type: none"> 1. The SW displays an error message; return to step 2

³ The medical parameters are the data coming from sensors, the ones inserted by the caregiver (blood pressure, weight...) and the questionnaire score.

For the data acquired by the sensors, we supposed to use the set of sensors present in the smartwatch, which can be directly connected with the app through Bluetooth. The smartwatch is worn by the patient also during the night.

TITLE:	EMERGENCY MESSAGE
PRECONDITION:	The SW has received the data from the sensors
POSTCONDITION:	An emergency message is sent to the nearest hospital
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The SW calculates the heart rate in relation to the activity level of the patient in that moment⁴ 2 The SW finds that the heart rate value is lower or higher than borderline thresholds 3 The SW searches the nearest hospital to the position of the patient 4 The SW sends an alarm message with patient's position and information to the emergency services 5 The emergency services call the patient to check the real seriousness of the situation 6 The patient does not answer the call 7 The emergency services send an ambulance to the patient's position
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 2 a) The SW calculates the heart rate, and it is normal; the use case ends 6 a) The patient answers the call and says he is fine; the use case ends b) The patient answers the call and asks for an ambulance; return to step 7

TITLE:	ANSWER THE QUESTIONNAIRE
PRECONDITION:	The patient is already registered on the SW
POSTCONDITION:	
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient selects the "Questionnaires" section 2 The patient chooses the desired questionnaire 3 The patient answers the first available question 4 The patient goes on to the next question 5 The patient finishes the questionnaire 6 The SW calculates the score of the questionnaire 7 The SW gives message of "Completed successfully"
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 3 a) The questionnaire has already been completed that week <ol style="list-style-type: none"> 1. The SW gives message of "Already completed": questionnaire can't be done again; the use case ends 5 a) The patient exits the questionnaire without finishing⁵ <ol style="list-style-type: none"> 1. The SW saves the inserted answers; use case ends

⁴ Through the activity level value the SW can understand if the patient is lying down, walking or running for example. According to the activity he/she is doing, there will be different thresholds of normal heart rate. Since we have read that depressive disorders are frequently correlated with strokes and cardiovascular anomalies in general, it is important to not underestimate these eventual symptoms.

⁵ The patient has the possibility of completing the questionnaire later on.

TITLE:	BOOK AN APPOINTMENT WITH THE PSYCHIATRIST
PRECONDITION:	The psychiatrist has sent a request for an appointment
POSTCONDITION:	The SW shows the appointment on the psychiatrist's and patient's calendar
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient visualizes the psychiatrist's calendar 2 The patient chooses a date and time slot 3 The SW gives message of "Successfully booked" 4 The SW withdraws the booking permission from the patient⁶ 5 The SW displays the patient's calendar with the appointments booked
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 2 a) The patient selects an occupied slot <ol style="list-style-type: none"> 1. The SW displays an error; return to step 2

TITLE:	CHECK APPOINTMENTS WITH THE PSYCHIATRIST
PRECONDITION:	The patient has booked an appointment with the psychiatrist
POSTCONDITION:	
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient accesses the appointments calendar 2 The patient exits the calendar
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 2 a) The patient selects an appointment <ol style="list-style-type: none"> 1. The patient deletes the selected appointment 2. The SW allows the patient to book another appointment; go to MSS "Book an appointment with the psychiatrist"

TITLE:	VISUALIZE MEDICAL EXAMS RESULTS
PRECONDITION:	The patient is logged in
POSTCONDITION:	The patient views the exam results
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient chooses the "Exams" section 2 The patient selects the desired time period 3 The patient selects the exam from the exams' list 4 The patient views the selected exam
ALTERNATIVE SCENARIO	

⁶ The patient can book an appointment only when requested by the psychiatrist or when he deletes another appointment, and he can book just one time slot.

TITLE:	CHECK PRESCRIPTIONS
PRECONDITION:	The patient is logged in
POSTCONDITION:	The patient visualizes the prescriptions
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient chooses the "Prescriptions" section 2 The patient selects the prescriptions he wants to visualize 3 The patient visualizes the selected prescription
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 2 a) There are no available prescriptions; the use case ends

TITLE:	CHECK THERAPY⁷
PRECONDITION:	The patient is logged in
POSTCONDITION:	The patient visualizes the therapy
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient chooses the "Therapy" section 2 The patient visualizes the therapy
ALTERNATIVE SCENARIO	

TITLE:	DRUG NOTIFICATION
PRECONDITION:	The patient has prescribed to the patient drugs in specific time slots
POSTCONDITION:	
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient receives drug notification at the time specified by the patient 2 The patient takes the medicine and clicks on the notification so it disappears
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 2 a) The patient does not click on the notification <ol style="list-style-type: none"> 1. The SW sends again the notification to the patient after 10 minutes; return to step 2

⁷ For therapy we mean for example the frequency and doses with which the patient has to take his/her drugs, activities he/she can do, like workout, yoga or others, advices for daily routine and so on.

TITLE:	"HOW ARE YOU FEELING TODAY" LINK
PRECONDITION:	The patient logged in for the first time in the day
POSTCONDITION:	The SW saves the answer of the patient
MAIN SUCCESS SCENARIO	<p>The SW displays the message "How are you feeling today?", with five possible answers (1 - very bad, 5 - very good)</p> <ol style="list-style-type: none"> 1 The patient selects the level 2 The SW saves the patient selection
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 2 a) The patient does not want to answer <ol style="list-style-type: none"> 1. The patient selects "I don't want to answer now" link 2. The SW closes the message; the use case ends

TITLE:	DIARY COMPILATION
PRECONDITION:	The patient is logged in
POSTCONDITION:	The SW saves the diary
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient chooses the "Daily diary" section 2 The patient selects the tool he wants to use (Writing, Vocal registration, Drawing) 3 The patient compiles the diary 4 The SW saves the changes
ALTERNATIVE SCENARIO	

TITLE:	VISUALIZE PSYCHOEDUCATIONAL CONTENTS
PRECONDITION:	The patient is logged in
POSTCONDITION:	The patient views the educational content
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient chooses the "Educational articles" section 2 The patient selects the page he is interested in
ALTERNATIVE SCENARIO	

TITLE:	READ NOTES FROM THE PSYCHIATRIST
PRECONDITION:	The psychiatrist has sent a note to the patient
POSTCONDITION:	The psychiatrist receives a confirmation that the patient has read the note
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient receives a notification of a new note from the psychiatrist 2 The patient clicks on the notification and visualizes the note 3 The SW sends the confirmation to the psychiatrist that the patient has read the note
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 2 a) The patient does not click on the notification <ol style="list-style-type: none"> 1. The SW sends again the notification to the patient after 1 hour; return to step 2

TITLE:	READ NOTES FROM THE CAREGIVER
PRECONDITION:	The caregiver has sent a note to the patient
POSTCONDITION:	The caregiver receives a confirmation that the patient has read the note
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient receives a notification of a new note from the caregiver 2 The patient clicks on the notification and visualizes the note 3 The SW sends the confirmation to the caregiver that the patient has read the note
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 2 a) The patient does not click on the notification <ol style="list-style-type: none"> 1. The SW sends again the notification to the patient after 1 hour; return to step 2

TITLE:	SEND NOTES TO THE CAREGIVER
PRECONDITION:	
POSTCONDITION:	The caregiver receives the note from the patient
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient types in the note and send it 2 The SW sends notification to the caregiver
ALTERNATIVE SCENARIO	

TITLE:	CALL PSYCHOLOGICAL SUPPORT NUMBER⁸
PRECONDITION:	
POSTCONDITION:	The patient starts the call
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The patient clicks on the button for immediate psychological support 2 The SW redirects to the telephone call service for starting the call
ALTERNATIVE SCENARIO	

⁸ People affected by depressive disorders often have thoughts about suicide. It is important to give them an easy and quick way to ask for help and be listened.

2.3 Psychiatrist

TITLE:	REGISTRATION PROCESS
PRECONDITION	
POSTCONDITION:	The psychiatrist is registered
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The psychiatrist accepts the privacy policy of the app 2 The psychiatrist chooses the account type (Psychiatrist, Caregiver, Patient) 3 The psychiatrist inserts a personal e-mail 4 The SW sends a verification e-mail to the psychiatrist 5 The psychiatrist inserts the verification code 6 The SW verifies the verification code 7 The psychiatrist inserts a new password twice 8 The SW verifies the two passwords are equal 9 The psychiatrist inserts the phone number 10 The SW sends a verification code to the psychiatrist's phone number 11 The psychiatrist inserts the verification code 12 The SW verifies the verification code 13 The psychiatrist inserts: Name, Surname, Gender, Birthdate, ID Number 14 The SW sends the inserted information to the technical administrator 15 The technician verifies the psychiatrist's personal information and confirms the profile creation 16 The SW sends a "Successfully registered" e-mail to the psychiatrist 17 The psychiatrist is registered
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 1 a) The psychiatrist does not accept the privacy policy of the app <ol style="list-style-type: none"> 1. The SW displays an error message; the use case ends 4 a) The psychiatrist does not receive any e-mail <ol style="list-style-type: none"> 1. The psychiatrist clicks "Send Verification Code Again" link 2. The psychiatrist receives the e-mail; return to step 5 b) The psychiatrist does not receive any e-mail <ol style="list-style-type: none"> 1. The psychiatrist clicks "Send Verification Code Again" link 2. The psychiatrist does not receive the e-mail; return to step 3 6 a) The psychiatrist inserts a wrong verification code <ol style="list-style-type: none"> 1. The SW displays an error message; return to step 5 8 a) The two passwords inserted are different <ol style="list-style-type: none"> 1. The SW displays an error message; return to step 7 10 a) The psychiatrist does not receive any message <ol style="list-style-type: none"> 1. The SW displays a message "Send Verification Code Again" 2. The psychiatrist receives the message; return to step 11 b) The psychiatrist does not receive any message <ol style="list-style-type: none"> 1. The SW displays a message "Send Verification Code Again"

	2. The psychiatrist does not receive the message; return to step 9
12	a) The psychiatrist inserts a wrong verification code 1. The SW displays an error message; return to step 11
15	a) The information given by the psychiatrist are invalid 1. The technician sends "Registration denied" e-mail with the explanation of what went wrong; the use case ends

TITLE:	GIVE REGISTRATION CODE TO THE PATIENT
PRECONDITION:	
POSTCONDITION:	The psychiatrist provides a registration code to the patient
MAIN SUCCESS SCENARIO	<ul style="list-style-type: none"> 1 The psychiatrist selects the option "Generate code" 2 The psychiatrist provides an OTP to the patient, manually or via external services
ALTERNATIVE SCENARIO	

TITLE:	ACCESS THE LIST OF PATIENTS
PRECONDITION:	
POSTCONDITION:	The psychiatrist visualizes the list of patients
MAIN SUCCESS SCENARIO	<ul style="list-style-type: none"> 1 The psychiatrist selects the option "List of patients" 2 The SW displays the list
ALTERNATIVE SCENARIO	<ul style="list-style-type: none"> 2 a) The list of patients is empty 1. The SW displays an error; the use case ends

TITLE:	GIVE FLAG OF PRIORITY TO PATIENTS⁹
PRECONDITION:	The psychiatrist is visualizing the patients list
POSTCONDITION:	The SW displays the updated list
MAIN SUCCESS SCENARIO	<ul style="list-style-type: none"> 1 The psychiatrist assigns/removes the priority flag to/from one of the patients on the list 2 The SW updates the flag status 3 The SW updates the list putting on top the patients with the priority flag
ALTERNATIVE SCENARIO	

⁹ The psychiatrist has the possibility to mark those patients he considers to be in more critical conditions (depending on the exam results and in general the medical data he has access to) and in need to be monitored.

TITLE:	AUTOMATIC ASSESSMENT OF PRIORITY
PRECONDITION:	The patient answered the questionnaire
POSTCONDITION:	The SW assigns a colour to the patient
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The SW compares the questionnaire score to the predefined thresholds 2 The SW highlights the patient's name in green, yellow or red depending on the result of the comparison 3 The SW notifies the doctor about new patients being highlighted in red
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 3 a) No new patients have been highlighted in red; the use case ends

TITLE:	ACCESS A PATIENT'S DETAILS
PRECONDITION:	The psychiatrist is visualizing the patients list
POSTCONDITION:	The patient's page appears
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The psychiatrist chooses a patient from the list 2 The SW displays the personal page of the patient
ALTERNATIVE SCENARIO	

TITLE:	VISUALIZE MEDICAL PARAMETERS OF THE PATIENT¹⁰
PRECONDITION:	The psychiatrist is visualizing a patient's personal page
POSTCONDITION:	The psychiatrist visualizes the desired information
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The psychiatrist enters the "Medical parameters" section 2 The psychiatrist selects the parameter of interest 3 The psychiatrist selects the time period of interest 4 The SW displays the data of interest
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 4 a) The data is missing, corrupted or unintelligible <ol style="list-style-type: none"> 1. The SW displays an error message; return to step 2

¹⁰ The medical parameters are the data coming from sensors, the ones inserted by the caregiver (blood pressure, weight...) and the questionnaire score

TITLE: UPLOAD EXAMS RESULTS	
PRECONDITION:	The psychiatrist is visualizing a patient's personal page
POSTCONDITION:	The SW displays the freshly uploaded exam in the "Exams" section
MAIN SUCCESS SCENARIO	
<ol style="list-style-type: none"> 1 The psychiatrist selects the "Exams" section 2 The psychiatrist specifies the type of exam (ECG, MRI...) 3 The psychiatrist fills in the exam details (name, date, comments...) 4 The psychiatrist selects the file to be uploaded 5 The psychiatrist uploads the file and saves the changes 6 The SW shows a message of "Successful uploading" 7 The SW updates the "Exams" section 	
ALTERNATIVE SCENARIO	
<ol style="list-style-type: none"> 4 a) The file format is not supported <ol style="list-style-type: none"> 1. The SW shows an error message; return to step 4 	

TITLE: ACCESS MEDICAL EXAMS OF THE PATIENTS	
PRECONDITION:	The psychiatrist has selected one of the patients from the list
POSTCONDITION:	The psychiatrist visualizes the medical exams of the selected patient
MAIN SUCCESS SCENARIO	
<ol style="list-style-type: none"> 1 The psychiatrist selects the "Exams" section 2 The psychiatrist selects the time window of interest 3 The psychiatrist inserts the type of exam 4 The psychiatrist selects the exam of interest 	
ALTERNATIVE SCENARIO	
<ol style="list-style-type: none"> 4 a) The psychiatrist wants to access the public health database instead <ol style="list-style-type: none"> 1. The psychiatrist clicks on the link to the external health services 2. The SW redirects the psychiatrist to an external website 	

TITLE: CREATE A NEW PRESCRIPTION	
PRECONDITION:	The psychiatrist has selected one of the patients from the list
POSTCONDITION:	The SW sends a notification to the patient and the caregiver
MAIN SUCCESS SCENARIO	
<ol style="list-style-type: none"> 1 The psychiatrist visualizes the "Prescriptions" section 2 The psychiatrist uploads a new prescription 3 The psychiatrist saves the changes 4 The SW updates the "Prescriptions" section 	
ALTERNATIVE SCENARIO	

TITLE:	DELETE PRESCRIPTIONS
PRECONDITION:	The psychiatrist has selected one of the patients from the list
POSTCONDITION:	The SW sends a notification to the patient and the caregiver
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The psychiatrist visualizes the "Prescriptions" section 2 The psychiatrist deletes one of the prescriptions 3 The psychiatrist saves the changes 4 The SW updates the "Prescriptions" section
ALTERNATIVE SCENARIO	

TITLE:	MODIFY THE THERAPY
PRECONDITION:	The psychiatrist has selected one of the patients from the list
POSTCONDITION:	The SW sends a notification to the patient and the caregiver
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The psychiatrist visualizes the "Therapy" section 2 The psychiatrist modifies the therapy 3 The psychiatrist saves the changes 4 The SW updates the "Therapy" section
ALTERNATIVE SCENARIO	

TITLE:	MODIFY THE CALENDAR¹¹
PRECONDITION:	
POSTCONDITION:	The SW displays the updated calendar
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The psychiatrist visualizes their calendar 2 The psychiatrist updates the time slots availability according to their schedule 3 The SW updates both the psychiatrist's and patients' calendars
ALTERNATIVE SCENARIO	

TITLE:	ASK THE PATIENT TO BOOK AN APPOINTMENT
PRECONDITION:	The psychiatrist has selected one of the patients from the list
POSTCONDITION:	The SW sends a notification to the patient
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The psychiatrist selects the "Request appointment" option 2 The SW enables the patient to book one appointment
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 1 a) The psychiatrist's calendar does not have free slots <ol style="list-style-type: none"> 1. SW shows an error message; the use case ends

¹¹ The psychiatrist can modify his calendar by adding new time slots for all his patients.

TITLE:	CONTACT THE PATIENT
PRECONDITION:	
POSTCONDITION:	The psychiatrist calls the patient
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The psychiatrist selects one patient from the list 2 The psychiatrist selects the option to call the patient 3 The SW redirects the psychiatrist to an external service from which the call starts
ALTERNATIVE SCENARIO	

TITLE:	SEND NOTES TO A PATIENT/CAREGIVER
PRECONDITION:	The psychiatrist has selected one of the patients from the list, or the patient's caregiver
POSTCONDITION:	The SW sends a notification to the target if priority level is high
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The psychiatrist selects the subject of the note 2 The psychiatrist selects the priority level of the note ("High priority" or "Low priority") 3 The psychiatrist types in the note 4 The psychiatrist sends the note
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 4 a) The psychiatrist forgets to insert the priority level of the note <ol style="list-style-type: none"> 1. The SW displays a message "Insert priority level"; return to step 2

TITLE:	READ NOTES FROM THE CAREGIVER
PRECONDITION:	The caregiver has sent a note to the psychiatrist
POSTCONDITION:	The caregiver receives a confirmation of read note by the psychiatrist
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The psychiatrist receives a notification of new note from the caregiver 2 The psychiatrist clicks on the notification and visualizes the note
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 2 a) The psychiatrist does not click on the notification <ol style="list-style-type: none"> 1. The SW sends the notification again after 1 hour; return to step 2

PROPOSE EDUCATIONAL CONTENT	
PRECONDITION:	The psychiatrist is logged in
POSTCONDITION:	The SW saves the new content
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The psychiatrist selects the "Propose educational content" option 2 The psychiatrist uploads the article of interest 3 The SW sends the proposed article to the technician 4 The technician verifies the source of the article 5 The technician accepts the proposed content 6 The SW uploads the proposed content
Alternative scenario	<ol style="list-style-type: none"> 4 a) The proposed article does not respect the system guidelines <ol style="list-style-type: none"> 1. The technician refuses the proposed content 2. The SW sends an e-mail to the psychiatrist with the reasons for the refusal; the use case ends

2.4 Caregiver

TITLE:	REGISTRATION PROCESS
PRECONDITION:	The psychiatrist has given the code to the caregiver
POSTCONDITION:	The caregiver is registered
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The caregiver chooses the account type (Caregiver, Psychiatrist, Patient) 2 The caregiver accepts the privacy policy of the app 3 The caregiver inserts a personal e-mail 4 The caregiver inserts the registration personal code given by the psychiatrist 5 The SW verifies the existence of the code and identifies the psychiatrist associated with it 6 The caregiver inserts a new password twice 7 The SW verifies the two passwords are equal 8 The SW sends a verification e-mail to the caregiver 9 The caregiver inserts the verification code 10 The SW verifies the verification code 11 The caregiver inserts the phone number 12 The SW sends a verification code to the caregiver's phone number 13 The caregiver inserts the verification code 14 The SW verifies the verification code 15 The caregiver inserts Name and Surname and Sex and Age 16 The caregiver is registered
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 2 a) The caregiver does not accept the privacy policy of the app <ol style="list-style-type: none"> 1. The SW displays an error message; use case ends 5 a) The code is not present in the database <ol style="list-style-type: none"> 1. The SW displays an error message; return step 4 7 a) The two passwords inserted are different <ol style="list-style-type: none"> 1. The app displays an error message; return to step 6 9 a) The caregiver does not receive any e-mail <ol style="list-style-type: none"> 1. The app displays a message "Send Verification Code Again" 2. The caregiver receives the e-mail; return to step 9 b) The caregiver does not receive any e-mail <ol style="list-style-type: none"> 1. The app displays a message "Send Verification Code Again" 2. The caregiver does not receive the e-mail; use case finishes 10 a) The caregiver inserts a wrong verification code <ol style="list-style-type: none"> 1. The app displays an error message; return to step 9 13 a) The caregiver does not receive any message <ol style="list-style-type: none"> 1. The app displays a message "Send Verification Code Again" 2. The caregiver receives the message; return to step 13 b) The caregiver does not receive any message <ol style="list-style-type: none"> 1. The app displays a message "Send Verification Code Again" 2. The caregiver does not receive the message; use case finishes

- | | |
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| | <p>14 a) The caregiver inserts a wrong verification code</p> <ol style="list-style-type: none"> 1. The app displays an error message; return to step 13 |
|--|--|

TITLE:	CHECK PRESCRIPTIONS
PRECONDITION:	The caregiver is logged in
POSTCONDITION:	The caregiver visualizes the patient's prescriptions
MAIN SUCCESS SCENARIO	
	<ol style="list-style-type: none"> 1 The caregiver chooses the "Prescriptions" option from the menu 2 The caregiver selects the prescriptions he wants to visualize 3 The caregiver visualizes the selected prescription
ALTERNATIVE SCENARIO	
	<ol style="list-style-type: none"> 2 a) There are no available prescriptions; the use case ends

TITLE:	CHECK THERAPY
PRECONDITION:	The caregiver is logged in
POSTCONDITION:	The caregiver visualizes the therapy of the patient
MAIN SUCCESS SCENARIO	
	<ol style="list-style-type: none"> 1 The caregiver selects the "Therapy" section 2 The caregiver visualizes the therapy of the patient
ALTERNATIVE SCENARIO	

TITLE:	VISUALIZE MEDICAL PARAMETERS OF THE PATIENT¹²
PRECONDITION:	The sensors have acquired the data from the patient
POSTCONDITION:	The caregiver visualizes the desired information
MAIN SUCCESS SCENARIO	
	<ol style="list-style-type: none"> 1 The caregiver enters the "Medical parameters" section 2 The caregiver selects the parameter of interest 3 The caregiver selects the time period of interest 4 The SW displays the data of interest
ALTERNATIVE SCENARIO	
	<ol style="list-style-type: none"> 4 a) The data is missing, corrupted or unintelligible <ol style="list-style-type: none"> 1. The SW displays an error message; return to step 2

¹² The medical parameters are the data coming from sensors, the ones inserted by the caregiver (blood pressure, weight...) and the questionnaire score.

TITLE:	UPLOAD MEDICAL PARAMETERS
PRECONDITION:	The caregiver visualizes the "Medical parameters" section
POSTCONDITION:	The caregiver successfully uploads the data
MAIN SUCCESS SCENARIO	
1	The caregiver selects the parameter to update
2	The caregiver updates the chosen parameter (blood pressure, weight, height)
3	The caregiver saves the updates
ALTERNATIVE SCENARIO	

TITLE:	NOTES TO THE PSYCHIATRIST
PRECONDITION:	
POSTCONDITION:	The psychiatrist receives the note
MAIN SUCCESS SCENARIO	
1	The caregiver chooses the subject of the note
2	The caregiver chooses the priority level of the note ("High priority" or "Low priority")
3	The caregiver types in the note
4	The note is sent to the psychiatrist
ALTERNATIVE SCENARIO	
4	a) The caregiver forgot to insert priority level of the note
	1. The SW displays a message "Insert priority level"; return to step 2

TITLE:	NOTES TO THE PATIENT
PRECONDITION:	
POSTCONDITION:	The patient receives the note
MAIN SUCCESS SCENARIO	
1	The caregiver chooses the subject of the note
2	The caregiver types in the note
3	The note is sent to the patient
ALTERNATIVE SCENARIO	

TITLE:	READ NOTES FROM PSYCHIATRIST
PRECONDITION:	The psychiatrist has sent a note to the caregiver
POSTCONDITION:	The psychiatrist receives a confirmation that the caregiver has read the note
MAIN SUCCESS SCENARIO	
1	The caregiver receives a notification of a new note from the psychiatrist
2	The caregiver clicks on the notification and visualizes the note
3	The SW sends the confirmation to the psychiatrist that the caregiver has read the note
ALTERNATIVE SCENARIO	
2	a) The psychiatrist does not click on the notification
	1. The SW sends again the notification to the psychiatrist after 1 hour; return to step 2

TITLE:	READ NOTES FROM PATIENT
PRECONDITION:	The patient has sent a note to the caregiver
POSTCONDITION:	The patient receives a confirmation that the caregiver has read the note
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The caregiver receives a notification of a new note from the patient 2 The caregiver clicks on the notification and visualizes the note The SW sends the confirmation to the patient that the caregiver has read the note
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 2 a) The caregiver does not click on the notification <ol style="list-style-type: none"> 1. The SW sends again the notification to the caregiver after 1 hour; return to step 2

TITLE:	FORWARD NOTES FROM PATIENT TO THE DOCTOR¹³
PRECONDITION:	The caregiver receives a note from the patient
POSTCONDITION:	
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The caregiver visualizes the note 2 The caregiver clicks the "Forward the note" option 3 The caregiver types in a comment to the patient's note attached 4 The SW sends the note to the psychiatrist 5 The psychiatrist visualizes the note 6 The SW signalizes to the caregiver that the message has been read
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 2 a) The caregiver does not forward the note <ol style="list-style-type: none"> 1. The use case ends

¹³ The patient can send directly notes just to the caregiver. The caregiver will decide if the note has to be sent to the psychiatrist, too.

2.5 Technician

TITLE:	UPDATE THE SOFTWARE
PRECONDITION:	
POSTCONDITION:	The software is updated
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The technician sends a global e-mail to all the users informing of the date and time in which the software will be updated 2 The technician updates the software in the date chosen
ALTERNATIVE SCENARIO	

TITLE:	ACCEPTANCE OF REGISTRATION OF THE PSYCHIATRIST¹⁴
PRECONDITION:	The psychiatrist submitted the personal information
POSTCONDITION:	The psychiatrist is registered
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The SW sends to the technician a notification of new registration 2 The technician visualizes the psychiatrist's profile 3 The technician verifies the identity of the psychiatrist 4 The technician confirms the registration of the psychiatrist 5 The SW sends a "Successfully registered" e-mail to the psychiatrist
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 4 a) The information given by the psychiatrist are invalid <ol style="list-style-type: none"> 1. The technician does not allow the psychiatrist to register 2. The technician sends "Registration denied" e-mail with the explanation of what went wrong; the use case ends

TITLE:	UPLOAD OF EDUCATIONAL CONTENT ABOUT THE DISEASE
PRECONDITION:	The psychiatrist sent the content to the technician
POSTCONDITION:	The content is uploaded on the software
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The technician verifies the originality of the article¹⁵ 2 The technician uploads the article in the educational section 3 The SW makes the article be accessible to everyone in the educational section
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 2 a) The technician decides to not upload the article <ol style="list-style-type: none"> 1. The technician sends an e-mail to the psychiatrist explaining their reasons; use case ends

¹⁴ The technician verifies that the person who wants to register is a real psychiatrist.

¹⁵ The article must have been published by a trusted source.

TITLE:	ANSWER TO REQUEST OF TECHNICAL ASSISTANCE
PRECONDITION:	A user sent a request of technical assistance to the technician
POSTCONDITION:	The technician solves the problem
MAIN SUCCESS SCENARIO	<ol style="list-style-type: none"> 1 The SW puts in order of priority the requests according to their category (bugs = High priority, advice = Medium, opinion = Low) 2 The SW sends to the technician a notification of technical problem 3 The technician visualizes the list of requests and clicks on the one of interest 4 The technician visualizes the message 5 The technician solves the problem or accepts and implement the advice 6 The technician exits the message 7 The SW asks if the technician wants to delete the message, keep it in the main list, or move it in the "Archive" 8 The technician deletes the message
ALTERNATIVE SCENARIO	<ol style="list-style-type: none"> 1 a) The user directly calls the technical assistance <ol style="list-style-type: none"> 1. The technician answers the call; use case ends 5 a) The user needs an advice on how to do something <ol style="list-style-type: none"> 1. The technician sends a message to the user through the chat option; use case ends b) The technician decides to solve the problem later <ol style="list-style-type: none"> 1. The technician exits the message 2. The SW asks if the technician wants to delete the message, keep it in the main list, or move it in the "Archive" 3. The technician keeps the message in the main list; use case ends c) The problem is considered inconsistent by the technician <ol style="list-style-type: none"> 1. The technician exits the message 2. The SW asks if the technician wants to delete the message, keep it in the main list, or move it in the "Archive" 3. The technician deletes the message; use case ends 8 a) The technician wants to keep the message <ol style="list-style-type: none"> 1. The technician moves the message to the archive, use case ends

3 USE CASE DIAGRAMS

3.1 Patient

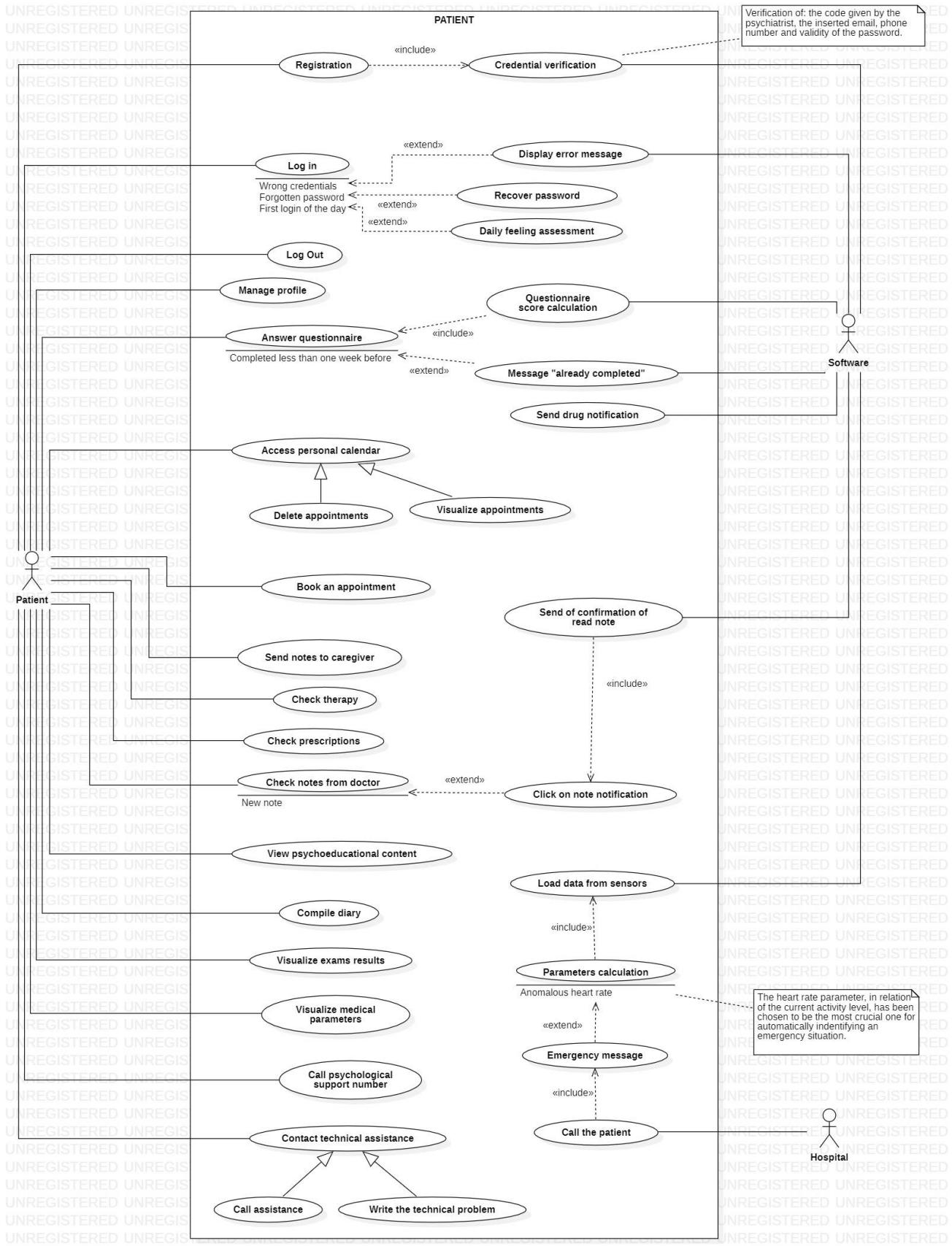


Figure 1: Patient's use case diagram

3.2 Psychiatrist

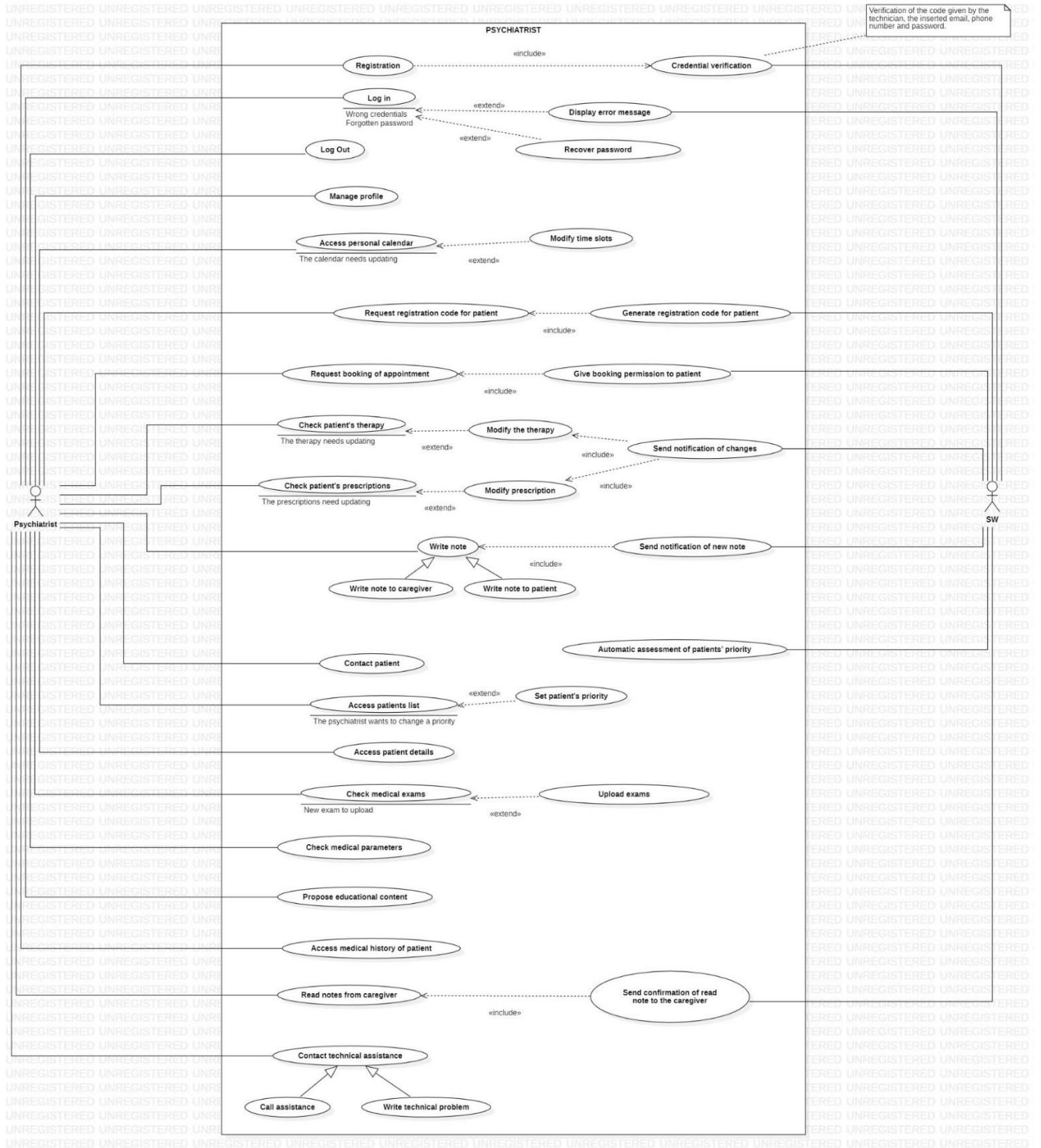


Figure 2: Psychiatrist's use case diagram

3.3 Caregiver

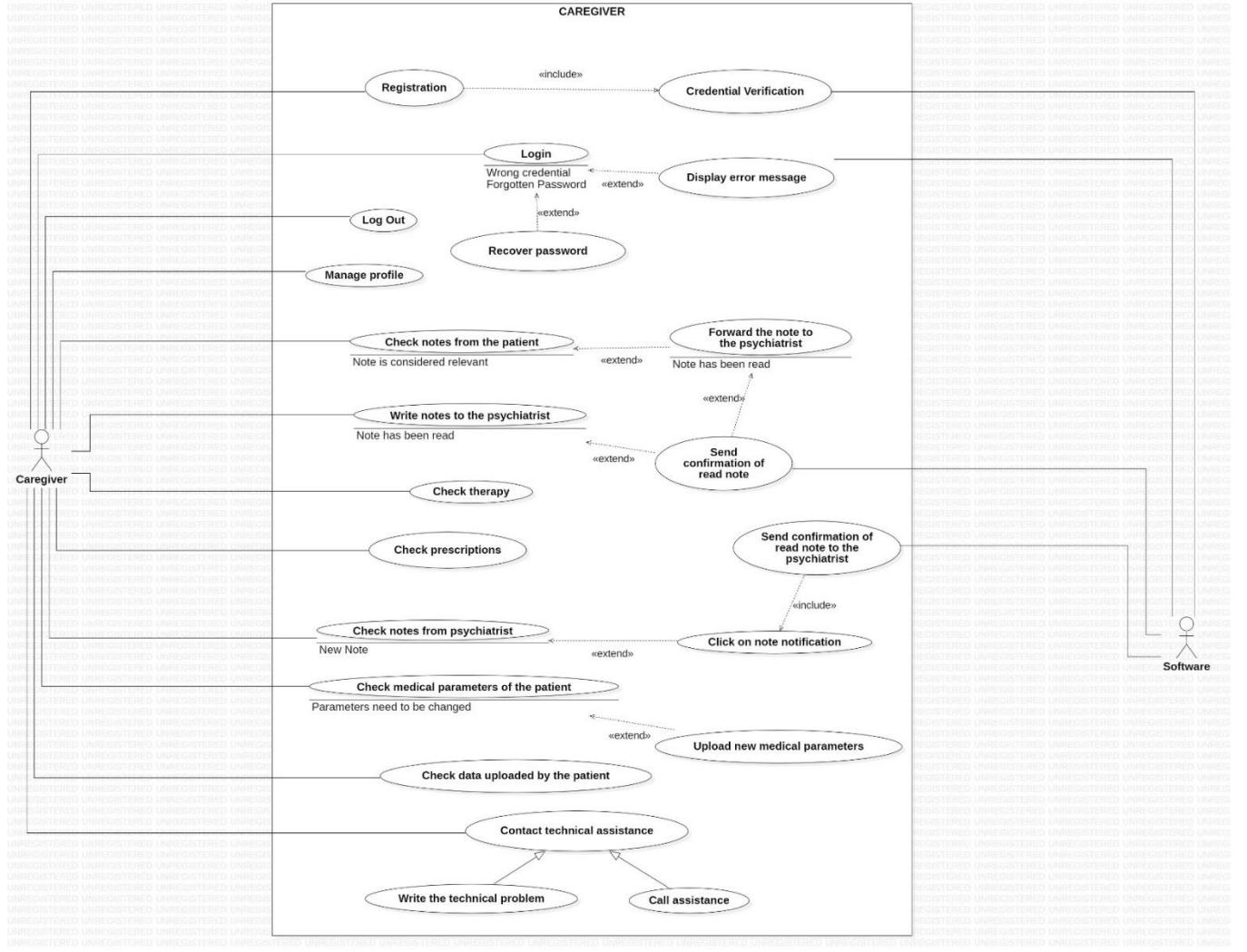


Figure 3: Caregiver's use case diagram

3.4 Technician

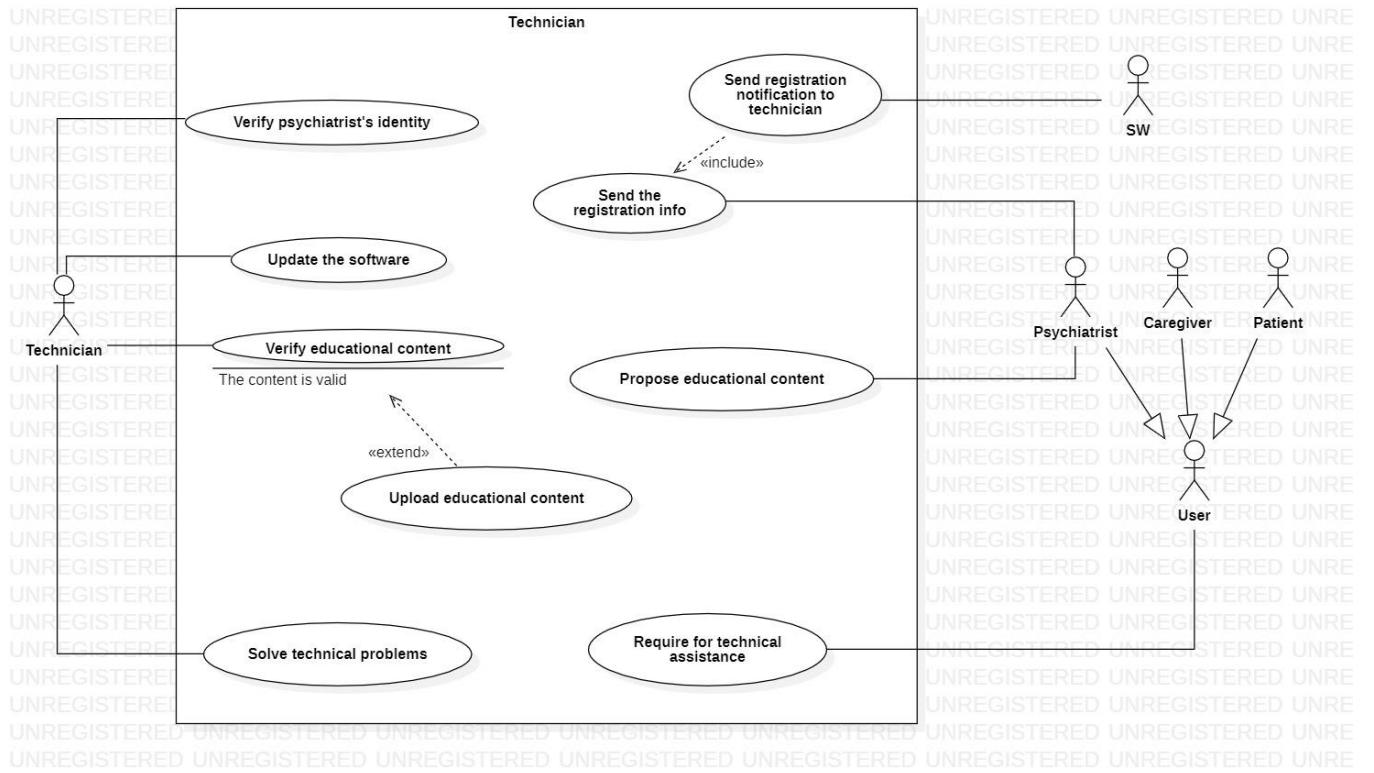
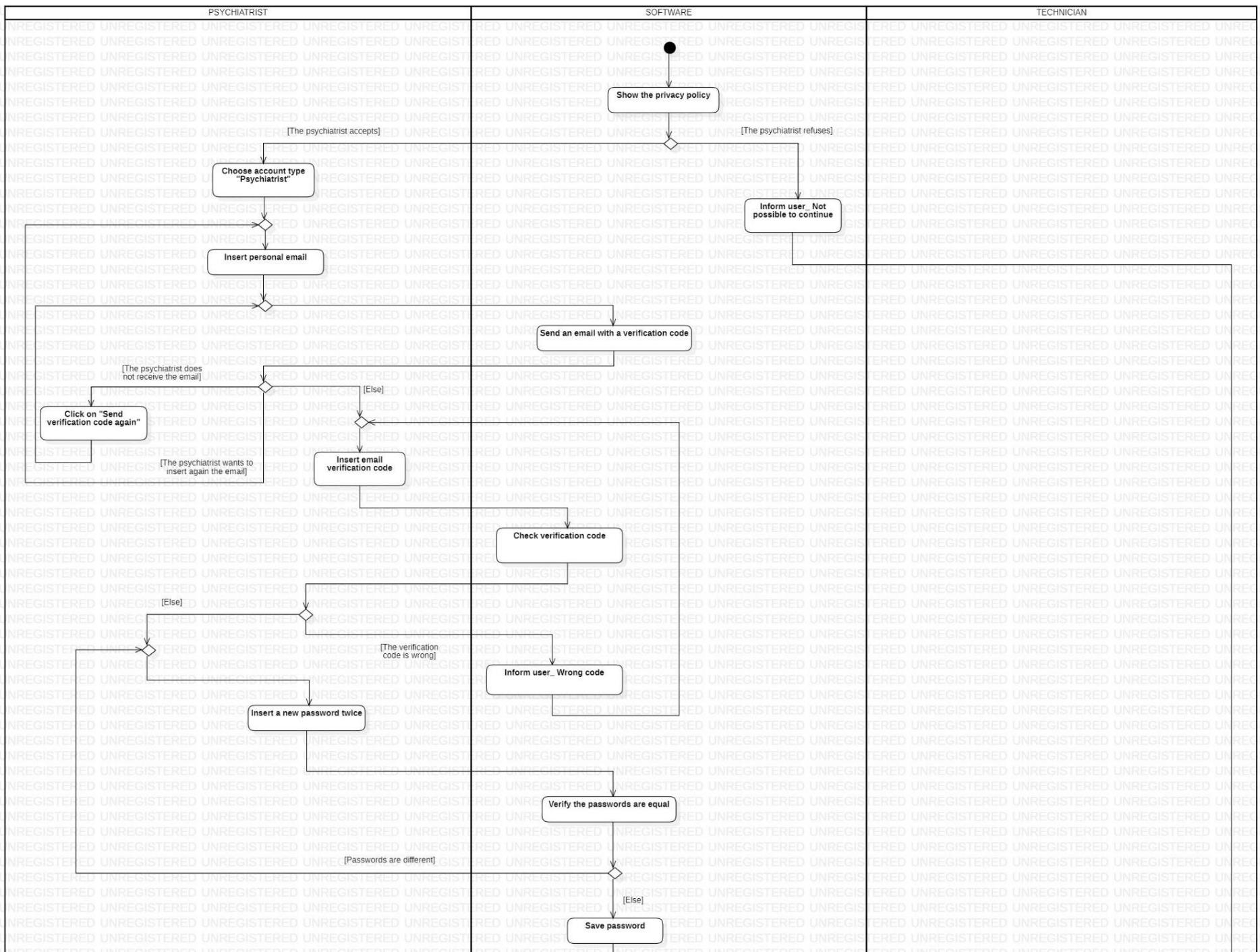
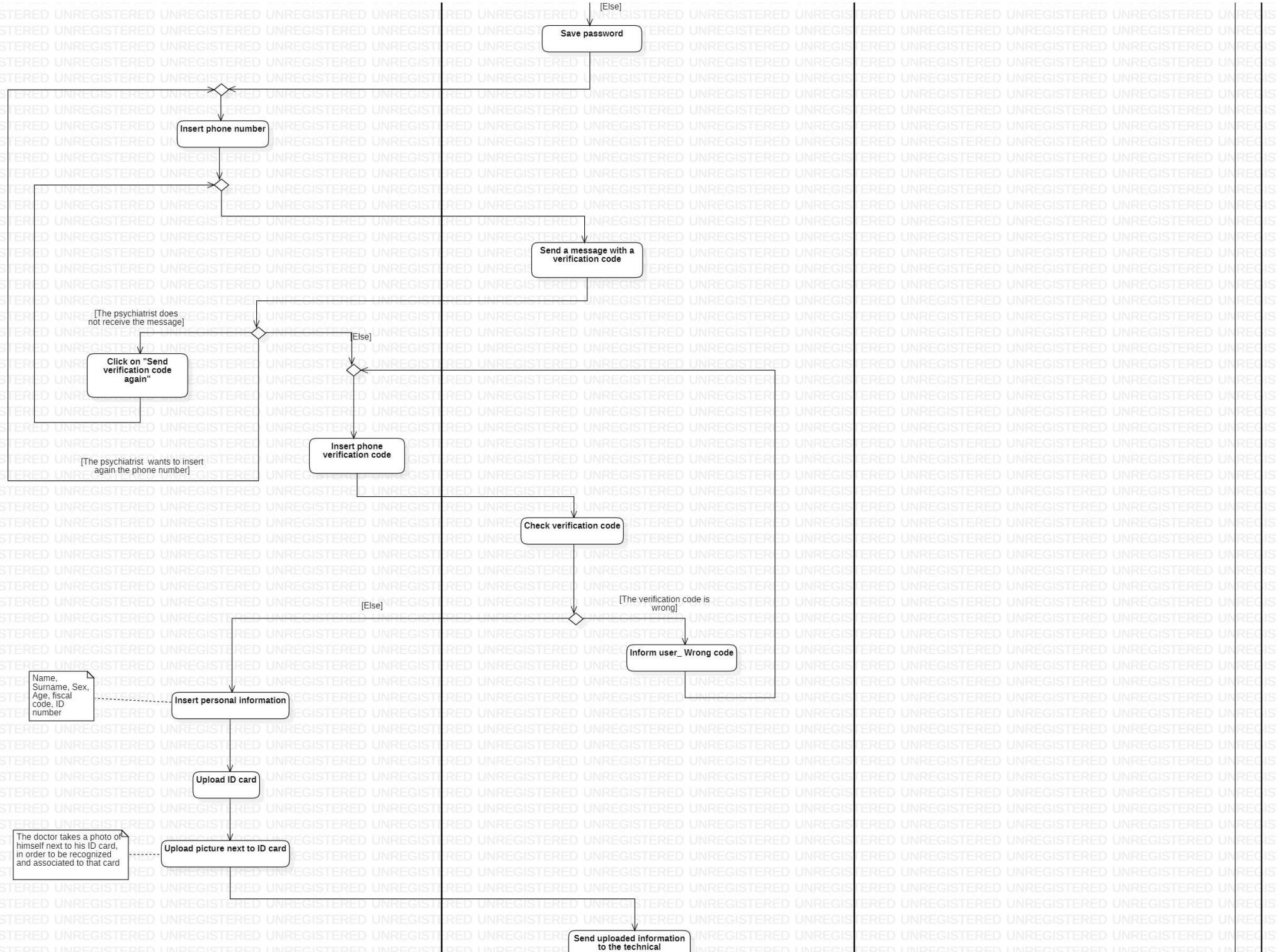


Figure 4: Technician's use case diagram

4 ACTIVITY DIAGRAMS

4.1 Registration of the doctor





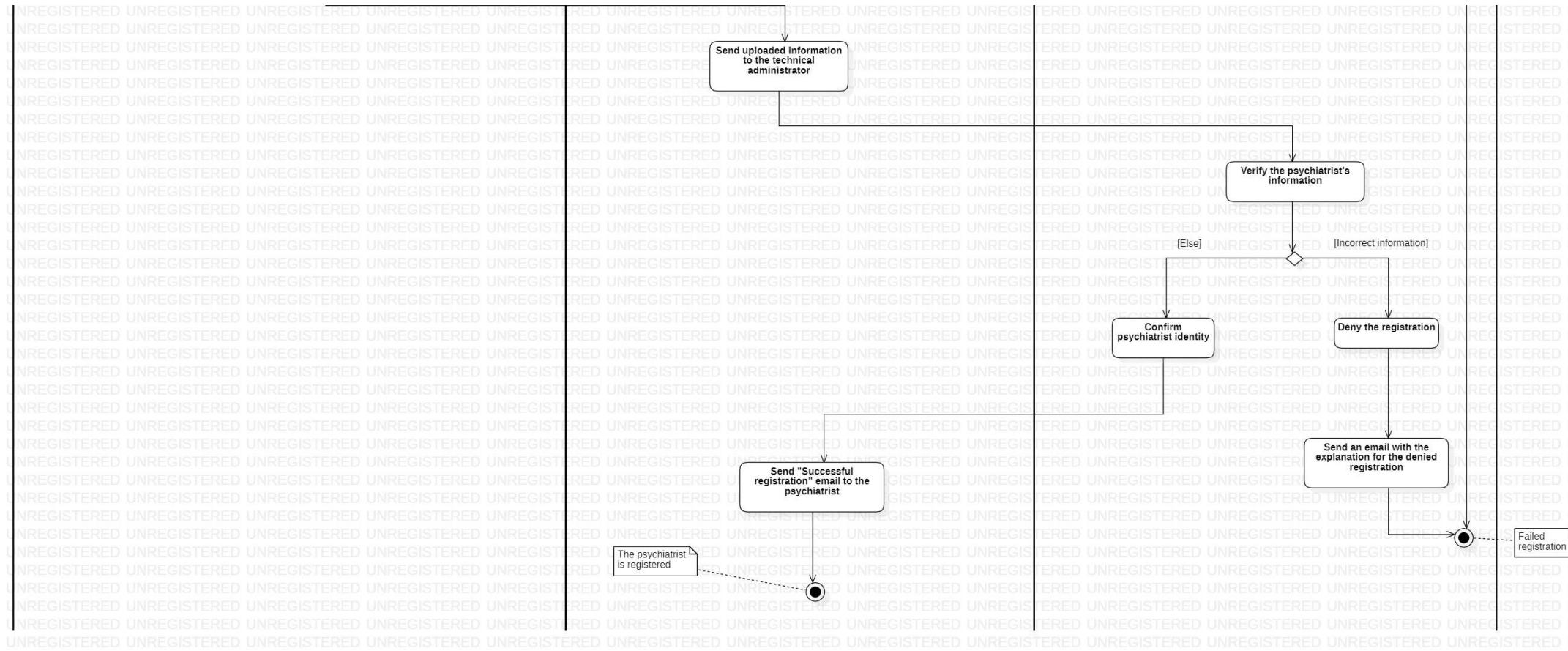


Figure 5: Registration activity diagram

4.2 Log In

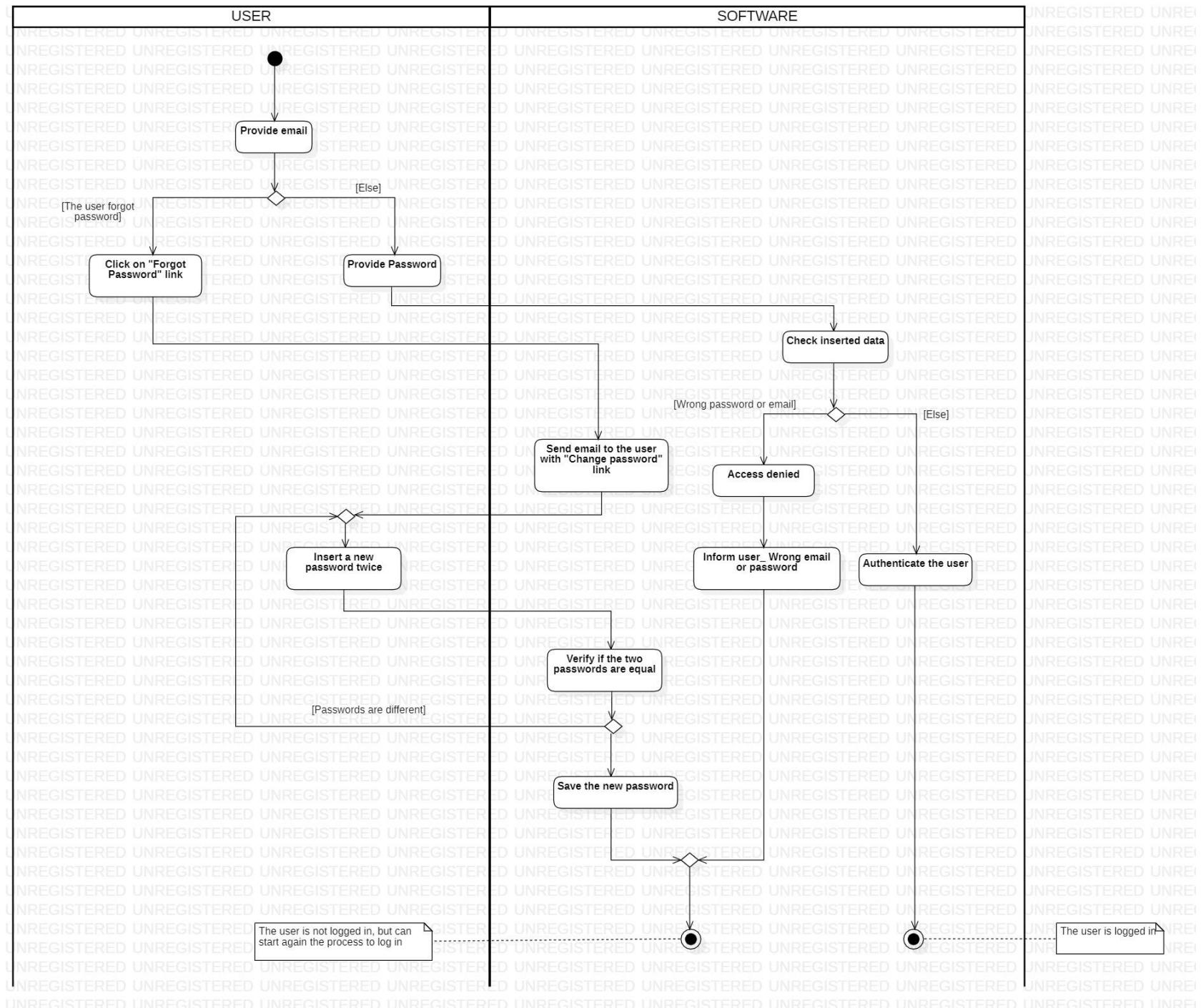


Figure 6: Log In activity diagram

4.3 Book appointments

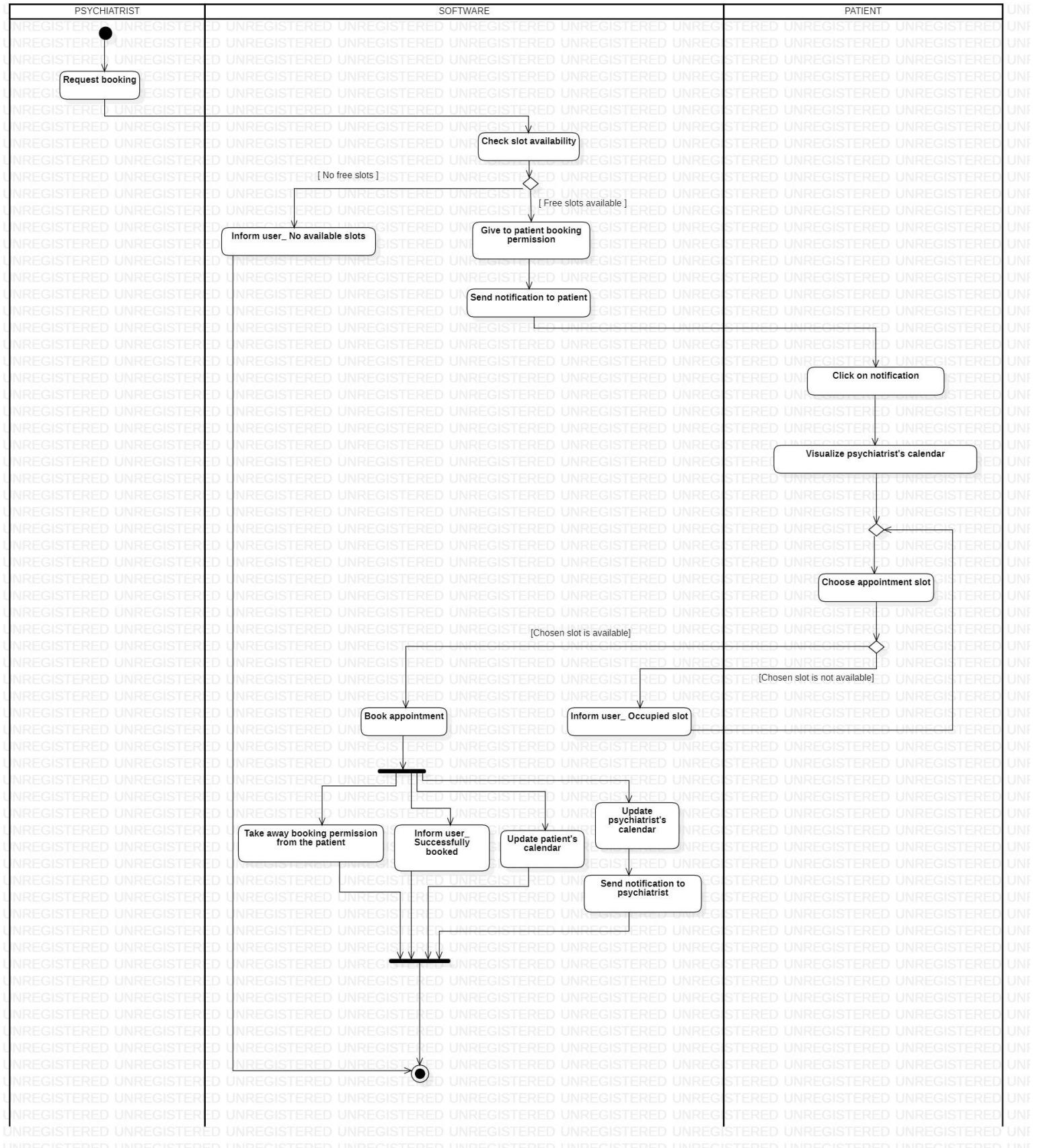


Figure 7: Book appointment activity diagram

4.4 Emergency message

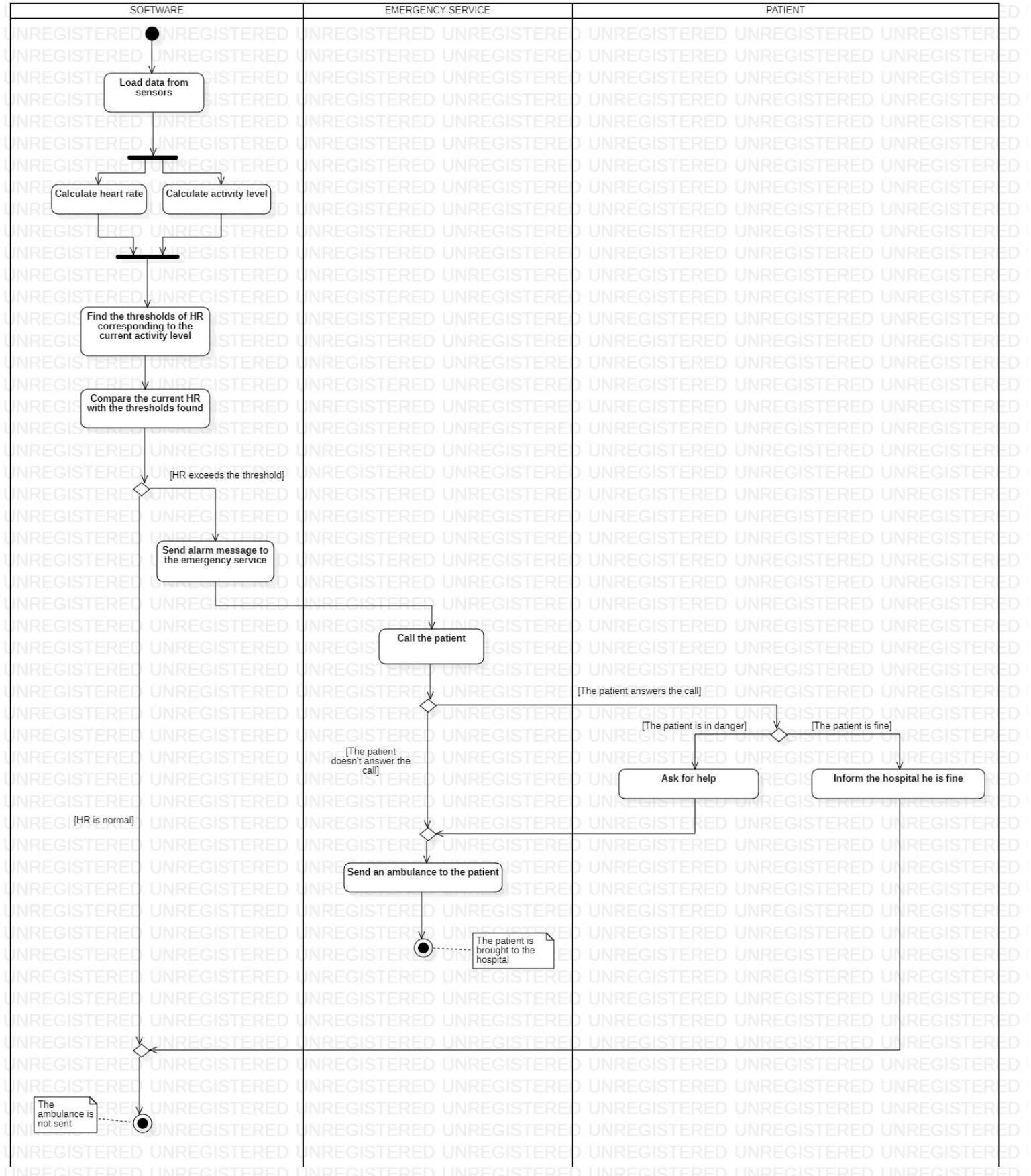


Figure 8: Emergency message activity diagram

4.5 Answer the questionnaire

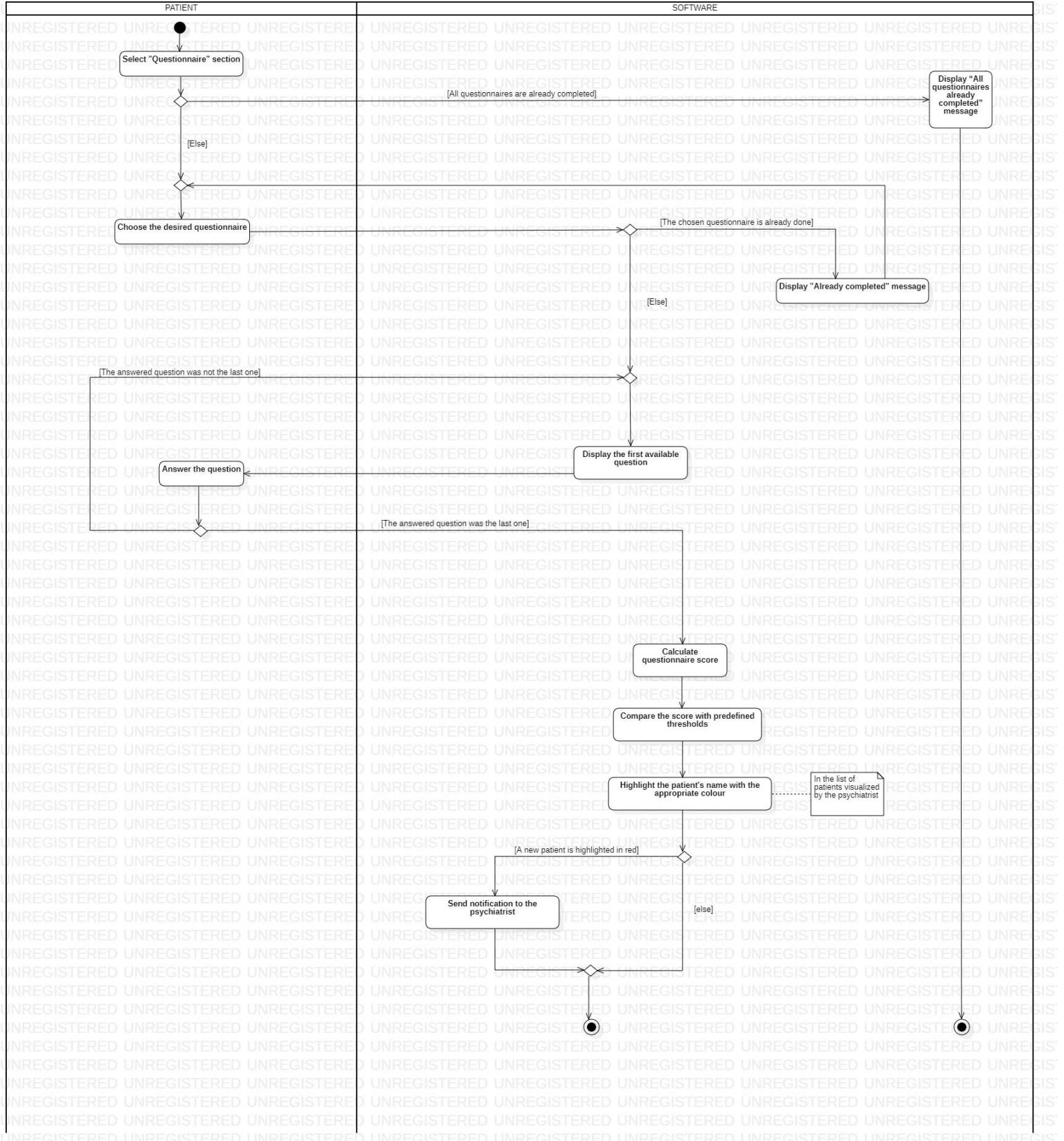


Figure 9: Answer questionnaire activity diagram

4.6 Forward notes

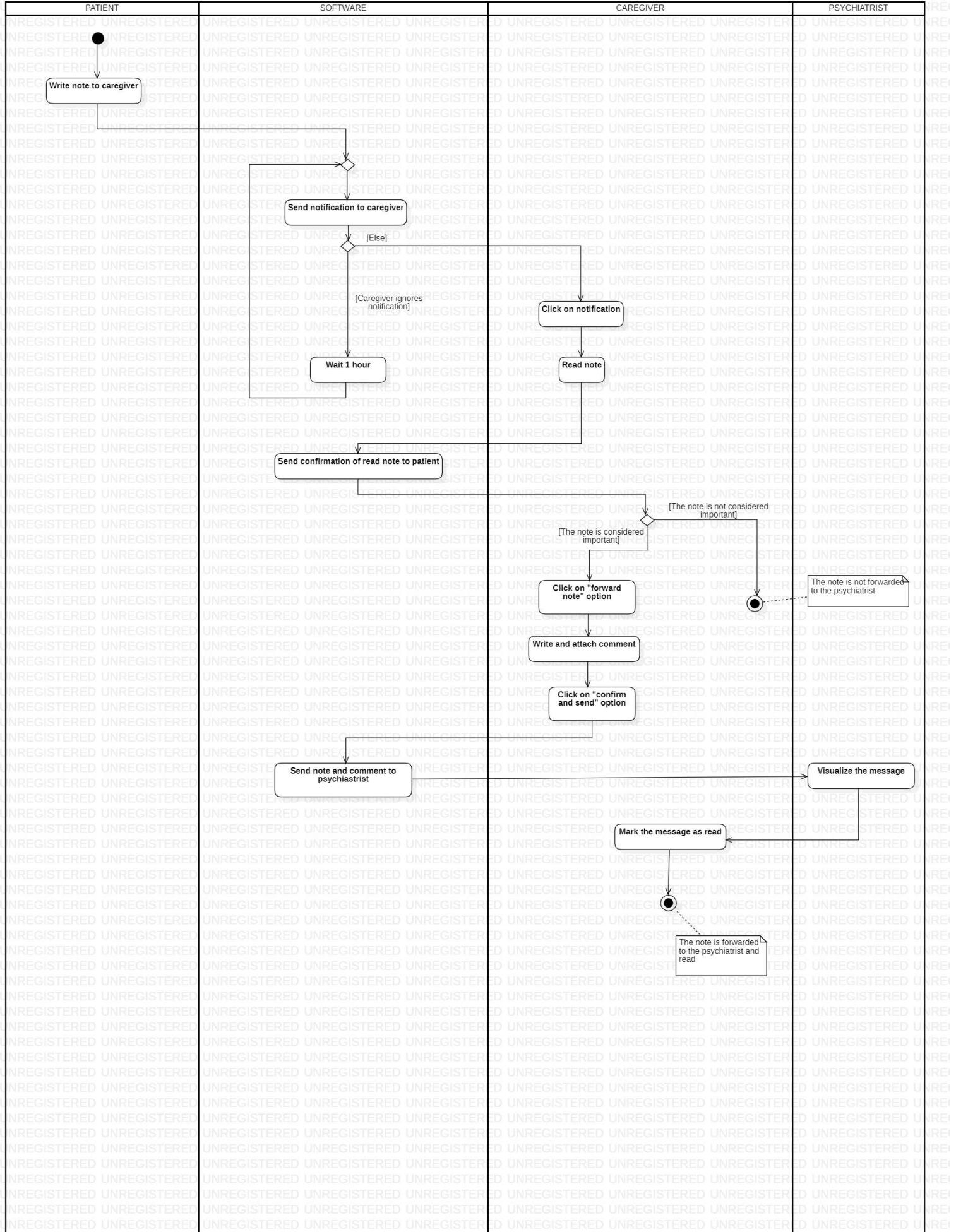


Figure 10: Forward note activity diagram

4.7 Answer technical request

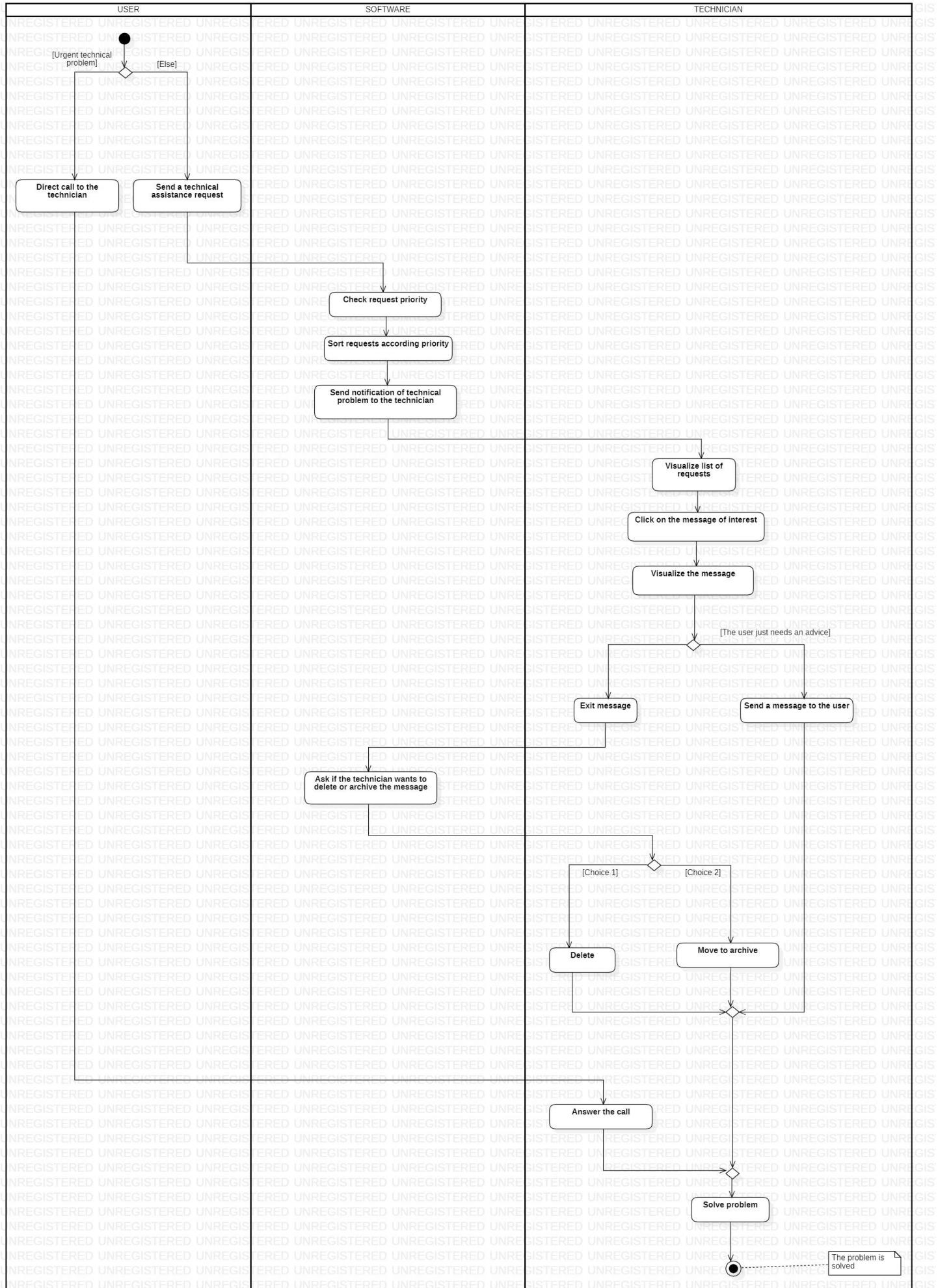


Figure 11: Answer technical request activity diagram

5 CLASS DIAGRAM

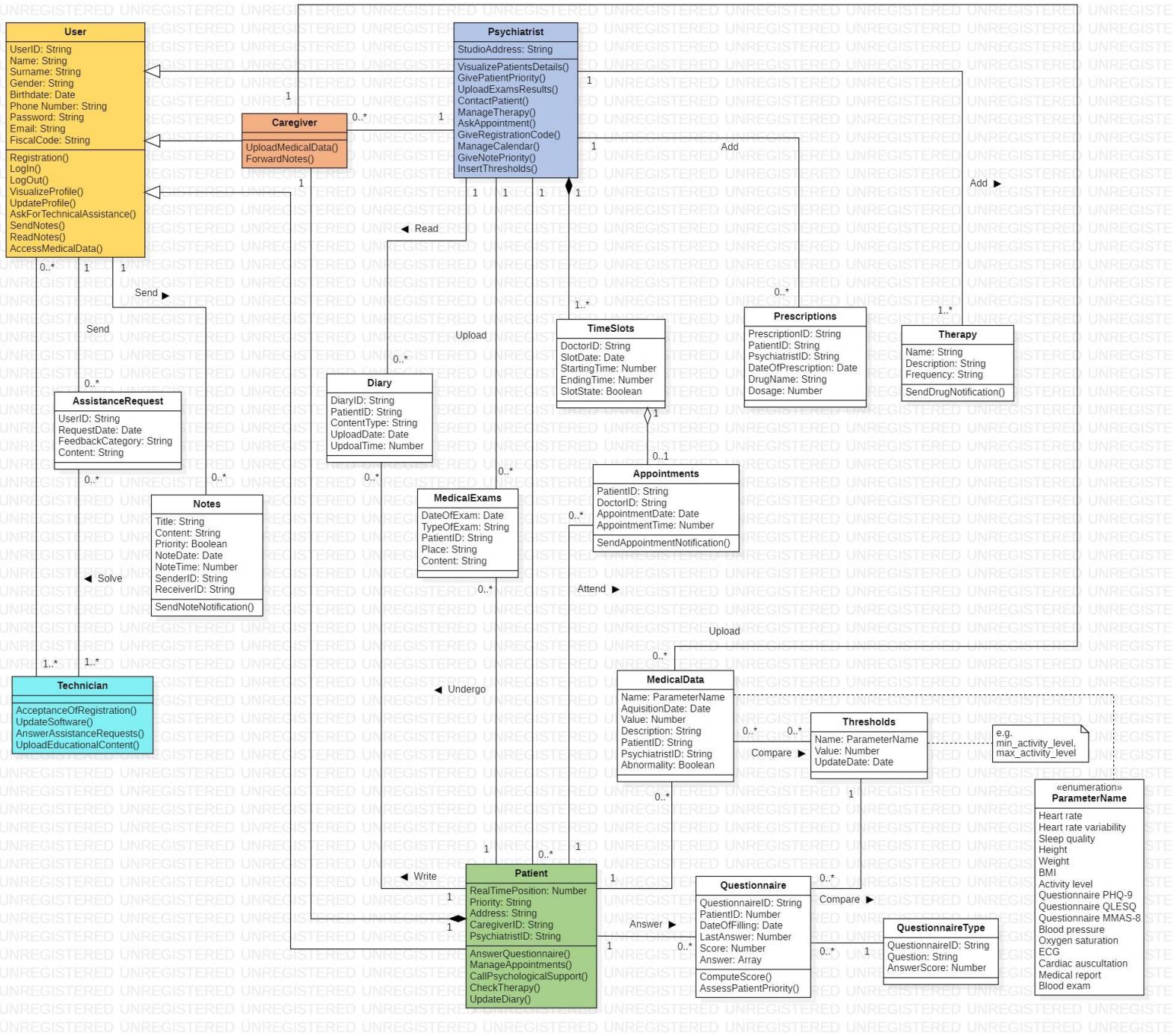


Figure 12: Class diagram

Notes: users can both send and receive notes, which are messages.

TimeSlots: the psychiatrist inserts in the app all his dates and time slots of availability.

Appointments: each occupied slot is associated with an appointment. When an appointment is booked, the related time slot is set from free to occupied.

Questionnaire: every time a patient starts to complete a questionnaire, a new item is created in the class.

QuestionnaireType: there are three types of questionnaire that the patient can answer.

«enumeration» ParameterName
Heart rate
Heart rate variability
Sleep quality
Height
Weight
BMI
Activity level
Questionnaire PHQ-9
Questionnaire QLESQ
Questionnaire MMAS-8
Blood pressure
Oxygen saturation
ECG
Cardiac auscultation
Medical report
Blood exam

e.g.
min_activity_level
max_activity_level

6 REFERENCES

SOURCE	AUTHOR	YEAR	FINDINGS
Canadian Network for Mood and Anxiety Treatments (CANMAT). Clinical Guidelines for the Management of Adults with Major Depressive Disorder.	Raymond W. Lam, et al.	2016	<ul style="list-style-type: none"> • Principals of Clinical Management: <ul style="list-style-type: none"> ◦ Support education and self-management ◦ Significance of patient's active participation in treatment planning, with a shared decision-making approach. ◦ Construct a comprehensive management plan together with the patient and his/her family or key friends ◦ Monitor outcomes with measurement-based care • Questionnaires: PHQ-9 and QLESQ
Depression and cardiovascular disease: a clinical review	David L. Hare, et al.	2013	<ul style="list-style-type: none"> • Importance of monitoring cardiovascular parameters: <ul style="list-style-type: none"> ◦ Frequent depressive symptoms in people with cardiovascular problems ◦ Choice of right anti-depressants ◦ Monitoring of medicines effects
Canadian Network for Mood and Anxiety Treatments (CANMAT) and International Society for Bipolar Disorders (ISBD) 2018 guidelines for the management of patients with bipolar disorder	Yatham et al.	2018	<ul style="list-style-type: none"> • Importance of ongoing monitoring of mood symptoms, sleep, cognition, functioning, and quality of life is encouraged, for instance through: <ul style="list-style-type: none"> ◦ mood diary ◦ rating scales <p>These elements can help identify early warning signs of relapse, and outline relationships between mood and treatment or lifestyle factors such as diet, exercise or stress.</p> • Significance of psychoeducation, with a focus on teaching skill development in: <ul style="list-style-type: none"> ◦ Detecting and managing prodromes of depression and mania ◦ Stress management ◦ Diminish effects of stigma and denial of the illness ◦ Provide tips on medication adherence and development of an healthy lifestyle (minimizing alcohol, tobacco, drugs, caffeine, regular exercise and regular sleep schedule)
Bipolar depression: the clinical characteristics and unmet needs of a complex disorder	Roger S. McIntyre & Joseph R. Calabrese	2019	<ul style="list-style-type: none"> • Frequent comorbidities (importance of monitoring for example weight and blood parameters): <ul style="list-style-type: none"> ◦ Cardiovascular disease ◦ Hypertension ◦ Obesity ◦ Metabolic syndrome ◦ Diabetes ◦ Sensitivity to variations in thyroid function and hypothyroidism ◦ Eating disorder ◦ Substance use disorders • Most commonly emergent events of treatment discontinuation are: weight gain, lethargy, anxiety,

			shaking/trembling, suicidal thoughts and circadian rhythm disturbance.
Pfizer Instruction Manual for the PHQ-9			<ul style="list-style-type: none"> • PHQ-9 questionnaire
Psychometric properties of the eight-item Morisky Medication Adherence Scale (MMAS-8) in a psychiatric outpatient setting	Carlos De las Cuevas and Wenceslao Peñate	2014	<ul style="list-style-type: none"> • Self-assessment questionnaire for medication adherence: MMAS-8