Lower Limb-Loss

System Requirements Specification

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Version 1

**Table of Contents**

**1. Introduction**

**1.1 Purpose**

This document informs the client about the development of a web-based application for lower limb-loss patients. This information is also useful for application testers and managers. Also included is information on the target audience, functional requirements, and interface features.

**1.2 Scope**

This web application program provides a convenient method for communication between patients and doctor/healthcare provider for patients of lower limb-loss surgeries and prosthetics. The patient will log in to view appointment information and input data about their recovery process. Doctors and healthcare providers log in to enter information about their patients manually. The application will not automatically generate reports from patient information.

**1.3 Users**

The intended users of this project are the lower limb-loss patients and their respective providers. The providers will enter most of the information into the system, however, there are various points where the patients enter the information themselves.

**1.4 Definitions**

* 6-Minute Walk Test: Test for recording the distance the patient walks in six minutes
* AmpNoPro: Amputee Mobility Predictor without prosthesis; survey that measures the ambulatory potential of lower limb-loss patients without the use of prosthesis
* AmpPro: Amputee Mobility Predictor with prosthesis; survey that measures the ambulatory potential of lower limb-loss patients with the use of prosthesis
* API: Application programming interface; a set of functions/tools used to assist in creating software applications
* Database: The organized collection of user data
* Database Read: The act of the program querying information from the database
* Database Write: The act of the program inserting, modifying, or deleting information in the database
* Limb Healing & Maturation (LHM): The third rehabilitation step which happens in the community setting. Together, steps 2 and 3 correspond to the preprosthetic phase
* Patient: An individual who has undergone lower limb-loss and has medical, appointment, and personal information stored in the application
* Phantom Limb Pain Scale: Arbitrary score from 0 to 10 rating the painful sensation of the amputated limb with 0 being the most uncomfortable and 10 being the most comfortable
* Plus-M: Prosthetic Limb Users Survey of Mobility; self-report instrument for measuring mobility of lower limb-loss patients
* Postsurgical Stabilization (PS): The first rehabilitation step which takes place at the acute hospital and involves surgery and stabilization thereafter, so that patients can be safely discharged to the next level of care
* Preprosthetic Rehabilition (PPR): The second rehabilitation step which occurs at the Inpatient Rehabilitation Facility and aims for functional independence and medical stability at the wheelchair/walker level to ensure a safe discharge to the community
* Prosthetic Fitting (PF): The fourth rehabilitation step which occurs in the community setting and involves prosthetic clinic visits and time taken to make a well-fitting prosthesis
* Prosthetic Rehabilitation (PR): The fifth and final rehabilitation step which takes place at the Inpatient Rehabilitation Facility and aims to achieve functional independence and medical stability at the prosthetic device level for safe discharge to the community
* Provider: An individual with the authority to read and/or write data to their associated patients within the application such as doctors, nurses, physician assistants, and other relevant medical personnel granted rights by the patient to read and/or write data to the patient
* Residual Limb Pain Scale: Arbitrary score from 0 to 10 rating the pain of the remaining residual limb with 0 being the most uncomfortable and 10 being the most comfortable
* Socket Comfort Score: Arbitrary score from 0 to 10 rating the socket comfortability with 0 being the most uncomfortable and 10 being the most comfortable
* Timed Up and Go: A test (measured in seconds) for getting the time it takes a patient to get up from a chair, walk a certain distance, turn around, walk back, and sit back down

**1.5 References**

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**2. Functional Requirements**

**2.1** **Application Format**

The system will be a web-based application. The application can be viewed on any web browser, but is primarily meant to be viewed through the associated smartphone app.

**2.1.1** The primary development focus will be phone-based. The secondary focus will be desktop-based.

**2.1.2** The web application should be able to have an icon on home screens of all smartphones. The icon will open the web browser on the user’s phone to take them to the website

**2.2** **Database**

A database connection is used to store the data of patients and recover information.

**2.2.1** The web site should be able to securely store user information regarding HIPPA. Users should have access to their personal information when they request it, and healthcare providers can access patient contact information at any time. Providers can use this information to view upcoming appointments or give patients reminders for upcoming appointments. However, providers can only access patients’ medical information when actively with the patient during an appointment.

**2.2.2** Each patient has an account that stores their personal information, which includes the patient’s name, (internal) patient’s ID, phone number, email address, login credentials, and next appointment. The account information is stored in a database table labeled “Patients.”

**2.2.3** The database also stores information related to the patient separately but connected to the account. This information includes patient response information, prosthesis sensor data, appointment details, medical providers, and additional related information.

**2.2.3.1** A database table named “Patient Entries” will store the patient response information. This information includes the patient ID, date of entry, Phantom Limb Pain Scale Average, Phantom Limb Pain Scale Maximum, Residual Limb Pain Scale Average, Residual Limb Pain Scale Maximum, Socket Comfort Score Average, and Socket Comfort Score Maximum.

**2.2.3.2** A database table named “Sensor Entries” will store the prosthesis sensor data. This information includes the patient ID, date of entry, Cadence, (daily) Walking time, (daily) Distance walked, (average daily) Walking speed, and (average daily) Step height.

**2.2.3.3** A database table named “Patients” will store the patient account data. This information includes the patient ID, name, phone number, e-mail address, and patient account password.

**2.2.3.4** A database table called “Time Points” will store appointment data. This information includes the patient ID, provider ID, time point number, specialty, location, date and time of when the appointment began, date and time of when the appointment ended, and the appointment type.

**2.2.3.5** A database table called “6Mins Walk Test Scores” will store information for the six-minute walk test. This information includes patient ID, date and time, and the score for the test.

**2.2.3.6** A database table called “TimedUpAndGo Scores” will store information for the timed up and go test. This information includes patient ID, date and time, and the score for the test.

**2.2.3.7** A database table called “AmpProScores” will store information for the AmpPro test. This information includes patient ID, date and time, and the score for the test.

**2.2.3.8** A database table called “AmpNoPro Scores” will store information for the AmpNoPro test. This information includes patient ID, date and time, and the score for the test.

**2.2.3.9** A database table called “Plus M Scores” will store information for the Plus M test. This information includes patient ID, date and time, and the score for the test.

**2.2.3.10** A database table called “Authorizations” will be used to give any provider access to patient information if they are given authorization. This table will store patient ID, provider ID, and the status of the authorization.

**2.2.3.11** A database table named “Providers” will store the medical provider data, allowing healthcare providers to access designated information in the system. This information includes the (internal) provider ID, provider name, phone number, email address, profession/specialty, organization, and provider account password.

**2.2.3.12** A database table named “Team Members” stores the relationship between patients and medical providers through the associated appointment number. This information includes the patient ID, provider ID, and appointment number.

**2.2.3.13** A database table named “Provider Entries” stores the information the providers will input during an appointment with the patient. This information includes the patient ID, provider ID, the date of the appointment when the information was entered, the AmpNoPro result, the AmpPro result, the Timed Up and Go test result, and the 6 Minute Walk Test result.

**2.2.4** Information entered should be kept for at least a year, possibly up to 10 years for research purposes.

**2.3 User Login**

Users will login to verify their identity and if they are a patient or a provider.

**2.3.1** Users can enter their email and password if they have an account. This will log them in and redirect them to either the patient home page or provider home page depending on which user logged in.

**2.3.2** If users do not have an account, they will have an option to make one. Users will need to enter their name, email, phone number and create a password and repeat the password. If the passwords do not match, the user will receive an error message which will prompt them to re-enter the account information. They will also need to select if they are a patient or a provider.

**2.3.3** If the user is logging in and the email and/or password is incorrect, a message will pop up to tell them to re-enter the email and password.

**2.4 Application Setup**

The web application will be split into two sections.

**2.4.1** The first section is for navigation post amputation.

**2.4.2** The second section is for visualizing prothesis sensor data.

**2.4.3** The navigation section should be split into five steps according to the process. The five steps are: Postsurgical Stabilization (PS), Preprosthetic Rehabilitation (PPR), Limb Healing & Maturation (LHM), Prosthetic Fitting (PF), and Prosthetic Rehabilitation (PR).

**2.4.4** The patient can enter information at each step of the navigation section. This information is the Phantom limb pain scale, Residual limb pain scale, Socket comfort score, and Plus-M for user input. This information will be stored in the “Patient Entries” database table.

**2.4.5** The provider should be able to enter the following information into the web portal for a given patient: AmpNoPro, AmpProTimed, Up and Go, and a 6-minute walk test. This information will be stored in the “Provider Entries” database table.

**2.4.6** The information entered should be able to be graphed over a period such that healthcare providers can view it. Time scales for the graph are monthly, three months, six months, one year, and two years.

**2.4.7** Each step should also include pertinent information regarding appointments with doctors and other providers such as the time, date, location, and the Heathcare team. This information will be obtained from the “Appointments” and “Team Members” database tables.

**2.4.8** Providers can schedule the next appointment for a specific patient.

**2.4.9** The application should send out reminders to a patient’s device after one week of inactivity.

**2.4.10** Users can log out when they are done using the app, but the application will remember their login information if the patient consents.

**2.5 Sensor**

A sensor will be used to gather information about the recovery.

**2.5.1** The application should be able to connect through Bluetooth to the sensors being developed by the mechanical engineering capstone group.

**2.5.2** The sensor section should be able to store the data from the sensor per day and graph it over selected time periods. The sensor data will be sorted as follows: Cadence (steps/minute), Walking time (minutes and seconds), Distance walked (m), Walking speed (m/s), and Step height (mm). Time Scales for the data are monthly, three months, six months, one year, and two years.

**3. Appendix**

Client Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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