Hospital Management System Requirements Specification

Version 1.0

April 21, 2022

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1. Executive Summary

1.1 Project Overview

This is a Project for the Software Engineering course at Epoka University, created by a group of 6 students of CEN. The project is a web site/application designed to help Hospitals, here in Albania, manage their operation in a more effective and convenient way.

1.2 Purpose and Scope of this Specification

The Main objective of the Web application is to allow Hospitals here in Albania a system to interact better and more conveniently with patients as well as having an easier time managing different aspects of running an effective Hospital. One of the main aspects of this solution is a way for patients to have an easier time looking for doctors and booking and appointment with specialists in regards to their needs. As for the hospital side, it will be a website that will allow an easier time to the hospital staff to manage their interaction with patients as well as the documentation needed for them (i.e. “Librez shendetsore”, analysis results, x-rays, MRI, ect).

In scope:

- This project is responsible for creating a platform where patients can contact and book appointments, as well as being able to see which doctors are available in the Hospital at which times.
- On the Hospital side, the web application will be able to create appointments for the Doctors. Will be able to archive and manage the necessary documents to run the hospital.
- There will be web security for the website, as well as 2FA for the login giving the log in process an extra layer of security.
- Maintenance of the web service will be provided by us.
- A mobile app will be developed to offer the booking services more easily.

Out of scope:

- The Web Application (and hence our service) will not be responsible for any monetary transaction between the Hospital and its patients.
- Changes will be made to accommodate for legislative requirements and changes along the way.

2. Product/Service Description

A website that serves at the same time the possible/current patients of the hospital, as well as the hospital staff/management to manage their appointments, their schedule as well as their documents.

2.1 Product Context

For now a good way to demonstrate the context of our project would be the diagrams made available on the projects repository on GitHub :
https://github.com/EloiSherifi/SoftwareEngineeringProject/tree/main/Diagrams

2.2 User Characteristics

User :

- Register
- Log-in
- Request appointment
- View own profile
- View available Doctors
- Use filters to better find the appropriate Doctor
- Delete their own profile
- Review their booked times
- Look up when a certain doctor is free.
- Look at their appointment history
- Look and print their X-Rays/MRI/Receipts

Doctor/Medical staff:

- Log-in
- Check his assigned patients / his history of patients
- Check their timetable
- Check their requested appointments and accept/deny them
- Upload Receipts into their patients profile
- Look at medical documents and the medical history of their patients

Non-medical staff:

- Log-in
- Look at their schedule
- In the case of Reception, request an appointment for an in-place patient.
- Fill up necessary documents for their respective work

Admin:

- Log-in
- Create/Delete/Change internal accounts (Medical and non-medical users)
- Archiving former staff members account and their respective documents

Guest:

- View the front page
- Look up the Frequently asked questions page (health library)
- Get the Hospital Contacts.

2.3 Assumptions

Our assumptions are that the staff members will adapt the use of this software and integrate it into their daily work. It's assumed that the technical background of the users of this software is of a degree that renders the use of the website intuitive. It's assumed that the scheduled appointments will be respected and the doctors as well as the patients will be on time.

2.4 Constraints

- Deadline : End of course/semester (spring semester of 2022)
- Technologies used : HTML, CSS, JavaScript, Bootstrap, PHP, MySql.
- The timetable will be updated by the internal staff of the Hospital and will be respected.

2.5 Dependencies

- This product will require daily/weekly maintenance by the system admin in order to add/remove staff members
- The timetable for the staff (working hours) needs to be updated with eventual changes that may happen during the working shifts.
- Regular updates of available staff will also be required to maintain functionality for the patients.

3. Requirements

3.1 Functional Requirements

Req#	Requirement	Priority	Date Rvwd	SME Reviewed / Approved
FR#01	The website should have an appointment booking system where users make requests and staff accept or deny them.	1	20/04/2022	
FR#02	The website should offer a way for doctors as well as patients to upload relevant medical files (in .pdf format) that are obtained from 3rd party sources.	1	20/04/2022	
FR#03	The website should offer to everyone a view of the available doctors in the hospital with their specific qualifications.	3	20/04/2022	
FR#04	The website should provide users who have selected a specific doctor out of the staff list with their timetable, showing their available time to take appointments.	1	20/04/2022	
FR#05	The website should allow doctors to give patients drug receipts and the patients should be able to view these receipts.	2	20/04/2022	
FR#06	The website should offer patient users to view their appointment history as well as their former receipts	2	20/04/2022	
FR#07	The website should be able to send to patients their specific documentation via email (as well as having it available in their profile page)	4	20/04/2022	
FR#08	The website should have a system for the receptionist(non-medical staff member) and the pathologist (family doctor) to arrange meetings between patients and other doctors.	1	20/04/2022	
FR#08	The website will have customizable font size to offer better accessibility to visually impaired users	4	22/04/2022	
FR#09	The website should have some small tutorial windows pop up whenever a feature is used for the first time by the user in order to aid them with their endeavor	4	02/05/2022	

3.2 Non-Functional Requirements

3.2.1 Product Requirements

3.2.1.1 **User Interface Requirements**

UI requirements :

- Legible fonts which will help users with visual impairments to still be easily readable as well as keeping a professional look for the website.
- The different aspects of the webpage will be flexible to be able to have the best user experience at different screen sizes (like desktop, smaller laptops, resized windows as well as mobile devices.
- The navigation bar will be present in every page of the website and have tabs specific to different users.
- The login/signup form will be as a sidebar opened on the side of the web page without loading in a new page.

User specific UI:

- Patients:

    - They will have a different taskbar offering the view of their profile (where they will find their documents as well as the ability to add and remove documents they have uploaded.
    - “Doctors” where they will be taken to the doctor’s list page where they can view and select the doctor they need.
    - “Appointments” where the patients will be able to check their booked appointments as well as a history of their past appointments.
    - “History” where the patients will have a view of their receipts.
    - A profile icon which will, when clicked, take the user to their profile where they will have the option to change their email and their password.
- Doctors:
    - Their navigation bar will have “Appointments”, “Schedule”, “Patients” and “Profile”.
    - “Appointments” will contain the timetable of the doctor’s appointments as well as the ability to see new requests that can then be accepted or denied.
    - “Schedule” will contain the working schedule of the Doctor for this week and for the upcoming weeks.
    - “Patients” will contain a history of patients that have taken appointments before with the doctor as well as the ability to view their profile as well as inserting documents/receipts.
    - “Profile”, just like with the patient's profile, doctors will be able to change their email and password.
- Staff:
    - They will have different navigation bar with respect to their position.
    - Receptionist will have a “create appointment request” tab to create an appointment for a patient that has shown up to the reception desk.
    - “View Doctors” tab to view the available doctors at this hour (doctors that are currently working this shift) to better aid the patients seeking help at the reception desk.
    - “Schedule” to, just like the doctors, view their shift for the current week and the upcoming weeks.
- Administrator :
    - Will have a more simplistic taskbar which will allow him to access the database and add/remove doctors from said database
    - “create new user” will take the admin into a page where he can create a new user himself and then send the username and password to the corresponding staff member
    - “view database” will allow the admin to observe the database as well as the possibility to filter through it.
    - “remove acc” will allow the admin to remove or block certain accounts from further activity in the website.
    - “create timetable”will contain the page that allows the admin to fill out the working schedule of the hospital.

3.2.1.2 **Usability**

The product should be intuitive, easy to learn and even easier to use. The focus should be to make it more accessible to older non-technically-savvy doctors and staff members. Small floating pop-ups will show up with explanations the first time a certain functionality is used that day. Obviously users can see and decide if they want to turn off this feature.

When a user is about to change sensitive information on their account, or is about the do some sensitive work, like requesting an appointment or accepting/declining an appointment in the case of the doctors then a message that asks for reconfirmation from the user will pop-up to inform them of the sensitive operation they are about to partake in.

3.2.1.3 **Efficiency**

3.2.1.3.1 Performance Requirements

- Latency from the server should be minimal, around 0.1s or less, provided the user has a stable internet connection.
- In order of capacity the server should be able to handle around 1000 users using it simultaneously
- The average traffic would be around 50-100 users per hour.

3.2.1.3.2 Space Requirements

Considering that on average each user will have 2 documents in pdf format saved in their user document folder. Also, the hospital documents and archives every appointment, visit, receipt and otherwise interaction between doctor and patient. While PDFs will not be that “heavy”, MRI and X-ray scans will have formats that are larger and offer a better visibility to the medical professionals. From research about this specific topic, for a relatively small Albanian hospital a 10Tb dataserver should be considered. A cloud based solution might be considered in the future to better accommodate the size and speed requirements of the system.

3.2.1.4 **Dependability**

Availability

- The service and any associated server will be running non-stop since the hospitals work 24/7.
- There should be minimal to no tolerance of downtime, although in cases of maintenance 30 minutes to 1 hour a week should be considered if necessary.
- There will be no geographical lock for the website since it can be used by patients that are residing elsewhere in order to retrieve any medical file they have, or even book an appointment in advance for when they will return.

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Reliability

The system should be reliable and running the entire day every day. Any maintenance work will be held during the late night hours since the workload of the hospital will be smaller during that period of time, causing less inconvenience and having less data that would be later inserted into the system.

Monitoring

A small IT team should be at the ready in order to fix any issues with the service. Logs will be kept in accordance with the legislative laws of the country hosting the hospital. System resources of the server must be kept in check with CPU and RAM usage preferably under 90%. The dataserver should also, always be kept under 90% of its capacity. Should the need arise, new storage units should be installed.

Maintenance

As stated before, maintenance should be held around once per week regularly, with emergency maintenance when needed. The regular maintenance will be held during the late hours of night where the traffic to the web application will be at the lowest since less people will come to the hospital.

Integrity

To keep the integrity of the data of clients a log will be maintained, containing every change made as well as old files, this to keep track of any change in the system as well as discouraging fraudulent activities from the hospital staff. Using HTTPS and TLS will help secure the exchange of data from server to client and vice versa.

3.2.1.5 **Security**

- Encryption: Passwords will be saved in the database in hashed form, using the hashing function in PHP to ensure that even the server administrator won’t have access to the plaintext password.
- Activity logging, historical data sets: Logs are crucial and mandatory for the hospital and they will be saved securely in the archive section of the dataserver.
- SQL injections and Cross-Side Scripting: With the help from the PDO library we can secure SQL statements from SQL injections, while using htmlentities() we can secure the user input and protect the site from Cross-Side attacks.
- HTTPS: All channels of communication between our product and its users will e done with the use of HTTPS and TLS for data encryption and safety.

3.2.2 Organizational Requirements

Requirements which are a consequence of organizational policies and procedures e.g. process standards used, implementation requirements, etc

3.2.2.1 **Environmental Requirements**

This web application will be accessible from any device that can connect to the internet be it PC/laptop/MAC or mobile devices as well as consoles, provided they have an internet connection. Unless the server is under maintenance it will be accessible at any location at any time. While using the application for mobile devices, provided that the user is still logged in and has permitted the application of notification privileges, it will alert the user of upcoming scheduled appointments.

3.2.2.2 **Operational Requirements**

This product is a web application which will provide a management facilitator for hospitals as well as an easy interface for patients to the hospital. Hospital's staff will benefit from the scheduling capabilities and documentation management of the product, making their jobs easier, thus dedicating more time to their patients. While for the patients, this product will provide a reliable and easy way to contact the hospital as well as view important and doctor curated articles and first response aid. The doctors will have a history of each patient's previous medication taken (in the form of receipts) thus giving him a clearer idea which possible new medication will be the best, with the least possible side effects.

3.2.2.3 **Development Requirements**

The technologies that we are going to use are :

- HTML,CSS, JavaScript and Bootstrap for the Front-End
- MySQL will be the chosen SQL language for the database
- PHP will be the language used for the Back-End

3.2.3 External Requirements

3.2.3.1 **Regulatory Requirements**

Being a management system for a public hospital, the web service will be sure to follow the privacy of data laws of the country. No information will be shared with third parties unless specified by law which data can be transferred to other parties.

3.2.3.2 **Ethical Requirements**

A certain degree of data must be shared from the users to the system in order for the web application to function properly.

Patients should agree to share their personal information about:

- Full name
- Email address
- Medical history (in our country in the form of "libreza shendetsore") obtained from other hospitals (this way it can e added to our logs as well.
- Results of analysis taken from third parties

This information can be accessed by admins and Doctors that have or have had an appointment with the patient.

Doctors and staff should agree to share their personal information about:

- Full name
- Email address
- Qualifications (i.e. diplomas and certifications as well as a license to practice medicine)

3.2.3.3 **Legislative Requirements**

As stated above, the service will be provided to hospitals in Albania. This means that the software will have to comply not only with general Albanian laws pertaining to web applications but more importantly will comply with laws, regulations and standards imposed on hospitals and medical service providers in Albania. Most importantly, our data management policy will ensure that the data stored in our servers will be managed consistently and according to the set of standards and guidelines required by hospitals.

As the laws are ever changing so will our data protection and management policies be.

3.2.3.3.1 Accounting Requirements

As the Hospital is public Accounting will not be held on the system. For any sort of required payment it will be done en-place if needed.

3.2.3.3.2 Security Requirements

Security of data will be of utmost importance since we are dealing with sensitive medical data for our patients. An appropriate security level will be reached via encryption. Other methods will be used to also provide SQL injection protection as well as Cross-Side Scripting, while also HTTPS and TLS will be used to safely move data.

3.3 Domain Requirements

The domain requirements for our product will be considering the framework for scheduling as well as doctor-patient communication system. The prime objective of the system is to help the patients have an easier remote access to medical help and aid the hospital staff with managing the operation of the hospital.

4. Software Design

4.1 Use Scenarios

- **Patient scenarios**

1- Scenario title **: Patient sign-in** :
   a. The user opens the website and is greeted by the main page.
   b. Clicking the user profile icon, a side bar pops up offering the login form.
   c. At the bottom of the sidebar there is a link to “sign in”.
   d. Clicking the link redirects the user to the registration page where they are required to fill in the form with their information (name, surname, gender, date of birth, address, phone number, email address, password)

2- Scenario title :**Patient log-in**:
   a. The user opens the website and is greeted by the main page.
   b. Clicking the user profile icon a side bar pops up offering the login form
   c. The user is prompted to enter his credentials, email and password.
   d. The login is successful and now the icon is inhabited by the users photo (if this is inserted by the user or admin)

3- Scenario title: **Patient forgets password**:
   a. The user opens the website and is greeted by the main page.
   b. Clicking the user profile icon a side bar pops up offering the login form
   c. The user is prompted to enter his credentials, email and password.
   d. The login fails since the credentials were incorrect.
   e. An error message invites the user to try again with a different password or to check the username. A “Reset password” link is offered below the login section.
   f. Once clicked the user is redirected to the “Reset password” page where he is prompted to enter his email address to receive the new temporary password.
   g. The system sends an email automatically to the user with a randomly generated temporary password.
   h. The user then grabs this password and logs into his account, this time being redirected to the “change password” page where they are prompted to insert a new password.

4- Scenario title : **Patient clicks “View doctors”**:
   a. The user enters the homepage and clicks on the navigation bar “View doctors”
   b. Clicking the link, the user is redirected to the doctors list page. The doctors are listed alphabetically by their specialization, if more than one doctor is available for a specific specialization they are ordered alphabetically.
   c. The user can click on the doctor they need to request an appointment to. When clicking on the doctor’s name they are taken to the doctor’s timetable.
   d. On the time table there are different sections that are grayed out, meaning that the doctor is busy or unavailable at those times.
   e. The patient can select a certain period of time on the timetable and request an appointment.

5- Scenario title : **Patient cancels the appointment or the request for appointment**:
   a. The user enters the homepage and clicks on the profile icon. On the drop down menu the patient clicks “view profile” thus being redirected to the profile page.
   b. On the profile page there is a section called appointments where the user can view their pending or approved appointments as well as their past ones.
   c. By clicking on the desired appointment they are redirected to the appointment page
   d. On the appointment page the patient has the option to cancel the appointment
   e. A message pops up to reconfirm this decision prompting the patient to press confirm once more.

6- Scenario title : **Patient/guest visitor views Frequently Asked Questions :**
   a. User opens the homepage and clicks on the "FAQ" part of the navigation bar.
   b. The user is redirected to the faq page where different categories of questions are presented.
   c. From here the user can select the "category" of questions and that category will be expanded and offer the available, pre-answered questions.

- **Doctor (medical staff) scenarios**

1- Scenario title : **Staff log-in :**
   a. The doctor member opens the website and is greeted by the main page.
   b. Clicking the user profile icon a side bar pops up offering the login form
   c. The user is prompted to enter his credentials, email and password.
   d. The login is successful and now the icon is inhabited by the user's photo (uploaded by the admin.

2- Scenario title : **Check schedule :**
   a. The staff member already logged in, opens the homepage and then proceeds to click on the "schedule" tab in the navigation bar.
   b. After being redirected to the schedule page, the doctor can view his scheduled shifts for this week as well as the upcoming weeks.
   c. At the top of the page, a link for the appointments timetable can be clicked.

3- Scenario title : **View appointments and accept/decline a request :**
   a. The doctor is redirected to the appointments page after clicking on the appropriate tab on their navigation bar or on the link from the schedule page.
   b. They are presented with the same timetable that is visible to all other users but now the information isn't hidden.
   c. On the timetable they can view their booked appointments as well as the new requested appointments.
   d. By clicking on the requests the appointment page is open giving the doctor a more detailed view of the appointment.
   e. On the appointment page the doctor can view the comments and details (if any) as well as who requested it. They can also view the patients profile
   f. From here the user can choose to accept/deny the request, confirming or deleting the booked appointment.

4- Scenario Title: **Booking/registering an appointment :**
   a. By clicking on the "Book appointment" on the navigation bar or the timetable page, the user can choose an empty time period in their timetable to fill in their new appointment.
   b. On the create applintment menu the doctor is presented with a search bar to search for the patient in the system to add for the appointment.

c. If a patient isn't in the system and the doctor is their first contact with the hospital, they can create a profile for the patient via the link "create patient profile" in the create appointment page.
d. After the patient is selected the doctor can confirm the creation of the appointment and it will appear as an already accepted appointment.

5- Scenario title : **Create patient profile :**

a. Once on the "create patient profile" page, the staff member can enter the required information, without entering a password. The password will be sent to the patient via email at the address specified during profile creation.
b. Having fulfilled the profile registration form, the staff member can confirm and create the patient's profile.
c. The staff member is redirected to their previous page after finishing this step.