Technical Report - Project specifications

Medical Management System

Course:	IES - Introdução à Engenharia de Software
Date:	Aveiro, 17th January 2022
Students:	98470: Artur Romão 98595: Diogo Cruz 98390: Mariana Rosa 98430: Paulo Pereira

Project abstract: We developed a system to be used by doctors and nurses to check patients' information such as medical and personal information (*age, name, background, past operations/surgeries, medication, allergies, etc.*). However, the main purpose of the application is the opportunity for medical staff to monitor admitted patients' important vital signs via real-time from anywhere they are and alert other staff members through a notification/chat-system if they are not present.

Table of contents:

1 Introduction

Our **goal** for the Introduction to Software Engineering course final project was to propose, conceptualize, and implement a multi-layer, enterprise-class application. Our team chose to develop a Medical Management System used by doctors and nurses to register new patients, keep track of their medical situation and be able to check admitted patients' vital signs at all times from anywhere to be more aware of their situation.

2 Product concept

Vision statement

Our system will be used by hospital staff to collect patient's personal and medical information to better understand their situation/problems, why they are there and to help doctors and nurses make better decisions faster because they have easier access to patient's information.

The application is more focused on admitted patients where it is possible to keep track of their vital signs in real time, which is very advantageous in case something isn't normal doctors can have a faster response.

Personas

Maia Mitchell is a married 37 year old pulmonologist who has worked at Centro Hospitalar Baixo Vouga since she finished Medical School in Universidade de Lisboa. The hospital is her second home (she actually spends more time there than at home), but that's okay because she is really passionate about medicine. Her days are exhausting, but she knows she does the best she can to help her patients. Currently, she is the best doctor in her field, so she is on the Emergency Schedule from time to time.

Motivation: Maia likes to always keep track of situations and to know what to do next, therefore, even when she is at home with her family, she worries about her patients and feels the need to check on their health. Also, she would like to have a schedule of her daily appointments, to see if she can combine emergency situations with day-to-day appointments.

Brandon Foster is a 56 year old doctor living in Aveiro. He is a veteran worker in Centro Hospitalar Universitário de Lisboa Central and is the main figure when dealing with patients who came out of surgeries or are in serious conditions because he has many years on the job and deals with these types of situations neatly. However, due to his age and his wife's medical condition he can't spend as much time in the hospital as he would like but knowing that his part of the job is important he would like to maintain constant surveillance on his admitted patients to observe any anomalies and notify the doctors and nurses working currently in the hospital while he is not there of anything important happening.

Motivation: He would like to have a chat/notification system where he could notify automatically any changes or abnormalities in an admitted patient's current situation so that doctors and nurses in charge at the hospital can rush to the situation right away.

.

Max Waldo is a nurse at Centro Hospitalar Baixo Vouga. He is 25 years old, he was born in Azores and recently graduated in nursing at Universidade dos Açores. He did his internship at Hospital de Santa Maria, in Oporto, and decided to stay on the mainland. He is a very caring person, his patients are the main purpose in life, since he only feels good about himself if he takes care of others.

Motivation: He would like to know what his patients' state is when going to work, therefore he could organize his day and get prepared to face it (in a good or bad way). He is also responsible sometimes for taking care of new patients or returning ones so he would like to have a page where he can check the person's health, vaccinations and important information like that so he can make a better report of the patient's symptoms and possible problems before he checks in with the doctor.

Main scenarios

Brandon sees that a patient is even more sick and needs help - The patient's oxygen level starts to drop down a bit, but not so bad that the monitor at the hospital notices, therefore no nurses or doctor are called. However, in this case every drop down matters. The management system helps him by tracking all of his signs and keeping the doctor aware of them and he can quickly use the chat system to notify his work peers to take care of the situation so it doesn't become problematic.

Maia sees that her patient's sinal vitals are going down - When Maia left work at the end of the day she was not happy with the health of one of her patients who was in a critical state. After a few hours at home, she opens up her Medical Management web-app with the purpose of checking on her patient. She sees that he's even worse than when she left him. She has two options: leave a note to the hospital through the application or rush back to it. As the situation is so bad, she chooses the second one.

Max checks on his patients - Max is on the bus going to work and opens up the system and sees some patients who have appointments to check their information and prepare some possible questions for them for better checkup and to then give some more precise information to the doctors.

3 Architecture notebook

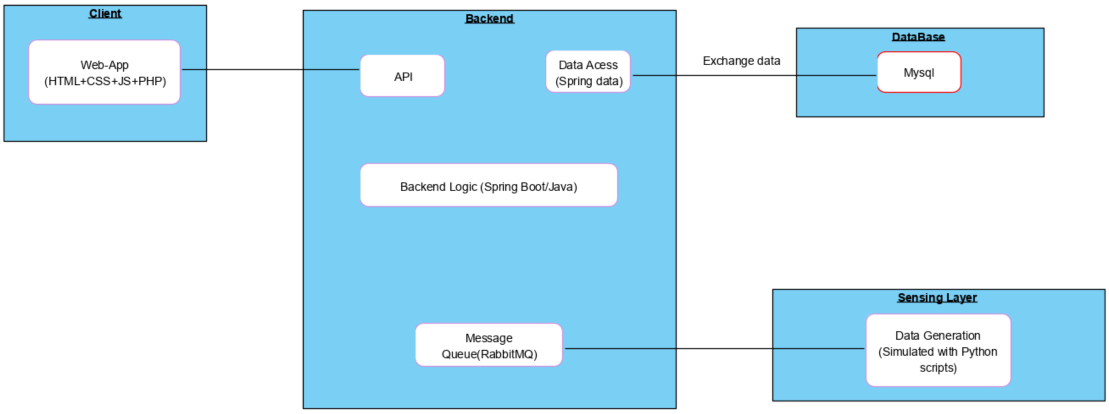
Key requirements and constraints

Our system is a Web-App and such has some constraints and key requirements. They are as follow:

- Every user should be able to login and be correctly identified and registered. Since they are medical professionals with access to very critical and personal information, security is one of the main requirements.
- Medical staff will be divided into nurses and doctors, with doctors having access to more functionalities and nurses being able to see any information they would need, such as major patient details, medical history and prescriptions.
- Our Web-App should update with real time data, and should be available at all times, specially the input sensors for the patients.
- A doctor should be able to perform real time queries to satisfy his needs, like getting a list of all current admitted patients at his care.
- The system should be able to use notifications.
- Some information about previous medical checkups should be stored to further help the professionals.
- There might be some problems with syncing Spring Boot and the handler of the RabbitMQ message queues.

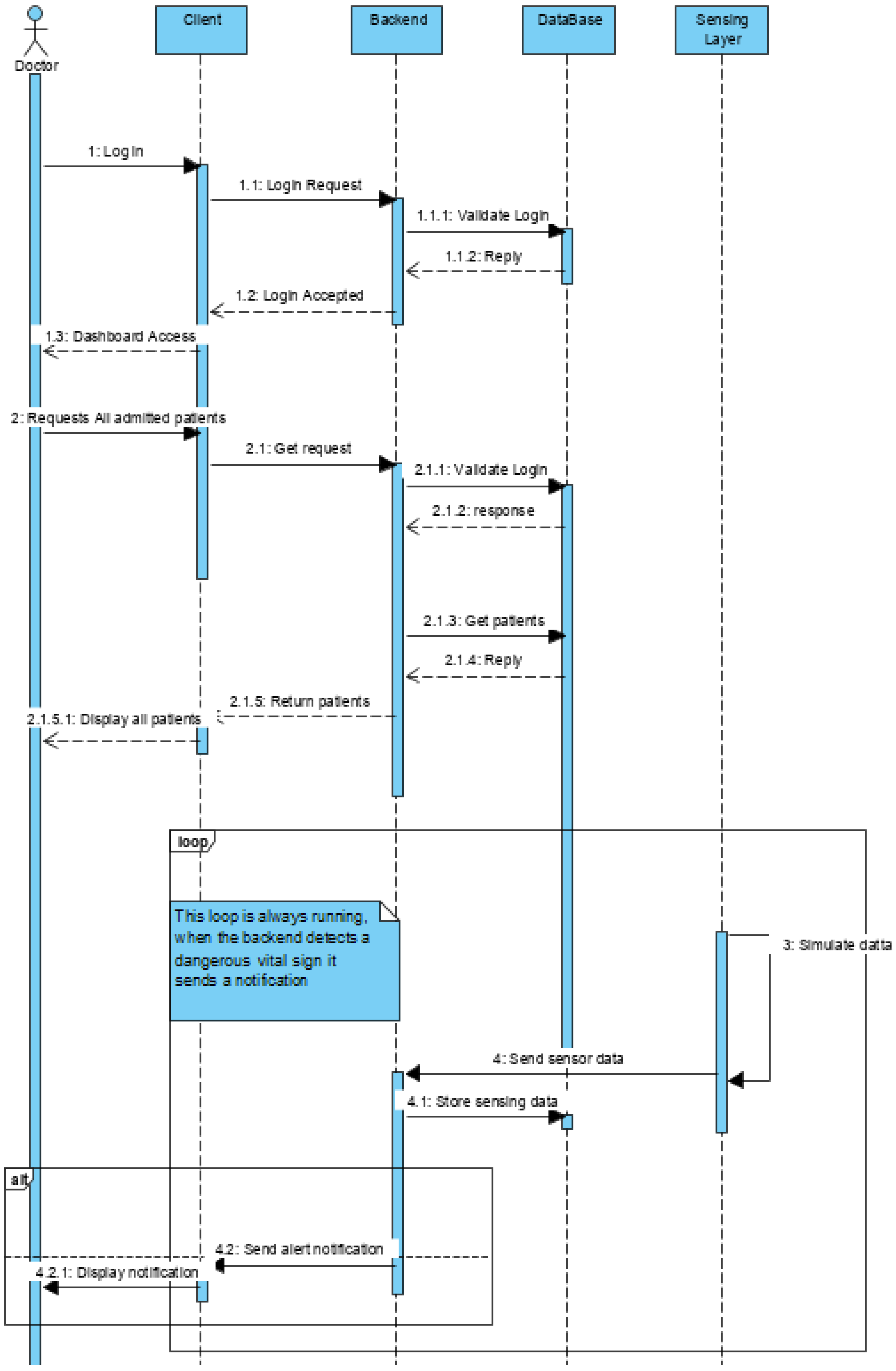
Architectural view

The system will be divided into a persistent DataBase developed in MySQL, a Data Generation layer, that will simulate the input of all the different sensors using a python script and will be connected to the backend through a message queue managed by RabbitMQ, the referred backend will be developed with Spring Boot and Java, the last component of our system is the client layer which will be a web app developed with HTML-CSS and related technologies like JS and PHP, this layer will be connected to the backend using an API.

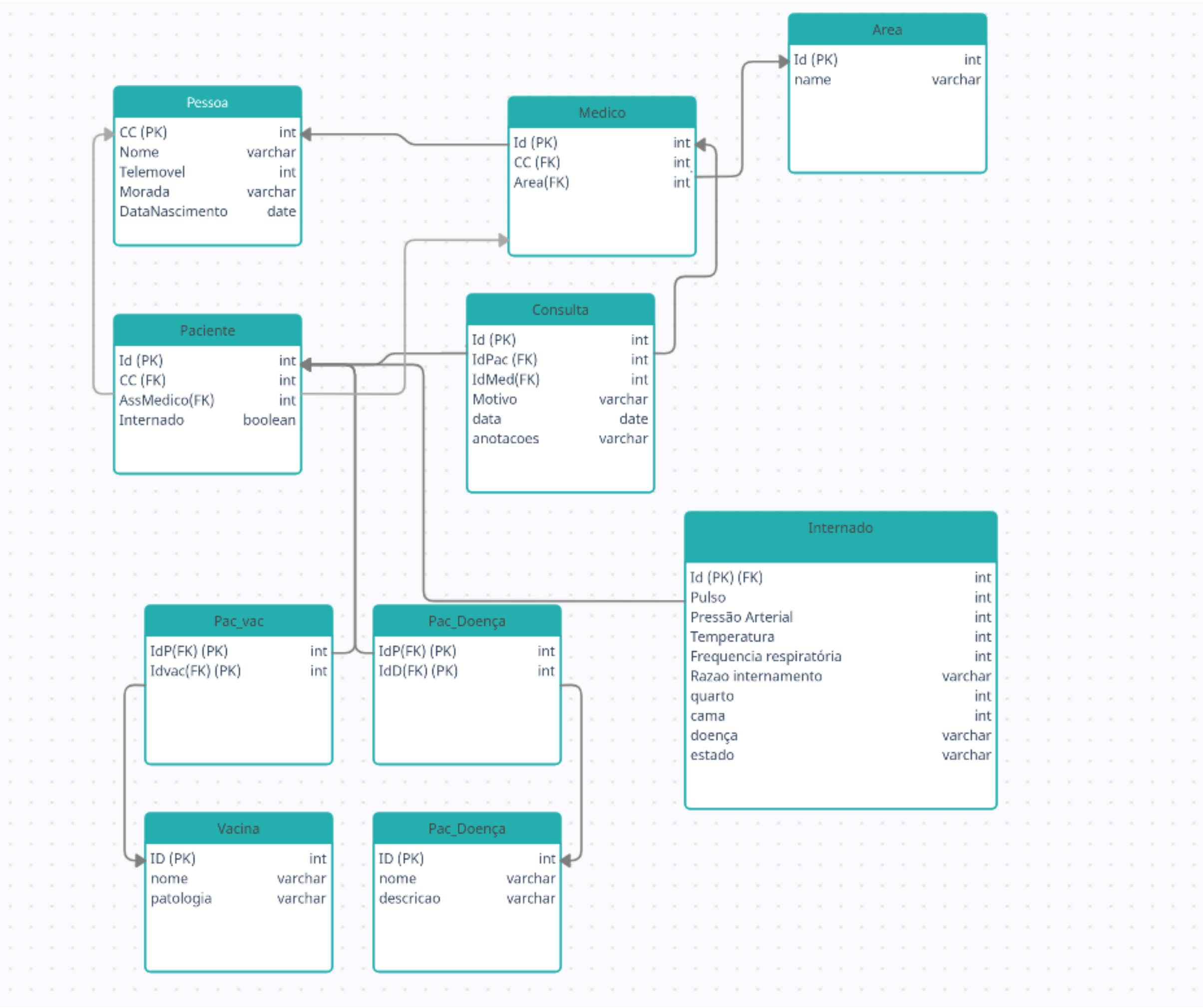

Client
Web-App (HTML+CSS+JS+PHP)
Backend
API
Data Acess (Spring data)
Backend Logic (Spring Boot/Java)
Message Queue(RabbitMQ)
Exchange data
DataBase
Mysql
Sensing Layer
Data Generation (Simulated with Python scripts)

Module interactions

When a user opens the web-app and performs a login the Client Module will interact with the backend which will interact with the database to check if it is a valid user login, if so a dashboard is provided according to whether it is a nurse or doctor login in. Everytime the user interacts with any information stored in the database this is what happens. The sensing layer will constantly feeding information to the system (backend and database),the backend is then responsible for checking it’s values and update the client state from normal to dangerous(for example) if a certain threshold is hit, when this happens an alert is sent to the client by the backend.


Doctor
Client
Backend
DataBase
Sensing Layer
1: Log In
1.1: Login Request
1.1.1: Validate Login
1.1.2: Reply
1.2: Login Accepted
1.3: Dashboard Access
2: Requests All admitted patients
2.1: Get request
2.1.1: Validate Login
2.1.2: response
2.1.3: Get patients
2.1.4: Reply
2.1.5: Return patients
2.1.5.1: Display all patients
loop
This loop is always running, when the backend detects a dangerous vital sign it sends a notification
3: Simulate datta
4: Send sensor data
4.1: Store sensing data
alt
4.2: Send alert notification
4.2.1: Display notification

4 Information perspective



5 References and resources

https://www.mdpi.com/1424-8220/18/4/1285