1 Name of Use Case

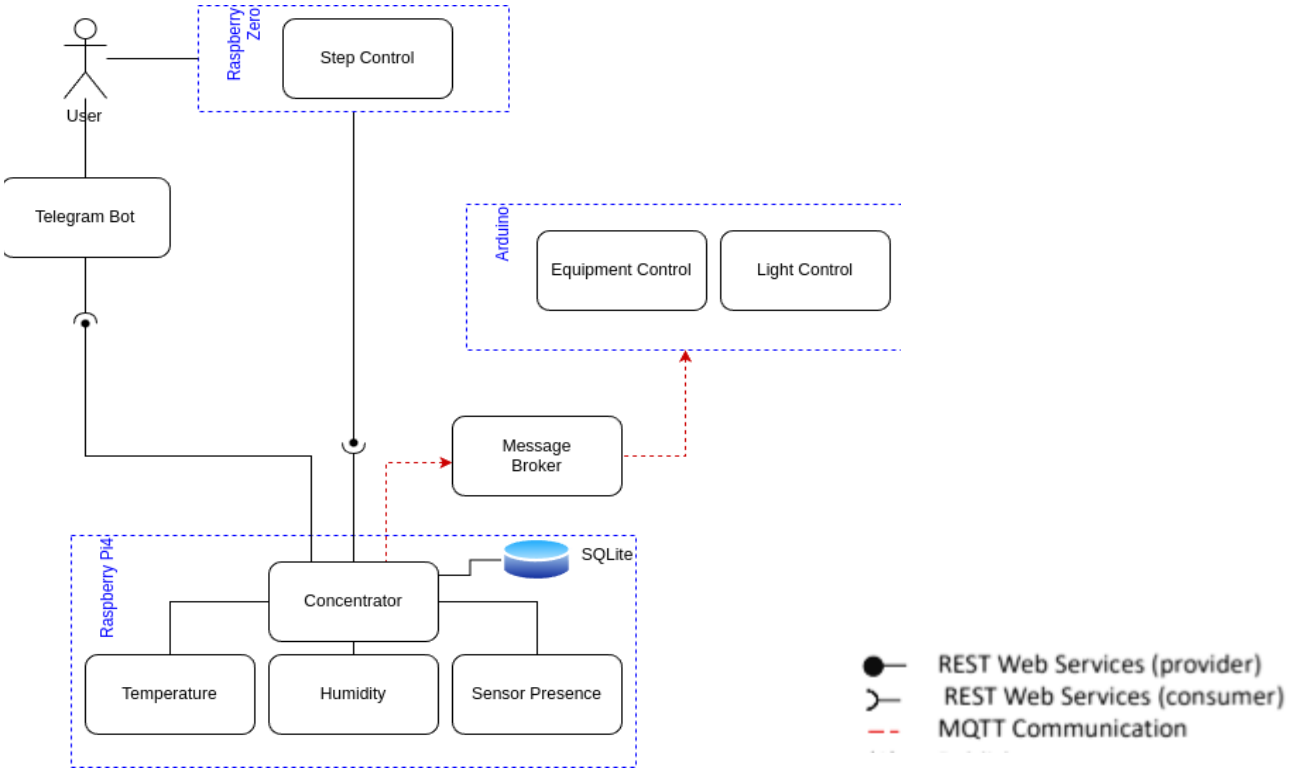
Name of the Use Case	Insurance health control and monitoring System
Version No.	1.1
Submission Date	12/12/2023
Team Members (with student ids)	Victor Cajubá: 304235 Atefeh Khalili Param 309328 Guilherme Portella: 304236 Victor Melo: 304216

2 Scope and Objectives of Function

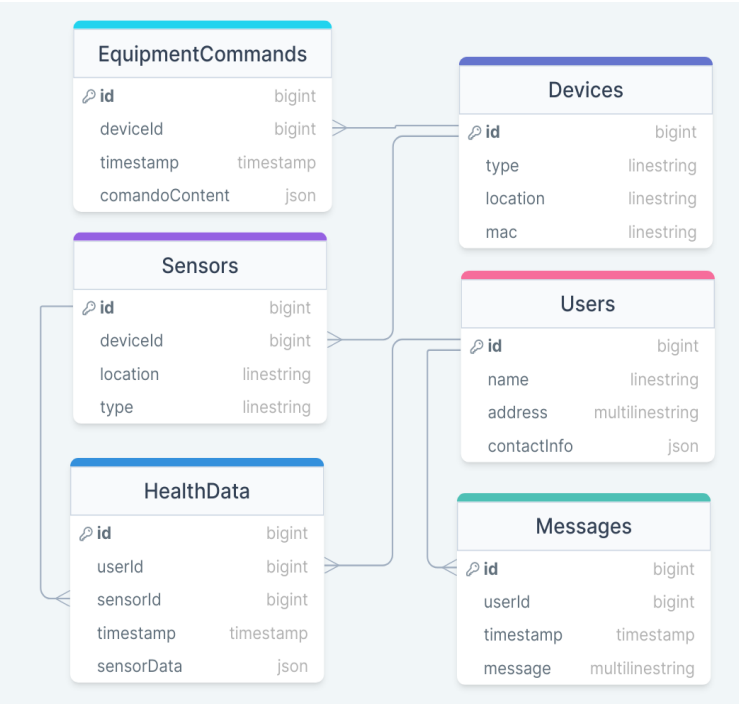
Scope and Objectives of Use Case	
Scope	Smart system that is wearable and capable of interacting with sensors deployed in strategic parts of the home in order to monitor health information and life aspects of patients to evaluate data to help in the treatment of diseases, avoid illnesses ,diagnose early possible health problems.and improve the patient life.
Objective(s)	Safety control:Ensuring mental and physical well-being of elderly
Domain(s)	Health care, Smart Home
Stakeholder(s)	Diseased, elders and comorbidities patients
Short description	The idea is to have some sensors deployed in key places in the home (bedroom, kitchen, bathroom) and a wearable for patient personal use that will collect data about the environment and the user (for now just steps). This information can be transferred to a central, a raspberry, where it concentrates all data. The data in the concentrator will be responsible for learning about the patients habits and evaluate information about the health to improve the patients follow up. The data will be sent to users, doctors that can evaluate eventual changes in patterns that may be indicational to underlying health conditions. A mental support for the patient is provided by adding a "panic" button on the wearable, giving the patient a secure feeling. Summarising devices and data: ● Raspberry Pi 4. Computes: temperature, humidity, presence data (GPIO). Receives: step count (REST Api). Send: telegram messages, equipment commands (MQTT). ● Raspberry Zero. Computes: accelerometer (GPIO). Send: step count, alert signal (REST Api). ● Arduino. Control: relay modules (GPIO). Receives: equipment commands (MQTT).

3 Diagrams

3.1 UserCase



3.2 Database



Relationships:

Users and HealthData: One-to-Many relationship between Users and Health Data.

Sensors and HealthData: One-to-Many relationship between Sensor Data and Health Data.

Devices and HealthData: One-to-Many relationship between Device Data and Health Data.

Users and Messages: One-to-Many relationship between Users and Telegram Messages.

Devices and EquipmentCommands: One-to-Many relationship between Device Data and Equipment Commands.

Flow of Data:

1. Raspberry Pi 4:
    - Computes temperature, humidity, and presence data.
    - Receives step count (REST API).
    - Sends Telegram messages and equipment commands (MQTT).
    - Stores health-related data in the "HealthData" table.
2. Raspberry Zero:
    - Computes accelerometer data.
    - Sends step count and alert signal (REST API).
    - Stores health-related data in the "HealthData" table.
3. Arduino:
    - Controls relay modules.
    - Receives equipment commands (MQTT).
    - Stores equipment command data in the "EquipmentCommands" table.

4 Complete description of the system

The first version of the project, model to be presented, will consist of:
A raspberry pi 4, as a concentrator, coupled with three sensors: presence(Passive Infrared Sensor), humidity and temperature (DHT11). This concentrator will receive the number of steps of the user and/or an alert signal from a Raspberry Zero (REST Api) and compute this data to tell the user and doctors, through a Telegram Bot, the recommendations based on the data. Also, with the data of the presence sensor the concentrator will check the temperature and humidity of the room to send commands to an Arduino (MQTT), which will control equipments and lights using relay modules.

Wearable (Raspberry Zero):
As long as the accelerometer is collecting data and computing to count steps there is no problem.
A comfortable armband with a panic button is gives the patient a feeling of security & is not fearful of forgetting it because you don’t need to take it off

Thermometer & humidity and PIR (Raspberry Pi 4):
These parameters are there as extra assurance. If it can deduce a pattern of the patient's habits we can make assumptions that some things are “not normal” such as temperature, humidity and low activity.
In order to improve the monitoring of patients at home and evaluate the presence in strategic parts of the house and how many times the user stays in each room and how long it takes in them.

Smart lights (Arduino):
The patient's house is equipped with smart lights. Each light is named after the place it’s hanging. Here we can also deduct habits. Moreover the lamps can serve as lamps. If the system thinks there is a problem it can switch the lights on & off. If the patient starts moving, to put out the alarm, the wearable will detect steps & the alarm switches if there is no problem. The switching of lights can also alarm the neighbours

Possible add-ons:
If the patient stays home more it can indicate something about mental health and add others kind of sensors to measure a blood pressure, sound noise and weight,

5 Desired Hardware components (only among those we can provide)

Device Name	Quantity	Needed for…
DHT11	1	Measure room's temperature and humidity
Sensor Presence(PIR)	3	Evaluate position of users in determined places in home
Leds	5	Indicate informations about the using aspects of the systems
Button	1	In emergency situations to call for help
Relay Module	1	Control the power source of any equipment
Arduino	1	Control Leds and Relay
Raspberry Nano	1	Wearable that computes the accelerometer
Raspberry Pi 4	1	Concentrator that controls and analyse all data
Missing		
ADXL335/ADXL326/ ADXL377(accelerometer)	1	Track the steps and the movements of patients