

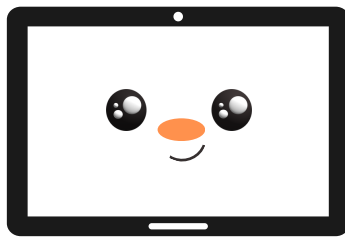
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UNIVERSITY OF
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REPORT ON IOT CONCEPT DESIGN

LH MOB & UBIQUITOUS COMPUTING



MONITO
THE HEALTH MONITORING COMPANION

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I. ABSTRACT

It often happens that the relatives of a person **feel overwhelmed** by the management of this person when she is old or has a pathology requiring daily follow-up to avoid any accident.

As mores have evolved over time, more and more people find themselves **without any company**, which can represent a real danger and a constant mental load. Visits from family, neighbours or acquaintances may be rare, or even in some cases are not recommended.

Feelings of **dependence, guilt** and **lack of autonomy** are felt.

How to allow an isolated person to be followed by his doctor and his family? How to fight against their isolation? How to strengthen the link with the outside and alert in case of problems?

Existing solutions such as human-to-human contact, retirement home placement, the passage of a person daily do not achieve satisfactory results: **too many cases of possible accidents** due to too little presence or negligence. Let's take the example of isolated elderly people, many of them die due to dehydration not managed in time because not detected during heatwaves.

Monito is the ideal solution.

Monito is a **companion for daily monitoring** but not only. Its primary goal is to **strengthen the link** between the isolated user and the outside world through the tools it offers, offer them a little autonomy, **fight against isolation and sedentary** lifestyle, prevent possible accidents, allow a dialogue with his doctor and **alert** him in case of falling constants.

Specially designed with **an intuitive and sleek design** for the best use by all categories of the population, it allows to offer a company by an interactive discussion on a multitude of topics, reduce boredom by generating activities and personalized meals based on the data collected by the connected bracelet: no more sedentary lifestyle and feelings of dependence, hello autonomy!

Contrary to what can currently be found on the market, **Monito** is able to pass small cognitive assessment tests, to transmit the constants to the doctor as real via the secure online platform, detect an anomaly or a fall to prevent and reassure the family through a monitoring application offering several functions.

Monito aims to accompany the user and his family in these difficult times by taking the role of intermediary.

On the user side, this solution comes in the form of a tablet with the Monito user application, specially designed for people who are not used to technology, a charging base with distance sensor to check that no tools are forgotten, a connected bracelet and a clip to fix on his belt to signal falls.

On the family side, this solution comes in the form of a mobile application for follow-up, medical appointments, video calls, to communicate with the doctor and for alerts.

On the medical side, this solution comes in the form of an online platform, which presents in the form of statistics, daily readings of the patient's constants evaluated thanks to the sensors present in the bracelet (temperature, sweating, pressure, sleep, etc.).

STAKEHOLDERS

The **first stakeholder** of this system is the user. It has been scientifically proven that morale plays a very important role in healing and end of life.

Thus, a child suffering from cancer under treatment, who cannot be in a community because the environment is not sterile, will be able to have fun with Monito on a daily basis, discuss various topics, play games evaluating his proposed cognitive system, and its medical follow-up will be less intrusive because integrated with the connected bracelet.

The **second stakeholder** of this system is the family and the medical team. Their daily activity will be rhythmic alert in case of constant low, dehydration or fall of the user. The medical team will receive, according to the desired frequency, the results, will be able to view the meals taken, the rate of physical activity achieved. Both will be able to schedule appointments and a reminder function will warn the user (very useful for the elderly or very young audience).

The **third stakeholder** of this system will be the manufacturers and suppliers, who will have to integrate several sensors to the connected bracelet (sensor analysis of sweating, temperature, pressure, heart rate etc...).

The **last stakeholder** of this system is the regulation on the security of personal data, medical data, it is necessary to use a secure means of storage to transmit medical information to the doctor and information involving the danger of the user to the family by avoiding security vulnerabilities and vulnerabilities.

II. ARCHITECTURE

We will now present 3 different views of the concept to present the general architecture and the connection between the different elements.

FIRST VIEW

The first view aims to explain how things are connected.

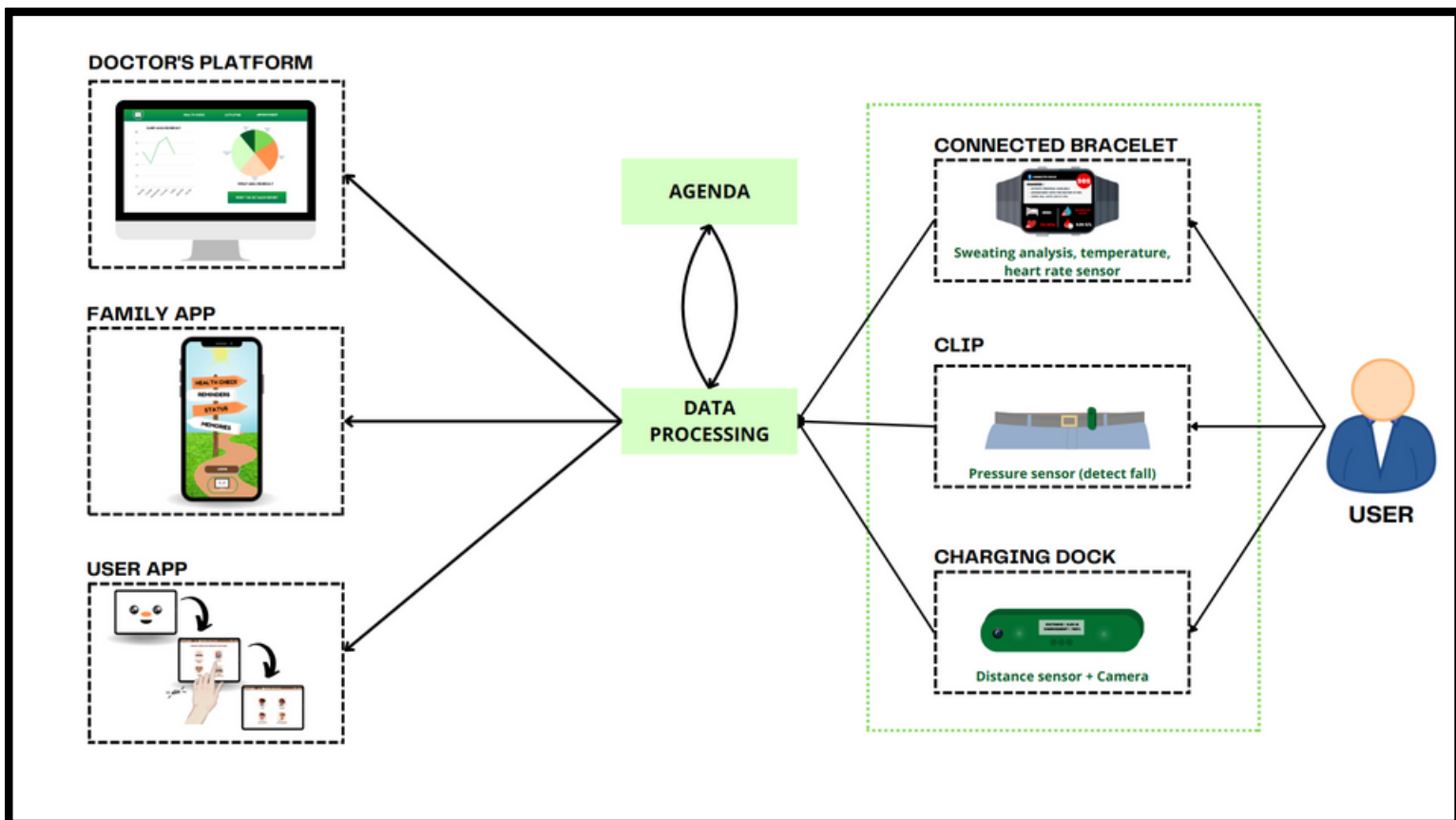


Figure : View of the connection between the different objects

The user is in physical contact with 3 things. The **first thing** is a connected bracelet attached to his wrist. This bracelet allows you to record the user's constants thanks to a temperature sensor, a sensor analyzing sweat (in the form of an adhesive patch under the bracelet) and a sensor analyzing the heart rate and oxygenation.

The **second thing** is a small discreet clip to fix on his clothes, for example on a belt, which contains a pressure sensor. Too much pressure difference will result in the user falling. The **third thing** is a charging base for the tablet that contains a distance sensor to alert the user in case of forgetting objects (bracelets, clips, tablet).

The data is then collected and sent to the various applications, linked to the calendar to manage the scheduled appointments. 3 applications are designed according to the recipients, an application for the user with the chat feature (assistant personal assistant intelligent conversation as for example Amazon Alexa), an application for the family and relatives of the user in order to alert, call and follow the main user, an online platform for the medical team with all medical data and appointment booking.

SECOND VIEW

Here is the second view that aims to show the flow of information between the things and the network (hub/ cloud).

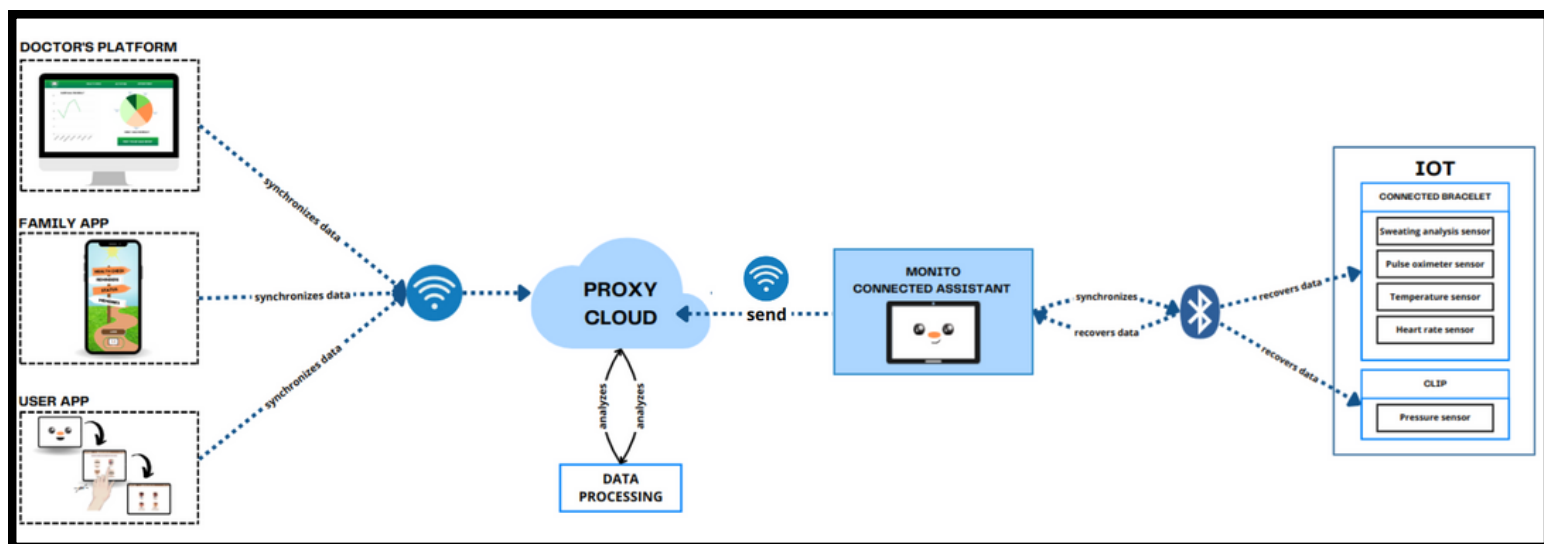


Figure : View of the flow of information between the things and the network

The information is **collected continuously by the sensors** contained in the connected strap and the clip attached to the user.

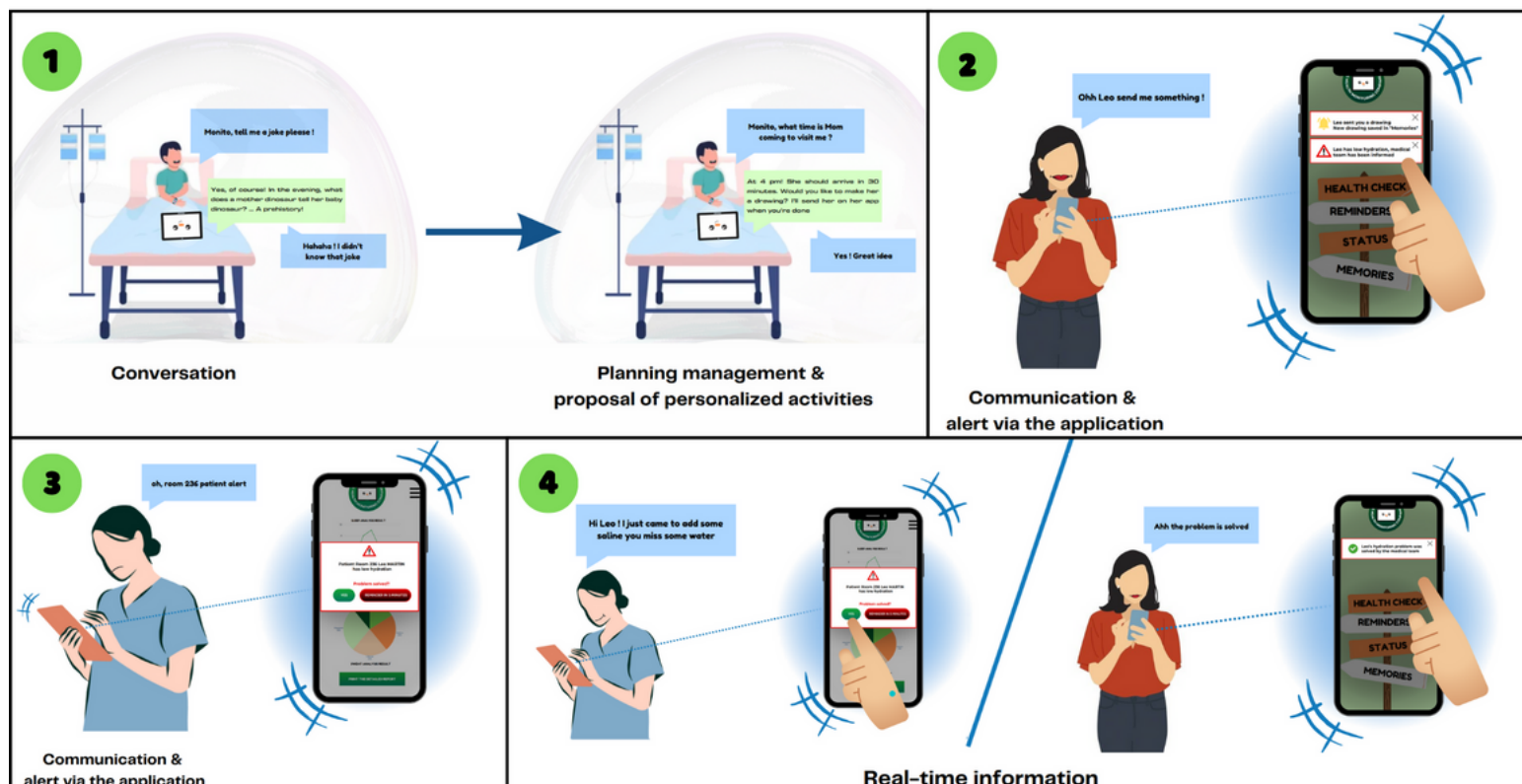
The Monito assistant **permanently connected** to Bluetooth (Bluetooth Low Energy) will synchronize and recover the data from the sensors in a **continuous loop**. The bracelet and the clip are connected to **bluetooth (BLE)** too.

The Monito assistant also connected to the **local WiFi network** will then send the data to the cloud proxy for storage and processing.

Once processed, the data is retrieved by the applications in real time via the **Wifi network**, using the **SSL and HTTPS protocol** to maintain the security of the action.

THIRD VIEW

Here is the last view that aims to show how a user interacts with the concept. To do this, we will make several use cases and explain in the form of an animated diagram the different possible actions.



Here is the first use case.

Leo is a child with a **severe immunodeficiency pathology** that requires him to evolve in a sterile environment with very little interaction and human contact. He wears the **connected bracelet**, the **clip** and has the tablet with the **software in his hands**.

Leo uses Monito for **conversations** on various topics, he uses it for the **management of his schedule** and for him to **propose activities** to fill his boredom.

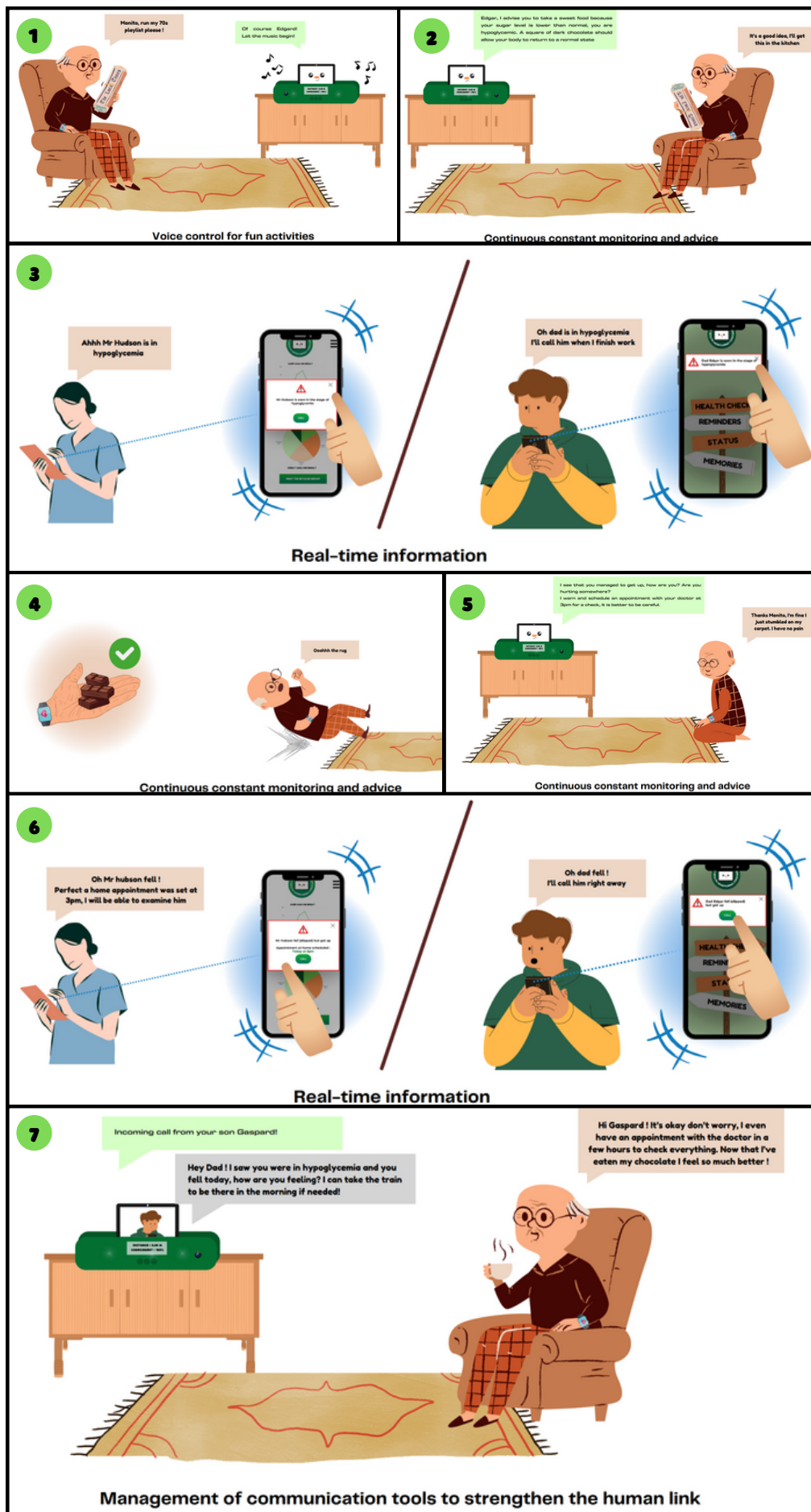
Here, Monito proposed to Leo to make a drawing on his touch screen. Once completed, **Monito sent it** on the application to the family. **His mother received an alert to inform him that the drawing was deposited in the memories section.**

The mother then notices a second alert that informs her that **Leo is dehydrating** and that the medical team has been informed. Indeed, the **sweat sensor** made it possible to detect **this onset of dehydration**, which was then translated into an alert following the analysis of the data.

At the same time, the **alert is sent to the medical team's application**. 2 choices are available to the alert recipient: validate that the action was performed or request a reminder in 5 minutes.

The doctor goes to Leo's room, adds physiological serum to rehydrate him and **validate that the action has been performed**. **Leo's mother receives a confirmation** of the support of her son.

Here is the second use case.



Edgar is **an elderly person with diabetes** who does not support the idea of being placed in a retirement home, who wants his independence but is far from his loved ones: his son Gaspard is not in the same city as him.

Suffering from this loneliness and seeing his son having this constant fear of not being alerted in case of problems, he decides to adopt Monito.

With his connected bracelet and clip attached to his belt, Edgar feels more secure and surrounded.

For example, he can **chat, perform voice commands to Monito**. Monito **takes care of him by monitoring his vitals** and giving him **advice to avoid critical situations**. The link between the doctor and the family is maintained by **alerting in real-time via the application**.

In the event of a fall, the sensor attached to the belt gives **information on movements**. This data is then processed to assess the severity of the fall, if it is necessary **to contact the emergency services or simply the doctor for a check**. The family is also updated in real time.

The application has a shortcut to allow quick contact. So, following his fall, Gaspard was **able to contact his father to make sure everything was okay** and was reassured that Monito had **anticipated the appointment through the doctor's schedule**, so his father will have a quick medical opinion.

III. REQUIREMENTS

We will now present a table showing the requirements for use, non-functional and functional.

Functional Requirements	Non-functional Requirements	Usability Requirements
Sensors must detect and report data in real time	Performance: The system must be able to quickly notify the family and physician in the event of a critical abnormality or fall.	The system must be easy to use with clear actions to include all categories of the population (child, adult, elderly)
The pressure sensor must be well calibrated to avoid unnecessary alerts in case of too sudden movement that would be considered a fall	Security: the system must be able to store and send data securely and encrypted to protect user privacy.	The system must offer a professional and medical display for the version intended for health professionals.
The sweat sensor must be positioned so as to be in contact with the skin (patch).	Security: the system must be able to give access to data only to authenticated persons.	The system must be reassuring and accompanying for the version for those close to the user (family).
The system must be able to analyze sensor data	Security : The system must comply with medical data regulations	The system must allow exchange and interaction between the different parties (doctor, family, user)
The system must be able to send alert notifications to the family and doctor based on the data analyzed	Performance : The system must allow the simultaneous connection of multiple devices and multiple users.	

Functional Requirements	Non-functional Requirements	Usability Requirements
<p>The user version of the system must be able to generate and offer customized activities to avoid the user's sedentary lifestyle.</p>		
<p>The user version must be able to assess cognitive tests in game form to prevent decline (rapid management improves the chances of recovery) and send it to family and doctors weekly</p>		
<p>The user version of the system must be able to analyze auditory commands, hold a conversation with the user to fulfill the role of life companion and orient his answers according to the interaction (appointment reminder, playlist or video call launch, google search ...)</p>		
<p>The system must offer an application for the doctor, family and user to maintain the link between the different parties.</p>		

IV. EVALUATION

We will now discuss the criteria that could be applied to evaluate and test the concept. The information is presented in the following table to provide a short explanation according to the criteria

Criteria	How to evaluate it
Functionality	<ul style="list-style-type: none">• Test the association and operation of the sensors within the bracelet• Test the sweat analysis thanks to the patch containing the sensor under the bracelet, test its good contact with the skin• Test and calibrate the pressure sensor to detect a fall• Check the data collection in bluetooth and the synchronization loop provided in the Monito software• Check the display of data collected in different applications, data analysis and alert sending• Check understanding of voice commands with different voices, accents, ages.• Check the activity generation adapted to the profile.
Security	<ul style="list-style-type: none">• Verification of the login page for access to applications,• Verify cloud security by testing unauthorized penetration into the system and performing regular updates to avoid security breaches and vulnerabilities,• Verification of data encryption and whether it is possible to intercept the flow of data including medical• Verification of the conformity of the mode of operation, in accordance with the regulations for medical solutions,
Availability	<ul style="list-style-type: none">• Test at any time of the day if the sending of alert is possible on the different applications, in case of constants too low, dehydration, fall etc. and identify possible errors

Criteria	How to evaluate it
Usability	<ul style="list-style-type: none"> • Perform User testing sessions on participants of all ages with or without pathology to qualify the usability of different applications (for a simple and intuitive design), in the form of a scenario with a simulation between the different pages to achieve the objective.
Quality	<ul style="list-style-type: none"> • Check if the response rate is fast for voice commands and sending data • Check the accessibility of the device • Check the quality of the data distribution flows between the different parties. • Check the respect of privacy • Check the quality of the applications and software for the medical team (compliance with expectations)