

# KeepingTrack – Helping dementia autonomy

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**Abstract** — Currently, the most developed countries are facing an increase in average life expectancy. This increase is mainly due to high technological advances in terms of techniques for preventing, diagnosing and treating diseases. In this way, more and more degenerative diseases will appear, including dementia. This disease affects memory, reasoning, judgment and learning capacity. Its carriers may, among other things, try to run away from home, lose their sense of direction and present changes in their personality leading to a state of mental confusion. In this way appears KeepingTrack, which, with a GPS pulse tracker and a camera capable of identifying when a patient leaves home, will allow the monitoring of patients diagnosed with this disease, ensuring their safety and assistance, without constant personal supervision by the caregiver, thus preserving the patient's daily autonomy. There are already several devices that serve this same purpose, but they present difficulties in terms of device portability, battery life and in maintaining an online history that is available for consultation.

**Keywords** — *Dementia, Biomedical Devices, Distance monitoring, Face recognition, GPS tracking*

## I. INTRODUCTION

The increase in the elderly population due to the development of medical technology has led to an increase in average life expectancy. This fact is creating challenges for health professionals and health system developers.[1]

It is expected that with the advancing years and progressive ageing of the population, there will be increasing social and economic pressure to maintain quality of life in older age groups.

Thus, it is of relevant interest to elaborate new strategies and means to promote the independence and activity of older people, mainly those affected by some kind of dementia or debility, privileging health in general, but also delaying the assistance of continued care.[2]

It is in this context that the project presented in this article arises, which is based on monitoring people with dementia, ensuring the safety and assistance of the patient, without having them require constant personal supervision of the caregiver, thus preserving some daily autonomy.

The project presented in this article is called KeepingTrack and allies two distinct aspects that are based on the use of two electronic devices which complement each other: a Global

Positioning System (GPS) pulse tracker, which enables the real-time location of the patient by his or her caregivers and a camera capable of facial recognition, to identify when a patient leaves home.

## II. MATERIALS AND METHODS

The project developed consists in monitoring the patient at home through a facial detection camera that records the date and time when one leaves home.

To implement image processing that would assist in monitoring and offer greater control of the patient's activities, a code was developed in Python language.

Facial recognition is a biometric security technology that identifies individuals based on their facial features. The process involves detecting and locating a face, capturing, and analyzing its geometry (to create a numerical code called a facial print), and comparing it to a database of known faces. For this purpose, a program was developed and uploaded to a camera, which makes it possible to recognize the patient from photographs previously uploaded to the device.

The monitoring of the patient outside is achieved through a bracelet that they carry with them, and which allows obtaining their location using Global Positioning System (GPS) technology. The caregiver can obtain their location in real time by sending a Short Message Service (SMS) to the number of the SIM card also installed in the bracelet.

The patient's location data and the communication with the carer via SMS are performed by a module known as SIM808. The processing of the data generated by SIM808 was performed through a microprocessor known as Arduino.

By consulting the mobile application, called KeepingTrack, the caregiver will have access to the history of all the locations requested in a more organized and convenient way, as well as the history of the patient's exits from his or her home.

In pursuance of developing a Python program that allows the user to do all this, this app must be able to receive and store GPS data sent by the SIM808 module. Several digital platforms were used, with the first one being Twilio. It provides programmable communication tools for making and receiving phone calls, sending and receiving text messages, and other communication functions.

The Flask platform was also used for application development, which allows for quickly building web applications with minimal overhead. The application sends an HTTP POST request to the Twilio platform, which then sends the message to the intended phone number. The application receives the message from the SIM808 module, which is sent to the Twilio virtual number, and then to the application through an HTTP request.

In addition, there is a light signal on the bracelet, which can be activated by an infrared remote control, so that, in case of danger or emergency, the patient can be found on site.

The following diagram shows the project overview.

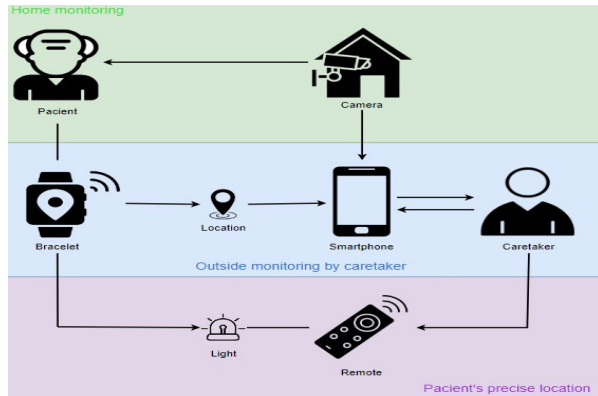


Fig. 1. Project Overview

### III. PROPOSED SOLUTION

The simplified model of the locator bracelet was designed, as shown in the figure below, where the central compartment will include the GPS module and a light warning signal (which can be activated by an external remote) and will be secured to the wrist by a bracelet with an adjustable snap closure.

Engraving of the KeepingTrack logo will allow light to exit the interior via a grille/grid.



Fig. 2. Prototype

An application (capable of communicating with both devices) was developed in Python for data presentation and supervision by the caregiver. The open-source library used for this purpose was Kivy, which allows the respective application to run on Windows, iOS, Linux and OS X.

The aim of this app is to keep a history of data in order to carry out continuous monitoring, both of exits from home, through the data provided by the facial recognition camera, and of locations when sending an SMS requesting the patient's location.

To display GPS data, a Python program was developed using the MapView class and a JSON file, which was converted to .csv and .db formats. Each location obtained via SMS is marked on the map with a marker. Clicking on a marker displays a new window with the corresponding longitude, latitude, and timestamp, as well as a Google Maps link to the patient's exact location. SMS can be sent through the app's Get Location option, which uses Twilio for communication. The patient's exit data is displayed similarly to the GPS data, but without converting the JSON file. The app displays the patient's name, date, and time of detection by the facial recognition system.

A brief description of the project is also available.

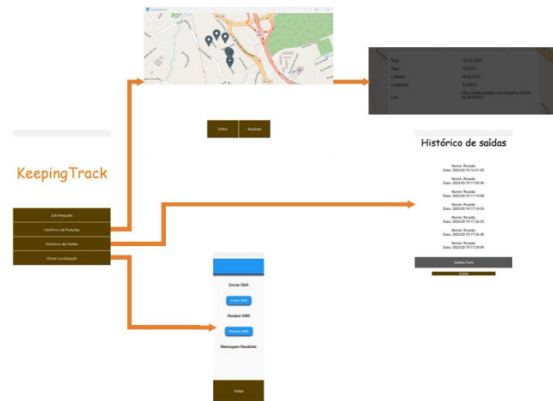


Fig. 3. App layout

### IV. CONCLUSION

In summary, the project presented in this article provides a novel and pragmatic solution for monitoring dementia patients, enabling them to live with greater independence and security. While not flawless, there is room for future enhancement and refinement.

This project faces challenges in integrating the necessary technologies into a wearable bracelet for practical patient use. Therefore, it is crucial to minimize the size of the components to maximize patient comfort. The developed application would benefit from a feature that alerts caregivers when the patient moves beyond a predetermined distance from home. The data capture process could also be made more accessible, as the current process requires the use of an international virtual number provided by Twilio, which can be expensive. Other options include considering a different platform or improving the Twilio subscription as the software limits message sending to only one number, preventing the use of another SIM card in the GPS location module.

### REFERENCES

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