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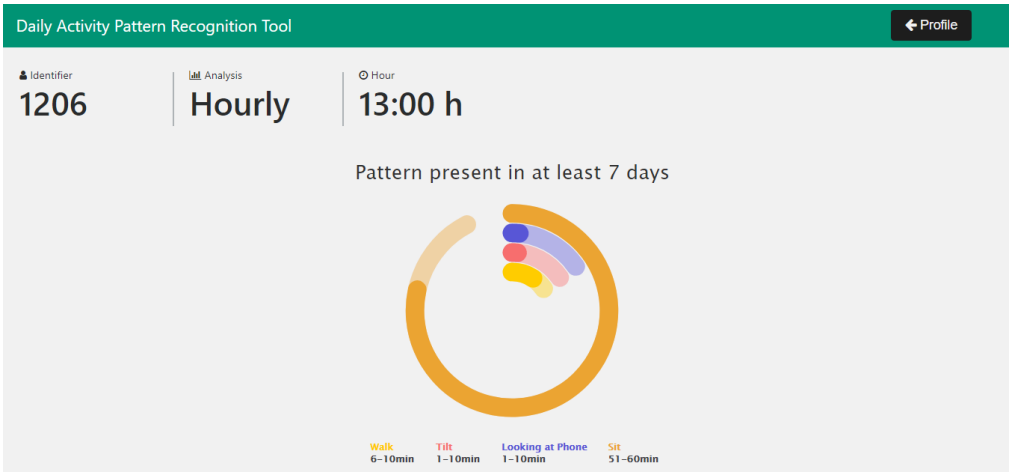

Fig1. User hourly analysis interface, with the hour being analysed and a graph representative of the physical activity pattern for that same hour.

DACTIVPR

DAILY ACTIVITY PATTERN RECOGNITION TOOL

The Problem

Because of the continuous advances and the raising interest in pervasive systems there are numerous solutions in this field released in today's market.

Most of the solutions are capable of recognizing user's activity with a high degree of certainty by implementing different classification algorithms in datasets retrieved by ubiquitous system's sensors.

Fraunhofer's Smart Companion is one of these solutions and uses an approach based on decision trees and data collected from accelerometers that accomplished an accuracy of 99,5% in the classification of user's physical activities.

The use of this system generates a big amount of data that, if treated accordingly, could result in the definition of user's physical activity pattern in different time frames.

The ability to delineate these patterns and then draw conclusions about them could be a huge step in order to identify prejudicial behaviours related with physical inactivity for example, which is one of the major health problems in the world, and is correlated with various chronic diseases.

Solution

With the mentioned problem in mind, the main goal of this project was to develop a pattern recognition tool using appropriate algorithms for the recognition of activity patterns based on hourly and daily records.

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Smart Companion

The Smart Companion is an award-winning set of applications for the Android smartphone that were specially designed to meet older adults' needs.

Frequent Pattern Mining

A pattern is classified as frequent if it appears repeatedly in the dataset, having a frequency that is greater or equal than the specified threshold. The discovery of these patterns can have significant relevance and create knowledge about the origin of the data or even reveal interesting associations in the dataset.

Visualization Methods

These are the primary tools to augment the human capabilities by improving data's quality and the ease of understanding. They are capable of surpassing the cognitive barrier if applied in the correct manner.

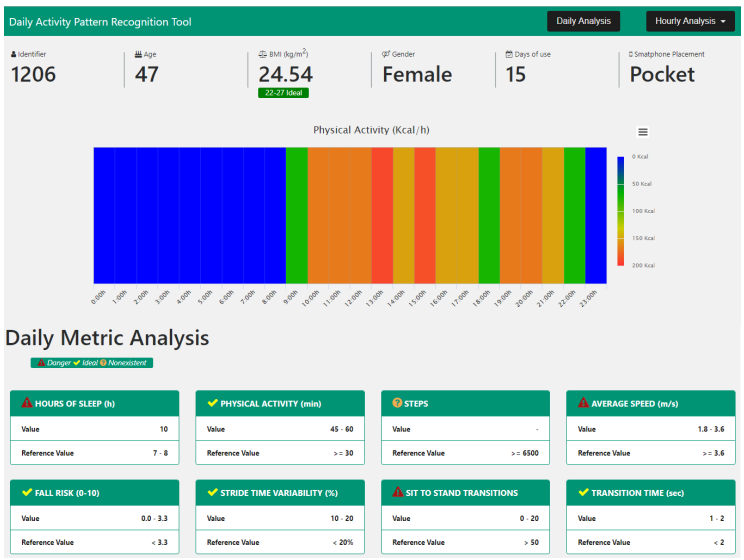

Fig2. User's profile interface, with a physical activity per hour graph at the top and the collection of daily metrics with the respective reference value at the bottom.

To do so, a web application was created, containing a parsing module to implement frequent patterns (FP) mining techniques and several interfaces to convey the knowledge created to the end-user, the Smart Companion user's caregiver.

Data Parsing

All the information generated by the Smart Companion's system was analysed so that the most important could be parsed into a defined data framework.

Then, the data structures referring to different time frames were used as input to try out several FP mining algorithms. The most efficient one was implemented in the web application backend.

In addition to the direct extraction of the FP from several physical activity metrics, other values, like hours of sleep, were calculated as we can see in Fig1.

Web Application

To make all the information easily accessible to the end-user, a web application, that follows the information flow portrayed in Fig3., was developed using adequate visualization methods. It includes the hourly and daily analysis (Fig1.) interfaces together with the profile interface (Fig2).

This tool was validated and improved through validation tests with possible end-users. In these tests, the web application scored a mean of 89.5, in a scale from 0 to 100, in a usability questionnaire.

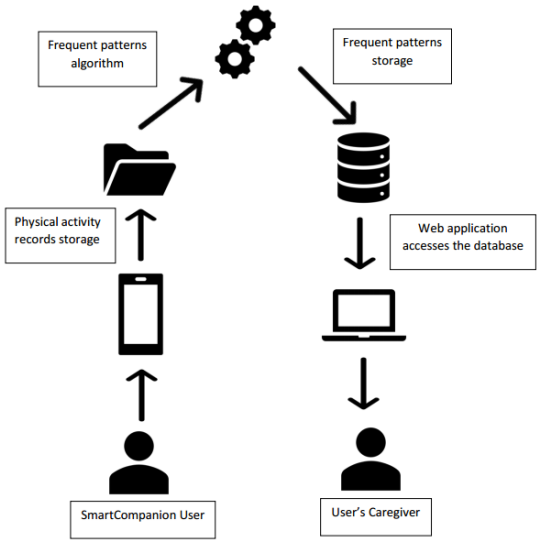

Fig3. Basic system's architecture and information flow.