Chapter 3

Novel paradigm for a social interaction

One of the main goals of the ACANTO project is to create an assisted living environment in which its users, i.e., elderly people, are socially connected, and in which they can share, though the CPSN, activities and interests. Task T6.3 has to develop paradigms to enable social interactions possible by means of haptic information. Activities like running, walking, visiting a cultural center, can be promoted to elderly people by making possible those interactions which were not available before. These new paradigms, which take the names of "social running/walking" and "human-human formation", will permit to increase the participation of the CPSN users to social activities.

In what follows, we describe the evaluation of a "social running" system exploiting vibrotactile feedback. This system deals with the technological pillar a) of T6.2 and the technological pillar a) of T6.3.

3.1 Introduction and Motivation

Social running is a popular fitness habit around the world nowadays. Many apps and websites are available for better organizing it, [27, 23]. The aim of task T6.3 is to go beyond the classical concept of social running, by introducing tactile communication of the pace of running companions. This possibility enables new forms of social interactions and empathizations between running mates.

Figure 3.1: Wearable haptic display for "social running". Main concept: each user felt the sensation of the running pace of the other user on her/his legs

3.2 Technical Implementation

Our system is composed by a central part and a couple (or multiple of couples) peripheral components. The central part of the system is acting as server for the peripheral incoming connections, and it is in charge of keeping one or more couples of users connected and of routing correctly the haptic cues to be provided. A single peripheral part of our system consists of a mobile app, installed on the user's smartphone (see Fig. 3.3), and of two wearable haptic devices (named A in Fig. 3.2), i.e., vibrotactile anklets, worn by the user. At the current state of the implementation, one user can be connected only to another single user.
Each vibrotactile anklet consists of four Precision Microdrives^{TM} 303-100 Pico Vibe 3.2 mm cylindrical vibration motors (named A in Fig. 3.2) and a triaxial accelerometer MMA8451Q, independently controlled and read by a on-board microcontroller Arduino^{TM} Pro Mini 3.3V - 8 MHz, working at a baud rate of 115200, and connected to the smartphone via a RN42 Bluetooth^{TM} 2.0 module. Each motor is placed into a fabric pocket, sewed on the external surface of the stretchable anklet. The electronic (D) components are packed into ABS containers, whereas the overall underlying appearance of the wristband can be covered (C) or not (B). The user's smartphone (see Fig. 3.3) is connected to the central part of the system via TCP/IP protocol through internet. At the current stage of the development, the smartphone is connected to the net primarily via 3G technology.
The microcontroller at the user side acquires at 100 Hz the triaxial accelerometer data, and communicates at 10 Hz with the smartphone. The microcontroller is in charge of: *a*) step detection and transmission; *b*) step detection reception; *c*) actuation of the haptic stimulus. The adopted policy for step detection is to check the euclidean norm of the three acceleration measurements; if this value is below a fixed threshold a step is detected.The threshold depends on the velocity and style of running, and is obtained by a calibration procedure in the first few seconds of running for each user.

Each time a step is made by one user (user A), his/her smartphone sends this information to the central part of the system, which routes this to the other user's smartphone (user B) for haptic actuation. The behavior just described is replicated by the anklets of user B, so the functionality of the system is in fact bidirectional. The mapping between the step made by a user and the vibration applied to the other one is one-to-one: a step made by the left leg of user A is mapped on to the left of the user B; the same is for the right leg of user A, and viceversa in the direction of communication (i.e., from user B to user A).

At this stage, the vibrational cues applied on the users are a simple activation of all four motors at the same time, i.e., the time related to one step of the other user, but in fact the hardware permits more complex pattern.

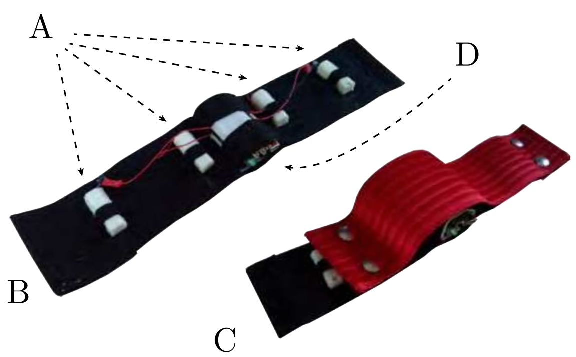

Figure 3.2: Wearable haptic display for "social running". Haptic devices detailed view: (A) vibrating motors; (D) electronics and battery. The anklet can be covered (C) or left uncovered (B).

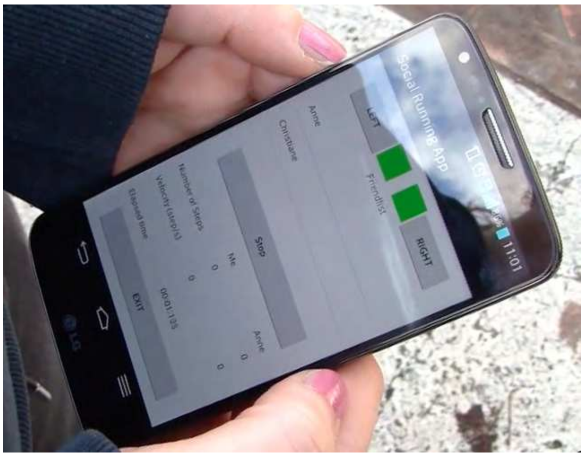

Figure 3.3: Wearable haptic display for “social running”. Mobile app.

Nevertheless, it is worth to add that the more complex is the haptic cues provided to the user the less intuitive the usage of the system becomes.

3.3 Experimental Validation

Fourteen participants (seven couples) volunteered to take part at our experimental validation. All participants had no motor or perception disabilities. Seven of them had previous experiences with the presented devices. The average age of the participants was 35 years old; nine of them were female. Informed consents were obtained from all the participants before they took part in the validation. For evaluating users experience, a questionnaire using bipolar Likert-type five-point scales was proposed to the participants. The questionnaire dealt with the system easiness of use and its social engagement effect. The users found the system easy to use, and they felt to be more social connected with the user at the other side of the system.

Although the average age of the participants to our evaluation is well below the expected average age of the FriWalk users, and in general of the ACANTO system, we deem this evaluation crucial to prove our concept. An extended evaluation of our “social running” paradigm with elder adults is already planned in the close future.

3.4 Results and Discussion

The current implementation of the system only permit couples of users. We will extend its functionalities to more complex inter-connections. Studying how to connect participants with haptic feedback is very challenging and poses interesting research question especially when their performances are very different. What will be interesting is to find, for instance, the optimal co-runner for each agent. Using the available activities list, the users preferences and past performances, the CPSN could be exploit to pair users for a social activity.

Chapter 4

User Interface Mobile Application Views

The visual interface is one of the primary means for providing input to the system and for received output from it, by selecting destinations and modes of operation. The video interface has been designed for emphasizing the easiness and the simplicity of use, In particular, the visual interface should not distract the user by capturing his/her attention beyond what is required for the interaction. Further developments of the visual interfaces are due inside task T6.4 "FriWalk construction and FriTab interfaces: design and testing", where the prototype is constructed and tested. Here a previous version of the user interface is shortly presented.

The application on the mobile device is structured in a number of different views which the user can navigate through in order to more easily reach the desired destination. In terms of design and in order to differentiate each option, our main motivations were the color contrast, and the position of main areas in the view.
The menus have been created in the clearest possible way, to offer simplicity in each screen, avoiding losses of focus in the navigation.

4.1 Application screens

The possible views have been developed in the mobile application included in the FriWalk prototype, and have been based on the guidelines and design decisions explained in the current document.

4.1.1 Login view

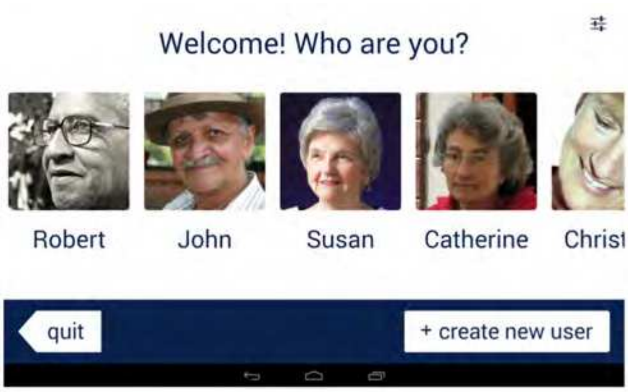

Figure 4.1: User interface. Login view.

This view, shown in Figure 4.1, is the one which the user can interact. It is directly shown after the startup of the application. In this view, one can find the profiles of the users with an active account in the system, along with their own photo, making the selection for the user easy. When the number of users exceeds the dimensions of the screen, the menu is extended horizontally. In this case, the users can find their profiles easily with a swipe gesture. If the user does not already have a profile, she/he can create a new one by pressing the corresponding button on the secondary toolbar. This view triggers two possible ways according to the application flowchart. The first gives access to the navigation functionality by touching the profile of the user, and the second offers the possibility to create a new profile for the users who did not have one.

4.1.2 New user view

This view is fired modally from the login screen. It is the first view of the creation profile flow, where the user completes her/his name for naming the profile which is being created. The view tries to follow the simplicity of the application guidelines, showing the text box and the possible actions in the clearest possible way. The screen generates two possible directions, by accepting the user is redirected to the next view in the creation profile flow, and by declining, the user is returned to the login screen.

4.1.3 Destination selection view

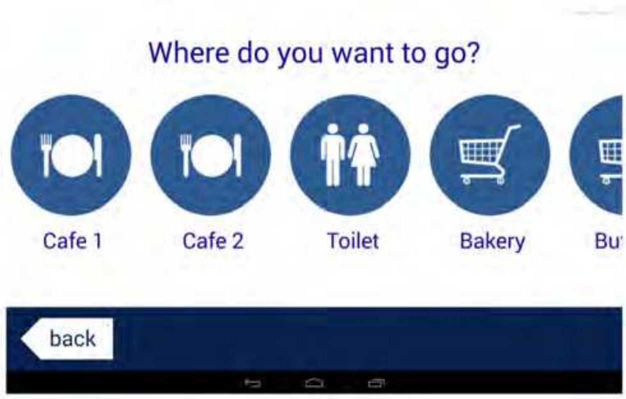

Figure 4.2: User interface. Destination selection view.

This view corresponds to the normal flow of the application, it is shown in Figure 4.2, and can be considered as the first view previous to starting the navigation screens of the system. There can be found a horizontal list of the available destinations of the system. The view uses the same interaction through swipe gestures as was explained in the login view. The icons and the descriptions help the user to find easily the desired destination. By touching in the destination, the user is redirected to the navigation view. In case the back button was pressed, the user cancels this session and is carried back to the login screen.

4.1.4 Navigator view

The navigator is the most important view in the application. Depending on the profile of the user and very directly on her/his sensorial deficiencies that were catalogued in the profile generation questionnaire, two possible navigations views can be launched: the expert view, which includes a map representation, and the non expert view, that directs the user by 'turn by turn' navigation based on known point of interest in the route.

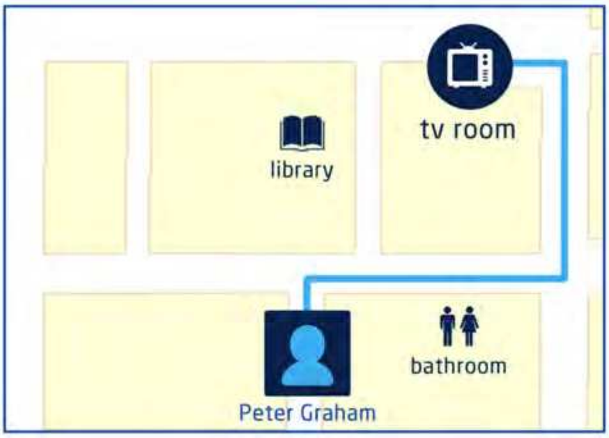

Figure 4.3: User interface. Navigation view.

Main Navigation subview

This view, shown in Figure 4.3, shows a clear image of the map where the user is. Its main purpose is to visualize a minimalistic map, with no superfluous graphical elements that let the users localize themselves with a quick sight on the device screen. The icon that represents the user location is always shown in the map, to avoid that the people could feel lost in their route. This icon displays the user photo defined in the profile creation phase. The destination is represented by the same icon used in the destination menu screen for simplicity and to favor a fast recognition to the users. These symbols are sufficiently representative to define a location or object without needing a very descriptive text. There are other locations displayed through the map, with the purpose of orientating the user while he/she is making progress in her/his route. These elements can be considered as markers of points of interest in the route path, which the user has to follow to reach the destination. The map background is made in light colors, which provide a high contrast with the text and icon shapes.

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