ActiveLifestyle: an application to help elders stay physically and socially active

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Abstract Age typically brings motor control impairments and loss of the lower body muscle strength, which can lead to falls, injuries and, in the worst case, death. It is well know that the practice of simple daily physical exercises can reduce the likelihood of falls, however, it is also known that it is far from easy to motivate elders to exercise, especially autonomously at home. To address this challenge, we have designed an app that not only makes it feasible and easier to follow a training plan for physical exercises, but that also introduces individual and social motivational instruments to increase the adherence to a plan – everything inside a virtual community composed of training partners, healthcare experts, and family members.

Introduction

The incidence of falls among older adults is high. Approximately 33% of the community-living elders fall at least once a year in developed countries (Deandrea et al. 2010). This percentage increases to 50%-70% for elders over 85 years old living in the same conditions (Iinattiniemi et al. 2009; Yeom et al. 2011). Falls can lead to injures, fractures, dependency to perform daily living activities, and, in the worst cases, to the elders' premature death.

As an attempt to decrease these numbers and promote elders' health, wellbeing, and independence, the Healthcare Community (i.e., physicians, gerontologists, and hu-

man movement scientists) strongly recommends a routine of physical exercises, more specifically strength and balance (Sherrington et al, 2008).

It is well known that being physically and mentally active implies many benefits to a person's health, while inactivity is at the origin of several chronic diseases (Katzmarzyk & Janssen 2004). However, people, and especially elders, typically don't know how to include even simple exercises in their routines, and they lack motivation. E.g., in Korea, even with strong support from the government and the healthcare system, only 9% of the elders practice vigorous physical activity, 10% practice moderate, and 48% practice walking (Yeom et al. 2011). Hence, the sole availability of money and training plans is not enough and the need for further studies to discover how to motivate elders to follow physical activities remains.

We introduce an IT-based solution for active and healthy ageing, named Active-Lifestyle app, that aims to improve elders' balance and strength and specifically aims to keep them motivated. For that, we propose a pro-active software for physical training that assists and monitors elders. The software comes with individual and social motivation features that aim to persuade elders to keep a routine of training exercises. The software was specifically designed for elders and runs on an iPad. The trainings and the design of the app were developed together with human movement scientists of the Institute of Human Movement Sciences and Sport at IBWS at ETH Zürich.

Example Scenario

As a fictitious scenario, let's take Albertina (80), a healthy and alone living woman that has been presenting some difficulties to stand up quickly and has fallen some times in the last year. In order to prolong her independence and avoid serious injuries, her doctor prescribes an 8 weeks plan of balance and strength exercises.

According to the plan, the strength workout sessions must be done twice a week, starting with 6 warming-up, followed by 9 strength, and finalized by 3 stretching exercises. For each, she has to do a minimum number of sets (1-3) and repetitions (10-15). In some exercises weights are required (2-6kgs). In practical terms, Albertina needs to know which exercises she has to do every day and how (i.e., sets, repetitions or seconds, as well as the amount of weights). As Albertina is not used with the exercises, she might have an easy way to learn/remember them[1,2].

[1] E.g. of balance exercise (Heel-to-toe walk) www.youtube.com/watch?v=krxw-1mfrDc

[2] E.g. of strength exercise (Chair stand) www.youtube.com/watch?v=RTXDWiCpSZQ

Albertina spends more than half an hour exercising the days she has to perform both sessions. Sometimes, following the rather repetitive, mechanical exercises is boring, and only her goal to remain independent is not always enough to maintain her motivation high. Supporting her to follow a plan of exercises autonomously at home therefore also means doing the work of a personal trainer and taking over planning of exercises, but also helping her track her progress and motivate her.

Requirements and Principles

The aforementioned barriers pushed us to extend our previous work (Daniel et al. 2011), developed to remotely assist and monitor runners during a marathon training plan, to support elders' strength and balance training plans. For that, we need to:

- design an interactive and friendly UI to be easily understood and managed by elderly users with no or only few computer skills;
- offer support for balance and strength training plans, informing the user when, what, and how to do each exercise;
- collect, process, store and report information to allow healthcare experts to remotely monitor the users' performance and compliance with the plan, their mood, and also detect eventual problems;
- allow remote communication between elders and healthcare experts;
- support motivation instruments to persuade elders to follow a plan.

Motivation is a very broad, multifaceted and complex topic that has been researched for ages by psychologists and sociologists without reaching an agreement about the real factors that motivate someone. Though, it is common to find research where motivation instruments have been successfully applied. In the IT field, we can mention the well-known work lead by Fogg (captolgy.stanford.edu) to motivate people to follow a certain behavior. As a first attempt we decided to follow his intrinsic and extrinsic motivation strategies (Fogg 2008):

Intrinsic motivation strategies are based on trigging someone to do something because it is inherently enjoyable for this person, independently of any external pressure. For example, by means of:

- goal-setting: establishing specific, measurable, achievable, realistic and time-targeted goals;
- self-monitoring: allowing people to monitor themselves to modify their attitudes and behaviors to achieve a predefined goal or outcome;
- creating awareness: showing the benefits of following a determined behavior or the progress toward a plan;
- conditioning though positive and negative reinforcement: immediately offering a reward/praise for someone after an expected behavior to encourage it and as a result increase the probability that it happens again, or the opposite, reprimand-

ing whenever undesired behavior happened aiming to decrease the probability of a relapse.

Extrinsic motivation strategies are build on social psychology, in which other people can be the source of motivation. For example, by means of:

- competition: proposing a goal that can be shared and at least two parties strive to reach it;
- collaboration: offering a beneficial outcome that the involved parties con only achieve collaboratively;
- comparison: allowing a person to compare similarities and differences between two or more parties, people tend to keep equity in their relationships.

Another important requirement is to facilitate human computer interaction, since our elderly users not necessarily have computer and high cognition skills. Previous works pointed to the mouse as the main barrier to computer adoption among such class of users (Loureiro et al. 2011; Tsai & Shang 2009). To facilitate the adoption of our system, we have seen that the iPad as mobile device – if equipped with suitable, easy-to-use software – is very promising in the context of elderly people (e.g., relatively robust, and using fingers instead of a mouse makes the iPad much more intuitive and easy to use compared with smartphones, notebooks, or desktops).

Architecture and Implementation

Figure 1 shows the architecture of the ActiveLifestyle platform, and its main components are described in the paragraphs below.

The iPad ***ActiveLifestyle app*** is the core of the platform. It is responsible for the communication with the elder. The app supports the elder during the workout sessions (e.g., via videos and written details about the correct movements), collects their feedback (e.g., the number of performed sets, repetitions, and used weights, as well as mood and additional comments) to be further remotely monitored by the expert and used as input to compute metrics and set the motivation instruments. Using this app, the elder can also send/receive messages to/from his/her healthcare experts and friends. For more details watch our video available on the Web: youtu.be/Akvs13UMvfc and youtu.be/ MT0UCQD5Odo.

The ***ActiveLifestyle web portal*** (test.lifeparticipation.org/ActiveLifestyleWebPortal) allows healthcare experts to create training plans, associate them to users, manage communities, and remotely monitor the users' performance, as well as communicate to them whenever necessary to send motivational feedbacks.

Finally, the iPhone ***ActiveLifestyle Friend app*** allows the elder's friends to send and receive messages. In addition, the app can show the elder's performance, allowing the friends to monitor the elder and to provide feedback.

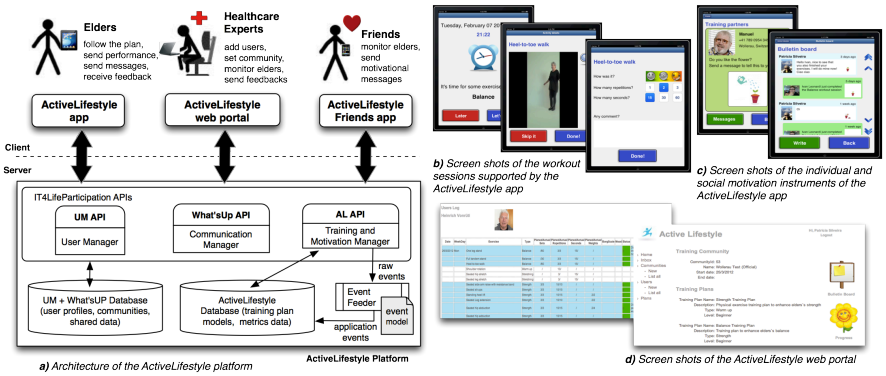

Fig. 1. a) Architecture of the ActiveLifestyle platform; **b-c)** Screen shots of the ActiveLifestyle app; and **d)** Screen shots of the ActiveLifestyle web portal.

The applications and web portal invoke REST services and exchange JSON messages with the IT4LifeParticipation APIs. The UM API deals with authentication and user management issues. The What'sUp API controls the communication and social aspects (e.g., communities, messages exchange). Finally, the AL API manages the training plans, the motivation instruments, and the feedbacks of the users sessions. The event feeder consumes raw events (JSON messages) containing the details of the performed activities, parses them according to an event model, and transforms them into application events to be finally stored on the database.

The ActiveLifestyle platform makes part of the LifeParticipation project, which not only aims to help elders to stay physically fit, but also to feel useful to society and be socially involved. More information about it and a complete state of the art is available on our website site at lifeparticipation.org.

Evaluation and Conclusion

To evaluate the ActiveLifestyle app, two tests are planned. At the moment we started the Feasibility Test, in which 15 Swiss elders (76-84 year old) are using the app during two weeks[3,4]. The test aims to evaluate the feasibility of the app and the iPad adoption by elders. To collect the results and evaluate our hypothesis we adopted

[3] Teaser of the Feasibility Test: www.youtube.com/watch?v=pgyYSjAR6h4
[4] Höfner Volksblatt newspaper note: lifeparticipation.org/IT4LifeParticipation/news.pdf

three questionnaires (i.e., health, technology familiarity, and feasibility). The test is ongoing, but we are already very satisfied with the preliminary results. Most of the participants have been doing the exercises and sending enthusiastic comments. For example: "*I feel fine thanks to your help*; "*I have age. I did the exercises more bad than good. Hope you all do it better"*, "*The right leg is much stronger than the left leg! I feel that the training is necessary"*; "*I'm glad my legs are not always so hard!"*). Apart of that, the participants already asked how to continue the exercises after the study, and one of them already bought an own iPad. So far, our participants seem very enthusiast. If this paper gets accepted, we will be able to present the complete results of our study in the final version and during the presentation.

In the second round, Physical Test, 30 elders will follow the physical plans for 12 weeks. At the first 6 weeks one sample will be supported by the app and the other not, and at the last 6 weeks we will switch this configuration to obtain a cross validated results. Apart from questionnaires, this second round includes a physical evaluation before and after the plan to measure their fitness and improvements.

We are strongly confident about the possible physical and social improvements that can be achieved with the ActiveLifestyle app. In the near feature, we will be working to add the missing motivation instruments and to fix the eventual issues raised during the on-going study to have a complete app for the second round of tests.

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