Fitness Mobile Guides and Virtual Trainers on PDAs: Supporting Users during their Physical Activities in Outdoor Fitness Trails

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Abstract. This paper investigates the use of mobile guides in fitness activities, proposing the Mobile Personal Trainer (MOPET) application. MOPET uses a GPS device to monitor user's position during her physical activity in an outdoor fitness trail. It provides navigation assistance by using a fitness trail map and giving speech directions. Moreover, MOPET provides motivation support and exercise demonstrations by using an embodied virtual trainer, called Evita. Evita shows how to correctly perform the exercises along the trail with 3D animations and incites the user. To the best of our knowledge, our project is the first to employ a mobile guide for fitness activities.

Key words: Mobile guides, virtual trainers, fitness applications

1 Introduction

Scientific evidence shows that the regular practice of physical activity and sports provides people of all ages and conditions with a wide range of physical, social and mental health benefits. Physical activity interacts positively with diet, enhances functional capacity and promotes social interaction and integration. Physical activity also has economic benefits especially in terms of reduced health care costs, increased productivity, healthier physical and social environments. In particular, open-air physical activity is characterized by additional valuable aspects, such as natural environments, air quality and sunlight. On the contrary, physical inactivity is a common and preventable risk factor for some chronic diseases.

Computer science researchers as well as companies are devoting an increasing attention to sports, fitness and physical activities. The developed products fall in three categories:

– computer-supported physical games, such as Hämäläinen et al.'s martial arts game [3], in which the user has to fight virtual enemies with punches, kicks and acrobatic moves;

- virtual trainers, such as the Philips Virtual Coach system [4], which is used to motivate the user while she cycles on a stationary home exercise bike;
- mobile applications and devices for physical activities, such as Polar devices [5], which can monitor user's heart rate and provide information (e.g., burnt calories) about the on-going physical activity.

The third category is very promising because it could allow users to be assisted anytime, anywhere. However, the user interfaces of current commercial products are extremely limited and do not focus much on user's motivation. To overcome their limitations and help users in performing fitness exercises correctly, this paper proposes MOPET, a mobile guide for fitness activities.

2 Our Proposal: MOPET

MOPET is a mobile guide which runs on PocketPCs connected to a GPS device and it is designed to help users in fitness trail sessions. A fitness trail is a trail where the user has to alternate jogging and exercising. The user runs along an indicated path and has to stop when she arrives at an exercise station. In each exercise station, the user finds an exercise tool that she has to use to perform a specific fitness exercise. Current commercial products usually offer extremely limited interfaces: most of them follow a digital-clock style that can provide only scarce motivational support. To overcome this limitation, MOPET includes an embodied virtual trainer, called Evita, which can attract users attention and convey conversational and emotional cues. MOPET helps users in:

- Navigation: location-aware audio and visual navigation instructions are provided to allow the user to follow the correct path in the fitness trail.
- Motivation: audio and visual feedback of user's speed are provided. The feedback motivates the user to maintain an adequate speed during all the session, according to her feelings.
- Training: when the user reaches an exercise station, Evita shows how to correctly perform the exercise with a 3D animation.

An alternative to virtual trainers consists in filming a real trainer performing the exercises and then displaying the videos on the mobile device. Anyway, using 3D animations presents several advantages with respect to pre-recorded videos: (i) 3D animations can be interactively explored by the user, who can easily change views and watch the exercise from the angles and positions that can clarify her personal doubts, and (ii) animations require much less space than videos on the mobile device.

2.1 Navigation

When the user starts MOPET, Evita introduces herself with a 3D animation. Then, a map of the trail where the user is training is displayed on the screen of the PDA and Evita briefly describes the map, the icons on the map, and how the

application works (if the user is already familiar with MOPET, she can skip this introduction). On the map, user position is marked with an icon representing a running person. Other icons are used to mark checkpoints: the start-finish (a chequered flag), the fitness trail exercise stations (a person performing an exercise), the points where the trail forks (a compass) and additional points where MOPET tells the user her speed (a red triangular flag). Besides, the trail is marked with a polygonal line which is initially blue. MOPET provides common navigational cues, such as changing the user's position in the map based on the data retrieved from the GPS device and changing the color of the polygonal lines to indicate the completed parts of the trail. Figure 1 shows the map after the user completed the left half of the trail. Anyway, this graphical feedback can be easily examined only by a user who is not running and so we provide the user also with audio navigational information: when she approaches a fork, MOPET gives her vocal directions using the internal speaker of the PDA.

Fig. 1. Map status with the left half of the trail completed.

2.2 Motivating the User

While navigation support is a common feature of mobile guides, fitness motivation on mobile devices has not been sufficiently explored yet. Moreover, a simple porting of desktop or console solutions is not possible or suitable: on one hand, mobile devices suffer of hardware limitations and user's activity may prevent her to constantly look at the device; on the other hand, these devices are capable of providing context-aware information, that may be used for motivational purposes. Our mobile guide exploits contextual information and offers motivation using both the graphical and audio channels. The application calculates average

user's speed on the different parts of the trail. After consulting a sports physician, we divided speed into four ranges: slow walking (< 5 km/h), fast walking (5-8 km/h), moderate running (8-12 km/h) and fast running (> 12 km/h). The lines corresponding to different parts of the trail are colored according to a blue-red temperature scale, giving the user visual feedback about her speed. To provide the user with immediate audio feedback, Evita tells the user her current range of speed and incites her to increase or decrease her speed, as soon as a checkpoint is reached. For each speed range, different pre-recorded sentences are available to the virtual trainer. All sentences are not imperative and try to highlight positive aspects of user's performance, even if she walked very slowly (e.g., "You are walking regularly. If you are not tired, try to increase your speed."). We chose to incite users gently because the evaluation results of Philips Virtual Coach [4], which incites aggressively (e.g., "Your heart rate is slow! Run faster!"), were not as positive as expected.

2.3 Training

In fitness trails, exercises are usually explained by using illustrated plates in the stations. These plates are often not easy to understand and the exercise could be performed improperly, wasting the benefits of the physical activity and also risking injuries. Therefore, Evita gives location-aware exercise demonstrations and explanations on how to perform the exercises correctly and safely: as the user approaches a fitness trail exercise station, Evita firstly whistles to attract user's attention and invites the user to look at the PDA display, then demonstrates how to correctly perform the exercise with a 3D animation. For example, in Fig. 2, it is performing an exercise with rings.

Fig. 2. Evita performing a typical exercise with rings on a fitness trail.

3 Conclusions and Future Work

This paper investigated the use of a mobile guide (called MOPET) for outdoor fitness activities. At present, MOPET provides navigation, motivation and training support in fitness trail sessions. MOPET includes an embodied virtual trainer called Evita for motivating the users and showing how to correctly perform the exercises. To the best of our knowledge, MOPET is the first mobile guide for fitness activities.

We evaluated the effect of our mobile guide on users' motivation as well as its navigation and training support on 12 users. Analyzed GPS logs, questionnaires and videos of users' performance showed that MOPET is more useful than fitness trail maps for helping users to orient themselves in a fitness trail. Our mobile guide is also more effective than metal plates for learning how to correctly perform exercises. Further details on MOPET and its evaluation can be found in [1].

Our research will proceed in several directions. First, we will monitor users' heart rate and the guide will give suggestions also based on this parameter. Second, we will look at wearable devices that could be more comfortable and possibly lighter than PDAs. Third, we will investigate and evaluate different game-style approaches to enhance motivation support of our mobile guide. Finally, we will consider mobile information visualization aspects [2] to design graphical presentations of users' performance data.

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