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AN INNOVATIVE SYSTEM FOR MONITORING OF PERFORMANCE DURING RESISTANCE EXERCISE TRAINING PROGRAMS

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INTRODUCTION

Objective performance assessment is fundamental to evaluate the success of resistance exercise regimens [3, 4]. Real-time feedback on exerted power may be used to spur the trainee during exercise and is already available in some commercial devices. However, even more crucial is day-to-day supervision of critical performance parameters, to ensure that the training regimen is progressing as scheduled which demands for specific assessment tools. In addition, on-site supervision from a personal trainer is not always possible.

Our goal was to design a cost-effective system that could: **1)** guide the trainee during the execution of the exercises; **2)** allow monitoring of the progress of his training program; **3)** permits a trainer to remotely supervise and guide the trainee.

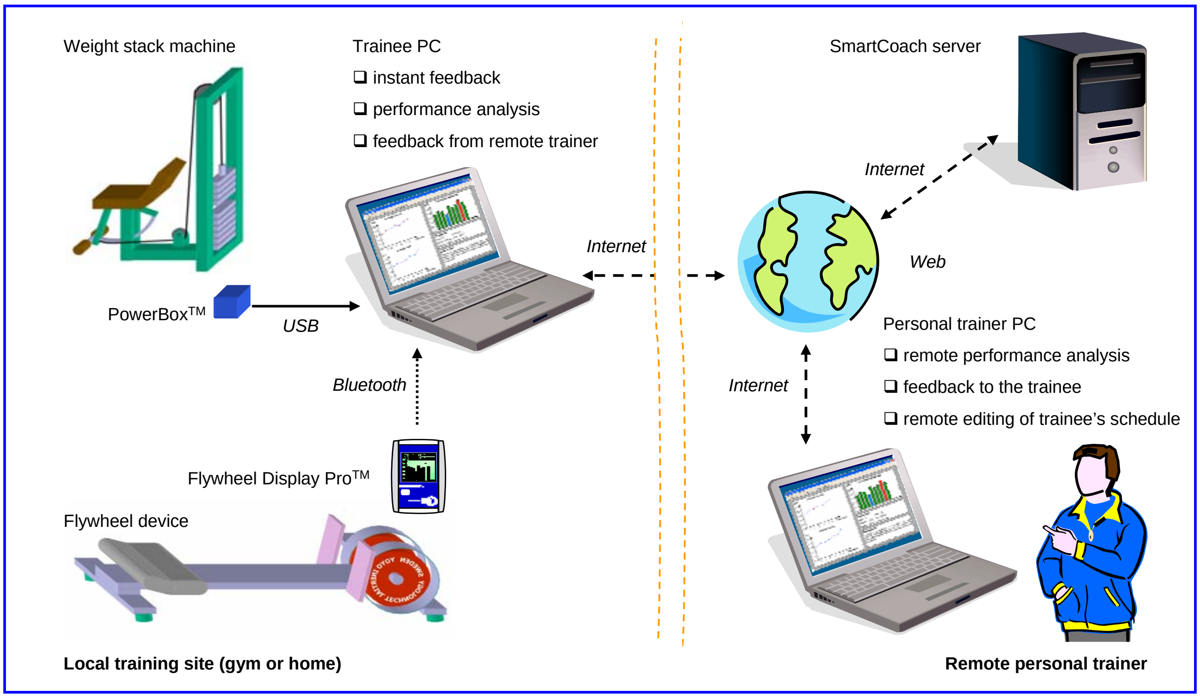

Figure 1. Overview of the system. By means of a dedicated sensor, instantaneous power is measured during the exercise and used as instantaneous feedback to the trainee. At the end of a training session, performance data is transmitted to a dedicated server, becoming accessible also for a remote personal trainer. He can can then assess the training progress at distance, administer guidelines and, if needed, change the training schedule. The system can be used for conventional machines and soon, also for flywheel exercise devices.

METHODS

An innovative integrated system was developed (**Figure 1**), consisting of:

- a sensor for the measurement of instantaneous power
- a software having the functions of instant feedback system, performance data review, training scheduler and communication system with a remote personal trainer

The software is the hearth of the system and feature several innovative functionalities:

- provides instant feedback and guidance to trainee for a correct execution of the exercise, at the desired power and correct rhythm (**Figure 2**, right)
- includes tools to review the trainee performance (**Figure 3**) through the time course of parameters such as power, work and others
- comprises a editor (**Figure 4**), which also guides the trainee through the execution of his daily exercises
- embeds an internet-based feature, that allows one or more personal trainers to access and analyze the trainee data and post notes for the trainee, in addition to create or edit his training schedule

At the end of an exercise session, training data is seamlessly transmitted to a dedicated server. A personal trainer can later connect to it to download the data, analyze his trainee's data and modify accordingly, if needed, his training schedule. He can also post messages or notes on graphs. The next time the trainee logs to the software, his schedule will be automatically updated and he will receive his trainer's communications. In turn, he can use the note system to reply with remarks or requests for advice.

The system is prepared to be soon interfaced also with flywheel exercise devices.

Figure 2. Left: the mechanical part of the encoder for power measurement. It has a robust construction and features easily maintenance (e.g., in case of substitution of the wire). Right: the instant power feedback window, which guides the trainee during the execution of his exercise with a given target power.

RESULTS AND CONCLUSIONS

Preliminary tests during a 5-week training study demonstrated the benefits of a tool for real-time assessment of training progress. Now a user-friendly, integrated system composed of sensor and software is available. It has an accessible cost, is simple to use for the inexperienced trainee, and yet is a powerful analysis tool for personal trainers.

Its remote monitoring feature leads to a new concept of virtual training, permitting an effective monitoring of progress of a training program without the need of an on-site trainer. Besides sports, other applications [1, 2] of such new concept can be envisaged.

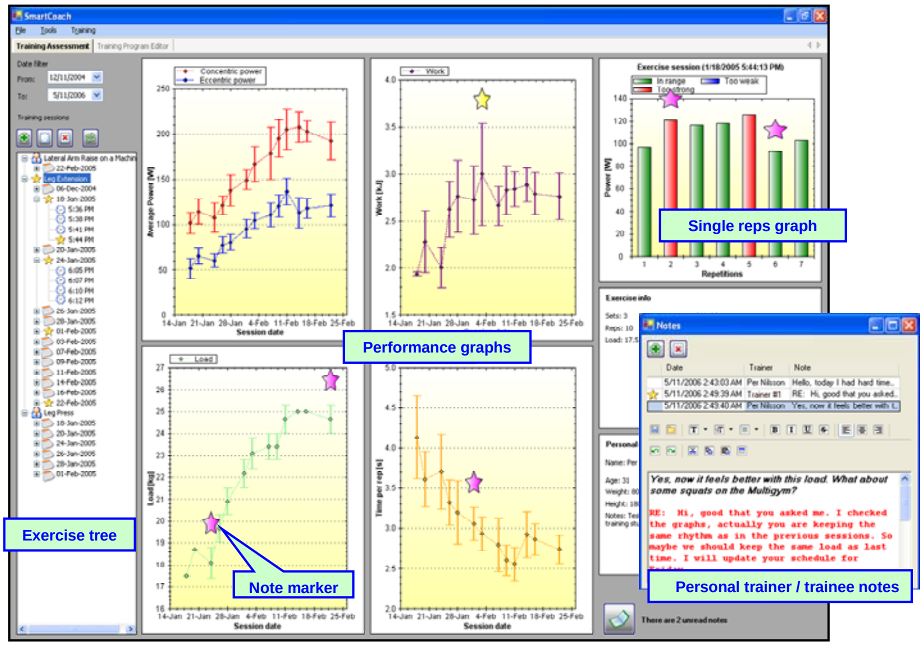

Figure 3. The performance assessment window. All the exercises performed can be browsed from the exercise tree; the evolution of performance parameters during training can be viewed in the performance graphs, as well as during single exercises (single reps graphs). The remote trainer has full access to the trainee's data set by means of the remote connectivity feature.
Both the trainee and his remote personal trainer can post general or specific notes (note marker). Such system is also used by the trainer to give guidelines to the trainee or edit his training schedule (Figure 4) if needed.

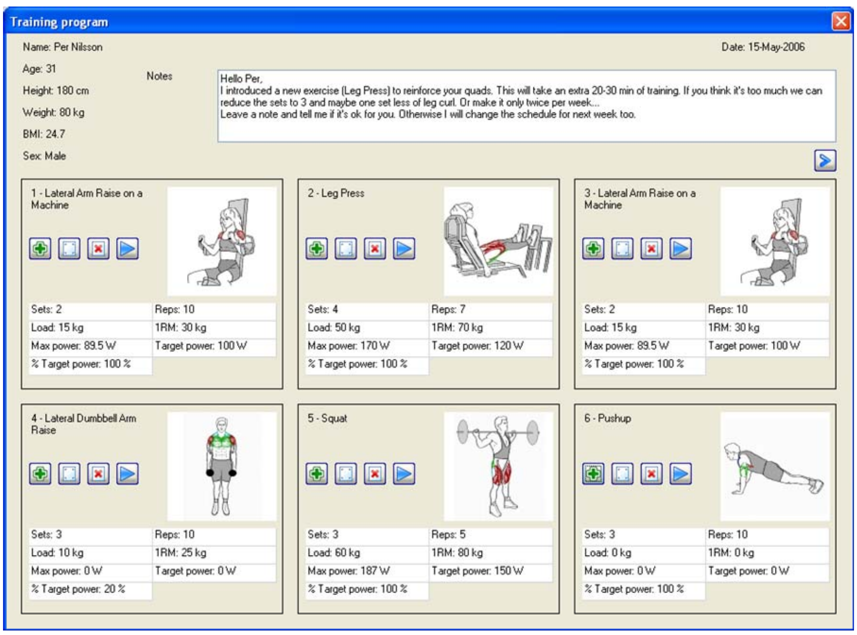

Figure 4. The training schedule editor. All different kinds of resistance exercises can be added, in the desired order and with selected parameters. For exercises whose power can be measured, the software will open the feedback window (Figure 2, right) and guide the trainee to the execution of the exercise with the desired target power.
A metronome function will help the trainee achieve the desired pace, and a countdown clock will help him to rest for the specified recovery time at the end of the exercise.

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