A User-Adaptive and Context-Aware Architecture for Mobile and Desktop Training Applications

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ABSTRACT

Our research aims at proposing a user-adaptive and context-aware architecture for mobile and desktop training applications. Our main result to date in the Mobile HCI field is an adaptive wearable system for fitness training.

Categories and Subject Descriptors

H.5.2 [**Information Interfaces and Presentation**]: User Interfaces; I.2.1 [**Artificial Intelligence**]: Applications and Expert Systems

General Terms

Design, Experimentation.

1. SUMMARY

User-adaptive systems and context-aware systems were proposed independently by different research communities. While a few recent proposals try to combine the advantages of both systems, further research is needed to tailor user-adaptive techniques for context-aware systems, expecially for mobile and ubiquitous ones, and to integrate context-awareness in user-adaptive systems. Therefore, the aim of our research is to propose an architecture that is both user-adaptive and context-aware, and that will serve as basis for desktop as well as mobile training applications, with particular focus on the largely unexplored fitness training domain.

A preliminary version of the architecture consists in the 5 subsystems shown in Figure 1. The *Context Analyzer* acquires raw data (e.g., ECG, GPS position) from wireless sensors, and analyzes it to derive higher level information on users' physiological state and movements (e.g., heart rate, burnt calories) by means of modules specialized for different sensors. Acquired and derived information are provided to the *User Modeling and Context Modeling Service (UM & CM Service)*. This subsystem receives also information about the user from the Adaptation Engine and the User Interface (e.g., age, gender, experience with training exercises), stores all the gathered information in User Model and Context Model databases, and provides the other subsystems with the information they require. The *Adaptation Engine* applies inference rules on such information to decide if (and which) adaptations (e.g., an increase in the difficulty of a particular exercise) or advice (e.g., suggestions to avoid overexertion) are needed. The *User Interface* implements the Adaptation Engine decisions providing users with proper textual, graphical, and audio feedback. The *Virtual Human* is responsible for providing users with advice and demonstrations by means of a virtual human (i.e. a 3D simulation of a human being), whose animations are adapted to both the user and the context, according to Adaptation Engine decisions.

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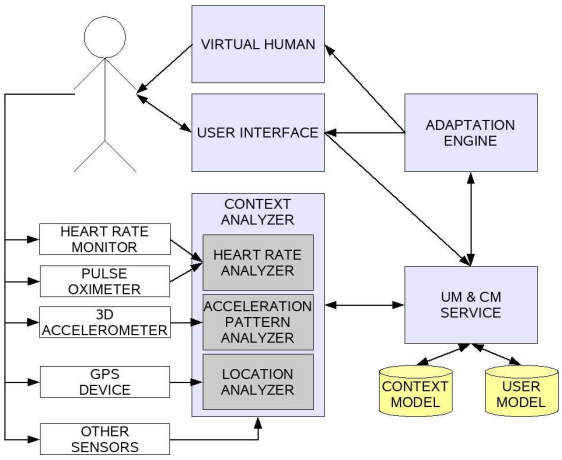

Figure 1: A preliminary version of the architecture.

The main result we achieved to date in the Mobile HCI field is an adaptive wearable system for fitness training [1]. The system runs on a PDA and is meant to supervise a physical activity based on alternating jogging and fitness exercises in outdoor environments. By exploiting real-time data coming from sensors, knowledge elicited from a sport physiologist and a professional trainer, and a user model that is built and periodically updated through a guided autotest, the system can provide motivation as well as safety and health advice, adapted to the user and the context. To better interact with the user, the system exploits a 3D virtual human that, as a personal trainer, incites the user, warns her not to overexert, and suggests tailored stretching or strengthening exercises, which are demonstrated by means of interactive 3D animations.

2. REFERENCES

[1] F. Buttussi and L. Chittaro. MOPET: A context-aware and user-adaptive wearable system for fitness training. *Artificial Intelligence in Medicine*, 42(2):153–163, Feb 2008.