Chapter 15
A Low-Cost Multi-Touch Surface Device Supporting Effective Ergonomic Cognitive Training for the Elderly

Vasiliki Theodoreli
Athens Information Technology, Greece

Theodore Petsatodis
Athens Information Technology, Greece

John Soldatos
Athens Information Technology, Greece

Fotios Talantzis
Athens Information Technology, Greece

Aristodemos Pnevmatikakis
Athens Information Technology, Greece

ABSTRACT
The emerging surface computing trend is a key enabler for a wide range of ergonomic interfaces and applications. Surface computing interfaces are considered appropriate toward facilitating elderly interaction with ICT devices and services. In this paper, the authors present the development of an innovative low-cost multi-surface device and its application in elderly cognitive training. The multi-touch device has been designed and implemented as a cost-effective motivating environment for elderly cognitive training. Along with the implementation of the device and the bundled services, this paper also presents a number of cognitive training exercises that have been developed on the device.

DOI: 10.4018/978-1-4666-0038-6.ch015
1. INTRODUCTION

Surface computing technologies (including multi-touch devices & surfaces) are increasingly leading to perceptive innovative ergonomic interfaces, which support natural interactivity and motivating environments for a number of different applications (Moscovich & Hughes, 2008; Murray-Smith et al., 2008). Recent applications enable faster and easier task completion, which overall results in productivity improvements (Kristensson et al., 2008; Muto & Diefenbach, 2008). The applications span typically various domains including information displays for public sectors applications and banking, as well as motivating interactive environments for gaming and ambient assisted living. A prominent application domain for surface computing is cognitive training of older adults suffering from normal cognitive decline, as well as mild dementia. Recent studies have concluded that multi-touch surface interfaces are ergonomic and highly acceptable by the elderly (Gamberini et al., 2006). Note that surface computing based cognitive training exercises could have a high societal impact given their importance towards alleviating the different forms of dementia. It is estimated that by 2030 an approx. 20% of the population will suffer from dementia, while by 2020, 40 million people will be affected by Alzheimer’s disease (AD) worldwide (Petersen et al., 2001; Alzheimer’s Association, 2009). At the same time, the average cost for the AD illness (from the diagnosis to death) is in the range of few hundred dollars. Cognitive training based on surface computing interfaces (including multi-touch interfaces) is promising to alleviate the above problems, which underpins the importance of surface computing technology.

Tabletops are the workspaces we regularly use in the daily life. In the home environment, we switch between tables to proceed with different types of work or amusement, such as reading/writing of documents and card games. With the help of an interactive surface we can enable a natural interface for controlling the technologies of a smart environment and playing cognitive games. As a result of the growing momentum of surface computing applications, several technologies (including both research prototypes and commercial products) have emerged. In the research field, we have witnessed frameworks for (multi-touch) surface computing (e.g., Natural User Interface Group, 2009), which include APIs (Application Programming Interfaces) towards leveraging multi-touch events and accordingly binding them to applications. As part of research projects, there are also perceptive components’ libraries (e.g., for finger/gesture) tracking, which can be used in conjunction with specialized middleware in order to map low-level events from the tracker(s) to high-level application events suitable for authoring and developing applications (Peltonen et al., 2008; Vandoren et al., 2008). At the same time, several commercial-off-the-shelf (COTS) frameworks for multi-touch surface computing have emerged. A prominent example is Microsoft’s Microsoft Surface product (http://www.microsoft.com/surface/), which represents the state of the art in surface computing. Microsoft Surface supports sophisticated robust multi-touch functionality, along with the possibility of (tag-based) object identification. Another example of commercial technology is Diamond Touch, a technology for creating touch-sensitive input devices which allow multiple, simultaneous users to interact in an intuitive fashion (Dietz & Leigh, 2001). Diamond Touch technology was originally developed at Mitsubishi Electric Research Labs (MERL) and is now exploited by company Circle Twelve Inc. It is a very intuitive technology, yet it requires a projector to be mounted on the ceiling. These commercial platforms provide high-quality ergonomics and extremely versatile programming environments at a relatively high cost.

In this paper, we introduce a new multi-touch surface platform, along with a pool of applications for elderly cognitive training. Our multi-touch surface platform is a low-cost device when com-
This title is available in InfoSci-Books, InfoSci-Intelligent Technologies, Science, Engineering, and Information Technology, InfoSci-Computer Science and Information Technology, InfoSci-Select. Recommend this product to your librarian:
www.igi-global.com/e-resources/library-recommendation/?id=1

Related Content

Intelligent Support for Building Knowledge Bases for Natural Language Processing
www.igi-global.com/chapter/intelligent-support-building-knowledge-bases/24174?camid=4v1a

Online Remote Control of a Wireless Home Automation Network
John Wade, Jose Santos and Noel Evans (2009). International Journal of Ambient Computing and Intelligence (pp. 39-52).
www.igi-global.com/article/online-remote-control-wireless-home/34034?camid=4v1a

Basic Cellular Neural Networks Image Processing
www.igi-global.com/chapter/basic-cellular-neural-networks-image/10251?camid=4v1a

A Database Service Discovery Model for Mobile Agents
Lei Song, Xining Li and Jingbo Ni (2006). International Journal of Intelligent Information Technologies (pp. 16-29).
www.igi-global.com/article/database-service-discovery-model-mobile/2399?camid=4v1a