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課題番号 P-9

Multimedia Interaction Interfaces in Collaborative E-learning Environments

[1] Organization

Leader: *Noriyuki Matsuda* (Faculty of Systems Engineering, Wakayama University, Japan)

Representatives at RIE: *Kamen Kanev* & *Hiroshi Inokawa* (Research Institute of Electronics, Shizuoka University)

Participants:

Tsukasa Hirashima (Graduate School of Engineering, Hiroshima University, Japan)

Julita Vassileva (University of Saskatchewan, Canada)

Bill Kapralos (Faculty of Business and Information Technology, University of Ontario Institute of Technology, Canada)

Karen Collins (Canadian Centre of Arts and Technology at the University of Waterloo, Canada)

Michio Yoneya (National Institute of Advanced Industrial Science and Technology, Tohoku Center, Sendai, Japan)

[2] Progress of the Research

The objective of this cooperative research project is to explore possibilities for combining expertise from different areas and fostering the design and development of innovative interfaces and environments for e-learning based on natural interaction paradigms that is adjustable to the needs of specific user groups.

First, sound interface design for smart table computer interaction was addressed in (1) where users position themselves around a horizontal computer screen and a combined audio/vision-based interface is employed for sound source and user tracking in real-time. Second, the SONIDO sonification tool for network traffic and security that is capable of generating distinguishable sounds based on traffic patterns, and has the potential to be of use in teaching and learning of intrusion detection was presented. In (2) SONIDO's architecture and report on the current state of usability studies was described. Third, in (3) an ontology-based annotations for test interpretation and scoring was considered. Image-based and CLUSPI enhanced annotation and scoring approaches were proposed and possibilities for their integration were investigated.

During the project period the following research meetings were held:

- August 27-28, 2009- Prof. Kanev from RIE visited Wakayama University, and conducted joint research collaborative meetings with Prof. Matsuda, Prof. Taki, and other faculty and students.
- December 11, 2009- Prof. Matsuda, Prof. Collins, Prof. Kapralos, Prof. Kanev, and Prof. Inokawa had a collaborative research meeting at the Research Institute of Electronics.
- February 3, 2009- Prof. Matsuda from Wakayama University visited RIE and had a collaborative research meeting with Prof. Kanev and Prof. Inokawa.

Project members were involved in organizing and presenting intermediate research results stemming from the project activities at the 12th International Conference on Humans and Computers as follows:

- Prof. Kanev worked as a Program Committee Chair
- Prof. Matsuda made a presentation on ontology-based annotations for test interpretation and scoring (3)
- Prof. Kapralos made presentations on sound interface design for smart table interactions (1) and on using sonification to enhance teaching and learning of network intrusion detection (2)
- Prof. Collins made a presentation on archetypal sound effect icons for improved multimedia accessibility (4)

[3] Results

(3.1) Research results

The project thus far highlights the need for further research into new interfaces for collaborative learning. We speculate that new modes of interacting that technologies, such as a multi-touch table afford require new understandings of how to best incorporate sound and visuals to enhance learning. At this preliminary stage, we are building prototypes to explore these new interfaces, and plan to complete the building and testing of these prototypes in the coming years.

In regards to sound interface design for smart table computer interaction (1), we proposed the setup of a table-top touchscreen computer and described a simple amplitude panning method to convey sound amongst four loudspeakers. Although simple, the method is independent of user position

and doesn't require extensive computational resources. Future work will explore further, more complex sound output/ interaction techniques and new methods for testing sound perception by users, combining elements from a broad range of disciplines. In examining the specific problems, this work will lead to a significant broadening of our understanding of sound interaction design, of multi-user interaction, of how users perceive sound on horizontal surface devices, of how to implement sound for games on multi-touch computers, and about methodologies we can use to test user preferences of sound in computer applications. Since sonic interaction design is a very new and emerging field, this research will make a significant contribution towards methods and practice. The prototypes will be built and tested and results published in the coming years.

In regards to sonification in teaching and learning (2) we described an analysis of educational gains on sonification, a number of challenges with respect to non-speech sound applications for teaching and learning about Network Intrusion Detection Systems (NIDS), and guidelines for future work on NIDS-based sonification in educational settings. We also presented the SONIDO system, a sonification tool for network traffic that is capable of generating distinguishable sounds based on traffic patterns, and has the potential to be of use in teaching and learning of intrusion detection. The SONIDO system is currently going through two phases of evaluation. The first phase of testing takes place during production and consists of usability studies to bring the system to acceptable levels of practicality. This phase of evaluation is being conducted with instructors of security-related courses at the undergraduate and graduate level of our institution. These tests will ensure that the tool is usable and that it accurately reflects network activity with sounds.

In regards to ontology-based annotations for test interpretation and scoring (3) we have proposed an innovative ontology-based approach which supports examiners and ensures proper interpretation of student answers. For better coverage of the variety of examination problems and question types our ontology still needs development and extension with additional annotations. An image-based and CLUSPI-based annotation and scoring have been discussed and possibilities for their integration in a unified system have been considered. The system discussed in this work is under continuing development; its functionality is being extended and further experiments and evaluation of its effectiveness are still to be conducted.

(3.2) Future work

We are planning to add more members to our project, to enhance our research, and to report obtained results at international conferences on a regular basis. Higher level results will be submitted to renown international journals for consideration and publication. New team members will include (amongst others) Dr. Michael Jenkin (Computer Science and Engineering, York University, Toronto, Canada), and Dr. Andrew Hogue (Game Development Program, UOIT), both of which have extensive computer vision-based experience.

We have discussed arranging for exchange students between Japan and Canada to train these students in cooperative research projects and in communication skills in addition to the specifics of the technology, methods, and practice.

We are currently developing a more complete research plan based on our preliminary findings, and will be submitting further grant applications in Canada to facilitate a larger collaborative project. Potential grant applications include the International Strategic Opportunities Program offered by the Ontario Ministry of Research and Innovation. This grant specifically emphasizes international collaboration and is thus particularly relevant to our established collaboration.

We are submitting a joint paper to the ACM FuturePlay 2010 conference, held in Vancouver, British Columbia, Canada May 6-7 2010.

[4] Publications

(1) Karen Collins, Bill Kapralos, Kamen Kanev: "Sound Interface Design for Smart Table Computer Interaction," International Conference on Humans and Computers (HC'2009), 2009.

(2) Miguel Vargas Martin, Bill Kapralos, Miguel A. Garcia-Ruiz, Mark Green, Adrienne Brown: "SONIDO: Using Sonification to Enhance Teaching and Learning of Network Intrusion Detection," International Conference on Humans and Computers (HC'2009), 2009.

(3) Noriyuki Matsuda, Kamen Kanev, Tsukasa Hirashima, Hirokazu Taki: "Ontology-based Annotations for Test Interpretation and Scoring," International Conference on Humans and Computers (HC'2009), 2009.

(4) Karen Collins, Peter Taillon: "Archetypal Sound Effect Icons for Improved Multimedia Accessibility," International Conference on Humans and Computers (HC'2009), 2009.

Traveling report

Name:	Kamen Kanev
Affiliation:	Research Institute of Electronics, Shizuoka University, Japan
Period of time:	August 27, 2009 – August 28, 2009
Destination:	Wakayama University, Japan
Purpose:	To carry out joint research and project organization meetings and to schedule future research activities
Name of receiver:	Prof. Noriyuki Matsuda

Name:	Karen Collins
Affiliation:	Canadian Centre of Arts and Technology at the University of Waterloo, Canada
Period of time:	December 5, 2009 – December 13, 2009
Destination:	Shizuoka University, Japan
Purpose:	*(Please see the description in the bottom of the page)*
Name of receiver:	Prof. Kamen Kanev

Name:	Bill Kapralos
Affiliation:	Faculty of Business and Information Technology, University of Ontario Institute of Technology, Canada
Period of time:	December 5, 2009 – December 13, 2009
Destination:	Shizuoka University, Japan
Purpose:	*(Please see the description in the bottom of the page)*
Name of receiver:	Prof. Kamen Kanev

Name:	Noriyuki Matsuda
Affiliation:	Faculty of Systems Engineering, Wakayama University, Japan
Period of time:	February 2, 2010 – February 3, 2010
Destination:	Shizuoka University, Japan
Purpose:	To discuss the research and project organization and to schedule future publications
Name of receiver:	Prof. Kamen Kanev

The purpose of the visit of Prof. Collins and Prof. Kapralos was two-fold:

i) To attend the Humans and Computers 2009 conference and present three papers including a paper outlining the research being conducted by Karen Collins, Bill Kapralos (Canada) and collaborators at Shizuoka University (led by Kamen Kanev).

ii) To further build upon and expand the research collaborations between the University of Waterloo and the University of Ontario Institute of Technology (UOIT) which are both in Ontario, Canada and the Research Institute of Electronics, Shizuoka University, Japan.

A portion of their time was dedicated to meeting the project leader Prof. Matsuda from Wakayama University and the representatives at RIE Prof. Kanev and Prof. Inokawa, and discussing collaboration details, including the future direction of the current collaborative project that investigates audio-visual interaction techniques for surface computers, and grant opportunities. Both Karen Collins and Bill Kapralos also had the opportunity to meet many researchers from Shizuoka University as well as researchers from other universities that attended the conference.

They discussed the potential of a two-way visiting opportunity between themselves (the researchers) and students at Shizuoka University, Waterloo, and UOIT. Finally, in preparation for a future extended visit, they also had the opportunity to learn about the University itself (resources, etc.) as well as life in Hamamatsu. The goals of their visit were not only met but exceeded. Their collaboration with Shizuoka University continues and they are currently preparing a submission to the ACM FuturePlay conference and exploring grant collaborative opportunities.