

Augmented Surfaces as a Basis of Applications for Imaging Devices

[1] Organization

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[2] Research Progress

The research work has been conducted mainly by the group of Professor Bottoni in Rome, Professor Kanev in Hamamatsu and Professor Mirenkov in Aizu, and has also taken advantage of the 2 months visit of Professor Kanev to Sapienza University of Rome in the fall of 2015. Joint meetings were held in Hamamatsu and Aizuwakamatsu in August and December 2015 while Professor Bottoni visited Japan. In the course of the December visit to Hamamatsu a joint CRP workshop was held, at which presentations from three different projects were combined.

This year we have focused on the exploration and integration of different forms of interaction considering the various types of support on which they can be performed. More specifically, we conducted research and development work on cases where interaction occurs on i) physical surfaces offering a permanent base for the integration of semantics, ii) physical and logical surfaces provided by digital devices where interactions lead

production of new persistent information, such as annotations, and iii) virtual environments supporting spatial gesture interactions such as “drawing in the air” without reference surfaces.

This has resulted both in the development of specific applications and in the proposal of a generic framework for the development of interactive applications based on a dataflow modeling of the application semantics.

[3] Results

(3 – 1) Research results

Most of the obtained research results have been presented at different international conferences in Japan and abroad and/or have been published in reputable scientific journals as documented in the Achievements section of this report.

In particular, the project has progressed on the topics specified in the proposal, as described below.

- With respect to meta-modeling of interactive mechanisms, work has been done on the development of methods for dataflow-based specification of interactive systems, including a proposal of a general framework for integration of components developed according to different ontologies.
- With respect to audio-visual interactions and VR work has been done on the development of integrated systems based on visual languages able to manage self-explanatory components for big information resources.
- With respect to the theory of annotations, the notion of annotation contract has been proposed where transformations of annotated content require the production of conformant annotations.
- With respect to the interaction with different interface devices, work has been done on gesture recognition systems based on smartphone.
- With respect to the integration of different interaction techniques, work has been done on the development of sketch-based annotation.

In view of the envisaged specific applications the following work has been conducted:

- Data formats based on self-explanatory component have been proposed.
- Security concerns for wireless communication have been addressed.
- Activities on 3D printing have kept developing.
- Research on problems related to marking of different materials has been conducted.

(3 – 2) Ripple effects and further developments

The CRP has developed synergies with other CRPs in which Professor Kanev is involved, as well as with the Italy-Japan bilateral collaboration project funded by the Italian Ministry of Foreign Affairs and with the facilities provided by Sapienza University of Rome for visiting professors, hosting Professor Kanev for two months (September – November 2015).

Of particular relevance is the possibility of integrating teaching programs relative to Big Data at SUNY Fredonia, Sapienza University of Rome, and Shizuoka University, as resulting from exchange of ideas during the CRP joint workshop. Based on the results achieved in this year, we plan to continue on the lines which have produced results, especially as concerns the development of dataflow languages for interacting with the Semantic Web, the development of theory and applications for annotations, the development of gesture-based interaction techniques, and the applications of visual languages based on self-explanatory components.

[4] Achievements (List of Publications)

- (1) P.Bottoni, K.Kanev, N.Mirenkov, M.Ceriani, “A Framework for Situated Interaction with Augmented Surfaces”, to appear in *Int J Software Informatics*.
- (2) P.Bottoni, M.Ceriani, “Towards an Ontology-Based Generic Pipeline Editor”, *Proc. DNIS 2015*, LNCS 8999, pp.56-73, 2015.
- (3) P.Bottoni, R.Navigli, F.Parisi Presicce, “Conditions, constraints and contracts: On the use of annotations for policy modeling”, *Proc. GCM@ICGT 2015*, pp.18-33.
- (4) P.Bottoni, M.Ceriani, “Linked Data Queries as Jigsaw Puzzles: a Visual Interface for SPARQL Based on Blockly Library”, *Proc. CHIItaly 2015*, pp.86-89, 2015.
- (5) P.Bottoni, M.Ceriani, “SPARQL Playground: A Block Programming Tool to Experiment with SPARQL”, *Proc. VOILA@ISWC 2015*, pp.103-108, 2015.
- (6) K.Kanev, M.De Marsico, P.Bottoni, “A Human Computer Interaction Framework for Biometric User Identification”, *Proc. InterAcademia 2015*.

- (7) K.Kanev, A.Mei, P.Bottoni, “Home Communications and Services with Enhanced Security: Augmented Embedded Systems for Communication Appliances as an Educational Platform”, *Proc. InterAcademia 2015*.
- (8) M.Antico, D.Avola, P.Bottoni, A. Hawash, K. Kanev, F. Parisi Presicce, “An Interactive Tool for Sketch-Based Annotation”, *Proc. InterAcademia 2015*.
- (9) M.Vynnycky, K.Kanev, “Mathematical Analysis of the Multisolution Phenomenon in the P3P Problem”, *Journal of Mathematical Imaging and Vision* 51(2): 326-337, 2015.
- (10) R.Yoshioka, N.Mirenkov, H.Sekine, K. Noda, “3D Kanji: A new paradigm of 3D objects to exploit additional dimensions of human sense for enhancing expression”, *J. Vis. Lang. Comput.* 28: 250-272, 2015.
- (11) Y.Watanobe, N.Mirenkov, “*AIDA: A Language of Big Information Resources”, *Proc. DNIS 2015*, LNCS 8999, pp.112-121, 2015.

Travelling Report (Mention each travel by CRP budget.)

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Period of time : 10-12 December 2015

Destination : Shizuoka University, Hamamatsu, Japan

Purpose: Research meetings and participation in a Cooperative Research Workshop at which a presentation titled "Augmented Surfaces as a Basis of Applications for Imaging Devices" was delivered.

Name of receiver : Prof. Kamen Kanev and Prof. Hidenori Mimura