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Imaging Devices and Digital Imaging of Semantic Surfaces in Active Knowledge Management

[1] Organization

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[2] Progress of the Research

This year we have focused on considering different application scenarios for the notion of Semantic Surfaces. This has resulted both in the development of specific applications and in the categorization of the scenarios in terms of the relations between a semantic surface and an imaging device.

In particular we have:

a) proposed a categorization of scenarios for applications of surface coding;

b) defined services for management of groups of users exploiting annotation processes on the presented material;

c) refined a metamodel by which methods and tools for visual data analysis can be integrated within an architecture supporting interaction with a world of identifiable objects;

d) designed applications combining augmented reality and marked surface;

e) considered problems and applications of laser techniques for creating layers of marking in 3D objects;

f) tested possibilities of different encoding schemes for the creation of semantic layers on generic objects and environments;

g) experimented with multi-touch surfaces with attached encodings, which can provide support to augmented reality and tangible objects.

[3] Results

(3.1) Research results

Results obtained within the scope of this project have been presented at various International conferences and published in corresponding Proceedings. International collaboration with

researchers from Bulgaria, Canada, Ukraine and Italy has been successfully continued.

The work on the notion of augmented surfaces has been conducted principally by Professors Kanev, Mirenkov and Bottoni, with the collaboration of Dr. Ceriani.

Augmented surfaces are a novel paradigm for supporting interaction, where information is coded on the surface of a physical object, from which it can be read and used for different purposes. Based on the architecture developed in the preceding years of the collaboration, we have defined different application scenarios, categorized according to the relations between the surfaces on which semantic information has been encoded and the imaging devices which can read and decode the information. In particular, we identify different typologies based on the relative positions of devices and objects:

- structural augmented surfaces, with fixed position and orientation (e.g. walls or ceilings), optically encoded to allow tracing of the absolute position of devices equipped with the appropriate reader;
- mobile augmented objects with optically encoded surfaces, used to trace their position/orientation in absolute terms or in relation to other objects or devices;
- structural readers with fixed position, that can trace the absolute position of mobile augmented objects;
- mobile reading devices, devices equipped with reader(s) (small-scale and/or large-scale), used to trace their position/orientation in absolute terms or in relation to other objects or devices.

Besides this, work has been initiated to integrate this kind of applications with traditional tabletop surfaces, providing augmentations with respect to the content observable on the tabletop. In this respect, previous work by Professor Bottoni and Dr. Michele Ceriani has been extended to provide a generic programming environment for dataflow programs managing the different forms of interaction, in particular supporting distribution of applications across mobile, surface-based, and desktop-based devices, allowing the composition of programs defined or deployed on the different devices, and adopting different languages based on the same dataflow paradigm.

With reference to the integration of user annotations in semantic contexts, Professor Bottoni and his collaborator Hamjad Hawash have formalized the notion of domain of interest for a group in terms of ontologies, supporting the formation of groups based on common interest on some domain by communities of annotators.

During the project period several visits for presentations and research meetings at Shizuoka University have been accomplished, at which other researchers from outside of Japan have participated. In particular, a CRP workshop was held, with presentations by Professors Kanev, Barneva, Bottoni, Kapralos, and Hung, Within the CRP collaboration, Professor Kanev has spent a period of three months, under the Visiting Professor Programme of Sapienza University of Rome, and Dr. Ceriani has visited Professor Kanev, sponsored by a funding scheme of the Italian Ministry of Foreign Affairs, which also stemmed from the CRP collaboration.

(3.2) Future work

We will progress in the lines discussed above leveraging on the results of this year.

[4] Publications

(1) P.Bottoni, K.Kanev, N.Mirenkov, M.Ceriani, “A Framework for Situated Interaction with Augmented Surfaces”, *under 2nd revision for Int J Software Informatics.*

(2) P.Bottoni, M.Ceriani, “SWOWS and dynamic queries to build browsing applications on linked data”, *J. Vis. Lang. Comput.* 25(6): 738-744 (2014)

(3) P.Bottoni, M.Ceriani, “SWOWS and dynamic queries to build browsing applications on linked data”, *Proc. DMS 2014*,121-127, 2014.

(4) P.Bottoni, M.Ceriani ,”A Dataflow Platform for In-silico Experiments Based on Linked Data”, *Proc. DNIS 2014*, 112-131, 2014.

(5) P.Bottoni, M.Ceriani, “Towards an Ontology-Based Generic Pipeline Editor”, *Proc. DNIS 2015*, 56-73, 2014

(6) D.Avola, P.Bottoni, A.Hawash, “Relevance measures for the creation of groups in an annotation system”, *J. Vis. Lang. Comput.* 25(6): 695-702 (2014)

(7) A.Hawash, D.Avola, P.Bottoni, “Relevance measures for the creation of groups in an annotation system”, *Proc. DMS 2014*, 79-85, 2015

(8) R.Yoshioka, N.Mirenkov, H.Sekine, "3D Kanji: A new paradigm of 3D objects to exploit additional dimensions of human sense for enhancing expression", *J. Vis. Lang. Comput.* (to appear in *Special Issue on 3D Printing Innovations*)

Travelling report

None