# Digital Imaging for Active Knowledge Semantic Surfaces

## [1] Organization

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Participants:

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## [2] Progress of the Research

This year we have addressed new aspects of Ambient Assisted Living (AAL) by investigating and applying:

1. our concept of semantic surfaces as object surfaces enhanced by special images for supporting access to information about object features, etc., and for organizing interactions between objects and people, and

2. our concept of a world of totally identified objects as a real world infrastructure, where most of the physical objects have their IDs, which are recognizable by appropriate portable or fixed devices for getting real-time and/or archive information related to the objects.

The new aspects are based on a wider view of "visualizing the invisible" where not only specific code images and optical devices for their recognition are involved, but also multimedia formats representing corresponding meaning of things play a fundamental role. As a result, this approach is becoming a fundamental basis for developing the infrastructure of "Internet of things" with co-existence of real and virtual worlds where people with very different knowledge and physical abilities can have access to the same information resources through different channels and remotely communicate with each other through different computer panels and different interface devices. In other words, people with different knowledge and abilities could have more equal opportunity to access to information and communication systems. This is what we need for an ageing society in the information era. More specifically, within the scope of the project we have considered how semantic surfaces can be directly used for ambient interactions and intuitive support of the elders and disabled. In the context of Technically Assisted Rehabilitation, semantic surfaces could make a difference in the treatment, rehabilitation, and consequent lifestyle of people in need and ensure their much desired self-confidence and dignity.

In a sense, anyone has his limitations and can recognize many things or activities which are difficult or even impossible for him to do. Consequently many of the technological innovations that are making our life easier are not directly accessible for some people. On the other hand, many people feel comfortable if they can continue the use of some existing things, technologies, and traditions. In this line we have investigated various Japanese traditions and attempted to blend them with new advanced technologies such as 3D printing and supportive computer graphic tools leading to the development of 3D Kanji as prototypes for new accessories, souvenirs, tea ceremony cups, etc.

We also consider some general cultural issues of how traditions should be preserved and developed, and how a multidisciplinary approach combining rapid prototyping, computer graphics, and fine art can help in creating new values for promoting

traditions by establishing special forms and activities.

In addition, we have proposed the use of the semantic surfaces as a framework for the construction of collaborative services where users can interact in an enriched and focused way with paper documents and object labels, both in desktop and mobile settings. We expect that combining immediate access to online information from physical support with creation and retrieval of annotations, while keeping in focus the context of their creation, would create a new collaboration space in which seamless access to both centralized and distributed information is supported. Such techniques are open to several extensions and generalizations, including a way towards our world of totally identified objects. Moreover, the combination of annotation with technologies based on unique identification of objects or sheets opens several scenarios for mobile applications, such as product evaluation. Producers could use the cluster patterns to advertise their products and consumers could share and exchange opinions, express their (dis)satisfaction with the products, and/or recommend them. In general, several types of interaction could be performed to access unique information on objects and create additional information.

In the course of the research the problem of developing information resources for attaching to virtual versions of objects has been especially addressed. A huge amount of such resources requires the participation of many people in their development. So, the above mentioned construction of collaborative services including involvement of technologies for web-based annotations is a way for solving the problem. Related annotations, on the other hand, can change over time as participants add and modify them interactively.

During the project period several visits for presentations and research meetings at Shizuoka University have been accomplished, and a few researchers from outside of Japan have participated.

## [3] Results

(3.1) Research results

Results obtained within the scope of this project have been presented at six International conferences and published in corresponding Proceedings. These make a very good foundation for a continuing collaboration with researchers from Italy and Canada demonstrating the additional potential of the project.

(3.2) Future work

In our future research we are planning to use the potential of semantic surfaces for solving various problems of "Internet of Things" including:

- developing specific code images and optical devices for their remote recognition,
- applying multimedia formats representing information resources and meaning of corresponding things of real world (with orientation to e-health and e-learning),
- introducing collaborative activity for joint creation of information resources,
- developing navigation techniques in indoor and outdoor environments.

## [4] Publications

(1) Kanev, K.. Mirenkov, N., Ambient Assisted Living and Rehabilitation Support Engaging Semantic Surfaces, In *Proceedings of the 3rd European Conference Technically Assisted Rehabilitation TAR2011*, Berlin, Germany, March 17-18, 2011. (in print)

(2) Kanev, K., Mirenkov, N., Satellite Cloud Computing, In *Proceedings of FINA2011 held in conjunction with the 25th IEEE Int. Conf. on Advanced Information Networking and Applications (AINA 2011)*, Biopolis, Singapore, March 22-25, 2011. (in print)

(3) Mirenkov, N., Yoshioka, R., Kanev, K., Rapid Prototyping and 3D Kanji Sculpturing, In *Proceedings of the 13th Int. Conf. on Humans and Computers HC'10*, Aizu-Wakamatsu, Japan, December 8-10, 2010, pp. 203-208.

(4) Bottoni, P., Kanev, K., Mirenkov, N., Distributed and Context-focused Discussion on Augmented Documents and Objects, *International Reports on Socio-Informatics*, Vol. 7, No. 1, 2010, "Workshop Proceedings of the 9th Int. Conf. on the Design of Cooperative Systems", Aix-en-Provence, France, May 18-21, 2010, pp. 298-307.

(5) Watanobe, Yu.,Yoshioka, R., Mirenkov, N., Embedded Clarity in Filmification of Methods, New Trends in Software Methodologies, Tools and Techniques, H. Fujita (Ed.), IOS Press, 2010, pp. 70-82.

(6) Watanobe, Yu., Mirenkov, N., Yoshioka, R., Browsing and Editing Tool for Programming in Pictures, Selected Topics in Applied Computer Science (Proc. of 10th WSEAS Int. Conference on Applied Computer Science, October 4-6, Iwate, Japan), 2010, pp. 242-250.

# Travelling report

| | |
|---|---|
| Name: | Noriaki Kamiya |
| Affiliation: | Department of Computer Science and Engineering, The University of Aizu |
| Period of time: | May 27, 2010 – May 29, 2010 |
| Destination: | Shizuoka University, Japan |
| Purpose: | To participate in joint research meetings and discuss future research activities |
| Name of receiver: | Prof. Kamen Kanev |

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|---|---|
| Name: | Nikolay Mirenkov |
| Affiliation: | Department of Computer Science and Engineering, The University of Aizu |
| Period of time: | December 7, 2010 – December 11, 2010 |
| Destination: | Shizuoka University, Japan |
| Purpose: | To carry out a joint research and project organization meetings, to schedule future research activities and to make a presentation related to the project at the 13th International Conference on Humans and Computers satellite session in Hamamatsu |
| Name of receiver: | Prof. Kamen Kanev |

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|---|---|
| Name: | Paolo Bottoni |
| Affiliation: | Department of Computer Science, "Sapienza" University of Rome, Italy |
| Period of time: | December 4, 2010 – December 12, 2010 |
| Destination: | Shizuoka University, Japan |
| Purpose: | To discuss joint research and to attend the 13th International Conference on Humans and Computers at Hamamatsu campus, Shizuoka University |
| Name of receiver: | Prof. Kamen Kanev |

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|---|---|
| Name: | Nikolay Mirenkov |
| Affiliation: | Department of Computer Science and Engineering, The University of Aizu |
| Period of time: | March 2, 2011 – March 6, 2011 |
| Destination: | Shizuoka University, Japan |
| Purpose: | To plan the future collaboration, coordinate the ongoing research, and participate in a collaborative research seminar organized at RIE with a presentation entitled "Programming in Pictures" |
| Name of receiver: | Prof. Kamen Kanev |