The HiveSurf Prototype Project
- Application for a Ubiquitous Computing World

Thomas Nicolai
Institute for Media and Communications Management
University of St.Gallen
thomas.nicolai@unisg.ch

Florian Resatsch
Institute of Electronic Business
University of Arts Berlin
resatsch@ieb.net

Lars Kirchhoff
Institute for Media and Communications Management
University of St.Gallen
lars.kirchhoff@unisg.ch

Abstract

As a result of new opportunities for research in ubiquitous computing and digital communication, this project intends to make a substantial contribution into the scientific and practical discussions around the application of wireless sensor networks to everyday objects. The main objective of the HiveSurf [1] prototype is to combine concepts from visual design, technical design and communicational design in order to create a vision for future development in this area. The prototype seeks to move beyond the world of business by exploring new applications in a playful, unconventional manner. Thus, it draws conclusions from a broad range of concepts from media studies and the surrounding design disciplines in order to develop concepts for new applications that could augment the digital sphere. The availability of ubiquitous computing and the ability to connect smart artifacts, mobile devices and web servers shifts the design focus from a technology perspective to a digital communications perspective. This paper attempts to combine concepts about the Web 2.0 with emerging ubiquitous computing applications in order to develop a vision of a social UbiComp+. The implications of these developments are explored through discussion of three different application scenarios for the HiveSurf Prototype, which will form the basis for a conceptual framework.

1. Introduction

Ubiquitous computing (Ubicomp) and its scenarios has had a wide ranging influence in the ideas of how the future would look like. Already described in the early 90ties by Mark Weiser, who foresaw the technological development of omnipresent computers, labelled as "Ubiquitous Computing" that can be seen today in various forms [2]. We are moving towards a future in which we will directly communicate with our clothes, pens and other everyday objects. In this future a communication amongst objects will become reality due to highly miniaturized processors and new wireless communication standards [3, 4, 5].

For a long time, researchers were and are still looking for an augmentation of the real world with the goal to assist everyday life. Furthermore the need of applications that do not only support and assist everyday life, but are an integrated part of life increases. A core component of any Ubicomp application is the context-awareness, possibly adapting the behaviour based on information collected from the physical environment. Finally "a large number of Ubicomp applications strive to automate the *capture* of live experiences and provide flexible and universal *access* to those experiences later on" [6]. Capturing real live experiences seemed to be hard, until the increasing potential of computer technology did offer an interesting solution - Wireless Sensor Networks (WSN).

Due to the consequential use of accepted Internet technologies and the focus on autonomous but connected functionality Wireless Sensor Networks can help bridging the gap between sensor systems that sense the surrounding environment and the still mostly physically as well as logically separated Internet applications and services (see Figure 1). The sensors that observe the physical phenomena in the real world are added to the applications that use world models to associate sensor observations with meanings. This paper aims to describe an application that uses sensors to create a unique ubiquitous computing application or as we would say a semantically enhanced Web 2.0 service.

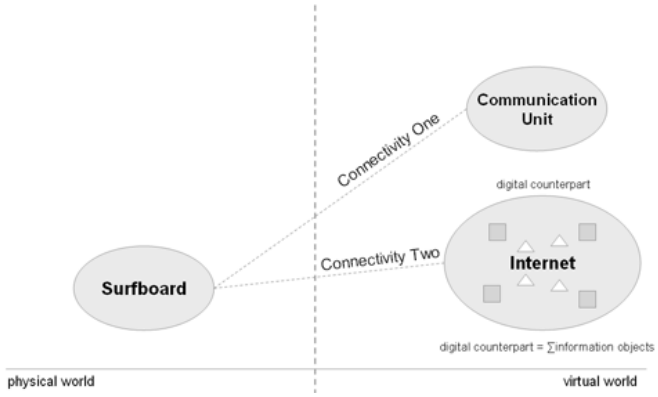


Figure 1: Bridging the gap [17]

2. The Ubiquitous Computing Enhanced Web 2.0 Vision

During O'Reilly's Web 2.0 conference in 2005, a core group of participants conducted a brainstorming about the future of the Internet, which focused on the importance of the user in the creation of future Internet services. In his article "What is Web 2.0" [11], O'Reilly argues that the

better the application, the more people are going to use it. Participation is the key fact in the Web 2.0 framework. While he outlines the user's impact in adding value to a system and the overall success, there is still a piece of the puzzle that is missing: The motivation to participate. Common Web 2.0 examples are the Blogsphere [8], Google Earth [9] and Flickr [10]. These applications require an implicit benefit for the user to support the community and like in any other online community most of the contributions are created by a core group of users. If the application is a success, it attracts enough contributors in a short time period to create a "positive feedback loop". Moreover, O'Reilly argues that ''the architecture of participation'' should be a primary designing goal for new applications. In addition, Stefan Decker (Figure 2) sees the influence of the Semantic Web in conjunction with the core Web 2.0 components as the next logical step towards a new generation of online services [12].

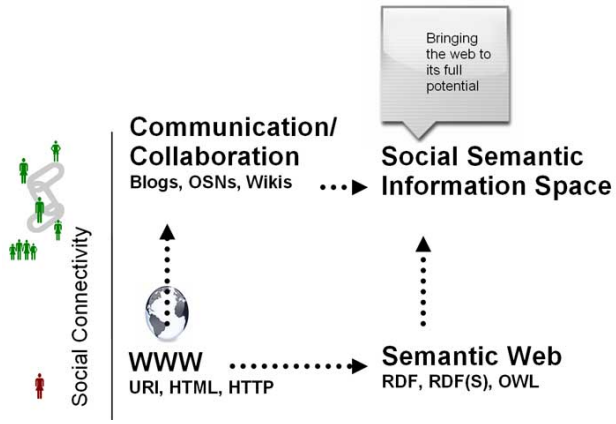


Figure 2: Stefan Decker - ''The social semantic side of the Web''

Considering these arguments we outline an important question: how can ubiquitous computing support and help to create a wider framework of a Web 2.0 vision for future research and development activities? The main dilemma of Web 2.0 is the creation of services that attract a critical mass of new audiences to contribute and to participate in content generation. Currently, most web development is focused on solving the dilemma of gratification and contribution. To further elaborate on this point, we look at a typical online community like the Surf Community platform wannasurf.com [13] who found ways to attract users to contribute (see Figure 3).



Figure 3: www.wannasurf.com

The wannasurf.com platform allows surfers from all over the world to share their photos and experiences, vote for different beaches and rank the quality of the surf. The gratification is usually

believed to be in the area of publishing photos and reviews, which support the surfer's reputation in the community. But, there is no direct link to the real surfing skills of the user or even real data from the beaches available. If the user could collect this information while surfing, we could lower the barrier of participation to step into the digital sphere. At the same time, it would enhance the platform with real-time physical data and semantic meaning as well. As a result, digital information would be connected to the physical space, which would therefore be augmented with semantic meaning. Overall, the added value would rise without much interaction by the user and, therefore, the result would be one step closer to a positive feedback loop.
The surfboard itself in the physical world gets a digital counterpart that includes additional information to become digitally augmented. Besides the stored and updateable physical world data (See Figure 4) the digital counterpart can be linked to even more information about the product, such as the dimensions to the board or tips and tricks from experts, previously stored. Based on this concept, we assume that prototyped augmented products would help understanding the basics of connecting the physical with the virtual world.

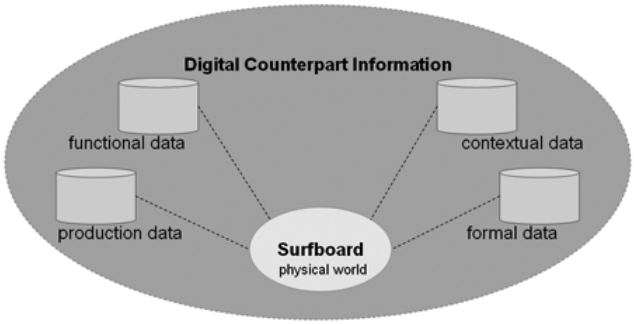


Figure 4: The Digital Counterpart (Adapted from [17])

To further elaborate on this point we want to introduce the HiveSurf project as a possible vision of future online services in conjunction with ubiquitous computing technologies. The next chapter introduces the major motivation behind the prototype and explains different application scenarios and their integration into existing online communities to leverage the community value according to the Web 2.0 vision.

3. The HiveSurf Prototype Project

3.1. The Hive Networks Inspiration

In 2002, a project called "Hive Networks" has been started in Austria to create new "multi-faceted transformation devices" in a "network of things"[14]. The main goal was to bring together artists, scientists and engineers from various disciplines to experiment at the forefront of advancement of a variety of semi-available technologies. The term "hive" was chosen as an analogy between insects and small embedded systems. In the case of surfing we see the individual surfer performing a ride as part of the hive of surfers which uses wireless sensor networks to share information in an unobtrusive, silent way as easily as possible without interfering the much desired solitude of the surfer (see Figure 5).



Figure 5: Merging separated worlds into one interactive vision

The Hive Networks Metaphor builds therefore the basis of the core HiveSurf Idea. HiveSurf tries to find new ways to transfer this metaphor into the physical world of sport and in particular into surfing (wave riding).

3.2. The HiveSurf Idea

Whenever we want to find peace and solitude, these activities often feature what could be called a communicational hiatus for a short period of time. But, we are social beings, and even in the midst of an individual activity like surfing, sometimes we would like to share our thoughts, our moves, and our inspiration with our friends, our local community or even with our global friends in a subversive way. This means we would like to show our peers what we've seen and done, and we would like to share the feelings that we had. This project is an attempt to bring a kind of silent digital communication also subsume as pervasive, ubiquitous technologies, to a world where it has never gone before: the waves of the ocean.

The HiveSurf prototype project intends not only to bridge the gap between the physical and virtual world but also to bridge the gab between formerly separated 'communication' landscapes. To achieve this we intend to record the physical movements, performances, styles and actions with wireless sensor nodes and transfer it from an outdoor area into the digital space of the internet. In addition the recorded data should be distributed between the digital augmented surfboards to form subliminal communication possibilities between them. The Global Positioning System (GPS) for example could be used to add geo-navigational data to the digital augmented surfboards. This enables the enrichment of surrounding environmental information with geo-navigational data and the real time tracking of surfers in contrast to the more or less passive usage of GPS on boats.
The HiveSurf prototype aims to integrate the physical surfing community into the existing online communities. We have been developing three main scenarios how we could extend the current application of Wireless Sensor Nodes.

3.3. Scenarios

3.3.1 Scenario One: The digital community space

Imagine you being a surfer on the beautiful beaches of Hawaii or Fiji. You know all the best spots and breaks to surf out there. You know where to get out and how to paddle into the waves of your favourite surf spot. You wait for the perfect wave and sometimes you get the right one - the perfect one. After that incredible ride, you tell your friends in the evening at the bonfire, how you did that "amazing" drop out after that nearly perfect run and their reaction might be: "Yeah, show-off, you

tell that all the time.". But with the HiveSurf prototype you're able to prove it, you're able to connect, to communicate and to discuss even with your friends that can't sit on the beach with you right now.

The surfboard that we want to develop can collect different information during the ride on a small wireless sensor node placed inside your board connected with a 3D movement recognition sensor and possibly a GPS sensor. After your ride you can upload the data automatically on a HiveSurf community platform and e.g. generate a flash movie out of your movement data for e.g. voting purposes in the community. You can watch from difference perspectives animations off your rides.

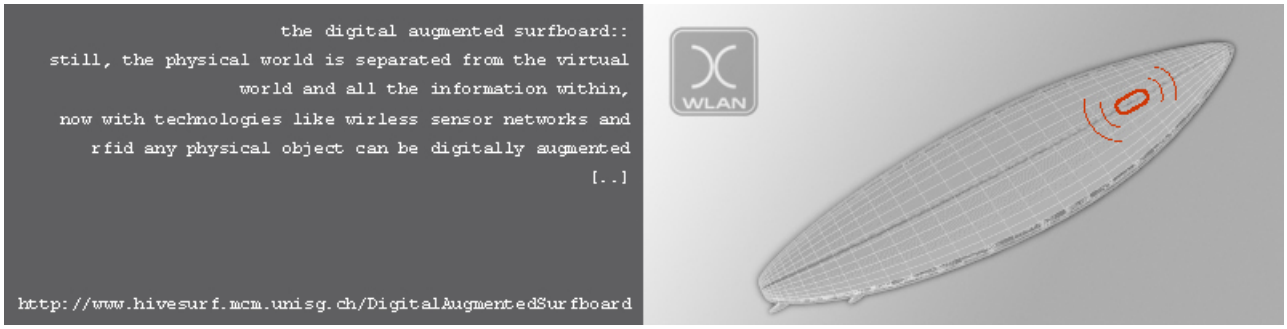


Figure 6: The digitally augmented Surfboard

The system even knows where you went for surfing and you can share this to the community as an indicator how difficult it is to surf on your beach. This could completely replace the current manual process needed for contributing information to the online communities.

3.3.2 Scenario Two: The real-time connected surfing

Once a snowboard legend said ''to ride in deep powder snow is like to draw a line on an empty sheet of paper''. This is more close to surfing than anything else. We seek after this line. Surfing has always been drawing a line on the water through the power of the waves but it was just for the moment. To makes these lines visible for the future, it needs creativity and new communication technology. If we augment a surfboard with a node it has the capability to record and submit your lines through the ocean. Therefore, this scenario is about the real-time connection of your board and the internet while you are surfing on the ocean. All that is needed is an onshore gateway [15] and a group of hive surfers which could create a direct link to the internet and the data about your rides could be shared in real-time everywhere with everyone. One of the major aims of this scenario would be to connect the beaches and shores not just via video cameras. To transfer this information to public spaces via a visual language on urban screens [16] or streaming this information directly into the digital community. It could show up what is currently happening on the beaches and therefore attract the digital space to new audiences. Imagine the impact into the global online surf communities if it would be possible in a next step to connect different hives while they are out on the oceans through placing a small touch screen connected to the node inside the boards? The display could show different information currently collected by the surroundings nodes (e.g. wave high via a radar sensor).

3.3.3 Scenario Three: The digital surf-buddy

This scenario is the one which is most far away from being realized but nevertheless still a vision of this prototype project. Imagine that you are out on the ocean and still a novice surfer. How good would it be to have a ‘‘Digital Surf-Buddy’’? A small touch screen would show you information like your current speed. If you try to catch a wave if would tell you to go faster otherwise you would not be able to catch the wave. The touch screen could be the interface to all information the hive nodes around you would collect. The information could be from your own node as well as from other hive members. It will feature information like the height of the waves in various places or the direction of their movements.

4. Discussion and Outlook

In this article we tried to tie the vision of Ubiquitous Computing with Web 2.0 principles in a prototype and three application scenarios. The impact of such applications is a rapid change in the usage of digital community platforms. In case it will become possible to connect smart digital artifacts with online communities the Semantic Web will become true but not as we suggested. Everyday objects will bring a real meaning to the world of digital information available in the internet because the information gets connected to real objects with a real meaning. This could enhance the current semantic web efforts and social network capabilities such as tagging which became popular with current Web 2.0 services and technologies like Flickr or Blogs.

We have demonstrated how to add implicit behavioural data recorded from smart digital artifacts to a community to leverage the overall value of the community for each individual user. As the participation of users is believed to be a key success factor for upcoming internet applications in recent discussion we think this project can deliver a substantial contribution to this discussion by showing how this can be achieved without the explicit user participation. Not only that we demonstrated how to use implicit recorded behavioural data, which is already discussed in length and implemented in various applications (e.g. collaborative filtering), but we also demonstrated how wireless sensor networks can be used to retrieve more of these behavioural data.

We believe that Meta data will become more and more important to organize available information and to provide semantics to information. Furthermore we believe that the creation of these Meta data in a manual fashion by humans only isn't enough to provide enough semantics to information and objects. Therefore we propagate the usage of implicit behavioural data recorded from various sources focusing on ubiquitous computing technologies.

7. References

[1] The HiveSurf Prototyp Project (2005): Breaking the classification of natural landscapes. http://www.hivesurf.mcm.unisg.ch

[2] Weiser, M. (1991): The Computer for the 21st Century. Scientific American, 265(3), pp. 66–75

[3] Mattern, F. (2004): Ubiquitous Computing: Scenarios for an informatized world. In: Zerdick *et al.* 2004

[4] Adamowsky, N. 2000. Kulturelle Relevanz. Ladenburger Diskurs „Ubiquitous Computing“. Available at www.vs.inf.ethz.ch/events/slides/adamowldbg.pdf

[5] Lucky, R. 1999. Everything will be connected to everything else. Connections. IEEE Spectrum, March 1999, p 19. Available at www.argreenhouse.com/papers/rlucky/spectrum/connect.shtml

[6] Abowd, G., Mynatt, E. (2000) Charting Past, Present, and Future Research in Ubiquitous Computing, ACM Transactions on Computer-Human Interaction, 7(1), 2000, pp. 29–58.

[7] Schmidt, A. (2005) From Sensors to Context, Summer School on Wireless Sensor Networks, 2005

[8] Brad L. Graham (1999): Introduced the Term Weblog http://www.bradlands.com/weblog/1999-09.shtml#September%2010,%201999

[9] Google Earth: http://earth.google.com/

[10] Online Photo Publishing: http://www.flickr.com

[11] O'Reilly, T. (2005): What is Web 2.0 – Design Patterns and Business Models for the next Generation of Software. http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html

[12] Decker, S. (2005): Semantic Web and Semantic Web services: Can One Go without the Other? http://www.stefandecker.org/images/zoom/CRUBXV/socialsemanticinformationspace.ppt

[13] WannaSurf.Com: http://www.wannasurf.com

[14] Hive Blob (2005): http://www.hivenetworks.net/mediawiki/index.php/Hive_Blob

[15] HiveSurfing (2005): Onshore Gateway Concept. http://www.hivesurf.mcm.unisg.ch/OnshoreGateway

[16] HiveSurfing (2005): Moving Arts. http://www.hivesurf.mcm.unisg.ch/MovingArts

[17] Nicolai, T., Resatsch, F., & Michelis, D. (2005). The Web of Augmented Physical Objects. In Proceedings of the International Conference on Mobile Business (pp. pp. 340-346). Los Alamitos: IEEE CS Press. Retrieved 2006-02-10, from http://www.alexandria.unisg.ch/publications/16586.