UBIQUITOUS AUTOMATION – A GOAL FOR FUTURE WORKSPACES?

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Abstract: Future workspaces will be decentralized and connected via the internet. Collaborative work will be computer mediated. Physical phenomena will be ubiquitously sensed and transformed in information. Analog-digital continuation of events is under development to assisting distributed workspaces to immersing in a common work of engineers or workers. Impacts on working condition are considered.

Keywords: collaborative work, ubiquitous sensing and generating, cobots, software agents.

1. INTRODUCTION

Ambient, pervasive, and ubiquitous computing is seen as the key to a future where people in an almost effortless way can do things or can work by means of technology they do not perceive. While ubiquitous computing (Ubicomp), coined by M. Weiser (1991), are more or less restricted to sensing, ubiquitous automation may be understood as sensing and acting (Bruns, 2005a). Data of distributed sensors are elaborated by tiny computers to provide information. Actions based on this information can be triggered by humans or automatically. Who is responsible for the effects of the action?

It will be possible in near future to sense dangerous situations in car-driving. Who acts accordingly to avoid accidents? That could be the driver based on the sensed information. Or actions could be done automatically to handle the situation. The driver will not perceive that he/she for this moment is not in control. To navigate ships or planes some years ago specialists were necessary aboard to interpreting sensed data for to put the master or pilot in a position to safe steering the passage. Today navigation is highly automated by sensing data of GPS, to locate easily where you are, and to steer automatic together with inertial navigation. Computers control the actions, sometimes not perceived by the masters or pilots.

Yoo & Bruns (2004) and their group developed simple computer animated virtual environments (CAVE) that generates a feeling of immersion in a virtual world without headsets or other special devices. Canvases are fastened on hexagonal scaffolding, and computer controlled video-projectors beam a landscape onto the canvases. Inside the cave one can walk through the landscape. The movements are sensed and generate actions of the projectors. The people inside the cave do not get aware of computers.

A project "Future Workspaces", funded by the European Commission, developed the vision: Supported by CAVEs engineers will be able to work seamlessly in their workspace environment

with documents, scientific models and virtual prototypes, both alone and collaboratively with distant colleagues as if they were in the same room. Virtual and hybrid prototypes will be available as means for engineers to design new products. They will access specialized services via intelligent and secure network infrastructures that can detect, predict and satisfy user demand at any time and any place through location- and device- independent applications, which are able to seamlessly migrate across network technologies. The computing power necessary for executing compute-intensive simulation tasks in real-time will be available through GRID technologies. A step-by-step work timeline could be stored by the system, allowing another user to understand the previous course of the work and thus be able to effectively carry on with the tasks in the process.

The reducing cost of technological equipment will enable companies to implement technologically integrated spaces, housing large embedded displays, networked furniture, wireless devices for tracking people and remote access to supercomputers etc. (Figure 1). The integration of technology with physical space will make the present computer systems and interfaces less visible or transparent in the future environment. The future may also see the use of satellite workspaces, secure out-of-town places for multi-business employees to work. Here they will be able to access their company's network and dock down to work for part, or all, of the day.

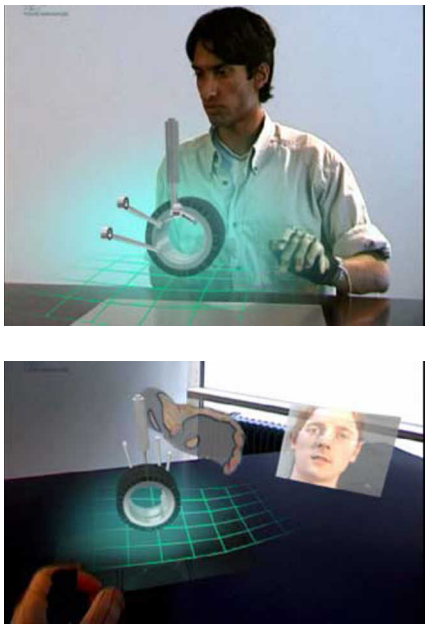

Fig.1. Images of connected workspaces (Future Workspaces, 2002-2003).

Despite the number of potential economic advantages, there are also substantial risks involved when relying on ubiquitous-computing technologies for large parts of an economy. The increasing automation of economically relevant aspects and the exclusion of humans as decision makers could certainly become a cause for concern. Under "normal" circumstances, automated control processes increase system stability – machines are certainly much better than humans if they have to devote their whole attention to a particularly boring task. But situations that have not been anticipated in the software can easily have disastrous consequences if they are not directly controlled by humans. Other problems might arise from the intricate interplay of several automated processes, which might quickly escalate into an unanticipated feedback loop that gets out of control (Bohn et al, 2004).

From a critical perspective the vision of ubiquitous automation is problematic because it could leave the users without control. Only in few cases is the focus of ambient computing on systems supporting humans in understanding what is going on at the level they choose, and supporting them in suggesting courses of action rather than action automatically. There seems to be a need for a balanced view emphasizing how ambient systems need to be visible, how they can be deconstructed, how coherence can be achieved, how they can provide stability and understandability, and in particular how users can stay in control when dealing with a large number of autonomous components (http://www.aarhus2005.org/).

2. HUMANS VS. MACHINES IN CONTROL

While the use of automation systems and the work with them penetrate all areas of life today, there are however many problems, which are not yet solved. They concern the acceptance on the one hand and on the other hand the reliability of the co-operation of humans and automation systems. The acceptance refers not only to the use of automated devices in household and leisure time, but likewise to the work with automation systems like machines and within plants. Effective, efficient and reliable work activities within and with automated systems are only possible, if the operators both know the consequences of their inputs into the system (operating) and can interpret the system feedback (understanding).