Works in Progress

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Security, Privacy, and Health

EDITOR'S INTRODUCTION

This Works-in-Progress department features three submissions. The first two directly relate to this issue's theme: security and privacy. The wide-spread deployment of cameras in public places, such as for security purposes in Britain, raises important questions about the access and use of such collected data. Likewise, supporting flexible privacy controls in a distributed, ad hoc, pervasive computing environment is a challenging problem that requires an equally flexible trust-management model.

The third work in progress discusses how ubicomp applications could help people with obsessive-compulsive disorder by providing them with additional audio, visual, or tactile feedback that helps break repetition loops. This area of research represents an interesting combination and application of medical and computer technology for societal benefit.

——*Anthony D. Joseph*

PEOPLEVISION: PRIVACY PROTECTION IN VISUAL SURVEILLANCE

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Much of the current pervasive computing research concentrates on devices and the communication between them. However, an important aspect of pervasive devices is their interface with the physical world—particularly, how they acquire information about their users. One rich medium (and the dominant one through which people receive information) is vision. As such, we expect future pervasive computing environments to depend on vision for passive perception of people. The PeopleVision project at the IBM T.J.Watson Research Center is tackling this problem, focusing on the privacy issues involved in such visual information gathering, both in pervasive computing environments and in video surveillance systems.

The PeopleVision system takes an object-oriented approach to video. It understands the video stream, decomposing it into people, objects, and areas of interest. It then abstracts or selectively re-renders this information based on the intended user. Client processes receive abstract information about people in the environment according to issued requests. Access control lists that can grant privileged processes access to richer (and more intrusive) information verify these requests. For example, the list might grant a face recognition security system access to facial images but tell the air conditioning process only how many people are in each room.

Access control lists also govern the information delivered to security guards, supervisors, and ordinary users. Re-rendering delivers reconstructed video, which preserves some objects unchanged and blanks out other areas of the image or replaces the area with a computer-graphics rendering that preserves relevant information. However, it does not convey more privacy-sensitive details. During ordinary use, a guard may only view silhouettes of people in the surveillance area, hiding irrelevant but privacy-sensitive information such as race, gender, and appearance.

We have developed a *privacy camera*—a single device combining a camera and processor that implements video-understanding algorithms. With this device, we can ensure that the privacy-intruding video is never available or only leaves the device in an encrypted form. All of the processed data leaving the device can also be encrypted, ensuring maximum privacy protection for the people in the pervasive computing environment.

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SECURITY MODEL FOR INTELLIGENT-AGENTS-BASED PERVASIVE COMPUTING ENVIRONMENTS

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According to the vision Mark Weiser introduced in 1991, pervasive computing involves environments saturated with communication and computation

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capabilities that can be integrated in a friendly way with humans. This new paradigm has created great challenges in diverse areas such as security, routing protocols, service discovery protocols, applications, device capabilities, communication protocols, and new technologies, such as wearable computing. Weiser's vision is becoming a reality with the proliferation of computational resources in the physical world.

Pervasive environments present security risks and access-control problems and require service discovery between agents. This is the aim of our research. A suitable and satisfactory model does not exist because most approaches lack formal trust models and perform centralized security management with a fixed infrastructure. This is inadequate for the flexibility required by and ad hoc nature of pervasive computing. We propose open and dynamic environments in which people can perform all security considerations and use intelligent agents. Our solution is based on a distributed trust-management model that determines access control to the services and guarantees authenticity between agents. This solution addresses several important security problems. Furthermore, we are defining a suitable secure service discovery protocol for these environments.

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UBICOMP TO PROVIDE FEEDBACK FOR PEOPLE WITH OBSESSIVE-COMPULSIVE DISORDER

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> *Roger was a successful vice president of a bank, unremarkable in every respect, except one. Before starting a task, he had to pull his socks up and down five times. Exactly five. Roger (not his real name) had obsessive-compulsive disorder. Like a skipping record, OCD patients repeat an act or repeatedly think about a phrase, number, or concept. "Most of us are able to switch things off," says Hopkins professor of psychiatry Rudolf Hoehn-Saric. "In obsessive-compulsive disorder, the person can't." (M. Hendricks, "The Man Who Couldn't Stop Adjusting His Socks," Johns Hopkins Magazine, June 1995; www.jhu.edu/~jhumag/695web/socks.html)*

In the US and Netherlands, one in 50 adults currently has OCD, and twice as many have had it at some point in their lives. OCD is a medical brain disorder that causes problems in information processing, creating a loop in the feedback procedure so that people miss the "ka-chung" that closes a car door or the click that shuts down the television. According to the Obsessive-Compulsive Foundation,

Our solution is based on a distributed trust-management model that determines access control to the services and guarantees authenticity between agents.

> *Worries, doubts, and superstitious beliefs all are common in everyday life. However, when they become so excessive, such as hours of hand washing, or make no sense at all, such as driving around and around the block to check that an accident didn't occur, then a diagnosis of OCD is made. In OCD, it is as though the brain gets stuck on a particular thought or urge and just can't let go. People with OCD often say the symptoms feel like a case of mental hiccups that won't go away. OCD is a medical brain disorder that causes problems in information processing. It is not your fault or the result of a "weak" or unstable personality. (The Obsessive-Compulsive Foundation, www.ocfoundation.org/ocf1010a.htm)*

How could ubicomp be instrumental here? Phase 1 is researching if ubicomp applications can assess if a person has a tendency for audio, visual, tactile, or other kinds of feedback that would signal the task scenario's closure. In Phase 2, we would have to access, for example, if visual feedback on clothing or another appliance could break the chain of repetition for a person who functions on visual feedback but is dealing with an apparatus that does not provide such feedback. Working closely with psychiatrists and OCD patients, in Phase 3 we could test whether such ubiquitous computing applications could break the loop of repetition, assuming that it is the kind of feedback that is responsible for the taskloop's nonclosure.

A group of researchers performed experiments and concluded that "the OCD group performed significantly worse than controls in the temporal ordering task despite showing normal recognition memory. Patients were also impaired in 'feeling-of-doing' judgments, suggesting they have a lack of self-awareness of their performance" (M.A. Jurado et al., "Obsessive-Compulsive Disorder (OCD): Patients are Impaired in Remembering Temporal Order and in Judging Their Own Performance," *J. Clinical and Experimental Neuropsychology*, vol. 24, no. 3, 2002, pp. 261–269).

Based on these findings, research into ubicomp applications could focus on temporal markers and serendipitous feedback scripting into various scenarios to raise self-awareness.

The three phases just discussed are being developed within the framework of contemporary performance and theatrical practice. There we find an actualization of (and ways of dealing with) the bottleneck scenarios that information experts envision.

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