National Science Foundation:
Home Monitoring While Maintaining Elder Privacy

This research will enable elders to maintain their privacy, while taking full advantage of home-based computing for their health and personal safety.

Lead Agency:

>   National Science Foundation
>>   Directorate for Computer and Information Science and Engineering
>>   Division of Information and Intelligent Systems

Agency Mission:

>   NSF's mission is to promote the progress of science: to advance the national health, prosperity and welfare; to secure the national defense (NSF Act of 1950).

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Partner Agencies:
>   N/A

General Description:

This project addresses the acute privacy challenge of home-based health care based on ubiquitous computing, or ubicomp, where vulnerable populations risk enforced technological intimacy. It will employ the well-defined "design for values" method to create an innovative toolkit that can be used by our aging population, their caregivers, and designers to ensure privacy and autonomy in home-based ubicomp.

Ubiquitous computing integrates technology into our everyday environments, fundamentally altering privacy by creating continuous, detailed data flows. Ubicomp will result in an environment that is aware, active and responsive. It creates an aware environment through the pervasive distribution of sensors. It is active because sensor data are processed and examined. It is responsive in that the technology acts on the environment based on processed data. As the ubiquitous computing devices are networked, the data and decisions have the potential to be observed from any connected locale on the planet. Thus privacy becomes a major concern.

Design for privacy is complicated by the fact that privacy is a socially constructed value that differs significantly across environments and individuals. Currently, design for privacy requires a user who understands the social implications of ubicomp technology, demands a design that respects privacy, and articulates specific technical design requirements. Design for privacy also requires a ubicomp designer with mastery of privacy enhancing technologies, security mechanisms, and a profound understanding of privacy. Neither of these is a reasonable burden. This research will decrease the burdens for both parties.

This project will create a system for designing highly customized privacy-enhancing ubicomp. The privacy framework that consists of three integrated, complementary components. The first component is a participant tool for eliciting individual elder privacy concerns, making it easy for non-technical people to express privacy concerns. The second is a designer tool that translates elder concerns into technical choices or suggestions. The third is a privacy-enhancing code library for ubicomp sensors that vastly simplifies privacy-sensitive design, including data filtering, access control list creation, and integration of cryptographic privacy enhancing technologies.

The broader impacts of the project include: (1) development of a multidisciplinary curriculum that will engage over 40 students in the research project; (2) a living laboratory to enable research and curricular activities in business, nursing, health and other disciplines; (3) expansion of the potential for privacy-enhanced home-based healthcare; (4) the development of tools to ensure that older people make their own choices about home monitoring and protection of their privacy and autonomy, and (5) a design tool and computer code library that enable ubicomp designers to easily embed appropriate privacy-enhancing and strong security-protecting mechanisms in home-based ubicomp without requiring expertise in privacy or security.

This project examines the role of information technology in the homes of elders with an emphasis on design and evaluation for privacy. The interdisciplinary team of computer scientists, clinical researchers on geronotology, and information scientists and their

students are creating a digital toolkit that enables elders to maintain their privacy, while taking full advantage of home-based computing for their health and personal safety. Elders have been shown to systematically underestimate their electronic privacy risk.

The tools will serve two functions. They will help elder make appropriate decision about home-based computing and guide designers in creating privacy-respecting technologies. Three current prototypes are being evaluated by a set of volunteers from a local retirement center. These tools facilitate social networks, encourage healthy behaviors, decrease isolation and support independence.

One prototype mimics a wall mirror and provides reminders and encourages social interaction. There is a motion sensor device so that when the person moves away from the mirror, the screen disappears. This Mirror Motive provides an interface that provides a way to arrange events with other individuals. The messages disappear when the person makes a waving hand gesture at the mirror. This exposure to events outside the home provides an opportunity to be more involved. The level of interaction by the user is shown to the user as a growing plant.

A second prototype encourages elders to increase their levels of physical activity while staying more tightly connected to a community of their peers. Older adults can seamlessly track the indicators of well-being of community member by looking at the e equivalent of a wristwatch. The elder can choose to share personal information with peers without concern that the data will show up in an internet search.

The team is also constructing a "living Lab", in which elders from the local community will interact with the previous prototypes and others embedded in the home, which preserves the look and feel of an historic house near campus. These volunteers will provide critical feedback about the technology's usability, appropriateness and privacy implications.