Chapter 11. Technologies to facilitate health and independent living in elderly population

11.1 Growth of technologies:

Today’s elderly can choose from various housing environments that meet their living and functional needs. This chapter will discuss how technology can be used to enhance these living environments.

Assistive technology serves three major purposes relevant to home safety:

1. detecting unsafe situations or emergencies,
2. facilitating independence and functional performance, and
3. supporting caregivers by facilitating provision of personal care.

The single common requirement is that the technology must provide a living environment that accommodates and supports the functional capacities of the residents. Assistive technologies must provide support for individual’s cognitive, perceptual, sensory, and physical capacities; and thereby prevent, mitigate, or compensate for declines resulting from disease or the aging process.
Falls and fire are the most important safety concerns in all housing environments.

- Hip fractures, head injury, poisoning by carbon monoxide, and burns are the most common household injuries among older adults.
- Features of the housing environment, e.g., stairs, grab bars, handrails, and lighting can contribute to safety by reducing the potential of loss of balance and falls.
- Discussion of home safety often focus exclusively on reducing home hazards – detection of smoke, heat, or carbon-monoxide – using passive sensors.

Community residence

Older adults reside in diverse living environments, including single-family homes and apartments, congregate senior housing, assisted living, and retirement communities. In many communities there is a zoning trend toward requiring design in all new residential construction to accommodate mobility and other impairments. These “universal design” features have numerous home safety benefits for all ages.

- No-step, at grade entrances reduce the chance of falls, while increasing the ability of elderly persons and those with mobility impairments to safely and easily enter and exit the home, even if using a walker or wheelchair.
- Widening of doorways and hallways makes it easier for people using mobility aides to safely navigate within the home.
- The ability to operate doors is enhanced by levers instead of doorknobs.
- Single-lever controls on kitchen and lavatory faucets are easier to operate and make adjustments of water temperature and volume simple for everyone.
- Electrical outlets located several feet up the wall are more reachable by those who may have trouble bending or reaching.
- Lighting should be provided in a variety of locations and at different levels to reduce glare and decrease shadows.
- Light switches should be located at the entrance to each room to permit sufficient illumination for the older resident to safely enter and move about.
- A useful alternative to the standard light switch is voice- or noise (clapping) activated switches.

11.2 Assistive technologies to support independent living

Assistive technology that can increase safety, while preserving independence for the frail elderly, is becoming commercially available.
Personal response systems (PERS)

The most established AT home safety application is the Personal Emergency Response System (PERS). PERS are intended to provide access to emergency assistance, 24 hours a day, 7 days a week, 365 days a year, to help people who fall and are unable to get up, or who have another medical emergency such as a heart attack. Data indicate that the risk of being found “down and dead” increases with age, from 3 per 1000 for people age 60-64 to 123 per 1000 for people age 85 and older living alone, with a 23% risk of death for those who cannot get up.

PERSs originally required a user to press an alarm button and send the signal over a nearby telephone line. Microchips and digital and wireless communication technologies have enabled the development of wireless PERSs.

The first of these systems was developed in the 1970s by Lifeline Systems, Inc. A study used Lifeline to see if users felt more secure with the technology. All users reported a greater sense of security during their PERS use. The 12-months users improved in vitality, role-emotional, and mental health SF-36 scores. The results indicate that PERS perceive support and positively affects their ability to function.

Cueing and reminding for medications and appointments have been added to most commercially available PERS services to provide additional support for older adults with cognitive changes. “Lifeline With Reminders” allow families to remotely record up to 6 personal family voice reminder messages and deliver them at selected times.

Universal design and smart house technology

- “Aware House” at the Georgia Institute of Technology: The cost of this technology was out of reach for many consumers since it was expensive and sometimes impossible to add to existing housing.

- “Future Home”, the home of David Ward: A 135-year-old tavern was renovated to provide a showcase of universal design for independent living for people with disabilities and those who want to age in place. The rehabilitation of Future Home in 1990 used commercially available products and systems, adapting or enhancing them to allow Mr. Ward to control his environment using his voice, breath, and the limited use of one arm in a brace. This technology cost an estimated $60,000. In 2002, he upgraded using wireless technology at an estimated cost of $8,500. This illustrates how off-the-shelf technology and cutting-edge assistive technology have become much more affordable for individuals who need it most, and for the average consumer.
Issues affecting dissemination of home safety technology

- Cost and maintenance: Older persons’ principle concern was the cost of adaptation of existing housing and the maintenance of the AT.
- Safety: Technology for home safety must address security and responsiveness of safety monitoring.
- Access to health care: Telemedicine and telerehabilitation have increased access to medical oversight in the home.
- A survey (in 2000) of 176 PERS or other alarm users, with a mean age of 76 years, indicated that 77% were interested in automatic fall detection, 68% were interested in lifestyle monitoring, 57% in telemedicine, and 46% in videoconferencing.

11.3 Assistive Technology in the supportive and long term care environment

11.4 The future of home safety technology

- The challenges of translating laboratory success into useful, marketable products and services.
- Studies that translate knowledge about aging from basic behavioral and social science research into products and services of benefit to elderly and the systems providing care, as well as new “use-inspired” basic research in the behavioral and social sciences.

ILSA: Honeywell international

- ILSA, Independent Life Style Assistant (ILSA), a 2.5 year, $5 million research and development program (http://www.htc.honeywell.com/projects/ilsa).
- Honeywell has long experience in control systems and home automation and believes that in many cases the needs of the elderly could be served better – and less expensively – by an intelligent, home based automation system that enables individuals to continue to live safely at home in an assisted environment.
- When fully implemented, ILSA will integrate a diverse set of passive motion sensors, medication dispensers, medical monitoring devices and “smart” appliances, using automated reasoning and situation assessment based on information about the individual’s medical diagnoses and functional assessment.
ILSA will collect and analyze these data to determine a person’s needs and adapt monitoring to identify and respond to critical situations, provide reminders, and support useful daily activities.

For example, the system will identify whether a medication caddy has been opened during the time window when the older person has been reminded to take medications, and if this time window is exceeded and the individual does not take the medication after a specified time, the system will send a notice to a caregiver.

User-friendly features such as voice interaction will eliminate the need for elders to “master” the technology.

**Proactive health research initiative: Intel Corporation**

- In April 2002, the Intel Corporation announced its Proactive health Research initiative (http://www.intel.com/research/prohealth).
- The goal is to understand how technology can support individual behaviors that help prevent disease, foster independence, and improve quality of life, as well as the use of technology to meet the growing shortage in home careworkers.
- Initially, the focus is on identifying markers of physical and cognitive decline and the way technologies can help elderly to age in place wherever they are living. This will involve three types of research:
  1. ethnographic field research in people’s homes to identify their needs through observation and interviews,
  2. application of these field results to develop and test prototypes of future home systems that could meet the health needs of an entire multigenerational household,
  3. outcome studies of beta prototype systems to determine their effect on targeted needs or desired outcomes.

INTEL’s approach to home monitoring involves the placement of radio-frequency tags on clothing or shoes, which interact with sensors in the home.

If someone is in the kitchen, sensors in cabinets, the refrigerator, microwave, and dishes would send signals to a computer that would then signal a television set to play a video clip with cueing assistance.
Aware home: Georgia Institute of Technology

- The project is attempting to determine how to design a home that will support the functional independence of elderly residents to postpone or prevent the need to move to assisted living or a nursing facility.
- Aware Home is part of the unique 5,040 square foot Broadband Institute Residential Laboratory. Georgia Tech scientists work with sensing technology to see how they can monitor movements from room to room and record movement and conversations of elderly people, using cameras and microphones embedded in the walls to create a home system which would collect and digitize data to send reports to family members offsite.
- For example, footsteps can be used to analyze the speed used to walk from room to room or climb stairs and changes in pattern detected by monitoring software.
- A Digital Family Portrait utilizing the sensing information provides a visual description of person’s daily life activities.

11.5 Conclusion

The speed with which creation of new assistive technologies has been advancing in recent years – becoming smaller, more versatile, and cheaper – bodes well for the future.