

**National Science Foundation:  
Collaborative Research of Intelligent Systems & Cognitive Robotics  
Used for Assistance**

*Quality of Life Technology Engineering Research (QoLT) Center will develop intelligent systems and assistive technologies in concert with a person to enable aging and disabled population to perform daily living activities more independently and to participate in society more fully.*

**Lead Agency:**

National Science Foundation (NSF)

**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).

**Principal Investigators:**

Prof. Takeo Kanade  
Carnegie- Mellon University  
500 Forbes Avenue, WH 405  
Pittsburgh, PA 15213-3890

Prof. Rory Cooper  
University of Pittsburgh,  
5042Forbes Tower, Room 5042  
Atwood & Sennott Streets  
Pittsburgh, PA 15260

**Partner Agencies:**

University of Pittsburgh  
Bosch Research  
Honeywell Life Systems  
Sanyo North America Corp.  
Sony Corp.  
Bluroof Technologies  
Etovia Systems Inc.

**General Description:**

The Quality of Life Technology Engineering Research (QoLT) Center will transform lives in a large and growing segment of the population - people with reduced functional capabilities due to aging or disability. Future compassionate intelligent QoLT systems will monitor and communicate with a person, understand her daily needs and tasks, and provide reliable and happily-accepted assistance by compensating and substituting for diminished capabilities.

Many previous attempts to use sophisticated assistive technology failed due to lack of basic understanding of human functions (psychological, physiological, physical, and cognitive) and how to relate them to the design of intelligent devices and systems that aid, interact, and work in symbiosis with a person of diminished capacity. Traditional robotic advances have been made without cognitive human component. The goal of QoLT is to develop assistive technologies in concert with a person. That fundamental difference defines the QoLT research. QoLT systems are person-aware as well as environment-aware. The focus will be on four areas of research: *Perception and Awareness* - performs research on sensing and perception technology that not only reliably detects, tracks and recognizes objects in cluttered real-life environments, but also understands the person's motion, activities, emotions, and intentions; *Mobility and Manipulation* seeks hardware and software that are not only capable of dealing with everyday life objects, but also are inherently safe for physical interaction of machines and people, so that robotic effectors touch people gently, even while moving them; *Human System Interaction* addresses the challenge of dynamically adjusting interfaces on the fly to account for changes in an individual over time. It also seek methods for support providers to modulate the level of compensation that QoLT systems provide in order to achieve desired clinical outcomes; *Person and Society* research brings socioeconomic considerations to the forefront of advanced technology research and into the system design from the beginning. QoLT systems respond to the population with the largest variety of functional support needs – older people and people with disabilities, and for the most diverse needs – everyday life. Testing the systems in *Natural Environment Testbeds*, the research is not only integrating components and subsystems, but is integrating systems with people's lives.

The technologies developed will enable older adults and people with disabilities to more independently perform activities of daily living and give them opportunity to participate in society longer and more fully. QoLT will augment the capabilities and extend the reach of professional and informal caregivers, increasing their cost effectiveness and improving their own quality of life. Having more people gainfully employed and reducing the need for or delaying the onset of institutionalization will have an even more profound impact on the national economy. QoLT will transform and eventually subsume the present assistive technology industry, one that is fragmented and composed primarily of very small companies serving a small market, into a space with a large consumer base including the soon-to-retire Baby Boomers. In terms of clinical impact, QoLT will accelerate the trend of engineers and clinicians collaborating for better treatment and will add computer and robotics specialists to patient care teams.

**Excellence:                    What makes this project exceptional?**

The **exceptional** nature of this project lies in the fact that it will not only assist the older adults and people with disabilities but will also augment the capabilities of professional and informal caregivers thus increasing their cost effectiveness. QoLT will also transform the current assistive technology industry. Other point of importance is that it will accelerate the trend of research collaboration between engineers and clinicians to provide better treatment of patients that includes computer and robotics specialists.

**Significance:           How is this research relevant to older persons, populations and/or an aging society?**

The research is very relevant to aging population as it is expected to increase substantially every year. We are facing an unprecedented shift in age demographics that has the potential to disrupt every business, industry, and economy. Modern medical and agricultural technologies have extended human life-spans into the 80s and 90s, but most countries will soon face an enormous care giving crisis. Perceptual, cognitive and musculoskeletal diseases that impair motor skills dramatically increase with age. Presently there are about 35 million people—one in eight—over the age of 65 in the United States. By 2030, those numbers will double to 70 million with older Americans accounting for 20% of the U.S. population. By then, one in two working adults will serve as informal caregivers. The aging U.S. Baby Boomers, those born between 1945 and 1964 and accounting for 39% of adult Americans, will find severe physician shortages in the specialties they most need. Of all of the challenges faced by older individuals, dementia - a chronic condition characterized by cognitive decline sufficient to affect functioning - is often most feared and has the largest negative impact on both older persons and their family members. Whereas due to longer life-expectancy the probability of a 65 year old woman living to age 85 is 65%, and correspondingly 53% for a man, nearly half of persons over age 85 suffer Alzheimer's disease (AD). In addition to AD, there are many other pathologies that affect cognitive function as well as movement ability - strength, coordination, and balance - such as stroke (2.5 million) and traumatic brain injury (5.3 million). In the United States disability affects 48.9 million people who have limitation in a functional activity or social role, whereas 24.1 million report having a severe disability and are unable to perform one or more activities of daily living. Their unemployment rates are notably high: 37.5% overall disability; 47.3% sensory disability; 31.8% physical disability; and 28.5% mental disability.

**Effectiveness:           What is the impact and/or application of this research to older persons?**

The technologies developed will assist the older population and people with disabilities directly in performance of their daily activities. Specifically this will be achieved through intelligent systems.

**Innovativeness:       Why is this research exciting and newsworthy?**

The research is transformative and innovative because this is the first time that assistive technologies will be developed in concert with human cognition.