

Chapter 64

Pathway to Independence: Past, Present, and Beyond via Robotics

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ABSTRACT

Robotic technologies can provide people with disabilities the invaluable tools to perform Activities of Daily Living (ADL). Few studies have investigated how effective and accessible the control of robotic aids is for people with severe physical disabilities with respect to their needs and current facility with technology. Though present-day robotic aids can help people with disabilities with important daily living tasks, there is still room for improvement. In this chapter, an overview of the state-of-the-art robotics that help promote independence for people with disabilities, especially individuals with physical limitations, is presented. Active research areas supporting tasks and services for persons with physical disabilities include development of robotic prototypes, designed specifically for domestic applications, rehabilitation, mobility assistance, personal hygiene care and meal assistance, and education and employment. Existing challenges and recommendations to support and increase independence for persons with motor limitations with robotics technologies are provided as insight to advance research.

INTRODUCTION

U.S. Census Bureau data from the 2008-2010 American Community Survey 3-Year Estimates indicated that 36.1 million people in America have a disability, approximately 12% of the population (United States Census Bureau, 2011). Within the disability population, approximately 73% have a prevalence of physical disabilities. Persons with physical disabilities can have diverse levels of motor strength and limitations in their range of motion. Common health conditions that are associated with physical disabilities are Amyotrophic Lateral Sclerosis (ALS), cerebral palsy, locked-in syndrome, missing limbs, multiple sclerosis, muscular dystrophy, spinal cord injury, spinal muscular atrophy, stroke, traumatic

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brain injury and many others that are often characterized by the symptoms of voluntary muscle weakness, breathing difficulties, speech impairment, and even complete paralysis (Sears & Young, 2003). With medical advancements and as life expectancy is extended, the prevalence of disabilities will also continue to rise with the aging of the baby boom generation.

Recently, the World Health Organization (WHO) and World Bank indicated in the first World Report on Disability that more than one billion people in the world experience disability in some form, amounting to approximately 15% of the world population (World Health Organization and World Bank, 2011). Although there are legislative policies established in many countries, the report noted that people with disabilities still have widespread barriers in accessing education, health care, rehabilitation, support services, employment and sustainability to thrive and flourish in their environment with equal opportunities. For example, the Americans with Disabilities Act (ADA) was signed into law in July 1990 in the United States to provide civil rights with legal protection for people with disabilities to receive services in the most integrated setting and prohibit discrimination in employment, public accommodations, and facilities on the basis of disability. Many developing countries have a conceptual foundation and recognize fundamental policies but lack effective legislation adherence in their governments. As a result, people with disabilities in these developing countries still have no improvement in their circumstances and cannot enjoy the same quality of life individuals without disabilities experience in life. Consequently, having a disability without adequate support services severely impacts more vulnerable populations, such as, women, the elderly, and those in poverty.

In particular, there are many characteristics that are common to both people with physical disabilities and older people. Thus, many technological solutions and legislative policies that may help people with disabilities can also aid the elderly in shaping of the overall prospective of achieving an improved quality of life. According to WHO, the proportion of the world's population over 60 years will double from about 11% to 22% between 2000 and 2050 and the absolute number of people aged 60 years and over is expected to increase from 605 million to 2 billion over the same period. The elderly and individuals with physical disabilities may require medical and long-term care services and assistance with tasks due to decreased functional strength. Many older people may also become a part of the disability population. Disability prevalence also increases considerably as people age. People who are a part of the disability and/or the elderly groups may also experience unequal access to transportation, healthcare, employment, and education. Additionally, they may face prejudice, stereotypes, and discrimination that limit opportunities for community inclusion and employment. As a result, people disabilities and the elderly do not experience the chance of having equal rights as people without disabilities.

Although people with disabilities and the elderly are often supported by family and friends, many mixed emotions, such as, feelings of frustration, gratefulness, guilt, loved, and sadness may be prevalent for these individuals without independence because they rely on others. Similarly, their family caregivers often may experience feelings of physical strain and overwhelming emotional stress while providing 24/7 support. When a primary family caregiver can no longer provide support or unexpectedly passes away, the individual that needs care may be at risk of abandonment because other family members are unwilling or unable to provide care. Additionally, access to health care is expensive so hiring nurses for quality care is a very difficult process and insurance coverage is limited. Even after hiring nurses, there are numerous challenges in training the caregivers according to the needs, preferences, and expectations of people with disabilities. The training may take days, months, or even years depending on the learning

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