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REVIEW ARTICLE

The Role of Digital Assistive Technology in Managing Functional Impairment

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ABSTRACT

Digital assistive technology (DAT) is revolutionizing the management of functional impairments by integrating advanced tools such as artificial intelligence (AI), the Internet of Things (IoT), and virtual reality (VR). This paper explores the potential of DAT in addressing the needs of individuals with functional limitations, identifies barriers to adoption, and proposes strategies for enhancing accessibility, affordability, and innovation. By fostering inclusivity and impairments independence, DAT is poised to transform healthcare, education, and employment, contributing to equitable opportunities in a connected world.

Keywords: Digital assistive technology, Functional impairments, Disability, Accessibility, innovation, Healthcare

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INTRODUCTION

Functional impairments affect approximately 30% of the global population at any given time, resulting from chronic diseases, aging, trauma, and other health conditions.[1,2] While traditional approaches to managing focus on specific health domains, the advent of digital functional impairment assistive technology (DAT) provides an integrated and inclusive framework for addressing these challenges.[3] This paper examines the role of DAT in bridging the gap between functionality and disability, emphasizing its transformative potential across multiple domains.

METHOD

This study utilized a comprehensive search strategy across databases like Google Scholar and PubMed to investigate digital assistive technology (DAT) for functional impairments. MeSH terms, including "Digital Assistive Technology" and "functional impairments," were combined with keywords such as "barriers to assistive technology adoption" which limited the search to articles published in the last ten years in English.

RESULTS

Defining Disability and Functionality

In India, disability is legally defined by the Rights of Persons with Disabilities Act (2016) and encompasses health, employment, education, and accessibility.[4] However, functionality—a broader concept—includes impairments in physical, sensory, or physiological capacities caused by chronic conditions, cognitive disorders, and aging.[3,5] These impairments necessitate assistive care, with digital technologies playing a pivotal role in enhancing functionality and independence.[3]

Digital Assistive Technology: Scope and Applications

Digital assistive technology refers to tools and services that leverage digital advancements to support individuals with functional impairments.[3,6] Key applications include:

Mobility

Smart wheelchairs, powered exoskeletons, and microprocessor-controlled prosthetics, robotic limbs, bionic hands etc.[7]

Sensory Support

Screen readers, wearable navigation devices, and hearing aids.

Cognitive Aids

Memory devices, alarming reminders, GPS trackers for dementia patients, and learning platforms.[8,9]

Communication Tools

Augmentative and alternative communication (AAC) devices, speech-to-text applications, and eye-tracking software.[10]

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Daily Living Assistance

Adaptive toilets, robotic feeding devices, and personal care robots.

These technologies enable individuals to participate in education, employment, and social activities, fostering a sense of dignity and independence.

Challenges in Adoption

Despite its potential, the adoption of DAT faces significant barriers[9,11]

High Costs

Many devices remain unaffordable, especially in low-resource settings.

Limited Awareness

A lack of information about available technologies hinders widespread adoption.

Inadequate Training

Healthcare providers often lack the expertise to prescribe and maintain DAT.

Policy Gaps

Insufficient government schemes to subsidize and promote DAT restrict accessibility.

Cross-Cutting Impacts of DAT

Digital assistive technologies address diverse needs across health domains[12,13]

Physical/Mobility Impairments

Exoskeletons and smart wheelchairs enhance mobility for individuals with spinal cord injuries or amputations.

Visual Impairments

Screen readers and wearable navigation devices improve access to education and employment.

Hearing Impairments

Cochlear implants and live captioning apps break communication barriers.

Cognitive Disorders

Memory aids and GPS trackers support individuals with Alzheimer's and dementia.

Communication Impairments

AAC devices empower individuals with speech disorders to express themselves.

The Path Forward

A multi-faceted strategy is essential to maximize the impact of DAT:

Improving Access

Establishing regional distribution centers and online platforms for DAT.

Enhancing Affordability

Subsidizing technologies through government schemes and public-private partnerships.

Promoting Awareness

Conducting outreach programs to educate stakeholders about the benefits of DAT.

Investing in Innovation

Supporting research and development to create cost-effective, culturally relevant solutions.

DISCUSSION

The rise of DAT represents a significant shift in managing functional impairments. Such technologies improve independence and quality of life. DAT integrates tools across multiple functional domains—mobility, sensory support, cognitive assistance, communication, and daily living. It empowers users to engage in activities of daily living in society. Despite its wide potential, several barriers hinder the adoption of DAT. High costs, higher out-of-pocket expenditure for users, limited access, and lack of awareness and training among healthcare providers result in underutilization of available assistive technology. Insufficient government funding lack of policies and inadequate subsidies restrict the availability and wide-scale adaption, leaving many without vital assistive technology support. Regulatory challenges and psychological barriers, such as stigma and fear of dependence, can impede acceptance. The digital divide may hinder effective implementation. Future advancements in technology, particularly in artificial intelligence (AI) and the Internet of Things (IoT), will lead to the development of smarter, more personalized devices that enhance user satisfaction. Integrating DAT into healthcare systems can improve patient support, while telehealth can provide remote training and guidance. Expanding access to DAT in low-resource settings and investing in research for affordable, culturally relevant solutions will be essential for its widespread adoption. A multifaceted approach is required to improve this. Increasing DAT availability and adaptability to improve the lives of those in need can be achieved through establishing access through regional distribution centers. Affordability can be improved through government health schemes and subsidies. Awareness can be raised through outreach programs by non-governmental organizations (NGOs). An increase in research funding will facilitate the development of affordable, and accessible DAT solutions.

CONCLUSION

Digital assistive technology represents a paradigm shift in managing functional impairments, offering innovative solutions to enhance independence, accessibility, and quality of life. By addressing existing gaps in awareness, affordability, and policy, DAT can unlock new opportunities for individuals with functional limitations. With a collaborative approach, India can foster an inclusive society by encouraging cooperation between governments, healthcare providers, and software developers.

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