

# Enhancing Accessibility: Exploring the Impact of AI in Assistive Technologies for Disabled Persons

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**Abstract-** As per the World Health Organization, approximately 15% of the global population experiences some form of disability. The integration of Assistive Technology with Artificial Intelligence of Things devices has witnessed significant advancements. This paper, through research, aims to identify various assistive models utilized in diverse studies focusing on the application of Artificial Intelligence. Starting with past research studies in this area and emphasizing the manifold and noteworthy roles of AI in assistive technologies, the paper delves into the prospective applications of AI in the future of assistive technologies.

**Keywords-** Assistive Technologies, Artificial Intelligence, AIoT, Dragon natural speech, Amber script, Voice Access, Speech note.

## 1. Introduction

Communication is a key factor in leading a fulfilling life. For people with communication disorders, this can be a major obstacle. An assistive technology is a tool or device used to assist people in carrying out their daily activities. A digital accessibility focuses on making digital content and technologies accessible to everyone, including people with disabilities. Assistive technologies have come a long way in helping people with disabilities live more independent and fulfilling lives. With the advancements in artificial intelligence (AI)[1], these technologies are becoming even more powerful and effective. In this paper, we will explore the latest trends and developments in AI-based assistive technologies for disabled persons. How AI is revolutionizing accessibility, how AI is breaking down barriers for Individuals with Disabilities, how AI is creating a more inclusive digital environment.

## 2. Assistive Technologies

Assistive technologies are devices or software that help people with disabilities perform tasks that they would otherwise have difficulty doing. These technologies can range from simple tools

like wheelchairs and hearing aids to more complex devices like speech recognition software and prosthetic limbs [1].

The goal of assistive technologies is to bridge the gap between a person's abilities and the demands of their environment. With the help of these technologies, people with disabilities can improve their quality of life, increase their independence, and participate more fully in society. As a cutting-edge journal covering the use of artificial intelligence (AI) and other cutting-edge technologies, the Assistive Technology Journal is proud of its position [9].

### **Type of Assistive technologies**

- Visual: Individuals with limited vision, color blindness, or blindness.
- Auditory: Individuals with hearing impairments.
- Motor: Individuals with tremors and spasms, slowness of the muscles, or restricted fine motor control
- Cognitive: Individuals who struggle with reasoning and problem solving, memory problems, learning impairments, or attention issues.

In order to improve a person with a disability's independence, mobility, communication, and general quality of life, assistive technologies are essential. The following are a few of the main advantages of assistive technology for the disabled:

- Increased Independence
- Enhanced Communication:
- Improved Mobility
- Access to Information
- Employment Opportunities
- Inclusive Education
- Social Inclusion
- Health Monitoring
- Environmental Control
- Customization and Personalization
- Empowerment and Self-Esteem
- Legislation and Advocacy

### **3. Role of AI in Assistive technology**

The integration of Assistive Technology with devices and machine learning in the realm of Artificial Intelligence of Things (AIoT) has experienced significant advancements—from now on referred to as AIoT—devices and machine learning. Artificial intelligence has revolutionized the field of assistive technologies. With its ability to learn, adapt, and make decisions, AI has opened up new possibilities for people with disabilities. AI-based assistive technologies can analyze data, recognize patterns, and make predictions, making them more efficient and effective than traditional assistive technologies. In general, people with impairments participate in society

more when they are not faced with hurdles. Under these circumstances, assistive technology, or AT, directly lowers the challenges that individuals with impairments face on a daily basis [10].

AI can also be integrated into existing assistive technologies, making them smarter and more user-friendly [11,12,13]. For example, AI can be used in prosthetic limbs to analyze the user's movements and adjust accordingly, providing a more natural and comfortable experience.

## **4. Previous Research**

Junior et al.'s [14] research introduced a system framework leveraging computer vision and machine learning within an IoT network, supported by cloud computing, aimed at enhancing capacity. In this setup, images captured by an IoT device are transmitted to an edge component (IoT node) for processing. This processing includes object identification, distance computation, and conversion of the gathered data into audible commands, intended to offer guidance to individuals with visual impairments.

In Su et al.'s investigation [16], they presented the development of a finger-worn gadget tailored for visually impaired individuals to recognize traditional Chinese characters. This device operates on a micro IoT processor. The setup worn on the index finger comprises a compact camera and buttons. These components capture images by detecting the position of the index finger in relation to the printed text. Visually impaired users utilize the buttons to capture an image, triggering an audio output of the corresponding Chinese character via a voice prompt.

Lee et al.'s [17] research introduced a smart wearable system for interpreting American Sign Language (ASL), employing deep learning techniques and sensor fusion. This fusion integrates six inertial measurement units (IMUs) to enhance the system's performance and functionality. The IMUs are affixed to each fingertip and the back of the hand to detect sign language gestures, allowing the proposed method to operate without limitations imposed by the field of view. The model reaches an average recognition rate of 99.81% in case of dynamic ASL gestures. Integrating the ASL recognition system with ICT and IoT technology offers a viable solution to aid hearing-impaired individuals in communication with others.

Al Shabibi and Kesavan [18] introduced an affordable smart wheelchair solution utilizing an Arduino Nano microcontroller and IoT technology. This system offers various features aimed at assisting disabled individuals, particularly those from low-income backgrounds who may not have access to expensive smart wheelchairs or the necessary assistance to complete daily tasks independently. The cost-effective smart wheelchair, suitable for a diverse spectrum of disabled individuals and built around the Arduino Nano, comes with features including a Wi-Fi module for connectivity, a fall detection module with voice message alerts through the IFTTT platform, obstacle detection with a buzzer, hazard lights using LEDs, a voice recognition system, and joysticks for wheelchair control.

Sharma et al. [19] introduced DeTrAs, an Internet of Health framework employing deep learning techniques to support individuals with Alzheimer's disease.

It operates through three key components: a recurrent neural network-based prediction model for Alzheimer's disease utilizing sensory movement data, and an ensemble method for tracking abnormalities in Alzheimer's patients, consisting of two distinct parts:

- a) An emotion detection scheme based on convolutional neural networks.
- b) a natural language processing scheme based on timestamp windows; and lastly, an IoT-based assistance system for Alzheimer's patients. The evaluation of DeTrAs shows a nearly 10–20% enhancement in accuracy compared to various other existing machine-learning algorithms.

## **5. Applications of AI as assistive technologies [1,10,11,12,13]**

### **Speech Recognition and Natural Language Processing (NLP).**

Advanced technological solutions have been developed to convert spoken language into written text. These tools leverage intricate algorithms and artificial intelligence (AI) to analyze and interpret spoken words, translating them into precise and readable text in real-time. This bridging of the gap between spoken and written communication not only facilitates accessibility but also offers an effective means of expression for individuals with disabilities or limitations. These tools seize audio input, undergo intricate processing via advanced speech recognition systems, and produce corresponding written text. This empowers users to communicate, generate content, and interact with others through written language. Given their capacity to improve accessibility and inclusivity, speech-to-text tools have evolved into indispensable resources for individuals dealing with speech impairments, hearing impairments, motor disabilities, dyslexia, and various other conditions.

Dragon natural speech: Dragon Systems [3], is a speech recognition software package. The software, designed for Windows personal computers, operates on both 32-bit and 64-bit editions of Windows 7, 8, and 10. Version 15, available in Professional Individual and Legal Individual editions, was released in August 2016.

Amberscript [2] stands out as an outstanding speech-to-text tool, offering numerous advantages for individuals with disabilities. With its advanced technology and user-friendly interface, Amberscript serves as a dependable and precise solution for transforming spoken language into written text. Amberscript employs cutting-edge speech recognition algorithms and AI technology, guaranteeing a high level of accuracy when transcribing spoken words. It has User-Friendly Interface. It provides versatile integration options, enabling users to seamlessly incorporate the tool into their preferred devices or software.

VoiceAccess is a mobile application from Google [4]. It can control mobile phone using voices in sending text messages, image messages, voice messages and video messages. Windows

also provides in built voice recognition applications as default in PCs. Apple also provides voice assistive applications for controlling the device using voice.

Speechnote is another technology[4] reliable and secure web-based speech-to-text tool that enables you to quickly and accurately transcribe your audio and video recordings, as well as dictate your notes instead of typing, saving you time and effort. With features like voice commands for punctuation and formatting, automatic capitalization, and easy import/export options, Speechnotes provides an efficient and user-friendly dictation and transcription experience.

Audible is helpful for individuals with reading problems. Kurzweil 3000 is a Natural Text - to - speech voices (over 70 languages). PCX 550 Wireless eliminate's or reduces noises for concentrating. SuperTalker[4]: allows users to record information for 16 minutes.

### **Predictive Text and Autocorrect.**

AI algorithms predict user input and correct spelling, aiding individuals with motor disabilities or difficulties in typing. It eases communication for those with conditions affecting fine motor control.

Mouseware [5] is an affordable head-wearable device that enables hands-free operation of computers & smartphones. Mouseware helps you to operate smart devices with any operating system hands-free. This helps people with various conditions use computers without the need for a mouse or any pointing device. There are various switches such as foot switch, finger switch etc to work mouse or any pointing device

Snap&Read[5] Universal is effective to utilize by those individuals who have reading problems. Co:Writer Universal is a word prediction software. Mathtalk: allows users to solve math equations. Spanish Talking Calculator: speech technology that would read out the numbers inputted. Inspiration: help's users organize information visually.

Ginger help's check spelling and definition of words. Watch Minder help's manage day to day activities. Conversor Personal FM is helpful for individuals with hearing issues. TrackerPro is computer input device that takes the place of a mouse. Mobile Connect is a personal hearing assistant for visual impairment.

### **Computer Vision for Object Recognition**

AI-based computer vision can identify and describe objects in the environment. Assists individuals with visual impairments in navigating their surroundings by providing information about the objects around them.

Tobil: A purpose-built[7] speech generating device controlled with your eyes to communicate

and access Windows. Eye tracking is a technology that is used to see where a person is looking on a computer screen. The technology can also be used to control the computer. Instead of using a traditional keyboard and mouse, you control it by using your eyes.

Smart glasses: are a revolutionary[7,15] form of wearable technology that combines augmented reality (AR) and artificial intelligence (AI) to provide users with a hands-free, interactive, and immersive experience. These futuristic glasses are equipped with a display screen, camera, sensors, and AI algorithms, enabling users to access information and interact with the digital world seamlessly. By utilizing AI algorithms, smart glasses can recognize objects and text in the user's surroundings. This allows individuals with visual impairments to receive audio descriptions of their environment, enabling them to navigate more easily and independently. Smart glasses equipped with AI can provide real-time translation of foreign languages. The AI capabilities of smart glasses enable facial recognition, allowing users to identify people they encounter. This feature can be extremely helpful for individuals with cognitive disabilities or memory impairments, as it assists in social interactions by providing information about the people they are engaging with.

### **Gesture Recognition and Motion Control.**

AI interprets gestures and motions, enabling users to interact with devices using physical movements. It benefits individuals with mobility challenges who may find traditional input methods difficult.

- Lift ware:

The mealtime [6] brings people together it's more than a we nourish our spirit and our relationships but tremor whether from essential tremor or Parkinson's disease takes away from this experience forcing people to focus instead on the basic task of eating. The liftware spoon cancel hand tremor and take the frustration out of eating for the first time. This technology actively stabilizes a person's tremor and the device so small that it fits in your hand. The spoon works by sensing a person's tremor and intelligently stabilizing itself to make the food's journey from the plate to the mouth much easier

- Personalized Interfaces.

AI adapts interfaces based on user preferences and needs. It creates customized user experiences, making technology more user-friendly for individuals with various disabilities

Weighted cutlery, smart technology like liftware spoon[6], built-up utensils, and universal cups are assistive devices for eating. Weighted cutlery can be helpful for individuals with tremor however it is important to note that not everyone benefits from this type of assistive device. liftware spoon is also designed to improve stabilization against tremors or shaky hands although these can be a more expensive option.

Another option is a universal cup and this device can be useful for those with limited grip and dexterity. It is called universal because it can be used with other items like a toothbrush or a razor. A plate guard can be easily attached and detached from round plates and is used to prevent food from being pushed off the plate at mealtime.

- Cognitive Assistance

AI plays a crucial role in improving cognitive assistance for disabled persons by enhancing the capabilities and effectiveness of cognitive support technologies. AI algorithms can analyze and understand individual cognitive needs, preferences, and challenges. It also can analyze contextual information, such as location, time, and user activities, to provide more contextually relevant and timely cognitive assistance.

AI enables cognitive assistance systems to learn and adapt to the changing cognitive abilities and needs of users over time.

Access Map [8] is an online and mobile app that helps users find accessible places. This app would find your required place which is nearest to you. You can request for ramp for disabled persons when making the request for visiting.

Assist Me is a mobility assistance app that allows users to request help and communicate their needs to service providers. This app functions as part of a broader system that employs computer vision and machine-learning methodologies within the IoT network, leveraging cloud computing to enhance capacity. Images captured by an IoT device are transmitted to an edge element (IoT node) for processing, where object identification, distance computation, and the conversion of this information into audible commands take place. This system is designed to offer guidance for individuals with visual impairments [14].

## **6. Future Implications of AI-based Assistive Technologies**

AI technology has the potential to significantly improve the lives of disabled persons across various aspects. Here are some key impacts of AI on enhancing the lives of individuals with disabilities:

- natural language processing and voice recognition technology enable individuals with mobility impairments or visual impairments to control devices and access information using voice commands, making technology more accessible and inclusive.
- AI-powered smart home systems can automate tasks such as controlling lights, appliances, and temperature, allowing individuals with mobility limitations to manage their environment without assistance.
- Speech-to-text and text-to-speech conversion algorithms enable individuals to express themselves, interact with others, and engage in social activities, fostering social inclusion and reducing communication barriers.

- AI-powered prosthetic limbs can adapt to the user's movements and intentions, providing a more natural and seamless user experience.
- Personalized prompts, reminders, and cognitive support systems powered by AI algorithms assist individuals in memory retention, task management, and decision-making.
- AI-enabled tools can facilitate job accommodations, assist in task completion, and open up new avenues for work for individuals with disabilities.
- AI-powered diagnostic systems can assist in the early detection and monitoring of medical conditions. Robotics and exoskeletons integrated with AI algorithms enhance physical rehabilitation efforts, enabling individuals with mobility impairments to regain strength and independence.

## **7. Conclusion**

In summary, the development of assistive technologies, particularly those that use artificial intelligence, represents a significant step toward a future that is more accessible and inclusive. Beyond just being convenient, AI-based assistive devices have a revolutionary impact on the lives of people with a range of abilities. The paper emphasizes the numerous and significant uses of AI in assistive technologies. These technologies, which range from computer vision and speech recognition systems to natural language processing, are empowering people with disabilities by removing obstacles and promoting their independence. The given example highlights AI's adaptability and potential to improve many people's quality of life.

But even as we celebrate these developments, it's important to acknowledge the difficulties that still lie ahead. It is crucial to carefully balance privacy issues, ethical issues, and the requirement for universal accessibility to guarantee that everyone can benefit from AI-based assistive solutions and that no one is left behind.

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