



THE IMPACT OF ARTIFICIAL INTELLIGENCE AND ASSISTIVE TECHNOLOGY ON THE QUALITY OF LIFE OF PEOPLE WITH VISUAL IMPAIRMENT

UTICAJ VJEŠTAČKE INTELIGENCIJE I ASISTIVNE TEHNOLOGIJE NA KVALITET ŽIVOTA OSOBA S OŠTEĆENJEM VIDA

Amela Teskeredžić^{1*}, Mirha Mehmedović¹

Faculty of Education and Rehabilitation, University of Tuzla Univerzitetska 1, 75000 Tuzla,
Bosnia and Herzegovina

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ABSTRACT

The aim of this review paper was to investigate the impact of the application of artificial intelligence and assistive technology on the quality of life of people with visual impairments. The paper systematically reviewed research from electronic databases: PubMed, Google Scholar and ResearchGate, in the period from 2015 to 2025. The criteria for including the research were: only research with a specific sample was considered, that visually impaired people, i.e. blind or partially sighted people were included, that the people used assistive technology before or during the research, that the papers had undergone peer review. 60 studies were included in the triage procedure. 6 studies were included in the final analysis, which met the inclusion criteria. The results of the analyzed studies showed that the use of artificial intelligence and assistive technology significantly contributes to improving mobility, orientation and safety for users. The paper also points to certain limitations in the aforementioned studies, including smaller samples, lack of user education and lower digital literacy, which future research and analyses should take into account.

Key words: artificial intelligence, visual impairment, assistive technology.

* Correspondence author: Amela Teskeredžić, Faculty of Education and Rehabilitation, University of Tuzla
E-mail: amela.teskeredzic@untz.ba

SAŽETAK

Cilj ovog preglednog rada je bio istražiti kakav je uticaj primjene umjetne inteligencije i asistivne tehnologije na kvalitetu života osoba sa oštećenjem vida. U radu su sistematski pregledana istraživanja iz elektronskih baza: PubMed, Google Scholar i ResearchGate, u periodu od 2015. - 2025. godine. Kriteriji za uključivanje istraživanja bili su: isključivo su razmatrana istraživanja s određenim uzorkom, uključene osobe oštećena vida, odnosno slijepe ili slabovidne osobe, da su osobe koristile asistivnu tehnologiju, prije ili tokom istraživanja, da su radovi prošli recenziju. U trijažni postupak je uključeno 60 istraživanja. U konačnu analizu uključeno je 6 istraživanja, koja su zadovoljila kriterije uključivanja. Rezultati analiziranih istraživanja pokazali su da korištenje umjetne inteligencije i asistivne tehnologije značajno doprinosi poboljšanju mobiliteta, orijentacije i sigurnosti kod korisnika. Rad ukazuje i na određena ograničenja u navedenim istraživanjima, uključujući manje uzorke, nedostatak edukacije korisnika i nižu digitalnu pismenost, što bi buduća istraživanja i analize trebala uzeti u obzir.

Ključne riječi: umjetna inteligencija, oštećenje vida, asistivna tehnologija

INTRODUCTION

Numerous daily barriers greatly describe the life and experience of people with visual impairment and make it difficult for them to perform activities that people with typical ocular functioning perform without any excessive problems. Visually impaired people can have congenital visual impairments or those that arise as a result of illness or an accident, trauma, etc. They often encounter limiting circumstances in their work and functioning. Their ability to live independently, study, participate in interaction with others and certainly work and earn money is restricted. Also, difficulties with movement, reading, identifying objects and people and communicating with the environment persist, as well as many other disturbances. In addition to their disability, the environment itself often does not provide them with enough support. This review paper will exclusively focus on their connection with assistive technology and artificial intelligence and how they benefit from their use. The rapid development of technology, which is more and more advanced every day, brings new ways of helping and supporting people with visual impairments and overcoming the aforementioned barriers. Visual impairment affects interactions with the physical world (West et al., 2002), interactions with others, and can result in poor mental health (Demmin and Silverstein, 2020). Chia et al. (2004) found that visual impairment significantly reduces the quality of life, including physical, social, emotional and mental factors, compared to those without visual impairment. Therefore, there is great potential for assistive devices to help visually impaired people and improve their quality of life. Rapidly developing artificial intelligence technologies are considered assistive technologies. They create the potential for new types of interactions between humans and artificial intelligence, considerably facilitating many aspects

of the daily lives of visually impaired people, such as their education, while increasing their autonomy and self-confidence.

Artificial Intelligence (AI) is proving to be transformative in addressing accessibility challenges, especially for the visually impaired. There is no clearly defined definition of artificial intelligence. Russel and Norvig classify them into the following categories: – systems that think like a human; systems that behave like humans; systems that think rationally; systems that behave rationally; systems that aim to have all appearances of intelligence (rational or human); systems whose internal functioning tries to be in harmony with a human being, that is, a rational being (Russell, Norvig, 2003). With advancement in machine learning, system-driven AI can perform complex tasks such as real-time object recognition, scene analysis, and natural language processing with unprecedented accuracy and efficiency (Envision, 2025). AI technologies that support and facilitate the learning and functioning processes of people with blindness and other severe visual impairments include smart mobile phones with cameras and AI algorithms, various wearable systems and robotics (Lanigan et al., 2006; Lopez-de-Ipina et al., 2011).

In addition, there are several applications based on mobile phone cameras, artificial intelligence algorithms and sound (Morrison et al., 2021). Assistive technology (AT), as such, includes assistive, auxiliary products, systems and services (including devices, equipment, instruments or software), which are specially produced or generally available. Their primary purpose is to maintain or improve the functioning and independence of the individual, thereby also promoting his well-being. Assistive products are also used to prevent impairment and secondary health conditions (World Health Organization, 2024). There are several types of AT categories to consider when choosing a device for a person. This can include low tech to high tech devices. Cook and Polgar (2008) describe low-tech devices as “cheap devices that are simple to make and easy to obtain”. On the other hand, high-tech strategies involve more sophisticated, usually programmable types of equipment.” From this perspective, any computer or similar device can represent high technology. The process of development of assistive technologies has undergone a transition from mechanical tools to digital and solutions with the help of artificial intelligence (Mann, 2005). Artificial intelligence has found its widest application in expert systems, in which a computer system replaces a human in a narrowly limited area of expertise. Copeland defines it as the ability of a digital computer or a computer-controlled robot to perform a task usually associated with intelligent beings (Copeland, 2025). Today, general progress in artificial intelligence and technology as a concept are improving every day, which allows for more advanced devices that can use "feedback" mechanisms and thus personalize and meet the needs and requirements of each person. These technologies are based, so to speak, on learning from the behavior of the user himself. For example, if AI is used for visually impaired people, these AI devices and software can now identify objects or read text aloud, making people more independent.

The aim of the review paper is to analyze available research that examined the impact of the use of assistive technology and artificial intelligence in the population of people with visual

impairments, in order to determine the answer to the question of whether the use of them can improve the quality of life of the said population?

METHODOLOGY

In order to identify and analyze the works, i.e. research, the following databases were thoroughly searched: Google Scholar, PubMed and ResearchGate. All actions relevant to identifying the works were carried out in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews) statement. The search included the period from 2015 to 2025, and a combination of the following keywords was used: visual impairment, artificial intelligence, assistive technology. The criteria for including the research were: a) only studies with a specific sample were considered; b) that they included visually impaired people, i.e. blind or partially sighted people; c) that the people used assistive technology, before or during the research itself;

d) that the works had been peer-reviewed. The exclusion criteria were: a) systematic works or review works; b) bachelor, master's or doctoral theses; c) studies without a defined sample population; d) studies presented only in abstracts, not in full text; e) studies outside the given time frame; f) limited access to full text.

RESULTS

The procedure for identifying, triaging, and including papers in the analysis is presented in Figure 1. Based on a combination of keywords in three electronic databases, a total of 487 papers were identified (PubMed n=50; Google Scholar n=337; ResearchGate n=100). Before the triaging procedure, 427 studies were excluded based on title, duplicate studies, and the given time frame (2015-2025). 60 studies were included in the triaging procedure, of which 6 studies met the inclusion criteria listed in the Methods section.

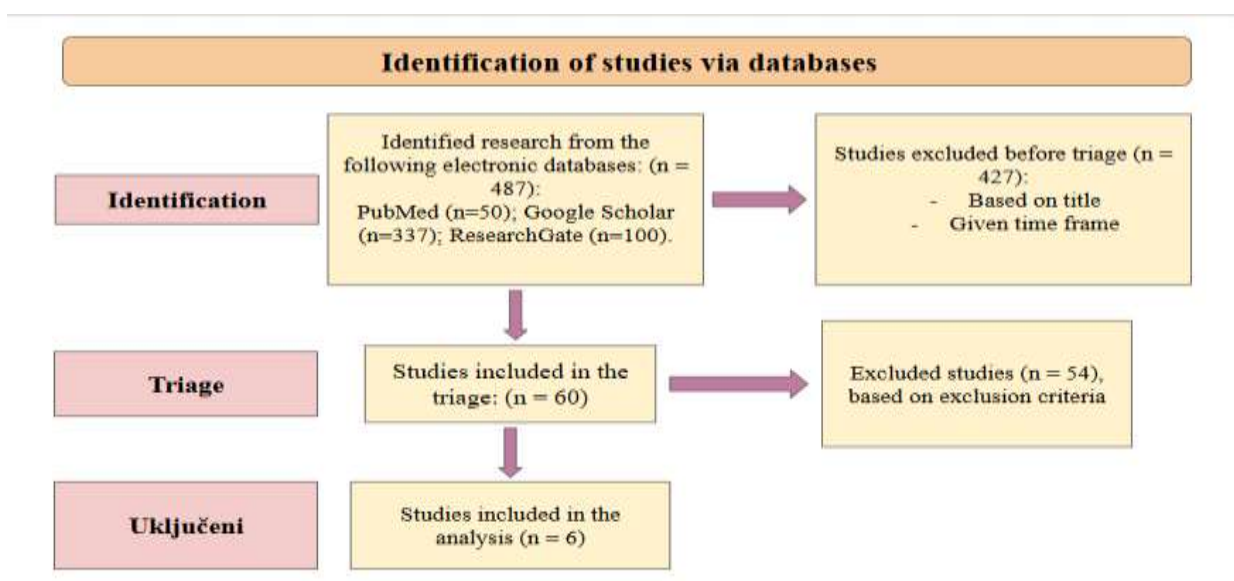


Figure 1. The PRISMA procedure of identification, triage and inclusion of works in the analysis.

Below is Table 1, which contains filtered summaries and results of all research included in the analysis of this paper, including the most sufficient details.

Table 1. Summary of specifications of all of the studies included in the analysis

RESEARCH	POPULATION	SAMPLE	APPLIED TECHNOLOGY	ACTIVITY	DURATION	RESULTS
Ghaffari et al. (2025)	Adults (between 50 and 78 years old)	7 respondents (n=7)	Auxiliary device, based on haptics, as an addition to the white stick	Walking through 2 paths, with and without an assistance system	One-time participation, limited to the period needed by the respondents to implement the program and fill in the post-experimental data	Shorter time to complete the route, fewer collisions; most respondents find the assistance system useful in navigation
Zahid & Lal (2025)	Heterogeneous group (from 5 to 85 years old)	(n=65; 60% men, 40% women)	LVAT (Low Vision Assistive Technology)	Application of the aforementioned technology in navigation and everyday life activities	4-month period of use, with post-experimental data collection	Significant improvements in all measured areas, with an increased sense of security in their implementation
Turkstra et al. (2025)	Adults (25 to 79 years old)	(n=16; 8 men, 8 women)	Low-tech and high-tech assistive technology	Interview on the application of the mentioned assistive technology in everyday life activities	Each interview lasted between 45 minutes and 1.5 hours, with t	Respondents believe that assistive technology greatly helps them in daily life activities, but that they need more time to perform activities, which sometimes results in frustration and lack of motivation

Yuan Zhu et al. (2023)	People over 18 years old	(n=14; n=7 blind or low-sighted people and n=7 sighted people)	FAD (Foveated Audio Device) and smart glasses; a combination of acoustic touch and smart glasses	Tasks of reaching (touching or lifting) objects in space, in a sitting and standing position, using the specified technology	The study session lasted 2-3 hours, after 10 attempts were made by the subjects.	Blind and low-sighted participants demonstrated success in reaching for objects and verbally identifying them, although reduced efficiency was observed in sighted individuals, as
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DISCUSSION

This review paper aimed to answer the question of whether the use of assistive technology and artificial intelligence can improve the quality of life of people with visual impairments in everyday life situations? Taking into account the same results of the aforementioned studies in the Table 1, the results indicate that assistive technology and artificial intelligence can certainly improve the efficiency of people with visual impairments in their everyday lives. These studies have shown that people's mobility, orientation in their subjective and objective space, and their general sense of security in performing activities have improved. The direct application of these devices and technologies, from simpler haptic (kinesthetic) devices, to more complex ones based on artificial intelligence and software, such as the aforementioned smart glasses, confirms the significant benefit in increasing the functional independence of people with visual impairments in their everyday lives. These affirmative data are observed in the analyses of Ghaffari et al. (2025) who presented a discrete and leisure device based on haptics. That device consists of two haptic, vibrating modules that were placed on the wrists of the subjects, which helped them navigate the paths presented to them, therefore significantly improving their spatial orientation. Turkstra et al. (2025) and Zahid and Lal (2025) have effectively concluded in their study that it is precisely the simplest or low-tech solutions, such as magnifying glasses or magnifiers, tactile labels for clothing, objects in the home, as well as white canes themselves, that can ease and minimize the obstacles that visually impaired or blind people encounter on a daily basis. Also, the use of some accessible digital tools can serve as practical support. These solutions are particularly suitable in low-income and resource-limited settings, so that visually impaired people have greater access to them. In addition to simpler solutions, the contribution is also seen in high-tech solutions based on artificial intelligence, which are noticeable in the studies of Yuan Zhu et al. (2023)

and Udayakumar et al. (2025). Yuan Zhu et al. (2023) pointed to technologies that provide auditory information and the integration of spatial sounds with computer vision. That auditory feedback enables the user to pinpoint where the certain object is in their environment. This greatly enables a person to perceive their environment in advance. Also, Udayakumar et al. (2025) emphasize the benefit of using smart glasses for the purpose of determining the ability to navigate, read, and recognize people and objects. Even though the users were lacking the visual sensibility, these smart glasses can certainly, when necessary, compensate that deficiency. Furthermore, the research by Lorenzini and Wittich (2021) implies the importance of telerehabilitation (also known as rehabilitation via telecommunication services, which allows the users to stay at home) and a personalized approach to user training, which indicates that the effectiveness of the same technology should not be emphasized only in its technical aspect, but also in its provision of support and education of users. It is generally known that the lack of education about available assistive and artificial technologies, prevents the people with visual and other impairments in purchasing and wisely using them. However, in addition to the positive aspects of these studies, significant limitations were also applied. Most of the research (Lorenzini and Wittich, 2021; Yuan Zhu et al., 2023; Turkstra et al., 2025; Ghaffari et al., 2025) had a smaller number of respondents, which reduces the possibility of generalizing the results. Even if remarkable effects were noticed in the subjects included in the studies, they are still only applicable to them, meaning that a bigger sample and population might not benefit as much from them or the effects would be even greater. This implies for extended sample in the future. The next limitation is noticeable in the research by Udayakumar et al. (2025) and Ghaffari et al. (2025) where evaluation in the form of self-assessment of the implemented programs was represented. Specifically, the respondents completed surveys and thus assessed their satisfaction with the program at the end of the sessions, which indicates that long-term monitoring of the effectiveness of these technologies in some natural conditions was not applied. Furthermore, limitations are also observed in the sensitivity of tactile sensors (Ghaffari et al., 2025), which limits their usability in different weather conditions (rain, snow, high temperatures, etc.). That is the problem with most sensor-based devices, which immediately restricts the user to a smaller space for movement. The authors also point out the lack of user training and education as a limitation (Lorenzini and Wittich, 2021; Turkstra et al., 2025), which certainly highlights their commitment to using and utilizing technology in everyday life. Accordingly, the high cost of purchasing devices and technologies, and generally limited access to them, in low-income countries, are also cited (Zahid and Lal, 2025). Also, the study by Zahid and Lal (2025) indicates the need to improve the accessibility of these technologies to older people, especially those over 65, because they often have lower digital literacy and thus reduced motivation to adopt the use of new technologies.

CONCLUSION

This review paper highlighted and confirmed the potential and significance of assistive technology and artificial intelligence in improving the quality of life of people with visual impairment. Their application enables people to move more easily and safely in space, to recognize people and the environment and to increase their functional independence in everyday life activities. People can also rely on low-tech solutions, which are affordable and simple, and at the same time extremely effective in their application. On the other hand, if a person has access to high-functioning devices, he will undoubtedly be able to unlock numerous other possibilities of its functionality, using computers, smart glasses or some other software systems. Certain challenges were surely recorded in these studies, such as small samples of respondents, insufficient education of the users or the lack of longitudinal monitoring of the program. Consequently, future research should be based on minimizing all the mentioned limitations, and further development of artificial intelligence and assistive technology should go in the direction of greater accessibility for users.

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