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Artificial Intelligence: A Case Study on Visually Challenged in Accessing AI applications

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Marshall McLuhan's (1960) 'Global Village' signifies new media technologies connect the people worldwide through technology-mediated communication, enhancing society's perceptions based on information and communication. The evolution of technology has drastically transformed communication by making the world more accessible. At the same time, Peter Drucker (1973) states that the quality of a societal relationship depends on the quality of communication. But still, the visually challenged encounter challenges in accessing information which generates impediments in communication and expressing their thoughts, ideas, and opinions. According to the report (2016) by the World Health Organization, people with disabilities are the world's largest and fastest-growing minority group, where they confront exclusion from the mainstream. So, to be part of the mainstream, communication and social development are essential. Still, for visually challenged, it gets delayed due to the inability to see the world around them, which creates disinterest in a social activity that affects socialization. Perhaps the AI application has now opened a new dimension that provides equal access to the visually impaired, improving communication and social development. Advances in technology build confidence in using audio devices such as audiobooks, voice-recognition software, voice assistants, and computer screen-readers, enabling communication. A qualitative case study was incorporated, and the study focuses distinctly on the congenital blind on how the AI applications become a rapid change that empowers them to connect and share information through different communication modes that foster social development. Technologies initiated a social, economic, and psychological facet to reshape the visually challenged distinctiveness and identity.

Keywords: Communication, Social, Access, AI applications, Identity

Introduction:

The World Health Organisation reports that globally, 2.2 billion people are visually impaired (Blindness and Vision Impairment, 2021). Early-onset vision impairment causes prolonged effects and detainment in cognitive, social, emotional, language, and motor developments. Due to vision loss, attaining a quality of life is challenging for the visually impaired; however cutting-edge technology offers a platform for equal access, which is requisite for social inclusion. Access is the key that gives unprecedented opportunities for the visually impaired to build their knowledge, opening up to extensive information. Moreover, the Convention on the Rights of Persons with

Disabilities Act (2016) proposes the right of access on an equal basis for the visually impaired, providing inclusive education and employment without discrimination. Access to education gives access to information and knowledge which is most important for an individual to live in the educated society. The dreams of living independently in educated society are arduous for visually impaired, as they do not have senses with superpowers, though senses help in navigating the world. But the AI technology acts as a supremacy that provides the opportunity to learn alternative skills, create positive hope, to become a productive and independent member of society.

Artificial Intelligence Applications

Artificial intelligence (AI) is the simulation of human intelligence processes by machines, including software applications, natural language processing, speech recognition, and machine vision. AI refers to algorithms capable of performing cognitive tasks to anticipate the visually impaired needs; also, Artificial Intelligence revolutionizes accessibility and inclusion that drastically improves the everyday lives of the visually impaired. AI programming focuses on three cognitive skills: learning, reasoning, and self-correction (Linda Tucci, 2021), and it is one of the most prominent technologies that allows the visually impaired to complete the task in very little time with more efficiency and accuracy, wherein AI is used to develop both mobile-based and web-based applications (USM systems, 2020). Artificial Intelligence applications are colouring the dream of the visually impaired in the era of digitization which provides access in every possible way to turn their life easy. Artificial Intelligence acts as a smart assistant, performing various functions such as providing information, reading text and documents, detecting objects, colours, and currencies, describing scenes, finding people, and recognizing images (Rastogi, 2020). Thus, it gives confidence to the visually impaired to live independently on their own.

Review of Literature

Accessibility

Over the years, many new technologies enable accessibility (Zhou,2018); however, Artificial Intelligence applications bring revolutionary change, and imperative for visually challenged to have a quality of access, which is essential for inclusion in new ways of accessing information to construct knowledge. AI applications simplify augmented content into an accessible, more and more grounded in various field to categorise things livelier for the visually impaired. Morris (2020) opines that AI technologies offer the possibility of removing many accessibility barriers helping better sense the visual world. Additionally, speech recognition and translation technologies offer real-time captioning in describing the scenes in the environment. Indeed, AI applications enable visually impaired to remain autonomous, as everything reads under the smartphone camera (Martinez, 2021). Furthermore, she adds that AI remove the accessibility barrier through different solutions like image recognition and face recognition. AI turns complicated message to decipher out to be an easy-to-understand text also, enable people to step into a world where their difficulties are understood.

2.1 Read short text and Scan documents:

AI application assists in real-time text reading that instantly reads any text that appears in front of the camera and helps the visually impaired recognise the text easily (Kelly, 2021) Moreover, it helps understand the structure and scanning the document provided with audio-guided feedback, whereas all the content wades through to the visually impaired. Reading documents helps to capture all corners of a document to capture full page and recognize headings, paragraphs and lists, allows rapidly to skip through the document using voiceover (Blind Cool Tech, 2017).

Most importantly, it imports and scans pdfs documents either single or multiple pages in order to provide access to vast source of information (Envision,2021). Further, it describes the image and recognise of all the text within it and supports with multiple different languages.

2.2 Read Hand written Documents:

AI applications rapidly read, print, and scan documents, but it is tough to recognise handwritten documents, whereas a person's handwriting style varies from time to time and is inconsistent (Matcha,2021). But AI application's deep learning and neural networks support to recognise of handwritten documents even in postcards, letters, photographs, and other paper works. Based on the users approach two types of handwriting recognition systems that operates both in online and offline (Great Learning, 2020). Moreover, AI helps to digitize and perceive each character correctly and identify form handwritten text to provide accurate results.

2.3 Scan barcodes and QR codes

Martinez (2021) opines that AI application helps scan barcodes that allow the visually impaired with simple identification and content tasks such as looking up a product to purchase, accessing event details, or completing a form. However, the visually impaired cannot read the printed label on the product even with its standard size and shape. Kelley (2021) states that AI application provides a barcode scanner that uses the camera to help locate the barcode printed on most product labels and then read out the available product information. Mainly gives the name of the product, size, and weight, or it may contain more comprehensive information, like ingredients, expiry, and manufacturing date. Also, it scans QR code automatically, if the code contains a text, it read instantly, or if the code contains URL, it will open the browser to the site and it helps customize QR codes and generate QR codes.

Knowledge construction:

In the context of learning, it is essential to generate new ideas and understandings that thrive innovation; evidently, AI technologies provide the opportunity to construct knowledge for the visually impaired. (Washoe, 2019). It provides a combination of technological awareness, the ability to work with problem-solving, and a space to express their ideas to communicate (Johan Lind, 2020). According to McCormick (2006), technology enables the visually impaired to develop critical awareness about living in the technological world. AI motivates the visually impaired to explore and learn things through websites, videos, apps, audio, and games due to quality access. Indeed, the need for AI technology enhances the learning process and promotes opportunities for knowledge construction, wherein accurate and proper information is necessary for effective learning (Haag, 1998; p.10).

Further, AI supports visually impaired collaborative and interactive learning environments to construct new ideas, share information, and communicate effectively.

Theory

Piaget's Theory of constructivism (1936) states that learners produce knowledge and form meanings based upon their experiences. The two of the critical components that create an individual's knowledge are assimilation and accommodation. Assimilation occurs when a learner encounters a new idea and must fit the new knowledge into existing schemas, whereas schemas note the package of information. While accommodation changes the schemas when further information is received, reframing one's mental representation of the external world to fit new experiences. However, constructivism is associated with active learning or discovery learning. In the study, visually impaired students assimilate their knowledge using braille, refreshable braille, and assistive devices, which constructs knowledge, experiences, beliefs, and insights that form the foundations for continued learning. Artificial Intelligence applications act as an accommodation for the visually impaired that restructure and redevelop existing schema that transforms from passive recipients of information to active learners. Typically, constructivism provides problem-solving and inquiry-based learning to formulate ideas, draw conclusions, inferences to structure knowledge.

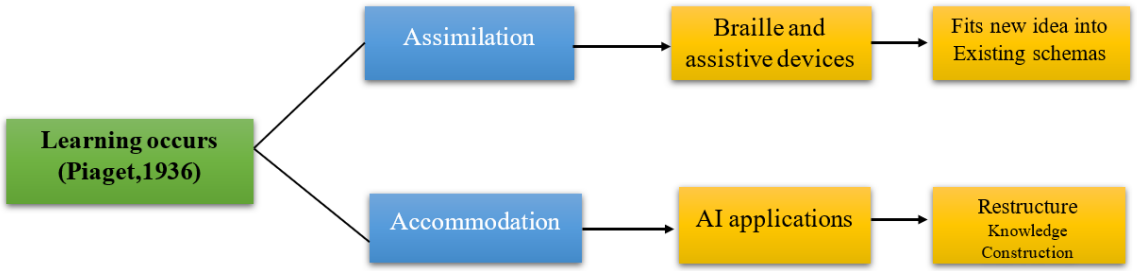

Image shows the model of Piagets (1936) Constructivism

The objective of the study:

- To determine the impact of Artificial Intelligence applications usage among visually impaired
- To identify the effects of accessibility in using Artificial Intelligence applications among visually impaired.

Research Methodology:

A qualitative exploratory case study was incorporated to understand the multiple facets of AI application usage among the visually impaired. Observation and interview techniques were used in the study to get the detail conception of the subject and apprehend the Artificial Intelligence application and its effects. Snowballing sampling technique was used to find the right respondent as population size is less in number. In particular, Linear snowball sampling is followed, though, with one individual subject provides information about the other subject, whereas AI users of the visually impaired referred the other AI users, and then the chain continues with only one referral from one subject.

Participant:

The study focused on the congenital blind both male and female who lost their vision by birth. Three cases were examined using unstructured interview with open ended questions to acquire the facts about the AI application in real context.

Data collection:

Primary data:

An in- depth interview was approached to collect the intensive data from the cases, wherein open-ended questions were asked to explore different perspective on AI application to have a clear understanding in the context of accessibility and usage of the AI application. The first schedules focus on the demographic details of the respondents like age, gender, educational qualification, occupation and family. The second schedule gathers tools used for learning and challenges in accessing the tools and materials. The third schedule focus on the AI application usage, purpose, challenges and accessibility in using everyday life of visually impaired.

Secondary data:

To understand the detail perspective of Artificial Intelligence applications, secondary data was collected from journals, articles, archives, newspapers, reports and books.

Case# 1

Parthiban, a 25-year-old male who works as a probationary officer in a reputed bank, pursues his dream career was not easy, which is highly challenging. He prepares himself in every aspect to make up his mind strong and does all the work types including customer relationship management, finances, etc. Eventually, AI application make it happen that trains him in every sector to have a practical knowledge. Technology enhances his ability to handle tough situation to bring positive way

> *"To access secure websites officially, AI applications are supportive. Few screens reader application did not read captchas during transactions and I ask for help. But AI applications help me in recognise and read text in images."*

AI application helps in tasks such as discrepancies in accounts, cross-checking the cash balance, issuing chequebooks and ATM cards, demand drafts etc. Further, it assists in handling transactions of the customers, recognise handwriting letters, characters and digits instructs in solving complex problems.

Case# 2

Elankothai, 27year old female, is congenital blind, fulfils her family's dream of completing a doctorate in English literature, and works as an assistant professor in a private college. She is ambitious and loves to read novels, stories, and fiction, whereas Bookshare online library accesses literature which is helpful for her to take notes. She uses Audible world's largest selection of audiobooks, audio shows, and podcasts that brings storytelling, read by some of the world's best-loved voices. Sometimes, she faces trouble in scanning books contains more than 300 pages using assistive devices. Still, AI application makes it simple, import and scan page single or multiple according to the requirements.

> "*I love to read biographies, novels, fiction, short stories, so I look for scanning an entire book that distresses me due to time-consuming, and I didn't find it in an accessible format. But AI application simplifies everything that brings entire pages to the screen. Moreover, AI application access to online books, a podcast which allows me to explore more wherein I access kindle which gives me comfort in reading, saving the document, placing bookmarks also easy to access."*

The autobiography of Dr. APJ Abdul Kalam s 'Wings of Fire', inspires her to move with the hardship in life wherein to read the book, she scans using with assistive device and converts into accessible braille format, which is time-consuming and expensive. But now, AI apps are adorable that give her access to the world of books instantly anywhere and anytime, which builds confidence and keeps her active.

Case# 3

Swathi, 24-year-old female, congenital blind, who breaks the stereotype of being at home and pursue her career in law, whereas practising law is challenging as she has to visit court for hearings, meet clients and updates herself with information every day. Mostly, she prepares and plan herself accordingly how her schedule of work has to go for her. She uses AI application to access pdf documents, scan books and read case sheets of the clients. She almost access everything but reading hand written documents is highly not possible in Talkback. Huge variability and ambiguity of strokes in hand written of case sheets from person-to-person is inaccessible, consequently, AI applications helps in recognising the character accurately in whatever style it possesses.

> *"The high variance in handwriting styles of clients and poor quality of the handwritten text pose significant hurdles in accessing. But AI apps help me in identifying handwritten documents and convert them into machine-readable text. Moreover, it makes work easier than before and, AI helps in scan QR codes for registration and paying bills; I do prefer effortless transactions."*

Indeed, she has to seek help from friends or readers to read the case sheets if the application did not give access. Significantly, AI applications help her access the handwritten documents that build her aspiration to work for

society. She was dejected every time she stepped up, but the only hope that intensified her in doing things was the predominance of technology.

Findings & Discussion

Accessibility

Access to information helps to make decisions and choices that enable to live independently to acquire rights to take part in society (Comhairle, 2005). The study affirms that AI application gives accessibility which is the key to an inclusive society for the visually impaired. Most importantly, AI application contributes equal access to read a short text, pdf documents, and handwritten text necessary to perceive the information from the world. Similarly, AI applications give access to websites, tools, and technologies that enable the visually impaired to perceive, understand, navigate and interact with the environment (Popescu, 2018). Accessing content through electronic resources is a standard communication method nowadays, which is readily and easily available through AI applications for the needs of the visually impaired. Turnbull (2019) points out the UN Convention on the Rights of Persons with Disabilities (2007) declares additional support in accessing the information must be in an appropriate format for the visually impaired. Also, Article 19 of the Universal Declaration of Human Rights (1948) proposes that everyone has the equal right to seek and receive information and ideas through any media. In the study case#1(Mr. Parthiban) affirms that AI helps in exploring barcodes, QR codes to know more about the extensive information about the product and for transactions. Moreover, AI supports in giving exact information written on the object or things, it never manipulates the information. It assists in handling all the calculations, transactions and secure passwords.

In the study, case #2 (Ms. Elangkothai) states that AI application allows exploring the mainstream with equal access. However, accessing the documents and texts is demanding for the visually impaired as it must be in alternative formats. As technology constantly changes in the information age, AI applications rebuild access in diverse ways for the visually impaired that facilitates opportunities. Visually impaired are self – advocating for their right to work like sighted peers, evidently AI application generates a huge chance for them. Before, it takes time to access the short text and pdf documents but now through voice assistant it become trouble -free. Similarly, Cecily Morrison (2017) points out that AI applications brings visually impaired all the possibiblites to achieve social status in the society.

Case#3 acclaims that the visually impaired are provided with deficient tools to operate the source of information; eventually, it is inadequate to acquire knowledge. Talkback and screen readers access specific documents and texts, but it denies reading handwritten texts, though access materials cannot always be printed. Significantly, AI applications deliver an optical character recognition to detect each letter and style of the handwritten documents. The results of the study is similar to the study conducted by Dilmegani (2021) opines that there is diversity in human writing types, spacing differences and irregularities of handwriting casues difficulty to read however, AI application provides higher than 99% accuracy with typed characters in high-qulaity images for the visually impaired.

Knowledge construction

Typically, the construction of knowledge is designed and developed through the basis of real-life experiences (Moar, 1999). The study acclaims that engaging in multiple perspectives and representations evolves the structure of knowledge, although AI applications establish knowledge and skills that foster self-regulation and self-awareness for the visually impaired. Doolittle and Hicks(2012) opine that AI applications provide tools and contexts in which visually impaired people develop their ability to understand the knowledge-making process. Furthermore, AI engages in active learning, constructs meaning in real-world environments that foster social engagement, and creates opportunities to think visually impaired to articulate their thoughts. In the study, case# 1(Mr. Parthiban) affirms that AI application gives the confidence to cope with the sighted peers in the mainstream. It constructs and processes knowledge about how it has to be done in the information world by learning by doing. Concurrently, it never shows discrimination in providing information, as it widely opens to access the world.

In the study, case#2(Ms. Elankothai) states that AI application generates new ideas and understandings in different context to interpret, analyse and synthesize information. for instance AI helps in applying their knowledge constructed to support another knowledge construction task in a new context (Innovative Teaching and Learning, 2018). Moreover, AI application gives in-depth understanding about the functional aspects of a automation of technology. Furthermore it constructs knowledge to participate in the mainstream that contributes a different dimension for the visually impaired.

Also case#3 (Ms. Swathi) states that AI application gives equal opportunity to construct knowlegde which is necessary for the fast moving tech world. It prepares visually challenged to participate socially and actively engage in activities to construct knowledge, in order to build meaningful ideas AI helps builds strong structure for the visually impaired (Kurt , 2021). Similarly, AI enhance the cognitive function like problem solving, analysing the data which enable visually challenged to collaborate, share, create, use the knowledge, further AI application improve performance, increase innovation of visually impaired to sustain in the information society (Rhem, 2017).

Conclusion

Indeed, the world demands, 'Every individual live their lives on screens' to connect with every moment for information and communication. It bridges the gap between society's cultures, ideologies, and stereotypes. Artificial Intelligence accommodation helps the visually impaired in transforming the world into an inclusive place with accessibility. Access to information is a fundamental human right, is essential that provide equal access and equal opportunity to people with visual impairment. The AI-enabled future will be a world with more access to all types of information that empowers the visually impaired in the facets of communication and social interaction. Also, it helps to meet the needs of the visually impaired in a meaningful way.

References:

AI, E. (2021, January 22). *Envision*. Retrieved from Envision AI, Learn more about Envision's products:: https://www.letsenvision.com/

Alake, R. (2020, september). *A Beginner's Guide To Computer Vision,A friendly introduction to one of the important fields within Artificial Intelligence*. Retrieved from Towards data science: https://towardsdatascience.com/a-beginners-guide-to-computer-vision-dca81b0e94b4

Cecily Morrison, E. C. (2017). Imagining Artificial Intelligence Applications with People with Visual Disabilities using Tactile Ideation. *Assets 17*.

Dilmegani, C. (2021, January 1st). *Handwriting Recognition in 2021: In-depth Guide*. Retrieved from AI in Marketing: Comprehensive Guide [2021 update]: https://research.aimultiple.com/marketing-ai/

Hicks, P. E. (2012). *The process of constructing knowledge*. Retrieved from Theory & Research in Social Education.

Johan Lind, S. P. (2020). Students' knowledge of emerging technology. *International Journal of Technology and Design Education*.

Kelley, S. (2021). *Seeing AI: Artificial Intelligence for Blind and Visually Impaired Users*. Retrieved from VisionAware, Seeing AI: An Exciting New Release: https://visionaware.org/everyday-living/helpful-products/using-apps/seeing-ai-app/

Martinez, C. (2021). *Artificial Intelligence and Accessibility: Examples of a Technology that Serves People with Disabilities*. Retrieved from Okeena Group.

Matcha, A. C. (2021, May). *Recognition using Deep Learning*. Retrieved from Nanonets.

Morris, M. R. (2020). AI and Accessibility. *Communications of the ACM*, 35-37.

Podcast. (2017, July 12). *Artificial Intelligence and Text Recognition unite in Microsoft's Seeing Ai iPhone App*. Retrieved from COOL Blind Tech.

Popescu, A. (2018). What accessibility is and why it's so important. *UX Collective*.

Rastogi, A. (2020, July 22). *AI, Artificial Intelligence, technology trends*. Retrieved from Applications of Artificial Intelligence.

Rhem, A. J. (2017). *The Connection between Artificial Intelligence and Knowledge Management*. Retrieved from KMI: https://www.kminstitute.org/blog/connection-between-artificial-intelligence-and-knowledge-management

Rhem, D. A. (2017, July). *The Connection between Artificial Intelligence and Knowledge Management*. Retrieved from KMI.

Ruiz-del-Solar, R. V. (2015). Object Detection: Current and Future Directions.

Shetty, K. .. (2019). Assistance System for Visually Impaired using AI. *International Journal of Engineering Research & Technology (IJERT)*.

Tucci, L. (2020, May). *Ultimate guide to artificial intelligence in the enterprise*. Retrieved from Techtarget: https://searchenterpriseai.techtarget.com/Ultimate-guide-to-artificial-intelligence-in-the-enterpris

Tufel Ali Qureshi, M. R. (2021). AI Based App for Blind People. *International Research Journal of Engineering and Technology (IRJET)*.

Turnbull, H. (2019, February 22). *The importance of access to information*. Retrieved from https://www.harmonyturnbull.org/2019/02/22/the-importance-of-access-to-information/

Why Accessible Information Is So Important During (and After) COVID-19. (2020, July 15). Retrieved from Ai media: https://www.ai-media.tv/why-accessible-information-is-so-important-during-and-after-covid-19/

Zhou, D. R. (2018). *Accessibility: The Intersection of Innovation and Inclusion*. Retrieved from IBM Research.