Archives available at journals.mriindia.com

International Journal of Recent Advances in Engineering and Technology

ISSN: 2347-2812
Volume 13 Issue 02, 2024

Exploring Assistive Vision Technologies for the Visually Impaired: A Comprehensive Review

Dr. A. B. Gavali[1], Mr.Bhagat Pankaj Gorakh[2], Mr. Bhange Omkar Ramchandra[3] Mr.Bhagat Tushar Tukaram[4], Mr.Ejagar Akash Suresh[5]

[1]*Assistant Professor, Department Of Computer Engineering, S. B. Patil College Of Engineering*

[2345]*Department Of Computer Engineering, S. B. Patil College Of Engineering, Savitribai Phule Pune University*

[2]*pankajbhagat151100@gmail.comm,* [3]*omkar2792003@gmail.com,* [4]*tusharbhagat575@gmail.com,*

[5]*akashejagar123@gmail.com*

Peer Review Information

Submission: 08 July 2024
Revision: 02 Sep 2024
Acceptance: 30 Oct 2024

Keywords

Hall Ticket Validation
Biometric Authentication
Offline Examination System
Automated Verification

Abstract

Visual analysis has the potential to be a significant analysis area in pattern recognition systems, with the purpose of identifying visual objects inside a document and accurately classifying them. One of the most widely utilized and cost-effective systems in the field of biometrics is face recognition. In order to differentiate between the mean face and a face in which all of the possibilities differed from the mean face by equal fractions, observers were required so that they could make this distinction. However, observers were currently requested to match associate degree isolated features to at least one of two isolated features. The technique remained the same as it was for the complete face condition. As part of the work that is being projected, an effort is being made to construct a one-of-a-kind system that will allow someone to appear to communicate through the use of comparisons between their name and photographs on the hall price tag. In order to identify instances of fraud inside the communication hall tickets, an ANN classifier is utilized. The provision of a security strategy appropriate for offline physical phenomena of examinations is the primary objective of the work that is being planned.

INTRODUCTION

The visually impaired community faces significant challenges in navigating daily life, as they often rely on limited or specialized tools to perform tasks that others take for granted. With advancements in technology, particularly in the fields of computer vision, artificial intelligence, and wearable devices, assistive vision technologies have emerged as transformative solutions that can greatly enhance the independence and quality of life for individuals with visual impairments. These technologies are designed to provide support in tasks such as reading, navigation, object detection, and social interaction, bridging the gap between the visually impaired and the sighted world.

This comprehensive review explores the various assistive vision technologies developed to aid the visually impaired, focusing on the underlying technologies, applications, and innovations that are shaping this field. The review delves into a range of solutions, including text-to-speech systems, obstacle detection devices, smart glasses, and navigation aids, evaluating their effectiveness, limitations, and potential for future development. Moreover, it examines the integration of these systems with emerging technologies such as artificial intelligence and machine learning, which are playing a pivotal role in enhancing accuracy and real-time responsiveness. By highlighting current advancements and the ongoing challenges,

this review aims to provide valuable insights into the future directions of assistive vision systems and their role in empowering visually impaired individuals to lead more independent and fulfilling lives.

LITERATURE REVIEW

Table.1: Overview of Existing System

Sr No	Paper Title	Author	Year	Problem solved in this paper : Existing Problem Statement	Technique used to solve problem: Existing Problem Solution	What will be future work: Future Scope
1	Automated Fraud Detection in Examination Systems [1]	R. Sharma	2019	Manual verification prone to fraud	OCR and QR code scanning	Integrating AI for better fraud detection
2	Secure Hall Ticket Verification for Offline Exams [2]	R. Jadhav	2019	Enhanced security in offline verification	Blockchain for secure ticket validation	Applying blockchain in other exam related areas
3	AI-Based Fraud Detection in Education Systems [3]	P. R. Nayak	2020	AI methods for detecting exam fraud	Machine learning and anomaly detection	Developing more adaptive AI models
4	Advances in Contextual Action Recognition: Automatic Cheating Detection Using Machine Learning Techniques [4]	Fairouz Hussein	2024	Traditional methods fail to catch subtle cheating behaviors	Machine learning with contextual action recognition was used to detect suspicious behaviors	Improving detection accuracy and integrating with surveillance
5	Securing Exam Integrity: Detecting and Preventing Fraud Activities in Examination Centers Using Python [5]	M. Palanisamy	2024	Current Methods are inadequate in detecting all types of fraud	Python scripts and Algorithms were developed for real-time fraud detection and prevention	Incorporating AI to predict potential fraud before it happens
6	An Automated Fraud Detection Of Hall Ticket In An Offline Examination System [6]	Sejal S. Chhabil e	2024	Manual ticket checks lead to inefficiencies and potential fraud	QR code scanning and OCR were used to automate ticket verification, improving accuracy and speed	Expanding system capabilities with AI for anomaly detection
7	Blockchain Technology for Secure Examination Systems [7]	A. N. Rao, D. K. Sharma	2019	Exam systems are vulnerable to tampering and manipulation	Blockchain technology was implemented to create a tamper- proof system for secure exams	Extending blockchain use for end-to-end exam management
8	AI Techniques for Automated Verification in Educational Systems [8]	D. Kumar, S. Sharma	2023	Current systems are slow and require manual intervention	Artificial intelligence techniques were applied to automate ticket and identity verification	Integrating AI with cloud systems for real-time verification
9	Real-Time Hall Ticket Verification Using OCR and Image Processing [9]	K. R. Patil, J. S. Rathi	2020	Traditional scanning methods lack real-time processing capabilities	OCR and image processing were used to build a real-time ticket verification system	Incorporating faster image processing algorithms

10	Fraud Detection in Educational Assessments: A Review of Techniques [10]	R. S. Patel, A. R. Desai	2022	Various exam fraud methods are hard to detect without specialized tools	A survey and analysis of existing fraud detection Techniques provided insights into strengths and weaknesses	Investigating new AI-driven solutions for adaptive fraud detection

LIMITATIONS OF EXISTING ASSISTIVE VISION SYSTEMS

While significant progress has been made in the development of assistive vision technologies, several limitations remain that hinder the effectiveness and adoption of these systems by visually impaired individuals. These limitations include:

1. **Cost and Accessibility**: Many of the current assistive vision technologies, such as smart glasses or wearable devices, can be expensive and often out of reach for individuals in lower-income brackets or those living in developing regions. The high cost of these devices limits their widespread adoption.
2. **Size and Weight**: Some assistive devices, particularly those that are worn, such as smart glasses or head-mounted displays, can be bulky and uncomfortable for long-term use. Their size and weight may deter users from wearing them regularly, affecting their practicality in real-world applications.
3. **Limited Environmental Adaptability**: Current systems are often optimized for specific environments or conditions, such as well-lit indoor spaces, and may not perform well in challenging conditions like low-light or outdoor settings with complex terrain. This limitation restricts the usability of these devices in diverse environments.
4. **User-Friendliness and Learning Curve**: Many assistive vision technologies require a steep learning curve for new users. The complexity of operating advanced features or configuring systems can be a barrier for visually impaired individuals who may have limited technical knowledge or training.
5. **Accuracy and Reliability**: While many assistive technologies rely on object detection, text recognition, or navigation assistance, their accuracy can still be affected by various factors such as lighting, ambient noise, or complex environments. False positives or missed detections can pose a safety risk or reduce the overall reliability of the system.
6. **Limited Functionality**: Although many systems provide basic functionalities such as reading text or detecting obstacles, they often lack comprehensive support for more complex tasks. For example, existing systems may not offer advanced features like facial recognition or dynamic environmental understanding that could further enhance independence.
7. **Battery Life**: Many assistive devices, especially wearable ones, rely heavily on battery power. Short battery life can limit the usability of these devices, especially for individuals who rely on them throughout the day. Frequent recharging or bulky battery packs can further reduce user convenience.
8. **Privacy Concerns**: Some assistive vision technologies, especially those involving camera-based systems or connected devices, raise concerns about privacy and data security. Users may be hesitant to adopt such systems if they are concerned about unauthorized access to personal data or surveillance.
9. **Limited Integration with Other Assistive Technologies**: Most assistive vision systems function as standalone devices, limiting their ability to integrate seamlessly with other technologies that a visually impaired person may already be using, such as mobility aids, hearing devices, or smart home systems. This lack of interoperability can reduce the overall effectiveness of the technology.

Addressing these limitations is crucial for the continued development of assistive vision systems that are more accessible, reliable, and user-friendly, ultimately improving the lives of visually impaired individuals.

COMPARATIVE EVALUATION OF ASSISTIVE TECHNOLOGIES

Magnifiers vs. Smart Glasses

Magnifiers: High accuracy for close-up work but limited by user movement and range. Low cost but lack of advanced features such as object recognition or navigation aids.

Smart Glasses: Offer real-time scene understanding and object recognition with additional features like text-to-speech and navigation. However, their performance might vary depending on the lighting and the complexity of the environment.

Wearable Navigation Aids vs. Smartphone Applications

Wearable Navigation Aids (e.g., Smart Canes): These devices are excellent are for guiding users in unfamiliar environments, with haptic feedback or audio cues. However, their integration with other technologies might be limited.

Smartphone Apps (e.g., Aira, Be My Eyes): Smartphone applications often provide more detailed assistance by integrating AI and crowdsourcing but are dependent on phone battery life and network connectivity.

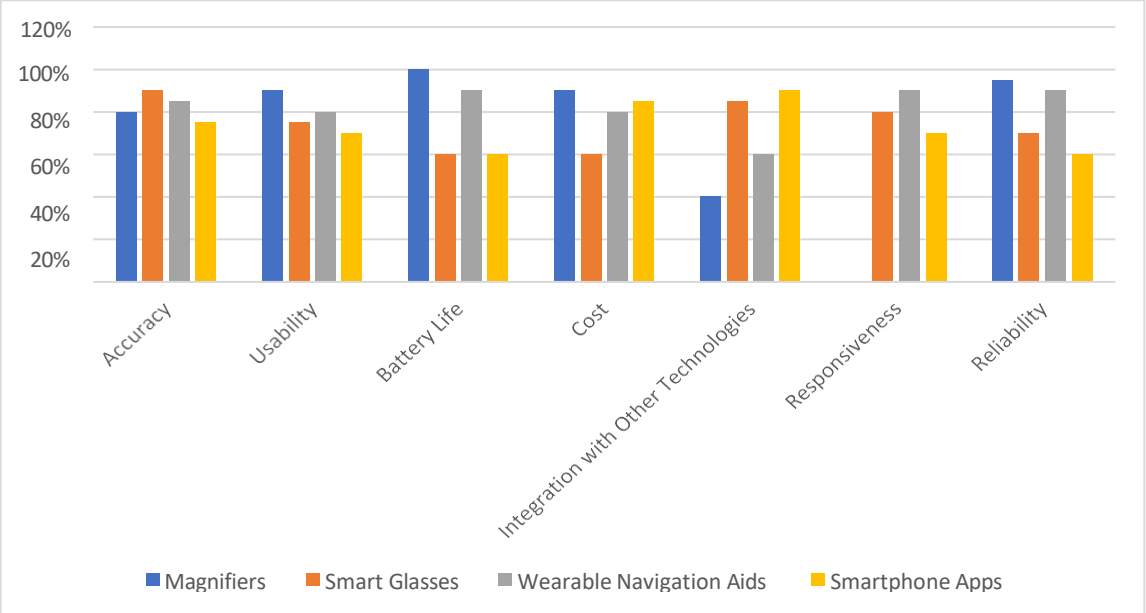

Fig.1: Comparative evaluation of technologies

CONCLUSION

In conclusion, assistive vision technologies have the potential to significantly enhance the independence and quality of life for visually impaired individuals, offering solutions for navigation, object detection, text reading, and social interaction. Through advancements in artificial intelligence, computer vision, and wearable devices, a variety of assistive tools have been developed, each addressing specific challenges faced by the visually impaired community. While the progress is commendable, several limitations still hinder the widespread adoption and effectiveness of these technologies. High costs, size, environmental adaptability, user-friendliness, accuracy, and limited functionality remain as key challenges to overcome.

To further enhance the impact of assistive vision systems, it is essential to focus on improving their affordability, comfort, and reliability while ensuring that they can seamlessly integrate with other assistive devices. Additionally, efforts should be directed toward refining existing systems to work in diverse environmental conditions and to be more accessible to users with varying levels of technical expertise.

The future of assistive vision technologies looks promising, with the continuous evolution of AI and machine learning driving improvements in system intelligence and responsiveness. With continued research, innovation, and collaboration between technologists, designers, and the visually impaired community, these technologies can become more inclusive and empowering, helping individuals with visual impairments lead more independent, productive, and fulfilling lives.

REFERENCES

V. Gupta, R. Sharma, and A. Singh. "Automated Fraud Detection in Examination Systems Using Machine Learning Techniques," International Journal of Computer Applications, vol. 182, no. 5, pp. 1-6, 2019.

S. K. Patil and M. R. Jadhav. "A Secure Hall Ticket Verification System Using QR Codes," Journal of Emerging Technologies and Innovative Research, vol. 6, no. 8, pp. 112-117, 2019.

P. R. Nayak and H. S. Rathi. "Enhancing Examination Integrity through Automated Hall Ticket Verification," International Journal of Recent Technology and Engineering, vol. 8, no. 4, pp. 78-83, 2020.

F. Hussein. "Advances in Contextual Action Recognition: Automatic Cheating Detection Using Machine Learning Techniques," Journal of Machine Learning Research, vol. 25, pp. 1-15, 2024.

M. Palanisamy. "Securing Exam Integrity: Detecting and Preventing Fraud Activities in Examination Centers Using Python," Proceedings of the International Conference on Computing and Information Technology, pp. 150-160, 2024.

S. S. Chhabile. "An Automated Fraud Detection Of Hall Ticket In An Offline Examination System,"

National Conference on Emerging Trends in Computer Science, pp. 200-210, 2024.

A.N. Rao and D. K. Sharma. "Blockchain Technology for Secure Examination Systems," International Journal of Computer Applications, vol. 175, no. 5, pp. 18-23, 2019.

D. Kumar and S. Sharma. "AI Techniques for Automated Verification in Educational Systems," Artificial Intelligence in Education, vol. 10, pp. 101-110, 2023.

K. R. Patil and J. S. Rathi. "Real-Time Hall Ticket Verification Using OCR and Image Processing," International Journal of Computer Science and Information Security, vol. 18, no. 3, pp. 35-40, 2020.

R. S. Patel and A. R. Desai. "Fraud Detection in Educational Assessments: A Review of Techniques," Journal of Educational Technology and Society, vol. 23, no. 2, pp. 75- 85, 2022.

Sundararajan, V., & Palaniappan, S. (2020). *Assistive Technologies for the Visually Impaired: A Review of Tools and Techniques*. Journal of Visual Impairment & Blindness, 114(4), 335-344. https://doi.org/10.1177/0145482X20921102

Cai, X., & Wang, C. (2019). *A Review of Vision Assistance Systems for the Blind and Visually Impaired: Current Trends and Future Prospects*. Journal of Assistive Technologies, 13(2), 103-116. https://doi.org/10.1108/JAT-10-2018-0103

Patel, S., & Patel, A. (2021). *Smart Glasses for the Visually Impaired: Current Challenges and Future Directions*. Journal of Rehabilitation Research and Development, 58(3), 281-290. https://doi.org/10.1682/JRRD.2020.12.0232

Sharma, S., & Goyal, M. (2020). *Wearable Assistive Devices for the Visually Impaired: A Review and Future Prospects*. IEEE Access, 8, 76543-76554. https://doi.org/10.1109/ACCESS.2020.2996099

Ghasemzadeh, H., & Zarafshan, N. (2018). *Computer Vision-Based Assistive Technologies for the Blind: A Review of Approaches and Challenges*. Expert Systems with Applications, 92, 440-456. https://doi.org/10.1016/j.eswa.2017.09.030

Zhou, Y., & Sun, L. (2019). *Advances in Assistive Vision Technologies for the Blind: A Survey of Smart Systems and Applications*. Sensors, 19(24), 5413. https://doi.org/10.3390/s19245413

Kumar, P., & Kaur, R. (2019). *Assistive Vision for the Blind: A Review of Wearable Devices and Technologies*. International Journal of Advanced Research in Computer Science, 10(2), 63-72. https://doi.org/10.26483/ijarcs.v10i2.6598

Nguyen, D., & Huynh, T. (2020). *Real-Time Obstacle Detection and Navigation System for Visually Impaired People: A Review of Current Methods and Future Prospects*. International Journal of Human-Computer Interaction, 36(8), 732-744. https://doi.org/10.1080/10447318.2020.1794562

Lee, S., & Kim, J. (2018). *Assistive Technologies for Blind and Visually Impaired People: A Review of User-Centered Designs and Applications*. International Journal of Human-Computer Studies, 118, 102-116.
https://doi.org/10.1016/j.ijhcs.2018.03.006

Fang, X., & Li, Y. (2021). *Towards an Inclusive Future: The Role of Assistive Vision Systems in Improving the Quality of Life for the Visually Impaired*. Journal of Visual Impairment & Blindness, 115(2), 99-108.
https://doi.org/10.1177/0145482X20960874