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Machine Learning Techniques for Urdu Audio Feedback for Visual Assistance: A Systematic Literature Review

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ABSTRACT

Visually impaired individual faces many challenges when comes to object recognition and routing inside or out. Despite the availability of numerous visual assistance systems, the majority of these system depends on English auditory feedback, which is not effective for the Pakistani population, since a vast population of Pakistanis cannot comprehend the English language. The primary object of this study is to consolidate the present research related to the use of Urdu auditory feedback for currency and Urdu text detection to assist a visually impaired individual in Pakistan. The study conducted a comprehensive search of six digital libraries, resulting in 50 relevant articles published in the past five years. Based on the results, a taxonomy of visual assistance was developed, and general recommendations and potential research directions were provided. The study utilized firm inclusion/exclusion criteria and appropriate quality assessment methods to minimize potential biases. Results indicate that while most research in this area focuses on navigation assistance through voice audio feedback in English, the majority of the Pakistani population does not understand the language rendering such systems inefficient. Future research should prioritize object localization and tracking with Urdu auditory feedback to improve navigation assistance for visually impaired individuals in Pakistan. The study concludes that addressing the language barrier is crucial in developing effective visual assistance systems for the visually impaired in Pakistan.

Keywords: *Visual Assistance, Visually Impaired, Auditory Feedback, Visually Impaired, Vision Impairment, Currency, Urdu Text, Urdu Auditory.*

1. Introduction

An individual with all-out visual deficiency or visual hindrance faces many difficulties in doing their different routine task [1]. Visually impaired people are dependent upon others for looking, moving, and other everyday tasks [1]. Worldwide 38.5 million are visually impaired including 1.12 million in Pakistan while the numbers are anticipated to grow nearly to 587.6 million, by 2050 [2]. The problem is becoming more of a concern as the number of visually handicapped people rises by millions every decade [3]. This circumstance has captured the attention of several in the search for improving the quality of life for those visually impaired [4]. Previously, human guides [5], and smart canes [6] have been the study of practitioners for navigational assistance.

Recently, machine learning algorithms have made significant contributions to the study of humans such as smile detection [7], robotic arms [8], and pose recognition [9]. Similarly, machine learning algorithms have also been used for the safe routing of the visually impaired using a convolutional neural network (CNN) [10]. To ensure the use of safe navigation deep learning-based object localization along with a range of distance-calculating sensors [11], the system contains a wearable interface made of the RGB-Depth camera that effectively instructs the visually impaired to roam [12], while understanding the surroundings [13], and recognizing the traffic signs [14]. Moreover, a deep learning approach is employed to calculate the current rotation, and speed performed by the visually impaired [15], with audio feedback in the English language [15], and alarm-based [16].

The existing review paper covers up to 2022 and mostly focuses on the detection of objects, text, and currency detection using English auditory response while paying less attention to Urdu text and Pakistani currency using Urdu auditory feedback as shown in Table 1, the following table brings comparison amid the present reviews centered on five key perceptions, navigation, object detection, Urdu text detection, currency detection, and audio feedback in the Urdu language. We included only comparisons for reviews that were published in reputable journals.

The novelty of our systematic analysis provides Urdu audio feedback for the visually challenged population integrating detection of Urdu texts [17], Urdu texts in images [18], and currency recognition [1]. Given that Urdu has been designated as the official language of the country, it occupies a central position in various domains, including government institutions, administrative offices, and educational establishments. Urdu serves as the primary medium of communication and instruction in schools and offices across the nation. Consequently, the provision of support and assistance in the Urdu language would be exceptionally appreciated and embraced on a national scale. The widespread adoption of such assistance throughout the country reflects the inherent value placed on Urdu as a means of communication and underscores the significance of catering to the needs of Urdu-speaking individuals, particularly in the visually impaired community.

This systematic literature review offers a full analysis of the problem tackled by the visually impaired while covering all 5 major perspectives discussed in Table 1. Additionally, 50 papers have been selected for further examination based on systematic reviews.

The paper is organized as follows. Section 2 debates the present survey and motivation for this systematic literature review. Section 3 provides the approach to conduct this review along with the research question and objectives. The answer to the queries has been examined in section 4. In section 5 the taxonomy of this literature review is discussed. Finally, the paper has been concluded in section 6.

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Table 1: Comparison table

Ref	Focus of Study	Survey	YOP	High-Level Feature Extraction					Target Library
				Navigation	Object Detection	Urdu Text Detection	Currency Detection	Urdu Audio Feedback	
1	Analysis of Navigation Assistance for Blind and Visually Impaired People	Review Paper	2021	✓	x	x	x	x	IEEE
2	Assistive Navigation System for Visually Impaired & Blind People	Review Paper	2021	✓	✓	x	x	x	IEEE
3	A Systematic Review of Urban Navigation Systems for Visually Impaired People	Review Paper	2021	✓	x	x	x	x	MPDI
4	A Survey on Currency Identification Systems for Blind and Visually Impaired	Review Paper	2021	✓	✓	x	x	x	MPDI
5	A Comparative Review on Object Detection System for Visually Impaired	Review Paper	2021	✓	x	x	x	x	IEEE
6	Indoor Navigation Systems for Visually Impaired Persons: Mapping the Features of Existing Technologies to User Needs	Review Paper	2020	✓	✓	x	x	x	MPDI
7	Tools and Technologies for the Blind and Visually Impaired Navigation Support	Review Paper	2022	x	✓	x	x	x	Taylor & Francis
8	Insight on Electronic Travel Aids for Visually Impaired People: A Review on the Electromagnetic Technology	Review Paper	2019	x	✓	x	x	x	MPDI
9	Developing Walking Assistants for Visually Impaired People	Review Paper	2019	x	x	x	x	x	IEEE
	Current Study	SLR	2023	✓	✓	✓	✓	✓	

2. Literature Survey

Prior employed approaches used for indoor and outdoor navigation includes: E-cane, trained dogs, and sensor-based walking sticks for the navigation of visually impaired individual, which incorporates infrared and ultrasonic-based navigation, has short-range capabilities for object detection, While, laser-based navigation can hurt assuming it straightly hitting them on their eyes [19]. Moreover, an electronic transfer aid was adopted for the direct routing of the blind in unfamiliar indoor conditions with embedded high points for finding the obstacles [20]. A large number of proposed indoor and outdoor navigation systems have weaknesses related to friendliness and adaptability, personal learning, and variation time with the new framework [21]. In addition, an electronic travel aid in the vision of electromagnetic was recognized as a rising invention, because of its high degree of accessible execution concerning accuracy adaptability, and cost viability [22]. Besides that, the global positioning system (GPS) tracker can assist to localize and recognize positions, planning, and security and health services [23]. Moreover, in the translation of the environment, utilization of computer vision and artificial intelligence more specifically the deep learning methodologies help outdoor navigation for the visually impaired individual [24].

Apart from that, a framework has been involved for expansion in the field of sensors, computer vision, and smartphone-based walking generations that guarantee the portability and security of blind people. The existing review articles emphasize more on sensors and lasers utilized for object localization, as well as the use of global positioning systems (GPS) for tracing the location of visually impaired individuals. However, there is a notable bias toward discussing tools, devices, power consumption, usability, and portability, while comparatively less attention is given to addressing the comprehension of assistive challenges specific to visually impaired individuals. It is essential to prioritize research that focuses on enhancing visual understanding.

The novelty of this systematic analysis incorporates visual assistance with audio feedback, enabling visually impaired individuals to effortlessly comprehend the objects in their native language. Introducing assistance through Urdu acoustic feedback can make a significant contribution to their independence and overall well-being. By providing tailored audio guidance in a language familiar to them, the paper aims to enhance their understanding and ensure a more effective and accessible assistive experience.

3. Research Methodology

We conducted this systematic literature review to examine and assess Urdu-based audio feedback assistance systems for visually impaired persons. We applied the identical method.

We applied the identical method [25], and [26], which recognizes and evaluates the publication of an Urdu-based aid system. Directing of this systematic literature review can be partitioned into three divisions. Preparation of review, conducting and finally reporting of the review as shown in Fig.1. The methodology of recognizing the research topic based on problem statements and research gap is displayed

in Fig. 2 and the research process used to acquire and examine existing material allied to audio feedback is shown in Fig. 3.

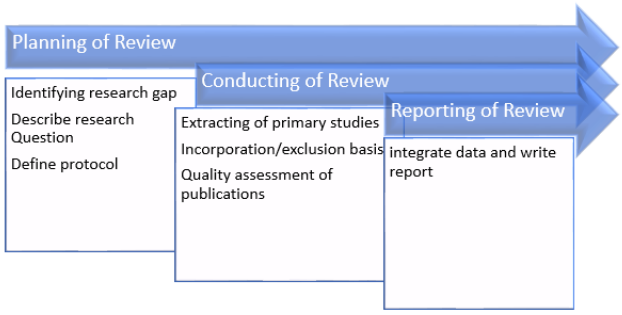

Fig. 1: Stages of study plan

3.1 Review Plan

A suitable search plan has been employed to gather all significant studies. Fig. 1 and 2 demonstrate the procedure for finding the related papers, publication mapping, and classification framework. A highly organized procedure was used in conducting this review which includes.

- Research questions and objectives
- Coordinating database searches
- Studies including/ excluding
- Inspecting related studies
- Combining result
- Concluding the review

It is crucial to express primary research questions (RQs) as mentioned in Table 2 to acquire the main objective as follows:

1. RQ 1: Aims to mention the objective to build a library of publications for the visually impaired including recognition of more efficient work for the visually challenged population in Pakistan
2. RQ 2: Focuses on comprehending the tools beneficial for the visually impaired and other applications of the navigational system.
3. RQ 3: The objective is to categorize the prior solution for indoor and outdoor navigation, which is mostly based on the sensor with audio feedback both in English and alarm.
4. RQ 4: Tries to recognize the challenges met while producing navigational assistance with auditory feedback.
5. RQ 5: The final question covers identifying the medium of instruction for the visually impaired person in Pakistan. The language is effective and easily adapted.

3.2 Review Conduct

The technique of carrying out this review has been stated in four steps, expressed below. At first, related primary studies have looked at the most used digital libraries. The selection of papers based on decided criteria has been included and excluded during the second phase. We have developed quality evaluation principles to improve the quality of our review and finally, the snowballing is executed to fetch crucial publications performing the last phase.

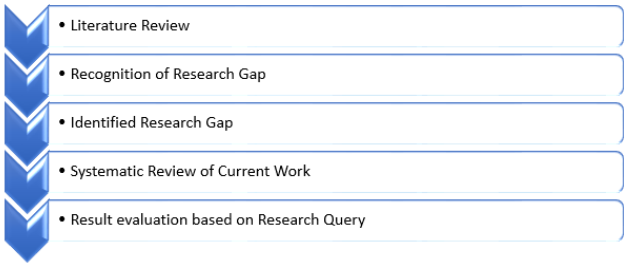

Fig. 2: Research Approach for systematic literature review

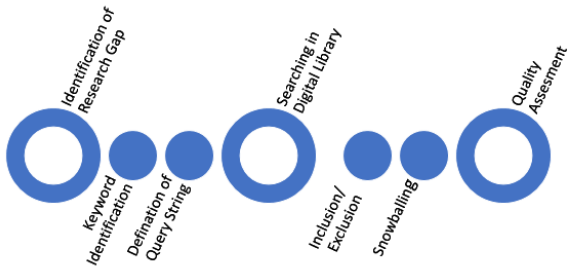

Fig. 3: Procedure to excerpt and study related to the research article

3.2.1 Research Question

The crucial step in conducting a systematic literature review is to look at the problem statement and research gap identified by the earlier studies. The research question makes it easier to formulate a research question. The collection of research questions that should be assessed for this study is shown in Table 2.

3.2.2 Search Strategy

The term searching strategy describes a series of activities necessary to carry out a systematic literature review. The procedure entails browsing relevant published research publications through digital libraries and search engines. Compose the search string after choosing the appropriate search environment. Below is the list of digital libraries that we utilized to find the research resources for automated extraction.

- ACM Digital Library Linkyhttp://dl.acm.org
- IEEE Explore http://ieeexplore.ieee.org
- Science Direct https://www.sciencedirect.com
- Springer Link https://link.springer.com/
- Google Scholar https://scholar.google.com/
- Semantic Scholar https://www.semanticscholar.org

The goal of the search is to gather specific publications in the library resources mentioned above.

Table 2: Research Queries and their objectives

RQ	Research Question	Objective and Motivation
1	Which articles are appropriate for navigational assistance? Determine the type of channel, as well as the demographic distribution?	To Recognize • High-impact papers for navigational assistance. • Selected papers from 2019- 2023
2	What are the principal purposes of navigational assistance?	To Study and understand • Real-time employment for navigational assistance i.e. Autonomous Vehicles, beneficial tools for visually impaired persons.
3	How to examine and recognize the similarities and differences between high-level extracted features in current research?	To identify and compare • Existing work for indoor and outdoor navigation, sensor-based navigation, and feedback both in English and alarm.
4	How to determine the primary concerns and challenges that navigation aid will face for Pakistani people?	To identify • Challenges encountered while developing navigational assistance with auditory feedback.
5	What are the effective and interactive communication mediums for the Pakistani population?	To Understand • To Provide Urdu auditory feedback to ease the navigation system for the visually impaired.

Table 3: Research keywords used to define our work

Term	Primary key	Secondary key	Third Key	Additional key
T1	Navigational assistance	Visually impaired	Sensors based	Voice feedback
T2	Navigational analysis	Blind	Machine learning based	Audio feedback
T3	Routing assistance	Weaken	AI-based	Auditory feedback
T4	Route guidance	Vision-impaired	Deep-learning	Acoustic feedback
T5	Navigation aid	Visually handicapped	Computer Vision	Aural feedback
T6	Travel routing	Non-sighted	Laser-based	Listening feedback

3.2.3 Define A Query String

The searching can be accomplished by capitalizing the right search string. Table 3 shows the keywords that contain the term and groups them to generate a valid string. The word "OR" is utilized to imply synonymous, while AND serves to link words together."

(Navigational assistance OR navigational analysis OR routing assistance OR route guidance OR navigation aid OR travel routing) AND (Visually impaired OR blind OR weaken OR vision-impaired OR visually handicapped OR non-sighted) AND (sensors-based OR machine learning OR AI-based OR deep-learning OR computer vision OR laser-based) AND (voice feedback OR audio feedback OR auditory feedback OR acoustic feedback OR aural feedback OR listening feedback).

List 1: Query String

We have used the primary term as a key component for research on blind assistance. Along with the primary key other keywords or additional words were chosen. Integrating the keywords, with "AND", and" OR" operators generate a final query string for search as mentioned.

The overhead mentioned query seems to be limited during the initial search process. It was found that the preceding search query was ineffective at including the article for the visually impaired. Table 4 shows the final search query employed to discover six digital libraries with custom filters by applying the keywords in ACM Journal, Science Direct, IEEE, Google Scholar, Springer Link, and Semantic Scholar.

Table 4: Searching plan for digital libraries

Digital Library	Search Query	Filter
ACM Digital Library	(Navigational assistance OR navigational analysis OR routing assistance OR route guidance OR navigation aid OR travel routing) AND (Visually impaired OR blind OR weaken OR vision-impaired OR visually handicapped OR non-sighted) AND (sensors-based OR machine learning OR AI-based OR deep-learning OR computer vision OR laser-based) AND (voice feedback OR audio feedback OR auditory feedback OR acoustic feedback OR aural feedback OR listening feedback)	Publication Date: 2019-2023 Journal and Conference paper
IEEE Explore	(Navigational assistance OR navigational analysis OR routing assistance OR route guidance OR navigation aid OR travel routing) AND (Visually impaired OR blind OR weaken OR vision-impaired OR visually handicapped OR non-sighted) AND (sensors-based OR machine learning OR AI-based OR deep-learning OR computer vision OR laser-based) AND (voice feedback OR audio feedback OR auditory feedback OR acoustic feedback OR aural feedback OR listening feedback)	2019-2023 Journal and Conference paper
Science Direct	(Navigational assistance OR navigational analysis OR routing assistance OR route guidance OR navigation aid OR travel routing) AND (Visually impaired OR blind OR weaken OR vision-impaired OR visually handicapped OR non-sighted) AND (sensors-based OR machine learning OR AI-based OR deep-learning OR computer vision OR laser-based) AND (voice feedback OR audio feedback OR auditory feedback OR acoustic feedback OR aural feedback OR listening feedback)	2019-2023 Journal and Conference paper

Springer Link	(Navigational assistance OR navigational analysis OR routing assistance OR route guidance OR navigation aid OR travel routing) AND (Visually impaired OR blind OR weaken OR vision-impaired OR visually handicapped OR non-sighted) AND (sensors-based OR machine learning OR AI-based OR deep-learning OR computer vision OR laser-based) AND (voice feedback OR audio feedback OR auditory feedback OR acoustic feedback OR aural feedback OR listening feedback)	2019-2023 Journal and Conference paper
Google Scholar	(Navigational assistance OR navigational analysis OR routing assistance OR route guidance OR navigation aid OR travel routing) AND (Visually impaired OR blind OR weaken OR vision-impaired OR visually handicapped OR non-sighted) AND (sensors-based OR machine learning OR AI-based OR deep-learning OR computer vision OR laser-based) AND (voice feedback OR audio feedback OR auditory feedback OR acoustic feedback OR aural feedback OR listening feedback)	2019-2023 Journal and Conference paper
Semantic Scholar	(Navigational assistance OR navigational analysis OR routing assistance OR route guidance OR navigation aid OR travel routing) AND (Visually impaired OR blind OR weaken OR vision-impaired OR visually handicapped OR non-sighted) AND (sensors-based OR machine learning OR AI-based OR deep-learning OR computer vision OR laser-based) AND (voice feedback OR audio feedback OR auditory feedback OR acoustic feedback OR aural feedback OR listening feedback)	2019-2023 Journal and Conference paper

Table 5: Stages and results of selected papers

	ACM	IEEE	Science Direct	Springer Link	Google Scholar	Semantic Scholar	Total Paper
QS Searching	1050	2230	890	915	3106	870	9061
Filter	450	1090	589	735	1130	385	4379
Filter (Title)	260	134	48	112	162	38	754
Filter (Abstract)	54	28	27	56	42	16	220
Filter (Introduction and Conclusion)	10	27	11	14	37	9	104
Inspection	10	20	2	8	6	4	50

3.2.4 Selection Upon Including and Excluding Norms

Inclusion norms

- The articles included must be relevant to the domain of blind assistance in auditory feedback.
- Articles with the appropriate organization of modeling, experiment approach, and assessment metrics are incorporated.
- An article with an experimental approach that utilizes the published dataset to train and validate it.
- Include the latest and most relevant research publication with a review on visual assistance in Urdu.

Exclusion Criteria

- Don't include the non-English Publications.
- Publications from unrecognized journals and unauthentic internet sources should be included.
- Don't include the paper that does not discuss visual assistance for blinds.
- Discard the papers published before 2019.

3.2.5 Selection Based on Snowballing

After conducting a quality evaluation, we performed snowballing [27] through the list of established studies to carry out publications. Those papers selected that have been passed through filtration of inclusion and exclusion criteria. The inclusion and exclusion of the publication have been finalized after scanning the abstract and additional portion of the paper. We identified a total of 50 papers for the primary study.

3.2.6 Quality Valuation

The quality valuation of the publications tracked for the addition of related papers is shown in Table 6 below. The quality evaluation score for each distinct criterion is shown in Table 7 which shows the selected publication in the range between 4 to 10.

The following are some unique quality assessment classification methodologies to consider.

- The unpublished papers are not included. Moreover, they are examined if they were published in peer-reviewed journals plus if they have any satisfactory citations.
- Is there any convincing explanation of how Urdu audio feedback is used for the visually impaired?
- Is the research goal aligned with the goal of the current research questions?
- Can the experimental techniques and findings from these investigations be repeated? Is the author able to sufficiently describe the experimental procedure such that it can be repeated using the supplied data and techniques?
- Does the published article aim to aid the visually impaired individual?

The act of conducting the quality evaluation is done by allocating proper scores to the above-mentioned criteria. The final score of all those mentioned questions is displayed in Table 8.

Table 6: Categorization for quality valuation

Ref	YOP	Journal/ Conference	Empirical	Approach	Citation	Quality valuation					Score
						a	b	c	d	e	
1	2021	Conference	Primary	Resnet 18	63	2	2	2	2	2	10
2	2021	Journal	Primary	Fuzzy logic based	35	2	2	2	1	1	8
3	2021	Conference	Primary	Haptic based cues	47	2	2	1	2	1	8
4	2019	Journal	Primary	CNN object recognition	69	2	2	2	2	0	8
5	2019	Conference	Primary	RANSAC method	31	2	1	1	0	0	4
6	2021	Journal	Primary	Sensor Based	58	2	0	0	2	2	6
10	2022	Journal	Primary	CNN object recognition	53	2	2	2	0	2	8
11	2020	Journal	Primary	YOLO V3	76	2	2	0	2	2	8
12	2021	Journal	Primary	Deep learning	49	2	2	0	0	2	6
13	2022	Conference	Primary	Raspberry Pi	29	2	2	2	0	0	6
14	2019	Conference	Primary	Open CV Raspberry Pi	81	2	1	2	0	0	5
15	2019	Journal	Primary	Deep learning	78	2	0	2	0	2	6
16	2021	Journal	Primary	Vibrating actuator	32	2	1	0	1	1	5
17	2020	Conference	Primary	Image Processing	24	2	2	1	0	0	5
18	2019	Conference	Primary	Deep learning	45	2	2	0	1	1	8
19	2021	Journal	Secondary	SLR	33	2	2	1	0	0	5
20	2021	Conference	Secondary	SLR	26	2	0	1	1	0	4
21	2021	Journal	Secondary	SLR	57	2	2	0	1	1	4
22	2020	Journal	Secondary	SLR	49	1	2	1	0	2	6
23	2020	Journal	Secondary	SLR	50	0	2	0	2	0	4
24	2019	Journal	Secondary	SLR	68	2	2	2	0	0	6
29	2019	Journal	Secondary	SLR	19	2	1	1	1	0	5
31	2023	Journal	Primary	Sensors	61	2	2	0	2	2	8
32	2021	Journal	Primary	Bluetooth, BLE	61	2	2	2	2	2	10
35	2020	Conference	Primary	IoT based sensors	54	2	0	1	0	2	5
36	2020	Journal	Primary	RFID based electronic	38	2	0	1	0	1	4
37	2019	Journal	Primary	Deep learning	61	2	2	1	0	0	5
38	2020	Journal	Primary	Deep learning	39	2	2	2	0	2	8
39	2023	Conference	Primary	Machine Learning	37	2	2	1	0	0	5
40	2021	Journal	Primary	Computer Vision	54	2	2	1	0	0	5
41	2018	Conference	Primary	Computer Vision	28	2	2	1	0	0	5
42	2020	Journal	Primary	Ultrasonic sensor,	37	2	2	0	0	2	6
43	2021	Journal	Primary	Machine Learning	64	2	2	0	2	2	8
44	2023	Journal	Primary	Computer Vision	27	1	2	0	1	0	4
45	2021	Journal	Primary	CNN	28	2	2	0	2	0	6
46	2020	Journal	Primary	Deep learning	33	2	2	0	2	0	6
47	2021	Journal	Primary	CNN- RNN	65	2	1	1	0	0	4
48	2019	Journal	Primary	Deep learning	41	2	2	1	0	0	5
49	2019	Conference	Primary	Gps tracking	19	2	2	2	1	1	8
50	2019	Conference	Primary	Gps location	30	2	2	2	1	1	8
51	2020	Conference	Primary	Voice output	43	2	2	0	2	2	8
52	2023	Journal	Primary	Voice feedback	35	2	2	2	0	2	8
53	2021	Conference	Primary	Emergency	17	2	2	0	0	2	6
54	2018	Conference	Primary	E-speak	30	2	2	2	0	2	8
55	2021	Journal	Primary	Voice	28	2	2	1	0	0	5
58	2019	Conference	Primary	Vision-based	41	2	0	1	1	0	6
59	2021	Conference	Primary	Visual positioning	27	2	2	2	2	2	10
60	2019	Journal	Primary	Tracking	64	2	2	0	1	1	6
61	2019	Conference	Primary	Navcane	31	2	2	0	1	1	6

Table 7: Quality evaluation score distribution

References	Score	Total
[1][32][59]	>8 to<= 10	3
[2][3][4][10][11][18][31][38][49][50][51][52] [54]	>6 to <=8	13
[[6][12][13][15][22][24][42][45][46] [53][58][60][61]	>5to <= 6	13
14][16][17][19][35][37] [39][40][41][48][55][57]	>4 to <= 5	12
[5][14][20][21][23][36][44]47]	>=4	8

Table 8: Article score

Publication score	Channel	Ref	No	%
Internal Conference on Emerging Technologies	Conference	[1]	4	2
Micromachines	Journal	[2]	1	0.5
28th Conference of Open Innovations Association (FRUCT)	Conference	[3]	2	1
Electronic	Journal	[4][24][47]	3	1.5
International Conference on Recent Trends in Electronics, Information, Communication & Technology (RTEICT)	Conference	[6]	1	0.5
Proceedings of the National Academy of Sciences	Journal	[10]	1	0.5
In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition	Conference	[9][12][42][48]	4	2
Sensors	Journal	[22][46]	3	1.5
Entropy	Journal	[11]	1	0.5
International Conference on Communication and Signal Processing	Conference	[13]	1	0.5
International Conference on Engineering of Modern Electric Systems	Conference	[14][54]	2	1
ACM Transactions on Accessible Computing (TACCESS)	Journal	[15]	1	0.5
Virtual Reality	Journal	[16]	1	0.5
2020 IEEE International Conference on Convergence to Digital World – Quo Vadis (ICCDW 2020)	Conference	[17]	1	0.5
International Workshop on Arabic and Derived Script Analysis and Recognition (ASAR),	Journal	[18]	1	0.5
IEEE Access	Journal	[19][20]	3	1.5
International Conference on Artificial Intelligence and Machine Vision (AIMV)	Conference	[21]	1	0.5
IETE Technical Review	Journal	[23][29][31]	5	2.5
Mechatronics	Journal	[32]	1	0.5
IEEE International Conference on Robotics and Automation	Conference	[44][55]	3	1.5
CHI Conference on Human Factors in Computing Systems	Conference	[41]	1	0.5
International Conference on Communication and Electronics Systems (ICCES)	Conference	[35]	1	0.5
Cloud Computing, Data Science & Engineering (Confluence)	Journal	[36][43]	2	1
CEUR Workshop Proc	Journal	[37]	1	0.5
International Conference on Microelectronics (ICM)	Conference	[38][52]	1	0.5
International Conference on Artificial Intelligence, Automation, and Control Technologies	Conference	[39][58]	2	1
International Conference on Trends in Electronics and Informatics (ICOEI)	Conference	[40]	1	0.5
Review of Applied Management and Social Sciences (RAMSS)	Journal	[41][56][57]	3	1.5
Applied Science	Journal	[45]	1	0.5
International Conference on Computational Intelligence in Data Science	Conference	[49][53]	2	1
Internal conference on smart structure and system(ICSSS)	Conference	[50][51][59]	3	1.5
International Journal of Advance Computer Science and Application	Journal	[60]	1	0.5
IEEE Transaction on Human-Machine System	Journal	[61]	1	0.5

3.3 Review Report

Understanding the assistive system for the blinds and formulating appropriate supervision through auditory feedback has become an emerging study these days. The present systematic literature review is executed to carry out related studies from digital libraries. These papers have undergone skimming and critical evaluation. Nonetheless, no previous research of this kind has been done that target high-level feature i.e., Urdu-based audio feedback, Urdu text detection, currency detection, and recognition using various deep learning methods. The extracted studies afterward an intensive study based on the above-listed research question.

4. Research Queries Valuation

4.1 Research Question (01) Which articles are appropriate? Determine the type of channel, as well as the demographic distribution.

In the area of navigational assistance, various approaches have been deployed. To evaluate and review the recent research we carried out a publication based on produced string with several filters for the extraction of the relevant publication. Fig. 4. demonstrates the complete number of publications filtered from the year 2019-2023. The bulk of the research articles come from IEEE with 40%. ACM also provides a significant contribution with 20% of the paper being downloaded from their digital library. Google Scholar was another valuable resource, providing 12% of the papers. Springer Link and Semantic Scholar were responsible for 16% and 8% of the research article downloads respectively. Science Direct, while providing fewer papers, still played a role, contributing 4% of the sources. Overall, with a diverse range of digital libraries, we have filtered the most relevant and effective research articles.

These publications are later evaluated through manual filtering such as reviewing the title, abstract, and other porting of the article, which is depicted in Table 5. The output of browsing based on the string with filter from 2019-2023 is presented in Fig. 5, which includes 14 papers published in 2019, 13 papers from 2020, 8 papers released in 2021, 11 papers from 2022, and 4 papers from 2023. It is excellent to have a varied collection of papers from different years as it enables you to stay current with the latest research and concepts in your field. The collection of paper is a valuable resource.

Additionally, instead of coming from a blog or another unpublished article. We chose articles for our study from high-impact journals, conferences, and relevant review papers. For this purpose, we have collected a variety of sources of our research with 60% being from journal papers, 34% being conference papers, and 4% being reports published. The journal papers are typically peer-reviewed and considered to be more rigorous and reliable, while conference papers may provide more recent or cutting-edge research. Reports can also be valuable sources of information, particularly if they contain data or analysis that is not available elsewhere.

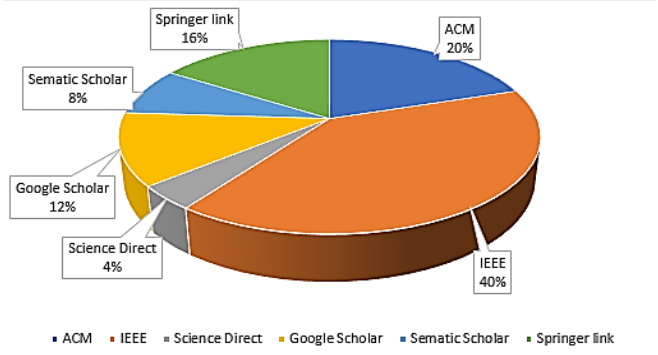

Fig. 4: Query string outcome in digital libraries

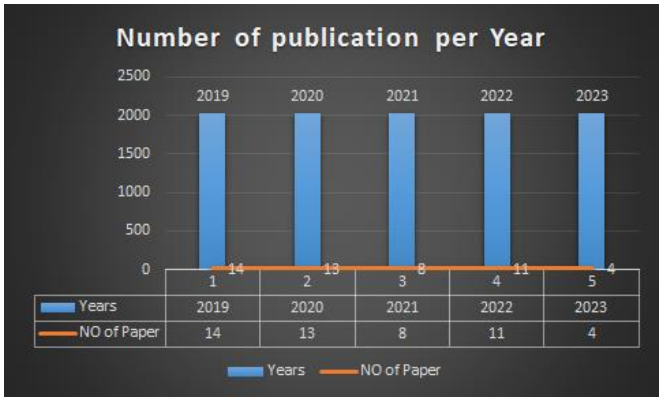

Fig. 5: Annual number of articles

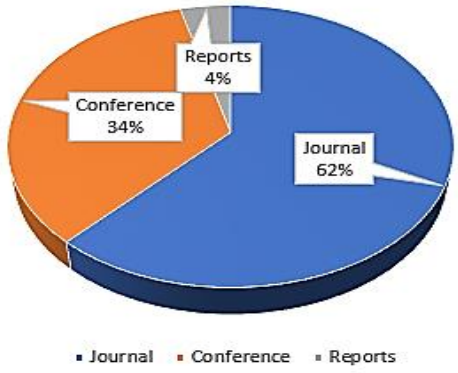

Fig. 6: Types of publications

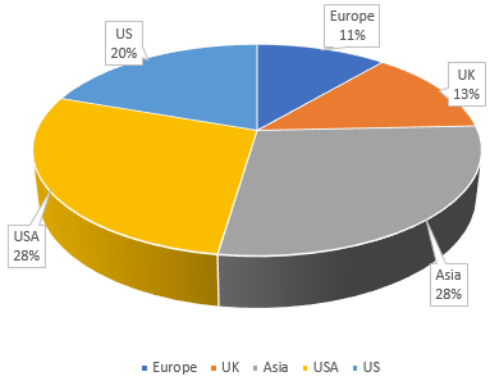

Fig. 7: Global classification of articles

Fig. 6 illustrates the comprehensive breakdown of the types of publications included in this study. The figure reveals a substantial majority, constituting 62% of the selected publications, correspond to esteemed journal papers. Conference papers, comprising 34% of the total, exhibit a notable presence in the research landscape, indicating their significance in disseminating scholarly findings. The remaining 4% encompasses other published reports, denoting a smaller yet noteworthy contribution from alternative sources of intellectual discourse. This presents a clear visual representation of the distribution of the publication types within the study. Fig. 7 illustrates the geographical distribution of the collected papers from

different regions across the world. Out of the total papers collected, 28% of them are from the United States of America, 20% are from Australia, 11% are from Europe, 13% are from the United Kingdom, and 28% are from Asia. Furthermore, Fig. 7 suggests that the paper collection is diverse and represents a broad range of perspectives and experiences from different parts of the world. It may also indicate that you have a particular interest in these regions.

Moreover, the contribution made by each journal and conference to the chosen research paper is demonstrated in Table 8 with publication scores for the papers.

4.2 Research Question (02) What is the principal purpose of navigational assistance?

Simple navigation is used to route people in unfamiliar environments, calculating the distance, route, and traffic. With the advancement of navigational assistance technology for the visually impaired person, making them independent. There are several applications including autonomous vehicles [28], currency identification [1], public transport [29], robot navigation [30], robotic dogs [31], and airport accessibility [32]. These applications aid the visually impaired in their everyday task while examining the navigational assistance. The following Table 9 displays the related application fields from the finalized published articles.

Table 9: Solution delivered by the particular publication

Study	Contribution	Approach
[16]	The video is forwarded to the caregiver to guide the user indoor and outdoor situations using haptic and audio communication.	Kinesthetic-based approach for routing guidance for moving left and right, while a single actuator for differentiating pattern.
[35]	To route through surfaces and obstacles based on IOT sensors with walking sticks.	The paradigm delivers a means to the visually impaired using various sensors to detect anomalies including obstacles, and stairs.
[36]	To provide the visually impaired the support to route in surrounding places and also access public transport.	Radio frequency identity is employed to aid the blind the accessing public transport, by buying a ticket, as well as reaching the bus stand using a global positioning system.
[34]	To evaluate the BLE navigation system for the blind at the airport and examine its effect.	The airport is equipped with Bluetooth low energy to perform user navigation and related routing exercises.
[37]	Smartphone cameras along with deep learning are used for the recognition of objects with the estimated distance from the visually impaired.	Mobile-based navigation system to aid the blind in and outdoors with audio feedback.
[38]	The system is founded for the blind to locate the object, and determine the position of the visually impaired for secure routing.	The model is trained to locate the object, wet surfaces, and the user's fall.
[41]	The sensory device with computer vision algorithm to deliver the surrounding knowledge to the visually impaired.	The basic aim is to deliver 3D information about the surroundings through hearing and sensing.
[43]	The shoes are integrated with IOT devices to traverse around using a computer vision algorithm to locate and recognize the hurdles.	An architecture to aid the blind in spinning around with shoes integrates the smart devices using a computer vision approach.
[48]	Generating three-dimensional information of a scene from video captured, which is comprehensively quickly delivered.	Depth map of the environment is calculated for the RGB images which later deliver three-dimensional information about the surroundings.
[50]	The system provides visual assistance to walk independently enabling the current location of the blind to their caretaker.	Audio routing and GPS are used for the bind. The SMS is delivered to the caregiver through a global system of mobile communication.
[39]	The platform is integrated with object localization and speech recognition based on deep learning for navigating purposes.	The system is modeled with a helmet mount camera in the front, using the web application and clouding computation.
[51]	The model easily traces the user in an unpleasant situation. The guardian gets an alert using SMS while the located object is informed using audio feedback.	The approach is conducted for observation and localization of the surrounding objects and provides the information using an audio command.
[54]	Raspberry Pi is the main source of collecting the frame of the environment and translating it into voice.	The cap aids the blind to route in the environment without anyone's assistance using the camera that captures the nearby objects.
[1]	The deep neural network is utilized to recognize the Pakistan currency for the visually impaired.	To manipulate the visual world into auditory by informing the blind about the obstacles in their way.
[52]	The approach provides a three-dimensional scene using voice output.	Travel aid system for the blind comprised of sensors for separating depth information and translating it into sound.

4.3 Research Question (03) How to examine and recognize the similarities and differences between high-level extracted features in current research?

Practitioners have made plenty of effort in the area of navigational assistance for the visually impaired ranging from sensor-based systems to advanced machine learning-based approaches, including deep learning, computer vision, and many other hybrid methodologies. These approaches assist in everyday daily tasks while aiding through sensing, locating, and identification of the object. Table 10 illustrates the classification of various methodologies for navigational assistance and the overview of related available articles is discussed below.

a) Sensors-based navigation system

The navigation system is the approach in which the object or the obstacle is detected using various types of sensors in real time. The application aid in daily life routine while locating various object through sensors mounted on walking sticks [16], an IOT-based E-cane [33], and radio frequency identification (RFID) for buying tickets and airport accessibility [32, 34].

Table 10: Prospectus outcome of the revised papers

Aspect	Basis	ref	Method	Finding
Sensor- Based	To reveal the sensor-based navigation	[16]	The vibrating sensor is utilized to instruct the visually impaired to move left and right and another single sensor is for differentiating the actuator	1) The study provides navigational assistance using various vibrating sensors for the blind to assist in the routing 2) Inform users through alerts using vibrators
	Internet of thing base smart came for navigation	[35]	IoT paradigm to deliver information through employing sensors utilized to locate anomalies	To route the blind through various surfaces and objects. The cane is to deliver the current location to the caregiver of the visually impaired individual
	Radiofrequency identification	[36]	Radiofrequency identification is used to traverse the blind to access public transport	The practice presents model gives support to the blind in accessing transport with any assistance
	Bluetooth low energy	[34]	BLE system is deployed for traversing and calculating user experience	The proposed system is found based on BLE for the navigation of the blind in the international airport
Computer Vision Based	Smartphone camera integrated with deep learning	[37]	The deep learning algorithm is generated for the recognition and various obstacles and calculating the distance	Mobile-based routing system to aid the blind in an outdoor navigation system with audio feedback
	Smart shoes	[38]	The model was developed mainly for detecting wet surfaces and placing the blind in real-time for safe and secure routing	The system enables the user to detect the wet surface and also inform their caretaker in case of a fall-down
	Raspberry pi	[40]	The system delivers walkable spaces, text identification, and text-to-speech	Wearable devices enable them to signal objects to users plus read the text
	Computer Vision	[41]	The vision model device is integrated with computer vision to deliver knowledge of the surroundings to the user	To develop a system while providing 3D information of the surroundings for travers
	Deep learning	[39]	Integrated system with OCR, speech processing, and another visionary to locate the object based on deep learning	Generated an integrated system with multiple functions for object localization and recognition
	Convolutional Neural Network	[45]	To assess the depth camera with Fast-SCNN and the depth map	To achieve walkability and guide the user with voice feedback
	Deep learning	[48]	To evaluate the novel technique to generate three-dimensional information using deep learning	To develop approaches with a depth camera that provide three-dimensional information for the blind
	Hybrid Approach	[47]	To examine the hybrid approach using CNN-RNN with decoder and encoder method	To secure a model that comprehends the distinct scene and is delivered in the form of text
Global Positioning System	Smart Eye	[49]	The device captures the location of the user, including generating a warning when objects are located on the way	Multiple devices are integrated to enable a system that directs the visually impaired with voice
	Global positioning location	[50]	The system delivers messages with their location during the hindrance. Visual voice using IOT to enable the walk	To achieve voice navigation and global positioning system tracking for the visually handicapped.
	Massage Generations	[51]	To analyze the system that can trace the user in an emergency using GPS	The system that locates the objects and provides voice output
	voice feedback	[53]	To acquire information of surroundings through voice using deep learning method object identification	The method provides an understanding of the surroundings in voice feedback

b) Object localization and identification

The process of locating the presence of an object in the video stream. Locating the various moving objects is the real-time application of the navigational system. Obstacles or objects can be localized and identified through various approaches including deep learning [35], smart shoes [36], and visual-based concurrent detection and mapping [37], Object detection and identification also convey assistive features. Such as locating various object from the continuous video stream aid the blinds to safely route in the surrounding [38], without collision using a computer vision technique [39]. The located objects in the frame can be further identified and traced by picturing depth information in the motion frame. This can be beneficial in the surveillance, traffic, and healthcare sectors.

c) Global positioning system with auditory feedback

Besides employing the different sensors [40] based on visually impaired navigation [41], machine learning approaches [42], CNN [43], deep learning [44] and hybrid methods [45] for object localization and recognition [46], while navigating in the surrounding the global positioning system [47] with the massage to their caretaker [48] is generated through voice feedback [49-50] which trace the current location of the person in an unpleasant situation [51].

4.4 Research Question (04) How to determine the primary concern and challenges that navigation aid will face for Pakistani people?

Though practitioners have done substantial research in the field of navigation for the visually impaired. Still, those approaches are shortages in covering millions of blinds in Pakistan. The developed approaches are mostly English-based [52-53]. While majority of Pakistanis do not speak or comprehend the English Language, which limits the concept of voice navigation and auditory feedback for them.

4.5 Research Question (05) What is the effective and interactive communication medium for the Pakistani population?

Urdu is a commonly spoken and comprehended language around Pakistan. The language was declared the national language [54], and is used in schooling, works, offices, and even law court [55]. For any navigational assistance, the medium of instruction in Urdu would be warmly welcomed by the people of Pakistan, especially by the visually impaired. Locating and identifying the object in the video frames [56], visual placing [57], tracking [58], and many other state-of-the-art sensor-based approaches [59-61] integrate with the language that is mostly understood to enhance the adaptability and improve the concept of autonomous navigation system for visually impaired in Pakistan.

5 Discussion and Future Direction

This part precise and debates the result relevant to the systematic literature review. The scrutiny of navigational assistance, tools, approaches, and evaluation for the development of an international standard for the visually impaired.

5.1 Taxonomic Hierarchy

The purpose of this SLR was to evaluate the existing knowledge in visual assistance by censoriously examining 50 relevant publications. To conduct this, we developed a taxonomic hierarchy of selected studies as shown in Fig. 8. Discarded the studies that have not authenticated their approaches empirically. We have explored development and challenges for the characteristics such as approaches and application of navigational assistance. However, these features are additionally distributed into many sub-levels displaying the depth of each feature and their role in the improvement of visually impaired life.

5.2 General Observations & Future Direction

Numerous opinions can be drawn from the findings of this systematic literature review (SLR), while comprehending the navigational assistance, various RQs were established to determine various approaches, resources, characteristics, and constraints. As a result, several patterns and discoveries can be noted regarding the constraints of navigational assistance. These include the subsequent observations and future directions.

5.3 Sensor Based

The goal of this systematic literature review is to examine the current research to carry out and comprehend useful information that incorporates the field of navigational assistance. Various elements of navigational assistance have been discussed by the practitioners. The features include: identifying multiple objects [32, 33], lane tracking [34], and an actuator [16] for differentiating the different patterns through alarm-based feedback.

Table 11: Finding a solution for auditory feedback.

Aspect	Basis	Ref	Method	Finding
Audio Feedback	Visionary based guide	[58]	To evaluate the architecture lies on camera the vision act and artificial cane able to locate lanes while walking	The proposed model helps in maintaining the lane while jogging or walking for the visually impaired
	Mobility solution for the blind	[59]	To find a method using the visual solution and API to identify text, images and logos	This model aims to integrate visual positioning and API for the recognition of objects
	Lidar based approach	[63]	The method uses Lidar to calculate the distance and the identified images are acknowledged using audio	To find an approach that facilitates the distance calculation and recognition of object
	currency recognition	[1]	The deep neural network is deployed to estimate the tag for the provided images and give the feedback using Urdu language	The proposed model employed deep learning for the recognition of currency and gives output in Urdu
	Urdu Text Recognition	[18]	To combine the OpenCV with OCR for Urdu text detection and the recognized text in then spoken for the blind	The developed model provides audio assistance for the blind detecting the Urdu text.
	Urdu text in images	[19]	To examine the CNN model for locating the Urdu text in the given image, and providing feedback using Urdu auditory feedback	The model aims to recognize the text in the given images while providing auditory feedback

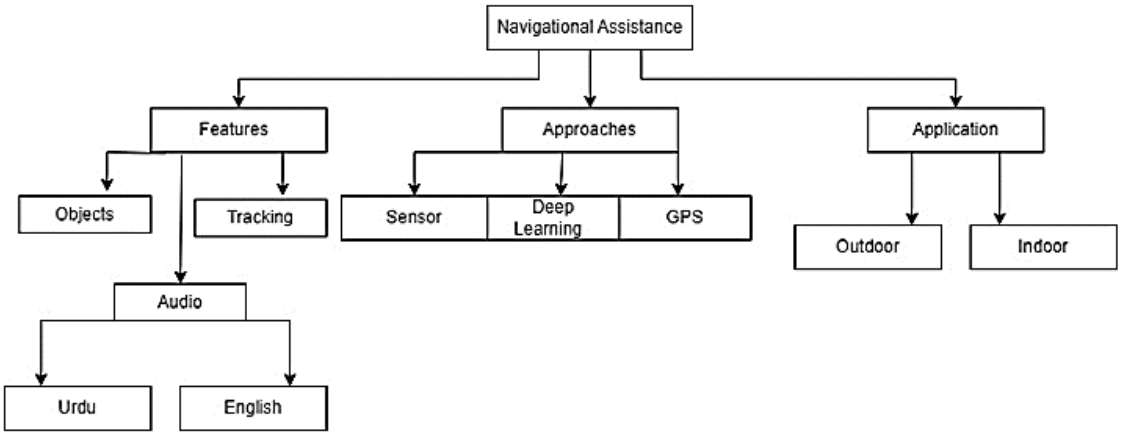

Fig. 8: Taxonomy of visually impaired

Various practitioners have put effort into the detection of objects and recognition, but still the gap exists. For the effectiveness of navigational assistance in real-time, the auditory feedback in the Urdu language for the Pakistani people is taken as a major challenge.

5.4 Deep Learning Approaches or Methods

Various practitioners recommended different methods to examine and comprehend object localization and recognition using different techniques for the routing of the blinds. Relatively, plenty of practitioners worked on different techniques of deep learning [35, 36], such as convolutional neural networks [43-46], and recurrent neural networks [45] for active calculation. The deep learning approaches provide better performance for the analysis of interest, which enhances the computational power. Reduces the training and testing time leading toward efficient object localization and identification.

5.5 Application of Visual Assistance

The massive mainstream of this literature is thought to be developed for providing the necessary assistance for a safe and independent life [47]. The practitioners at the beginning concentrated on the navigation system for the blinds, then they put effort into this developing field of navigational assistance with voice feedback [48, 49], to enhance their movability [50] and confidence in traveling freely and performing daily tasks with ease.

The visual assistance-based extraction of quality papers, location and quantitative study is needed. A maximum of 20 papers have been selected from the IEEE library and around partial of the amount is finalized from ACM as displayed in Table 5. The total number of publications concerning the years is shown in Fig. 4. It is also witnessed from Fig. 6 that a huge number of publications were recognized from journals and the second-highest publications were taken from quality conferences. The SLR included in our article is identified as a report which is about 4% of the total percentage. The regional distribution of articles is depicted in Fig. 7. Where the majority of available publications are from the USA and Asia sharing an equal number of 28%. The rest of the publications are from European countries.

The article score for the selected study is awarded related to questions shown in Table 8, it is obvious to see that the score ranges between 4-10. Overall classification results and quality valuation of finalized studies have been presented in Table 6. Additionally, we have acknowledged the sources of chosen research, the publication platform, and the overall study proportion mentioned in Table 8. About 40% of selected papers have been published in a journal named IEEE, where the ACM preceding is the second highest publication source 20%.

4. Conclusion

The existing literature on navigational assistance mainly focuses on object detection using sensors and GPS tracking to monitor the location of individuals. In addition, these sources explore the effectiveness of deep learning in object localization, as well as the adaptability and portability of such systems. However, there are limitations associated with these approaches that hinder their ability to provide comprehensive support for the visually impaired. To address this gap, we conducted a review of current research trends in visual assistance for the visually impaired, specifically in the English language. We employed a systematic approach to evaluating the impact of high-level characteristics, interpreting research findings and exploring various domains to gain a better understanding of the topic. Moreover, we aim to include additional insights that highlight the unique challenges and opportunities associated with providing navigational assistance for individuals with visual impairments. To obtain relevant publications related to visual assistance for the visually impaired, we developed a custom query string and applied it to six distinct digital libraries. The search criteria included: inclusion-exclusion guidelines and a thorough quality evaluation process that spanned from 2019 to 2023. We identified 50 articles that were considered worthy of further criticalexamination.

Moreover, Urdu auditory feedback has also contributed to the visually impaired by locating the Urdu text [17], Urdu text in images [18] and Pakistani currency recognition [1].

The limitations of a systematic literature review typically relate to search strategies, insufficient selection of data and incorrect categorization. Nevertheless, we have minimized the potential for biased selection by utilizing various search terms across multiple digital libraries in this study.

Through the use of firm inclusion/exclusion criteria and appropriate quality assessment methods, primary papers were selected based on their relevance to the research topic. The results indicate that the majority of the chosen articles were sourced from journal proceedings, with enough conference papers being selected. The majority of the research that was selected focused on exploring various approaches to the development of navigation assistance through voice audio feedback in the English language. However, the vast majority of the Pakistani population doesn't understand the English language so navigational assistance would not be so efficient. Finally, the future studies on navigational assistance, more consideration should be paid to object localization and tracking with Urdu auditory feedback for the visually impaired people in Pakistan. Mitigating the limitation of the language barrier who don't comprehend the English language since plenty of work has been done for the Urdu language including Urdu text so the navigation assistance for the visually impaired would in Urdu be a great contribution.

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