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Retraction

Retracted: Assessing Usability and Accessibility of Indian Tourism Websites for Visually Impaired

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] G. Agrawal, A. Dumka, M. Singh, and A. Bijalwan, "Assessing Usability and Accessibility of Indian Tourism Websites for Visually Impaired," *Journal of Sensors*, vol. 2022, Article ID 4433013, 11 pages, 2022.

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Research Article

Assessing Usability and Accessibility of Indian Tourism Websites for Visually Impaired

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The tourism industry cannot ignore the needs of people with special needs. Providing accessible tourism is essential because of social and legal obligations, but also because they have large business opportunities. These people with special needs face challenges in every social, economic, and digital environment. One of the greatest barriers they face is the lack of accessible and usable information on the Internet, which thwarts their travel plans. This research is aimed at identifying the usability and accessibility status of official state tourism websites of India. The usability evaluation was done on various web quality parameters using automated online tools. The accessibility evaluation was done to check the compliance of Web Content Accessibility Guideline version 2.0 by the tourism website using the automated tool TAW. Further manual inspection was applied to identify accessibility and language options on the webpage. The result revealed that Indian state tourism websites had low usability and accessibility status, and they need much improvement to make them accessible to people with special needs.

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1. Introduction

Tourism is one of the most important social and economic activities worldwide, contributing to 10.4% of the global GDP (9.2 trillion USD) and leading the job-providing industry with a contribution of 10.6% (334 million) of all jobs worldwide [1]. The tourism and travel industry's GDP growth exceeded the overall economy from 2011 to 2019; however, the COVID-19 pandemic impacted the tourist sector, which saw its growth drop by 49% in 2020. India tourism is one of the major leading contributors to global GDP and holds the 7th position worldwide in 2020. Over the last few years, India's tour and travel GDP has expanded at a phenomenal rate of 6.7 percent, reaching 247 billion U.S. dollars in 2018 [2].

Approximately 15% of the world's population is disabled in some way. This number is rising as the population ages, since the risk of chronic disease rises with age, contributing to a whopping 66 percent of people's disabilities [3]. The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) was the first to protect disabled people's rights. In 2016, India passed the Rights of Persons with Disabilities Act [4] to ensure that the disabled are included in society.

In regard to leisure and tourism, people with impairments do have the same desires and needs as others [5]. In recent years, there has been an upsurge in the number of disabled individuals engaging in tourist activities. The study on the benefits of holidays on disabled people's lives revealed that a holiday trip increased the level of life satisfaction in people with disabilities [6]. [7] in their findings acknowledged the benefit of accessible tourism and concluded it as a stress-releasing activity that positively impacted the social and physical health of disabled persons. Despite the market opportunities, tourist suppliers have failed to provide accessible tourism information in printed or online media [8]. [9] highlighted the fact that accessible and usable web information increases the participation of the disabled in tourism-

related activities, and as people with disabilities tend to travel with a companion, this significantly improves the revenue generated by the tourism sector.

The tourism industry also sees these persons with disabilities as their potential customers [10] as increased economic status and high expenditure behaviour for tourism have been seen in recent years [11]. However, these tourists and their needs were overlooked since they faced numerous information barriers limiting their use of tourism services [12]. These information barriers will be removed only when tourism websites comply with online accessibility guidelines and standards, and the content offered is accessible and usable to disabled people.

The main objective of this research is to evaluate the usability and accessibility of the official state tourism website in India. Based on the results, the authors suggest recommendations for the improvement of web accessibility.

1.1. Research Questions. The following research questions were framed to determine the quality of Indian state tourism websites.

RQ1: What is the usability status of the state tourism websites in India?

RQ2: Did India's official state tourism websites comply with Web Content Accessibility Guideline version 2.0?

RQ3: What are the main WCAG 2.0 guidelines on which India's official state tourism websites failed?

2. Literature Review

In the past, software quality metrics and evaluation were the major focus for researchers, with numerous studies and frameworks dedicated to the reusability of software products. In [13], the authors define various software quality matrices and evaluate software products' quality using the fuzzy logic approach. In the last decade, websites as software products have evolved in abundance. The web developers only focus on providing the information and neglect the quality attributes for accessibility and usability. Tourism is a leisure activity that is carried out by all people, including people with disabilities. Tourism websites have been neglected on accessibility issues, even in most developed nations like the United States. Williams et al.' study on accessibility analysis of hotel websites in Australia, the United Kingdom, and the United States discovered that poor accessibility is due to web designer ignorance. They were unclear about the technological needs of the impaired and the role of assistive technology in representing information in alternative ways due to poor technological advances in 2007 [14]. In [15], the author assessed the official tourism websites of the United States in 2010 and reported that none of the state tourism websites adheres to Section 508 accessibility criteria. The quality of the U.S. tourism website has not improved in over a decade, and it still does not meet the accessibility criteria. In a research published in 2020 [16], the authors looked at the official tourist departments of the 57 U.S. states and territories. The authors used TAW and AChecker to guarantee that the tourism website followed WCAG and Section 508 criteria. The findings found that tourism websites had severe accessibility issues, making navigation difficult for impaired individuals. In [17], the authors evaluated the performance of Beijing, Hong Kong, Shanghai, and Taipei tourism websites on 23 consumer-centric usability parameters. According to the results of the manual evaluation, the website of Hong Kong was the best of the four. Tourism websites are also neglecting the usability needs of disabled people.

The European Network for Accessible Tourism published the accessibility evaluation report of 41 European tourist national board websites [18]. The automatic and manual testing results revealed that none of the websites meets the basic fundamental level A accessibility guidelines. In 2019, [19] evaluated the accessibility of 14 tourism websites in three regions of northern Europe. The authors used the free version of the automatic tool named the web accessibility test. The result shows that different European countries have adopted different accessibility policies. Most of the European websites suffer from several accessibility errors. In [20], the authors tested the accessibility of European National Tourism Board websites. The websites were evaluated to check their compliance with WCAG 2.1 guidelines using AChecker and the accessibility evaluation tool. The result shows that the accessibility of European websites had improved a lot and had a high accessibility score. Missing alternative text on the images and missing transcripts in video content are some of the errors that exist.

Domínguez Vila et al. [21] analyzed the accessibility status of 210 tourism websites worldwide. Despite 90% of the countries under study having signed the Convention on the Rights of Persons with Disabilities (CRPD) and having adopted one or the other version of WCAG accessibility guidelines, none of the websites passed the WCAG 2.0 accessibility test. In another study in 2020 [22], the authors evaluated the country's commitment to adopting and implementing accessibility standards in tourism websites. The results show that despite the countries having signed an international agreement on disabilities, the websites were not accessible to the people with disabilities and needed much improvement in navigation and compatibility. In [17], web quality evaluation of four tourist destination websites was done using manual evaluation on 23 quality parameters. The result shows that the website of Hong Kong behaved best on the selected quality criteria.

In [23], the authors used automated tools to access 182 tourism agent websites in the Portugal region. The results revealed numerous critical errors in the WCAG 2.0 guideline perceivable and robust principle. In another study [24], the authors used an online diagnostic tool to assess the accessibility of three tourism supply agents in the Portugal region; among the three, the travel agent websites were found to be the least accessible and failed on many WCAG 2.0 accessibility criteria. In [25], the authors evaluated the quality of Nepal's official tourism website based on user usability experience on the website. The study's findings revealed that the website design had several flaws, and the content was difficult to navigate and understand the information offered. In [26], the authors used the student participants to test the usability of Indonesia's tourism website. The result shows that the websites need to be improved in efficiency and user

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satisfaction. In [27], the authors evaluated the accessibility of websites and mobile applications of destination management organizations in Portugal and Spain. The compliance results of WCAG 2.1 guidelines revealed that the websites failed on many success criteria and need to be improved to make tourism accessible to all. In [28], the authors evaluated the usability and accessibility of Indian airline websites using automated tools and found that the websites do not cater for the need of disabled tourists as they did not comply with accessibility standards.

The literature review revealed that many studies had been done on the accessibility analysis of tourism websites worldwide, but none of them had evaluated the Indian tourism websites. India is a preferred choice for tourism, and according to the 2019 report of the world economic forum, India was ranked 34 in the travel and tourism competitive index [29]. This is the first study to assess the usability and accessibility of official state tourism websites in India from the perspective of disabled users.

3. Methodology

3.1. Sample Data. India is a geographically diverse country, with 28 states and eight union territories. Each state is distinct in culture, religion, language, and historical significance. India attracts tourists from all over the world because of its diversity. The state tourism ministry governs tourism in each state, and each ministry has its official state tourism website providing all tourism-related information about the states. This study examined 36 tourism websites from states and union territories. The weblink's address was obtained from the Indian government's Ministry of Tourism website [30]. The recently established union territory of Ladakh does not have a tourism website. For Uttar Pradesh state tourism website, the HTML validator tool used reports an input/output error as the HTTP resource was not retriable due to the 404 HTTP response. Thus, 34 websites were considered for evaluation on various quality parameters of usability and accessibility, excluding these two websites. The evaluation of the selected websites was carried out from December 2021 to February 2022. Table 1 shows the list of official state tourism websites evaluated.

3.2. Selected Web Quality Parameters and Tools Used. This section presents the various parameters used to evaluate the state tourism websites of India.

3.2.1. Usability. ISO 9241-11:2018 defines usability as "the degree to which specific users can utilize a product to achieve specified goals effectively, efficiently and with satisfaction" [31]. The website should be usable by all people irrespective of any physical or mental disability. Traditionally, many usability inspection methods have been found in literature, such as heuristic evaluation [32], cognitive walkthroughs [33], formal usability inspections [34], pluralistic walkthroughs [34], consistency inspection, and standard inspection [35]. These usability testing methods require a manual review of the website, either by a single evaluator or a group of usability specialists. The expert's expertise and experience determine the usability outcome. Manual usability inspection results may be skewed because they are exclusively based on user experience during web interactions, and testing the entire website's usability is a time-consuming operation. Another problem with manual usability tests is the rare availability of usability experts. Automatic usability analysis via automated tools is required to achieve effective, efficient, and quick usability analysis of the website [36]. Human-centric web usability measures the extent to which a web user is happy with the website. It is concerned with the overall quality of the user's experience while exploring the website. The factors affecting the web users' experience are web page load time, valid hyperlinks on the website, and the usage of standardized language for the website.

Page load time is the amount of time a webpage takes to load, and it is the first impression a user has on the website. According to Akamai's study [37], if the webpage takes more than three seconds to load, more than half of the visitor leaves the page and never returns to revisit the page. The time taken by the page to load is mainly affected by the web page size, its constituents, and the number of HTTP requests required to fetch the page from the server to the client. The page load time, size, and HTTP requests required were evaluated using the Pingdom tool [38].

The nonstandard and error-prone use of HTML and CSS for web development may also result in a slow website, and web browsers find it difficult to render the content correctly. Error on the page makes the web page less usable to people with disabilities as assistive technologies like screen readers cannot efficiently parse the erroneous page. The W3C HTML validator [39] and CSS validator [40] services were used to identify the HTML and CSS errors on the tourism website.

Broken links on the page are another serious usability parameter. The presence of broken links on the web page degrades the user navigation experience and limits the search engine crawler to identify and rank the website. With the broken links on the web page, the intended user cannot find the required service on the page, and the user accessing the page with assistive technology will result in an unpleasant situation. The online tool Deadlink checker [41] is used to identify the broken links on the tourism website.

3.2.2. Accessibility. Web accessibility is aimed at providing barrier-free access to web content for disabled people. Different disabilities have different barriers and require some special requirements for accessing the web. The persons suffering from vision impairment in both eyes (blindness) rely on screen readers. They face challenges in accessing the web when the image on the web page does not contain the alternative text, the video on the web page does not have a text alternative to it, table data is not accessible serially through keyboard access, and forms are not accessible in a logical sequence through the tab button. The people suffering from low vision, tunnel vision, and clouded vision access the web using large font sizes, large images, and a specific combination of background and text color. The website should have screen magnification and a color theme selection facility to provide access to people with low vision.

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Table 1: Official state tourism website link.

Sr	Indian state/union territory	Official state tourism website
1	Andaman & Nicobar	https://www.andamantourism.gov.in/
2	Andhra Pradesh	https://tourism.ap.gov.in/
3	Arunachal Pradesh	http://www.arunachaltourism.com/#0
4	Assam	https://tourism.assam.gov.in/
5	Bihar	https://tourism.bihar.gov.in/en/circuits/buddhist-circuit
6	Chandigarh	http://chandigarhtourism.gov.in/
7	Chhattisgarh	https://www.chhattisgarhtourism.in/
8	Dadra-Nagar Haveli	https://www.tourismdddnh.in/
9	Goa	https://goa-tourism.com/
10	Gujarat	https://www.gujarattourism.com/
11	Haryana	http://haryanatourism.gov.in/
12	Himachal Pradesh	https://himachaltourism.gov.in/
13	Jammu and Kashmir	http://www.jktourism.jk.gov.in/
14	Jharkhand	http://jharkhandtourism.gov.in/
15	Karnataka	https://www.karnatakatourism.org/
16	Kerala	http://www.keralatourism.org
17	Lakshadweep	https://www.lakshadweeptourism.com/
18	Madhya Pradesh	http://www.mptourism.com
19	Maharashtra	http://www.maharashtratourism.gov.in/
20	Manipur	http://www.manipurtourism.gov.in/
21	Meghalaya	https://www.meghalayatourism.in/
22	Mizoram	https://tourism.mizoram.gov.in
23	Nagaland	http://tourismnagaland.com/
24	Delhi	http://www.delhitourism.gov.in/delhitourism/index.jsp
25	Odisha	https://odishatourism.gov.in/content/tourism/en.html
26	Puducherry	http://www.pondytourism.in/
27	Punjab	https://punjabtourism.punjab.gov.in/
28	Rajasthan	http://www.tourism.rajasthan.gov.in/
29	Sikkim	https://www.sikkimtourism.gov.in/Public/index
30	Tamil Nadu	http://www.tamilnadutourism.org
31	Telangana	https://www.telanganatourism.gov.in/
32	Tripura	http://tripuratourism.gov.in
33	Uttarakhand	http://uttarakhandtourism.gov.in/
34	West Bengal	https://www.wbtourismgov.in/

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The website should provide an inadequate color contrast ratio between the background and the foreground to make the content accessible to the person suffering from color blindness.

The person suffering from hearing impairments requires the caption and transcript of audio content on the web. People with motor disabilities access the web interface through the specialized mouse, mouth-stick, or eye gaze systems. The website should support assistive technology and provide support to access the web through keystrokes, and interactive content should not have time constraints on response. The website should also be made accessible to persons suffering from learning disabilities, memory impairment, impairment of intelligence, and seizure disorders.

The World Wide Web Consortium website (W3C) developed web content accessibility guidelines that provide the recommendation to be followed by web developers to make the web universally accessible to people irrespective of any physical or mental impairment. The first version, WCAG 1.0, was discontinued in 2009 after adopting the WCAG 2.0 guideline [42]. With the advancement of technology in the last decade and to include new accessible assistive technology, WCAG 2.0 was further extended in 2018 to WCAG 2.1 [43]. In this paper, the WCAG 2.0 guidelines are used to evaluate the compliance of accessibility. WCAG 2.0 provides guidelines to make the web accessible to people suffering from speech, visual, auditory, cognitive, learning, language, and neurological disabilities. These guidelines also

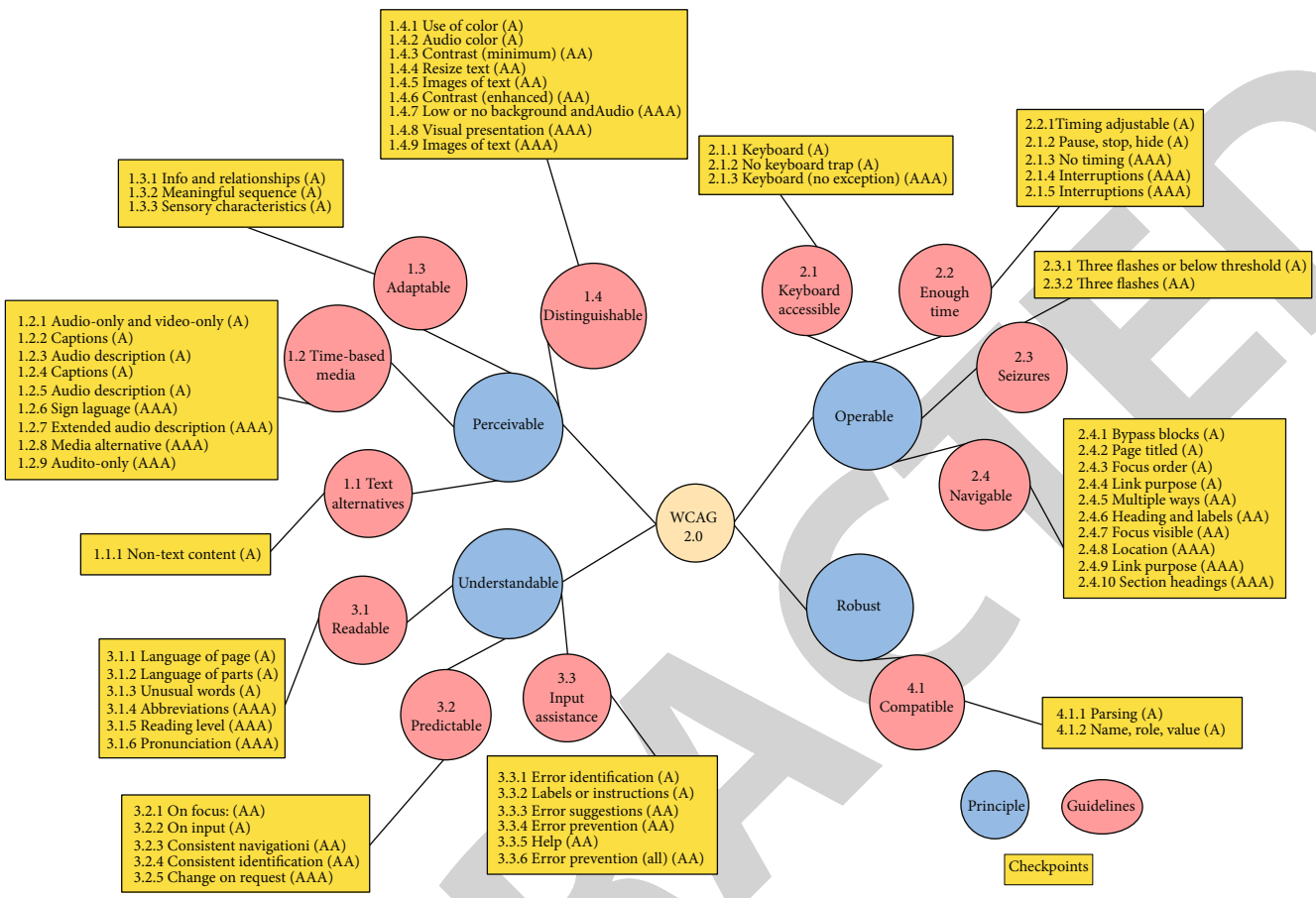

Figure 1: WCAG 2.0 guidelines and checkpoints.

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help older people suffering from disabilities due to ageing and increase the usability of the web. The WCAG 2.0 standard is designed in a layered structure to meet the varying need of the disabled people. At the top, it has four basic principles:

(i) Perceivable: the objective of this principle is to ensure that the information presented on the web is perceivable to all. The disability should not hinder the user from understanding the content

(ii) Operable: this principle intends to provide an operable web interface to people

(iii) Understandable: this principle ensures that the information presented is understandable by all

(iv) Robust: this principle ensures that the web content should be easily interpreted and accessed by assistive technologies

Under each principle, there are guidelines, and each guideline has testable success criteria. The WCAG 2.0 comprises 12 guidelines under four principles, and 61 success criteria or checkpoints are provided within these 12 guidelines. These success criteria define what must be accomplished in order to meet the WCAG standard. The details of checkpoints in each guideline are shown in Figure 1. Many countries have formulated their own country-specific web accessibility guideline based on WCAG 1.0 or higher versions. Many accessibility checking tools may be found on the World Wide Web Consortium website [44]. Out of these listed tools, some provide the facility to check the accessibility of websites according to WCAG 1.0, some check the website against WCAG 2.0, and some tools provide the facility to check the websites against country-specific accessibility guidelines. Some of these online tools are for a fee, and some are free.

This paper evaluated the Indian state tourism websites using the TAW online tool [45]. TAW is a free accessibility tool that provides the facility for evaluating the website against WCAG2.0 guidelines. It takes the URL as the input and lists the number of violations per checkpoint. The WCAG 2.0 provides three conformance levels: level A, level AA, and level AAA. Level A is the most basic requirement that the websites must follow to be accessible and usable. If the website passes all the level A and level AA checkpoints, it confirms level AA. To achieve level AAA, the website should pass all the checkpoints of levels A, AA, and AAA. TAW reports the violation at each level of conformance. The authors reviewed other important factors that improve web accessibility, such as the presence of a screen reader on the website, the ability to change font size, color contrast, and the website's language through manual inspection.

Table 2: Web usability parameters.

Usability parameters	Website count	Minimum	Maximum	Mean	Standard deviation
HTML errors	34	0	306.0	58.3	61.7
HTML warnings	34	0	132.0	30.2	33.0
CSS errors	34	1	258.0	39.4	53.0
CSS warning	34	0	4346.0	1118.6	853.7
Page load time (s)	34	1	36.5	10.1	7.9
Page size (MB)	34	0.0013	256.2	22.0	47.3
Image size (MB)	34	0.0032	57.9	10.2	14.3
HTTP requests	34	2	385.0	119.6	77.5
Broken link (%)	34	0	18.6	5.1	4.8

4. Results and Discussion

This section represents the usability and accessibility results obtained. The result of the usability parameters collected is shown in Table 2.

4.1. Page Size and Page Load Time. The result of page load time is shown in Figure 2. The result shows that only 20 percent of the website understudy had three seconds or less load time. About 38 percent of state tourism websites take more than 10 sec to load, and 80 percent of websites take more time than the Akamai guideline standard. The average load time of tourism websites is slower in loading and takes 10 sec to load. Lakshadweep's state tourist website has the fastest load time, taking only 1 second to load. The Madhya Pradesh state tourism website is the slowest, with 36 seconds of load time. The Core i3 processor with a broadband Internet connection of 40 MBPS was used to check the load time of the websites.

The web page's composition and the number of HTTP requests required to load the page are assessed to determine the causes of slow loading times. The web page size and number of HTTP requests directly affect the page load time. According to Google's recommendations, page sizes should not exceed 500 kb for a 3G Internet connection to load a page in under 3 seconds. The website's average page size understudy was 22 MB. The West Bengal tourism government website (https://www.wbtourismgov.in/) has the smallest size of 13 KB, and the largest page size is of the Chandigarh tourism website (http://chandigarhtourism.gov.in/) with a page size of 256 MB. Because images take longer to load, 82 percent of websites (28 out of 34) used images for more than half of their content. Tourism websites have become slow due to large amounts of visual content. Another factor contributing to the long load time is the high number of HTTP requests; the average number of HTTP requests per website was 119.

4.2. Broken Links. The result of broken links on the state tourism websites of India is shown in Figure 3. Only Punjab's (http://www.punjabtourism.gov.in) and Andhra Pradesh's (https://tourism.ap.gov.in/) state tourism websites are free of dead links. 17 percent (6 out of 34) of the websites had fewer than 1% dead links, 44 percent had less than 5% dead links, and the remaining 38 percent had more than

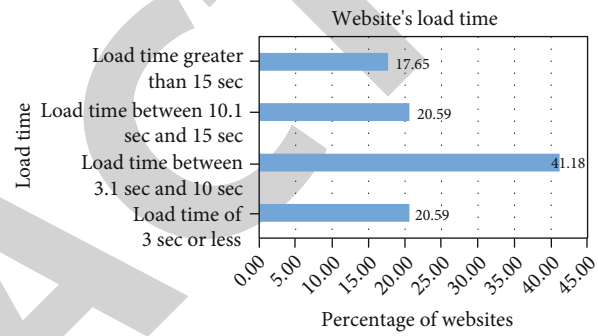

Figure 2: Website load time.

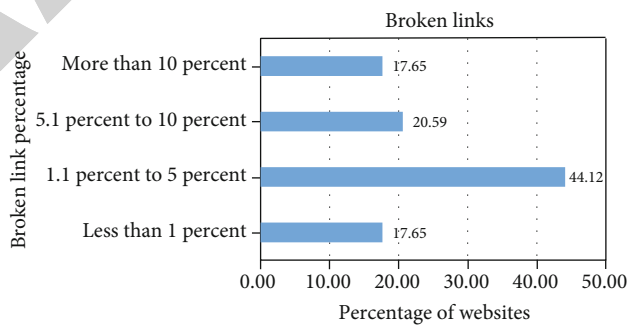

Figure 3: Broken links.

5% dead links. The website of Uttarakhand state tourism (http://uttarakhandtourism.gov.in/) has the highest percentage of dead links (18 percent). Broken links make it harder to use assistive tools to navigate the web and degrade the user experience and usability.

4.3. HTML and CSS Validation. The result of HTML and CSS errors is shown in Figure 4. The results show that tourism websites had many severe HTML and CSS errors. The state tourism websites reported an average HTML error of 58.3 and CSS error of 39.4. The CSS validator tool revealed a massive number of CSS warnings. A total of 1118 CSS warnings were recorded on average. Nearly 40 percent of the websites have more than average HTML errors. The website of Andhra Pradesh tourism (https://tourism.ap.gov

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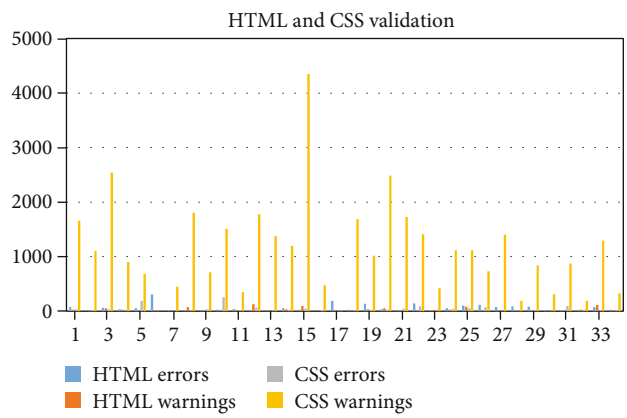

Figure 4: HTML and CSS errors in tourism websites.

.in/) and Kerala state tourism (http://www.keralatourism.org) did not report any HTML errors. All websites suffered from CSS errors. The Chandigarh tourism website (http://chandigarhtourism.gov.in/) reports maximum HTML errors (306 in count), and the maximum CSS error was reported by the Gujrat tourism website (https://www.gujarattourism.com/). On analysis, the following prominent categories of errors were reported by the websites.

(i) Use of the wrong attribute in HTML elements. For example, the attribute "name" not allowed on the "meta" element was used in many websites, and the attribute "alt" not allowed on element "svg" was used by many sites

(ii) Use of missing attributes in HTML elements. For example, the element "meta" used was missing the "property "attribute

(iii) Use of wrong values for attributes on HTML elements

(iv) Many websites use an HTML element that is not allowed as a child element. For example, element "h4" is not allowed as a child element of the "ul" element in HTML, and the element "table" is not allowed as a child element of the "span" element

(v) Use of unclosed element

(vi) Use of obsolete elements

(vii) Use of obsolete attributes of the elements. For example, the attribute "scrolling" on the element "iframe" is obsolete and has been used on many websites

(viii) The "alt" attribute was missing on many "img" elements

(ix) Sections on the web pages lack the heading, and use of h2 to h6 elements is recommended to add heading to all the sections

(x) Duplicate use of "id" attribute for different elements

(xi) Attribute "lang" in the element "start" was missing on many websites

Table 3: TAW results.

	N	Sum	Min	Max	Mean	Median
Problems	34	4644	23	856	136.59	91
Warnings	34	10533	50	1109	309.79	273.5
Not reviewed	34	901	24	29	26.50	27

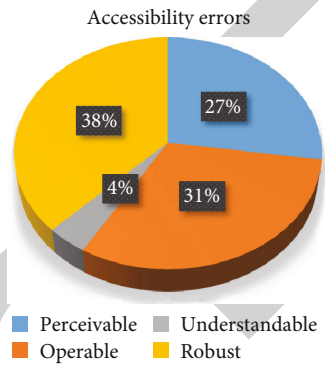

Figure 5: Accessibility errors reported in four principles.

(xii) Some websites use multiple body tags

(xiii) Use of unknown pseudo-element or pseudo-class in the CSS code

(xiv) Use of wrong and invalid CSS property

4.4. Accessibility. The accessibility of Indian state tourism websites was evaluated against WCAG 2.0 guidelines using the online tool TAW. The results obtained from TAW are shown in Table 3. TAW reports 4644 problems with a mean of 136.5 and 10533 warnings, and 901 were not reviewed in thirty-four Indian state tourism websites. The number of problems and warnings recorded is significantly higher compared to nonreviewed checkpoints.

The results showed that the website failed many checkpoints at levels A and AAA. The checkpoint failure results in conformance failure. Level A accessibility compliance is the most basic, and these are the criteria that every website must comply with to obtain a minimal level of accessibility. The greatest level of accessibility is level AAA, and websites may follow these guidelines. The website had AAA accessibility compliance if it passed all level A, AA, and AAA checkpoints. Figure 5 shows the WCAG 2.0 errors reported according to the four basic principles. Thirty-eight percent of the errors reported are of the robust category, which means that the website's content is not adaptable to be accessed by assistive technologies. Thirty-one percent of the reported errors were in the operable category, meaning that persons with disabilities would have a hard time accessing the web user interface, and navigating these websites with assistive technology is challenging. The information and web interface presented on the tourism websites are hard to perceive as 27 percent of errors were of perceivable type. The user's information is readable and easily understandable, and the results show only 4 percent of errors in the understandable principle.

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Table 4: WCAG 2.0 failed checkpoints.

WCAG 2.0 principle	Checkpoint violated	Total error	Number of websites	Mean errors
	Conformance level A			
Perceivable	1.1.1. Nontext content	823	33	24.9
	1.3.1. Info and relationship	455	33	13.8
Operable	2.2.2. Pause, stop, hide	10	9	1.1
	2.4.2. Page titled	8	2	4.0
	2.4.4. Link purpose (in context)	697	34	20.5
Understandable	3.1.1. Language of page	11	11	1.0
	3.2.2. On input	17	9	1.9
	3.3.2. Labels or instructions	156	23	6.8
Robust	4.1.1. Parsing	1535	34	45.1
	4.1.2. Name, role, value	208	28	7.4
	Conformance level AAA			
Operable	2.1.3. Keyboard (no exception)	123	14	8.8
	2.4.9. Link purpose (link only)	398	26	15.3
	2.4.10. Section headings	214	29	7.4

Further detailed analysis of accessibility errors at each conformance level is shown in Table 4. At the conformance level A, 97 percent (33 out of 34) failed to pass checkpoint 1.1.1. That means that the websites do not have text alternatives to nontext content on the website. 97 percent of the websites failed to meet criteria 1.3.1. This requirement ensures that the data and relationships provided can be identified programmatically, allowing assistive technology to access the web effectively. On operational criteria 2.2.2, 26% of websites (9 in total) failed. This criterion is aimed at providing users control over blinking and scrolling data on the website, making it easier for those with intellectual disabilities to utilize the Internet.

All websites failed criterion 2.4.4, which ensures that people with mobility disabilities and vision impairments can access the links in the order of their choice. Two websites failed to have a descriptive page title and failed on criterion 2.4.2. 32 percent (11 in count) of websites failed criteria 3.1.1, which prevents a person with a cognitive disability from using text-to-speech converting assistive technology. Criteria 3.2.2, which is intended to give individuals with visual impairment a predictive response to an interactive online platform so that the web page state does not change throughout the interaction, was failed by 26 percent of websites. 67 percent of the website entries failed on criteria 3.3.2 because they failed to provide relevant labels and clues for inputting the data to the form. All tourism websites failed to meet criterion 4.1.1; this criterion intends to provide proper tags so that assistive technology can easily parse the page. 82 percent of websites failed to meet criteria 4.1.2.

At conformance level AAA, the state tourism website of India failed three criteria of the operable category. The website's content should be accessible via the keyboard so that people with motion impairments can use it. 41% of websites do not have this capability and hence fail to meet success criterion 2.1.3. The hyperlink text on the webpage should express the purpose and semantics of the link so that people with motor or cognitive disabilities only choose the required link; 76 percent of the websites fail to provide such links and fail on criterion 2.4.9. As shown in Figure 6, all state tourism websites failed on many success criteria and are inaccessible to disabled people through screen readers and other assistive technologies.

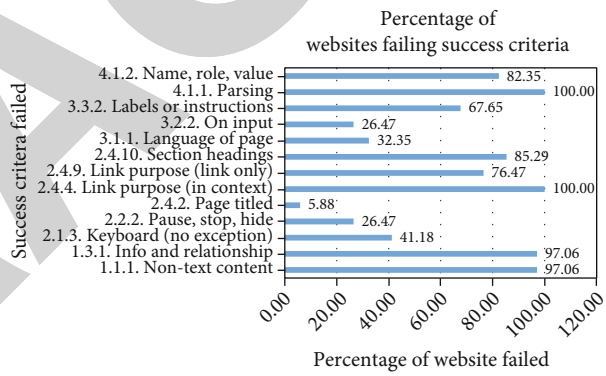

Figure 6: Percentage of websites that failed on WCAG 2.0 success criteria.

4.5. Accessibility Options. People with disabilities benefit from the inclusion of options to increase or reduce the text size of the web page, options to adjust the page's color contrast, and the ability to access the website using a screen reader. The presence of these three accessibility options is investigated manually by visiting the home page of each state's tourism website. The result is shown in Figure 7. Only 23% of tourism websites have the option of being accessible by a screen reader; the remaining websites are inaccessible to visually impaired people using assistive technologies. The option to change the color theme of the web page was only present on 35 percent of websites. 44% of websites allow people with low vision or visually impaired to change the

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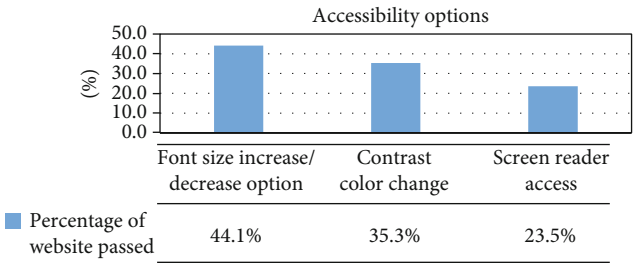

Figure 7: Presence of accessibility options in tourism websites.

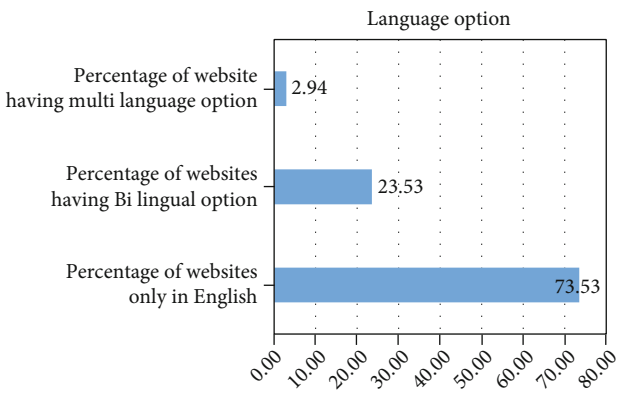

Figure 8: Language of the website.

font size of the online page. The results indicate that the tourism website had a low accessibility score.

4.6. Language Option. Many languages are spoken in different parts of India, and many people in India and other parts of the world do not speak English as their native language. Since tourism websites attract users from all over the world, language is a vital accessibility factor. The result of the website language analysis is done manually, and the result is shown in Figure 8.

5. Conclusion

In this paper, we have investigated the quality of Indian state tourism websites by evaluating the usability and accessibility in the context of disabled users. The usability testing results showed that most websites were poorly coded in HTML and CSS. According to the load time results, the majority of websites were slow to load. Large web pages with many uncompressed images and multimedia content were the primary cause of slow sites. These findings revealed that the Indian tourism websites lack usability. The accessibility result shows that the websites do not comply with web accessibility WCAG 2.0 guidelines, and most of them did not follow the minimum accessibility requirement of level A. The navigation structure of tourism websites is poor as they suffer from many broken links. The tourism website failed to provide options like a screen reader, color contrast adjustment options, and font size magnification options, which make the website inaccessible to people with disabilities. The websites reported accessibility errors in all the four principles indicating that the information presented is not perceivable, website interfaces are not operable, content is not understandable, and the content is not robust to adopt technological changes. Most websites fail to provide a text alternative to nontext multimedia content, making it difficult for persons with blindness or low vision impairment to access it through assistive software. The websites failed to provide a relationship between the content and the presentation, thus making it difficult to parse them.

To safeguard the rights of disabled people and ensure their active participation and inclusion in mainstream society, web developers and government agencies should come together to make the web universally accessible to all. The authors suggest that web developers should use best practices to incorporate WCAG 2.0 guidelines into the web development phase. To improve usability, unnecessary multimedia content should be removed, images should be compressed, different CSS files should be combined, and content caching should be used. The government should schedule a regular audit to check the compliance of accessibility guidelines and other accessibility parameters in the government websites. Policymakers can consider this research while creating policies for providing an accessible environment for disabled people.

The main limitation of this research was the use of an automated tool for evaluating the usability and accessibility status. In the future, this research can also be carried out with actual disabled participants to include their web experiences.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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