International Research Journal of Education and Technology

Peer Reviewed Journal

ISSN 2581-7795

ENHANCING WEB FORM ACCESSIBILITY: A COMPREHENSIVE FRAMEWORK FOR VISUALLY IMPAIRED USERS

DR.J.NOORUL AMEEN ,M.E, Ph.D, ARCHAYA . D, DHESIKA . E, LAKSHYA . T

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

E.G.S.PILLAY ENGINEERING COLLEGE NAGAPATTINAM,611002.

ABSTRACT:

This paper outlines an integrated framework for enhancing the accessibility of web forms for blind users. Notwithstanding improvements in web technologies, most web forms are still inaccessible owing to inappropriately labeled elements, poor keyboard navigation, and insufficient screen reader support. The proposed structure addresses such problems by employing semantic HTML, accessibility best practices, and user feedback adoption. The project's feasibility is guaranteed by existing standards, adequate resources, and a well-structured methodology. The outcomes aim at enhanced usability and accessibility, enabling visually impaired users to independently access digital content.

KEYWORDS:

Web accessibility, voice recognition, speech synthesis, Java script events, WCAG compliance, form navigation, screen reader support, inclusive design, web speech API

I.INTRODUCTION

With the web era, web forms have become a fundamental user interface for interaction, supporting tasks such as online signups, e-commerce purchases, and access to essential services. For visually impaired users, however, completing these forms is typically an intimidating experience due to poor

accessibility design. Despite the advances in web technologies, the majority of online forms remain inaccessible, with unlabeled fields, inconsistent keyboard focus, and inferior screen reader compatibility. These barriers limit visually impaired individuals' ability to accomplish tasks independently, exacerbating digital exclusion and restricting their engagement in an increasingly digital world.

Web accessibility significance is highlighted through global initiatives such as the Web Content Accessibility Guidelines (WCAG), that facilitate inclusive design best practices. But gaps between practices and implementations continue, particularly in dynamic and advanced web forms. Visually disabled users find unoptimized assistive technology-forms frequently and respond with frustration and task dropout. This exclusion affects not just individual users but also has a broader societal effect, as it restricts access to education, employment, and government services.

This project responds to these challenges by outlining a comprehensive framework to increase the accessibility of web forms for visually impaired users. Through the incorporation of semantic HTML, strong labeling, and keyboard navigation, the framework seeks to meet WCAG standards while emphasizing real-world usability. The project also focuses on user-centric design, integrating comments from visually impaired users to make the solutions functional and efficient. By iterative prototyping and testing, the framework will demonstrate how accessible design can make users independent through facilitation of access to digital participation.

II. LITERATURE REVIEW

Recent studies highlight persistent problems with web form accessibility for blind users. Usharani et al. (2020) developed a speech recognition-based voice-based form-filling system with potential for independent filling of forms. Their approach, though, reported vulnerability in handling multiple accents and dynamic fields. Paul and Das (2020) examined Indian e-government websites and reported general non-compliance with accessibility guidelines, especially in the design of forms. Their research highlighted the importance of WCAG-compliant solutions that minimize screen reader dependence.

Feiz et al. (2019) investigated assistive technologies with real-time audio feedback when filling out forms. Although well-suited to static fields, their solution did not quite work so well with dynamically filled fields. JAWS and NVDA, two widely used commercial screen readers, although popular, are barriers due to the high cost and complicated interface, according to several studies of accessibility.

Recent research points to three main areas of gaps: (1)exorbitant implementation costs of assistive technologies, (2)unstable cross-platform compatibility, and (3) inadequate management of advanced form structures. The suggested project tackles these via a Web Speech API-based implementation that directly utilizes available web technology. This diverges from previous efforts by disavowing dependencies while still retaining screen reader compatibility.

New research indicates voice interaction systems can augment and not replace existing accessibility tools. This work continues this idea by creating a light-weight JavaScript platform that augments instead of competes with traditional screen readers, possibly providing an alternative to sustainable universal web accessibility.

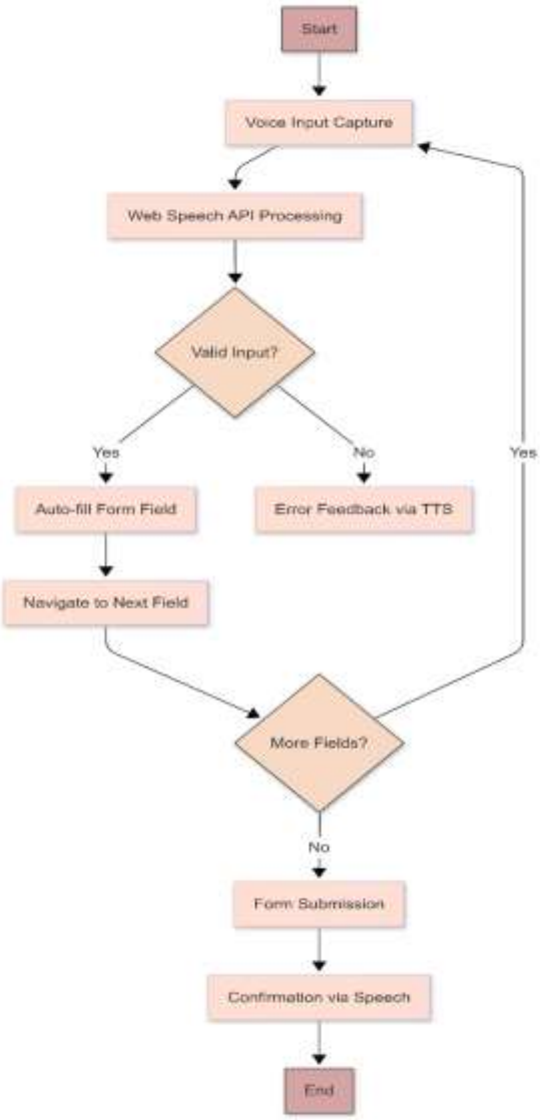
III.PROPOSED DESIGN

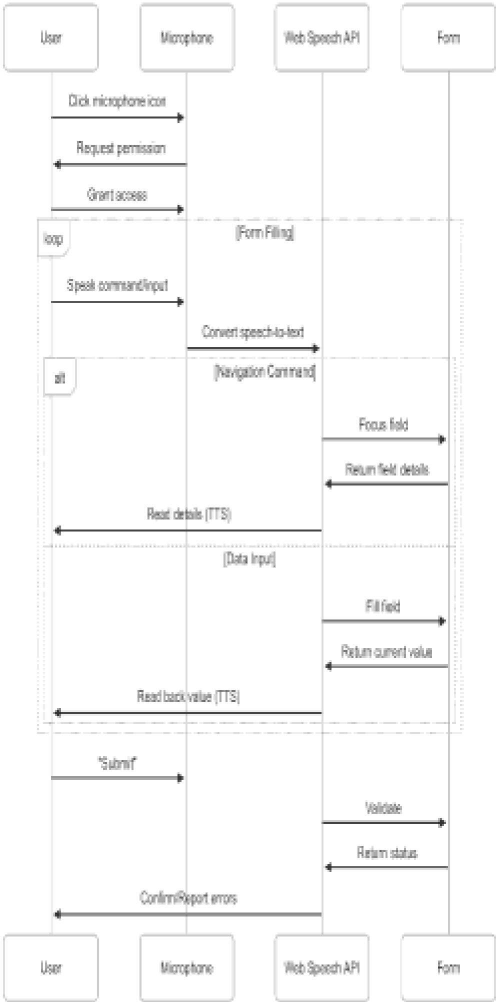
The proposed design to enhance web form accessibility utilizes the Web Speech API to create an entirely voice-enabled interface that enables visually impaired individuals to complete web forms on their own. The system at its core consists of a voice input module where the users activate voice control by the presence of an easily visible microphone button, and speech recognition technology captures navigation instructions like "next field" or "submit" as well as form content entry. The navigation smarts, created using JavaScript, cleverly maps voice prompts to relevant form fields as it provides dynamic voice prompts through text-to-speech (TTS) that voice-out the name of each field, the requisites, and their value. The system converts spoken answers back to text input while typing data, populating fields automatically with audio output being read aloud upon which users self-validate. Strong form validation occurs during data input as well as before submission, with the TTS interface indicating any errors such as invalid format or absence of required fields. Submission process entails comprehensive validation - in case error-free, users receive a success message and the form submits by itself; in case of errors, the system indicates errant fields and assists in fixing them. As a

International Research Journal of Education and Technology
Peer Reviewed Journal
ISSN 2581-7795

design goal with universal accessibility in mind, the interface supports recent screen readers like NVDA, features fallback keyboard navigation, and fully complies with WCAG AA color contrast and focus indicators. For eyesight, the visual style consists of high-contrast color schemes and a streamlined layout to limit cognitive load, and all interactive elements are properly labeled for screen readers. This whole solution obviates the need for visual feedback or expensive assistive technology while giving consistent, independent filling out of forms by easy voice entry and immediate audio feedback at every step in the process.

ACTIVITY DIAGRAM





IV.REQUIREMENTS

Hardware Requirements

Processor : Intel processor 3.5GHZ

Ram :8gb

Hard disk:256GB

Keyboard:Standard keyboard

Software Requirements

Front End: java script,html,css

IDE :visual studio code

V.METHODOLOGY

The design process for developing this voice-accessible web form system is holistic and multi-phased with a focus on technical robustness as much as user-centered design. We began with a very detailed requirements analysis phase, comprising large-scale research into the specific challenges visually impaired users encounter in filling out web forms, combining existing literature with unprocessed feedback gathered through user interviews and questionnaires. This groundwork guided our system design whereby we tactfully integrated the Web Speech API in order to undertake dual functionality - speech-to-text for user commands and text-to-speech translating system responses for audible feedback. The technical design was carefully built with JavaScript to develop natural voice command mappings, allowing easy navigation between form fields ("next field," "previous field") and effective data entry, while retaining full keyboard accessibility as an essential fallback mechanism to provide universal usability.during the development stage, we constructed three interoperable basic components: an improved voice input processor for precise speech recognition, an intelligent form navigation component handling focus changes and runtime validation, and an adaptive feedback component offering persistent audio cues.

Large-scale usability testing with visually impaired users was the cornerstone of our testing practice, allowing us to maximize command recognition accuracy, offer optimal audio feedback timing, and customize the overall user interface experience. Additionally, the system was tested for its compatibility with other well-established screen readers like NVDA and JAWS to ensure seamless integration with users' existing assistive technology configurations. Moving closer to deployment, we're finalizing detailed user manuals and tutorial documentation to support seamless uptake while, at the same time, laying plans for future development enhancements like AI-powered accent adaptation algorithms and increased mobile functionality to enable wider system coverage across all digital platforms. The careful, step-by-step approach guarantees the deployment of an all-embracing solution that best tackles the digital obstacles visually impaired users encounter when interacting with forms on the web.

VI.CONCLUSION

This voice-enabled web form system design approach is a technical robustness, multi-stage holistic approach with user-centered design focus. Starting with an exhaustive requirements analysis phase, we carried out rigorous background research into the exact problem of visually impaired users filling in web forms, combining information from existing literature with qualitative responses garnered from user interviews and questionnaires.This groundwork informed our system design, where we methodically employed the Web Speech API to enable dual functionality - text-to-speech conversion of user inputs and system outputs to sound utilizing text-to-speech technology. Technical design was carefully executed using JavaScript to enable natural voice command mappings, enable smooth navigation between form fields ("next field," "previous field") and rapid data entry with full keyboard accessibility as an extremely important fallback plan to enable global usability. During the development phase, we built three inter-operable core modules: a high-level voice input processor that provides accurate speech recognition, an intelligent form navigation system that supports focus changes and real-time validation, and a responsive feedback system that provides constant audio cues. A huge amount of testing with visually impaired users made up most of our testing cycle, allowing us to enhance command recognition accuracy, tune audio feedback latency, and increase overall user satisfaction. The system was also validated for compatibility with mainstream screen readers like NVDA and JAWS to allow full integration with the users' existing assistive technology infrastructure.As we progress towards deployment, we're developing detailed user manuals and tutorial content to ensure easy adoption, while at the same time charting future improvements like AI-powered accent adaptation algorithms and enhanced mobile functionality to make the system fully accessible across every digital platform. This careful, incremental approach ensures the provision of an actually inclusive solution that meaningfully tackles the digital impediments to visually impaired users in form-based web interactions.

VII.REFERENCES

[1] C.-Y. Tsai, L.-C. Woung, P. Chou, C.-S. Yang, M.-M. Sheu, J.-R. Wu,

T.-L. Chuang, and T.-H. Tung, ‘‘The current status of visual disability in

the elderly population of Taiwan,’’ Jpn. J. Ophthalmol., vol. 49, no. 2,

pp. 166–172, Mar. 2005.

[2] S. Vishnu Prasad, M. Kumar, M. Ramakrishnan, and D. Ravikumar,

‘‘Report on oral health status and treatment needs of 5–15 years old

children with sensory deficits in Chennai, India,’’ Special Care Dentistry,

vol. 38, no. 1, pp. 58–59, Jan. 2018.

[3] A. Aizpurua, S. Harper, and M. Vigo, ‘‘Exploring the relationship between

web accessibility and user experience,''Int. J. Hum.-Comput. Stud., vol. 91,

pp. 13–23, Jul. 2016.

[4] U. Uckun, A. S. Aydin, V. Ashok, and I. Ramakrishnan, ''Breaking the

accessibility barrier in non-visual interaction with PDF forms,'' Proc. ACM

Hum.-Comput. Interact., vol. 4, pp. 1–16, Jun. 2020.

[5] M. Ferati, B. Raufi, A. Kurti, and B. Vogel, ''Accessibility requirements

for blind and visually impaired in a regional context: An exploratory

study,'' in Proc. IEEE 2nd Int. Workshop Usability Accessibility Focused

Requirements Eng. (UsARE), Aug. 2014, pp. 13–16.

[6] B. Raufi, M. Ferati, X. Zenuni, J. Ajdari, and F. Ismaili, ''Methods

and techniques of adaptive web accessibility for the blind and visually

impaired,'' Proc.-Social Behav. Sci., vol. 195, pp. 1999–2007, Jul. 2015.

[7] H. Petrie, A. Savva, and C. Power, ''Towards a unified definition of web

accessibility,'' in Proc. 12th Int. Web All Conf., May 2015, pp. 1–13.

[8] A. Alsaeedi, ''Comparing web accessibility evaluation tools and evaluating

the accessibility of webpages: Proposed frameworks,'' Information,

vol. 11, no. 1, p. 40, Jan. 2020.

[9] J. M. Fernández-Batanero, M. Montenegro-Rueda, J. Fernández-Cerero,

and I. García-Martínez, ''Assistive technology for the inclusion of students

with disabilities: A systematic review,'' Educ. Technol. Res. Develop.,

vol. 70, no. 5, pp. 1911–1930, 2022.

[10] S. Brinsmead, ''Towards an accessible iPad for children and young people

with cerebral palsy,'' J. Enabling Technol., vol. 13, no. 4, pp. 228–239,

Dec. 2019.

[11] S. Paul and S. Das, ''Accessibility and usability analysis of Indian

e-government websites,'' Universal Access Inf. Soc., vol. 19, no. 4,

pp. 949–957, Nov. 2020.

[12] S. Alim, ''Web accessibility of the top research-intensive universities in the

UK,'' SAGE Open, vol. 11, no. 4, 2021, Art. no. 21582440211056614.

[13] P. Acosta-Vargas, M. González, and S. Luján-Mora, ''Dataset for

evaluating the accessibility of the websites of selected Latin American

universities,'' Data Brief, vol. 28, Feb. 2020, Art. no. 105013.

[14] S. Usharani, P. M. Bala, and R. Balamurugan, ''Voice based form filling

system for visually challenged people,'' in Proc. Int. Conf. Syst., Comput.,

Autom. Netw. (ICSCAN), Jul. 2020, pp. 1–5.

[15] S. M. Billah, V. Ashok, and I. Ramakrishnan, ''Write-it-Yourself with the

aid of smartwatches: A wizard-of-oz experiment with blind people,'' in

Proc. 23rd Int. Conf. Intell. User Interfaces, Mar. 2018, pp. 427–431.