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SUGAM (Simplified Universal Gateway for Accessible Media)

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Abstract- Digital exclusion remains a critical challenge for differently-abled individuals, as most platforms are designed without considering diverse accessibility needs from the outset. People with visual, hearing, motor, and cognitive disabilities often encounter barriers such as incompatible screen readers, lack of captions or sign language support, complex navigation, and rigid interfaces that cannot adapt to individual requirements. This results in reduced independence, limited access to education and employment opportunities, and increased reliance on caregivers, reinforcing social inequity in an increasingly digital world. Existing solutions frequently treat accessibility as an afterthought or a compliance checkbox, leading to fragmented, inconsistent, and suboptimal user experiences. To address this, we propose an accessibility-first platform that embeds inclusive design and assistive technologies at its core. The system will enable users to create personalized accessibility profiles specifying their needs across visual, auditory, motor, and cognitive dimensions. Based on these profiles, the platform dynamically adapts interface elements such as contrast, font size, layout complexity, input modalities (voice, gesture, switch control), and content presentation (text-to-speech, speech-to-text, captions, sign-language avatars). AI-driven personalization will learn from user behaviour to further refine recommendations, while strict adherence to WCAG guidelines ensures baseline compliance. The architecture will support modular integration of assistive tools, allowing seamless access to educational content, job portals, e-governance services, and social platforms through a unified, adaptive interface. The anticipated impact is a significant reduction in digital barriers for differently-abled users, fostering greater independence, social participation, and equitable access to opportunities. By prioritizing accessibility from the ground up, the platform sets a scalable precedent for future digital services, demonstrating that inclusive design benefits all users.

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Ultimately, this solution aims to transform accessibility from a reactive accommodation into a proactive, user-centered foundation for digital innovation.

Keywords- Digital Accessibility, Assistive Technology, Inclusive Design, Artificial Intelligence(AI), Personalized Accessibility, Web Content Accessibility Guidelines(WCAG)

I. Introduction

The rapid advancement of digital technology has significantly changed the way people communicate, learn, work, and access essential services. Websites and mobile applications are now widely used in areas such as education, healthcare, banking, employment, and public services. These technologies provide convenience and allow users to access information from different locations. However, the benefits of digital technology can be fully realized only when digital platforms are designed to accommodate the diverse needs and abilities of users.

Digital accessibility is an important aspect of inclusive technology development. It focuses on making websites, applications, and digital services usable by people with different abilities, including those who rely on assistive technologies. An accessible digital environment enables users to interact with information more effectively and independently. It also promotes equal opportunities for participation in education, employment, communication, and other essential activities. Therefore, accessibility should be considered a fundamental part of the design and development process rather than an additional feature introduced after a platform has been developed.

An accessibility-first approach emphasizes understanding users' needs from the initial stages of development. It encourages developers to consider different ways in which people interact with digital content and to provide flexible navigation, readable interfaces, clear visual elements, and alternative methods of interaction. This approach can improve the overall usability of a platform and create a more inclusive experience for a wider range of users. Furthermore, incorporating accessibility into the development process can help identify potential usability challenges at an early stage.

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This research proposes an accessibility-first digital platform designed to support inclusive and user-friendly digital interactions. The proposed platform incorporates features such as adjustable text size, high-contrast display options, screen-reader compatibility, voice navigation, and simplified interface layouts. It also considers multiple interaction methods to support users with different requirements. These features aim to make digital information easier to access and navigation more convenient for a diverse user population.

The primary objective of this study is to explore how accessibility-focused design can contribute to reducing digital barriers and improving user independence. The proposed platform provides a conceptual approach to integrating assistive features into a single digital environment. By prioritizing accessibility, usability, and inclusive design, this research aims to contribute to the development of digital systems that are more adaptable to users' needs and accessible to a broader community.

II. Problem Statement

Many digital platforms are not designed with differently-abled users in mind, making it difficult for people with visual, hearing, speech, or mobility impairments to access information and services independently. Common barriers include small text poor contrast, complex navigation, lack of screen-reader support, and interaction methods that depend only on touch or a mouse. These limitations reduce usability and may force users to depend on others to complete basic digital tasks. Therefore, there is a need for an accessible platform that incorporates inclusive design principles and provides multiple ways to access information and interact with digital services.

II. Literature Survey

The development of digital technologies has increased the need for accessible and inclusive websites and applications. Digital accessibility research focuses on making online information and services usable by people with different abilities. Previous studies have examined accessibility guidelines, assistive technologies, interface design, and evaluation methods to identify barriers and improve the usability of digital

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platforms. These studies provide a foundation for developing an accessibility-first platform that supports users with visual, hearing, speech, and mobility impairments.

S.No	Author	Year	Method Used	Data Set	Advantages	Major Findings	Limitations
1	Navkiran Kaur	2022	Systematic Review	1. Disability Exceptions 2. Web Accessibility Guidelines	1. Addresses a Critical Knowledge & Service Gap 2. Methodological Scaffolding & Structured Scope 3. Interdisciplinary Synthesis	1. Widespread Non-Compliance Across Library Websites 2. Common Technical & Design Violations 3. Discrepancies Among Evaluation Tools	1. Time and Database Scope 2. Homepage-Centric Evaluations 3. Exclusion of Purely Theoretical Work
2	Hamideh Kerdar	2024	Scoping Review	1. Identifying the Research Question 2. Identifying Relevant Studies 3. Charting the Data	1. Comprehensive Multi-Domain Scope 2. User-Centric First-Hand Perspective 3. Actionable Structural Framework	1. Persistent Basic Failures 2. Guideline Insufficiency 3. Assistive Technology Incompatibility	1. Single Disability Focus 2. Database Selection 3. Language Restrictions
3	Hancy Rozetta & Jibi Mol K	2025	A Survey	1. Web Image Description Dataset 2. Multi-Country Institutional Inclusion Literature	1. Comprehensive Multi-Technology Overview 2. Disability-Specific 3. Framework & Policy Alignment	1. High Accuracy in Modern STT Tools 2. Multi-Modal Personalization 3. Impact of Institutional Support	1. High Computational & Financial Costs 2. Narrow Disability Focus in Individual Studies 3. Environmental & Technical Dependencies
4	Sheela Paramasivam	2022	Semi-structured Interviews	1. Cognitive Evaluation 2. Organismic Integration 3. Basic Needs	1. In-Depth Qualitative Insight 2. Multi-Stakeholder Triangulation 3. Theoretical Framework	1. Severe Psychological & Emotional Stress 2. Unfamiliarity with Digital Platforms 3. Impact on Self-Confidence	1. Small Sample Size 2. Geographic & Discipline Scope 3. Methodological Constraint
5	R. A. Oyekunle & H. C. Chukwura	2025	Survey & Interview	1. Digital Accessibility Challenges 2. Assistive Technologies in E-Learning	1. User-Centered Iterative Development 2. Strict Accessibility Compliance 3. Cost-Effective & Practical	1. Addresses the E-Learning Accessibility Gap 2. Positive User Validation 3. System Requirements Met	1. Small Test Sample 2. Basic Technology Stack 3. Lack of Extended Disability Scope

Fig 1

Navkiran Kaur (2022): Navkiran Kaur's study used a systematic review approach to examine disability exceptions and web accessibility guidelines. The study focused on identifying accessibility-related issues, reviewing existing guidelines, and understanding the challenges associated with accessible information services. Its advantages include addressing an important knowledge and service gap, providing a structured review methodology, and combining insights from different areas. The major findings highlighted widespread non-compliance with accessibility requirements across library websites, common technical and design violations, and differences among

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accessibility evaluation tools. However, the study was limited by its time and database scope, its focus on library websites, and the exclusion of purely theoretical work.[1]

Hamideh Kerdar (2024): Hamideh Kerdar and colleagues conducted a scoping review to understand the digital accessibility challenges experienced by people with visual impairment and blindness. The study involved identifying the research question, selecting relevant studies, and organizing the collected findings. The authors searched two databases and reviewed additional sources, with 49 articles meeting the inclusion criteria. The advantages include a comprehensive understanding of accessibility challenges, consideration of users' experiences, and a structured framework for identifying barriers. The major findings revealed persistent accessibility failures, insufficient implementation of accessibility guidelines, and incompatibility with assistive technologies. However, the review primarily focused on visual impairment and blindness, depended on the available literature, and was subject to language restrictions. [2]

Hancy Rozetta and Jibi Mol K. (2025): According to the provided sample, this study used a survey method and focused on web image-description datasets and institutional inclusion literature from multiple countries. Its reported advantages include a broad overview of accessibility technologies, disability-specific frameworks, and alignment with institutional policies. The major findings presented in the sample concern the accuracy of modern speech-to-text tools, multimodal personalization, and the influence of institutional support on accessibility. The limitations include high computational and financial costs, a narrow focus on particular disabilities in individual studies, and environmental and technical dependencies. The exact title, dataset, and publication details of this study are not available in the photograph, so these details should be verified before the study is cited in a research paper.[3]

Sheela Paramasivam (2022): The provided sample identifies semi-structured interviews as the research method, with a focus on cognitive evaluation, organizational integration, and basic needs. The reported advantages include in-depth qualitative insights, consideration of multiple stakeholders, and the use of a theoretical framework. The major findings listed in the sample concern psychological and emotional stress, unfamiliarity with digital platforms, and effects on users' self-confidence. The

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limitations include a small sample size, geographical and disciplinary restrictions, and methodological constraints. Since the study's title and publication details are not visible in the photograph, the specific findings and reference information need to be confirmed before inclusion in the final paper.[4]

R. A. Oyekunle and H. C. Chukwura (2025): According to the sample, this study used surveys and interviews to examine digital accessibility challenges, assistive technologies, and e-learning. Its reported advantages include user-centred iterative development, attention to accessibility requirements, and practical implementation. The major findings listed in the sample suggest that the approach addresses e-learning accessibility gaps, receives positive user validation, and meets system requirements. However, the limitations include a small test sample, a basic technology stack, and limited coverage of different disability groups. The exact study title and publication details are not visible in the photograph and should be verified before the study is used as a formal academic reference.[5]

IV. System Architecture

The proposed accessibility-first digital platform is organized into five logical components. These components work together to provide an inclusive, user-friendly, and accessible digital experience for users with different abilities.

- User Interface Layer: Displays web pages, menus, forms, buttons, and accessible controls. It provides a simple interface that allows users to access information and services easily.
- Accessibility Settings Layer: Manages user preferences such as text size, contrast, and layout. These settings allow users to customize the interface according to their accessibility requirements.
- Interaction Layer: Handles keyboard input, supported voice commands, and other interaction methods. It provides alternative ways for users to navigate and interact with the platform.
- Application Logic Layer: Processes user actions and performs the platform's main functions. It connects the interface with the required services and ensures that requests are handled appropriately.

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- Data Layer: Stores information and user preferences when persistent storage is required. It enables saved accessibility settings and other necessary information to be retrieved when users return to the platform.

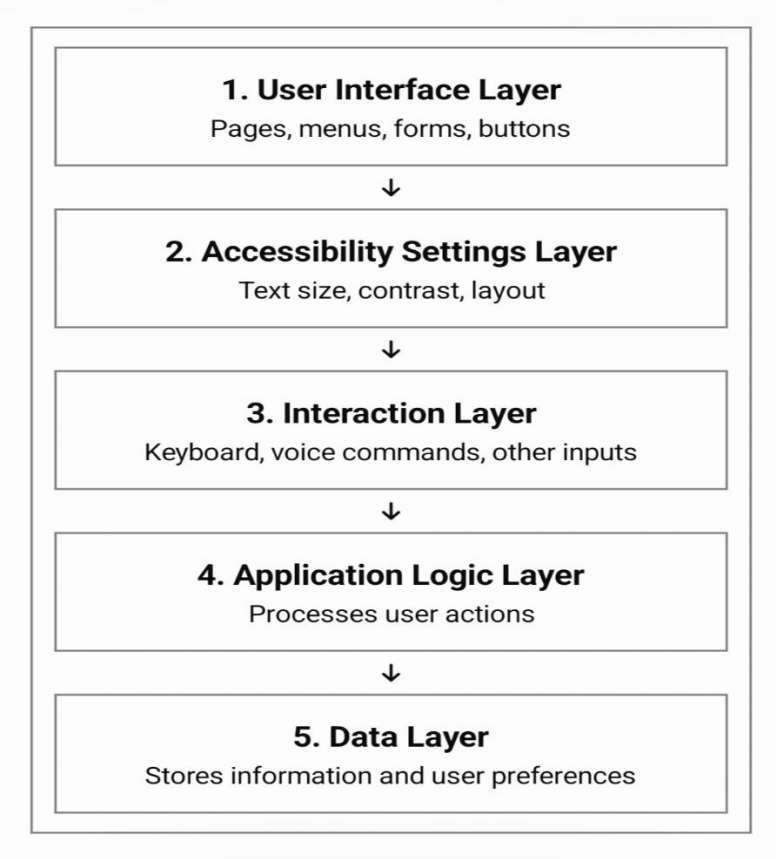


Fig 2

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V. System Workflow

The system workflow of the proposed accessibility-first digital platform describes the sequence of steps through which users interact with the platform and access information in an accessible format. The workflow begins when a user opens the platform and ends when the requested results are displayed according to the user's accessibility needs.

The workflow begins when the user opens the accessibility-first digital platform through a web browser or a supported device. The platform is designed to support users with different abilities, including visual, hearing, speech, and mobility impairments. Its main objective is to provide an interface that enables users to access information and services more independently.

After the user opens the platform, the interface loads and displays the available pages, menus, buttons, forms, and navigation controls. The interface is designed to be simple and understandable, helping users locate the required information without unnecessary complexity. Accessible labels and properly structured content can also help users navigate using assistive technologies.

Once the interface loads, the user can select accessibility preferences according to their requirements. These preferences may include adjusting text size, choosing a high-contrast theme, selecting a suitable layout, or using available navigation options. This customization allows users to make the platform more comfortable and convenient to use.

After the user selects the preferences, the system applies the corresponding settings to the interface. For example, increasing the text size makes the displayed text larger, while selecting a high-contrast theme improves the distinction between text and background. These adjustments help users interact with the platform more easily. If persistent storage is implemented, the selected preferences may also be saved for future visits.

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The user then navigates through the platform using the available interaction methods. Depending on the implemented features, these methods may include keyboard navigation, mouse or touch input, supported voice commands, and screen-reader-compatible controls. Providing multiple interaction methods allows users to choose the approach that best suits their accessibility requirements.

When the user selects a button, opens a page, submits a form, or requests information, the application logic processes the selected action. The system identifies the requested operation and performs the necessary processing. If additional information is required, the platform retrieves it from the appropriate data source and prepares the response.

Finally, the platform displays the requested results in an accessible format. The results are presented using the selected interface settings and supported accessibility features. Depending on the implemented functionality, users may access the information through readable text, keyboard navigation, or compatible assistive technologies. This workflow aims to provide a simple, inclusive, and user-friendly digital experience that helps people with different abilities access information and services more independently.

The system workflow represents the logical operation of the proposed platform. The final implementation may combine or separate these components depending on the technology stack and the accessibility features selected for development.

User opens the platform -> The interface loads → User selects accessibility preferences
→The system applies supported settings → User navigates through accessible controls
→The platform processes the selected action →Results are displayed in an accessible format.

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VI. Methodology

The proposed accessibility-first digital platform follows the Design Thinking Methodology, which consists of six stages: Empathize, Define, Ideate, Prototype, Test, and Iterate. This methodology focuses on understanding users' needs, identifying accessibility barriers, developing suitable solutions, and continuously improving the platform based on user feedback.

Empathize: In this stage, the needs and difficulties faced by people with visual, hearing, speech, and mobility impairments are understood. The focus is on identifying common digital accessibility barriers, such as small text, poor contrast, complex navigation, lack of screen-reader compatibility, and limited interaction methods. Understanding these challenges helps ensure that the platform is designed around users' actual requirements.

Define: The information collected during the empathize stage is used to identify and clearly define the main problem. The problem is that many digital platforms are not designed to support users with different abilities, making it difficult for them to access information and services independently. The project therefore aims to develop an accessibility-first platform that provides inclusive and user-friendly digital access.

Ideate: In this stage, different ideas are generated to address the identified problem. Possible solutions include adjustable text sizes, high-contrast themes, screen-reader compatibility, voice navigation, simplified layouts, and multiple interaction methods. These ideas are considered according to their usefulness, feasibility, and ability to improve accessibility for different users.

Prototype: A preliminary model of the platform is developed to demonstrate the proposed accessibility features. The prototype may include a simple home page, navigation menus, accessibility settings, text resizing controls, contrast options, and accessible buttons. This model helps demonstrate how users can interact with the platform before the complete system is developed.

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Test: The prototype is evaluated to determine whether its interface is understandable, usable, and accessible. Testing may include checking text readability, colour contrast, keyboard navigation, screen-reader compatibility, and the ease of using available controls. Feedback from users or evaluators can help identify problems and areas that require improvement.

Iterate: Based on the testing results and feedback, the prototype is refined and improved. Difficult navigation, unclear labels, inaccessible controls, and other identified issues are addressed. The testing and improvement process can be repeated until the platform provides a more accessible and user-friendly experience.

Conclusion: The Design Thinking Methodology provides a structured and user-centred approach to developing the accessibility-first digital platform. By progressing through these six stages, the project focuses on understanding user needs, generating practical solutions, developing a prototype, evaluating its accessibility, and continuously improving the design.

Implementation

The accessibility-first responsive web application was developed using Lovable to demonstrate how accessibility features can be integrated into a digital platform. The application is designed to provide a user-friendly interface that adapts to the needs and preferences of users with different abilities.

User Login and Accessibility Profile

Users can log in to the platform and create a personalized accessibility profile based on their individual needs. The profile allows users to select suitable accessibility settings, helping the platform provide a more comfortable and convenient experience.

Adaptive User Interface

The interface includes accessibility options such as high-contrast mode, large text, dark mode, and Easy Read mode. These features aim to improve readability, make content easier to understand, and provide a clearer interface for users with different visual and cognitive needs.

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Assistive Features

The application includes voice navigation, text-to-speech, speech-to-text, and screen-reader support. Voice navigation helps users interact with the platform using supported voice commands. Text-to-speech converts written content into spoken output, while speech-to-text converts spoken words into text. Screen-reader support helps users with visual impairments access interface information through compatible assistive technologies.

Backend and Data Management

The backend is designed to store user profiles and accessibility preferences. It also includes caregiver access to support situations where users choose to involve a caregiver. Appropriate access controls are important to protect personal information and ensure that user data is accessed only by authorized people.

AI-Based Assistance

The platform includes AI-based accessibility suggestions and simple-language assistance. These features aim to help users understand information more easily and identify settings that may improve their experience. The usefulness and accuracy of these AI features should be evaluated through testing.

Testing and Accessibility Evaluation

The application is intended to be evaluated through keyboard navigation, screen-reader testing, and accessibility checks based on the Web Content Accessibility Guidelines (WCAG) 2.2. These checks can help identify issues related to navigation, readability, interface structure, and assistive technology compatibility. Actual compliance should be confirmed through appropriate testing rather than assumed from the presence of accessibility features.

Application Deployment

The application is deployed online and can be accessed through the following link:
Website: Inclusive Access Platform
https://inclusive-access-platform.lovable.app/

Fig 3

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VII. Results and Discussions

The proposed accessibility-first digital platform aims to demonstrate how accessibility features can be included in website design and interaction.

The platform is expected to improve the readability of digital content through adjustable text sizes and suitable contrast settings. It is also expected to make navigation easier for keyboard users and provide a clear, user-friendly interface for people with different abilities.

Screen-reader compatibility can help users with visual impairments access digital information. Multiple interaction methods can also reduce dependence on using only a mouse or touch screen.

Overall, the platform aims to promote inclusive digital experiences and make online information and services easier to access. The actual effectiveness of these features should be evaluated through testing and feedback from users with different accessibility needs.

Advantages and Limitations
Advantages

- Improved Accessibility: Helps people with visual, hearing, speech, and mobility impairments access digital services more easily.
- User-Friendly Interface: Simple layouts and easy navigation improve the user experience.
- Customizable Settings: Users can adjust text size, contrast, and themes according to their needs.
- Multiple Interaction Methods: Supports different ways of interacting with the platform, such as keyboard navigation and voice commands.
- Screen-Reader Support: Helps users with visual impairments understand digital content through compatible screen read ers.
- Greater Independence: Enables users to access information and services with less assistance from others.

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- Inclusive Design: Promotes equal access to digital information and technology.

Limitations

- Voice Recognition Issues: Background noise and different accents may affect voice recognition accuracy.
- Browser Compatibility: Screen-reader support may vary across browsers and assistive technologies.
- Third-Party Content: Some external content may not be fully accessible.
- Layout Problems: Changing text sizes or themes may affect the website layout if not tested properly.
- Hardware Integration: Specialized devices, such as refreshable Braille displays, may require additional development.
- Different User Needs: One set of accessibility features may not meet everyone's requirements.
- Testing Challenges: Automated tools alone cannot identify every accessibility issue, so manual testing and user feedback are necessary.

Future Scope

The proposed accessibility-first digital platform can be improved in the future by adding more features to support people with different abilities.The platform can support multiple languages to help users access information in their preferred language.AI-powered voice assistance and text-to-speech features can be introduced to make navigation and information access easier.

Braille display compatibility and improved support for assistive technologies can be added to help users with visual impairments. The platform can also be developed as a mobile application to provide easy access through smartphones and tablets.

In the future, it can be integrated with educational, healthcare, and government websites to improve digital accessibility across different services. Regular testing and user feedback can help identify problems and improve the platform's usability, security, and accessibility.

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Overall, these improvements can make the platform more inclusive, user-friendly, and accessible to everyone.

VIII. Conclusion

Technology plays an essential role in enabling access to information, services, education, communication, and opportunities. However, its benefits can only be truly inclusive when digital platforms are designed to accommodate users with diverse abilities. Ultimately, accessibility should not be treated as an additional feature, but as a fundamental principle of digital design.

The proposed accessibility-first digital platform aims to reduce digital barriers faced by people with visual, hearing, speech, and mobility impairments. By incorporating features such as adjustable text sizes, high-contrast themes, screen-reader compatibility, voice navigation, simplified layouts, and multiple interaction methods, the platform seeks to make digital information and services easier to access. The use of a user-centred Design Thinking Methodology helps identify users' needs, develop suitable solutions, and improve the platform through testing and feedback. Overall, this project promotes inclusive digital design, greater independence, and equal access to technology. With further development and evaluation, the platform has the potential to provide a more accessible, user-friendly, and inclusive digital experience for everyone.

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