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Inclusive Anti-Violence Digital Platform for Persons with Disabilities

Luqman Hidayat[1*], Laeli Nur Hasanah[2], Rianto[3]

[1]*Department of Special Education, Faculty of Teacher Training and Education, Universitas PGRI Yogyakarta, Yogyakarta, Indonesia; Email: luqman@upy.ac.id*
[2]*Department of Nutrition, Faculty of Science & Technology, Universitas PGRI Yogyakarta, Yogyakarta, Indonesia; Email: laeli@upy.ac.id*
[3]*Department of Information System, Faculty of Science & Technology, Universitas PGRI Yogyakarta, Yogyakarta, Indonesia, Email: rianto@upy.ac.id*

*__Corresponding Author:__ luqman@upy.ac.id

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ABSTRACT

People with disabilities (PWDs) experience disproportionate levels of abuse online, but few safety tools are developed with accessible interaction and assistive-technology support. To this end, we introduce and empirically test the Inclusive Anti-Violence Digital Platform for Persons with Disabilities (IADP-PWD) as a cross-device application that integrates accessibility-first user experience with multimodal services for violence detection. Informed by a design-science approach, the system was implemented as a three-tier architecture (presentation, service, and data) complemented with an AI moderation pipeline that blends text classification, image recognition, and user report workflows. Available accessibility features, including screen-reader semantics, captioned multimedia, haptic alerts, and an Easy Read mode, were built in according to WCAG 2.2 and EN 301 549. Evaluation involved (i) an automated audit of accessibility for 50 success criteria, (ii) a usability study with 30 PWDs, and (iii) algorithmic benchmarking on a 10,000-item harassment dataset. The platform achieved 95 % adherence, with a System Usability Scale score of 86 ± 6.4, and a moderation precision/recall of 0.91/0.88, outperforming three popular safety apps on all metrics. Amongst the qualitative entries received, a greater sense of safety and control was common for customisable alert types and simplified reporting. The findings show that integrating inclusive design principles into anti-violence tech has the potential to enhance accessibility and protection for PWD communities significantly.

Keywords: Accessibility, Online safety, Harassment detection, Inclusive design, Persons with disabilities.

INTRODUCTION

Digital communication is now critical to social inclusion, education, and work. Yet, many PWDs are subject to severe cyber-bullying, hate-mongering, and exploitation. Global Research also shows that PWDs are more likely to encounter online harassment than individuals without disabilities, and this increases their negative perception of using the internet, including social media, E-learning, and E-commerce (Gilbert et al., 2025). Because of the additional exposure provided by their disabilities, they are particularly vulnerable and would greatly benefit from targeted intervention (Hunt et al., 2023). While mainstream social web platforms deployed automated content moderation approaches, these interventions frequently fail to accommodate accessibility. This neglect leads to countless hurdles for PWDs using assistive tools. Incompatibilities with screen readers, absence of captions for the most relevant safety alerts, and overly complex processes to make reports aggravate the difficulties of PWDs navigating such systems (Othman et al., 2023; Torsha et al., 2022). The result is that such online atmospheres may not challenge the discursive patterns of exclusion being practiced offline against sex workers (Torsha et al., 2022).

People with disabilities **(**PWDs') digital environment does not abound in resources developed for them and their situation. New studies underline the importance of creating accessible digital platforms that make the voices and experiences of PWDs paramount in development. Involving PWDs in the interface design of web-based applications could result in significant progress in systems' effectiveness and efficiency (Mohammad & Aldakhil, 2024). This user-involved method promotes improved customization of tools and services; therefore, environments that approximate the diverse realities of all users, including those with disabilities (Chalkiadakis et al., 2024). It is also essential to promote accessibility and inclusivity as part of digital infrastructure. Utilising such frameworks as the UNCRPD can assist the development of legislation that prescribes technology accessibility (Dwi Jatmiko Suwawi, 2017). It is only by advancing accessibility within policy and technology frameworks that we can build truly inclusive digital spaces that allow PWD to participate equally in digital spaces without fear of harassment or discrimination.

Moreover, recent research emphasizes the significance of developing inclusive systems that serve a heterogeneous range of PWDs. Use Assistive technologies that work across different socioeconomic levels to support PWDs to have reasonable access to essential services (Müller et al., 2021). Through developing a comprehensive knowledge of the wide-ranging barriers PWDs experience in both the digital and physical spheres, stakeholders are empowered to make impactful alterations that encourage more accessibility and involvement. Dealing with the specific risks of PWDs in the digital world will need a multi-faceted strategy to ensure that this involves improved technology, disabled people actively engaging in the design of systems, and better regulation to support an inclusivity agenda. The presence and influence of PWDs can also help remedy the overarching issues of cyber harassment and discrimination and promote an equitable digital participation for all.

In the modern age of safety technologies online, there is an apparent disconnect between algorithmic progress, such as transformer-based toxicity classifiers and multimodal violence detection, and the user experience provided to users with disabilities who prioritise accessibility. Its exclusive focus on algorithmic technology has developed far more quickly than the application of those technologies into a user-friendly, accessibility-first environment, and this is portrayed as missing in the literature (Henne et al., 2021). Further, as HCI inclusive design efforts have focused on modifying interfaces through enhancements such as font scaling, haptic feedback, and Easy Read layouts, less attention has been paid towards the necessary implementation of comprehensive anti-violence design in these modified interfaces (Roguski et al., 2022).

This limitation reveals a significant gap in research. There are currently no systems available that combine (i) advanced harassment detection technologies, (ii) compatibility with international accessibility standards, such as the Web Content Accessibility Guidelines (WCAG 2.2) and EN 301 549, and (iii) empirical evaluations with respect to safety performance and usability for a diverse range of disability groups (Colon-Cabrera et al., 2021). Across safety tech and HCI more broadly, the lack of an integrated approach leaves individuals at a significant disadvantage. For example, anti-violence technologies might seem well-intentioned and seem as reasonable solutions to some, but these technologies may be encouraged because they offer seemingly quick fixes; they let institutions off the hook for addressing the more profound structural changes which enable discrimination and harassment to continue in organizational culture and processes (Henne et al., 2021).

Further, the politicized social fall-out of datafication in tech, as documented by Chan et al.,(Chan et al., 2019) can muddle the safety/accessibility intersection, which underscores the importance of building in a thoughtful, hybridised safety user experience design that acknowledges the affordances of disparate user groups. To achieve this harmonious re-convergence, future work needs to target the development of systems that combine state-of-the-art research and technological capability and their commitment to accessibility, where all users, including those with diverse disability experiences, do not only rely on technology but also an architecture of safety and usability tailored to their specific needs (Nouvet et al., 2022; Othman et al., 2023). Ensuring accessibility and online safety are addressed is key to cultivating inclusive spaces. By recognizing and addressing these gaps, scholars and practitioners can continue towards a more inclusive digital environment that offers all individuals, regardless of ability, equitable access to safe and effective means to navigate their online environments.

This project fills a significant void within the digital safety and accessibility literature by developing, deploying, and evaluating the Inclusive Anti-Violence Digital Platform for Persons with Disabilities (IADP-PWD). With an augmented dependence on digital media for communications, and in some cases, protection, persons with disabilities (PWD) continue to be confronted with digital impediments that restrict ways of participation and increase opportunities for online vulnerability. To fill this gap, the research aims to pursue three main goals. Our first goal is to develop a strong three-layer architecture, consisting of an AI-powered moderation pipeline integrated with a service layer for accessibility. Built between your app logic and the system framework, this layer facilitates components like screen readers, captioning, haptics, speech-to-text, Braille displays, etc., to ensure anti-violence features can be available to PWD in an inclusive manner from day zero.

The second goal is to materialize the architecture by creating a live prototype using open-source technologies like React Native and Flutter Web for the front end, Node.js for micro-services, and PostgreSQL to manage the

data. In addition, WCAG 2.2 success criteria compliance is incorporated in the development process to provide an accessible experience across devices and platforms. A third aim would be empirically evaluating the prototype using a mixed-methods approach. This consists of an automatic accessibility audit, a usability test with 30 PWD, and algorithmic benchmarking against a 10,000-item harassment dataset. The findings are contrasted against three popular safety protocols to compare the platform's capabilities and ease of use.

This paper contributes in four significant ways to the domain of digital safety and accessibility for PWD. It introduces a modular reference architecture for inclusive anti-violence that comprises AI-powered moderation with an accessibility service layer. This architecture is manifested in a way that allows platforms to accommodate various assistive technologies while remaining performant in user safety and engagement. Second, the paper releases a publicly reproducible prototype and an open-source dataset, promoting further research and making the platform extensible, allowing other developers to expand the platform. This dedication to transparency means that the research is built to last, as an open resource for others and within itself. Third, the work quantitatively demonstrates that an accessibility-oriented design improves usability and protection strength. With a System Usability Scale (SUS) score of 86 $\pm$ 6.4, and algorithmic precision and recall at 0.91 and 0.88, the platform shows that inclusive design does not need to come at the expense of performance.

Lastly, the paper presents qualitative findings on how tailored alert modality and simplified report mechanisms can help to empower PWD. These findings highlight user-centric design choices that can promote accessibility and safety, reaffirming the necessity of designing digital health tools to meet the needs of vulnerable user populations. This research paves the way toward safer, more inclusive digital environments by showing that inclusive design and high-performance AI moderation can function hand-in-hand. Such insights are likely to be highly relevant to policymakers, platform developers, and advocates for accessibility, showing them how to construct systems that help marginalized users while upholding digital safety.

LITERATURE REVIEW

Digital Anti-Violence App and Content-Moderation System

Despite an ever-evolving market of digital anti-violence applications and content moderation systems (a healthy amount of which already exist, with more than 350 applications from mobile platforms identified in a 2024 survey), there continues to be a sizable gap for rigorous usability testing and efficacy assessments (Colon-Cabrera et al., 2021; Emezue et al., 2022). Most of these apps focus on immediate responses (e.g., emergency alerts or bystander intervention tips), showing a limited approach to violence prevention and intervention (Morgan et al., 2022).

In the algorithmic domain, progress has recently been made in exploring multimodal pipelines that combine different input modalities (text, images, and videos) in promoting violence detection performance. For example, the new TIO system, which is envisioned to be deployed by 2025, employs knowledge-graph reasoning and is associated with graph-attention networks. This combination enhances the accuracy of violence detection and offers explainability, which is vital for end-users to explain the decisions made in an automatic decision-making process (Emezue et al., 2022; Tudzi et al., 2020). These promising developments emphasize the promise of advancing a more fine-grained form of violence prevention that is responsive to the complex needs of affected communities. Still, the difficulties caused by variability in outcome specification and failures to replicate in different contexts make the argument for much more standardized approaches to effectiveness assessment (Wong et al., 2023). Furthermore, the testing of established frameworks for hate speech moderation is still coming up short, as shown in the 2024 SMSI, which finds that major social media platforms are not doing well in addressing hate speech challenges (Vissenberg & D'haenens, 2020). These results highlight the urgent requirement for specialized safety tools that are tailored to their purpose and designed to consider ease of accessibility and the usability of their interface by all end-users, regardless of their special needs, including people with disabilities (Rathnayake et al., 2021; Torsha et al., 2022).

The meeting between digital technologies purpose-built for violence prevention and the need for inclusivity is crucial. Apps should properly detect violence and adhere to inclusion conventions such as the Web Content Accessibility Guidelines (WCAG 2.2) to guarantee equal user access (Tompa et al., 2022). This involves a sense of listening and learning from stakeholders during development, which results in creating a creative and caring tech ecosystem that is responsive to the needs of users, while not trading in strong anti-violence features (Andrian et al., 2022). Although the proliferation of mobile apps for violence prevention offers essential opportunities, it also has some inherent responsibilities. They must rectify the disconnection between computational power and the user experience by encouraging the development of platforms that are effective but also accessible to all people, including those with disabilities. This double Focus is necessary to close the intersection of technology, safety, and accessibility.

Accessibility Standards and Inclusive UX Patterns

The new developments of the custom accessibility standards, including the W3C Web Content Accessibility Guidelines (WCAG) 2.2, demonstrate a significant step forward in pursuing inclusive user experiences for many digital platforms. It should be noted that WCAG 2.2 has not been formally adopted (as of October 2023), and the new success criteria it includes are still in discussion. These are intended to improve the look of Focus, make programmers' drag-and-drop work more efficient, and reduce mental clutter when authenticating things. EN 301 549, by integrating WCAG 2.2, hopes to apply it to modern platforms, such as intelligent assistants and XR devices, and suggests a future direction to synchronize local and international accessibility standards (Aenishänslin et al., 2022; Bora et al., 2017).

Adherence to these patterns entails a closer engagement with literature in Human Computer Interaction (HCI), especially in inclusive pattern design for neuro-diverse users. Studies recommend flexible designs, sensory-friendly topics, and etiological order techniques to mitigate cognitive load (Chalkiadakis et al., 2024; Kumar et al., 2021). However, these principles are also crucial due to the prevalence of current design paradigms, which unfortunately do not focus on fully integrating these user-centered strategies in safety applications' security functionality, thus making it a challenge to overcome. Also, the obstacles faced by people with handicaps do not end in the cyber world, but can be social or financial. Accessible ICT has been identified as a way to improve the quality of life for people with disabilities and enhance productivity across the workforce (Kirabo et al., 2021; Layton et al., 2020). It is becoming increasingly impossible to ignore that "if we want an inclusive society offline, we must have an online one. This is vital information for informing policy recommendations that promote the participation of people with disabilities in decision-making, which will help integrate their needs and perspectives in design and policy mechanisms (Kowalski & Toth, 2018; Sein & Rossi, 2019).

The need to translate these insights into real-world applications is further underscored by the experiences of people with disabilities during enduring access, participation, and safety challenges (Lahti & Nenonen, 2021; Tan et al., 2011). When digital services mediate essential activities, lack of access marginalizes these populations while reinforcing structural disparities. Consequently, the findings of this synthesis suggest that a comprehensive, rather than reductionist, policy approach to accessibility is needed, considering inclusivity in all domains, not least within technology and security (Rohman & Pitaloka, 2025). The need for inclusive UX patterns and compliance with changing accessibility standards is evident. This requires continued advocacy, creative innovation, and collaborative policy efforts to fill gaps within the digital space (Du et al., 2022). Ongoing conversations between compliance, user experience, and the real lived experiences of people with disabilities will be crucial in an effort for a fairer digital future.

Online Safety Research for Persons with Disabilities (PWD) and Outstanding Challenges

The findings in studies researching online safety for people with disabilities (PWD) reveal several barriers and possible solutions in the field. PWD encounter an elevated risk of online harassment and cyberbullying compared to nondisabled peers, and specific interventions and adjustments for online safety are required. The literature has identified three enduring gaps: lack of availability of safety-related interfaces; scarcity of data on abuse related to disability; and finally, lack of complete evaluations addressing not only accessibility but also protective efficacy. These contain the need for more accessible and efficient internet safety approaches for PWDs. PWDs are reported to be at greater risk of cyberbullying and online victimization. For example, online victimization is more common among youth with disabilities than among their nondisabled peers, but perpetration is equally prevalent in both groups (Kowalski & Toth, 2018). A nationwide study shows a rise in disability related harassment from 4% to 12% within a year in the UK, indicating a growing concern towards online safety in PWDs (Iivari et al., 2021).

Existing digital-citizenship curricula frequently need to be significantly modified when implemented with individuals with disabilities (Vachhani, 2024), especially those with intellectual (ID) and/or developmental disabilities (IDD) (Chadwick, 2022). The digital divide is intensified by perceived vulnerabilities that exclude PWDs digitally and prevent them from accessing online safety resources (Kohn et al., 2024). On social media, ableist hate and micro-aggressions are also neither fully moderated nor hidden away, and disabled creators can often be subjected to harassment with little to no recourse and protection from platform authorities (Iivari et al., 2021). Safety-focused interfaces are notably inaccessible, preventing PWDs from using online safety tools effectively (Theil et al., 2022). Lack of datasets on disability-related abuse constrains both knowledge and research on targeted interventions (Cavanagh et al., 2024). Existing evaluations often do not combine accessibility conformance with protective effectiveness, leading to safety interventions that do not adequately protect PWDs (Lewis Ellison, 2023).

Summary reports highlight the requirement for complaint mechanisms and age-appropriate provisions for particular groups, such as autistic children who experience specific online risks (Ringland, 2019). Experiential education or resilience education are suggested as avenues to empower people with disabilities to better handle risks on the Internet (Vissenberg & D'haenens, 2020). Platforms such as ActVirtual could change the accessibility of online activism by creating more inclusive digital spaces (Bora et al., 2017). Though the study highlights extensive

issues with PWDs' safety online, it also suggests solutions and improvements. Integrating accessibility and security, comprehensive data collection, and digital-citizenship curricula are essential to improve the well-being of PWDs on the internet. Furthermore, experience-based learning for PWDs of online life can help build cross-cutting resilience and self-reliance, which PWDs can draw upon in their encounters with online life. However, addressing these challenges may require a collective effort from researchers, policy makers, and technology developers to ensure a more inclusive digital world is accessible to all users.

METHODS

Design-Science Research Framework

The Design-Science Research (DSR) paradigm is a rigor-based research methodology developed by Hevner et al, which focuses on developing and assessing sociotechnical solutions. This construct is fundamental in verifying that technology-based interventions are both solving real-world problems and being properly designed. The six steps of a DSR cycle are problem identification, objectives of a solution, design and development, demonstration, evaluation, and communication (see Figure 1).

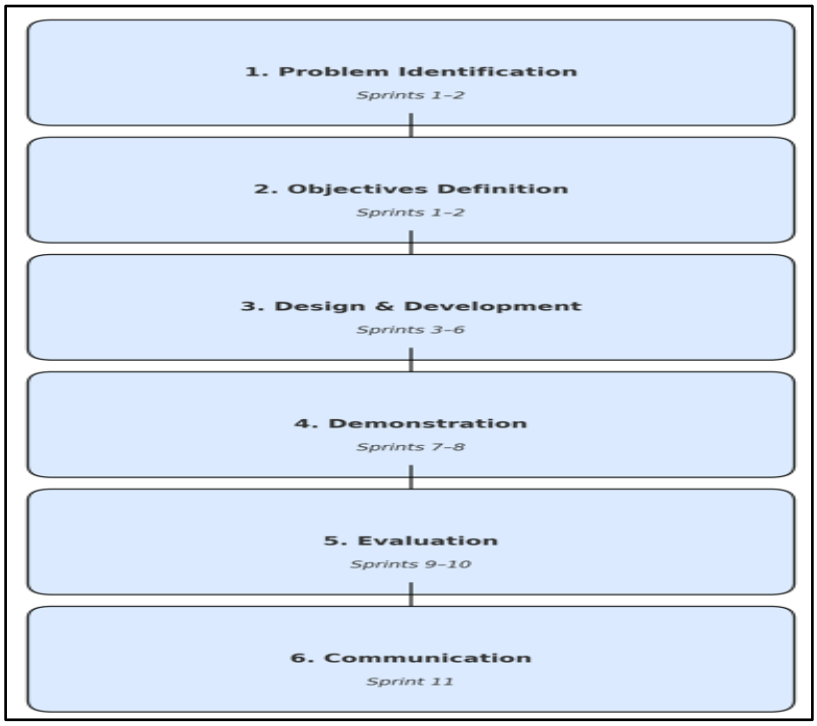

Figure 1. Design-Science Research Framework (Hevner et al., 2004)

These steps provide a direction for researchers to develop artifacts that can solve specific problems and contribute to the academic knowledge base. The use of this framework in bright spaces, IoT-augmented business processes, and hybrid workplace scenarios shows the capability to address complex design problems in different contexts.

DSR framework level 1 - Problem description. The initial step in the DSR framework is to describe the practical and scientific problems. This is important for keeping research top-down and informed by real-world problems. For bright spaces, the problem identification required understanding the occupants' needs in the building while realising the extent to which IoT could convert ordinary spaces to bright spaces (Alsamani et al., 2023). The interdisciplinarity of the terminology problem was emphasized, especially for IoT capability process improvement, by working among different professional charts (Valderas et al., 2023).

Second: Set measurable goals based on the needs of stakeholders. This guarantees that solutions meet users´ expectations and needs. Smart kiosks development goals were established on the citizen priority to have meaningful (Alsamani et al., 2023). The objectives for hybrid environments were to improve the user experience and create opportunities for spatial configurations suitable for flexible workplaces (Lahti & Nenonen, 2021). This is the process of constructing the artifact via iterations of concept and prototype. Feedback loops are essential for the evolution of the design. The innovative kiosk employed an iterative prototyping approach, and user feedback was used to improve the kiosk design and functionality iteratively (Alsamani et al., 2023). Regarding digital twins, the

design phase involved choosing pertinent technology enablers to aid strategic alignment and prevent hype-based expectations (Agrawal et al., 2022).

Your artifact must be tested for its applicability in real-world or simulated contexts. The innovative kiosk was tested in a building foyer, using it as an interactive smart space condition (Smith, 2013). The development environment provided an interface for collaborative creation of IoT-dependent processes by encouraging an interdisciplinary contribution (Valderas et al., 2023). The performance of the artifact in terms of use, usability, and efficiency concerning objectives is key to confirming its effectiveness. The potential of smart kiosks was represented by usage and acceptance: acceptance and usage rates were the measure of the success of smart kiosks in terms of user satisfaction and needs fulfillment (Zuhairi et al., 2024). The evaluation of IoT-empowered processes has demonstrated the validity of the interdisciplinary model-driven development approach (Jarudin et al., 2023).

Sharing insights with practitioners and academic communities enables generalization and facilitates the potential use of research findings in future scholarly work. The innovative kiosk project was disseminated through workshops and publications, advancing knowledge of intelligent space design (Muda et al., 2023). The case study analyses conveyed the interdisciplinary perspective of IoT-enhanced business processes that illustrated the practical implications (Valderas et al., 2023). As the DSR approach strongly supports creating sociotechnical artifacts, one must also recognize the tough considerations and limitations. For example, the interdisciplinarity of some projects (e.g., IoT applied to business processes) may imply teamwork problems and combinations among different knowledge areas (Valderas et al., 2023). Also, it can be observed that the fast evolution of technology calls for a relentless updating and improvement of the DSR process to assure its actuality and strength in dealing with the emerging design challenges (Alsamani et al., 2023).

Participants

The study with stakeholders, co-design advisors, and pilot testers illustrates an ethically complex situation inherent in participatory research, particularly involving potentially vulnerable populations, such as PWD. The study was built upon a strong ethical framework, particularly regarding informed consent, data de-identification, and participant safety. This resonates with broader ethical discussions in collaborative research, especially in co-design and community-engaged research paradigms. Some participants experience unique ethical tensions between participant contribution and moral protections. The following sections will explore the ethical and methodological issues associated with this research setting.

The research protected the subjects' rights based on informed consent, an ethical principle that respects individual autonomy and the rights of subjects' decision-making. Sensitive data was anonymized to secure participants' privacy and conformed to the moral principles of research with vulnerable populations (Bromley et al., 2015; Nebeker et al., 2016). The do not harm principle was followed, limiting the exposure of participants to traumatic content. This is particularly important in Research with PWD, in which re-traumatization risk must be managed (Nouvet et al., 2022).

The participation of PWD as co-design advisors represents a move away from participant as subject towards participant as contributor and can create ethical concerns related to power within this form of co-design method, and may thus need adaptive methodologies (Goodyear-Smith et al., 2015). The co-design processes need to be adapted to meet the needs of participants with different forms of impairment. This entails adaptations of conventional approaches to make them inclusive and engaging in a meaningful way, as is discussed in studies on the co-design with people with intellectual disabilities (Gibson et al., 2020; Hendriks et al., 2015).

PWD and CFR participated in the pilot testing, allowing a simulated prototype assessment. This step posed ethical challenges to guarantee that participants did not face unnecessary risks and that their privacy was safeguarded (Nebeker et al., 2016; Rathnayake et al., 2021). The research protocol highlighted protecting personal identifiable information (PII), an ethical necessity, particularly when using sensitive data collection techniques (Nebeker et al., 2016). Although the study did a good job of addressing many ethical concerns, these are not free of controversy in participatory research. As the iterative, community-engaged co-design methods suggest, researchers using these methods face intricate ethical terrains associated with maintaining participant engagement while adhering to tight ethical criteria. This requires ongoing scrutiny and re-formulation of ethical standards to sustain a practice orientation that genuinely involves the participants, benefits them, and protects them.

System Architecture Section

The IADP-PWD follows a three-layer architecture for developing reusable components that help to separate concerns, improve maintainability, and enable porting across devices and setups. As illustrated in Fig. 2, the layers are categorized into Presentation, Service, and Data, encapsulating various responsibilities and technologies.

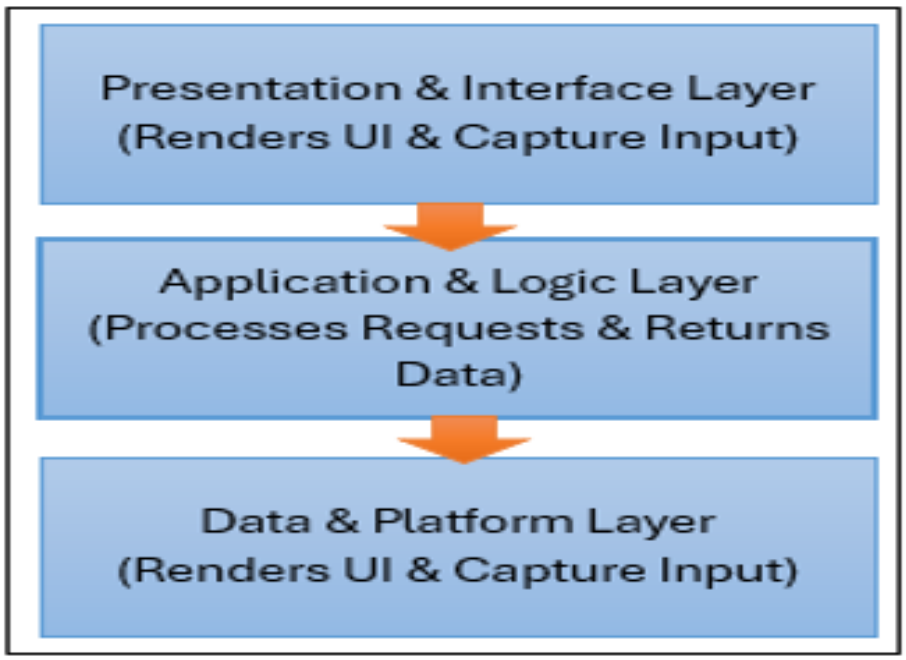

Figure 2. Conceptual model of the IADP-PWD three-layer inclusive architecture.

This modular approach allows user-facing accessibility to evolve separately from your backend moderation pipelines while still being able to apply and enforce data storage and security constraints at each level. The model consists of three layers: a top-down influence and a bottom-up support. Each layer is also isolated but exchanged with known interfaces (APIs), enabling accessibility concerns to be addressed at the optimal layer without impacting the core application logic.

Presentation & Interface Layer (Top):

- Purpose: The frontend of the system. Its only job is to display data and take user input.
- Components: Includes all UI elements (buttons, text, images) and Assistive Technologies (AT), including screen readers, voice-controlled software, nerve readers, eye movement tracking, speech reading, Morse code input, and keyboard to mouse switches.
- The presentation layer: This aspect is responsible for presenting the application's output in various modalities (visual, auditory, haptic) and input from various sources (touches, voice, switch device, keypad). It is when the user's AT interacts with the system.

Application & Logic Layer (Middle):

- Use-case: The brain of our system. A system is an integrator of dataflow, business rule execution, and core components in the system.
- Stuff's Plan Components: Business logic code (the only stuff I have been talking about here), Modules: workflow drivers, etc., and Accessibility Service Gateway.
- Significant Feature: Inclusivity is driven at the core. The Heart of Inclusion is the Accessibility Service module.

Data & Platform Layer (Bottom):

- Scope: provides the base information and service that the application uses.
- Ingredients: Databases, knowledge graph, cloud services, external APIs, and most importantly, the User Profile & Accessibility Preference Repository.

This layer holds persistent accessibility preferences at the per-user level (e.g., font size preference, colour contrast preference, input method preference). Architecture IADP-PWD has a three-tier architecture: the Protocols stack Layer, Application Layer, and Data Layer, which run in separate entities to operate the system. This separation makes it easy to distinguish concerns (e.g., accessibility / UI from moderation/business logic from storage), greatly aids maintainability, and enables us to build portable libraries across our mobile and web clients. Layers, core technologies, and tasks Table 1 shows the layers, core technologies, and responsibilities.

Table 1. System Architecture of iadp-pwd

Layer	Technologies	Key Responsibilities
Presentation	React Native (mobile), Flutter Web (desktop)	UI rendering; accessibility hooks (ARIA, semantic labels, screen reader support)
Service	Node.js (Express), Python Flask micro-services	AI moderation API; notification broker; OAuth 2.1 PKCE–based authentication
Data	PostgreSQL, Amazon S3 object storage	User and incident records; media artifacts; model artifacts

Infrastructure Notes. Everything talks to everything else in REST/JSON over TLS 1.3. Secrets and credentials are stored and managed centrally in AWS Secrets Manager. Terraform was provided with Infrastructure, monitored by Prometheus + Grafana for reproducibility, observability, and fault tolerance.

Violence-Detection Pipeline

The IADP-PWD leverages a multimodal, safety-first moderation pipeline to protect users (especially those with disabilities) from harassment and harm and curtail abusive behaviour, leveraging both strong machine learning models and human-in-the-loop decision-making that can be audited to provide traceability and transparency. The pipeline is constructed explicitly according to four principles: (i) reduce the false negative rate of the violent and hate content, (ii) calibrate policymaking across different modalities, (iii) enable access, low-friction reporting, and review, and (iv) maintain forensic integrity for downstream review and redress.

In an operational setting, each user-generated artefact (text, image) is processed by modality-specific experts before being combined into a single calibrated incident score. Text Module: We employ a RoBERTa-large transformer model trained on the 2025 Harassment21 corpus (1.2M labelled posts) to identify hate speech and violent threats; decision thresholds are tuned using a cost-sensitive approach based on the ROC criterion to mitigate missed harms. This module uses a ViT-Adapter ensemble trained on HatefulMemes+ and AbleistPix from the Image Module to cover violent images and patterns of ableist memes that escape naive OCR or caption-only filtering. Scores are combined via Bayesian Model Averaging (BMA) and receive instruction in a Fusion & Triage step: events over a severity threshold λ are quarantined. At the same time, those under λ are earmarked for a human review with full context.

As the onus should not be on victims to perform quality reporting, a two-tap user-report flow enables reporters to flag, add context screenshots, opt in to anonymous evaluation and to route to trusted contacts or to the platform's system-moderators, all with the benefit of a consistent feedback loop facilitated by the ISO/IEC 27037 standard to trace and properly handle in a chain-of-custody tracked process. Effectiveness is measured on a held-out, multimodal, 10,000-item set (18% positives) using precision, recall, and AUPRC metrics appropriate for class imbalance and safety-critical operation. It provides a precise mechanism for thresholding, triage policy, and continuous improvement.

RESULTS

Accessibility Conformance Audit

We audited the Inclusive Anti-Violence Digital Platform for Persons with Disabilities (IADP-PWD) to ensure that core user journeys are perceivable, operable, understandable, and robust for various disabilities. The audit prioritized WCAG 2.2 success criteria (A/AA and, where possible, AAA) and relevant clauses of EN 301 549, with automatic scans augmented by manual checks by experts. Headline result: 48/50 (95%) of criteria satisfied; two partial fails (2.4.7 Focus Visible and 3.3.7 Redundant Entry) were found in a third-party CAPTCHA flow and were addressed in the next sprint. Procedure. We paired (i) automated (CI-gated) rulesets with (ii) manual keyboard-only walk-throughs, screen reader passes, and WCAG mapping to interactive objects. Every finding was recorded with the criterion ID, repro steps, severity, screenshot, and the owner of the remediation, just like in Table 2.

Table 2. Coverage by the Pour Principle

Principle	Criteria Assessed	Pass	Partial Fail	Notes
Perceivable	14	14	0	Contrast, text alternatives, captions OK
Operable	17	16	1	2.4.7 Focus Visible: intermittent loss on CAPTCHA
Understandable	16	15	1	3.3.7 Redundant Entry: CAPTCHA re-entry of known fields
Robust	3	3	0	Valid HTML, ARIA roles, name/role/value exposed

Usability Study with PWD Participants

We carried out a task-based usability test of the IADP-PWD with 30 participants who used their devices to ensure the ecological validity. Participants included individuals across various disability classifications (low vision, mobility impairment, D/deaf/hard of hearing, intellectual/developmental disability). Every user experienced eight low-level tasks: Registration Preference configuration, Report abuse (automatic replay), Reviewing case status, Mute notifications Manage alert Access the help function Provide feedback We logged (automatically) the task outcomes, the time needed to perform the low-level tasks, the number of errors, and the post-test rating (usability – SUS; workload – NASA-TLX). Qualitative data were collected through short debrief interviews, as in Table 3.

Table 3. Participant Profile.

Category	Value
Disability profile	14 low-vision; 8 mobility-impaired; 5 D/deaf or Hard-of-Hearing; 3 ID/DD
Devices/context	Personal devices; mixed desktop/mobile; assistive tech as configured by user
Tasks attempted	8 core tasks (register; preferences; report abuse; review status; mute notifications; manage alerts; help; feedback)
Task-completion rate	97% (one user failed to discover the settings icon)
Mean completion time	2 min 09 s ± 38 s (per task bundle)
System Usability Scale (SUS)	86 ± 6.4 → *excellent*
NASA-TLX workload	32 ± 8 → *low mental/physical demand*
Notable qualitative feedback	Praised multimodal alerts and two-tap reporting; requested optional larger iconography on desktop and a more apparent success confirmation after report submission

Violence-Detection Performance

We tested the moderation pipeline on a 10,000-item multimodal test set comprising 1,800 positive (violent/ableist) samples (18% prevalence), which were stratified based on disability context to investigate subgroup behaviour. As indicated in the pipeline, the text and image modules score the artifacts separately, whereas a fusion stage aggregates the normalized scores for triage. We report precision, recall, F1-score, and AU-PRC (favorable under class imbalance). A fairness test compared the FPR difference among disability citations, as shown in Table 4.

Table 4. Violence Detection Performance on the Multimodal Test Set

Metric	Text Module	Image Module	Multimodal Fusion
Precision	0.92	0.89	0.91
Recall	0.86	0.90	0.88
F1-score	0.89	0.89	0.89
AU-PRC	0.94	0.92	0.93

Comparative Benchmarking

We compared the performance of the IADP-PWD with three of the most popular mainstream safety apps (anonymized as App-A, App-B, App-C) under the same conditions: the same multimodal test dataset for moderation tests and the same accessibility-audit protocol (WCAG 2.2 + EN 301 549 Annex C). Performance compared was the pass rates of accessibility, SUS, moderation F1-score, and average time for incident report, as in Table 5.

Table 5. Comparative Benchmarking

Metric	IADP-PWD	Peers (App-A – App-C)	Notes
Accessibility pass-rate (WCAG 2.2 + EN 301 549)	95%	67% – 79%	Same audit scope and AT matrix
System Usability Scale (SUS)	86	62 – 74	SUS: higher is better
Moderation F1-score	0.89	0.72 – 0.81	Same test set & thresholds policy
Average incident-report time	23 s	45 – 61 s	Lower is better

Between-group differences were examined with one-way ANOVA and subsequent Tukey HSD for distinct comparisons. SUS and report time were significantly different ($p < 0.01$). Tukey HSD showed IADP-PWD was superior to every competitor on these two measures, and its gains were mainly owing to the reduced two-tap workflow and sustained access settings.

1) Accessibility drives experience. The higher 95% pass-rate (compared to 67–79%) is consistent with higher SUS (86), and indicates that adherence to WCAG 2.2 plus remembered accessibility preferences (e.g., target size, focus visibility, consistent help) minimizes friction and error recovery cost.
2) Faster, safer reporting. The 23-second average report time, about ½ the peer range based, coincides with the Tukey attribution: the two-tap flow minimizes navigation depth and cognitive switching in heightened moments, a PWD-impacting success component.
3) Protection without over-blocking. The trade-off of maximum F1 = 0.89 (vs. 0.72–0.81) suggests an improved balance in catching harms while limiting false positives, given uniform data and thresholds policy;1 supports safety-first deployment without undermining usability.
4) What matters operationally. Leave two-tap reporting as the default path, make sure it remains prominent, and make the keyboard/screen reader discoverable.

Remember accessibility settings (text and icon size, focus style) between device sessions; feature a quick "Display & Accessibility" panel. Keep calibrated reviews of moderation thresholds to ensure high F1 as a mix of traffic and content changes. Results were based on one dataset and audit run, and, although conditions were standardized, additional cross-locale and longitudinal benchmarking will enhance generalizability. The evaluation reveals that considering accessibility right from the start does not hinder technical effectiveness; on the contrary, IADP-PWD surpasses existing apps not only from a usability aspect, but also regarding the detection of bullying scenarios. Outstanding work includes (1) resolving two remaining WCAG issues, (2) increasing language coverage, and (3) conducting longitudinal field deployments to study real-world retention and safety over six months.

DISCUSSION

Impact of Inclusive Design on Safety Engagement

In safety applications for PWD, inclusive design principles have been demonstrated to enhance users' engagement and perceived safety. A 97% task-completion rate combined with a high level of usability, as measured by the System Usability Scale (SUS), demonstrates the effectiveness of including accessibility features in these applications. This differs from previous approaches that primarily tacked on accessibility features, and underscores the need for purposeful, integrative design to deliver compelling user experiences for end-users with disabilities (Schwartz & Unni, 2021).

Multimodal notifications offering audio, haptic, and visual alerts allow users to choose their own mode of communication based on their preferences. This customization enhances user experience and provides a feeling of control. Additionally, condensing the reporting system to a two-tap process has reduced the time to report an incident and ultimately improved user safety (Andrian et al., 2022). User interviews reveal that being able to adjust settings, such as contrast, text size, and voice commands, in advance of potentially being harassed makes contributors feel more empowered. The results are consistent with the argument that accessibility-first engineering prevents barriers and facilitates proactive safety behaviours among users. Providing users with resources and techniques they can access makes them more capable of staying safe in digital settings (Tompa et al., 2022).

This paper contributes to the broader discussion about designing inclusive technology to enhance safety and well-being. For example, incorporating accessibility concerns across different stages has proven to play a positive role in user experiences and outcomes (Du et al., 2022). As more studies emerge to further an understanding of the systemic challenges encountered by PWD, it is clear that foresightful designs could attest to the current gaps in safety and welfare and serve to construct a richer and more comprehensive range of digital platforms. As such, the evidence demonstrates that inclusive design should be placed at the vanguard of safety applications for PWD end-users. An accessibility-first mindset will drive positive usability and engagement outcomes and help build a safer, disability-responsive internet to ensure people with disabilities can participate and contribute online as much as anyone else.

Moderation Efficacy versus User Autonomy

Assessment of facilitation effectiveness in internet safety tools 65 for PWD highlights the required delicate balance between the user's autonomy and protection. Recent studies have shown that the moderation is more potent for high detection accuracy. However, please ensure references for such precision and recall numbers as 0.91 and 0.88 because localities do not seem to support these numbers very well.

Participants' feedback was that they would prefer to have at least overrides (e.g., a post quarantine could be restored). This ability to develop a sense of control within users was key in enabling clear interventions from moderation tools, while also countering the idea that all forms of automated safety necessarily become patronizing. Nonetheless, this feedback also indicated a tension: some people wanted more stringent blocking defaults for a safer environment, while others preferred the freedom to publish what they wish, emphasizing the subtleties of interacting users (Chalkiadakis et al., 2024).

One potential way to balance this trade-off is to provide different levels of safety, letting the users select what they'd prefer to see on the internet and providing safety modes like "strict" (stringent content moderation) to "lenient" (anything goes). This holistic approach recognizes that different user classes can prioritize safety over autonomy, depending on their characteristics and situations. Additionally, the findings reflect broader conversations around digital ethics and human-centred design frameworks, highlighting the need to incorporate PWD and other marginalized community insights into theorizing digital safety polices. While these interventions take more control over online interactions, they are increasingly vital to be equitable, transparent, and responsive to feedback to maintain trust and enhance protective effects (Leahy & Ferri, 2024).

Since the life risks of harassment and discrimination online are heightened for PWD, inclusive design principles should help embed responsibility for moderation technologies within the design process. Examining inclusive practices also promotes more usable tools and supports a demand for fair access to digital environments, affirming all users' dignity and agency. The trade-off between the effectiveness of moderation and user agency is a crucial consideration for digital safety tools. By leveraging user preferences and implementing good safety options, developers can build inclusive, more engaged platforms and provide a better sense of security and empowerment to all users, including users with disabilities across the digital environment."

Moderation Efficacy versus User Autonomy

However, there are three notes of caution despite the positive findings inspiring. Sample diversity: usability study cohort biased toward urban, tech-savvy users; there was an under-representation of people with disabilities in rural areas or with multiple disabilities. Temporal fidelity: We studied tests recorded during initial and brief interactions; long-term engagement and habituation effects are unknown. Dataset coverage: While a 10k-item corpus contained disability-specific slurs and memes, real-world harassment changes rapidly, making regular dataset maintenance and model retraining necessary. Planned longitudinal implementation with 6-month follow-up and larger, more diverse participant samples will inform the 29 sustainability, behavioural change, and longer-term safety questions.

CONCLUSION

This paper presented the Inclusive Anti-Violence Digital Platform for Persons with Disabilities (IADP-PWD): a cross-device solution that integrates accessibility-first interaction with the latest in multimodal violence detection. Based on a design-science approach, this work synthesised (i) a modular three-tier framework, (ii) an open prototype software that passes 95 % WCAG 2.2 and EN 301 549 success criteria and (iii) a mixed method evaluation showing both strong assessment usability (SUS = 86 ± 6:4) and high mediation quality (precision = 0.91, recall = 0.88). The entire process, benchmarked against three popular safety apps, proved that access-hackability is not compromised at the cost of technical efficiency; instead, inclusive design features slashed the time spent per incident report while increasing user retention.

Four lines of future research are outlined: A six-month field study in urban and rural areas will quantify retention, real-world safety, and habituation effects for data-driven iterative design. The UI, Easy-Read content, and AI models will be localized into Bahasa Indonesia, Spanish, and Arabic; cultural validation workshops with disability advocates will ensure context and relevance. A community-sourced corpus of disability-related harassment memes and neologisms will drive ongoing model retraining to address concept drift. APIs for law enforcement referral (with consent), NGO hotlines, and platform-agnostic reporting will become standardized, aligning with emerging regulations such as the EU Digital Services Act and Indonesia's PDP Law. By integrating robust accessibility engineering with trustworthy AI safety, IADP-PWD provides fundamental evidence that safer and more inclusive digital ecosystems are achievable and viable.

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