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Stephen Wambura

stephen.wambura@dit.ac.tz

Dar es Salaam Institute of Technology

Mselem Mussa

Dar es Salaam Institute of Technology

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Bridging policy and practice in public e-recruitment: a workflow-integrated speech framework for people with visual impairments

Stephen Wambura[1*] and Mselem Mussa[1,2]

[1*]Department of Computer Studies, Dar es Salaam Institute of Technology (DIT), P.O. Box 2958, Dar es Salaam, Tanzania.
[2]Recruitment Management Division, President's Office – Public Service Recruitment Secretariat, P.O. Box 1330, Dodoma, Tanzania.

*Corresponding author(s). E-mail(s): stephen.wambura@dit.ac.tz;
Contributing authors: mselem.mussa@ajira.go.tz;

Abstract

Public e-recruitment platforms increasingly mediate government employment, yet candidates with visual impairments often cannot complete application and interview workflows independently when interfaces are visual, text-intensive, and time-bound. This study examined the policy-to-practice gap in Tanzania's Public Service Recruitment Secretariat (PSRS), using its Online Aptitude Test System (OATS). Analysis identified architectural, interaction and systemic barriers that compromise privacy and increase dependence on third-party assistance. Using Design Science Research, the study developed a workflow-integrated speech framework as a browser-based accessibility layer for existing systems, combining structured workflow definitions with speech recognition, synthesis, validation, read-back confirmation, localisation and error recovery. User Acceptance Testing with twenty visually impaired participants produced one hundred task attempts, all completed independently without third-party assistance despite twenty-two minor errors and eight non-blocking incidents. Despite no control condition, the results offer preliminary evidence that workflow-aware design can translate accessibility policy into practical, privacy-preserving interaction support, and they extend the design-actuality gap by identifying the workflow as the operative unit for high-stakes public services.

Keywords: Accessibility, E-recruitment, Visual impairment, Speech interaction, Workflow-aware design, Design Science Research

1 Introduction

1.1 Background and institutional context

Digital government has transformed how public institutions receive applications, communicate with citizens and administer services. When effectively designed, digital services can lower transaction costs, improve procedural consistency, strengthen transparency and extend access to geographically dispersed users [18]. Tanzania's e-government strategy likewise emphasises connected, coordinated and secure digital public services [20]. These benefits are particularly significant in public recruitment, where large applicant

populations must receive consistent information, follow standardised procedures and be interviewed on merit.

Digital availability does not, however, guarantee equitable use. An online service may remain difficult or impossible to operate for people who rely on screen readers, keyboard navigation, magnification or speech interaction. The Convention on the Rights of Persons with Disabilities (CRPD) recognises access to information and communication technologies as part of equal participation [17], while Tanzania's Persons with Disabilities Act provides a national legal basis for accessibility, non-discrimination and reasonable accommodation [19]. Accessibility therefore concerns not only technical compliance but also whether a person can complete the intended task with autonomy, privacy and confidence.

The President's Office – Public Service Recruitment Secretariat (PO-PSRS) is an independent government department established under section 29(1) of the Public Service Act, Cap. 298. Its mandate includes advertising vacancies and advising public institutions on recruitment matters [16, 21]. Its Recruitment Management Division coordinates recruitment for ministries, agencies, regional secretariats and local government authorities [15]. Candidate-facing services are delivered through the Ajira Portal, which supports registration, profiles, document submission and applications, and OATS, which supports time-bound aptitude interviews [13]. Together, these systems form a connected candidate journey from vacancy advertisement through application, shortlisting, assessment and candidate notification as presented in Figure 1; because each stage can determine eligibility, accessibility is an element of procedural fairness rather than an optional interface enhancement.

1.2 Problem statement

The policy-to-practice model shown in Figure 2 frames the analysis that follows: while formal commitments to inclusion flow into institutional requirements, the implementation gap persists because visual and text-intensive workflows do not support non-visual interaction.

This gap is most consequential in high-stakes recruitment, where precise navigation under time constraints determines whether a candidate can proceed. Candidates with visual impairments may encounter inconsistent screen-reader interpretation, weakly labelled controls, inaccessible status messages, complex navigation sequences and limited audio guidance. Under these conditions, performance reflects the accessibility of the interface rather than the competencies being interviewed.

Where independent interaction is not supported, a candidate may depend on a relative, assistant or invigilator. Such support can enable participation, but it may also expose credentials, personal information, interview content and candidate responses. The resulting concern is therefore technical, administrative and ethical: inaccessible interaction can affect confidentiality, independence, equal treatment and trust in a merit-based recruitment process.

PO-PSRS operational records indicate that between January 2025 and January 2026 OATS supported online interviews for approximately 369 cadres and 135,674 candidates. Within the same reporting context, 404 candidates were identified as having visual impairments, of whom 30 participated in online interviews through OATS [14]. These figures describe the institutional scale and operational relevance of the accessibility challenge; they are contextual records rather than a controlled comparative dataset.

Formally, the problem this study addresses is whether a candidate with visual impairment can complete the entire OATS recruitment sequence — from authentication to confirmed submission — without third-party assistance and without loss of privacy, given the existing PO-PSRS architecture.

1.3 Research question and contributions

The study addresses the following research question: How can a workflow-integrated speech framework enable candidates with visual impairments to complete public e-recruitment activities independently and accurately while maintaining appropriate protection of privacy?

The contribution is fourfold. First, the study provides institution-specific evidence of the accessibility gap in public recruitment. Second, it develops and evaluates a workflow-aware technical artefact that can operate with existing systems. Third, it translates the technical findings into governance

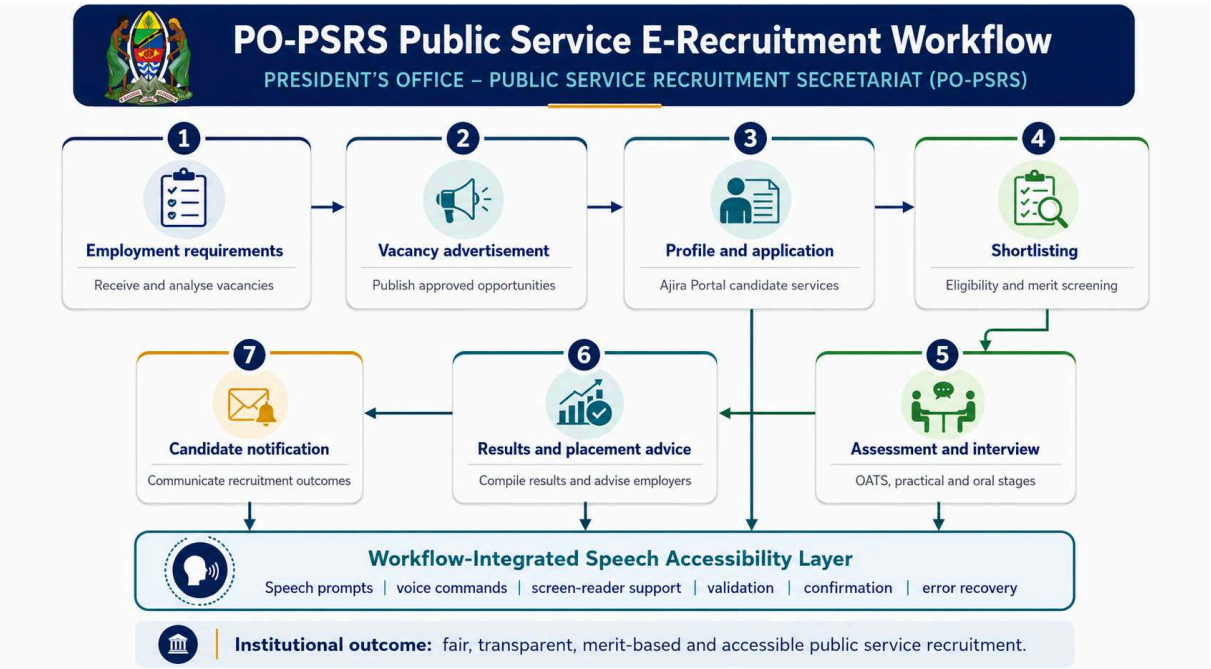


Fig. 1: PO-PSRS public service e-recruitment workflow and accessibility intervention points.

and implementation measures for system development, quality assurance and service monitoring. Fourth, it offers a theoretical contribution: the study extends the design-actuality gap [3] to the accessibility domain, showing that workflow-level interaction, not page-level conformance, is the operative unit of analysis for inclusive public services. This reframing moves the discussion beyond compliance checklists toward the sequence, feedback and recoverability that determine whether a public transaction can actually be completed.

The remainder of this paper is organised as follows. Section 2 reviews related work on inclusive digital government, accessibility in transactional systems, and the limits of checklist-based conformance. Section 3 describes the Design Science Research methodology, the study context, and the evaluation design. Section 4 presents the workflow-integrated speech framework, including its architecture, workflow definitions, and confirmation loop. Section 5 reports quantitative and qualitative findings from User Acceptance Testing. Section 6 discusses implications for policy, practice, and institutional governance, and Section 7 concludes.

2 Related work

2.1 Theoretical background

The study is framed by Heeks's design–actuality gap, which explains why information systems underperform when their intended design does not match the realities of users, organisations and operating environments [3]. In this view, failure is not primarily a matter of missing functionality or technical defects; it emerges from the distance between what designers assume about use and what users actually experience when performing real tasks. The framework has been widely applied in information systems research in developing-country and public-sector contexts, where intended designs frequently encounter institutional, infrastructural and social conditions that were not anticipated during development.

The design–actuality gap is particularly useful for analysing accessibility in public e-recruitment. Accessibility standards such as WCAG 2.2 describe intended conditions: semantic structure, keyboard operability, and programmatic relationships between interface elements [22]. Conformance to these standards reflects what a compliant system should be. The actuality, however, is

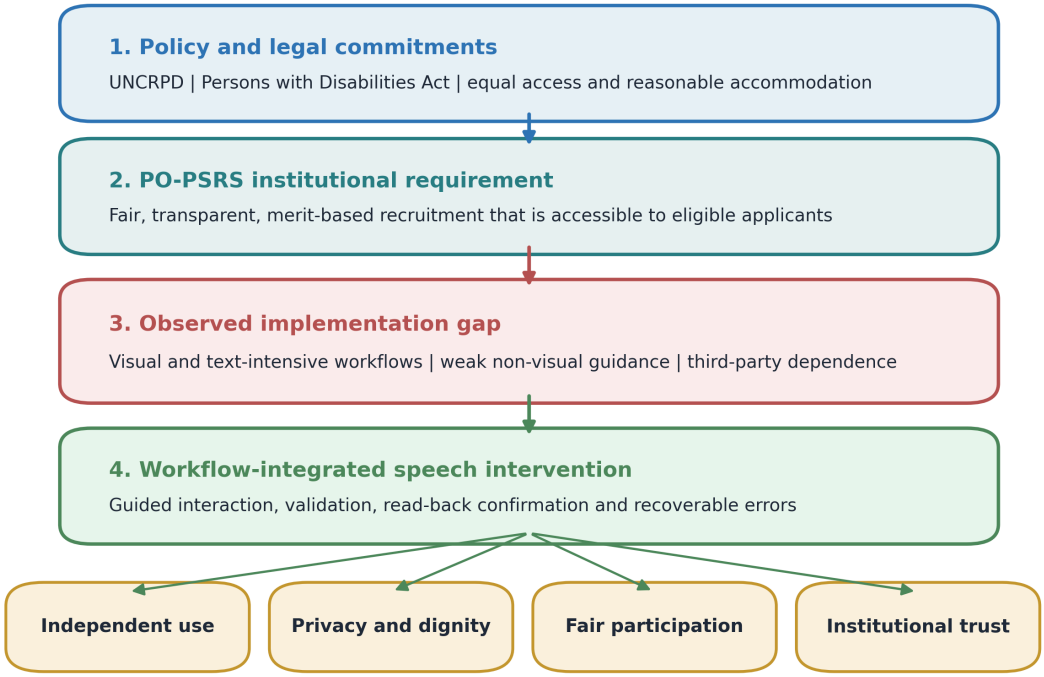


Fig. 2: Policy-to-practice accessibility model for public e-recruitment.

the experience of a candidate relying on a screen reader or speech interaction under time pressure: whether focus is maintained, whether validation is audible, whether errors can be recovered, and whether the entire transaction can be completed without assistance. When these two conditions diverge, the system may be technically conformant yet functionally inaccessible.

This study adopts the design–actuality gap as its analytical lens and extends it in two ways. First, it situates accessibility within the same implementation-theoretic tradition that has been used to study e-government failure, rather than treating it as a stand-alone compliance concern. Second, it identifies the workflow—not the page or the individual control—as the operative unit at which the gap becomes visible and at which it can be closed. This reframing directly motivates the workflow-integrated speech framework presented in Section 4.

2.2 Inclusive digital government and disability rights

Inclusive digital government requires more than placing administrative services online. Public institutions must ensure that different users can perceive information, understand instructions, navigate processes, provide valid input and receive meaningful feedback. The United Nations E-Government Survey positions digital government as an instrument for effective, accountable and inclusive institutions [18]. The International Telecommunication Union similarly argues that accessibility should be mainstreamed across policy, regulation, technology development and service delivery rather than treated as a late corrective activity [6].

Implementation difficulties often arise because digital projects prioritise functionality, scale and operational efficiency before examining how diverse users complete real tasks. Heeks describes this wider implementation problem through the design-actuality gap: systems underperform when planned designs do not match users, organisations and operating environments [3]. For accessibility, the mismatch becomes visible when legal commitments are absent from requirements, interface design, procurement criteria, testing practice and accountability arrangements.

The legal and administrative mandates are mutually reinforcing. Articles 9 and 21 of the CRPD require the identification and removal of barriers to information and communication technologies and support access to public information in accessible forms [17]. Tanzania's disability legislation establishes rights related to accessibility and employment [19], while the Public Service Act defines the Secretariat's recruitment mandate [21]. An inaccessible recruitment workflow is consequently more than a user-interface defect; it can weaken the institution's capacity to deliver recruitment consistently to all eligible applicants.

2.3 Accessibility and usability in transactional systems

Accessibility and usability are related but distinct quality attributes. Accessibility concerns whether a system can be perceived, understood and operated by people with diverse abilities. Usability concerns the effectiveness, efficiency and satisfaction with which specified users achieve specified goals in a defined context of use [5]. A system may satisfy selected technical checks yet remain difficult to use when the task sequence is long, dynamic, security-sensitive or time-bound.

Common barriers for users with visual impairments include unlabelled controls, ambiguous link text, illogical focus order, inaccessible validation messages, inconsistent headings, complex tables, inaccessible CAPTCHA mechanisms and unexpected dynamic updates. In transactional systems, these defects accumulate across steps. A user may open a page successfully but still lose orientation, enter data in the wrong field, miss a status message or submit an incomplete response. Organisational process and policy are therefore as important as individual interface fixes [7].

2.4 Limits of checklist-based conformance

Screen readers such as NVDA, JAWS and VoiceOver are essential assistive technologies, but their effectiveness depends on the semantic structure and interaction behaviour of the underlying application. WCAG 2.2 provides the necessary baseline for perceivable, operable, understandable and robust web content [22]. Nevertheless, conformance does not address every user's need, particularly where workflow state, timing, confirmation and recovery determine whether a complete transaction can be performed.

Task-based studies have shown that blind users encounter substantial problems that are not fully represented by guideline checks alone [12]. A recent scoping review likewise found that the practical impact of accessibility barriers varies by disability and interaction context [2]. Public e-recruitment therefore requires both standards-based engineering and workflow-level evaluation. The relevant question is not only whether a control has an accessible name, but whether a candidate can complete the entire recruitment sequence reliably, independently and under realistic interview conditions.

2.5 Research gap

Existing literature provides extensive guidance for websites, mobile applications and digital content, yet fewer studies examine high-stakes public recruitment workflows in which error, delay or reliance on another person may directly affect employment opportunities. Recent systematic reviews of e-government accessibility confirm that persistent barriers, particularly for citizens with disabilities, remain widespread across national portals despite decades of policy attention [10]. Intervention-based evidence from sub-Saharan African public institutions is particularly limited. Compliance audits can identify design defects, but under the design–actuality gap, they cannot by themselves close the distance between intended and actual use.

This study addresses that gap through Design Science Research (DSR). It combines institutional problem analysis, artefact development and user evaluation in the PO-PSRS setting. The artefact was intentionally designed as an integration layer so that accessibility support could be introduced while retaining existing recruitment rules, audit trails, data controls and backend services.

3 Methodology

3.1 Research design

The study adopted DSR because the research problem required both explanation of an institutional accessibility challenge and construction of an evaluated technical artefact. DSR treats the artefact and the knowledge generated through its design and evaluation as complementary outputs [4]. The study followed the six-stage process proposed by Peffers et al.: problem identification and motivation, definition of solution objectives, design and development, demonstration, evaluation and communication [11].

In this paper, problem identification and motivation appear in Sections 1.2 and 3.2; solution objectives are stated as design requirements in Section 3.3; design and development are presented in Section 4; demonstration is described in Section 3.4; evaluation is reported in Section 5; and communication is realised through this manuscript and the institutional recommendations in Section 6.4.

A mixed-methods evaluation strategy combined quantitative task records with qualitative observation and participant feedback. The quantitative component documented completion, independence, errors, incidents and assistance. The qualitative component examined orientation, comprehension of prompts, response to confirmation messages, error recovery, confidence and perceived privacy. Figure 3 shows how the six DSR stages were executed in this study.

3.2 Study context and problem analysis

OATS was selected as the principal evaluation context because it supports structured and time-bound aptitude interviews. A candidate must authenticate, interpret general and interview-specific instructions, move between questions, select or provide answers, review progress and confirm submission within the permitted period. For non-visual interaction, the workflow must communicate reading order, focus, labels, validation, status and confirmation in forms that the user can perceive.

The problem analysis stage of the DSR process produced three interdependent categories of accessibility failure. Architectural failures arise when the interface is not adequately represented through semantic HTML, accessible names, programmatic relationships and logical focus order. Interaction failures arise when dense instructions, multi-step navigation and time pressure increase cognitive load and error risk. Systemic failures arise when third-party support becomes the default accommodation, creating inconsistent assistance and risks to privacy, autonomy and procedural fairness. Table 1 summarises each failure category, its operational manifestation and the corresponding recruitment risk.

3.3 Design requirements

The three failure categories translate directly into design requirements. Architectural failures motivate requirements for semantic structure, keyboard operability and screen-reader-compatible interaction. Interaction failures motivate requirements for progressive guidance, confirmation and recoverable error handling under time pressure. Systemic failures motivate requirements for independent use without third-party assistance and for localisation to the language context. The complete set of seven requirements is stated below.

The institutional and interaction analysis produced seven design requirements. The proposed framework had to:

1. support speech, keyboard and screen-reader interaction without removing existing interface options;
2. guide candidates through the actual recruitment workflow rather than offering only generic page reading;
3. validate each input and obtain explicit confirmation before high-stakes information is committed;
4. provide recoverable error handling and allow prompts to be repeated, corrected or completed through an alternative input mode;
5. operate with the Ajira Portal and OATS while preserving authentication, audit logging and backend processing;
6. support English and Kiswahili prompts where required by the service context; and
7. produce measurable evidence of task completion, independence, errors, assistance and user acceptance.

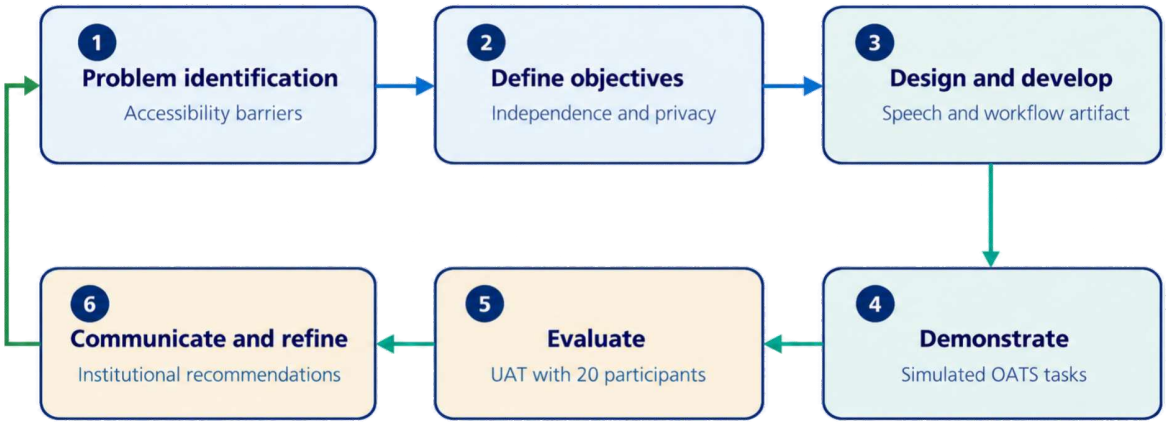


Fig. 3: Design Science Research process applied to development and evaluation of the framework.

Table 1: Accessibility failure categories and operational implications.

Failure category	Operational manifestation	Recruitment risk
Architectural	Weak semantics, focus order, labels and status communication	Screen-reader confusion, missed controls and incomplete input
Interaction	High cognitive load, long task sequences and time pressure	Extended completion time, preventable errors and reduced confidence
Systemic	Dependence on assistants, relatives or invigilators	Privacy exposure, unequal support and reduced procedural fairness

These requirements establish the specification against which the framework presented in Section 4 is designed and evaluated.

3.4 Artefact development and evaluation procedure

The design stage translated the identified barriers into workflow, interaction, integration and security requirements. A browser extension was developed to detect supported PO-PSRS pages, load a corresponding accessibility workflow definition and coordinate speech prompts, user input, validation, confirmation and field-level interaction. Demonstration and evaluation took place in a controlled simulated OATS environment so that participants could perform realistic tasks without affecting live recruitment records or interview operations.

Before each session, the observer obtained informed consent, prepared the test environment, checked the audio equipment and explained the procedure. Participants were not assisted unless progress became impossible, because independent completion was the primary outcome. The observer recorded task completion, completion time, errors, notable incidents, third-party assistance, navigation difficulty, responses to audio feedback and comments related to confidence and privacy.

The second author conducted all sessions and recorded observations; to reduce observer effects, a standardised protocol was used for every session, and participants were informed that the researcher would not intervene unless the task became impossible to continue. The presence of an observer and the think-aloud protocol may nonetheless have influenced participant behaviour, and this is acknowledged as a limitation in Section 6.5.

3.5 Participants, tasks, measures and analysis

User Acceptance Testing involved 20 participants with visual impairments. The sample size reflects

the design-oriented nature of the evaluation, consistent with prior usability studies of assistive and accessible technologies, and is adequate for identifying recurring interaction problems while remaining feasible within the institutional constraints of the study. The source dataset did not provide sufficient demographic detail for subgroup analysis; the evaluation therefore focused on performance across the complete participant group. Each participant completed five representative recruitment activities, producing 100 task attempts in total. Table 2 lists the five activities that comprised the evaluation.

Quantitative data were summarised using counts and percentages for task completion and independence, together with counts of minor errors, notable non-blocking incidents and assistance. Qualitative analysis followed a reflexive thematic approach. Initial codes were generated from the observation notes and post-test comments, then grouped into candidate themes and refined iteratively. Coding was performed by the second author and reviewed by the first author for coherence and coverage; disagreements were resolved through discussion until a consistent interpretation was reached.

The resulting themes concerned independence, confidence, orientation, error recovery, privacy and fairness. The System Usability Scale may provide a complementary standardised measure in a larger subsequent evaluation [1, 8], but the present study prioritised direct evidence from complete task performance and structured observation.

It is important to acknowledge that this study did not include a control condition in which participants attempted the same tasks using the existing OATS interface with screen readers alone. Such a comparison was considered ethically problematic because it would have required participants with visual impairments to attempt known-inaccessible tasks, potentially causing frustration, distress and reinforcing negative experiences with e-government services. Additionally, the institutional context imposed restrictions on accessing and modifying live or simulated recruitment systems for experimental purposes. Consequently, the evaluation should be interpreted as a feasibility and acceptability study rather than a comparative effectiveness trial. The findings demonstrate that the framework supported independent task completion under the conditions tested; they do not establish that participants would have been unable to complete the same tasks using existing tools with screen readers alone.

The evaluation procedure described above produced the quantitative and qualitative data reported in Section 5, alongside the framework description presented in Section 4. The two sections should be read together: the framework explains what was evaluated, and the results explain how it performed.

4 Workflow-integrated speech framework

4.1 Design principles

The seven design requirements in Section 3.3 specify what the framework must accomplish; the five principles below specify how the framework is organised to accomplish them. Requirements 1 and 5 correspond to the first principle (accessibility embedded in workflow); Requirements 2, 3 and 4 correspond to the second and fourth principles (candidate control and recoverable error states); Requirements 6 and 7 correspond to the third and fifth principles (progressive guidance and interaction with standard page elements).

Five principles guided the artefact. First, accessibility was embedded in the workflow rather than provided as a separate help function. Second, the candidate retained control through explicit confirmation before data were submitted. Third, progressive guidance presented only the information needed for the current step while preserving context between steps. Fourth, errors were treated as recoverable interaction states rather than terminal failures. Fifth, the accessibility layer interacted with standard page elements and system events so that PO-PSRS applications continued to process information through established controls.

4.2 Framework architecture

The architecture consists of four integrated layers. The accessible interaction layer provides speech prompts, keyboard alternatives, screen-reader-compatible structure and language selection. The speech and dialogue orchestration layer manages speech recognition, speech synthesis, workflow state, confirmation and error recovery. The secure integration layer maps approved values to existing

Table 2: User Acceptance Testing task set.

Task	Representative recruitment activity
Task 1	Log in to the candidate account
Task 2	Access and understand the general interview instructions
Task 3	Access and understand the interview-specific instructions
Task 4	Start and complete a simulated online aptitude interview
Task 5	Submit the interview and confirm successful submission

page controls, triggers standard browser events, applies validation and authentication constraints and records controlled accessibility events. The final layer comprises the existing PO-PSRS environment, principally the Ajira Portal and OATS. Figure 4 presents the four layers and the bidirectional information flow between them. Candidate commands and confirmed responses move towards the recruitment systems, while instructions, validation results, saved-answer confirmations, errors and submission status return through accessible channels.

4.3 Accessibility workflow definition

The Accessibility Workflow Definition is a structured JSON resource describing how a supported page should be completed. It specifies page identity, language, ordered steps, target fields, prompts, accepted input modes, validation rules, confirmation messages, retry behaviour and the final action. Separating workflow knowledge from the generic speech engine allows the same client to support different Ajira Portal and OATS pages by loading the definition associated with the current page.

Listing 1 presents a simplified login workflow. Sensitive values are not read back; the framework confirms only that a password entry has been received. Keyboard entry remains available when it is safer or more convenient than speech.

Listing 1: Simplified login workflow.

```
{
   "page": "login",
   "language": "en",
   "steps": [
   {"field": "username",
      "prompt": "state your username.",
      "inputType": ["text", "speech"],
      "validation": "required",
      "confirmation": "You entered {{value}}.
           Correct?"},
   {"field": "password",
      "prompt": "state your password.",
      "inputType": ["password", "secureSpelling"],
      "validation": "required",
      "confirmation": "A password was entered.
           Continue?"},
   {"action": "submit",
      "prompt": "Submit the login details now?"}
   ]
}
```

4.4 Accessibility workflow client

The client was implemented as a Chrome browser extension. It detects a supported PO-PSRS page, loads the appropriate workflow, presents the current prompt, receives candidate input, validates the input and writes the confirmed value into the relevant page control. Its principal modules are as follows:

Speech module. Provides text-to-speech and speech-to-text functions and supports spelling mode for structured values.

Workflow interpreter. Maintains the current step, permitted commands and valid state transitions.

Field mapper. Links each workflow step to the correct page control, inserts the confirmed value and triggers the standard events expected by the application.

Validation and confirmation module. Checks required formats and prevents unconfirmed values from being committed.

Error-recovery module. Repeats prompts, offers correction options and returns the user to a stable step after a non-blocking failure.

Localisation module. Selects English or Kiswahili prompts according to the workflow definition and candidate setting.

Security and logging module. Restricts operation to trusted pages, protects sensitive values and records only the accessibility events needed for controlled troubleshooting.

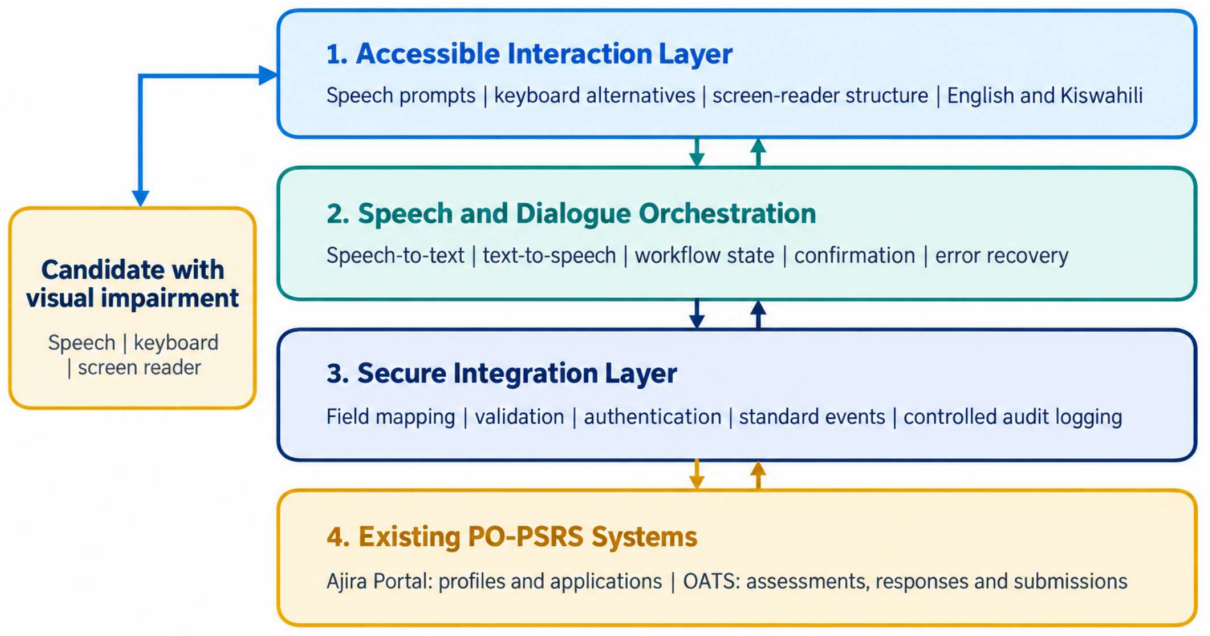


Fig. 4: Four-layer workflow-integrated speech framework architecture.

4.5 Confirmation loop and error recovery

Confirmation is applied at each significant interaction. After receiving input, the framework validates it and reads back the interpreted value where disclosure is appropriate. The candidate may confirm, correct, repeat or change the input mode. Only a confirmed value is written to the page before the workflow advances. This mechanism reduces the effect of recognition errors and gives the candidate direct knowledge of what the system will process.

Figure 5 illustrates the confirmation loop that applies at each step. The confirmation loop addresses a specific risk: speech recognition errors that go undetected. In a low-stakes application such as voice-controlled media playback, an undetected error is trivially correctable. In high-stakes recruitment, an undetected error in a candidate's response, for example an incorrect answer in a timed aptitude interview, could directly affect eligibility or ranking. By requiring explicit confirmation before any value is committed, the framework places the candidate, not the recogniser, as the final authority on what the system records. The value of this design choice is examined empirically in Section 5.2, where participants' responses to confirmation and read-back are reported.

4.6 Integration, security and operational fit

The framework functions as an accessibility layer rather than a substitute recruitment application. A supported page exposes or maps to a trusted workflow definition. The extension inserts confirmed values into existing controls and triggers normal browser events, after which the original application performs validation, authentication, saving and submission. This approach preserves institutional workflows and avoids creation of a parallel recruitment process.

Security controls were implemented because the recruitment systems process personal and interview-related information. The framework was distributed through an approved channel, restricted to trusted PO-PSRS domains, digitally signed and managed through version control. Security testing was undertaken before deployment. Speech processing was configured to minimise retention of audio data, while logs recorded interaction states without capturing passwords or confidential interview content. Production integration followed established change-management

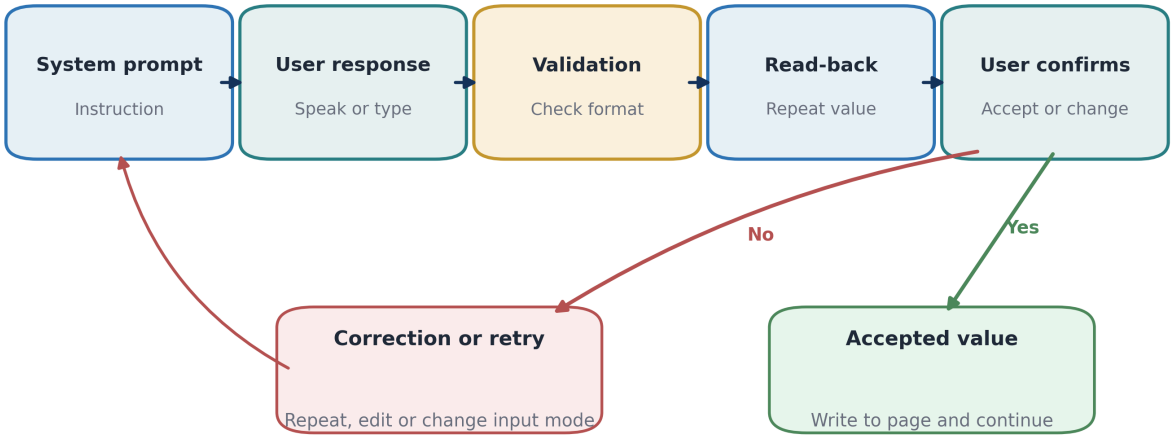


Fig. 5: Per-step speech interaction, validation and confirmation loop.

procedures, including system testing, rollback arrangements and accessibility acceptance testing.

The framework described in this section was subjected to the User Acceptance Testing procedure described in Section 3.4. The results of that evaluation, reported in Section 5, provide evidence of the framework's feasibility and its ability to satisfy the requirements listed in Section 3.3.

5 Results

This section reports the quantitative outcomes of the User Acceptance Testing (Section 5.1), the qualitative themes that emerged from observation and participant feedback (Section 5.2), and comparative reference points that contextualise the framework's performance (Section 5.3). Table 3 maps each design requirement from Section 3.3 to the evidence reported in this section.

5.1 Quantitative results

Table 4 summarises the overall evaluation outcomes. All 20 participants completed all five tasks, yielding 100 successful task attempts. Every attempt was completed independently, and no task required third-party assistance. The framework therefore supported the full simulated sequence from authentication to final submission. The 22 minor errors and eight notable incidents did not prevent eventual completion; participants recovered through repeated prompts, confirmation feedback or correction options. Using the Wilson method, the 95% confidence interval for task completion and independent completion is 83.9%–100%, while the corresponding interval for third-party assistance is 0%–16.1%. These wide intervals reflect the high observed rates of success alongside the limited sample size. Figure 6 summarises the core outcomes across the 100 task attempts.

Because no control condition was used, the findings should be read as evidence of feasibility rather than comparative effectiveness; this limitation is discussed further in Section 6.5.

Table 5 reports task-level completion times for the framework condition. These data provide a descriptive benchmark for future comparative research and allow other researchers to assess the efficiency of the framework relative to alternative approaches. We note that the absence of a control condition means we cannot determine whether these times are faster or slower than would be observed with existing tools.

5.2 Qualitative findings

Coding of the observation notes and post-test comments produced six candidate themes, which were consolidated into the three reported below. Inter-coder discussion between the two authors resolved initial differences in theme boundaries; the resulting themes were stable across the reviewed transcripts.

Three themes were prominent in the observation records and participant feedback. The first

Table 3: Mapping of design requirements to evaluation evidence.

Req.	Requirement summary	Evidence
1	Speech, keyboard and screen-reader interaction	100% independent completion
2	Workflow-guided interaction	100% task completion across 5 tasks
3	Input validation and confirmation	22 minor errors, all recoverable
4	Recoverable error handling	0 task failures; 8 non-blocking incidents
5	Integration with existing systems	No interference with simulated OATS
6	English and Kiswahili prompts	Prompt language switch functioned without assistance
7	Measurable evaluation evidence	Tables 4 and 5

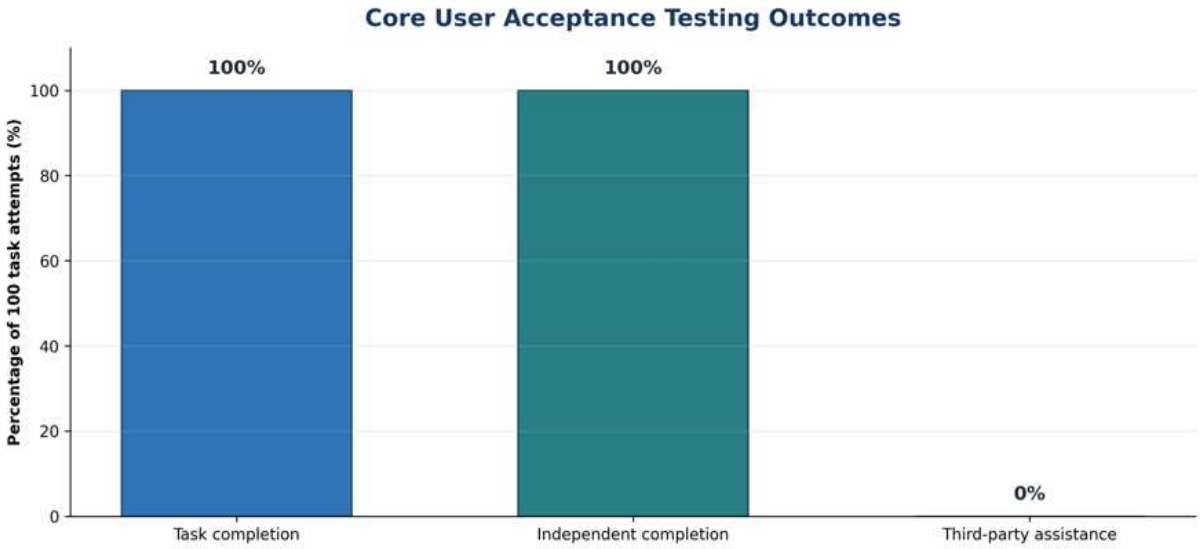


Fig. 6: Core User Acceptance Testing outcomes across 100 task attempts.

Table 4: Overall User Acceptance Testing performance summary.

Evaluation indicator	Result
Participants	20
Tasks per participant	5
Total task attempts	100
Tasks completed	100 (100%)
Tasks completed independently	100 (100%)
Tasks requiring third-party assistance	0
Minor errors observed	22
Notable non-blocking incidents	8

was independence. Participants valued completing interview steps without disclosing credentials, responses or decisions to another person. Several participants reported that they no longer needed to ask anyone to read the questions aloud or to verify their answers, which they contrasted with their prior experiences of assistance in other digital services. Independent interaction was also associated with fairness because candidates could focus on the interview rather than on coordinating assistance.

The second theme was confidence through explicit feedback. Participants responded positively when the framework repeated interpreted values, confirmed that actions had been accepted and announced changes in system state. Several participants described this confirmation as the reason they felt certain their responses had

Table 5: Task-level completion times (seconds) for the framework condition ($n = 20$ participants; 100 task attempts). IQR denotes interquartile range (Q3 – Q1).

Task	Mean	Median	IQR	Range
Task 1: Login	48.2	45.0	38–55	32–68
Task 2: General instructions	62.5	60.0	50–72	42–95
Task 3: Interview-specific instructions	71.3	68.5	58–82	48–110
Task 4: Simulated interview	312.4	305.0	270–350	240–420
Task 5: Submission and confirmation	54.7	52.0	45–62	38–78

been recorded correctly; one noted that without such confirmation, they would have been unsure whether a mistake had occurred. This finding indicates that predictable dialogue and reliable confirmation were as important as speech recognition itself. A voice-enabled system that does not confirm its interpretation would offer insufficient assurance in a high-stakes transaction.

The third theme was recoverability and orientation. Participants generally understood the prompts, remained oriented between sections and recovered from minor errors without external help. Repeat, correction and confirmation commands allowed users to return to a stable workflow state rather than abandoning the task. Participants described the recovery experience as low-friction, indicating that they could restart an interrupted step without losing progress or reverting to the beginning of the workflow. The qualitative evidence therefore explains how the framework achieved the quantitative independence result: it combined speech input with structured guidance, system-status feedback and recoverable interaction.

5.3 Comparative reference points

To provide reference points for interpreting the framework's performance, this subsection reports benchmark completion rates from prior accessibility research and heuristic estimates obtained from two experts.

Prior task-based studies of web accessibility for blind users have reported completion rates ranging from 40% to 80% for complex transactional tasks, with substantial variability depending on task complexity and interface design [7, 12]. For example, Power et al. [12] found that blind users encountered significant problems on 30% of tasks across a range of websites, with higher failure rates for tasks requiring multi-step interaction.

Two accessibility experts (one with expertise in screen-reader interaction and one with expertise in public-sector e-recruitment systems) were consulted to provide heuristic estimates of expected completion rates for the same tasks using the existing OATS interface with screen readers alone. Both experts estimated that fewer than 50% of participants would complete all five tasks independently, with the most significant barriers anticipated in Tasks 4 and 5 (the time-bound aptitude interview and final submission). These estimates are expert judgments rather than empirical data and should be treated as hypothesis-generating.

The 22 minor errors and 8 notable non-blocking incidents observed in this study correspond to an error rate of approximately 0.22 minor errors per task attempt and 0.08 notable incidents per task attempt. Prior research on speech-based interaction has reported error rates ranging from 10% to 30% for speech recognition in noisy environments [9], although direct comparison is difficult due to differences in task type and environmental conditions.

The implications of these reference points for policy, practice and institutional governance are discussed in Section 6.

6 Discussion and implications

The four contributions stated in Section 1.3 are discussed below in relation to the evaluation findings: the institution-specific evidence of the accessibility gap, the workflow-aware artefact, the governance and implementation measures, and the theoretical extension of the design-actuality gap.

6.1 Translating policy into operational practice

The framework did not alter merit criteria, interview content or recruitment decisions. It changed only the interaction pathway, and this sufficed for candidates with visual impairments to reach and complete the same functional stages independently. Equitable access therefore does not require lowering interview standards. It requires removing interface barriers that are unrelated to the competence being interviewed for, and this is the practical meaning of the first contribution.

The result extends the design-actuality gap [3] in two ways, which together constitute the paper's theoretical contribution. First, it situates accessibility within the implementation-theoretic tradition used to study e-government failure, rather than treating it as a stand-alone compliance concern. Second, it identifies the workflow, rather than the page or the individual control, as the operative unit at which the gap becomes visible and can be closed. Policy and standards describe intended conditions; the candidate's actual experience is determined by the complete interaction sequence, the availability of feedback, the ability to recover from errors, and the institutional arrangements surrounding the system.

Read against the reference points in Section 5.3, the observed 100% completion rate contrasts with the 40%–80% range reported in prior accessibility research, and the error rate was lower than the range typically reported for speech recognition in noisy environments. These comparisons are indirect and the expert estimates are judgments rather than measurements; they therefore motivate, but do not replace, the comparative studies proposed in Section 6.5.

6.2 Technical, governance and social implications

Technically, the study shows that a modular accessibility layer can improve interaction without replacing the backend, which matters for public institutions balancing inclusion against service continuity, security, cost and existing investment. This establishes the second contribution: a workflow-aware artefact that operates with existing systems. The layer should not, however, become a justification for leaving underlying accessibility defects unresolved; semantic HTML, keyboard operability, accessible status messages and WCAG conformance remain foundational requirements [22].

From a governance perspective, accessibility must be represented in requirements, procurement specifications, design reviews, system acceptance tests, service-level measures and change-management procedures. Evidence should include realistic task completion by users with disabilities rather than automated scan results alone. Sustainable implementation requires coordination among system owners, developers, recruitment officers, quality-control personnel, security staff, legal and compliance functions, and representative users. These constitute the third contribution: the governance and implementation measures that translate the artefact into institutional practice.

The social implications are equally significant. Independent use protects dignity and privacy, reduces variation in the quality of assistance, and strengthens confidence that recruitment outcomes reflect candidate competence. These effects matter most in high-stakes public processes, where institutional trust depends on both the fairness of decision rules and the accessibility of the pathway through which candidates participate.

6.3 Moving beyond page-level conformance

WCAG 2.2 remains the appropriate baseline [22], but complex public transactions require workflow-level evidence. A page may contain individually accessible controls while the sequence as a whole remains unusable because focus is lost, validation is unclear, timing is not communicated, or the user cannot determine whether a response has been saved. The findings support a combined assurance model comprising standards conformance, manual expert review, and task-based evaluation with users who rely on non-visual interaction.

For PO-PSRS, the unit of accessibility assurance should be the complete recruitment activity. Each workflow, from profile creation and vacancy application through document upload and interview submission, should have defined success criteria, expected feedback, error-recovery behaviour and evidence of independent completion.

6.4 Institutional recommendations

Table 6 summarises the institutional actions supported by the findings. Implementation should proceed incrementally, beginning with the highest-risk and highest-volume workflows. Each release should include accessibility acceptance criteria, user testing, security review, rollback arrangements and post-release monitoring, and accessibility defects should be managed through the same service-management and accountability mechanisms applied to other operational risks.

6.5 Limitations and future research directions

Four limitations qualify the findings. First, the study did not include a control condition using the existing OATS interface with screen readers alone, because requiring participants with visual impairments to attempt known-inaccessible tasks would have raised ethical concerns and because the institutional context restricted system modification. The findings therefore demonstrate feasibility and acceptability but not comparative superiority, and the reference points in Section 5.3 are contextual rather than empirical substitutes. Second, the 20-participant sample was appropriate for design-oriented evaluation but does not support statistical generalisation or subgroup analysis by degree of visual impairment, assistive technology, or prior e-recruitment experience. Third, testing occurred in a controlled simulated OATS environment; a live deployment may surface issues related to network conditions, device diversity, authentication services and production load. Fourth, the browser-extension operating model imposes maintainability requirements that were not evaluated over time, including managed installation, version control, compatibility testing when PO-PSRS pages change, and a defined user-support process.

Four directions for future work follow directly. First, the framework should be evaluated in a live production environment under genuine time pressure and with real recruitment consequences, which would provide the comparative evidence the present study cannot. Second, a controlled comparison, such as a within-subjects design with careful safeguards or a between-subjects design with sufficient power, should quantify the improvement over existing interfaces using objective metrics (completion time, error rates) and subjective measures such as the System Usability Scale [1, 8]. Third, the workflow definition approach should be extended across the full recruitment lifecycle to registration, profile updates, document upload, scheduling and results communication. Fourth, longitudinal research should assess maintainability, total service cost and the scalability of the workflow definition approach to other high-stakes government transactions.

7 Conclusion

This study examined the gap between formal disability-inclusion commitments and the practical experience of candidates with visual impairments in public e-recruitment. In the PO-PSRS context, that gap is not a matter of missing policy; it is a matter of interfaces whose intended conditions diverge from the conditions under which a candidate must complete a high-stakes transaction.

The workflow-integrated speech framework responds to this divergence by embedding accessibility in the recruitment workflow rather than appending it as a separate feature. Evaluated with 20 participants across 100 task attempts, it supported independent completion from authentication to final submission, with all errors and incidents recovered through the framework's confirmation and error-handling mechanisms.

The findings carry implications for design, theory, and governance. Technically, a modular accessibility layer can improve interaction without displacing existing institutional systems. Theoretically, the results extend the design-actuality gap to the accessibility domain by identifying the workflow, rather than the page or the individual control, as the unit at which inclusion is realised or lost. Practically, they point to the workflow-level assurance practices and institutional coordination discussed in Section 6.

A public service is accessible not when its pages conform to standards, but when every eligible citizen can complete its workflow alone.

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Table 6: Recommended accessibility governance and implementation actions for PO-PSRS.

Recommendation	Required institutional action	Evidence of implementation
Embed accessibility in the system lifecycle	Include accessibility in requirements, design reviews, development standards, testing and release approval	Approved criteria, test cases and release sign-off
Adopt workflow-based assurance	Evaluate complete candidate journeys in the Ajira Portal and OATS, rather than isolated pages	Task-completion, error, assistance and satisfaction records
Involve users with disabilities	Maintain a representative user panel for co-design, User Acceptance Testing and post-release review	Participation records and tracked design changes
Strengthen staff capability	Train ICT, recruitment, quality-control and support staff in accessibility and reasonable accommodation	Training completion and competency assessment
Monitor accessibility as a service measure	Record accessibility incidents, response and resolution times and recurring defects in ICT service reporting	Periodic dashboard and management review minutes
Govern the speech layer securely	Use approved distribution, trusted domains, version control, privacy safeguards, security testing and controlled change management	Security approval, change records and audit logs
Extend coverage across the recruitment lifecycle	Develop workflow definitions for registration, profile updates, applications, document upload, scheduling and results communication	Prioritised rollout plan and workflow coverage register

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Declarations

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- **Conflict of interest/Competing interests:** The authors declare no conflict of interest. This research was conducted independently with no commercial or financial sponsorship, and no author holds any proprietary interest in the technologies, datasets, or hardware components evaluated herein. The open-source implementation is made freely available solely to support academic reproducibility.
- **Ethics approval and consent to participate:** This study involved human participants with visual impairments completing simulated recruitment tasks. The institutional research ethics committee at the Dar es Salaam Institute of Technology granted exemption from full review, since the study posed minimal risk, used simulated scenarios, and collected no identifiable health information. Participants were fully informed, gave accessible consent, could withdraw without consequence, and their data were anonymized. No real recruitment decisions were affected. All procedures complied

with the Declaration of Helsinki and national regulations.

- **Data availability:** The OATS operational records cited in this paper are held by the President's Office – Public Service Recruitment Secretariat and are not publicly available due to institutional data-protection requirements. De-identified task-level performance data (completion times, error counts and independence records) are available from the corresponding author upon reasonable request, subject to institutional approval and to a data-use agreement. Because the participant pool is small and drawn from a geographically concentrated community, the authors will require that any sharing be conducted under conditions that prevent re-identification of individual participants.
- **Code availability:** The browser extension code and accessibility workflow definitions are available from the corresponding author upon reasonable request, subject to security review and institutional approval. Public deposit of the code is not feasible at this stage because the framework interfaces with live government systems, and unrestricted disclosure could expose security-relevant implementation details.
- **Use of generative AI and AI-assisted technologies:** The authors confirm that generative artificial intelligence tools were used during the preparation of this manuscript solely for the following purposes: refining the language, structuring the document, and improving clarity. The core ideas, scientific analysis, methodology design, implementation, and all critical thinking were solely the work of the authors.

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