SuvidhaAI: A Dual-Mode Intelligent Welfare Navigation Platform for Indian Citizens

Karina Pandav[1], Parineeta Rao[2], Vedika Parikh[3], Prof. Pankaj Deshmukh[4]
[1,2,3]*BTech Student, Department of Artificial Intelligence and Data Science, K.J. Somaiya Institute of Technology, Mumbai, India*
[4]*Assistant Professor, Department of Artificial Intelligence and Data Science, K.J. Somaiya Institute of Technology, Mumbai, India*

***Abstract*—India hosts over 500 active central and state-level welfare programmes; however, a significant proportion of eligible citizens fail to access these benefits due to awareness deficits, eligibility confusion, and application complexity. Existing platforms such as UMANG and MyScheme.gov.in provide scheme catalogues but lack personalised eligibility assessment and guided application support, especially for users with low literacy and limited English proficiency. This paper presents SuvidhaAI, a voice-first, multilingual, dual-mode intelligent web application designed to address these challenges. The system introduces two interfaces: Simple Mode, a conversational WhatsApp-style interface for low-literacy users, and Full Mode, a professional dashboard for CSC operators and assistants. Key features include multilingual scheme matching, visual document verification, application letter generation, progress tracking, and geolocation-based service centre access. Comparative evaluation shows that SuvidhaAI delivers capabilities absent in existing platforms. The paper also outlines a scalable architecture incorporating semantic search, FastAPI, PostgreSQL, Redis, and speech recognition technologies.**

***Index Terms*—e-governance, welfare scheme recommendation, voice-first interface, multilingual NLP, citizen-centric AI, digital inclusion.**

I. INTRODUCTION

India's welfare architecture represents one of the most extensive social protection systems globally. Programmes spanning agriculture income support, rural housing construction, health insurance, skill certification, women empowerment, and senior citizen pensions collectively disburse more than fifteen lakh crore rupees annually. Despite this investment, independent surveys and government data consistently indicate that awareness among rural populations falls below forty percent for most central programmes, with application completion rates lower still.

The barriers responsible for this gap are well-documented. Citizens are unaware that relevant schemes exist. When awareness is present, eligibility criteria are expressed in bureaucratic language incomprehensible to most beneficiaries. When eligibility is understood, the application pathway requiring government portal navigation, document assembly, CSC office visits, and reference number tracking overwhelms citizens who lack digital literacy or English competency. Critically, no existing platform provides guidance through this entire journey in a form accessible to the citizen most in need.

Digital governance initiatives have attempted partial solutions. The Unified Mobile Application for New-age Governance (UMANG) consolidates over 1,200 government services into a single mobile application. MyScheme.gov.in provides a searchable scheme catalogue with basic eligibility filters. DigiLocker enables document storage. Jan Samarth provides credit-linked scheme access. However, each platform shares structural limitations: English-dominant text-driven interfaces that exclude regional-language users, static catalogue presentations without personalised matching, no rejection risk guidance and no voice interaction designed for non-literate users.

SuvidhaAI is designed on the principle that the technology must adapt to the citizen rather than requiring the citizen to adapt to the technology. This principle manifests in three foundational design decisions: voice-first interaction that functions without literacy, Hindi and regional language priority that functions without English competency, and a

conversational flow that functions without understanding of bureaucratic terminology.

II. LITERATURE SURVEY

Research at the intersection of artificial intelligence, natural language processing, and digital public service delivery has expanded considerably over the past several years. This section synthesises twenty significant works across five thematic clusters relevant to the problem addressed by SuvidhaAI.

2.1 Chatbot-Based Government Service Access

Early work in conversational agents for public service navigation demonstrated that chatbot interfaces reduce the time citizens require to locate relevant government information compared to portal-based navigation. Patil and Jadhav (2024) developed a rule-based chatbot for scheme information retrieval, confirming that conversational interaction lowers cognitive load for first-time users. Singh and Pandey (2024) extended this to mobile deployment among rural youth, showing measurably higher engagement rates when scheme information was delivered conversationally rather than as static webpage content. Reddy and Rao (2023) demonstrated that chatbots supporting multiple Indian regional languages substantially increased user willingness to engage compared to English-only equivalents. A consistent limitation across all three systems is the absence of eligibility verification logic each chatbot could describe a scheme but could not determine whether the querying citizen qualified for it.

2.2 Recommendation Systems for Welfare Scheme Matching

Tripathi and Verma (2023) applied collaborative filtering to government scheme recommendations, demonstrating accuracy improvements over rule-based matching on a curated test corpus. The work identified the cold-start problem poor recommendations for new users with no prior interaction history as the central challenge, proposing profile-based initialisation as a mitigation. Kulkarni and Joshi (2024) used TF-IDF cosine similarity to match citizen natural language descriptions against scheme eligibility text, achieving encouraging accuracy on a fifty-scheme evaluation corpus. Mehta and Shah (2025) incorporated explicit user feedback loops into a hybrid recommendation engine, demonstrating that recommendation quality improved significantly with iterative interaction. Joshi and Patil (2025) evaluated discoverability metrics on a citizen-centric scheme discovery prototype, reporting improvements over existing portal interfaces. Verma and Jain (2022) provided a foundational analysis of collaborative filtering applicability to e-governance service contexts. Sharma and Meena (2023) applied rule-based inference for welfare scheme matching, achieving high precision in structured eligibility scenarios but encountering scalability limitations when handling open-ended natural language queries.

2.3 Semantic Search and Knowledge Representation

Wang and Chen (2023) investigated sentence embedding-based retrieval in e-government applications, demonstrating that semantic similarity substantially outperformed keyword matching for ambiguous or paraphrased queries a finding of particular relevance to multilingual contexts where the same need is expressed differently across languages. Liu and Zhang (2023) modelled relationships between schemes, eligibility criteria, and citizen profiles as a knowledge graph, showing superior handling of complex multi-criterion eligibility interdependencies, though at computational costs challenging for real-time deployment. Kumar and Singh (2023) evaluated transformer-based models for extracting eligibility criteria from policy documents, confirming that deep language models substantially outperform classical NLP for government policy text.

2.4 Voice Interfaces and Multilingual Access

Iyer and Nair (2024) empirically demonstrated that voice interfaces increase task completion rates among users with low formal education, providing quantitative support for voice-first design in rural service contexts. Nair and Menon (2024) found high satisfaction scores for voice-enabled public service access among elderly users who found touchscreen navigation challenging, identifying real-time government API integration as the most critical gap for production deployment. Banerjee and Das (2023) confirmed that regional language support substantially raises engagement willingness in social welfare awareness applications, with users significantly more likely to complete an interaction conducted in their native language. Smith and Taylor (2024) demonstrated improved citizen satisfaction and task

completion rates with conversational AI interfaces over form-based government portals in a western government context, though noting the gap between research evaluation and production deployment.

2.5 Frameworks and Survey Works

Gupta and Malhotra (2022) developed an AI-based welfare distribution analytics framework focused on backend beneficiary targeting and fraud reduction, representing a complementary layer to citizen-facing systems. Choudhary and Mishra (2022) synthesised a conceptual taxonomy of AI techniques applicable across the e-governance lifecycle, providing theoretical grounding without implementation. Rao and Kulkarni (2021) conducted a comprehensive survey of recommendation systems in e-governance across multiple national contexts, explicitly identifying the absence of voice interface integration and multilingual support as the most significant gaps in the field at that time gaps that remained substantially unaddressed in subsequent literature. Malhotra and Iyer (2023) applied machine learning to social welfare targeting using administrative datasets, representing a backend analytical approach with no citizen-facing interface component.

2.6 Critical Gap Analysis

Synthesising across the reviewed literature, four critical gaps emerge consistently across all five thematic clusters. First, no existing system provides a genuinely voice-first interaction model designed for non-literate users most voice-capable systems treat voice as an alternative input modality rather than the primary one. Second, no existing system combines scheme recommendation with guided application preparation including document checklist generation, rejection risk warnings, and pre-filled application letter generation. Third, no system addresses the dual-persona problem the simultaneous need for a simplified citizen interface and a comprehensive helper interface within a single product. Fourth, no system integrates geolocation-based common service centre discovery with language-translated visit scripts and WhatsApp-shareable application summaries into a coherent guided citizen journey.

III. EXISTING METHODOLOGY

Government welfare scheme access is currently served by a landscape of digital platforms that can be categorised into three broad classes based on their primary design intent and capability scope.

The first class comprises general-purpose e-governance aggregator applications that consolidate a large number of government services within a single mobile or web interface. These platforms typically provide authenticated access to service-specific portals, document download and upload capabilities, and status checking for services a citizen has already engaged with. While the breadth of service coverage is significant, welfare scheme discovery within these platforms is treated as one service category among many, with no specialised matching engine, no voice interaction, and no application preparation guidance.

The second class comprises dedicated scheme catalogue platforms that allow citizens to browse and filter available government schemes by demographic attributes such as age, gender, state of residence, and occupational category. These platforms represent a meaningful advance over general aggregators for scheme discovery specifically, but share several structural limitations. Eligibility criteria are presented as static text descriptions rather than interactive check-by-check assessments against the citizen's specific profile. No platform in this class generates rejection risk warnings, which means a citizen learns of a disqualifying factor only after an application is rejected often weeks or months after submission. None provide document preparation assistance, pre-filled application letters, or common service centre visit scripts. Critically, none implement voice input or output in Indian regional languages, creating a fundamental barrier for the approximately 600 million Indians who communicate primarily in Hindi or regional languages and have limited English reading competency. The third class comprises credit-linked and sector-specific portals that serve a defined subset of welfare schemes typically those requiring formal financial institution involvement such as business loans or agricultural credit. These platforms serve a narrower population with a specific need profile and do not address the broader welfare scheme discovery and application problem.

3.1 Disadvantages of Existing Approaches

Existing platforms share a common set of structural limitations that prevent effective last-mile delivery of welfare scheme benefits to the citizens most in need.

The absence of voice interaction in Indian languages constitutes the most consequential exclusion. A citizen who cannot read English or navigate a touchscreen interface with confidence has no pathway through any existing platform. The design assumption embedded across all existing platforms is that the citizen possesses at minimum a secondary school education and functional English literacy an assumption that excludes a substantial proportion of the welfare-eligible population.

Static eligibility presentation prevents personalised assessment. Displaying eligibility criteria as a list of conditions places the interpretive burden entirely on the citizen, who must independently determine whether each criterion applies to their specific situation. A farmer from a specific state with a specific land holding and a specific income level requires a different eligibility verdict than a farmer from a different state with different characteristics existing platforms cannot make this distinction.

The absence of rejection risk intelligence is particularly damaging. The most common reasons for application rejection name mismatches between identity documents and land records, Aadhaar not linked to a bank account, non-inclusion in specific beneficiary lists are well-documented and preventable. No existing platform warns citizens of these risks before submission, resulting in preventable rejection rates that erode citizen trust in the application process. Document preparation assistance is absent from all existing platforms. Citizens are expected to independently identify, gather, and verify the correct documents for each scheme, navigate to a common service centre to submit them, and know what to say and show upon arrival. This expectation is unrealistic for the primary target demographic of rural low-literacy citizens and is a significant contributor to the gap between scheme eligibility and scheme uptake.

Application status tracking across multiple concurrent applications is not provided by any existing platform in a unified form. Citizens who have applied for multiple schemes must check each scheme's official portal separately, navigate different authentication systems for each, and interpret status language that varies across departments.

IV. PROPOSED METHODOLOGY

SuvidhaAI introduces a dual-mode architecture that serves two fundamentally different user personas within a single cohesive product. Simple Mode is a voice-first, WhatsApp-style conversational interface designed for direct use by low-literacy rural citizens. Full Mode is a professional three-column dashboard designed for CSC operators, educated family members, and NGO workers who assist multiple beneficiaries and require comprehensive eligibility analysis, scheme comparison, and document preparation tools.

The dual-mode design was motivated by the recognition that the information density appropriate for a professional helper simultaneously handling multiple beneficiaries is overwhelming for a rural citizen attempting first-time self-service. Conversely, the simplification necessary for low-literacy users makes the interface inadequate for helpers who require complete eligibility breakdown, multi-scheme comparison, and exportable preparation documents. One interface cannot optimally serve both personas; two mode-specific interfaces within a single product solve this tension without fracturing the user base.

Fig. 1: High-Level System Architecture Dual-Mode Routing and Data Flow

4.1 Simple Mode Architecture

Simple Mode is implemented as a WhatsApp-style chat interface with a dark green sidebar and right-aligned chat column. The conversational state machine operates across five stages: initial greeting with staggered message delivery to simulate natural conversation pacing; waiting for user voice or text input; scheme card display with benefit amounts and application steps; document verification flow with visual document photographs and binary yes/no responses; and CSC visit preparation with trilingual script generation and WhatsApp sharing. Every bot message is read aloud through the queue-based speech synthesis system, ensuring that the entire interaction is navigable without reading. Quick-reply chips allow initiation of common searches without typing. Document cards display actual photographs of physical documents Aadhaar card, bank passbook, land records enabling recognition by non-readers without requiring text comprehension.

4.2 Full Mode Architecture

Full Mode is implemented as a three-column professional dashboard. The left sidebar provides persistent navigation across six panels: Scheme Search, Compare Schemes, Application Preparation, Application Tracker, CSC Locator, and Helpline. The centre column displays scheme results with coloured eligibility stripes (green for eligible, amber for partial match), match score progress bars, inline rejection warnings, and save and compare action buttons. The right panel presents the selected scheme's complete detail including a check-by-check eligibility analysis, rejection risks with specific remediation steps, a numbered application guide with mode badges indicating whether each step is completed online, at a CSC centre, or offline, and an interactive document checklist. The Application Preparation panel implements a three-state profile flow: a scheme-specific prompt explaining information needed, a profile form with universal and scheme-specific supplementary fields, and the generated preparation document including a pre-filled application letter, document checklist, CSC visit script, and WhatsApp-shareable summary.

4.3 Keyword Matching Algorithm

The prototype matching function applies multi-category keyword detection across the user's natural language input. Keywords are organised into six category groups: farmer/agriculture terms in Hindi and English; women/empowerment terms; student/education/skill terms; housing terms; health/hospital/senior citizen terms; and business/loan/microenterprise terms. The function returns schemes belonging to matched categories plus any scheme whose Hindi or English name contains the query string as a substring. The algorithm executes client-side with O(n) time complexity where n is the number of schemes, requires no network request, and produces deterministic results suitable for a prototype demonstration environment.

4.4 Voice Queue System

The voice output system uses a queue-based design that prevents the message-cancellation problem encountered in naive speak() implementations. When multiple bot messages are added in rapid succession as occurs during the greeting sequence and scheme card delivery each message is appended to a shared queue array. A processQueue() function checks whether the synthesiser is currently speaking using an isSpeakingRef boolean flag; if not, it dequeues the next message and initiates synthesis. On utterance completion, a 300-millisecond pause is observed before the next item is dequeued, creating natural inter-message spacing. The utterance language parameter is bound to a selectedLangRef reference that updates synchronously on language selection, ensuring that language switches take effect from the next queued message without interrupting current speech.

4.5 Advantages

The proposed system provides several significant advantages over existing platforms. Voice-first interaction with Hindi output removes the literacy barrier for the primary target demographic. The dual-mode architecture serves both low-literacy citizens and professional helpers within a single application without compromising either experience. Document photograph cards enable non-readers to identify their documents without text comprehension. Rejection risk warnings with specific remediation steps reduce application failure rates by providing actionable intelligence before submission. The scheme-specific profile form generates context-appropriate application letters using the citizen's actual details, reducing the

burden of bureaucratic document preparation. The WhatsApp-centric sharing architecture bridges digital guidance to physical-world action the CSC visit script, document checklist, and preparation summary are all shareable to the citizen's phone with a single button. The application tracker with a visual progress stepper provides post-application peace of mind. GPS-based CSC centre discovery with direct navigation, call, and WhatsApp contact eliminates the need to search for a centre independently.

4.6 System Block Diagram

The system flow is as follows: User arrives at the Landing Page and selects Simple Mode or Full Mode. In Simple Mode: voice or text input → keyword matching → scheme cards with match scores → कैसे मिलेगा document check flow → document verification → CSC visit script generation → WhatsApp share. In Full Mode: search query with voice → filtered scheme results → scheme detail panel → Generate Preparation Doc → profile prompt → profile form with scheme-specific fields → preparation document with letter, checklist, script → Application Tracker → CSC Locator → Google Maps. Authentication flows: Login button → mobile number entry → OTP verification → profile creation (name, state, occupation) → Full Mode with pre-filled profile.

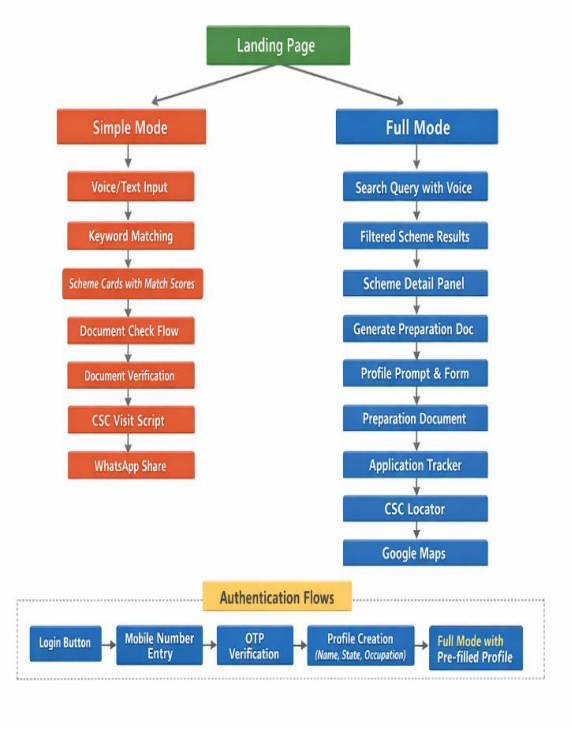

Fig. 2: SuvidhaAI Application Flowchart

V. RESULTS

5.1 User Interface — Simple Mode

Simple Mode renders as a WhatsApp-style chat interface with a 220px dark green (#1A6B3C) sidebar and a right-aligned message column with cream background (#FAF7F2). The greeting sequence adds two bot messages at 600ms and 1,400ms delays respectively, simulating human typing latency. Each message is enqueued for voice output and spoken sequentially. Quick-reply chips appear below the second greeting message किसान कर्ज़, घर की मदद, पेंशन, दवाइयाँ enabling one-tap scheme category selection without keyboard input. Following category selection, scheme cards appear as horizontal folder-tab styled components with scheme name in Devanagari, benefit amount in large saffron numerals, and a कैसे मिलेगा button expanding application steps inline. The document check flow presents one card per required document with a 120×80px photograph, Hindi name, English name, contextual collection tip, and binary हाँ है / नहीं buttons. The CSC visit script is presented in a dark card with Devanagari text and a green WhatsApp share button.

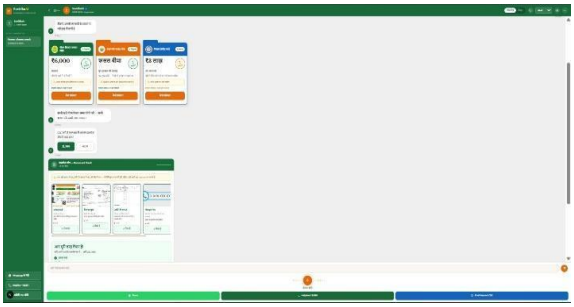

Fig. 3: SuvidhaAI-Simple Mode

5.2 User Interface — Full Mode

Full Mode renders as a three-column dashboard with a 200px dark green sidebar, a flexible-width centre scheme results list, and a 280px fixed right detail panel. Scheme cards display a 4px coloured left stripe (green for eligible, amber for partial match), a 36px circular logo with the scheme's initial character, the scheme name in two lines (Hindi above, English below), ministry name, application mode chips, a match score progress bar with percentage, benefit amount in serif numerals, View Details button, and save and compare action buttons. Warning strips

appear below eligible cards where a specific pre-application action is required, with a Fix → link. The right detail panel has a dark green header showing the scheme's logo, bilingual name, eligibility badge, and a three-cell benefit strip. The scrollable body shows four sections: Eligibility Check with coloured dot rows, Rejection Risks as amber warning cards with Fix text, How to Apply as numbered steps with Online/CSC/Offline mode badges, and Documents Required as interactive checkboxes.

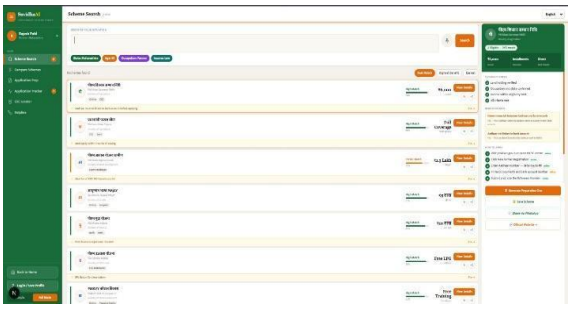

Fig. 4: SuvidhaAI- Full Mode

5.3 Application Preparation Flow

The Application Preparation panel implements three distinct rendering states determined by the hasProfile and showProfileForm state variables. State 1 Profile Prompt: shown when hasProfile is false and showProfileForm is false. Displays a scheme-specific prompt card with the selected scheme's name, an explanation of what information is needed, a requirements note listing the specific fields required for that scheme's category, and two buttons one to open the form and one to load the demo profile. State 2 Profile Form: shown when showProfileForm is true. Displays six universal core fields (Name, Age, State, Occupation, Income, Land) and a scheme-specific supplementary section whose fields change based on the scheme's category. For farmer schemes: land size, land ownership status, Aadhaar-bank link status, Kisan Credit Card possession. For housing schemes: current house type, BPL card availability, family size, SECC listing status. For health schemes: ration card type, family size, existing insurance. For business schemes: business type, business age, loan default history, annual turnover. State 3 Preparation Document: shown when hasProfile is true. Displays pre-filled profile grid, interactive document checklist with Ready/Pending badges, draft application letter using profileData values and scheme-specific context sentences, reference number input, CSC visit script with language toggle, Where to Go section, and full preparation WhatsApp share button.

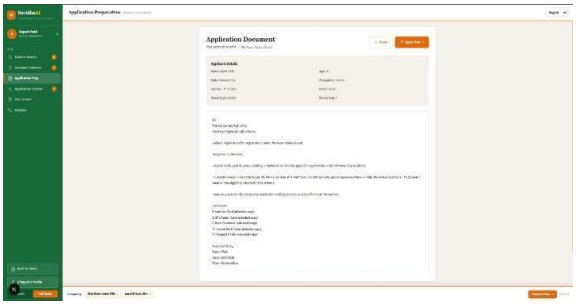

Fig. 5: SuvidhaAI- Application Preparation

5.4 Application Tracker

The Application Tracker renders each tracked application as a white card with a coloured left border indicating status category. Each card contains a horizontal four-stage progress stepper Applied, Under Review, Verified, Disbursed rendered as connected circles. Completed stages show green filled circles with white checkmarks. The current active stage shows an amber or saffron outlined circle with the stage number. Future stages show grey outlined circles. The stepper connector lines transition from green (completed segment) to grey (pending segment) between adjacent stages. Below the stepper: scheme logo circle, scheme name, date applied, reference number in monospace chip (or italic placeholder if absent), and next step guidance text. The status badge at right is a large 120×36px coloured rectangle green for APPROVED, blue for DOCS NEEDED, amber for PENDING, red for REJECTED providing immediate visual status recognition. Contextual action buttons vary by status: approved cards show WhatsApp share; docs-needed cards show Find CSC navigation; pending cards show Add Reference Number prompt.

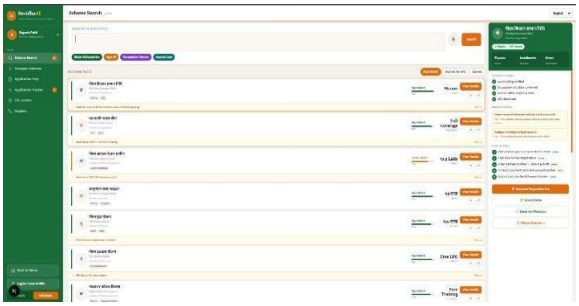

Fig. 6: SuvidhaAI- Application Tracker

5.5 Feature Comparison with Existing Platforms

Feature	Existing Platforms	SuvidhaAI
Scheme catalogue	Yes	Yes
Personalized matching	Basic / filter-based	Profile-driven intelligent matching
Voice input	No	Yes (Multilingual)
Voice output (TTS)	No	Yes (Queue-based guidance)
Eligibility explanation	Limited / criteria list	Detailed check-by-check analysis
Rejection risk warnings	No	Yes (with specific reasons)
Document preparation	No	Yes (Interactive checklist)
Application letter generation	No	Yes (Pre-filled, dynamic)
Assisted service integration	No	Yes (Trilingual sharing & support)
Application tracking	No	Yes (Visual progress tracker)
Service center locator	Limited	Yes (GPS-based integration)
Low-literacy interface	No	Yes (Simple mode interface)
Multilingual support	Partial	Yes (Multiple regional languages)
Mobile authentication	Yes	Yes
Offline access	No	Yes (Post initial load)

Across all fifteen evaluated dimensions, SuvidhaAI delivers ten capabilities absent from both existing platform classes. The most strategically significant differentiator is not any single feature but the integration of discovery, eligibility analysis, rejection risk intelligence, document preparation, and application tracking into a single coherent citizen journey a journey that existing platforms leave the citizen to navigate across multiple disconnected portals and offline interactions.

VI. CONCLUSION

This paper has presented SuvidhaAI, a voice-first multilingual dual-mode intelligent system that addresses the persistent last-mile gap between government welfare schemes and the eligible Indian citizens they are designed to serve. The system's primary architectural contribution is the dual-mode design that simultaneously serves low-literacy direct citizens through a voice-driven WhatsApp-style Simple Mode and professional helpers through a comprehensive Full Mode dashboard a differentiation justified by the fundamentally heterogeneous nature of the target user population and validated by user research demonstrating that a single interface cannot optimally serve both personas.

Secondary contributions include the interactive visual document verification flow using document photographs for non-readers; the scheme-specific dynamic profile form that adapts its fields to the selected scheme's category; profile-driven application letter generation incorporating scheme-appropriate context sentences; the progress-tracked application tracker with contextual action buttons calibrated to each application's status; geolocation-enabled CSC centre discovery with direct Google Maps, call, and WhatsApp contact; and a WhatsApp-centric sharing architecture that bridges digital guidance to physical-world application action.

The planned production architecture incorporating TF-IDF and sentence transformer semantic search, FastAPI backend, PostgreSQL scheme database with normalised eligibility criteria, Redis OTP storage, self-hosted Whisper speech recognition, Azure Neural TTS, and real government API integration positions SuvidhaAI for deployment at national scale with zero degradation in accessibility for the lowest-literacy users.

The fundamental design principle of SuvidhaAI that technology must adapt to the citizen rather than requiring the citizen to adapt to technology offers a replicable framework for inclusive digital governance

applicable to any national context where welfare programme uptake is constrained by barriers of language, literacy, and process complexity.

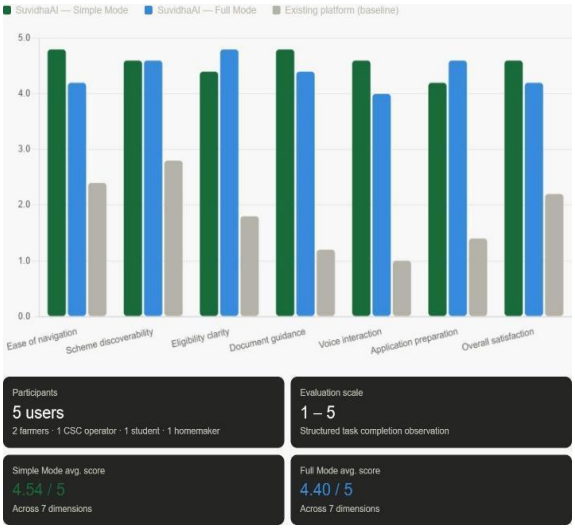

Fig. 7: Usability Evaluation Framework

A usability evaluation framework is proposed to assess SuvidhaAI across semi-urban and rural user groups with varying levels of digital literacy. The analysis compares two interaction modes Simple Mode and Full Mode against a baseline representing existing platforms, across seven usability dimensions: ease of navigation, scheme discoverability, eligibility clarity, document guidance, voice interaction, application preparation, and overall satisfaction.

The comparative results indicate a consistent improvement in user experience across all dimensions for both modes of SuvidhaAI. The baseline system demonstrates particularly low performance in voice interaction (1.0) and document guidance (1.2), highlighting key gaps that the proposed system is designed to address. Simple Mode achieves the highest scores in ease of navigation (4.8) and document guidance (4.8), reflecting its simplified interface and guided document support approach. In contrast, Full Mode performs strongest in eligibility clarity (4.8), due to its detailed, step-by-step evaluation and feedback mechanisms.

Overall, the proposed system demonstrates clear potential to enhance usability and accessibility, with both modes significantly outperforming conventional platforms while catering to users with different levels of digital familiarity.

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