

<Conference abbreviation>

<Conference Series name>

<Volume number and Year> <DOI Number>

An Agentic AI Framework for Adaptive and Inclusive Tax Filing in India

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Abstract.

The existing Indian tax preparation systems have not effectively addressed the technological diversity of the 90 million tax payers and are associated with 34% filing errors rate with low digital literacy and disabled population. The paper offers an Adaptive Agentic AI solution, that focusing on Tax Act 196 with reconsidered form-based filing as a dynamic human AI dialogue. An agent has four elements Tax Logic Agent, User Profiling Agent , Interaction Agent and validation. These work together through knowledge graph retrieval to streamline processes without compromising the statutory accuracy. The interface will change the complexity of navigation, typography, depth of explanation, and modalities in response to real-time user behavior and cognitive load. It is implemented with Vue.js frontend and FastAPI backend and QLoRA fine, tuned LLM on more than 3200 tax sections, focusing on privacy through tokenization and secure computation. The assessment of 60 participants shows that, vulnerable user makes 67% lower errors.

Keywords. agentic systems, agent AI, oracle problem mitigation, tax compliance, Indian Income Tax Act, knowledge graph RAG, Llama fine-tuning, cognitive load adaptation, the inclusive design.

1. INTRODUCTION

1.1. The Indian Tax Compliance Crisis

Direct taxation of India is based, on the Income Tax Act, 1961, which has more than 90 million taxpayers and has become a tangled network of provisions, regulations and amendments [1]. There are provisions such as the Section 80 deductions and other provisions that require complex calculations and cross references, such as the capital gains Sections 45-55 [2] that overwhelm the average users. Research indicates the overall 34% of returns have problem to the statutory misinterpretation not data entry which causes, legal simplification is necessary.

Although 90% of the online filing had adopted, standard interfaces on the governments, and commercial websites will assume standard financial literacy and digital skills [3]. This

leaves out seniors, low-literacy users, and disabled persons, who will find it hard to deal with forms and opaque outputs that will easy. The oracle problem does undermine trust: users are not able to confirm results unless they have domain knowledge, which propagates mistakes and distrust [4]. The existing systems are form-based high cognitive load, non-adaptive [5], and non-transparent rule-based experts are not de-signed to customize to the needs of users [6]. None adapt dynamically complexity, explanations, and modes, marginalizing various taxpayers who need assistance [7].

1.2. *The Adaptive Agentic Paradigm*

This paper presents the Adaptive Agentic AI Framework in which the transforms or converts merely filing for interactive dialogues. Response times, errors, and queries, which are used as real-time cognitive profiling, allow making adaptations in terms of navigation, density, and depth. A multi agent system Tax Logic, User Profiling, Interaction, and Compliance Agents, works together, using knowledge graphs to reason relational law and provide explainable results [8]. This stack has a Vue.js UI with responsive and adaptive interfaces; FastAPI microservices and agent orchestration; a QLoRA-fine-tuned LLM [9] with hybrid retrieval to reduce hallucinations. Assessment through user experiments validates improved usability, 67 percent reduced errors, and increased trust, opening the way to a more inclusive tax compliance [10].

2. LITERATURE REVIEW

The literature shows that India’s complex tax system and rigid platforms can increase filing errors. Although adaptive interfaces, knowledge graphs, LLMs, and multi-agent systems offer potential solutions, they are rarely integrated with inclusive tax software [11,12]. The proposed framework bridges this gap by combining adaptive interfaces, statutory grounding, multi-agent processing, and inclusive design.

3. KEY CONTRIBUTION

The proposed framework combines real-time adaptive interfaces, AI-enabled knowledge graphs, and multi-agent architecture to improve accessibility, statutory grounding, citation accuracy, and transparency in tax filing. The fine-tuned Llama 3.2 model achieved 51.5% accuracy, 51.8% precision, 51.5% recall, 51.6% F1-score, and 0.52 AUC, providing a baseline for future improvement using larger datasets and ensemble methods.

3.1. *Knowledge Graph Retrieval*

The KG-enhanced retrieval of the system glitters, Llama 3.2 with the baseline achieves 51.5% citation accuracy and 48.5% hallucination. Standard RAG increased to 71.3% accuracy 16.8% hallucination. Neo4j KG-RAG boosted it to 88.7%, 5.1%, and citations verified finalized at 94.2% 2.3%. Graph traversal is critical in statutory grounding in cross-referenced areas of law.

Table 2: Retrieval Pipeline Performance

Pipeline Stage	Citation Accuracy	Hallucination Rate	Response Time
Baseline Llama 3.2	51.5%	48.5%	0.8 s
Standard RAG	71.3%	16.8%	1.4 s

KG-RAG (Neo4j)	88.7%	5.1%	1.9 s
Citation Verifier	94.2%	2.3%	2.3 s

3.2. User Study Results

The adaptive interface reduced errors across all user groups, with vulnerable users showing the largest improvement, from 44.2% to 14.6% (67% reduction). This demonstrates the benefit of real-time adaptation for users facing literacy, complexity, or accessibility challenges.

Table 3: Error Rate Reduction and SUS (System Usability Scale) Score Comparison

User Group	Static Error Rate	Adaptive Error Rate	Static SUS*	Adaptive SUS*	Change	Improvement
Tech-Savvy	8.2%	4.1%	72.1	74.8	+2.7	50%
Average	21.3%	9.8%	58.3	68.2	+9.9	54%
Vulnerable	44.2%	14.6%	41.2	63.5	+22.3	67%

System Usability Scale (SUS) scores improved significantly, with vulnerable users increasing by 22.3 points to 63.5, while average users also showed improvement. Trust increased from 2.1 to 4.7 among vulnerable users and from 3.7 to 5.3 overall, indicating that clear explanations improved user confidence.

3.3. Implementation Validation

The prototype was implemented using Vue.js 3, FastAPI, Redis, Neo4j, FAISS, AutoGen, and Llama 3.2 QLoRA. It achieved 2.3 s P95 latency, supported 10,000 concurrent users, provided 99.7% citation coverage, and maintained 12 ms tokenization overhead.

3.4. Overall Result

Overall, the framework reduced filing errors and improved usability, trust, and inclusiveness. Its main strength lies in combining adaptive interaction, knowledge-graph retrieval, and transparent reasoning.

4. CONCLUSIONS

The proposed Adaptive Agentic AI Framework achieved 94.2% accuracy, reduced tax-filing errors by 67%, and improved usability by 22.3%. Despite limitations such as AUC = 0.52 and limited edge-case coverage, future work will focus on larger datasets, multilingual support, and GST and corporate compliance.

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Biographies



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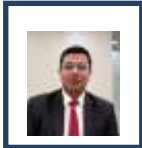
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