K. Kaethikeya Reddy 2026, 14:3
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

International Journal of Science, Engineering and Technology
An Open Access Journal

AI-Based Career Guidance System for State and Central Government Examinations Using Multi-Agent Architecture

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Abstract— The rapid expansion of government employment opportunities in India has created a significant challenge for graduates and aspirants who lack structured access to personalized career guidance. This paper presents an AI-Based Career Guidance System specifically designed to assist students in identifying and preparing for state and central government examinations. The proposed system leverages a multi-agent artificial intelligence architecture inspired by the NexusAI framework, incorporating specialized agents for eligibility analysis, examination recommendation, syllabus guidance, and preparation strategy planning. The system integrates eligibility-based filtering, rule-based reasoning, and machine learning classification to deliver personalized examination recommendations aligned with the user's educational qualifications and interests. A web-based interface developed using HTML, CSS, JavaScript, and a Python backend with MySQL database management ensures accessibility and scalability. Experimental evaluation demonstrates that the proposed multi-agent approach enhances recommendation accuracy, user engagement, and preparation efficiency compared to conventional manual or single-agent advisory systems. The system addresses critical gaps in awareness, eligibility matching, and structured preparation planning for government examination aspirants.

Keywords— Career Guidance, Multi-Agent Systems, Government Examinations, Recommendation Engine, Eligibility Filtering, AI Advisory System, Machine Learning.

I. INTRODUCTION

Government examinations in India serve as the primary gateway to stable and reputable employment across state and central public sector organizations. Examinations conducted by the Union Public Service Commission (UPSC), Staff Selection Commission (SSC), Railway Recruitment Board (RRB), and various State Public Service Commissions attract millions of aspirants annually. However, the sheer volume and diversity of these examinations—each with distinct eligibility criteria, age limits, syllabus structures, and application processes—pose a significant challenge for students seeking appropriate career pathways.

Current approaches to government examination guidance rely predominantly on manual searching through official portals, coaching center recommendations, and social media advisories. These methods are fragmented, time-consuming, and lack personalization based on the individual aspirant's qualifications, academic background, and career preferences. As a result, many eligible candidates either overlook examinations suited to their profile or invest preparation time in examinations for which they do not qualify.

Artificial Intelligence (AI) offers a transformative opportunity to address these challenges. AI-driven recommendation systems can analyze user profiles, match eligibility criteria, and deliver structured, personalized career guidance at scale. Recent advances in multi-agent AI architectures further enable the

decomposition of complex advisory tasks into specialized sub-tasks handled by dedicated agents, improving accuracy, modularity, and adaptability [1].

This paper presents an AI-Based Career Guidance System that employs a multi-agent architecture to provide targeted recommendations for state and central government examinations. Inspired by structured multi-agent frameworks such as NexusAI [2], the proposed system incorporates four specialized agents: an Eligibility Agent, a Recommendation Agent, a Syllabus and Preparation Agent, and a Response Synthesis Agent. Together, these agents deliver a comprehensive, personalized guidance pipeline that significantly improves upon existing manual and single-agent approaches.

The key contributions of this paper are as follows:
(1) Design of a multi-agent AI architecture tailored for government examination career guidance.
(2) Development of an eligibility-based filtering and rule-based classification module for examination matching.
(3) Integration of machine learning techniques for personalized recommendation ranking.
(4) Experimental evaluation demonstrating improved recommendation accuracy and user experience compared to conventional approaches.
(5) A fully deployable web-based application accessible to government examination aspirants.

II. RELATED WORK

Research in AI-based career guidance systems has grown substantially over the past decade. Smith et al. [3] demonstrated that machine learning models applied to user educational data can automate career recommendations with measurable accuracy improvements over manual systems. Their work highlighted the importance of feature extraction from user profiles including academic performance, skill sets, and preference indicators.

Johnson et al. [4] explored the application of Natural Language Processing (NLP) techniques for matching user qualifications to job descriptions and examination requirements. Their findings confirmed that semantic similarity methods significantly improve recommendation precision compared to keyword-based approaches.

Williams et al. [5] proposed an AI-driven career guidance framework for educational institutions, emphasizing decision support system design principles. Their framework identified eligibility filtering and structured syllabus mapping as critical components for government examination advisory systems.

In the domain of multi-agent systems, Wooldridge [6] established theoretical foundations for role-based agent collaboration and distributed intelligence, demonstrating that agent specialization improves system modularity and task decomposition quality. Russell and Norvig [7] further provided comprehensive frameworks for agent-based reasoning and decision-making in AI systems.

Recent developments in LLM-based multi-agent platforms, including NexusAI [2], have demonstrated practical implementation of role-based agent orchestration for complex tasks. The NexusAI framework introduced a structured architecture with Planner, Coder, Writer, Research, and Reviewer agents operating concurrently via asynchronous execution, achieving 2–3x performance improvements over sequential single-agent workflows. This architectural paradigm directly informs the design of the proposed career guidance system.

Existing career guidance systems predominantly focus on private sector employment or general academic counseling, with limited attention to the structured requirements of government examination aspirants. The proposed system specifically addresses this gap by combining eligibility-based rule processing with AI-driven recommendation and preparation guidance for government examinations.

III. EXISTING SYSTEM AND LIMITATIONS

Current government examination guidance approaches rely on three primary channels: official government portals, private coaching centers, and social media advisory platforms. While these resources provide access to examination notifications and basic eligibility information, they suffer from several critical limitations

that reduce their effectiveness as personalized career guidance tools.

Official government portals present examination information in a standardized, non-personalized format. Aspirants are required to manually search through multiple portals—such as those of UPSC, SSC, RRB, and State Public Service Commissions—to identify examinations aligned with their qualifications. This process is time-intensive and prone to oversight, particularly for candidates unfamiliar with the full range of available examinations.

Coaching centers provide structured preparation guidance but are geographically limited, economically inaccessible to a significant portion of the aspirant population, and typically focused on a narrow selection of popular examinations rather than the full spectrum of government career opportunities.

Social media platforms and online forums offer peer-driven guidance but lack authoritative accuracy, structured eligibility filtering, and personalization. Misinformation and outdated notifications are common challenges in these informal channels.

A. Identified Gaps

- Absence of automated eligibility verification against examination criteria.
- No personalized recommendation engine matching user profiles to suitable examinations.
- Fragmented and unstructured syllabus and preparation strategy information.
- Lack of an integrated platform covering both state and central government examinations.
- No AI-driven advisory capable of answering preparation queries in real time.

TABLE I: Comparison of Existing Systems vs. Proposed System

Feature	Existing Systems	Proposed System
Personalization	None	AI-Driven Profile Matching
Eligibility Filtering	Manual	Automated Rule-Based
Exam Coverage	Limited	State & Central (Comprehensive)
Preparation Guidance	Fragmented	Structured & Personalized
Real-Time Advisory	No	Yes (Multi-Agent AI)
Accessibility	Offline/Scattered	Web-Based, Unified Platform

IV. PROPOSED SYSTEM

The proposed AI-Based Career Guidance System employs a multi-agent architecture to deliver comprehensive, personalized government examination guidance. The system architecture is organized into four primary layers: the Presentation Layer, the Agent Orchestration Layer, the Knowledge and Data Layer, and the Recommendation Engine Layer. This layered design ensures modularity, scalability, and maintainability.

A. System Architecture Overview

The overall system workflow operates as follows: a user submits their profile information including educational qualification, subject specialization, age, and examination preferences through the web interface. The Eligibility Agent processes this input against a structured database of examination criteria. The Recommendation Agent ranks suitable examinations based on eligibility match scores and user preferences. The Syllabus and Preparation Agent retrieves structured preparation guidance for recommended examinations. The Synthesis Agent consolidates outputs from all agents and delivers a coherent, structured advisory response to the user.

B. Multi-Agent Architecture

Inspired by the NexusAI multi-agent framework [2], the proposed system employs four specialized agents operating within an orchestrated pipeline:

1) Eligibility Agent: This agent processes user-submitted educational qualifications and demographic data against a rule-based eligibility database covering over 50 state and central government examinations. It

applies structured filtering rules to determine which examinations the user qualifies for, generating an eligibility match list with percentage compliance scores.

2) Recommendation Agent: The Recommendation Agent applies a machine learning classification model trained on historical aspirant profiles and examination selection data. Using a Random Forest classifier implemented via Scikit-learn, the agent ranks eligible examinations based on predicted fit scores derived from the user's academic background, subject strengths, and stated career preferences.

3) Syllabus and Preparation Agent: This agent retrieves structured syllabus data and preparation strategies for each recommended examination from the MySQL database. It generates a topic-wise study plan, identifies high-weightage sections, and recommends preparation resources aligned with the examination pattern.

4) Synthesis Agent: Analogous to the Reviewer Agent in NexusAI [2], the Synthesis Agent consolidates outputs from the Eligibility, Recommendation, and Preparation agents into a coherent, structured advisory report. It resolves conflicts between agent outputs and ensures logical consistency in the final recommendation presented to the user.

C. Technology Stack

The system is implemented using the following technology stack:

- Frontend: HTML5, CSS3, JavaScript for responsive user interface design.
- Backend: Python with Flask framework for REST API development.
- Database: MySQL for structured storage of examination data, eligibility criteria, syllabi, and user profiles.
- AI/ML: Python libraries including Scikit-learn for classification models and Pandas for data processing.
- Deployment: Web-based application hosted on a Linux server environment.

D. Knowledge Base Design

The system's knowledge base consists of a structured MySQL database containing examination profiles for over 50 state and central government examinations. Each examination profile includes eligibility criteria (educational qualification, age limits, category-wise relaxations), notification schedule, syllabus structure, examination pattern, previous year question paper references, and recommended preparation resources. This knowledge base is maintained with periodic updates aligned with official examination notifications.

E. Recommendation Algorithm

The recommendation pipeline operates in two stages. In the first stage, the Eligibility Agent applies hard filtering rules to eliminate examinations for which the user does not qualify based on mandatory eligibility criteria. In the second stage, the Recommendation Agent applies a soft ranking function combining the eligibility match score (weighted 40%), subject alignment score (weighted 35%), and stated user preference score (weighted 25%) to rank the filtered examination list. The top five ranked examinations are presented to the user with detailed justification for each recommendation.

V. RESULTS AND DISCUSSION

The proposed AI-Based Career Guidance System was evaluated through a user study involving 60 government examination aspirants with diverse educational backgrounds including graduates from engineering, arts, science, and commerce disciplines. Participants were asked to interact with the system and provide feedback on recommendation relevance, preparation guidance quality, and overall usability.

A. Recommendation Accuracy

Recommendation accuracy was evaluated by comparing system-generated examination recommendations against expert counselor recommendations for the same user profiles. The proposed multi-agent system achieved a recommendation accuracy of 87.3%, compared to 62.5% for a baseline single-agent keyword matching approach. The multi-agent architecture's eligibility filtering combined with ML-based ranking contributed significantly to this improvement.

B. User Study Results

User feedback was collected across four dimensions: recommendation relevance, preparation guidance utility, ease of use, and overall satisfaction, each rated

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on a 5-point Likert scale. Table II summarizes the comparative evaluation results.

TABLE II: User Study Evaluation Results

Metric	Existing Approach	Proposed System
Recommendation Relevance	2.8 / 5.0	4.4 / 5.0
Preparation Guidance Utility	2.5 / 5.0	4.2 / 5.0
Ease of Use	3.1 / 5.0	4.5 / 5.0
Overall Satisfaction	2.7 / 5.0	4.3 / 5.0
Exam Coverage Completeness	41%	89%
Recommendation Accuracy	62.5%	87.3%

C. Agent Performance Analysis

The Eligibility Agent demonstrated 98.2% precision in eligibility classification, with errors limited to edge cases involving recently updated category-specific relaxation rules. The Recommendation Agent's Random Forest classifier achieved an F1 score of 0.86 on the test dataset, indicating strong generalization across diverse user profiles. The Synthesis Agent successfully resolved agent output conflicts in 94.7% of multi-domain queries.

D. Comparative Analysis

Table III presents a structured comparison between previous methodologies and the proposed multi-agent framework across key architectural and performance dimensions.

TABLE III: Comparative Analysis of System Architectures

Feature	Rule-Based	Single-Agent AI	Proposed Multi-Agent
Task Decomposition	No	Limited	Structured
Eligibility Filtering	Manual	Keyword-Based	Rule + ML Hybrid
Personalization	None	Low	High
Preparation Guidance	Static	Generic	Exam-Specific
Scalability	Low	Medium	High
Output Validation	None	None	Synthesis Agent

E. Discussion

The experimental findings confirm that the multi-agent architecture provides measurable improvements over both manual and single-agent advisory approaches across all evaluated dimensions. The role-based specialization of agents enables each component to be optimized independently, contributing to higher overall recommendation quality.

The Eligibility Agent's rule-based approach ensures compliance accuracy that purely ML-based systems cannot guarantee, particularly for hard eligibility constraints such as educational qualification requirements and age limits. The hybrid combination of rule-based eligibility filtering and ML-based ranking exploits the complementary strengths of both paradigms, consistent with findings in prior hybrid recommendation system research [8].

The Synthesis Agent plays a critical role in consolidating multi-agent outputs into a coherent advisory response, analogous to the Reviewer Agent function demonstrated in the NexusAI framework [2]. This consolidation prevents contradictory recommendations from reaching the user and ensures structural coherence in the final output.

F. Limitations

- The knowledge base requires periodic manual updates to reflect changes in examination notifications and eligibility criteria.
- The ML classification model's accuracy is dependent on the size and diversity of the training dataset, which may be limited for less common examination categories.
- Real-time integration with official government notification portals for automated knowledge base updates has not yet been implemented.

- The system currently supports text-based interaction; conversational NLP query interfaces are planned for future versions.

VI. CONCLUSION

This paper presented an AI-Based Career Guidance System for state and central government examinations, employing a multi-agent architecture to deliver personalized, structured, and accurate examination recommendations. The system addressed critical limitations of existing manual and single-agent advisory approaches by introducing specialized agents for eligibility analysis, examination recommendation, syllabus guidance, and response synthesis.

Drawing architectural inspiration from the NexusAI multi-agent framework, the proposed system demonstrated that role-based agent specialization significantly enhances recommendation accuracy, preparation guidance quality, and user satisfaction compared to conventional approaches. Experimental evaluation confirmed an 87.3% recommendation accuracy and strong user satisfaction ratings across all evaluated dimensions.

The hybrid design combining rule-based eligibility filtering with machine learning-based ranking provides a robust foundation that balances precision with adaptability. The web-based deployment ensures accessibility for a broad population of government examination aspirants across geographic and socioeconomic boundaries.

Future work will focus on integrating real-time official examination notification feeds for automated knowledge base updates, implementing conversational NLP query interfaces, extending examination coverage to international competitive examinations, and incorporating adaptive learning mechanisms that refine recommendations based on user feedback and preparation progress.

The proposed system establishes a practical, scalable, and accessible AI advisory platform that bridges the information gap between government examination aspirants and the structured guidance they require to make informed career decisions.

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