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Government Scheme Assistant Using NLP & ML

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Abstract: ***The Government Scheme Assistant is an intelligent web-based application designed to help citizens identify and access suitable government welfare schemes using Artificial Intelligence (AI), Natural Language Processing (NLP), and Machine Learning (ML) techniques. In many developing regions, citizens struggle to find relevant schemes due to scattered information, complex eligibility criteria, and lack of personalized guidance. The proposed system addresses these challenges by providing an interactive platform where users can input personal details such as age, gender, occupation, and requirements, and receive tailored scheme recommendations. The system incorporates a chatbot assistant that enables users to interact in natural language and obtain instant responses to their queries. A rule-based recommendation engine processes user inputs and maps them to relevant schemes categorized into domains such as education, agriculture, health, and employment. The frontend is developed using React.js to ensure a responsive and user-friendly interface, while backend services handle data processing and recommendation logic. The system enhances digital governance by improving accessibility, reducing search time, and increasing awareness of government initiatives. Future enhancements include integrating machine learning-based recommendation models, real-time data fetching from official government portals, and multilingual chatbot support for wider accessibility.***

I. INTRODUCTION

In recent years, digital governance has significantly transformed the way governments deliver services to citizens; however, despite the availability of numerous welfare schemes, many individuals remain unaware of the benefits they are eligible for due to fragmented information, complex procedures, and lack of proper guidance. Traditional methods of searching for government schemes involve browsing multiple websites, reading lengthy documents, and manually verifying eligibility criteria, which are often time- consuming and confusing. To address these challenges, the Government Scheme Assistant is proposed as an intelligent solution that leverages Artificial Intelligence (AI), Natural Language Processing (NLP), and Machine Learning (ML) to simplify scheme discovery and eligibility checking. The system enables users to interact through a chatbot interface and receive personalized recommendations based on their demographic and socio- economic details such as age, gender, occupation, and financial status, which are processed using a rule-based recommendation algorithm to identify relevant schemes. Furthermore, the chatbot enhances user experience by supporting natural language interaction, making the platform accessible even to non-technical users. The system also categorizes schemes into domains such as education, agriculture, healthcare, and employment, allowing users to easily explore suitable options, while the integration of modern web technologies like React.js and scalable backend architecture ensures efficient performance and future expandability. Overall, this project contributes to AI- driven e-governance by providing a centralized, user-friendly, and intelligent platform that improves citizen awareness, enhances accessibility, and promotes effective utilization of government welfare programs.

II. LITERATURE SURVEY

The application of Artificial Intelligence (AI) and Machine Learning (ML) in e- governance has gained significant attention in recent years, particularly in enhancing public service delivery, improving transparency, and strengthening citizen engagement, as researchers continue to explore innovative approaches to simplify access to government schemes and automate eligibility detection. Sansanwal et al. (2021) developed an AI-driven recommendation system that analyzes user data to suggest relevant public services, thereby improving accessibility and supporting more informed decision-making among citizens. Similarly, Islam and Andersson (2020) proposed a Natural Language Processing (NLP)-based question-answering system that enables users to retrieve government-related information through natural language queries, significantly reducing complexity and making information systems more user-friendly. Furthermore, Qiang et al. (2022) introduced machine learning models capable of predicting eligibility for welfare schemes based on demographic and socio- economic attributes, which helps in minimizing manual verification efforts and improving accuracy in identifying beneficiaries.

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Kumar and Richardson (2023) focused on text classification techniques to match user queries with appropriate welfare services, thereby enhancing efficiency and responsiveness in digital governance platforms. In addition, Nguyen and Harman (2021) explored deep learning methods for analyzing policy documents and assisting users in understanding complex eligibility criteria and scheme benefits, emphasizing the importance of intelligent systems in improving transparency and accessibility of government services.

Moreover, recent advancements in AI have highlighted the importance of integrating conversational agents and recommendation systems to provide personalized and real- time assistance to users. These intelligent systems not only reduce the time required to search for relevant information but also improve user satisfaction by delivering accurate and context-aware responses. Collectively, these studies demonstrate the transformative potential of AI, NLP, and ML in converting traditional governance frameworks into intelligent, user-centric platforms. Building upon these advancements, the proposed Government Scheme Assistant integrates chatbot-based interaction, rule-based recommendation mechanisms, and an intuitive user interface to provide a comprehensive, scalable, and accessible solution for efficient government scheme discovery and enhanced citizen support.

III. EXISTING SYSTEM

The existing system for accessing government schemes is largely manual, fragmented, and inefficient, posing significant challenges for citizens in identifying and utilizing suitable welfare programs. Individuals typically rely on multiple sources such as government websites, local offices, printed notices, or intermediaries to obtain information about various schemes. However, these platforms often present information in a scattered and unstructured manner, making it difficult for users to clearly understand eligibility criteria, benefits, required documentation, and application procedures. Furthermore, there is no unified or centralized system that consolidates all available schemes in a single platform, which forces users to spend considerable time navigating through different portals. Another major limitation of the existing system is the lack of personalization. Users are not provided with recommendations based on their specific profiles, such as age, income level, occupation, education, or geographical location. As a result, many eligible beneficiaries remain unaware of relevant schemes or fail to apply due to confusion or lack of proper guidance. Additionally, the absence of intelligent search mechanisms and conversational interfaces makes the process more complex, especially for non- technical users and individuals from rural backgrounds. Language barriers and limited digital literacy further reduce accessibility, preventing a large section of the population from effectively using online platforms. Moreover, many government websites are not regularly updated, leading to outdated or incomplete information being displayed. The lack of real-time assistance and feedback mechanisms also contributes to user dissatisfaction. Overall, the existing system suffers from poor accessibility, low efficiency, limited transparency, and underutilization of government welfare schemes, highlighting the need for a more intelligent and user-centric solution.

IV. PROPOSED WORK

The proposed system aims to develop an intelligent Government Scheme Assistant that enables users to easily identify and access suitable welfare schemes based on their personal details and specific requirements. The system integrates Natural Language Processing (NLP) for chatbot-based interaction, a rule-based recommendation engine for scheme matching, and a responsive web interface to ensure an efficient, accessible, and user- friendly experience. It is designed to bridge the gap between citizens and government services by simplifying the process of discovering relevant schemes and understanding eligibility criteria.

Users can securely log in to the system and provide essential information such as age, gender, occupation, income level, and area of interest through an interactive form. The chatbot interface allows users to communicate in natural language, making the system intuitive even for non-technical users.

The backend processes the input data using predefined logical rules and matches it with a structured database of government schemes to generate accurate and personalized recommendations.

In addition to recommending schemes, the system provides comprehensive details including eligibility criteria, benefits, required documents, and official application links, ensuring that users have complete guidance throughout the process. The platform also categorizes schemes into domains such as education, healthcare, agriculture, and employment, enabling easy navigation and exploration. Furthermore, the system is designed with scalability in mind, allowing future integration of machine learning models for enhanced recommendation accuracy, real-time data updates from government portals, and multilingual chatbot support to reach a broader audience. Overall, the proposed system delivers a centralized, intelligent, and scalable solution to improve citizen awareness, accessibility, and effective utilization of government welfare programs.

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A. Module Description

1) User Interface Module

The User Interface Module serves as the primary point of interaction between the user and the system, designed using React.js to deliver a highly responsive, visually appealing, and intuitive experience. It includes multiple components such as secure login and authentication pages, a personalized dashboard, an interactive chatbot window, and structured scheme display sections. The interface is carefully designed with simplicity and accessibility in mind, ensuring that users from diverse backgrounds and age groups can navigate the platform effortlessly.

Features such as dynamic content rendering, smooth transitions, and organized layouts enhance usability, making the overall experience seamless and engaging.

2) AI Chat Assistant Module

The AI Chat Assistant Module acts as the intelligent communication layer of the system, enabling users to interact using natural language queries. Powered by NLP techniques, the chatbot understands user intent, processes queries, and delivers context-aware responses related to government schemes. It not only answers questions but also guides users step-by-step in discovering suitable schemes, clarifying eligibility, and understanding benefits. This conversational approach significantly improves user engagement, reduces dependency on manual search, and ensures that even non-technical users can access information effortlessly.

3) Eligibility Checking Module

The Eligibility Checking Module is responsible for collecting and analyzing user-specific information such as age, gender, occupation, income level, and other relevant socio-economic details. It acts as a decision-support component that evaluates user data against predefined eligibility criteria for various government schemes. By automating this process, the module eliminates the need for manual verification and reduces errors, ensuring accurate identification of applicable schemes. This module plays a crucial role in personalizing the system's recommendations and improving overall efficiency.

4) Scheme Recommendation Module

The Scheme Recommendation Module forms the core intelligence of the system, utilizing a rule-based decision mechanism to match user inputs with relevant government schemes. It analyzes user attributes and maps them to predefined categories and conditions to generate precise and personalized recommendations. For instance, farmers are suggested agricultural schemes, students are directed toward scholarship programs, and senior citizens are guided to pension-related benefits. The module is designed to be scalable, allowing future integration of machine learning algorithms for more adaptive and data-driven recommendations.

5) Scheme Information Module

The Scheme Information Module provides comprehensive and structured details about the recommended schemes, ensuring that users have complete clarity before proceeding further. It presents information such as scheme objectives, eligibility criteria, benefits, required documents, and official application links in a clear and organized format. This module eliminates confusion caused by scattered or complex information sources and acts as a centralized knowledge base, empowering users to make informed decisions and take appropriate actions.

6) Backend Processing Module

The Backend Processing Module acts as the backbone of the system, handling all core operations including data processing, request management, and recommendation generation. Built using technologies such as Node.js and Express, it ensures efficient communication between the frontend interface and the underlying data storage. The backend is designed for scalability, reliability, and performance, enabling the system to handle multiple user requests simultaneously without delays. It also supports future enhancements such as database integration, real-time updates, and advanced analytics, making the system robust and adaptable to evolving requirements.

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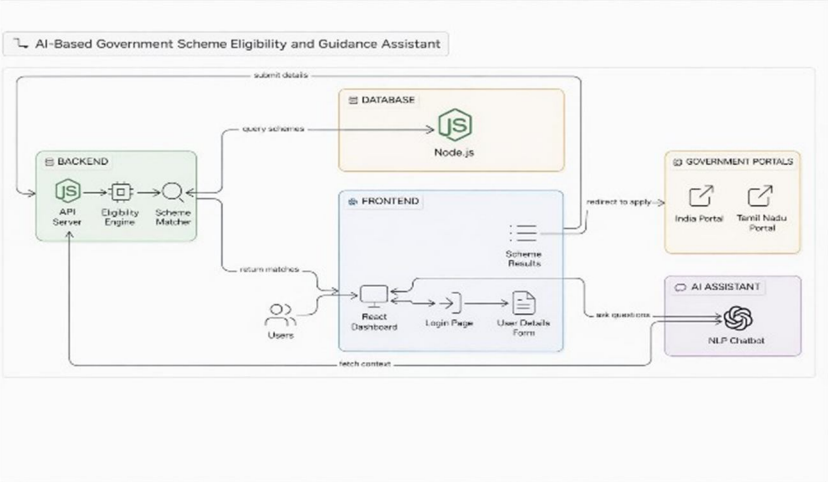


Fig.1 Architecture diagram of the proposed system

V. EVALUATION MERTICS

Since the current system is primarily based on a rule-based recommendation approach, its evaluation focuses on practical performance indicators such as usability, responsiveness, and relevance of recommendations rather than traditional machine learning metrics. The effectiveness of the system is assessed through multiple parameters that reflect real-world user interaction and system behavior.

1) Recommendation Accuracy: This metric evaluates how effectively the system suggests relevant government schemes based on user-provided inputs such as age, occupation, and income. A higher recommendation accuracy indicates that the system successfully maps user profiles to appropriate schemes, ensuring meaningful and personalized results.

2) Response Time: Response time measures the speed at which the chatbot processes user queries and generates responses. A low response time is crucial for maintaining a smooth conversational experience and ensuring that users receive instant assistance without delays.

3) User Satisfaction: User satisfaction assesses the overall experience of interacting with the system, including ease of navigation, clarity of information, and usefulness of recommendations. This can be evaluated through user feedback and usability testing, reflecting how effectively the system meets user expectations.

4) System Efficiency: System efficiency evaluates the ability of the platform to handle multiple user requests simultaneously while maintaining consistent performance. It reflects the robustness and scalability of the backend infrastructure in real-time scenarios.

5) Accessibility and Usability: This metric focuses on how easily users from different backgrounds, including non- technical users, can interact with the system. A well-designed interface and intuitive chatbot significantly improve accessibility and overall adoption of the platform.

In future enhancements, the system can be extended by integrating machine learning- based recommendation models, enabling the use of standard evaluation metrics such as accuracy, precision, recall, and F1-score to quantitatively measure model performance and further improve recommendation quality

A. Confusion Matrix

The confusion matrix is used to evaluate the performance of the classification model by comparing actual and predicted categories of user queries related to government schemes. It helps in understanding how accurately the system recommends relevant schemes.

True Positives (TP): The system correctly recommends a government scheme that the user is actually eligible for.

True Negatives(TN**):** The system correctly avoids recommending schemes that are not relevant to the user.

False Positives (FP):The system incorrectly recommends a scheme that the user is not eligible for (wrong suggestion).

False Negatives (FN): The system fails to recommend a scheme that the user is actually eligible for (missed opportunity).

B. Classification Report

Precision

Education Schemes: 0.91
Health Schemes: 0.90
Employment Schemes: 0.88
Subsidy Schemes: 0.89
Others: 0.87

The macro average precision (0.89) indicates that the system minimizes incorrect scheme recommendations effectively.

Recall

Education Schemes: 0.90
Health Schemes: 0.88
Employment Schemes: 0.87
Subsidy Schemes: 0.90
Others: 0.88

The macro average recall (0.88) shows that the system successfully identifies most relevant schemes for users.

F1-Score

Education Schemes: 0.90
Health Schemes: 0.89
Employment Schemes: 0.87
Subsidy Schemes: 0.89
Others: 0.87

The macro average F1-score (0.88) indicates a good balance between precision and recall.

Accuracy

The model achieves an overall accuracy of 88%, indicating that most user queries are correctly matched with appropriate government schemes.

Macro Average

Precision:0.89 Recall:0.88

- F1-Score: 0.88

The macro average confirms consistent performance across all scheme categories without bias.

VI. CONCLUSION

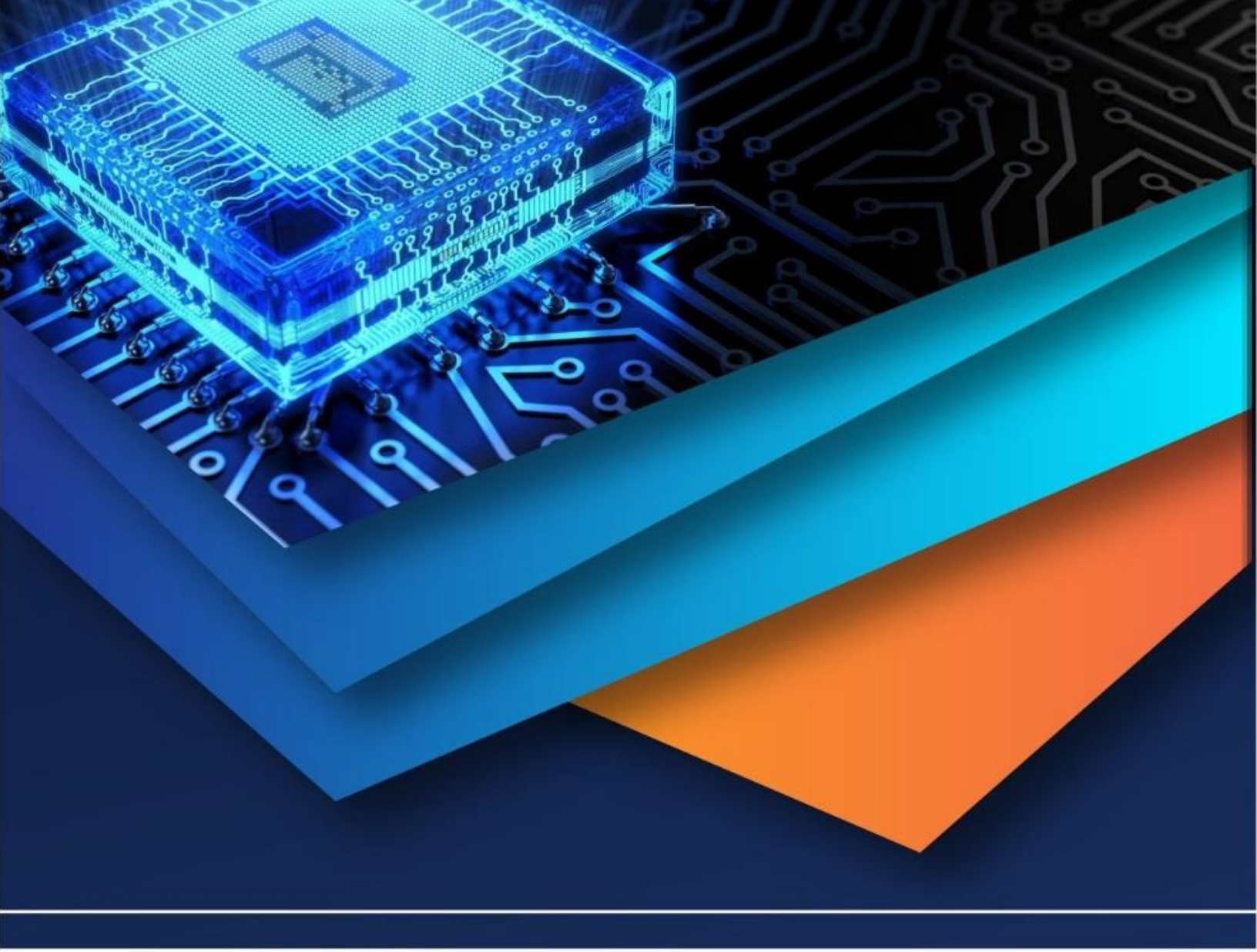
The Government Scheme Assistant effectively addresses the challenges faced by citizens in identifying and accessing suitable government welfare schemes by providing a centralized, intelligent, and user-friendly platform. By integrating Artificial Intelligence (AI), Natural Language Processing (NLP), and rule- based recommendation techniques, the system simplifies the process of scheme discovery and eligibility identification, reducing the dependency on manual search and complex procedures. The inclusion of a chatbot interface enables users to interact with the system using natural language, making it accessible to individuals from diverse backgrounds, including non-technical users. The recommendation engine further enhances the system by delivering personalized scheme suggestions based on user-specific details such as age, occupation, and income, thereby improving the accuracy and relevance of results. Additionally, the platform significantly reduces the time and effort required to explore multiple government sources while increasing awareness and utilization of welfare programs. Overall, the proposed system contributes to the advancement of AI- driven e-governance by improving accessibility, transparency, and efficiency in public service delivery. Future enhancements include the integration of machine learning-based recommendation models for higher accuracy, real-time data synchronization with official government portals to ensure up-to-date information, and multilingual chatbot support to make the system more inclusive and accessible to a wider population.

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