

YOJANASETU – AI POWERED GOVERNMENT SCHEMES ELIGIBILITY ANALYSIS AND RECOMMENDATION SYSTEM

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Abstract: *The efficient dissemination of government welfare schemes is hindered by issues of fragmented information systems, complex eligibility conditions, and a lack of personalization. In this paper, we propose a hybrid AI-assisted recommendation system, namely YojanaSetu, which enables automated eligibility analysis and scheme recommendation. The system represents users in a structured format using feature vectors and incorporates a deterministic rule-based eligibility analysis system, along with a relevance-based ranking system. Our proposed system is inspired by existing AI-based welfare systems and hybrid recommendation systems. To this end, we incorporate filtering, scoring, and explainability in the proposed system, which enables decision support. Our system architecture is based on a RESTful backend using Node.js, a frontend using React, and PostgreSQL for database persistence. Our experimental results show improved precision in scheme matching and reduced cognitive loads for users, which are beneficial for e-governance service delivery.*

Keywords: Hybrid Recommendation System, Eligibility Engine, Explainable AI, User Profiling, Decision Support System, Context-Aware Recommendation, E-Governance, Constraint-Based Filtering Artificial Intelligence (AI), Personalized Recommendations, Natural Language Processing (NLP), Recommendation Algorithms; Demographic Profiling, Scheme Eligibility Matching, Digital Governance.

1. INTRODUCTION

The welfare ecosystem of the government in India consists of a large number of heterogeneous schemes catering to different segments of the population. In recent years, the Government of India has introduced numerous welfare schemes aimed at improving the socio-economic conditions of citizens across different sectors such as education, healthcare, agriculture, and employment. The discovery of schemes in the existing system remains an inefficient process because of the lack of intelligent filtering and personalization techniques. The existing system highly relies on keyword-based searching and manual browsing, resulting in an unproductive utilization of government resources. Recent studies highlight the importance of data-driven recommendation systems, which can utilize the attributes and behavioural patterns of the population to enhance the discovery of government schemes. However, most existing systems lack strict eligibility checks and interpretable output. This work proposes a novel hybrid system, YojanaSetu, which integrates three essential techniques:

- Deterministic Eligibility Evaluation
- Feature-based Recommendation Ranking
- Explainable Output Generation

The proposed system aims to reduce the complexity of searching and maximize the output in terms of relevance and transparency.

2. LITERATURE SURVEY

The existing literature reveals the increased role of Artificial Intelligence, Recommendation Systems, and Data-based approaches in facilitating the accessibility of government welfare schemes. The following sections discuss some of the techniques and their contributions in this

Regard:

1. AI-Based Recommendation Systems

Applications in Public Services: The system relies on structured attributes of users (age, income, occupation, category) to provide personal scheme recommendations.

○ An example is provided by Thiagarajan et al., who proposed a welfare assistance system using AI, which combines eligibility checking and chatbot interaction.

Challenges:

- Lack of explainability of recommendations
- User data quality

2. Hybrid Recommendation Techniques

Role in Personalization: Hybrid techniques combine content-based and collaborative filtering techniques.

○ Example: Mandalageri et al. showed how precision can be improved by using demographic and behavioural information.

Advantages:

Hybrid techniques can avoid the cold start problem and increase relevance and flexibility.

Disadvantages:

Hybrid techniques require large data and have high computational costs.

3. Rule-Based Eligibility Systems

Role in Validation: Rule-based systems use deterministic rules such as age, income, and category to ensure the accuracy of the eligibility process.

○ Eligibility validation modules in AI-based welfare schemes ensure that only valid schemes are recommended.

Limitations:

- Lack of flexibility in static rules
- Constant need for updating

4. NLP and Chatbot Systems

Role in Interaction: NLP-based chatbots facilitate natural language interaction and aid in scheme discovery for the user.

○ Example: Real-time guidance and query resolution are provided by AI chatbots .

Limitations:

- Complex queries are not addressed by chatbots

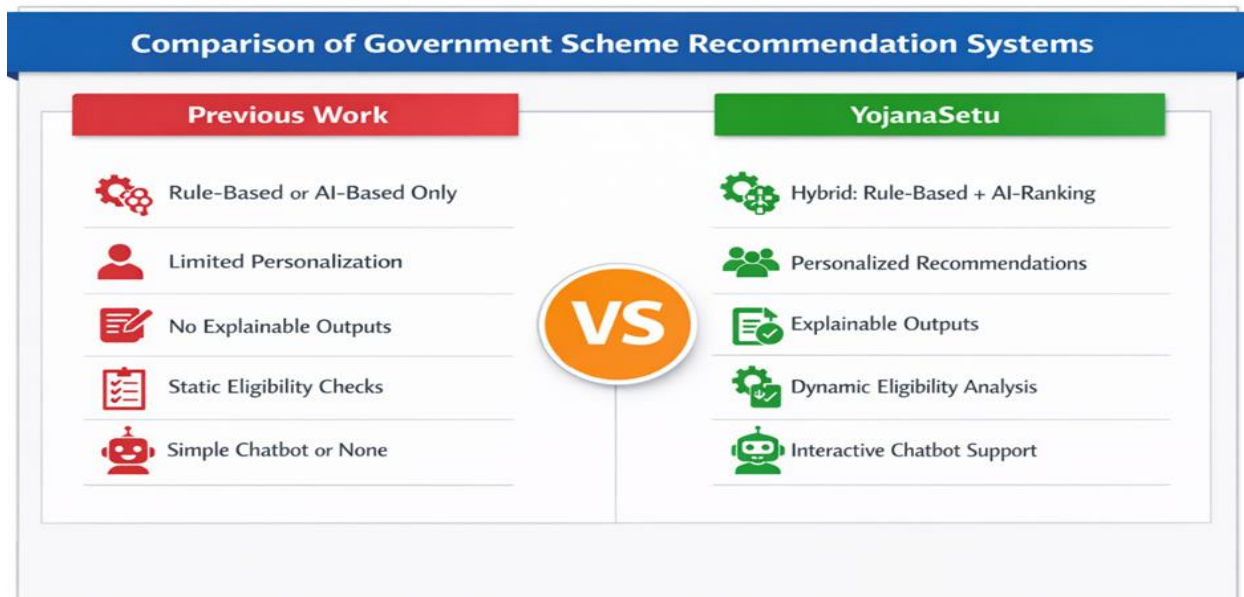


Fig 1: Comparison with other works

3. PROPOSED SYSTEM

The YojanaSetu system has been developed in a modular and scalable manner, such that different components of the system can work in collaboration to offer efficient scheme recommendations.

The major components of the YojanaSetu system are:

3.1 System Components

- **Presentation Layer:** React-based UI for user interaction
- **Application Layer:** Node.js REST API handling business logic
- **Data Layer:** PostgreSQL database storing user profiles and scheme metadata

3.2 Functional Modules

1. User Profiling Module

Collects user information through structured data.

Captures structured attributes:

2. Scheme Database

Stores scheme information and requirements.

3. Eligibility Engine

Uses rule-based logic to check for user eligibility

Implements rule-based filtering:

4. Recommendation Module

Ranks the schemes on the basis of relevance for the user.

Computes relevance score:

where represents feature matching functions and are weights.

4. METHODOLOGY

The methodology of the proposed system will be as follows:

1.Data Collection:

User information such as age, income level, occupation, gender, and category will be collected by the user.

2.Eligibility Analysis:

The user information will be analysed by a rule-based system based on the eligibility criteria of the schemes.

3.Filtering Process:

If a scheme does not fulfil the eligibility criteria, it will be filtered out by the system.

4.AI-Based Ranking:

The remaining schemes will be ranked by the use of relevance-based scoring techniques by the proposed system.

5.Explainability Module:

The explanations of the schemes will be provided by the proposed system.

6.Result Presentation:

The final recommendations will be provided by the proposed system to the user.

This methodology ensures both accuracy and usability while reducing manual effort for users.

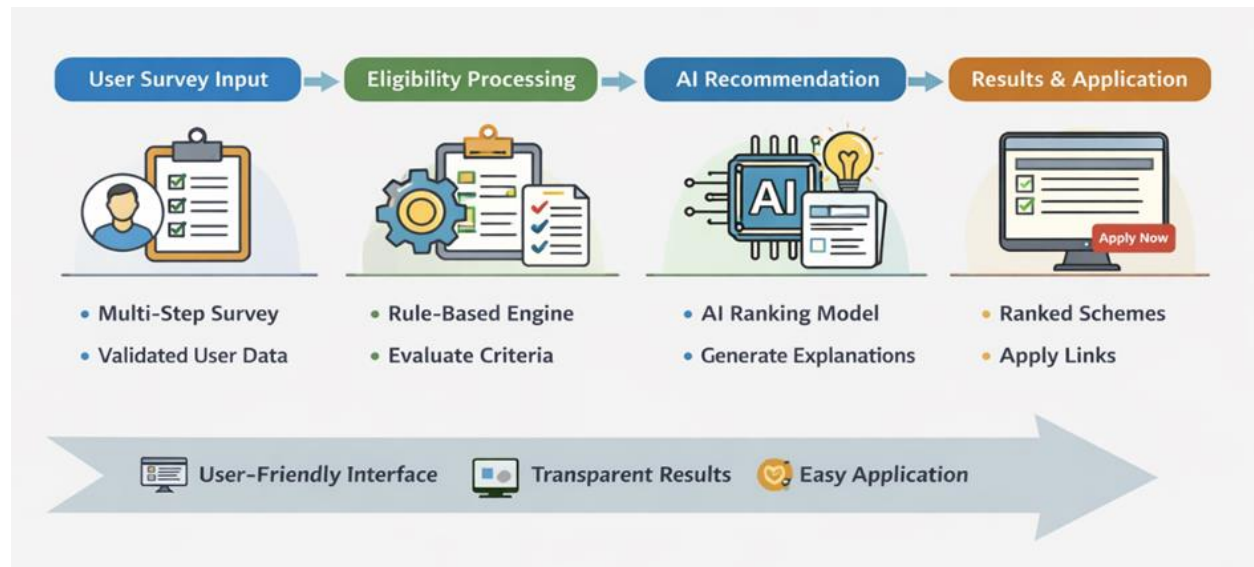


Fig 3: Design Methodology

5. IMPLEMENTATION AND RESULTS

The proposed YojanaSetu system, as implemented, is a full-stack web-based system with a modular architecture. The frontend is implemented using React (Vite) for a dynamic and responsive interface, while the backend is implemented using Node.js and Express.js for handling API requests and business logic. PostgreSQL is used as a relational database for storing user profiles and scheme data, with a structured schema design for efficient querying. The eligibility module is implemented using deterministic rule-based filtering, where user attributes are filtered using logical operators with scheme constraints. The recommendation module calculates a relevance score using feature matching between user profiles and

scheme attributes, which enables prioritized ranking of eligible schemes. Additionally, a lightweight chatbot interface is implemented for enhanced user interaction. The implemented system has been tested using multiple test scenarios with varying demographic inputs. The results show high precision in filtering eligible schemes, where only valid schemes are recommended, meeting all constraints. The ranking module improves relevance by prioritizing schemes with high similarity to user profiles, reducing manual search efforts. Additionally, the explainability module improves transparency in scheme recommendations, where users can interpret the reason behind a scheme recommendation. Therefore, the system offers improved efficiency, usability, and accuracy in scheme.

The system is implemented as a full-stack web application using:

- **Frontend:** React (Vite), HTML, CSS
- **Backend:** Node.js, Express.js
- **Database:** PostgreSQL with Drizzle ORM

Key features include:

- User authentication
- Multi-step eligibility form
- Personalized recommendations
- Chatbot assistant
- Notification system



Fig 4: Home Interface

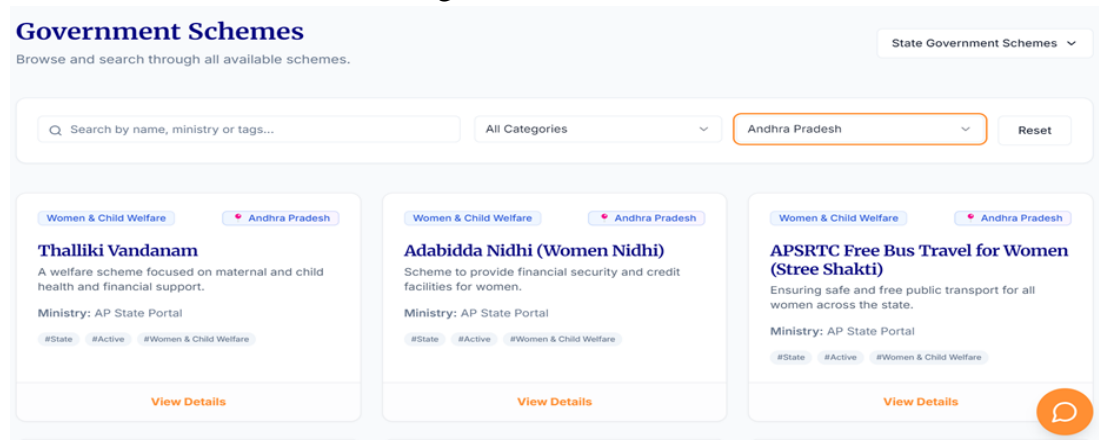


Fig 5: Schemes Page

Fig 6: Eligibility Check Survey Form

Fig 7: Results Page

6. FUTURE SCOPE

It can also be enhanced by incorporating machine learning-based models for intelligent recommendations. Real-time API integration with government databases can also enhance the accuracy and reliability of the system. Furthermore, the system can be enhanced by incorporating intelligent chatbot interactions through the use of advanced NLP techniques. The scalability of the system can also be enhanced through optimized indexing techniques.

7. CONCLUSION

The paper proposes a system called YojanaSetu, which is a system based on artificial intelligence to enhance accessibility to government welfare schemes through personalization and eligibility analysis. The results show that the proposed system will enhance usability, reduce user efforts, and improve decision-making capabilities. The addition of explainable recommendations and chatbot support will further enhance the system's capabilities in terms of user interaction. The proposed system, YojanaSetu, will contribute to the development of digital governance and enhance accessibility to public welfare schemes.

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