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AI Based Internship Recommendation Engine for Pm Internship Scheme

E Shapna Rani[1], S K Varsha[2], P Teja Sri[3], T Siganthini[4]

Assistant Professor, Department of Computer Science and Engineering, Saranathan College of Engineering, Tiruchirappalli, Tamil Nadu, India[1]

Students, Department of Computer Science and Engineering, Saranathan College of Engineering, Tiruchirappalli, Tamil Nadu, India[2-4]

Corresponding author

ABSTRACT: The paper introduces an AI-powered recommendation system that helps students discover the most suitable government internship schemes, with a special focus on the Prime Minister's Internship Scheme (PMIS). The system evaluates each student's profile by analyzing their skills, qualifications, academic performance, and personal preferences.

To ensure both accuracy and eligibility compliance, the model follows a hybrid approach — it first applies rule-based filters based on official government criteria and then uses machine learning to rank the most relevant schemes. The system relies on authentic internship metadata collected from central government portals, and uses a semantic feature-engineering pipeline to intelligently match student competencies with internship requirements.

Compared to traditional manual searching or simple keyword-based filtering, this AI-based approach provides more precise and relevant recommendations. The overall goal is to simplify the internship discovery process, improve student–scheme matching, and support educational institutions and government bodies in boosting student participation in national-level internship programs.

KEYWORDS: Recommender systems, Internship matching, Artificial intelligence in education, Government internship schemes, Learning-to-rank.

I. INTRODUCTION

The AI-Based Internship Recommendation Engine for PM Internship Scheme initiative represents a forward-thinking project which provides complete personalized guidance to students who want internships with special emphasis on the Prime Minister's Internship Scheme (PMIS). The system aims to develop an easy-to-use recommendation system which effectively connects student profiles with their academic history and personal interests to appropriate internship positions. The system exists to support Indian youth from all backgrounds especially first-generation learners who live in rural areas and tribal districts and urban slums because they lack digital experience.

The proposed work uses a hybrid rule-based and machine learning (ML-light) model to enhance user engagement and matching accuracy within the government service enhancement domain. The system employs semantic feature-engineering to connect student competencies with internship needs which results in better recommendations than standard keyword-based filtering methods.The system will deliver an advanced recommendation system with a user-friendly interface that works on mobile devices to provide a smooth experience for users who have limited digital skills and unreliable internet access. The project introduces an innovative feature which shows users only three to five customized recommendations to help them avoid feeling overwhelmed by numerous options.

The system developers created a solution which works in low-bandwidth conditions because it uses simple deployment methods and integrates seamlessly with the current PM Internship Scheme portal. The solution includes a user interface (UI/UX) that supports minimal text content and visual indicators and regional language support and voice assistance for

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complete accessibility. The system developers plan to add offline functionality with data storage and SMS search capabilities for reaching users in rural and tribal areas with unreliable internet access.The recommendation engine simplifies internship discovery to enhance student-scheme compatibility which enables educational institutions and government bodies to increase student enrollment in national programs.

II. LITERATURE SURVEY

2.1 AI AND RECOMMENDER SYSTEMS IN EDUCATION

AI is beginning to have a significant impact on increasing access to public services, and internships are no exception. With so many options and regulations, it can be difficult for students to find the right fit, even though programs like the Prime Minister's Internship Scheme (PMIS) are meant to give them a genuine taste of working for the government. AI can save time and effort by suggesting internships that truly fit a student's profile based on their interests, skills, and qualifications.

Shefin Thomas Mathew of Bengaluru City University investigated developing an AI engine for PMIS in a 2024 study. After reviewing student profiles, the system suggested internships that fit the students' backgrounds and professional objectives. The goal was to encourage more students to take part in these government programs by making it simpler for them to find worthwhile opportunities without having to sift through numerous websites and eligibility paperwork.Meanwhile, new programs like the AI Skills Passport, which was introduced by Microsoft and EY in 2025, are giving students free instruction in important AI skills. Such programs not only give students real-world experience but also increase the efficacy of AI-based recommendation systems by matching students with internships that better suit their actual skill set.Further demonstrating how technology is changing how students connect with opportunities are the government's digital internship platforms, like MeitY's Digital India Internship Scheme. These programs give students the opportunity to work on actual digital governance and technology projects, emphasizing how crucial it is to match student skills with the real requirements of public sector initiatives.All things considered, students are finding the right internships more easily thanks to AI-driven recommendation systems, which also help them save time, avoid frustration, and obtain useful experience. In addition, these systems help the government engage young talent and develop a skilled workforce, which benefits all parties.

2.2 INTERNSHIP AND JOB MATCHING SYSTEMS

For students in particular, finding the right internship or job can be like navigating a maze. Opportunities abound, each with specific prerequisites, due dates, and skill requirements. Students have historically been required to conduct time-consuming and frequently frustrating manual searches across numerous websites, placement cells, or social networks.AI-powered job and internship matching platforms are extremely helpful in this situation. These systems suggest opportunities that are a good fit based on a student's profile, which includes their skills, qualifications, prior experiences, and even personal preferences. In contrast to straightforward keyword searches, AI is able to comprehend the context and meaning of internship or job descriptions as well as student profiles, ranking opportunities in a way that truly makes sense for each individual.

Numerous recent studies have demonstrated how successful these strategies are. To increase the relevance of recommendations, Raja Kishore Babu et al. (2025) created a customized job search system that incorporates real-time data and skill-based matching. Similar to this, Sahil Panchasara et al. (2025) developed a recommendation system that improves matching accuracy by capturing semantic relationships between user profiles and job postings by analyzing over a million LinkedIn job listings. Additionally, MH Ajjam (2025) showed how AI-powered hiring platforms that employ semantic similarity can comprehend job descriptions and resumes more effectively, providing candidates with more accurate matches.

The ability of AI-driven systems to change with students is one of their greatest benefits. The system adapts its recommendations to students' development as they pick up new abilities, finish projects, or discover new interests. This guarantees that students always receive instruction that is pertinent to their present skills and goals.AI-powered job and internship matching platforms are transforming how students find opportunities. They help students and organizations make better, more informed decisions, lessen the headache of manual searching, and improve the likelihood of finding the right fit. These systems can guarantee that students are paired with jobs that genuinely fit their abilities and career objectives for government internship programs like PMIS, which will streamline and improve the process for all parties.

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2.3 GOVERNMENT INTERNSHIP & SKILL DEVELOPMENT PLATFORMS

The Prime Minister's Internship Scheme (PMIS), the Digital India Internship Portal, the National Career Service (NCS), and the Skill India Digital Platform are just a few of the digital platforms that the Indian government has introduced to increase youth employability and boost national skill development. These platforms are intended to help close the gap between academic learning and practical demands by connecting students with organized internship and training opportunities provided directly by government agencies and their business partners.

The majority of students must manually search for pertinent schemes without any individualized guidance or intelligent filtering, which makes the discovery process time-consuming and frequently ineffective despite their potential.

Today, the majority of government internship portals still use a static listing format, meaning that all students, regardless of their interests, background, or skill level, see the same set of opportunities. According to Pravendra Dixit and Santosh Kumar Singh (2025), many students lose out on appropriate programs just because the eligibility requirements are unclear and the information is dispersed across several platforms. For students from Tier-2 and rural areas, who frequently lack adequate guidance on identifying schemes that match their abilities, this issue is even more acute. According to Zeenat Husain (2024), students must manually navigate numerous PDFs and eligibility documents on these portals, despite the fact that they provide worthwhile opportunities. They also lack personalized or adaptive intelligence.

These difficulties make it abundantly evident that an AI-based recommendation system is required in order to automatically match students with the best government internship programs according to their interests, academic background, and skill set. By making the entire process more approachable, pertinent, and much simpler to use, such a system would guarantee that the right opportunities are given to the right students at the right time. Additionally, it would increase overall efficiency by assisting government platforms in reducing applications that are superfluous or unqualified. Given the speed at which artificial intelligence is developing, particularly in the wake of the post-COVID digital acceleration, it is not only feasible but also extremely timely and significant for government internship platforms to implement a personalized and student-focused recommendation system.

2.4 HYBRID RECOMMENDATION MODELS (RULE-BASED + AI)

Relying exclusively on rule-based or AI-based systems for skill-matching and internship platforms has drawbacks. By imposing strict eligibility requirements, rule-based systems are very good at making sure that students meet the requirements for a government internship. However, they are rigid and cannot adapt to various learning preferences, styles, or aptitudes. Even though AI-based systems can intelligently rank opportunities based on a student's interests, abilities, and past experience, they sometimes suggest internships for which the student isn't really qualified.

Researchers have suggested hybrid recommendation models, which integrate the advantages of both strategies, to get around these restrictions. This approach first eliminates all opportunities that a student is ineligible for, such as those with rigorous age restrictions or academic requirements, using a rule-based filter. The remaining internships are then ranked by an AI algorithm that highlights those that best match the student's qualifications, experience, and professional objectives. This two-step process guarantees both individualized recommendations and adherence to eligibility requirements.

Raja Kishore Babu et al. (2025), for instance, demonstrated that hybrid systems perform better than exclusively AI or rule-based models in internship recommendation tasks, attaining greater accuracy in matching students to the best opportunities. Similar findings were made by Sahil Panchasara et al. (2025), who used hybrid learning-to-rank techniques on more than a million internship listings and discovered notable gains in user discoverability and relevance. According to these results, hybrid models provide a workable and scalable way to match students with government internships while upholding equity and legal compliance.Intelligent personalization and eligibility enforcement are well-balanced in hybrid recommendation systems. These technologies can decrease the number of pointless applications, increase the overall efficacy and efficiency of government internship programs, and facilitate students' search for internships by fusing rule-based filtering with AI-based ranking.

2.5 LEARNING-TO-RANK AND ML TECHNIQUES FOR PERSONALIZED RECOMMENDATION

In recent years, machine learning (ML) techniques and learning-to-rank (LTR) algorithms have become important elements in the design of personalized recommendation systems, particularly for platforms that match internships and

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skills. Unlike traditional keyword-based or rule-based methods, these techniques can simultaneously analyze multiple aspects of a student's profile, including skills, academic background, certifications, interests, and engagement patterns. This multi-dimensional analysis allows the system to prioritize the most relevant internships, allowing students to focus on those that best match their qualifications and career goals. Learning-to-rank models optimize the order in which opportunities are presented by giving various features varying degrees of importance. LTR guarantees that the best opportunities show up at the top of the list, in contrast to basic recommendation systems that handle every match equally. Relevance is crucial for meaningful engagement on large platforms, where hundreds or even thousands of opportunities may be available.Additionally, machine learning enables ongoing customization and adaptation. The system can dynamically change how opportunities are ranked as students interact with the platform, update their academic records, or acquire new skills. This guarantees that suggestions change as each student's interests and skills do. Furthermore, ML models are able to identify minute relationships and patterns between internship requirements and student profiles, which are often overlooked by conventional rule-based systems.

By converting structured and unstructured data from student profiles, academic records, previous applications, and internship descriptions into useful inputs for ranking algorithms, feature engineering and data enrichment further increase the efficacy of these models. These systems strike a balance between compliance, fairness, and personalization when paired with hybrid strategies, such as using rule-based eligibility checks prior to ML-based ranking. In addition to making individual recommendations, learning-to-rank and machine learning techniques can also spot trends and patterns in big student populations. Platforms can improve eligibility requirements, anticipate new skill demands, and improve recommendation logic by examining common skills, frequently used internships, and successful outcomes. In this sense, machine learning improves the overall efficacy of government internship and skill-development programs in addition to helping individual students by offering tailored recommendations.All things considered, recommendation systems based on learning-to-rank and machine learning provide a scalable, flexible, and student-centered solution. They can effectively manage massive amounts of data, dynamically rank opportunities, and change with students' learning paths, guaranteeing that suggestions stay applicable, useful, and very successful over time.

III. PROPOSED DESIGN

An AI-powered recommendation engine for internships that is lightweight and seamlessly integrates with the PM Internship Scheme (PMIS) platform is the suggested solution. Even students who live in remote areas or have poor internet connectivity can use it because it is made to provide highly customized, language-inclusive, and inexpensive recommendations to students all over India.

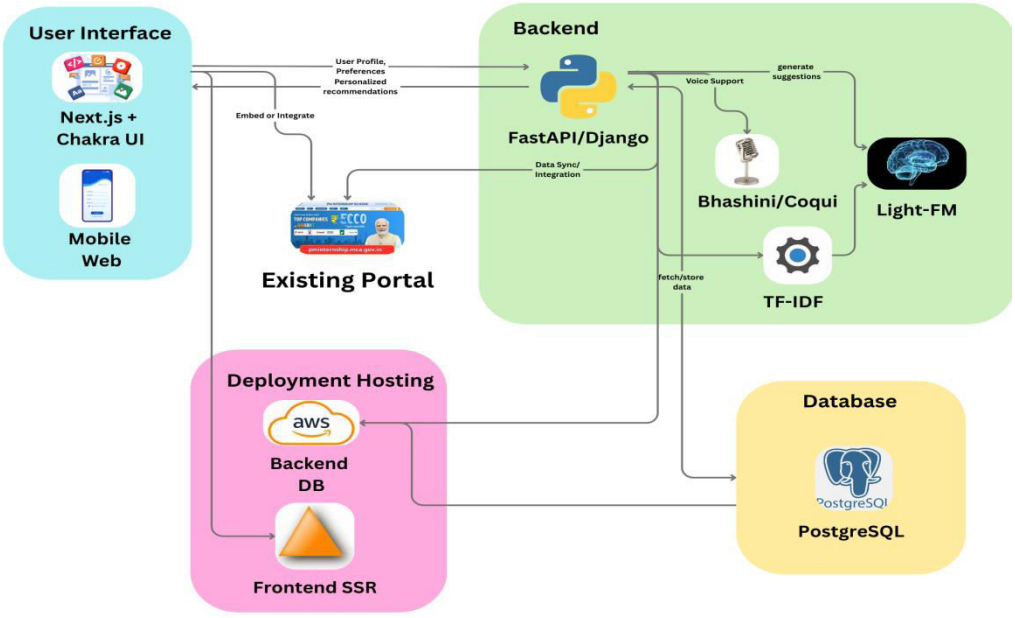

Fig.1. Structure of Proposed design

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Through a straightforward, guided interface, the engine collects vital data from students, including their abilities, educational background, interests, and preferred location. Even users who are not familiar with digital technology can interact with the system with ease thanks to its support for regional language input, voice-based communication through Bhashini, and SMS access through Exotel or MSG91. A hybrid AI and rule-based recommendation engine starts working as soon as the data is gathered. While the AI layer produces the top three to five customized internship recommendations, ranked by relevance using Scikit-learn with TFIDF and Cosine similarity, the rule-based layer makes sure that eligibility requirements and government policies are followed. LightFM can be added to the system in the future to enable hybrid collaborative filtering. Instead of overwhelming students with too many options at once, the user interface is made to be straightforward and easy to use, guiding them step-by-step. With optional Chabot support offered in the student's preferred language, each recommendation clearly outlines eligibility requirements, application deadlines, and next steps. Without requiring a lot of processing power, a feedback loop enables the system to learn continuously and improve recommendations by examining user feedback, applications, and preferences. In order to ensure that the information is always up to date and relevant, internship listings are automatically updated on the backend from partner institutions and authorized government databases. Offline prefetching and SMS notifications allow students to stay informed even if they do not have constant internet access.

Existing PMIS and Skill India portals can be seamlessly integrated with the system since it is designed as a plug-and-play API layer, negating the need for system migrations or redesigns. The technology stack consists of a FastAPI backend for high-performance APIs, PostgreSQL for safe data storage, a Next.js frontend with Chakra UI for an accessible and responsive interface, and Redis for handling asynchronous tasks like batch recommendations and notifications. AWS or Render provide dependable and scalable infrastructure for the backend, while Vercel hosts the frontend. These elements work together to provide a system that is inclusive, lightweight, and modular with intelligent personalization, making it a strong platform for students all over India. By providing three to five AI-matched internship options based on students' interests, skills, and career goals, this solution streamlines the internship search process. It connects students with opportunities that bridge academia and industry, functions flawlessly on smart phones even in places with low bandwidth, and is constantly improved through feedback analysis. With support for regional languages, it provides students with a simple and stress-free experience. It makes hiring quicker, more intelligent, and more diverse for employers. It offers the government a data-driven, transparent, and inclusive approach. Additionally, it greatly improves employability in general for society.

IV. SYSTEM IMPLEMENTATION

4.1 User Authentication and Profile Management

In order to prevent users from feeling overwhelmed on their first visit, we designed the signup and login process to be easy and friendly. By sharing important information, such as their interests, education, and skills, users enable the platform to instantly customize their experience. Strong encryption protects all sensitive information, particularly passwords, and administrators and users have different access controls. With features like "Remember Me," sessions are kept convenient but safe, and multi-factor authentication will be added in later versions for added security. Over time, users can freely update their profiles, guaranteeing that the platform will always be pertinent to their development.

4.2 Frontend Design and Accessibility Features

The interface is clean, friendly, and works smoothly on any device—from smartphones to desktops—thanks to React.js and Chakra UI. To make it accessible to everyone in India, the platform supports regional languages through Bhashini and even allows voice-based interaction to help users who are not comfortable typing. The PWA setup ensures the platform works even with slow or patchy internet, allowing access to saved data offline. Clear buttons, helpful prompts, and a guided design help first-time or non-tech users navigate effortlessly. The focus is on comfort, inclusivity, and zero confusion.

4.3 Backend Services and API Integration

Behind the scenes, FastAPI powers a fast, responsive backend that handles user login, data syncing, and personalized recommendations in real time. Every request is securely verified to block unauthorized access and protect user data. The system automatically fetches the latest internships from trusted government and private sources, so listings are always up to date. The AI engine works closely with the backend to suggest relevant internships based on each user’s profile and interactions. Hosted on the cloud, the system is built to handle thousands of users smoothly and expand easily as new features are added.

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4.4 Database Management and Data Synchronization

PostgreSQL serves as the main database because it is ACID compliant, secure, and suitable for handling sensitive government data. To support changing user information without frequent schema updates, we store semi-structured data like candidate skills and feedback interactions in flexible JSONB fields. A dedicated FastAPI worker service regularly synchronizes new internship listings from the PMIS portal. Before we store the data, we clean and enrich it using synonym-based tagging to fix vocabulary mismatches and improve the quality of matches.

4.5 AI/ML Recommendation Engine

The system uses a hybrid, ML-light architecture that focuses on speed, relevance, and usability. It starts with a rule-based eligibility filter in PostgreSQL to narrow down candidates based on strict criteria like qualifications or age. This ensures compliance and reduces the computational load. We then rank the shortlisted results using a lightweight Scikit-learn model, applying TF-IDF and cosine similarity to determine relevance in milliseconds. A feedback loop enhances personalization over time. To prevent decision fatigue, we display only the top 3 to 5 suggestions, each with explainable “Reason Tags” to build trust and clarity.

4.6 Deployment, Security, and Scalability

The system functions as a high-performance FastAPI microservice and is made to seamlessly integrate with existing government platforms. It features a lightweight Next.js Progressive Web App (PWA) frontend that operates well in low-connectivity situations through offline caching. An SMS-based search mode enables users without reliable internet access to request and receive internship recommendations instantly, achieving nationwide coverage. Strict PostgreSQL role-based access control, HTTPS/TLS encryption, authenticated API access using API Keys or OAuth, and a fairness-first strategy that employs rule-based filtering to prevent algorithmic bias are all necessary for security.

V. TECHNOLOGY STACK

5.1 Recommendation & Backend Framework: FastAPI + AI Pipeline

The core intelligence of the system is powered by FastAPI, chosen for its lightning-fast performance and clean architecture. It handles everything from user login and profile updates to generating real-time internship recommendations. FastAPI keeps responses instant, secure, and scalable — making it capable of serving thousands of users without lag or failure. This layer also acts as the brain that connects AI models, database, and frontend into one seamless flow.

5.2 Frontend: Next.js + Chakra UI with PWA for Offline Access

The user interface is built using Next.js, which ensures super-fast loading and a smooth browsing experience. Chakra UI adds a clean, accessible, and mobile-friendly design that works perfectly across all device types — including low-end rural smartphones. The system is also developed as a Progressive Web App (PWA), meaning users can still view internships and continue sessions even with poor or no internet — a critical feature for real Indian users.

5.3 Database & Sync Layer: PostgreSQL with Smart FastAPI Worker

PostgreSQL serves as the secure and reliable database for user data and internship details. It supports both structured and semi-structured data using JSONB, allowing user profiles to evolve naturally over time. A dedicated FastAPI worker service silently runs in the background, automatically syncing real internship listings from PMIS and other government portals — keeping the platform fresh without any manual updates.

5.4 AI/ML Recommendation Engine: LightFM Hybrid Model

The recommendation engine is powered by LightFM, a modern hybrid machine learning model used by industry leaders like Spotify and LinkedIn. It combines both what users like (behavior) and what internships contain (content) to generate deeply personalized suggestions. As users interact with the system — by clicking, favoriting, or even ignoring — the engine continuously learns and improves, ensuring recommendations become smarter over time without needing massive GPU servers.

5.5 Multilingual & Accessibility Layer: Bhashini API + SMS Support

To ensure true Bharat-scale inclusivity, the platform integrates Bhashini API, enabling instant translation and even voice support in multiple Indian languages. For users without internet or smartphones, the system also offers SMS-based search, where they can simply send a text like “Internship B.Tech AI Chennai” — and instantly receive the top recommendations via SMS. This guarantees 100% accessibility, even in low-tech rural zones.

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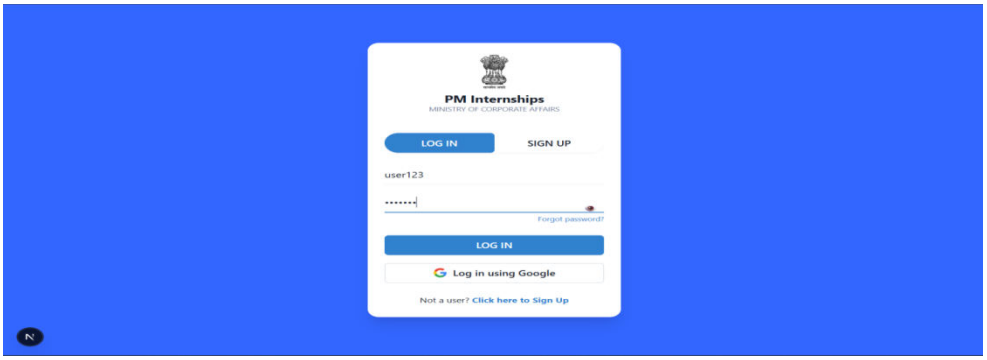
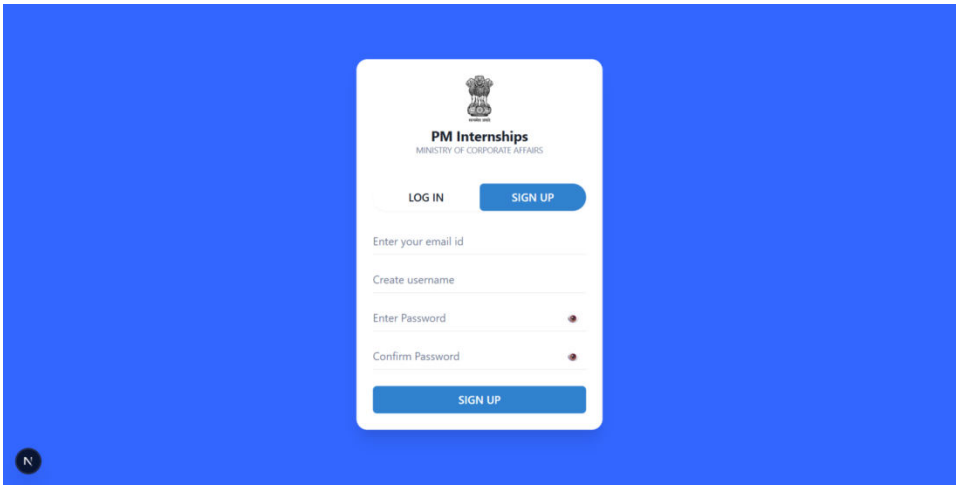
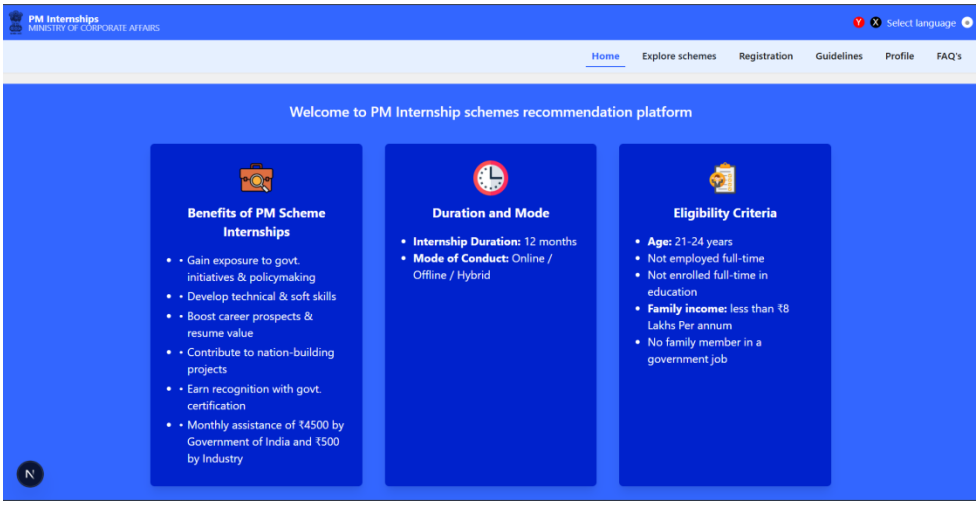
VI. RESULTS



6.1 Login page, with username and password (Alternative way of login using Google account)



6.2 Sign Up page with email id, username and custom password



6.3 Home page where users can find the information about the website

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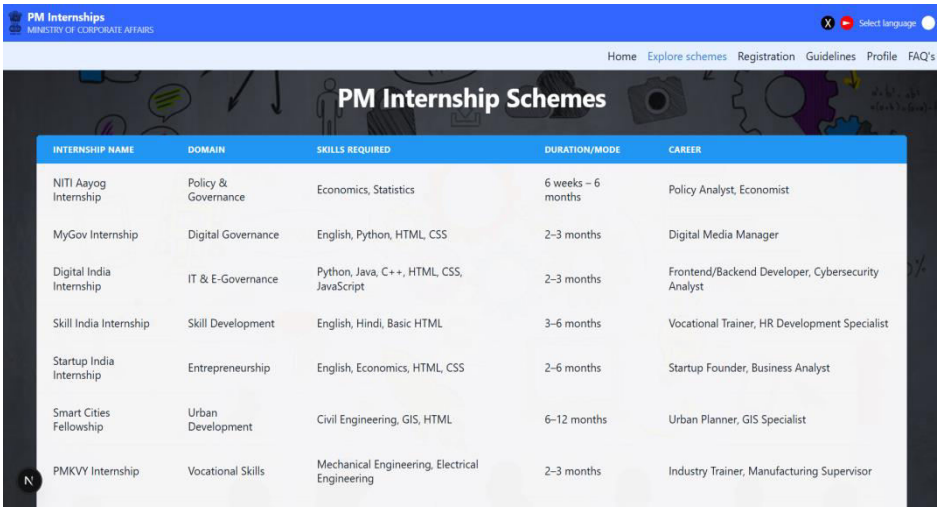
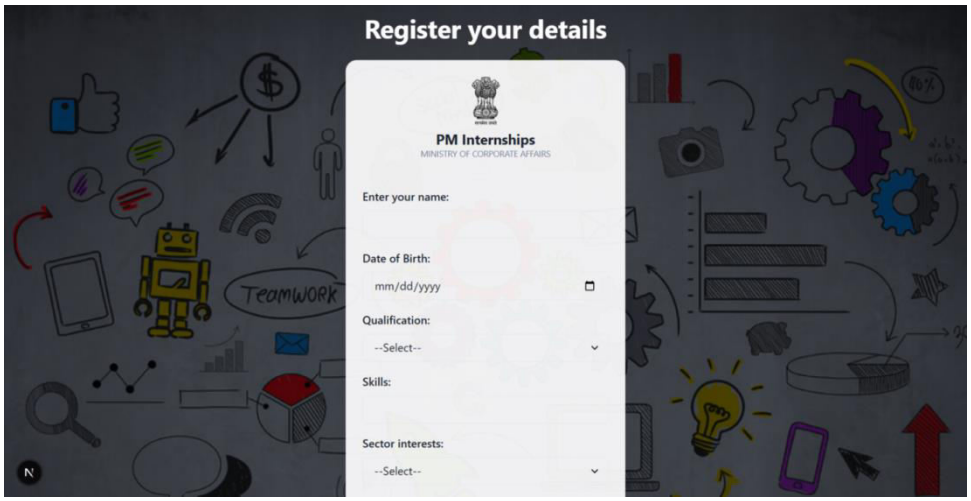
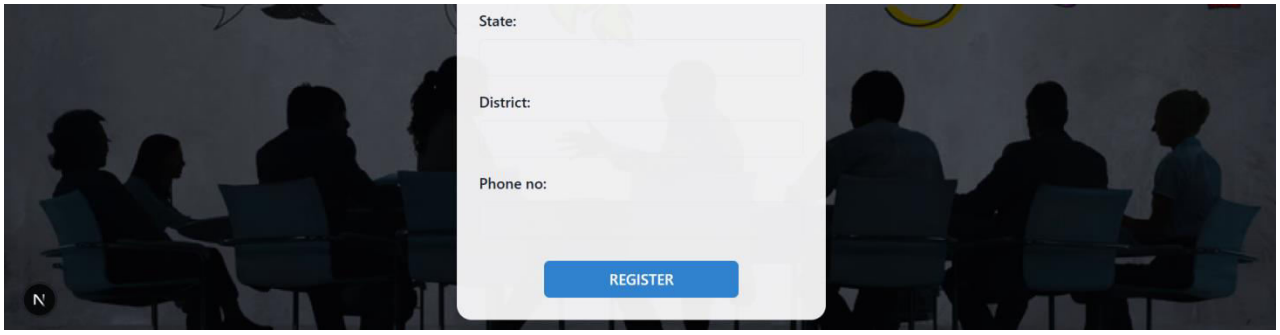


6.4 Explore Schemes page which displays the list of internships available



6.5 Registration form for submitting the details of the student



6.6 On submitting the form it generates the recommendation

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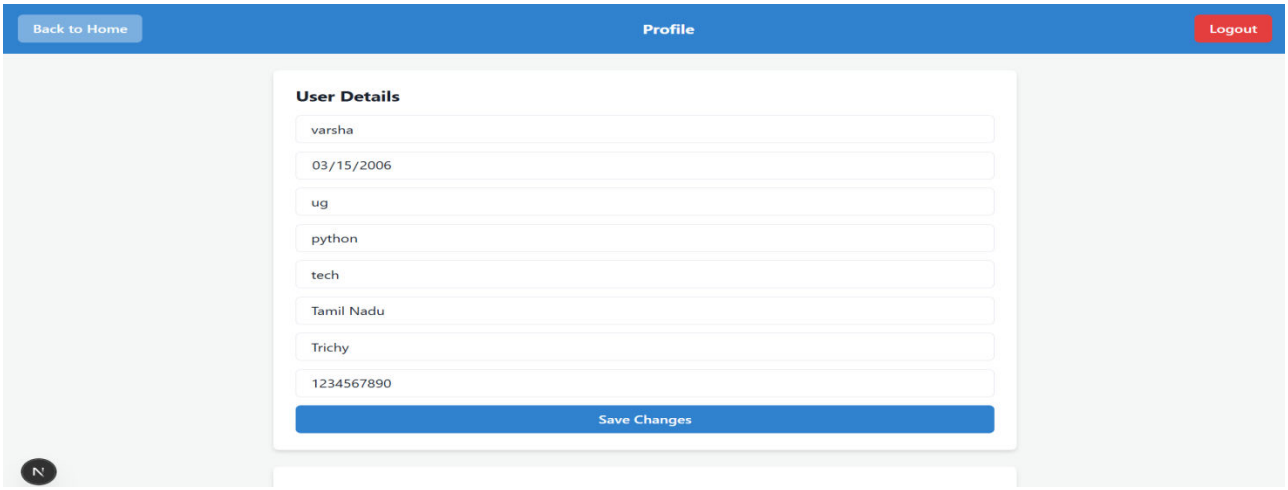

6.7 The student profile page displays all details, editable except for the name and date of birth (DOB).

6.8 Personalized recommendations are displayed based on the input given

VII. CONCLUSION

This paper shares the design and development of an AI-based Internship Recommendation Engine created for the PM Internship Scheme (PMIS). The main purpose was to make internship access easier for first-generation learners across India, who often struggle to find reliable information. Our work introduces a lightweight hybrid model that keeps official standards in mind but still focuses on personal relevance. Using a simple setup with PostgreSQL, FastAPI, and Scikit-learn, along with a TF-IDF ranking method, we were able to build a system that is both efficient and accurate without needing high-end infrastructure.

What worked best was keeping things simple for students. Instead of long lists, the system shows only the top three to five personalized results, which helps users avoid decision fatigue and makes the process easier to follow. Another important part of this project is its focus on inclusivity. We deployed the platform as a Progressive Web App (PWA) and added SMS-based search support, so even students in remote or low-internet regions can access internship details. This was a big step toward ensuring equal opportunities across the country.

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To sum up, the system works as a plug-and-play recommendation service that can easily fit into the existing PMIS portal. By adding elements of Explainable AI (XAI) and keeping the overall design lightweight, we created a tool that improves how students and schemes are matched. Beyond the technical side, the project supports the government's broader aim of making public services more transparent, data-driven, and accessible to everyone.

VIII. FUTURE WORKS

8.1 Profile Integration That Is Easy

In order to eliminate the need for human data entry, future versions of the system may integrate with DigiLocker, AICTE, or college ERP portals to automatically retrieve student credentials, grades, and abilities.

8.2 Evaluation of Skill Deficits and Perceptive Suggestions

In order to suggest short certification courses, learning pathways, or skills that are lacking so that the student can be considered for better internships, the platform may review the student's resume and learning history.

8.3 Availability of Several Platforms (Voice Support & WhatsApp)

To improve accessibility, the system could be made available through voice-based communication and WhatsApp, allowing students to quickly receive recommendations without using the main website or app.

8.4. Guidance on Career Roadmaps

The system might develop into a comprehensive career planner that directs students toward the best next step, rather than just suggesting internships (internships → scholarships → certifications → entry-level jobs).

8.5. The Dashboard for Government Insights

An analytics dashboard for government officials that displays regional demand, skill gaps, and trends in student interest could be added in the future to help with national policy planning.

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