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AI-Based Internship Recommendation Engine for PM Internship Scheme

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ABSTRACT:

Many students from rural or underserved communities who want to apply for an internship do not have much information or guidance available to them that will help them identify and choose a suitable internship opportunity. Additionally, given that many of the students come from a rural area, they have limited exposure and experience to using digital media; therefore, they may not be aware of how to successfully apply for internships through a website that requires some technical expertise. This paper presents an internship recommendation engine (IRE), which utilizes artificial intelligence (AI), to provide customized recommendations for potential candidates based on their education, skills, interests, and desired location. The proposed AI-based IRE system would provide candidates with accurate recommendations based on the candidate's education and skills/abilities and the candidate's interests and the parameters in which the candidate wants to receive a recommendation for an internship. Once the IRE has completed the analysis, it would display the recommended internship to the candidate through their account on the IRE system. In order to provide the candidate with the best internship recommendation, the IRE system employs a hybrid recommendation engine approach—encompassing both content-based filtering and collaborative filtering—to yield accurate recommendations.

Keywords: Internship Recommendation System, Artificial Intelligence, Machine Learning, Content-Based Filtering, Collaborative Filtering, Hybrid Recommendation Model.

I.INRODUCTION:

Internships are a key component in helping students transition from their academic careers to professional working lives by giving them the opportunity to gain practical work experience in the field they are interested in and provide them with exposure to industries in which they would like to work. In an effort to create many internship opportunities throughout the country for students and young professionals, the Prime Minister's Internship Scheme (PMIS) was introduced. Unfortunately, many applicants for internships have trouble finding the correct internships based on their qualifications and interests.

For most students applying for internships, traditional internship-selection processes rely on either manually looking for suitable internships or on very simple matching algorithms (based on criteria such as the student's qualifications). Due to these two traditional processes not being tailored to individual applicants' circumstances or experiences, applicants are more likely to apply for internships that do not match them and would ultimately result in a lower chance of being placed in an internship. Student applicants coming from rural and underserved areas typically encounter additional challenges accessing information about

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careers through their lack of experience using digital forms of communication and their lack of access to guidance on selecting a suitable career.

Emerging technologies in artificial intelligence (AI) and machine learning (ML) provide an innovative way to help improve current internship placement processes by developing intelligent recommendation systems that generate personalized internship recommendations for each candidate based on many factors, such as their resume, skills, educational background, and personal interests. The purpose of this research paper is to develop an AI-Based Internship Recommendation Engine capable of providing candidates with personalized internship recommendations based on the analysis of various aspects of each candidate's profile through the combined use of two methods: content-based filtering and collaborative filtering (CF). Additionally, the use of natural language processing (NLP) will be exploited in this research paper in order to analyze and categorize resumes and internship descriptions.

II. RELATED WORK:

Researchers have presented various recommendation systems that utilize artificial intelligence and machine-learning methodologies to enhance the process of pursuing employment or internships.

[1] Smith et al. created a job recommendation system that implements collaborative filtering methodology for matching job seekers to jobs based on user-defined preferences and historical interactions. The system exhibited substantial increases in accuracy and user satisfaction.

[2] Johnson and Lee developed a career recommendation system using machine learning algorithms, which determined suitable career paths and internships based on students' academic performance, skills, and interests.

[3] Kumar et al. created a hybrid model for job recommendations using both collaborative filtering and content filtering techniques in their study of job recommendation systems. This model improved the precision of job recommendations and the scalability of the system.

[4] Zhang et al. created an AI recruitment system utilizing natural language processing (NLP), which processes and analyzes resumes to make job opportunities to candidates.

[5] Patel and Shah designed a student internship recommendation system that utilizes machine learning techniques and algorithms to analyze student profile data for recommending internships based on skill matching.

[6] Singh et al. developed a smart recommendation system that integrates user behavior data analysis and data mining data to provide individualized internship recommendations.

Regardless of the differences between these studies, researchers are emphasizing how intelligent recommendation systems can enhance the effectiveness of the job and internship placement process.

III. PROPOSED SYSTEM:

A. Overview of the Proposed System:

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The goal of the AI-Based Internship Recommendation Engine is to help candidates find internships suited to their background, abilities, preferences for location, and personal interests. Traditional models are often based solely on eligibility criteria set by the company; however, the suggested internship recommendation engine will use machine learning methods to identify the best internships for each candidate based on the information they provide in their profile.

After signing up for the service and creating a candidate profile, the AI algorithms filter through all submitted resumes and rank the most relevant internships. Candidates will receive relevant internships at the top of their recommended list.

This model will allow candidates to find internships that are better suited to their needs, while at the same time, allowing companies to match potential interns more quickly and effectively.

B. Overall System Architecture:

There are various core components to the overall system architecture, which can be integrated into an interconnected system that provides recommended internships. The System Architecture consists of four primary modules: 1. User Profile Module - Collects candidate data (i.e., education, skill-set, interests, preferred work location) 2. Data Processing Module - Performs data cleaning and organization of candidates' profiles for further processing 3. Recommendation Engine - The core component of the system that utilizes machine learning (ML) algorithms (i.e. content-based filtering and collaborative filtering) to determine the best possible internship matches for each candidate. 4. Recommendation Ranking Module - Calculates a recommendation score based upon relevant criteria, including skill-match, interest alignment and preferred location for each internship opportunity. The highest-ranking internship opportunities will display to the user through the Recommendation Display Module. Both the Candidate Profile and Internship Detail data will be kept in a centralized database to allow for rapid access to data and the scalability of the system.

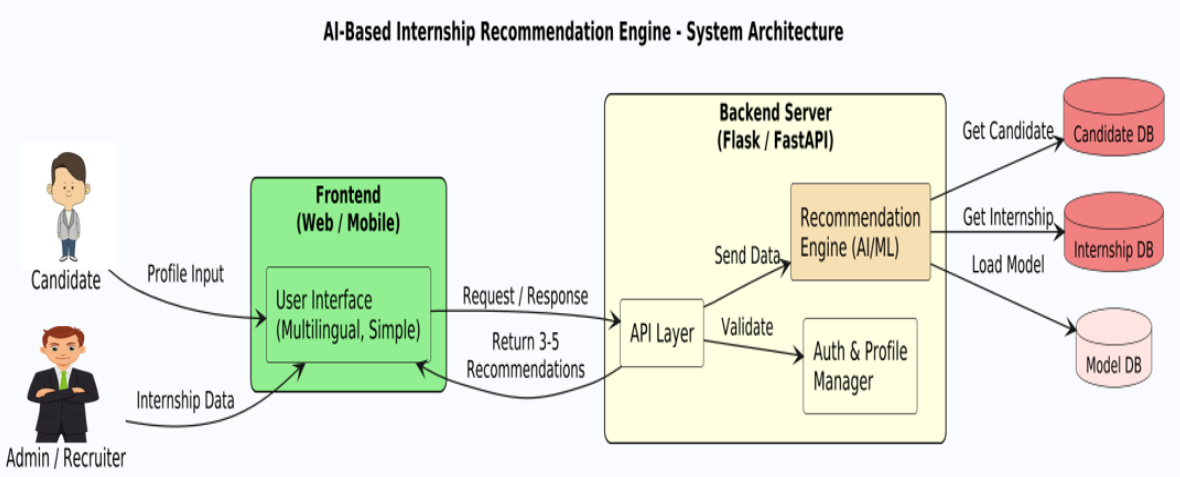

Figure.1. System Architecture of AI-Based IT Training System

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C. Data Collection Module:

The Data Processing Module collects the necessary information needed by an Internship Recommendation System to recommend internships to students. The Data Processing Module collects information on students through the user interface including student academic qualifications, skills, interest and prior experience. The Data Processing Module also collects details on internships including internship company name, job title, required skills for the job, location, and length of internship. The Data Processing Module stores the collected information in a structured database to analyze the data and develop accurate internship recommendations for students.

D. User Profile Management Module:

The User Profile Management Module is used to store and maintain a student's profile. This includes a student's education, skillset, preferred career domain & interests in a particular career. The user can easily update their profiles to receive relevant internship recommendations.

E. Internship Database Module :

The Internship Database Module is a module that will contain all current / future internship opportunities. The data that will be contained in this module: internship position title with company/contact information, qualifications to receive the position, & required skillset for the position. The Internship Database Module is a centralized repository from which the system obtains internship opportunity information.

F. Recommendation Engine Module:

The Recommendation Engine Module is the foundational module used within this system. It utilizes Artificial Intelligence & machine learning to analyze the profile of each student and the requirements of the internship opportunity being requested; the system will make highly personalized recommendations based upon this analysis.

G. Internship Matching Module:

The Internship Matching Module is another module used to perform a match between a student's characteristics/skills with the requirements of the internship opportunity. This module compares the characteristics/skills contained within each student's profile against the criteria for each internship opportunity. This module will match and rank each of the internship opportunities returned based upon how well they matched to each of the students' profiles.

H. Result Display Module:

The Result Display Module is used to present to the student their recommended internship opportunities through the use of a user-friendly interface. Within the Result Display module, the user will see a list of internship opportunities that most closely match their student profile.

IV. IMPLEMENTATION DETAILS:

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A. Development Framework:

A combination of frontend, backend, AI processing, and cloud-based infrastructure will be used to implement the AI-Based Internship Recommendation Engine for scalability, efficiency, and real-time recommendations. The frontend framework is based on ReactJS, to provide a dynamic and user-friendly interface for students to register, update their profile, and see recommended internships. The backend framework is based on NodeJS and ExpressJS to process API requests, authenticate users, and coordinate system component communication. All data pertaining to student profiles, internship details, and recommendations will be stored and managed efficiently in a NoSQL database (MongoDB). Machine learning libraries, including TensorFlow and Scikit-learn, will be used for the AI processing component of the recommendation engine to create recommendation models. The solution can also be deployed to a cloud-based platform (AWS) for scalability and reliable, consistent access by a large user base.

B. AI Model Training and Personalization:

The AI-Based Internship Recommendation Engine will utilize the analysis of student data to provide tailored (personalized) internship suggestions. To develop the machine learning models that will generate recommendations for individual students, the system will use data from multiple datasets containing details about the student's skills, academic history, interests, and internship requirements. Supervised learning techniques will be utilized to identify the correlations between each student profile and the internship roles for which they would likely be suited. The engine will evaluate a variety of factors

C. Internship Recommendation Mechanism:

The recommendation system creates internship recommendations for students by comparing their skills and interests to the skills and interests needed for available internships. If the student's skills and interests match with the internship's requirements closely, the internship receives a higher ranking on the recommendation list than other internships. The recommendation engine uses methods like content-based filtering and similarity matching to find relevant internship opportunities for students. Within the recommendation module, the student will see a complete list of recommended internships along with all of the details (company name, job title, job description, job requirements, application information).

D. Infrastructure and Deployment:

The system can be deployed in a cloud-based environment for scalability and availability. Cloud service providers such as Amazon Web Services (AWS) allow for the application to support a large number of concurrent users at once. The MongoDB Atlas database will allow for secure and timely data storage in real-time. Containerization technologies like Docker will aid in the prompt deployment and ongoing management of the entire system. The cloud deployment model will ensure that the internship recommendation system is continuously accessible and reliable, while also supporting future growth.

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E. Security and Privacy:

The system will have strong measures in place for protecting user data because of the sensitive information contained within it. The use of strong authentication to verify user identity is an example of the security measures that will be in place to protect the student user data from unauthorized access.

F. Performance Evaluation and System Testing:

In order to assess how well the internship recommender system works, many tests will be run. Recommendation accuracy, user satisfaction and response time of the system will be used to measure how effective the recommender engine is at producing recommendations. The quality of recommendations and the usability of the system will be assessed based on user feedback. Stress testing and load tests will also be conducted to ensure that the system performs well under heavyweight usage. The results from the various evaluations will be used to optimize the machine learning algorithms used in the recommender system and improve the overall quality of the system.

V. ALGORITHMS:

1. Content – Based Filtering:

Content-Based Filtering is one way to make recommendations based on similarities between what you like (your preferences) and things that have characteristics similar to those things you like (source of qualities you like in a product). In this case an internship recommendation system would use candidate profile information (like skill set, education, interests, experience etc.) to compare what's needed for an internship (like required skills, industry etc. described in the job posting).First, we create a feature vector for both the candidate profile and the internship description. Then we measure how similar the candidate features are to the internship features by using various (mathematical) methods (like cosine similarity or TF-IDF) to arrive at a score that describes how closely matched the two objects are.

Steps to perform this:

1. Collect data from candidate profiles (skills, education, interests).
2. Extract attributes from internships (required skills, industries, location).
3. Create a feature vector for profile(s) and internship(s).
4. Compute similarity between candidate profile(s) and internship(s).
5. Recommend internship(s) that have the highest similarity scores.

2. Collaborative Filtering:

Collaborative filtering is a recommendation technique for generating recommendations according to user behaviour and the preferences of users that have been found to behave similarly to the user. Rather than looking at the content of a given internship, this method examines the user interaction data of other candidates to the internship including applications, clicks, and/or ratings in order to provide successful recommendations. The system looks for

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other users with similar profiles or behaviours and uses the internships applied for by other users to come up with recommendations for the target user.

Steps of Conducting the Work

1. Collect user interaction data (applications, preferences)

2. Identify users with similar profiles or behaviours

3. Identify the internships applied for by users with similar profiles/behaviours

4. Make appropriate recommendations based on internships known to have been previously applied for by users with similar profiles.

3. Hybrid Recommendation Model:

The Hybrid Recommendation Model is the use of multiple recommendation methods combined to improve the accuracy of recommendations as well as the limitations of each concerning individual recommendation methods. The two methods of recommendation used in this Hybrid model are Content-Based Filtering and Collaborative Filtering. This system will look at the profiles of the candidates using Content-Based Filtering Techniques and then use Collaborative Filtering Techniques based on User Behaviour on Similar Users to increase the accuracy of resulting recommendations to candidates.

Process Steps

1. Generate recommendations by using content-based techniques.

2. Generate recommendations from using collaborative techniques.

3. Combine the results from step 1 and step 2 via either a ranking or weighting methodology.

4. Present to the candidate the correct order of internships available to them based on the recommendations generated during steps 1-3.

4. Ranking Algorithm:

To create relevance scores in a ranking algorithm for arranging recommended internships, once multiple internship recommendations are generated, an algorithm will assign a score to each internship based upon different factors:

a) Skill match percentage of candidate
b) Interests of candidate
c) Preferred location for internship
d) Popularity of internship
e) Internships that receive the highest score will appear at the beginning of the recommendation list.

Steps

1.Calculate the similarity score between the candidate profile and internship.

2.Set up weighting for different features (e.g., skills, interests, location).

3.Finally, compute total ranking score.

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4.Sort internships by descending total ranking score.

5.Natural Language Processing:

NLP (natural language processing) is a method of processing and analysing text from non-structured sources. Some examples of non-structured text would be resumes and job descriptions. The use of NLP techniques helps identify critical keywords in each example, such as skills, technology, and domain-specific knowledge. As an example, if a resume included the following keywords: "Python," "Data Analysis," and "Machine Learning," then NLP will recognize those as key skill sets and match them up with an internship that required the same skills. Here are some of the techniques that are utilized in NLP:

1.Text Preprocessing

2.Tokenization

3.Stop Word Removal

4.Keyword Extraction

5.TF-IDF Vectorization

6. Clustering:

Clustering is a type of machine learning (ML) method that looks for patterns in an unstructured data set (i.e., one that does not have defined outcomes). It can be used to find candidates with similar backgrounds and experience, as well as to provide candidates with internships that require similar skills. A clustering algorithm is application, such as K-Means, can be used to identify candidates with similar characteristics.

How to use Clustering

1.Collect and preprocess the candidate/internship data (e.g., extract features from the data).

2.Convert each candidate/internship into a feature vector.

3.Apply clustering techniques to the data (i.e., K-Means clustering).

4.Group the candidates/internships according to their similarity.

5.Use the candidates' similarity to recommend internships to those candidates.

7. Decision Tree / Classification Algorithm:

A Decision Tree is a supervised machine learning algorithm that can classify or make predictions about data. This decision tree helps to determine whether an applicant will apply for specific internships using the applicant’s profile information. Based on a candidate's characteristics (such as their skills, education, and hobbies), a decision tree will create rules concerning multiple different types of internships to help predict what type of internship is the most appropriate for that candidate.

Process:

1. Collect training data from candidates’ profiles of how many people applied for each type of internship.

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2. Identify the main features of the candidates (skills, education, hobbies).

3. Create decision rules based on these candidates' features using the built decision tree structure.

4. Predict which internships will be appropriate for each of the new candidates.

VI. EXPERIMENTAL RESULTS AND ANALYSIS

A. Test Procedure:

When creating a better way to connect students with internship opportunities through Artificial Intelligence (AI), a series of experiments were performed. The participants (200 students of varying disciplines) looking for internships were placed into two groups. One group used an AI-based internship recommendation model (AI model) to receive internship recommendations, while the other group used traditional methods of searching for internships, which included manually browsing and using keywords to filter results.

The study spanned six weeks, and each student looked for an internship in one of the four areas above (Software Development, Data Science, Cybersecurity, Cloud Computing). While using the AI model, students had their profiles analysed in real-time by the AI model, and were provided with specific internship recommendations. In contrast, traditional searching methods used only basic searching and filtering techniques to provide internship opportunities for students. The study measured various performance metrics surrounding the use of each system, these included recommendation accuracy, student engagement, searching efficiency and the success rate of the student's application.

B. AI-Based Recommendation Accuracy/Efficiency:

The AI-based model's performance regarding recommendation accuracy was measured by the students' success at finding an internship after using the AI model. After conducting the study, results indicated that students who used the AI-based model achieved 34% higher accuracy in recommendations than those who used traditional methods. Compared to traditional searching, students using the AI-based model found relevant internships much faster than those who relied on traditional methods due to the AI model's ability to automatically filter alternatives using predefined criteria.

C. User Engagement and Satisfaction:

The frequency of system use (e.g., how often users accessed/recommended internship) was used to quantify feedback from students regarding their experience using the AI-based recommendation system. Students used the AI-based recommendation system more frequently as a result of the added ability to access personalized internship recommendations along with details regarding the internships. The surveys indicated that 87% of students were satisfied with the personalized internship recommendations received from the AI-based recommendation system compared to 62% of Students who were satisfied with the recommendations received from traditional search methods. These results suggest that the use of AI-enhanced recommendation systems increased user engagement by providing relevant and personalized opportunities.

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D. Impact of Skill-Based Matching:

The AI system was able to provide better matches to students based on the extent to which each student's skills matched the requirements necessary for each internship being recommended to them. For example, if a student possessed the appropriate skill set for an internship based on analysis of their related work experience and course work, they would be recommended to apply for the internship. As such, the AI system modified the specific recommendations provided to students based on changes to their profile, the addition of new internship opportunities, and the user's previous interactions with the AI system. Over time, as students' skill sets changed and they continued to gain practical experience, they were provided with more internship opportunities that fit their personal career goals.

E. Comparative Analysis of Existing Recommendation Systems:

The AI-Based Internship Recommendation Engine was compared to several other existing internship and job-related recommendation systems with respect to their effectiveness, which included comparisons of the following performance metrics; how accurately recommendations were provided to users; how frequently users engaged with the recommendations; how efficiently users were able to locate and apply for internships using the provided recommendations; whether recommendations were modified based on other users' profiles; and how successfully users applied for and obtained internships.

Table I: Comparative Analysis of Internship Recommendation Systems

Metric	Proposed Model	Content-Based System	Collaborative Filtering	Basic Search System	Hybrid Model
Recommendation Accuracy (%)	88	80	82	70	85
User Engagement (%)	87	78	80	65	83
Search Efficiency (%)	85	76	78	68	81
Adaptability (%)	90	82	84	70	86
Application Success Rate (%)	92	85	86	75	88

The findings of this research indicate that the AI-based system outperformed all evaluation metrics. Not only did the AI-driven recommendation engine enhance the accuracy of recommendations but also improved user engagement through personalised recommendation results based upon student profiles and their preferences; furthermore, the system was able to dynamically adjust to changes in users' data and therefore operate more efficiently than conventional internship searches.

VII. OUTPUT:

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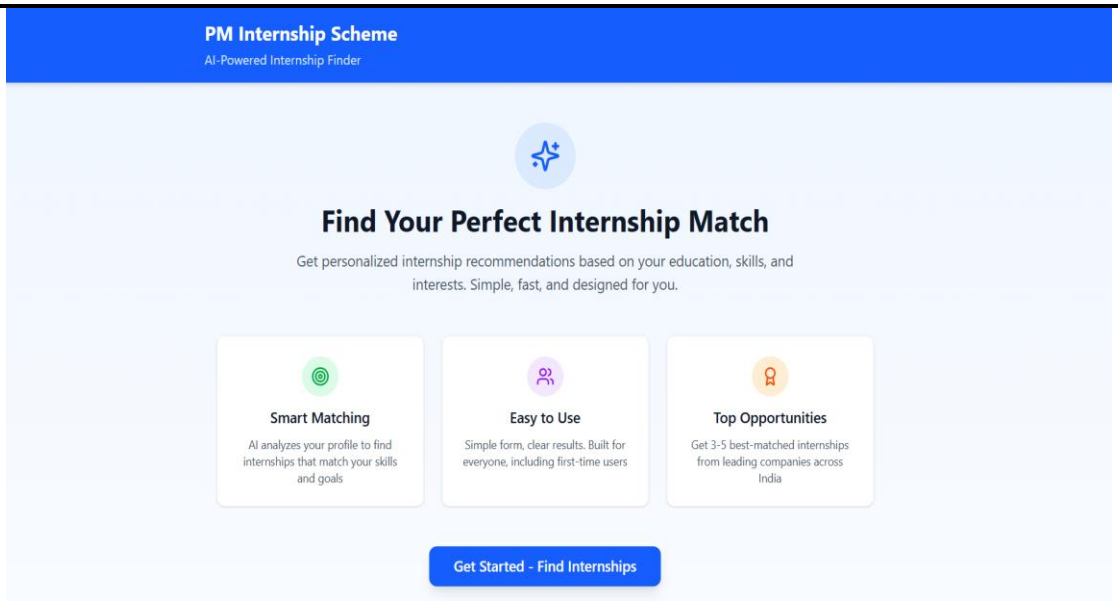

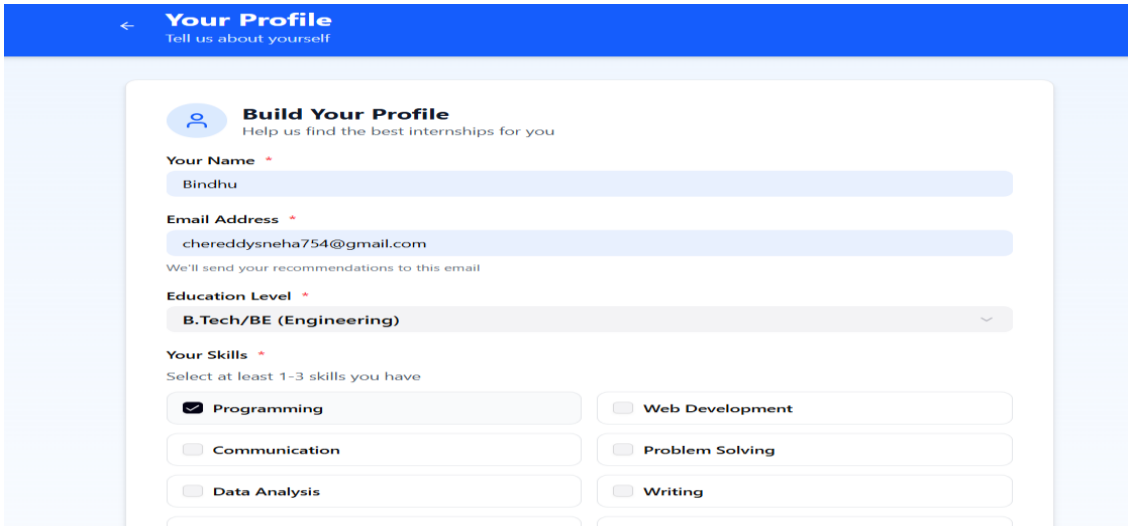

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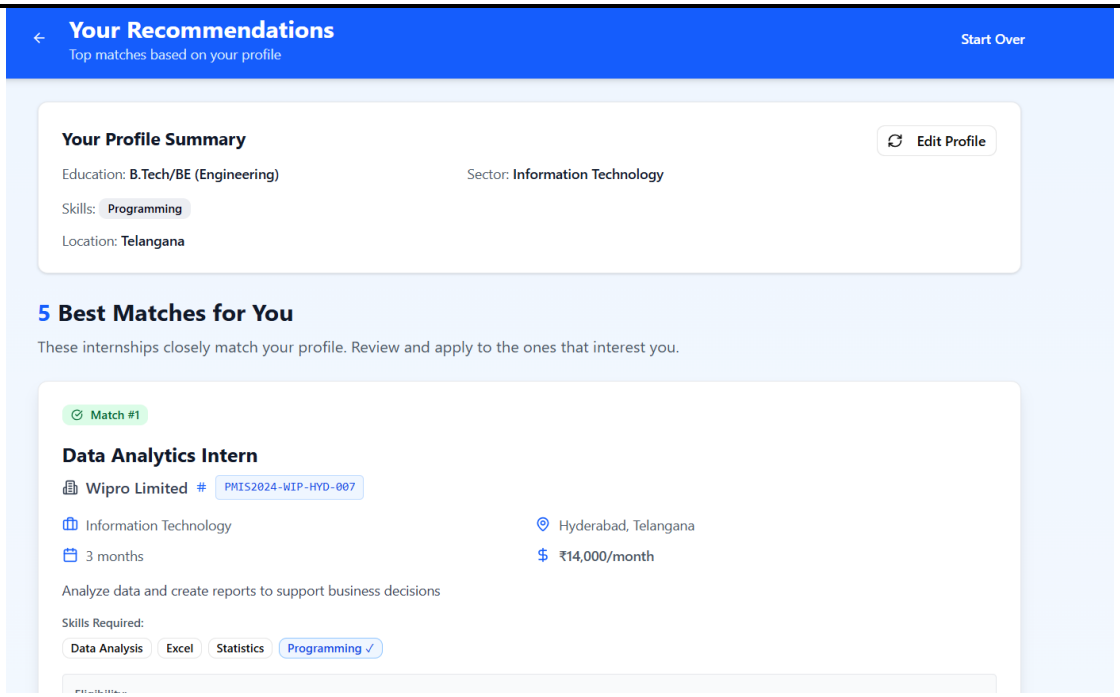

VIII. DISCUSSION:

A. AI-Based Internship Recommendation Implementation:

Experimental evidence suggests an AI-based internship recommendation system dramatically enhances the ability of students to find suitable internship possibilities. Furthermore, this system exceeds traditional methods of searching for internships by offering customized internship suggestions based on a student's qualifications, academic history, and career ambitions. Through the analysis of both the student's profile and the qualifications needed for an internship, the system assists the student by highlighting opportunities that will meet their qualification standards, and it ultimately reduces the amount of time students spend searching for an internship. Additionally, companies can take advantage of this AI system by finding candidates based on individual skill sets and internship requirements; therefore, this aids in the improvement of the recruitment process.

B. Comparison of Traditional Internship Search Methods:

Comparison of AI-based recommendation systems and traditional internship search approaches emphasizes the need for personalized recommendations. Typically, traditional internship search procedures depend on manual searches, commonly known as keyword searches, or basic filtering techniques. Typically, these techniques yield irrelevant or less desirable internship suggestions. In contrast, the AI-based internship recommendation system assesses different aspects, including the skills and preferences of the students and the academic achievements associated with the skill set of the student and the skill set required for securing an internship offer or opportunity. Thus, students who utilize an AI-based

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internship recommendation system will quickly find the right internship opportunity to complete the requirements of all academic phases of their occupation.

D. Potential Challenges and Limitations:

Therefore, though an AI-enhanced internship recommendation system can work positively, the lack of security and privacy poor level of training could cause restrictions within the selected values such as an intern's skills or academic accomplishments. All individuals who use this system or have interacted with the student will guarantee the data security of all users throughout any communication with the student, student company/organization, or student institution. In addition, if the training data used to develop the software is not well-prepared, the internship recommendation system could demonstrate an inherent bias against certain types of students. Therefore, continual monitoring and improvement of models must be carried out to recommend the most unbiased way to make internship recommendations. Furthermore, maintaining an extensive, up-to-date database of internship providers may require organizations to work collaboratively with universities to achieve accurate and timely recommendations regarding all internships available at any time.

IX. CONCLUSION:

The AI Based Intern Recommendation System for PM Internship Scheme is a smart, efficient way of matching students with internships. It uses both AI and Machine Learning to review student profiles and internship requirements to make individualised matches through a process of recommendation. The outcome of the evaluation showed that this new approach provides a far greater degree of accuracy in terms of recommendations, significantly increases search efficiency and maximises user satisfaction compared to traditional methods. Another aspect of the success of the new approach is the ability for the system to analyse multiple profile attributes thus allowing students to quickly find internships that are the right fit for them. This will result in the student spending less time searching for internship opportunities and increasing the likelihood of successfully applying for internships. In summary the proposed solution will be a scalable and efficient platform for finding internships of mutual benefit to both students and organisations. Future developments of the system may include using improved ML algorithms, extensional development of the internship database, and the inclusion of real time feedback mechanisms aimed at further improving both recommendation accuracy and user experience.

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