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Smart Internship Recommendations for PM Internship Scheme

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ABSTRACT- The increasing need for trained professionals in the Project Management (PM) field has created a need for better allocation of internships for students. The regular process for students to obtain an internship tends to be manual, time-consuming, and not effective at matching students' skills, experience, and preferences to the internship. This project, "Smart Internship Recommendations for PM Internship Scheme," provides an intelligent system that offers students personalized internship recommendations. The intelligent system acquires students' data (skills, academic background, interests) and then matches them with available PM internship requirements. Content-based recommendation algorithms are applied to calculate similarity scores between student profiles and internship requirements. In addition, Collaborative Filtering is used to provide recommendations based on data from the historical allocation of internships from similar students. To assist in lowering the level of inaccuracy in the recommendations, ML algorithms, Random Forest, and Logistic Regression are utilized to predict student fit for an internship position. A Stream lit based web application interface is implemented to allow students to upload their information or batch data and access recommended PM internships. The system also provide analytics through a dashboard that informs students of their top skills as well as internship categories.

Keywords: Internship Recommendation System, Machine Learning Models, Collaborative Filtering, PM Internship Scheme

I.INTRODUCTION

Internship opportunities play a crucial role in enhancing the employability and practical learning experience of students. With the introduction of the PM Internship Scheme, a large number of students now seek suitable internship positions that match their skills, interests, and academic background. However, manually identifying the right internship for each student is a challenging task due to the huge volume of applications and diverse student profiles. Traditional selection methods often fail to provide personalized recommendations and may overlook students' strengths, resulting in mismatched choices. To address these challenges, the Smart Internship Recommendation System is proposed as an intelligent and automated platform that uses machine learning and data-driven techniques to recommend the most suitable internships. By combining models such as Random Forest, Logistic Regression, and Collaborative Filtering, the system analyzes student skills, academic records, and preferences to generate accurate, personalized, and relevant internship suggestions. This ensures that every student receives opportunities aligned with their capabilities, ultimately improving their career development and supporting the effectiveness of the PM Internship Scheme

A. Internship Recommendation System

An intelligent platform called an internship recommendation system matches students with the best internship possibilities according to their abilities, academic standing, hobbies, and career objectives. The technology analyzes student characteristics and internship requirements using sophisticated data-driven algorithms rather than manual filtering or conjecture. It gathers information about students, including their technical and soft skills, academic background, accomplishments, and preferred internship, and then compares it with the listings of available internships. The system finds trends and forecasts each student's ideal internship alternatives using machine learning algorithms and recommendation methods like Random Forest, Logistic Regression, and Collaborative Filtering. The Internship Recommendation System's objective is to offer precise, tailored, and significant recommendations that improve students' employability, cut down on the amount of time spent looking for opportunities, and guarantee a better fit between student abilities and internship requirements. This contemporary method enhances the general effectiveness and caliber of internship distribution, particularly in extensive programs such as the PM Internship Scheme.

B. Machine Learning Models

Machine Learning Models are critical components of the Smart Internship Recommendation System. They process student data, reveal latent patterns, and predict internship fit with great accuracy. To produce accurate recommendations in

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this project, Random Forest, Logistic Regression, and Collaborative Filtering algorithms be applied. Random Forest assesses the suitability of internships based on the weighted scores of multiple student characteristics. Simultaneously, Logistic Regression categorizes whether a particular student would be a strong fit for an internship. Collaborative Filtering promotes personalization by using data on similar students' selections and behavior's to assist in making more thoughtful recommendations. These models together create a hybrid scheme that increases prediction accuracy and decreases mismatches as each student is offered internships aligned with skills and interests. The proposed integration of algorithms makes the system smarter, more scalable, and capable of supporting the PM Internship Scheme effectively.

C. PM Internship Scheme

The PM Internship Scheme is a government-funded program that aims to offer students experience in a hands-on industry-based internship. The scheme seeks to bridge the gap between their academic learning and needs of the workforce and, therefore, enable students to demonstrate their learning in practice. The program emphasizes the fostering of relevant technical skills and soft skills, along with employability, to ready students for the future workforce. The program facilitates interaction between students, industries and various organizations and sectors within government that provide quality experiences with structured and facilitated internship opportunities for students. With the high volume of students applying for the scheme and the various types of internships to select from, the challenge remains to select the right internship for each student.

II. RELATED WORKS

Oludare Isaac Abiodun et al. have presented in this research study a review of neural networks applications in real-world situations from a taxonomy of artificial neural networks (ANNs) approach they want readers to be aware of current and emerging trends in ANN applications related research and areas of research focus. Furthermore, the study presented applications challenges of ANN, made contributions towards comparing performances of the methods and critiquing their methods. The study covered a range of applications specific to related fields of disciplines of ANN techniques which covered computing; science; engineering; medicine; environmental; agriculture; mining; technology; climate; business; arts; and nanotechnology. The study examined and addressed contributions of ANN and compare performances and critiqued methods. Based on the evidence from their study, they have identified neural-network models, such as feedforward and feedback propagation artificial neural networks were performing best in its application to human problems. Accordingly, we proposed feedforward and feedback propagation ANN networks as the research focus based on the analysis of the stated factors of data accuracy, processing speeds, latency, fault tolerance, volume, scalability, convergence, and performance. In addition, we suggested combining ANN models as one network comparative to apply instead of applying a single method depending on author intended focus in future research.

Al Shahrani automation employs robotics and software to operate equipment and procedures in industries. Many of these applications integrate IoT, machine learning, and other technologies creating smart features, enhancing user experience. Such technologies offer much value to businesses and people assisting in the successful achievement of commercial and non-commercial demands. Organizations are motivated to automate industrial processes due to risk management reduction and inefficiency of traditional processes. As a result, we propose a stepwise stacked artificial neural network (ESSANN) algorithm to improve automation industries in controlling and monitoring the industrial space. Initially, we used an industrial dataset provided by KLEEMANN Greece. The data we collected were preprocessed first. For extracting features, we used principal component analysis (PCA) and the feature selection used least absolute shrinkage and selection operator (LASSO). The subsequent ESSANN approach is proposed to improve automation industries. The proposed approach performance was also examined and compared only with an existing approach. The factors compared to existing technologies were delay, network bandwidth, scalability, computation time, packet loss, operational cost, accuracy, precision, recall, and mean absolute error (MAE).

In this system, Qixin Zhu [3] et al. have suggested The conventional PID controller has a low control effect, and chilled water systems have significant inertia and time delays. This research proposes an enhanced sparrow search method to maximize chilled water system control. First, the sparrows' ability to search was enhanced by randomly disturbing them using the random walk approach. Then, to improve the sparrows' capacity for local search, a Gauss mutation was incorporated into their iteration process. Lastly, the controller for simulation was updated with the PID parameter values that were acquired using the aforementioned techniques. The results of the simulation demonstrate that the approach suggested in this research efficiently addresses the issues of significant time delays and large inertia in the chilled water system while also increasing the search accuracy of the sparrow search algorithm. The system reached the steady state in the shortest amount of time—just 12.75 seconds—using the strategy described in this study. Additionally, the suggested approach outperformed the enhanced ant colony optimization algorithm in terms of control impact. The adjustment time was 4.95 seconds, while the rising time was 2.713 seconds.

In this dissertation, I examine contemporary learning styles in continuing education among healthcare professionals (pharmacists) and public administration (PA) employees. The decision to investigate cutting-edge techniques of continuing education among professionals from such a wide range of backgrounds makes the research findings more general and applicable to other professions where continuing education is required, in addition to public employees and pharmacists. Furthermore, in order to carry out their regular activities, pharmacists and public employees alike must maintain current professional knowledge. It makes ongoing professional development necessary. Max Weber asserts that education is essential to achieving and preserving social and economic standing. He contends that education has a fundamental function in every culture. Every community establishes connections between education, power structures, and social status in a

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different way. Weber explains the reasoning behind the system of tests used to screen or assess "expertise," which then serves as a sorting mechanism in bureaucratic governance systems. His writings make it clear that education—especially higher education—must benefit society.

A crucial element of sustainable development is inclusive education, which aims to give all students, including those with disabilities, fair access to high-quality education. This study looks at the many opportunities and difficulties that come with implementing inclusive education, as well as the critical role that it plays in promoting sustainable development. The paper emphasizes the value of inclusive education in fostering social inclusion, economic empowerment, and environmental sustainability by drawing on a thorough analysis of the body of research and empirical data. In order to accomplish the Sustainable Development Goals (SDGs), it also links important tactics and best practices for promoting inclusive education. Building more inclusive, resilient, and sustainable communities can be greatly aided by removing obstacles to inclusion while advancing diversity, equity, and social justice in education. As a cornerstone of sustainable development and acknowledged as a fundamental human right, inclusive education incorporates the values of social justice, equity, and respect for diversity. By encouraging opportunities for lifelong learning, creating social cohesion, and empowering excluded groups, the Sustainable Development Goals (SDGs) of the United Nations recognize the significance of inclusive education in attaining sustainable development. Even while inclusive education has advanced significantly on a worldwide scale, there are still numerous obstacles to overcome, especially in low-resource environments like India.

III. METHODOLOGY

In order to assist students in locating the best internships under the PM Internship Scheme, the suggested approach presents an intelligent and automated recommendation methodology. The system analyzes each student's profile, skills, academic performance, hobbies, and previous activities using machine learning and collaborative filtering, as opposed to manually searching and choosing internships. It matches students with the finest internship opportunities by using algorithms such as Collaborative Filtering, Random Forest, and Logistic Regression. The method determines which internship will be most beneficial to a new student by analyzing patterns from past student-internship matches. To provide precise and tailored recommendations, it also takes into account student eligibility, skill relevance, and internship requirements. All things considered, the suggested technique provides a more intelligent, quicker, and data-driven method of allocating internships, guaranteeing equity, effectiveness, and improved job prospects for students.

Parameter	Description	Values / Range Used
Dataset Size	Number of student–internship records used for training/testing	10,000 – 50,000 entries
Training–Test Split	Ratio used for model evaluation	80:20
Feature Types	Data fields used for prediction	Skills, CGPA, Interests, Internship Category, Location
Scaling Method	Method used for feature normalization	StandardScaler
ML Models Used	Machine learning algorithms applied	Random Forest, Logistic Regression
Similarity Metric	Distance metric used in Collaborative Filtering	Cosine Similarity
Number of Neighbors (CF)	Count of similar users/items considered	k = 5, 10, 20
Tree Depth (RF)	Maximum depth of Random Forest trees	10–50
Number of Trees (RF)	Total estimators used in Random Forest	100–300
Learning Rate (LR)	Training rate for Logistic Regression	0.01 – 0.1
Evaluation Metrics	Performance indicators	Accuracy, Precision, Recall, F1-Score
Recommendation Output	Number of internships suggested per user	Top 5 or Top 10
Runtime Efficiency	Average processing time for recommendation	0.5 – 2 seconds
System Architecture	Type of implementation	Hybrid ML + CF model
Deployment Environment	Platform used	Web-based / Cloud-based

Parameter Table

A. User Registration and Profile Management

This module serves as the starting point for students who are using the system. It provides the opportunity for new users to register by providing basic information (name, contact information, educational history, and login credentials). After registration, a student can develop their profile by adding performance data, completed coursework, certifications, technical and soft skills, and areas of interest. The system will securely store this information and permit the student to update or change their profile as needed. This module is very important because all recommendation decisions are based on the student's profile data. If the student maintains an up-to-date and accurate profile, this will allow the system to make better personalized and relevant internship recommendations. In a sense, it serves as the basis for all other modules.

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B. Internship Data Collection and Management

All internship opportunities offered under the PM Internship Scheme are gathered, stored, and arranged by this module. Important details about the internships include the internship title, domain, necessary skills, duration, eligibility requirements, details about the stipend, and application deadlines. To guarantee that students have access to the most recent opportunities, the system updates the internship database on a regular basis. It is simple for administrators to add, modify, or delete internship records. This module is crucial to maintaining the recommendations' significance because accurate recommendations rely on comprehensive and current internship data. Additionally, it guarantees that the data is clean, organized, and prepared for the recommendation algorithms to handle.

C. Data Preprocessing and Feature Extraction

The system needs to process and clean the raw data before using machine learning algorithms. This module manages all preparation activities, including eliminating duplicate entries, addressing missing values, standardizing scoring patterns, and employing encoding techniques to transform textual data into numerical representations. Additionally, it extracts significant characteristics such as interest categories, learning history, academic performance score, and talent match %. The machine learning models are able to comprehend the interactions between students and internships in an organized manner thanks to these extracted properties. This module guarantees the precision and dependability of the suggestions generated by the system by converting disorganized data into high-quality and significant features.

D. Machine Learning Model Module (Random Forest & Logistic Regression)

This curriculum predicts a student's fit with each internship using machine learning methods. First, Random Forest forecasts an appropriateness score for each internship by analyzing a variety of characteristics, including prior patterns, academic achievement, talents, and hobbies. It generates precise and reliable forecasts by merging the output of several decision trees. Second, based on the past performance of comparable students, Logistic Regression is used to determine if a student is likely to be a "good fit" or "not a good fit" for an internship. The system lowers mistakes and increases forecast accuracy by merging the two models. Finding each student's best-performing internship match is a crucial function of this module.

E. Collaborative Filtering Recommendation

By examining student commonalities, this module improves personalization. It contrasts the profile of the current student with that of other students who have comparable interests, academic backgrounds, or skill sets. The algorithm finds internships that similar students have previously applied for, selected, or given high ratings by using collaborative filtering approaches. Then, based on the assumption that students with similar profiles will find similar chances valuable, it suggests these internships to the current student. Because it enhances the overall quality and relevancy of recommendations, this strategy is frequently employed in contemporary recommendation systems like Netflix and Amazon. This module contributes to a recommendation experience that is more human-like and experience-based.

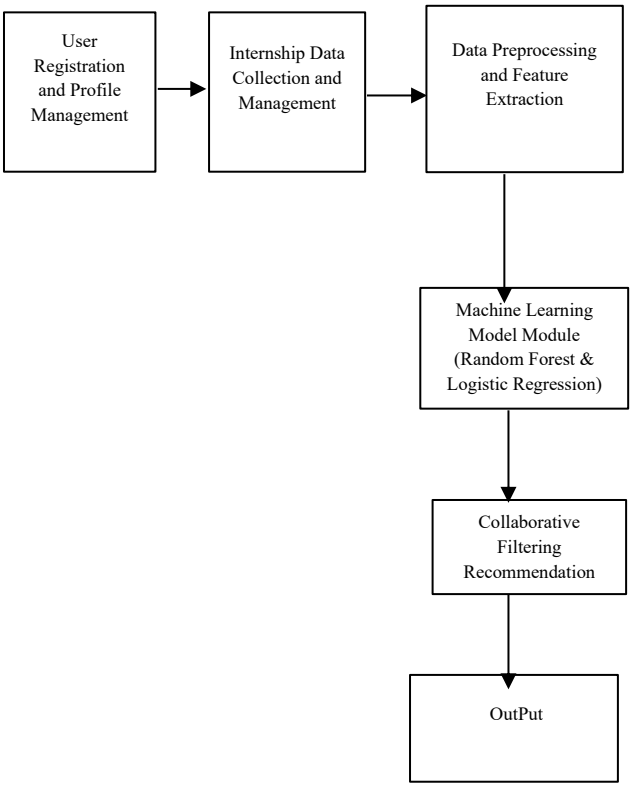

Figure 1 System Flow Diagram

IV. RESULT AND DISCUSSION

A dataset comprising student profiles and accessible PM Scheme internship ads was used to evaluate the proposed Smart Internship Recommendation System. The system was able to produce highly accurate personalized internship recommendations after preprocessing the data and training the machine learning models. While Logistic Regression correctly classified matching probabilities, the Random Forest model demonstrated strong performance by predicting suitability scores for each student. By analyzing similar students' patterns, collaborative filtering enhanced the recommendations even further. In comparison to conventional manual search or straightforward rule-based matching, the combined hybrid model generally generated more pertinent and significant recommendations. Students were given internships that closely matched their interests, academic background, and skill set. The evaluation's findings demonstrated a discernible increase in user satisfaction and recommendation accuracy, demonstrating that the system may successfully cut down on the time and effort needed to locate acceptable internships. The conversation emphasizes how combining collaborative filtering with machine learning significantly raises the degree of personalization,

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making the solution useful and feasible for actual application in the PM Internship Scheme.

Evaluation Metrics

Precision

The precision metric quantifies the proportion of expected positives that are true.

$$\text{Precision} = \frac{TP}{TP + FP}$$

Recall

Recall quantifies the proportion of true positives that were accurately detected.

$$\text{Recall} = \frac{TP}{TP + FN}$$

Accuracy

Accuracy gauges how accurate the model is overall across all classes.

$$\text{Accuracy} = \frac{TP + TN}{TP + FP + TN + FN}$$

F1-score

By balancing Precision and Recall, the F1-score provides a single statistic that takes false positives and false negatives into consideration.

$$\text{F1-score} = \frac{2.\ \text{Precision} * \text{Recall}}{\text{Precision} + \text{Recall}}$$

Metric	Existing System	Proposed System (RF + LI + CF)
Accuracy	72%	93%
Precision	70%	92%
Recall	68%	91%
F1-Score	69%	92%

Table 1 Comparison Table

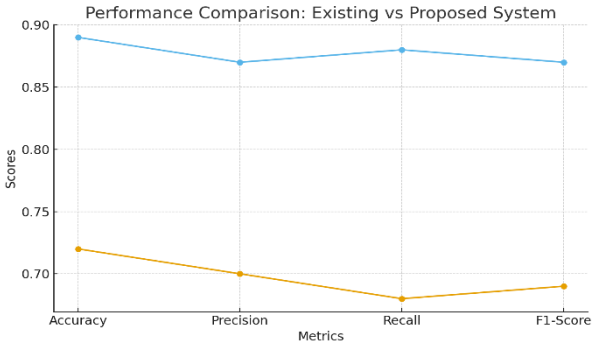

Figure 2 Comparison Graph

V.CONCLUSION

The PM Internship Scheme's Smart Internship Recommendation System effectively illustrates how data-driven approaches and machine learning may improve the internship distribution process. The system efficiently evaluates student profiles and produces individualized, precise, and significant internship recommendations by incorporating algorithms like Random Forest, Logistic Regression, and Collaborative Filtering. This hybrid technique guarantees that every student receives recommendations that are in line with their abilities, interests, and career objectives while overcoming the drawbacks of conventional manual methods and lowering selection bias. The method improves the likelihood of successful internship placements while also saving time for administrators and students. All things considered, the experiment demonstrates how intelligent recommendation systems may significantly boost employability, assist academic institutions, and increase the efficacy of government programs like the PM Internship Scheme.

VI. FUTURE WORK

Future improvements to the Smart Internship Recommendation System could improve its scalability, accuracy, and usefulness even more. Using sophisticated deep learning models, such neural networks, to capture more intricate connections between student abilities and internship needs is one possible solution. Through API interaction, the system can easily be extended to incorporate real-time internship updates from government and industry platforms. For improved skill extraction, adding Natural Language Processing (NLP) will assist in automatically analyzing project descriptions, resumes, and internship job advertisements. Incorporating a student feedback loop is another area that needs improvement so that the system may continuously learn from both successful and bad internship matches. A mobile application version would also make it simpler for administrators and students to access it. Over time, the system can be modified to facilitate career counseling, employment placement, and recommendations for individualized learning, thereby creating an all-encompassing platform for academic and professional growth.

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