AI-Driven Career Path Finder & Navigator Revolutionizing Career Guidance with Artificial Intelligence

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Abstract— Most students worldwide struggle to find a career path after completing the higher secondary education. As students move through the phases, the most common question students have is what to do after the 12th grade, which causes them to have many doubts and second thoughts. The academic journey of a student becomes a crucial factor in directing them towards an appropriate professional path in the suggested automated career counseling system. The system efficiently assesses the student's complete profile by entering their scores from the tenth grade and giving information about their extracurricular activities. By taking a comprehensive strategy, the likelihood of academic misalignment is decreased and the danger of making poor professional decisions is increased. After that, the system creates customized suggestions based on the student's extracurricular activity and academic standing, promoting a more knowledgeable and individualized approach to career counseling.

Index Terms— Career Counseling, Classification, K Nearest Neighbor, Machine Learning Algorithms, Support Vector Machine.

I. INTRODUCTION

When deciding on a career, consider other factors as well the path one take is more than just what one hope to accomplish soon after person graduate. The career development advice mostly focuses on comprehending and being aware of oneself and one's skills and abilities. Every student receives a lot of advice during this period from numerous groups (parents, instructors, other students, educational experts, etc.), and the student as a result chooses the course want to enroll in. Frequently, there are cases when students choose incorrect course or stream and then regret decision. For instance, there is a common misconception that students who excel and receive the best grades in Computer in the 12th grade would select Computer engineering as a major. In reality, this is not the case. Students who are presently enrolled in engineering programs and students who are currently in grades 11 and 12 participated in many rounds of discussion. The proposed system adopts a more individualized and student-focused methodology. By entering their tenthgrade test results and providing information about their extracurricular activities, students actively engage in the system's evaluation process. This interactive platform uses the student's academic performance and extracurricular activities to identify and evaluate a variety of comprehensive skill sets that are important for different future routes. Rather of depending on an objective exam, the system examines each person's distinct profile to offer suggestions for career trajectories that best play to their strengths. To have a better understanding of the influence of the system, consider the following illustrative examples: 1) Academic Prominence: A student's career choices in data science, analytics, or mathematics-intensive fields may be highlighted by the system if one have demonstrated consistent excellence in math classes and active participation in math-related extracurricular activities. 2) Leadership and Teamwork: A student may earn recommendations for jobs in management, project leadership, or entrepreneurship if one have proven their excellent leadership abilities through extracurricular activities like team sports or student government. 3) Creative Aptitude: Based on their extracurricular activities and academic achievement in related courses, the system may recommend career routes in design, marketing, or

content production for students who have a passion for the arts or creative undertakings. Students can obtain individualized insights on their particular skill sets by interacting with the system and answering questions that are tailored to them. Because of this empowerment, individuals are better equipped to decide on their job path and have a deeper awareness of their hobbies and strengths.

II. PROPOSED SYSTEM

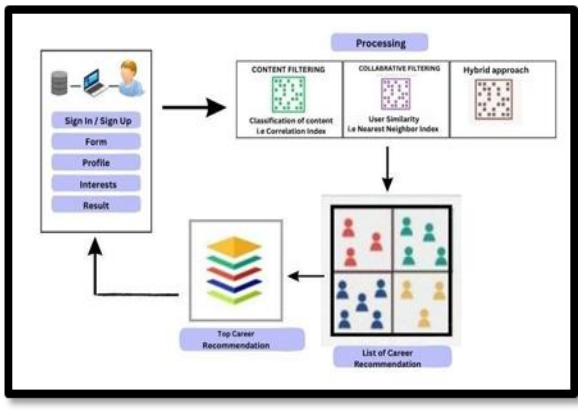

Fig. 1 Architecture Diagram of the recommended system.

III. OVERVIEW OF THE PROPOSED SYSTEM

The process involves the system shown in Fig 1, analysing a candidate's skill set where user will registered in the system, there will be questionnaire assessments where user will add tenth-grade test results and providing information about their extracurricular activities etc. students actively engage in the system's evaluation process. This interactive platform uses the student's academic performance and extracurricular activities to identify and evaluate a variety of comprehensive skill sets that are important for different future routes. Those data will be stored in database and undergo processing task includes various approaches like content-based filtering, collaborative filtering and Hybrid approach and after that data extraction techniques and machine learning algorithms applied. Based on that, display user's highlighted strength which will be recommended by system and displays the Top career recommendations as a result.

IV. LITERATURE SURVEY

The author [1] Reema Goyal et.al. explains the idea of an Intelligent Career Counseling Chatbot (ICCC) created to offer career counseling to students in the 10th and 12th grades. The ICCC seeks to serve students by answering their questions, promoting their learning, and guiding them as one selects a professional route for further education. The creation of an intelligent career counseling chatbot has a number of advantageous effects. First off, it gives students a scalable and convenient way to get academic and career help. By making career guidance more broadly available, this may lighten the workload for human career counselor's educators. Additionally, by using machine learning techniques, the chatbot may be able to deliver unique suggestions depending on each user's replies, enhancing the efficacy of the advice given. Students may make better-informed judgments and achieve greater academic results if their questions can be answered and assistance in selecting a vocation for further education is provided. Although negative effects are not specifically mentioned in the research, there may still be some issues. Assuring the precision and dependability of the chatbot's assistance is a difficulty. Students may receive misleading advice if the machine learning algorithms or the questions are not well-designed or current, which might result in the wrong career choices.

In [2] Shaikha Al-Dhari et.al. underlines the importance of job choice as a crucial choice people must make in their academic and professional life. The main emphasis is on the methods employed by artificial intelligence and machine learning to forecast and suggest career options. There are various advantages to using data analytics to anticipate job choices. First of all, it makes use of machine learning and artificial intelligence to provide people individualized career advice based on data-driven insights. This may result in better career selections and maybe more successful and satisfying employment. The over-reliance on data analytics for professional decisions is one potential downside. While these methods can offer

insightful information, it's possible that one doesn't adequately account for the complex and unique components of professional decisions.

In [3] Muskan Sharma; Anita Kumari et.al. introduces Career and Personal Mentorship for Higher Secondary Education presents mentorship and assistance for higher secondary education students. This system's main goal is to help students choose professional paths, academic programs, and personal development options in an educated manner. The suggested chatbot-based solution intends to give students a place where one may ask for advice anonymously, free from prejudice or fear of judgment. Traditional mentoring meetings can take a lot of time, and one might not always be accessible to all students. It is now simpler for students to get assistance whenever one need it thanks to the chatbot, which provides a 24/7 alternative. It doesn't address questions about the chatbot's comprehension of and capacity to deal with difficult emotional or personal situations that kids may experience. Moreover, the quality of its training data and the precision of its algorithms determine how well the chatbot performs in terms of offering individualized and relevant mentorship. A crucial factor that ought to have been covered is making sure the chatbot is properly educated and updated on a regular basis to meet students' changing demands.

The author [4] Muhammad Arif, describes necessity of career counseling is explicitly emphasized in the study as a way to improve graduates' employability. It makes the case for the creation of a customized career counseling model that is adapted to the changing demands of the labor market and unique student characteristics. The article highlights the potential to improve the employability by supporting individualized career assistance. Graduates' prospects of finding employment after graduation can be improved by better matching their talents and interests with existing job opportunities. Challenges in implementation are one of the main issues. Personalized career advising might provide substantial obstacles, requiring extensive resources, infrastructure development, and training.

In [5] John Robert D et.al. introduces sets the scene by discussing the difficulties junior high school students in the Philippines have while choosing a career path within the framework of the K–12 curricula. The research suggests using a Deep Neural Network (DNN)-powered web-based career track recommender system to help guidance counselors identify the best academic route for kids in senior high school. A web-based career track recommender system that makes use of DNN offers numerous potential advantages. Such as by automating the process of determining the best academic strands for students, it can increase the effectiveness of guidance counselors. Counselors may then be able to offer more individualized advice and assistance to those who most need it. It is crucial to keep in mind that choosing a vocation involves a complex interaction of one's own interests, aptitudes, passions, and values, which a DNN-based model would not adequately reflect.

The author [6] Vignesh S et.al. introduces to solve the problem of picking a suitable professional path, a problem that arises frequently for students after finishing their upper secondary education, the paper presents a novel solution. The authors acknowledge that many students, even at the age of 18, lack the knowledge and maturity necessary to make wise career selections. This system's ability to drastically lower the number of students making poor career decisions is one of its beneficial effects. It may offer tailored suggestions based on individual skill sets utilizing objective evaluationsand AI algorithms, improving the possibility that students choose occupations that complement their skills and interests. There are certain potential restrictions to take into account, though. First off, the system's accuracy is largely dependent on the caliber of the assessment questions and the availability of a large dataset.

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In [8] Panjab Mane et.al. which addresses the significant challenge of helping students make informed career choices in an era of increasing career options and opportunities. The paper presents a mobile application designed to assist high school students in selecting a suitable career path based on their personality traits, interests, and aptitude. This paper's method of fusing technology and psychology to offer career recommendations is one of its main strengths. The approach tries to provide more accurate and individualized suggestions by taking into account the student's potential to pursue a certain course as well as personality traits, hobbies, and other factors. On the downside, the paper does not address any potential restrictions or difficulties related to the deployment of the suggested career advice application written.

In [9] Min Nie et.al. examines the important decision students must make regarding their job and how it affects their life planning. In the past, career appraisers have used questionnaires and diagnostics to determine the many aspects that can affect students' career selections. It presents a viable and data-driven strategy to forecast the job preferences of students. This approach may considerably improve the accuracy of career forecasts through the use of behavioral data, enabling students to make better informed selections. The model's focus on data-driven insights may also be able to lessen the subjectivity connected to conventional job advising techniques. Strict privacy measures and laws must be followed

while gathering and analyzing student behavioral data. Sensitive personal information handled improperly or improperly might lead to privacy violations and ethical issues. Additionally, relying too much on behavioral data may ignore certain important non-behavioral aspects that affect job decisions, such as individual beliefs, interests, and environmental conditions.

The author [10] Vishal. D. et.al. suggests creating an Android-based mobile application that offers full information on universities, eligibility requirements, fees, and more to solve these issues. The application's goal is to help students, both in India and overseas, choose the best institution and course based on their qualifications and interests. The career coaching mobile app for Android provides a number of potential advantages. The application may direct students toward universities that offer a well- rounded educational experience, boosting their entire college experience, by integrating characteristics like institution ranking, scholarship facilities, and campus placement chances.

In [11] Pavel Kiseleva et.al. focuses on the crucial role that personality traits play in career advising and explores how social network data analysis may be used to employ machine learning to forecast these attributes. The notion of social constructivism is introduced in this study as the basis for machine learning techniques used in career counseling. It is stressed that the AUC-ROC measure computation used in career counseling modeling provides empirical support for this theory. It presents a viable and data-driven strategy to forecast the job preferences of college students. This approach may considerably improve the accuracy of career forecasts through the use of behavioral data, enabling students to make better informed selections. The research emphasizes the empirical support for social constructivism's theoretical foundations in the context of career counseling in its result analysis. The research highlights the significance of comprehending professional identity creation within social networks and how this process is impacted by values, even if particular experimental results are not included in this review. The research emphasizes the significance of values in career building and makes the case that by integrating machine learning into the context of social networks, this process may be improved. Although the article suggests that this strategy could be helpful, a more thorough examination of the experimental data would reveal important details about its usefulness and efficacy.

V. METHODOLOGY

The most crucial sections of the approach are Skill Enlightenment, The Oracle of Prediction, and Skill Discovery displayed in Fig 2, where the entire procedure was carried out. Candidates learn about their individual results across several skill areas when the evaluation is finished. The second module—the Prediction sections— then enters the picture. Predictive operations are carried out in this case by using a machine learning algorithm that is fluidly working in the backend of the web application, using the scores attained by applicants in the previous module.

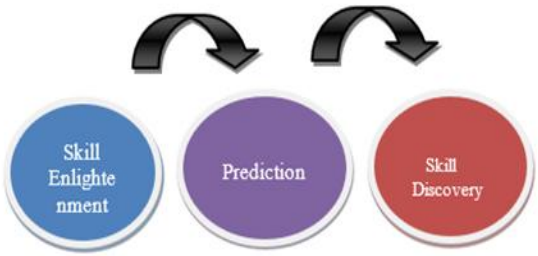

Fig. 2 Process Flow

The forecast of the best department for each candidate's profile is the second segment ultimate result. The Skill Discovery final segment, and it examines applicants' performance in great detail. This thorough examination is provided in a variety of ways, giving applicants access to a rich and detailed understanding of their results**.**

A. Skill Enlightenment

In envisioned system, developed a user interface named "Pathfinder AI," designed to provide career recommendations. This interface serves as a comprehensive guide, navigating users through different facets of the subject matter to enhance the effectiveness of the content.

On the Pathfinder AI website, users can engage by utilizing their individual user accounts. Each user is required to either sign in or sign up with their accounts to access personalized career recommendations. (User Profile: Sign In/Sign Up).

1) Below presents interface of system :

2) Signup and Login as mentioned in Fig.3

3) Banner creation as mentioned in Fig.3

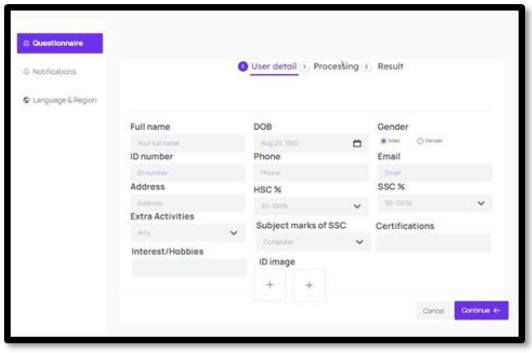

Fig 4. Questionnaire Assessment Test Dashboard

Which are designed to sign up. User information is gathered and stored in the database by the register page. Subsequently, the user is routed to the login page, wherein he or she must input their credentials, including academic records, extra circular reports, and hobbies. Based on the user's form data, the recommendation provides a precise and suitable career advice. The three finest professional paths that an individual can pursue are recommended. Python was utilized for the backend. Proposed method utilized Python Flask to link the front-end and back-end. It also employed cosine similarity to estimate the user's career depending on the data they enter. Similarity between two vectors is measured by their cosine similarity. It can be used to register the proximity of items on a dataset using keywords. The dot product divided by the magnitude value yields the closeness between two vectors (A and B). Pandas, a quick and efficient data frame for data manipulation, is used to get data into the format needed for cosine similarity. NumPy files are also utilized.

A. The Oracle of Prediction

B. Questionnarie selection as mentioned in Fig.4

C. Popular Categories as mentioned in Fig.4

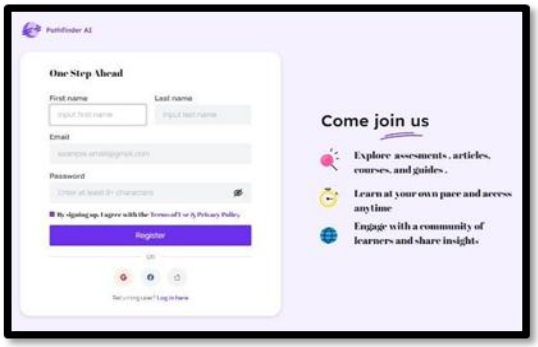

Fig 3. Dashboard of Pathfinder AI

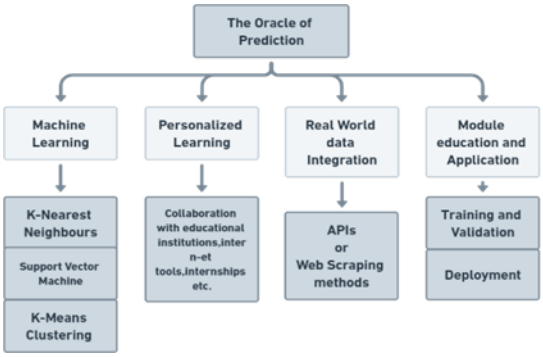

Fig 5. The Oracle of Prediction Module

performance of Support Vector Machine and AdaBoost, aimed to enhance the model's ability to analyze user data effectively, providing users with accurate and well-informed guidance as one navigates

their career choices which has been discussed below. These testing efforts underscore the commitment to delivering a robust and reliable career recommendation system.

1)Machine Learning: The machine learning algorithm used for classification as shown in Fig.5, is K-Nearest Neighbors. It's a supervised learning algorithm that finds distances between each neighbor using formulae like Minkowsky, cosine similarity measure, chi square, Euclidean distance, and correlation to categorize the target variables. Classification issues are a good fit for K-Nearest

Neighbor as it can be used with different datasets

is tested. These advanced techniques were employed to finetune the system, ensuring its proficiency in making precise and reliable career recommendations. By evaluating the Support Vector Machines (SVM) and AdaBoost algorithms to achieve accuracy greater than 90%.

Machine learning clustering is accomplished using the K- Means Clustering technique. The K-Means Clustering technique divides n observations into K clusters, where each value merges with the cluster that has the closest mean. KMeans Clustering is employed in this framework primarily to group the departments that are best mapped to the candidate's performance and to offer secondary and tertiary suggestions. Multiple models can be combined to increase prediction accuracy using ensemble approaches like Random Forest or Gradient Boosting, Support Vector machines etc.

2)Personalized Learning: Personalized learning plans for students based on their assessment results should also be provided by the recommendation engine, which should be created. These programs might incorporate pertinent textbooks, internet tools, extracurricular pursuits, and internships.

Collaboration with educational institutions to include the proposed courses into their curricula will ensure that students have access to the tools one need to enhance their skills.

3)Real-World Data Integration: Integrated real-world data sources that offer insights into industry demands, employment market trends, and compensation statistics for various career pathways. Students may use this information to make educated judgments.

APIs: Using APIs or web scraping methods to collect current data from job-search websites, official labor statistics, or sector-specific websites.

4)Model Education and Application: Model works on following stages

Data Preprocessing: To get data ready for training, perform extensive data preprocessing, including feature scaling, resolving missing values, and encoding categorical variables.

Training and Validation: Use a broad and representative dataset to train machine learning models. Utilize methods like cross-validation to evaluate the performance of models.

Deployment: To make predictions in real time on the website deployed trained model as a web service or API. To ensure effective deployment, think about using containerization with technologies like Docker.

C. Skill Discovery

Used cutting-edge data visualization methods, such as interactive dashboards, to give a thorough evaluation of the student's performance and suggested career prospects.

Comparative Analysis: Let pupils analyze several career alternatives side by side, taking into account factors like expected salaries, employment prospects, and educational prerequisites. Implementing a feedback mechanism so that students may offer input on the career advice procedure, assisting in the system's ongoing improvement.

Key points of Highlighted System:

1) User Interface: Developed an application that will make it simple for students to get career advice and complete tests on their cell phones. Integrated a chatbot option for ondemand advice and direction over the course of the career planning process.

2) Integration with Educational Institutions: Integrate chatbots with AI into school websites to offer immediate career advice and respond to frequently asked questions.

3) User Feedback: Implementing a user feedback loop will enable continual customization and upgrades by accepting input from students, counselors, and instructors.

4) AI mentorship: Introduce an AI mentoring tool that

allows students to communicate with mentors who are powered by AI for advice on questions pertaining to their careers.

5) Social Integration: Give students the opportunity to interact and network online with classmates who have similar professional interests.

6) Language Support: To accommodate a varied student body, offer assistance for different languages.

VI. RESULTS

The precision, recall, accuracy, f-measure, and errorrate of the classification model are calculated by the confusion matrix shown in Table 1, to quantify its performance. The formulas for the aforementioned performance metrics are as follows:

TABLE 1. CLASSIFICATION METRICS

Parameter	Formula
True Positive (X) =	X/(X+Z)
False Positive(Y)=	Y/(Y+Q)
False Negative(Z)=	Z/(Z+X)
True Negative (Q)=	Q/(Q+X)
Precision(p) =	X/(X+Y)
Recall(r) =	X/(X+Z)
Accuracy =	(X+Q)/(X+Y+Z+Q)
F-Measure=	2*(p*r)/(p+r)
Error-rate=	1-accuracy

From the above inferred Table 2, Determined prediction results on using classification techniques such as K-Nearest-Neighbor, Support Vector Machine and Adaboost algorithm and calculated their performance metric.

The supervised learning classifier known as the knearest neighbor algorithm, or KNN or k-NN, uses proximity to predict or classify how a single data point will be clustered. Although both approaches yield images with a reasonable level of classification accuracy, the SVM performs significantly better than the k-NN in terms of both classification speed and accuracy. AdaBoost, or adaptive boosting, is an ensemble machine learning method that is applied to various regression and classification tasks. In order to categorize data, it is a supervised learning technique that transforms multiple weak or base learners into a strong learner.

TABLE II. STUDENT DATA

Student ID	GPA	Test score	Extracurricular Activities	Chosen Career
1	3.9	1500	Debate team, math club	Software engineer
2	3.8	1400	Science Olympiad, robotics team	Doctor
3	3.7	1300	Band, student council	Lawyer
4	3.6	1200	Art club, drama club	Architect
5	3.5	1100	Soccer team, video game club	Engineer

TABLE III. PERFORMANCE MEASURES

Classification Technique	Accuracy	Precision	Recall	F1 score
SVM	90%	85%	95%	90%
KNN	80%	75%	85%	80%
Adaboost	95%	90%	95%	92%

Table 3 indicates that Adaboost algorithm is the classification technique, which is determined as the efficient classifier in terms of accuracy and F1 score.

Based on the classification performance measures in Table 2, we built training and testing sets from the dataset. An 80/20 split should be used, with 80% of the data used for training and 20% used for testing.

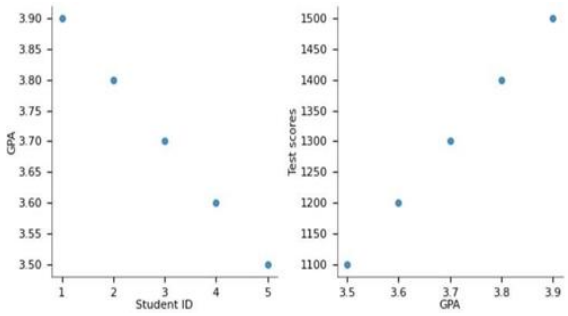

Fig 6. 2-d Distributions

On the training set, train a k-nearest neighbor, Support Vector Machine, and Adaboost classifier. For the k-nearest neighbor classifier, K=3 is the value that employ. Select a kernel function for Support Vector Machine. Before the Support Vector Machine classifier provides a prediction, the data is converted according to the kernel function. The radial basis function (RBF) kernel is a frequently used kernel function for classification problems. Adjust the Support Vector Machine classifier's hyperparameters. The Support Vector Machine classifier's performance is governed by its hyperparameters. To get the ideal values for the hyperparameters, may utilize a grid search. Finally, initialized the weights of the training examples in Adaboost to be equal. Trained a slow learner with the practice materials. Determined the weak learner's mistake on the training set. Based on the weak learner's error, adjust the weights of the

training instances. Till desired results, repeat the steps. Make assumptions about the test set.

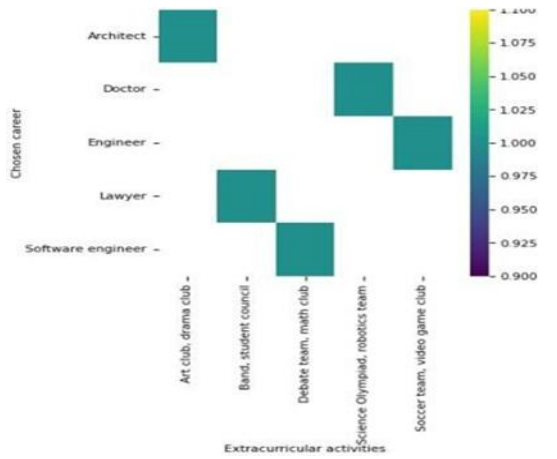

Fig 7. 2-d categorical distributions

Below, Equation (1) represents the sum of squares of the distance of each data point to its assigned vector m_k.

$$J = \sum_{i=1}^{I} \sum_{J=1} r_{ij} \|(x_i - m_i\|^2 \quad (1)$$

1) *I is to total number of data points,*
2) *J is the number of clusters*
3) *X_i is the vector of measurement i*
4) *M_j is the mean for cluster j*
5) *R_{IJ} is an indicator variable that indicates whether to assign x_i to j.*

Hence, The Adaboost classifier has the highest F1 score, followed by the Support Vector Machine and k- nearest neighbor classifiers. This indicates that the Adaboost classifier is the best performing classifier on this dataset overall, considering both precision and recall.

VII. CONCLUSION

The K-Nearest Neighbor method for skill categorization and the K-Means Clustering technique for department choices are combined in Envisioning Tomorrow, a major advancement in AI-driven career advising that offers individualized recommendations. The system can perform better than conventional career counseling techniques, as evidenced by the Adaboost classifier, which shows how effective it is currently. Going forward, possible improvements might concentrate on optimizing algorithms for higher precision, adding new functionalities like psychometric tests, encouraging greater user engagement, adding input from the industry, and putting continuous learning techniques into place. With the goal of continuously improving the process of giving students well-. informed and customized career advice, Envisioning Tomorrow establishes the foundation for a flexible and dynamic career counseling program

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