iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** IV **Month of publication:** April 2023

DOI: https://doi.org/10.22214/ijraset.2023.50888

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IV Apr 2023- Available at www.ijraset.com

Career Recommendation System

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Abstract: ***Career recommendation system aims to offer direction and assist students in selecting engineering streams with the help of a WebApp. Nowadays, there are more educational courses available, making it easier for students to pick courses that interest them. However, in the 22nd century, more than half of the youths do not exercise their freedom of choice and make well-informed decisions. A number of factors contribute to this. One of the main reasons is the lack of awareness of all the available options. The other well-known hindrance is the family pressure of following a well-known or previously followed path when it comes to choosing a career. This results in candidates ending up in the wrong fields and dropping out of college midway through the course. As a result, time and money are wasted. Moreover, it may happen that a deserving candidate was denied a seat in an institution since its capacity was full at the start of the course. The proposed WebApp aims to develop a system that would suggest a course based on certain fundamental information about the student such as academic performance, extracurricular activities, personal interests and aims. The WebApp will try to mimic the role of a career counselor, use a chatbot to interact with the student and recommend to them the branches of engineering that align with their interests the most, by making use of Machine Learning to provide an unbiased recommendation.***

Keywords: Educational Technologies, Engineering disciplines, Machine Learning, Recommender System, chatbot.

I. INTRODUCTION

From the dawn of the twenty-first century, significant changes have taken place in many facets of society, including the crisis of population growth, rapid technological advancements, and climate change. It takes originality, creativity, and imagination to mount a successful defense against these new issues. Hence, higher education, and specifically engineering education, needs to be improved to take into consideration highly sought-after talents like teamwork, critical thinking, and interpersonal skills, in addition to conventional background knowledge. In addition to having technical expertise in STEM fields, creative students with strong communication skills will improve the caliber of university graduates, making them more productive, creative, and successful in their career paths. According to CMIE, the country's unemployment rate in October 2022 is 6.5% - urban 7.7% and rural 6%. One contributing factor to the disparity in skills between the caliber of college graduates and those needed by the business sector is a significant issue. By assisting students in selecting a professional choice based on their abilities, personality traits, and educational background, this gap can be closed.

In high school, students begin to think about career opportunities. Children receive support from their parents, friends and/or school counselors to create detailed career plans. Giving students expert advice is crucial to aid them in making their decision about their future career path. This advice should take into account a number of variables, including cultural and personal beliefs, personality type, educational background, parental expectations, and academic achievements. In addition to considering the student's individual traits and talents, parents and friends base their advice on personal experience. School counselors, on the other hand, are prepared and trained to assess students' academic and personal histories and assist them in selecting the appropriate professional path. In underdeveloped nations, parents and families serve as pupils' primary sources of guidance. However, in the 22nd century, more than half of the youths do not exercise their freedom of choice and make well-informed decisions. A number of factors contribute to this. One of the main reasons is the lack of awareness of all the available options. The other well-known hindrance is the family pressure of following a well-known or previously followed path when it comes to choosing a career. This results in candidates ending up in the wrong fields and dropping out of college midway through the course. As a result, time and money is wasted. Moreover, it may happen that a deserving candidate was denied a seat in an institution since its capacity was full at the start of the course.

To address the above drawbacks in the country, this paper introduces a “Career Recommendation System” that aims to help students in choosing by examining their academic and personal profiles, one can determine their field of study and intended job. The suggested WebApp aims to develop a system that suggests a course based on some fundamental student information, such as academic performance, extracurricular activities, personal interests, and aspirations. WebApp will make an effort to imitate the function of a career counselor by interacting with users via a chatbot. student and recommend the engineering majors that best fit their interests, using machine learning to provide unbiased recommendations.

II. LITERATURE REVIEW

Engineering Students' Personalized Career-Path Recommender System (PCRS): A customized career-path recommender system is provided by the research study to provide guidance and help high school students choose an engineering specialty. The link between personality type and engineering discipline was developed using a sample of 1250 engineering students from An-Najah National University who were enrolled in seven different engineering fields. PCRS can provide assistance to high school students who want to pursue engineering degrees. [1]

Intelligent e-course recommender based on learning preferences: A clever e-course recommender tool has been developed, and it evaluates the e-courses in terms of how well they support different types of student learning styles, suggests learning objects that should be included to the courses, and it illustrates the suggestions and the rise in the help offered to those students by the course. [2]

Individualized course recommendation system using a hybrid methodology: A recommender system is presented in this study to help learners choose the courses that best suit their needs. To find relevant data and generate precise 3 recommendations, the hybrid methodology has been employed in conjunction with ontology. The limitations of the simplest individual recommender systems would be addressed by the proposed recommender systems, improving their performance. [3]

Student career path recommendation in the engineering stream: This article offers a thorough recommendation system centered on students and built on a research analytics architecture to help them select the optimal career route. These measurements are combined with the relative weighted set generated by the Analytic Hierarchical Process decision system to produce a desired score of students connected with each career-oriented engineering program. [4]

Career Development: Exploration and Planning For young individuals, finding employment can be difficult. They must decide what professions are accessible, what their interests are, and what abilities they now possess or still need to work on. Youth can find out about job opportunities, obtain work experience, and get a sense of their interests and skills by using a variety of tools. [5]

GSTEM-CAT: University-program recommender The Generalized STEM-College Aptitude Test is a mobile-based decision assistance application that makes use of fuzzy logic. An application can advise a college applicant on the most appropriate university program for them to enroll in depending on their personality type and level of expertise. The respondents evaluated the generated tool, and according to the evaluation's findings, the program satisfies its implied functions and is dependable, useable, and functional. [6]

A system that recommends careers based on fuzzy analysis for seniors in high school: This essay presents a potential method for career recommenders that aims to help seniors in high school, as well as guidance counselors, in assisting them in examining a variety of variables related to their decision on which field they will pursue. Features that are irrelevant to the performance of the proposed fuzzy-based system will be eliminated, and a feature selection technique is appropriate. The experiment's findings demonstrate sound conclusions for making decisions. [7]

A customized method for group-based recommendations for Web searches in e-learning: It aims to improve search engines that can provide recommendations for search results based on the learning styles and actions of the users. [8]

Job Recommendation System Based on Skill Sets: The study provides a broad overview of the job suggestion problem with the intention of facilitating research and real-world application creation about this crucial subject. [9]

Job Recommender Systems: This essay offers a survey of the recent literature on employment recommendation systems. In comparison to earlier evaluations of the literature, we place more attention on contributions that take into account the reciprocal and temporal nature of job recommendations. It might also result in a more consistent distribution of applicants among a group of positions that are comparable. [10]

A systematic Review on Educational Data Mining: The study of educational data mining began as a result of this problem. Because they may have a specific goal and function, traditional data mining techniques cannot be used to solve educational issues directly. This suggests that a preprocessing procedure must be implemented first, and only then can some particular data mining techniques be used to solve the problems. [11]

Findings of Empirical Research on the Adoption of Job Recommender Systems by Job Seekers: This work enhances general research on recommender systems and trust by revealing the three moderators for the relationship between trust and intention. It provides the framework for further investigation into the understudied topic of job recommender system acceptance. [12]

Study on the use of an agent-based expert career counseling system with college students: Using artificial intelligence expert system technology with career-counseling work, we created a web-based career counseling expert system for college students with an emphasis on the practical demands of help for current students. Visitors' necessary data may be automatically collected by the system, which will then determine any professional concerns they may be having before providing guidance and remedies. [13]

A Career Path Recommendation Framework: CaPaR Recommendation systems are employed today to address the issue of information overload in a variety of contexts, enabling users to concentrate on pertinent information depending on their interests. Such systems can greatly aid students in achieving their professional goals by offering tailored employment and skill recommendations. The algorithm initially reads the user's profile and resume, determines the candidate's essential talents, then delivers customized job recommendations using text mining and collaborative filtering approaches. [14]

The future of Engineering Education - Revisited: This article revisits the influential CEE series "The Future of Engineering Education," which was first released in 2000, to look at the tools and methods described as well as the predictions made in the original paper. Most of the advice given in the first season is still applicable. [15]

III. REQUIREMENTS AND SPECIFICATIONS

A. Functional Requirements

1) The user should respond properly to the chatbot
2) Each module's operation and function must be flawless. The users will be able to operate effectively.
3) The application is made up of modules that make it simple for users as the user only has to give input and wait for the recommendations to be generated.
4) The user can generate recommendations multiple times.

B. Software Requirements

Windows, Mac, and Linux operating systems.
HTML, CSS, Javascript, Bootstrap, Flask, Python programming language with Anaconda Navigator and Microsoft Visual Studio

C. Hardware Requirements

Intel I3 processor or above is required for the system.
Display: 15 VGA Color.
RAM: 4 GB.

D. Algorithm Used

The mathematical equations for the random forest algorithm can be described as follows:
Let X be a matrix of size n x m, where n is the number of samples and m is the number of features. Each row of X represents a sample, and each column represents a feature.
Let Y be a vector of size n x 1, representing the output (class or regression) variable for each sample in X.
Let T be the number of decision trees to be grown in the forest.
Let M be the number of randomly selected features for each tree.
Let D be the maximum depth of each decision tree.
Let L be the minimum number of samples required to be at a leaf node.

The random forest algorithm can be described as follows:
For t = 1 to T:
Sample with replacement n samples from X to create a bootstrap sample X_t.
Randomly select M features from the m total features.
Grow a decision tree using X_t and the selected features, by recursively splitting the data based on the selected feature values, until a stopping criterion is met (e.g., maximum depth D or minimum samples per leaf L).
For classification tasks:
For each new sample x_i:
Predict the class for x_i using each of the T decision trees.
Count the number of trees predicting each class.
Assign x_i to the class with the most votes.
Output the predicted class labels for all new samples.
For regression tasks:
For each new sample x_i:

Predict the output value for x_i using each of the T decision trees.
Compute the mean of the predicted values.
Output the predicted output values for all new samples.
The equations for growing a decision tree can be more complex, depending on the splitting criterion used (e.g., entropy, Gini index, mean squared error, etc.), but the general idea is to recursively split the data based on the selected features until the stopping criterion is met.

IV. FIGURES AND TABLES

A. System Architecture

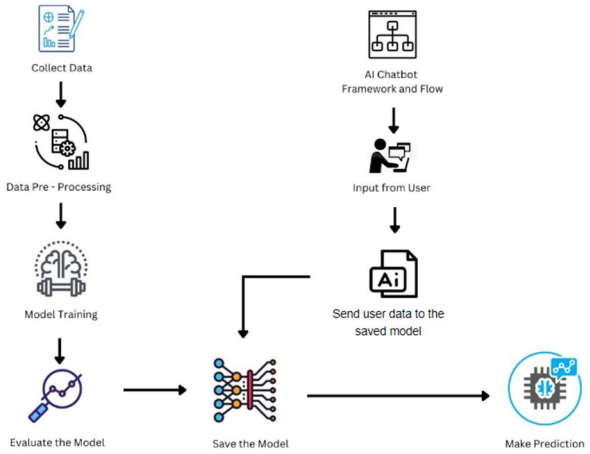

Fig .1 System Architecture

The objective of the architecture is to calculate a personalized score for academic performance for each engineering discipline based on their interest, skills and academic performance. The student's academic score will be used in the processing layer as input to the membership function.

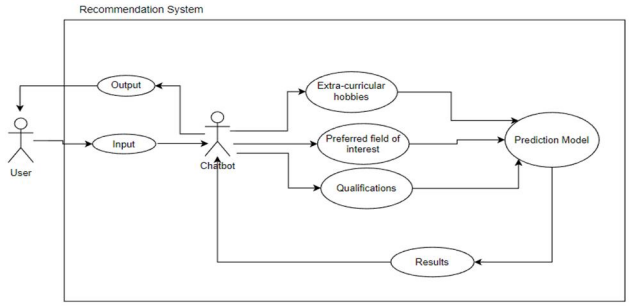

Fig .2 Use Case Diagram

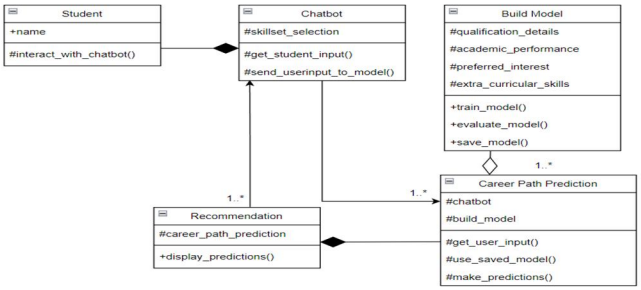

Fig .3 Class Diagram

V. SPECIFICATIONS

A. *Applications*

1) Students wanting to pursue engineering as a career but are not sure about the stream can use this WebApp as an advisor.
2) This system can be used by parents and educationalists who aim to search engineering streams.
3) There are different prediction techniques that help recommendation systems to obtain data.

B. *Advantages*

1) The results are highly relevant: The course recommendations are likely to be highly relevant to the user's unique interests and are not biased by course ratings from peers with dissimilar career goals.
2) Recommendations are transparent: The process by which a recommendation is generated can be made transparent, which may increase students' trust in the recommendations or allow them to tweak the results.
3) New items can be recommended immediately: Unlike collaborative filtering, content-based filtering does not require a user to interact with an item before it can be recommended. Furthermore, Next Level's ensemble approach is able to rely on data outside of the user's basic query. This can be a useful technique for automatically expanding the search scope when the user's query does not yield any matching courses.

C. *Future Scope*

1) For now, we're building a recommender system that only recommends branches of engineering so in the future for candidates whose interest lies outside of the project domain, the machine will give them a generic output instead of recommending a specific branch.
2) Since all the branches of engineering are not equally popular, it is difficult to get a large dataset to train an unbiased model.

VI. CONCLUSION

Career-path Recommender System is designed to help future engineering students choose their discipline based on various factors such as the academic performance, the personality type, and extracurricular activities.

Indecisive prospective students are to be guided to select study programs. Most of the study programs are closely related and recommending specific programs is difficult. Further, existing solutions lacking in the use of students' skills, interests and academic performance towards filtering a possible recommendation. Hence, the proposed system enables students to choose from the recommended study field. The design process considered the factors such as academic performance of the student's school results; his/her skills from activities and interests.

VII. ACKNOWLEDGEMENT

We would like to express our gratitude to our project supervisors for their guidance, advice, and support throughout the project. We also want to acknowledge the participants who generously provided us with their time and data, as well as our classmates and colleagues who provided us with constructive feedback and suggestions. Lastly, we would like to acknowledge the contribution of the research community whose work and publications were instrumental in providing us with the necessary knowledge and understanding to undertake this project. We appreciate all the valuable contributions and support in making this project a success.

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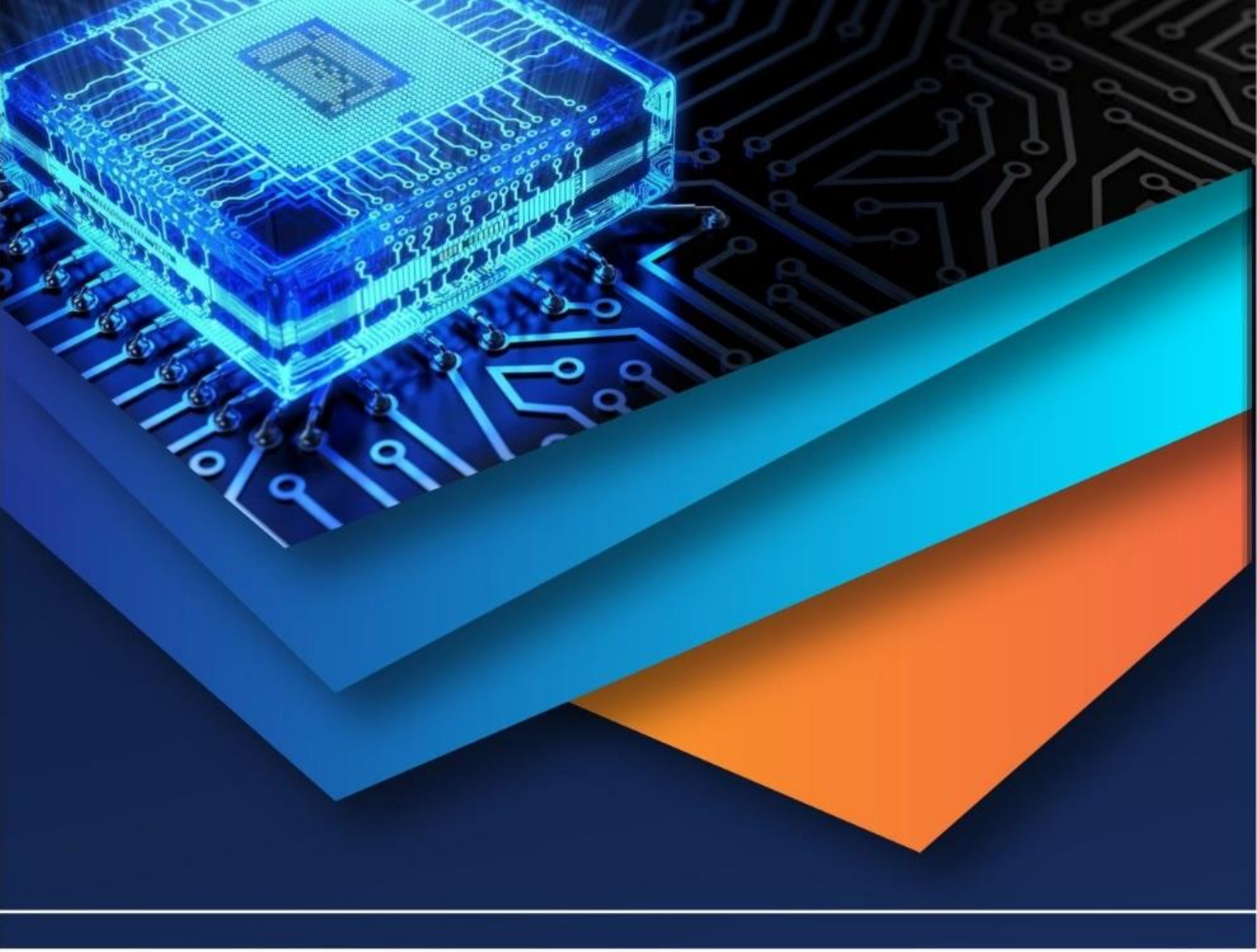

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