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Design of an AI-Based Career Guidance System for Students

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Abstract

Choosing an appropriate career path after secondary and higher secondary education is a challenging task for students due to lack of proper guidance, awareness, and structured information. Traditional career counseling methods are often time-consuming, expensive, and not easily accessible to all students. This paper proposes the design of an AI-Based Career Guidance System that provides a structured and interactive approach to career decision-making.

The system follows a step-by-step decision model where students select options such as academic percentage, stream preference, and course interests. Based on these inputs, the system recommends suitable streams (Arts, Commerce, Science), courses, entrance examinations, and colleges along with relevant details such as cut-offs, fees, and syllabus. Additionally, the system integrates an AI-based chatbot to provide personalized guidance and answer user queries.

The proposed system is designed using modern web technologies with a Python-based backend and Supabase for data management. The solution aims to simplify career planning, improve decision accuracy, and provide accessible guidance to students without requiring expert intervention.

Keywords: Career Guidance System; Artificial Intelligence; Decision Support System; Web Application; Student Career Planning

How to Cite This Article

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Introduction

Selecting a career path is one of the most critical decisions in a student's life, especially after completing 10th and 12th grade education. Many students face confusion due to a lack of proper guidance, limited awareness of available career options, and insufficient access to structured information about courses, colleges, and entrance examinations. This often leads to poor career choices, dissatisfaction, and reduced professional growth.

Traditional career counseling methods rely heavily on human experts, making them costly and not easily accessible to all students, particularly in rural or underprivileged areas. Furthermore, the rapid growth in educational opportunities and career paths has made it increasingly difficult for students to explore all available options effectively.

With advancements in web technologies and artificial intelligence, it is now possible to design intelligent systems that can assist students in making informed career decisions. These systems can analyze user inputs, provide structured recommendations, and offer personalized guidance.

This paper proposes the design of an AI-Based Career Guidance System that guides students through a step-by-step selection process. The system acts as a decision support tool, helping users navigate through streams, courses, and career paths based on their academic performance and preferences. Additionally, the integration of an AI chatbot enhances user interaction by providing real-time answers to queries related to career options.

The primary objective of this system is to make career guidance simple, accessible, and efficient for students, thereby reducing confusion and improving decision-making outcomes.

Literature Survey

The development of career guidance systems has evolved significantly with advancements in artificial intelligence and web technologies. Traditional career counseling methods rely heavily on human experts who evaluate students based on academic performance and interests. Pressman and Maxim [1] highlighted that such traditional systems face challenges related to scalability, cost, and accessibility.

Web-based career guidance platforms were introduced to overcome these limitations. However, Nunamaker et al. [2] observed that many information systems provide static data and lack dynamic interaction, making them less effective for personalized decision-making.

Decision Support Systems (DSS) have been widely used to assist users in structured decision-making processes. According to Turban et al. [3], DSS models use rule-based logic and analytical frameworks to guide users through complex decisions, making them suitable for educational guidance systems.

In recent years, machine learning techniques have been applied to recommendation systems. Pedregosa et al. [4] demonstrated the effectiveness of machine learning libraries such as scikit-learn in building predictive models. However, these systems often require technical expertise and large datasets, limiting their usability for non-technical users.

The integration of AI-powered chatbots has further enhanced user interaction in educational platforms. Følstad and Brandtzæg [5] emphasized that chatbots improve user engagement by providing real-time assistance using Natural Language Processing techniques.

Moreover, research by Elshawi et al. [6] on automated machine learning highlights the growing importance of intelligent systems in simplifying complex workflows. However, many existing platforms remain either expensive or difficult to use, especially for beginners.

Despite these advancements, several research gaps remain:

- Lack of structured step-by-step career navigation
- Limited personalization based on academic performance
- Absence of integrated AI-based interaction
- Incomplete visualization of full career pathways
- Lack of user-friendly systems for non-technical users

The proposed system addresses these gaps by combining a rule-based decision framework with AI-driven interaction, providing a comprehensive and accessible career guidance solution.

Proposed System

The proposed system is a web-based AI-driven career guidance platform designed to assist students in making informed decisions through a structured and interactive workflow.

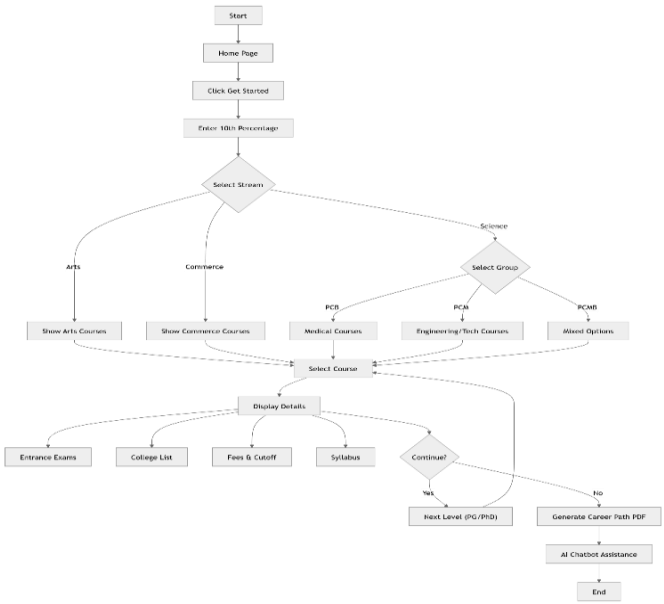
The system begins with a user-friendly homepage that introduces the platform and its objectives. Upon initiating the process, the user is guided through a sequence of decision steps.

Decision Flow Structure

The system follows a hierarchical selection process:

- Input of academic percentage (after 10th grade)
- Recommendation of streams (Arts, Commerce, Science)
- Further specialization (PCB, PCM, PCMB for Science)
- Selection of undergraduate courses (BCA, BBA, BSc, etc.)
- Display of detailed information:
  - Entrance examinations
  - Eligibility criteria
  - College options
  - Fee structure
  - Syllabus
  - Cut-off trends

The process extends to postgraduate and doctoral levels, enabling long-term career planning.



Output Generation

At any stage, users can terminate the process and generate a downloadable PDF summarizing their selected career path.

AI Integration

An AI chatbot is integrated to:

- Provide personalized recommendations
- Answer user queries
- Assist in decision-making

Methodology

The proposed system is designed using a **rule-based decision tree model combined with AI-assisted interaction**, enabling a structured and intelligent approach to career guidance. The methodology focuses on guiding users through a step-by-step decision process while dynamically generating personalized recommendations based on user inputs.

Decision Tree Model

The system follows a hierarchical **decision tree structure**, where each user input determines the subsequent set of available options. This model ensures a logical flow of decisions, starting from basic inputs such as academic percentage and progressing toward advanced career selections.

Each node in the decision tree represents a decision point (e.g., stream selection), while branches represent possible choices (e.g., Arts, Commerce, Science). This structured approach simplifies complex decision-making and enhances user understanding.

Rule-Based Filtering

The system applies a set of predefined rules to filter and recommend suitable options at each stage. These rules are designed based on academic standards and eligibility criteria.

The filtering process includes:

- Percentage-based thresholds for stream selection
- Course eligibility criteria based on selected streams
- College admission requirements including cut-offs and entrance exams

This rule-based mechanism ensures that recommendations are accurate, relevant, and aligned with real-world educational requirements.

Data Management

All system data is stored in a structured **relational database (Supabase/PostgreSQL)**, ensuring efficient storage, retrieval, and scalability. The database contains information related to streams, courses, colleges, entrance exams, and eligibility criteria.

Data is dynamically fetched based on user selections, allowing the system to provide real-time recommendations. This approach ensures consistency, reduces redundancy, and improves system performance.

AI Module

The system integrates an AI-based module to enhance user interaction and provide intelligent assistance. The AI component utilizes Natural Language Processing (NLP) techniques to enable smooth communication between the user and the system.

Key functionalities of the AI module include:

- Natural language interaction through a chatbot interface
- Context-aware responses based on user-selected career paths
- Additional career insights and suggestions
- Clarification of doubts related to courses, exams, and colleges

This integration improves user engagement and provides a more interactive and personalized experience compared to traditional systems.

System Architecture

The system follows a three-tier architecture:

Presentation Layer

- Web interface (React/Streamlit)
- Handles user interaction

Application Layer

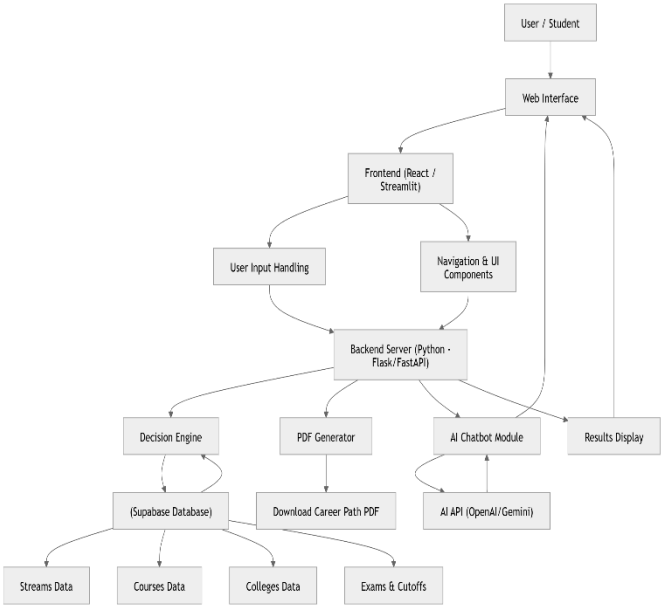
- Python backend (Flask/FastAPI)
- Implements business logic and decision algorithms

Data Layer

- Supabase (PostgreSQL)
- Stores academic and career-related data

AI Layer

- External AI API integration
- Provides chatbot functionalit



Results And Discussion

The proposed system is designed to simplify the career decision-making process by providing structured guidance and reducing information overload.

Compared to traditional methods, the system:

- Reduces decision-making time
- Improves accessibility of career information
- Enhances user understanding through structured flow

The integration of AI further improves user engagement and provides personalized assistance, making the system more effective than static guidance platforms.

Advantages

- Structured and guided career selection
- Personalized recommendations
- Time-efficient and accessible
- Reduces dependency on human counselors
- Interactive and user-friendly

Future Scope

The proposed AI-Based Career Guidance System provides a strong foundation for assisting students in structured career decision-making. However, there are several opportunities to enhance the system further by incorporating advanced technologies and additional functionalities.

One of the major future enhancements includes the integration of machine learning algorithms to provide more personalized and data-driven recommendations. Instead of relying solely on rule-based logic, the system can learn from user interactions and historical data to improve the accuracy of career suggestions over time.

Another important extension is the inclusion of real-time data integration. The system can be connected to official educational databases and government portals to fetch updated information regarding college admissions, entrance examinations, cut-off marks, and fee structures. This will ensure that users always receive accurate and up-to-date information.

The system can also be enhanced by introducing user authentication and profile management features. By allowing users to create accounts, the system can store their preferences, track progress, and provide personalized dashboards. This would enable users to revisit and modify their career paths at any time.

Further improvements can include the development of a career comparison module, where users can compare multiple career options based on parameters such as salary potential, job demand, course difficulty, and required skills. This will help users make more informed decisions.

The integration of advanced AI capabilities, such as Natural Language Processing (NLP) and recommendation engines, can significantly enhance the chatbot functionality. The chatbot can be trained on domain-specific data to provide more accurate, context-aware, and meaningful responses.

Additionally, the system can be extended into a mobile application, making it more accessible to a wider audience. Mobile support would allow students to access career guidance anytime and anywhere, increasing usability and reach.

Another promising direction is the use of data analytics and visualization tools to present career trends, job market insights, and future demand for specific fields. This will help students understand industry requirements and align their career choices accordingly.

Finally, the system can incorporate multi-language support, enabling students from diverse linguistic backgrounds to use the platform effectively. This would significantly improve accessibility, especially in rural and regional areas.

Conclusion

This paper presented the design of an AI-Based Career Guidance System aimed at assisting students in making informed and structured career decisions. The system addresses the challenges associated with traditional career counseling methods by providing an accessible, cost-effective, and user-friendly solution.

The proposed system utilizes a rule-based decision model combined with AI-driven interaction to guide users through a step-by-step career selection process. By considering factors such as academic performance, stream selection, and course preferences, the system provides personalized recommendations and detailed information about educational pathways.

The integration of features such as dynamic content retrieval, PDF generation, and AI chatbot assistance enhances the overall functionality and usability of the system. The structured decision flow ensures clarity and simplifies complex decision-making processes, making the system suitable for students with minimal technical knowledge.

Furthermore, the system architecture is designed to be scalable and flexible, allowing for future enhancements and integration of advanced technologies. The use of modern web technologies and cloud-based databases ensures efficient data management and seamless user experience.

The proposed solution has the potential to significantly improve the career decision-making process by reducing confusion, saving time, and providing reliable guidance. It also promotes equal access to career information, especially for students who may not have access to professional counseling services.

In conclusion, the AI-Based Career Guidance System represents an effective application of artificial intelligence in the educational domain. With further development and real-world implementation, it can serve as a powerful tool for guiding students toward suitable academic and professional paths, ultimately contributing to better career outcomes and overall societal development.

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