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An AI-Powered Digital Career Counseling System for Higher Secondary Students Using Machine Learning and Generative Artificial Intelligence

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Abstract:

Career selection is one of the most important decisions in a student's academic and professional journey. However, many higher secondary students choose career paths based on parental expectations, peer influence, or limited awareness of available opportunities rather than their aptitude, interests, personality, and skills. Traditional career counseling methods often depend on trained counselors, making the process time-consuming, costly, and difficult to access, particularly for students in rural and semi-urban areas. These challenges highlight the need for an intelligent, scalable, and personalized career guidance system.

This research proposes an AI-powered Digital Career Counseling System that utilizes Artificial Intelligence (AI), Machine Learning (ML), Explainable Artificial Intelligence (XAI), and Generative Artificial Intelligence (GenAI) to provide personalized career recommendations. The proposed framework develops a comprehensive student profile by analyzing academic performance, aptitude, interests, personality traits, extracurricular achievements, and career preferences. Based on this multidimensional analysis, machine learning algorithms identify suitable career domains and educational pathways.

To improve transparency and user trust, the system incorporates an Explainable AI module that provides clear justifications for every recommendation. In addition, a Generative AI-based conversational assistant enables students to interact naturally, explore career options, compare educational programs, receive information about scholarships and future opportunities, and obtain personalized learning guidance. The proposed architecture also considers evolving labor market trends to ensure that recommendations remain relevant and future-oriented.

The proposed system aims to enhance career decision-making, improve the accuracy and transparency of career recommendations, reduce career mismatch, and expand access to quality career counseling. Rather than replacing human counselors, it serves as an intelligent decision-support system that supports educators and counselors while empowering students to make informed and confident career choices.

Keywords: *Artificial Intelligence, Machine Learning, Career Counseling, Recommendation System, Explainable AI, Generative AI, Student Profiling, Decision Support System.*

I. INTRODUCTION

Career selection is one of the most important decisions in a student's academic and professional life, as it significantly influences future education, employment opportunities, and career satisfaction. Higher secondary students often struggle to choose an appropriate career due to limited awareness of available options, changing industry demands, and insufficient understanding of their own aptitude, interests, and skills. Consequently, many students make career decisions based on parental expectations, peer influence, or societal perceptions rather than informed self-assessment.

Traditional career counseling methods mainly depend on teachers or professional counselors. Although these methods provide valuable guidance, they are often limited by counselor availability, high costs, subjective evaluation, and a lack of personalized recommendations. These limitations create a need for an intelligent and accessible career guidance system that can provide accurate, personalized, and data-driven career recommendations.

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Recent advancements in Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP), Explainable Artificial Intelligence (XAI), and Generative Artificial Intelligence (GenAI) have transformed educational support systems. These technologies enable the analysis of multiple student attributes, including academic performance, aptitude, personality, interests, and skills, to generate personalized career recommendations. Explainable AI further enhances transparency by providing clear reasons behind each recommendation, while Generative AI enables interactive career counseling through natural conversations, helping students explore career options, educational pathways, scholarships, and future opportunities.

Despite these advancements, many existing AI-based career recommendation systems rely primarily on academic performance and often ignore important factors such as personality, aptitude, and labor market trends. In addition, several systems function as black-box models, making it difficult for students to understand the basis of the recommendations.

To address these challenges, this research proposes an AI-powered Digital Career Counseling System that integrates Machine Learning, Explainable AI, labor market intelligence, and Generative AI into a unified decision-support framework. The proposed system generates personalized and transparent career recommendations while providing interactive guidance through an AI-powered conversational assistant. The framework aims to improve the quality, accessibility, and effectiveness of career counseling, enabling students to make informed and confident career decisions.

II. LITERATURE REVIEW

Artificial Intelligence (AI) has significantly transformed the education sector by enabling personalized learning, intelligent tutoring systems, educational recommender systems, and predictive analytics. These advancements have improved academic decision-making and created new opportunities for providing personalized career guidance. AI-based career counseling systems analyze student data to recommend suitable educational pathways and career options based on individual characteristics.

Educational recommender systems utilize Machine Learning (ML) algorithms such as Decision Trees, Random Forest, Support Vector Machines (SVM), and Artificial Neural Networks (ANN) to evaluate student performance, interests, aptitude, and skills. Research indicates that combining multiple student attributes produces more accurate career recommendations than relying solely on academic performance. Personality assessment models, such as Holland's RIASEC framework, further enhance recommendation quality by identifying career preferences based on individual personality traits.

Recent developments in Natural Language Processing (NLP) and Generative Artificial Intelligence (GenAI) have improved digital career counseling through conversational AI. These systems allow students to interact naturally, explore career options, understand admission requirements, learn about scholarships, and receive personalized guidance. Compared to traditional counseling methods, AI-powered assistants provide continuous, accessible, and interactive support.

Another important advancement is Explainable Artificial Intelligence (XAI), which improves the transparency of AI-based recommendations. Techniques such as SHAP and LIME help explain the factors influencing career suggestions, increasing user trust and supporting informed decision-making. In addition, modern career recommendation systems are increasingly incorporating labor market intelligence to align student interests with current employment trends and future workforce demands.

Although existing AI-based career recommendation systems have shown promising results, many focus primarily on academic performance or university course selection while overlooking factors such as personality, aptitude, explainability, and labor market trends. Furthermore, most available solutions are designed for university students rather than higher secondary students.

To address these limitations, this research proposes an AI-powered Digital Career Counseling System that integrates Machine Learning, psychometric assessment, Explainable AI, Generative AI, and labor market intelligence into a unified framework. The proposed system aims to provide personalized, transparent, and future-oriented career guidance for higher secondary students.

III.RESEARCH GAP

Despite significant advancements in AI-based career recommendation systems, several research gaps remain. Most existing systems rely primarily on academic performance or personality assessment, without integrating multiple student attributes such as aptitude, interests, skills, extracurricular activities,

and career aspirations. As a result, the recommendations often lack personalization and accuracy.

Another major limitation is the absence of real-time labor market intelligence, making many recommendations less relevant to current industry demands. In addition, several AI models operate as black-box systems, providing recommendations without explaining the reasoning behind them, which reduces user trust and transparency.

Most existing career counseling platforms also offer static recommendations and lack interactive guidance through conversational AI. Furthermore, the majority of research focuses on university students, while limited attention has been given to higher secondary students, who require career guidance before selecting higher education programs.

To address these gaps, this research proposes an AI-powered Digital Career Counseling System that integrates Machine Learning, psychometric assessment, Explainable AI (XAI), Generative AI (GenAI), and labor market intelligence into a unified framework. The proposed system aims to provide personalized, transparent, and future-oriented career guidance for higher secondary students.

IV.PROBLEM STATEMENT

Many higher secondary students choose their careers based on parental influence, peer pressure, or limited awareness rather than their aptitude, interests, and skills. Traditional career counseling is often time-consuming, subjective, costly, and inaccessible, especially in rural and semi-urban areas. As a result, students may experience poor career choices, academic dissatisfaction, and reduced employability. Therefore, there is a need for an AI-powered Digital Career Counseling System that provides personalized, transparent, and data-driven career recommendations by analyzing multiple student attributes. The proposed system aims to support informed career decision-making and make quality career guidance accessible to all students.

V.OBJECTIVES OF THE STUDY

The primary objective of this research is to develop an AI-powered Digital Career Counseling System that provides personalized and data-driven career guidance for higher secondary students.

The specific objectives are:

- To develop a comprehensive student profiling framework using academic, aptitude, personality, and interest data.
- To apply Machine Learning techniques for personalized career recommendations.
- To integrate psychometric assessment for improved career prediction.
- To incorporate Explainable AI (XAI) for transparent recommendations.
- To integrate Generative AI (GenAI) for interactive career counseling.
- To consider labor market trends for future-oriented career guidance.
- To improve career decision-making and reduce career mismatch.
- To develop a scalable framework for educational institutions.

VI.PROPOSED AI-POWERED DIGITAL CAREER COUNSELING FRAMEWORK

The proposed AI-powered Digital Career Counseling Framework is designed as a comprehensive intelligent decision-support system that integrates Artificial Intelligence (AI), Machine Learning (ML), Educational Data Mining (EDM), Explainable Artificial Intelligence (XAI), Natural Language Processing (NLP), and Generative Artificial Intelligence (GenAI). The framework aims to provide higher secondary students with accurate, transparent, and personalized career recommendations based on multiple dimensions of their academic and personal profiles.

Unlike conventional career counseling systems that rely primarily on academic performance, the proposed framework evaluates a student's complete profile, including academic achievements, aptitude, personality traits, interests, extracurricular activities, communication skills, logical reasoning ability, and labor market trends. This multidimensional approach enables the recommendation engine to generate evidence-based career suggestions while minimizing bias and improving decision accuracy.

The architecture of the proposed framework consists of six major functional layers, each responsible for a specific stage of data processing and recommendation generation. These layers operate sequentially while maintaining modularity, scalability, and flexibility for future enhancements.

6.1 Student Data Collection Layer

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The first stage of the framework focuses on collecting comprehensive information related to the student. The quality and diversity of input data directly influence the effectiveness of machine learning models; therefore, the framework gathers information from multiple sources rather than depending solely on examination scores.

- The student profile includes:
- Personal Information
- Academic Performance
- Subject-wise Marks
- Attendance
- Aptitude Assessment Scores
- Personality Assessment Results
- Interest Inventory
- Communication Skills
- Logical Reasoning Ability
- Creativity Score
- Leadership Assessment
- Extracurricular Activities
- Preferred Career Choices
- Family Background (Optional)
- Socioeconomic Information (Optional)

Collecting multidimensional information enables the recommendation engine to understand both the academic capabilities and psychological characteristics of each student, resulting in more personalized career recommendations.

6.2 Data Preprocessing Layer

Educational datasets frequently contain missing values, duplicate records, inconsistent formats, and noisy information. Before applying machine learning algorithms, collected data undergo preprocessing to improve data quality and model performance.

The preprocessing stage performs the following operations:

- Data Cleaning
- Missing Value Handling
- Feature Normalization
- Outlier Detection
- Data Encoding
- Feature Selection
- Dimensionality Reduction
- Dataset Balancing

These preprocessing techniques improve prediction accuracy while reducing computational complexity and enhancing model robustness.

6.3 AI Assessment Layer

After preprocessing, the framework evaluates the student's profile using multiple analytical models. Rather than relying on a single parameter, the AI assessment module examines various dimensions of student performance.

Academic Analysis

This module evaluates:

- Subject-wise strengths
- Academic consistency
- Performance trends
- Learning progress

Aptitude Analysis

The aptitude assessment measures:

Numerical Ability
Analytical Reasoning
Verbal Ability
Logical Thinking
Problem-Solving Skills

Personality Assessment

The framework adopts Holland's RIASEC Personality Model, which classifies students into six personality categories:

Realistic
Investigative
Artistic
Social
Enterprising
Conventional

Interest Profiling

Student interests are analyzed through:

Preferred Subjects
Hobbies
Career Aspirations
Technology Exposure
Learning Preferences

The outputs generated from these analyses are combined to create a comprehensive student profile that serves as the foundation for career prediction.

6.4 Career Recommendation Engine

The Career Recommendation Engine represents the core component of the proposed system. It integrates information generated by previous modules to recommend suitable career domains.

The recommendation engine combines:

Machine Learning Predictions
Rule-Based Reasoning
Knowledge Graph Relationships
Career Ontology
Industry Demand Analysis
Student Preferences

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Based on these inputs, the system recommends careers from various domains, including:
Engineering
Medicine
Pharmacy
Nursing
Biotechnology
Computer Science
Artificial Intelligence
Cyber Security
Commerce
Chartered Accountancy
Law
Agriculture
Architecture
Design
Psychology
Journalism
Civil Services
Entrepreneurship
Each recommendation is associated with a Career Suitability Score (CSS) ranging from 0% to 100%, enabling students to compare multiple career options objectively.

6.5 Explainable Artificial Intelligence (XAI) Module

One of the major limitations of conventional AI systems is the lack of transparency in decision-making. To overcome this issue, the proposed framework integrates Explainable Artificial Intelligence.
Instead of simply recommending a career, the system clearly explains why the recommendation has been generated.
For example:
Engineering is recommended because the student demonstrates consistently high performance in Mathematics and Physics, possesses strong analytical reasoning ability, exhibits an Investigative personality profile, and current labor market analysis indicates increasing demand for AI and Robotics Engineers.
Such explanations increase transparency, improve user trust, and help students, parents, and educators understand the reasoning behind each recommendation.

6.6 Generative AI Career Counselor

The final layer of the framework integrates a Large Language Model (LLM) that functions as an intelligent virtual career counselor.
Unlike conventional recommendation systems, students can interact with the AI through natural language conversations.
Students may ask questions such as:

- Which engineering branch is most suitable for me?
- Should I choose Computer Science or Electronics Engineering?
- Which universities offer Artificial Intelligence programs?
- Which entrance examinations should I prepare for?
- What scholarships are available?
- Which technical skills should I develop?
- What is the expected salary in this profession?
- What are future career opportunities abroad?

The Generative AI module generates personalized responses based on each student's profile rather than providing generic information. Consequently, students receive individualized guidance throughout their career planning process.

VII.OVERALL SYSTEM ARCHITECTURE

The overall architecture of the proposed system consists of interconnected modules that work together to generate intelligent career recommendations.
The workflow begins with Student Registration, followed by the creation of a Student Profile Database containing academic records, psychometric assessments, aptitude scores, interests, and extracurricular achievements.
The collected information then passes through the Data Preprocessing Module, where missing values are handled, features are normalized, and irrelevant attributes are removed. The processed dataset is subsequently analyzed by the Machine Learning Prediction Engine, which performs personality assessment, aptitude analysis, and interest analysis simultaneously.
The outputs generated from these analytical modules are integrated within the Career Recommendation Engine, which predicts suitable career domains. The recommendations are then processed by the Explainable AI Decision Module, enabling transparent reasoning for each recommendation.
Finally, the Generative AI Career Counselor interacts with students, answers their career-related questions, compares educational pathways, recommends

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universities and certifications, and generates a personalized career roadmap.

The modular architecture enables each component to be independently enhanced without affecting the functionality of the remaining system, thereby ensuring scalability, maintainability, and future extensibility.

VIII.SYSTEM WORKFLOW

The operational workflow of the proposed AI-Powered Digital Career Counseling System consists of a sequence of interconnected processes that transform raw student information into intelligent and personalized career recommendations. Each stage contributes to improving the overall recommendation quality while ensuring transparency and personalization.

Step 1: Student Registration

The process begins with student registration. Students create their individual profiles by providing basic demographic information such as name, age, gender, school details, academic stream, and contact information. Each student is assigned a unique profile that stores all subsequent assessment data.

Step 2: Academic Record Collection

The system collects academic information including:

- Subject-wise marks
- Grade Point Average (GPA)
- Attendance
- Academic achievements
- Previous examination performance

These records provide insight into the student's academic strengths and consistency.

Step 3: Online Aptitude Assessment

Students complete an AI-based aptitude assessment designed to evaluate various cognitive abilities including:

- Numerical Ability
- Logical Reasoning
- Analytical Thinking
- Verbal Ability
- Problem Solving

The aptitude scores assist in identifying the student's natural capabilities.

Step 4: Personality Assessment

Students complete psychometric questionnaires based on Holland's RIASEC personality model. This assessment identifies personality characteristics that influence career preferences and professional satisfaction.

Step 5: Interest Inventory

Students indicate there:

- Favourite subjects
- Hobbies
- Preferred activities
- Career aspirations
- Learning preferences

Interest profiling enables the system to understand career inclination beyond academic performance.

Step 6: AI Data Processing

All collected information undergoes preprocessing, including cleaning, normalization, feature encoding, and missing value handling before being supplied to machine learning models.

Step 7: Machine Learning Prediction

The trained machine learning model analyzes the multidimensional student profile and predicts career suitability scores for multiple career domains.

Step 8: Explainable AI Analysis

The Explainable AI module generates human-readable explanations describing why specific careers have been recommended and identifies the factors contributing most significantly to the prediction.

Step 9: Generative AI Counseling

Students interact with the AI-powered virtual career counselor to clarify doubts, compare career options, obtain university recommendations, explore scholarship opportunities, and understand future career prospects.

Step 10: Personalized Career Roadmap

Finally, the system generates a comprehensive personalized career report containing:

- Recommended Career Domains
- Suitable Degree Programs
- Entrance Examinations
- Skill Development Plan
- Certification Recommendations
- Scholarship Opportunities
- Five-Year Learning Roadmap

This workflow ensures that students receive end-to-end digital career guidance through a single intelligent platform.

IX.RESEARCH METHODOLOGY

The proposed research follows the Design Science Research (DSR) methodology because the primary objective is to design, develop, implement, and evaluate an Artificial Intelligence-based Digital Career Counseling System.

The research methodology consists of six major phases that ensure systematic development and continuous improvement of the proposed framework.

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Phase 1: Requirement Analysis

Initially, the limitations of existing career counseling systems are analyzed through an extensive literature review. User requirements are identified from the perspectives of students, teachers, educational institutions, parents, and career counselors.

The study also investigates current challenges including:

- Limited access to professional counselors
- Subjective decision making
- Lack of personalization
- Absence of labor market intelligence
- Poor recommendation transparency

The findings form the basis for designing the proposed framework.

Phase 2: Data Collection

Comprehensive student data are collected from multiple sources, including academic records, aptitude assessments, personality profiling, interest inventories, and extracurricular achievements.

The multidimensional dataset provides sufficient information for accurate career prediction.

Phase 3: Data Preprocessing

Before model development, collected data undergo preprocessing to eliminate inconsistencies and improve machine learning performance.

The preprocessing stage includes:

- Data Cleaning
- Missing Value Imputation
- Normalization
- Encoding
- Feature Selection
- Dataset Balancing

Phase 4: AI Model Development

Various supervised Machine Learning algorithms are trained using historical student datasets.

Different classification models are compared to identify the algorithm that provides the highest prediction accuracy.

Phase 5: Recommendation Generation

The trained machine learning model predicts career suitability scores based on the processed student profile.

The recommendation engine integrates:

- Machine Learning Predictions
- Rule-Based Logic
- Labor Market Intelligence
- Explainable AI
- Student Preferences

to generate personalized recommendations.

Phase 6: System Evaluation

Finally, the proposed framework is evaluated using standard performance metrics such as:

- Accuracy
- Precision
- Recall
- F1-Score
- Mean Absolute Error (MAE)
- Root Mean Square Error (RMSE)

The evaluation process also includes user feedback to improve future recommendation quality.

The iterative nature of Design Science Research allows continuous enhancement of the system as educational requirements and labor market conditions evolve.

X.DATA COLLECTION

The effectiveness of any Artificial Intelligence system depends heavily on the quality of input data. Therefore, instead of relying solely on examination scores, the proposed framework collects multidimensional student information that reflects both academic and personal characteristics.

The dataset consists of the following categories:

Category	
Personal Information	Age, Gender, School, L
Academic Performance	Subject-wise Marks, GI
Aptitude Assessment	Numerical Ability, Logi
Personality Assessment	Holland's RIASEC Sco
Interest Inventory	Preferred Subjects, Hob
Extracurricular Activities	Sports, Arts, Leadership
Technical Skills	Programming, Commur
Career Preference	Preferred Career Domai
Labor Market Information	Industry Demand, Salar

The collected data are securely stored within a relational database while complying with applicable privacy regulations. Such multidimensional information enables the recommendation engine to generate more accurate and personalized career suggestions.

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XI.DATA PREPROCESSING

Educational datasets frequently contain incomplete records, duplicate entries, inconsistent formats, and missing values. If these issues are not addressed before model training, prediction accuracy may decrease significantly.

Therefore, the proposed system performs comprehensive preprocessing before applying machine learning algorithms.

11.1 Missing Value Treatment

Missing values are replaced using appropriate statistical techniques depending on attribute characteristics, including:

- Mean Imputation
- Median Imputation
- Mode Imputation
- K-Nearest Neighbor (KNN) Imputation

These methods improve dataset completeness without significantly affecting data distribution.

11.2 Data Normalization

Continuous variables often exist on different numerical scales. To ensure equal contribution from all features, the framework applies Min-Max Normalization.

Normalization improves training efficiency and prevents features with larger numerical ranges from dominating the learning process.

11.3 Feature Encoding

Machine learning algorithms require numerical input. Therefore, categorical variables such as:

- Personality Type
- Preferred Subject
- Career Interest

are converted into numerical values using One-Hot Encoding.

11.4 Feature Selection

Not all collected variables contribute equally to prediction accuracy. Irrelevant and redundant features are removed using:

- Correlation Analysis
- Information Gain
- Chi-Square Test
- Random Forest Feature Importance

Feature selection reduces computational complexity while improving model performance.

The preprocessing pipeline ensures that only high-quality and relevant data are supplied to the recommendation engine, thereby increasing prediction accuracy and system reliability.

XII.SYSTEM EVALUATION

To assess the effectiveness of the proposed AI-Powered Digital Career Counseling System, a comprehensive evaluation strategy is adopted. The evaluation focuses on measuring the accuracy, reliability, interpretability, and usability of the recommendation engine. Both quantitative performance metrics and qualitative user feedback are considered to ensure that the proposed system provides meaningful and trustworthy career guidance.

The performance of the machine learning models is evaluated using a test dataset that contains student profiles with known career outcomes. The predicted career recommendations are compared with the actual outcomes to assess the effectiveness of the system.

The following evaluation metrics are used:

- Accuracy: Measures the percentage of correct career predictions generated by the model.
- Precision: Indicates how many predicted career recommendations are relevant.
- Recall: Measures the system's ability to identify all suitable career options for a student.
- F1-Score: Provides a balanced measure by combining precision and recall.
- Mean Absolute Error (MAE): Evaluates the average prediction error.
- Root Mean Square Error (RMSE): Measures deviations between predicted and actual values.

In addition to these statistical measures, user satisfaction surveys are conducted to evaluate the clarity, usefulness, and trustworthiness of the recommendations. Feedback from students, teachers, and career counselors is incorporated to continuously improve the recommendation engine.

XIII.EXPERIMENTAL SETUP

The proposed framework is implemented using modern Artificial Intelligence and web technologies to ensure scalability, efficiency, and user accessibility.

Software Environment

- Python
- Jupyter Notebook
- Visual Studio Code
- Flask Framework

- HTML, CSS, JavaScript

Machine Learning Libraries

- Scikit-learn
- Pandas
- NumPy
- TensorFlow
- Keras

Database

- MySQL / PostgreSQL

Visualization Tools

- Matplotlib
- Plotly
- SHAP (Explainable AI)

Generative AI Integration

- Large Language Model (LLM)
- Natural Language Processing (NLP)
- Prompt Engineering

The experiments are conducted using historical student datasets consisting of academic records, aptitude assessment results, psychometric profiles, and career outcomes. Different machine learning algorithms are trained and tested under identical conditions to identify the best-performing model.

XIV. Comparative Analysis

To validate the effectiveness of the proposed framework, its features are compared with those of conventional career counseling approaches.

Feature	Traditional Counseling	Proposed AI-Based System
Academic Analysis	✓	✓
Aptitude Assessment	Limited	✓
Personality Analysis	Limited	✓
Interest Profiling	Partial	✓
Machine Learning Prediction	✗	✓
Explainable AI	✗	✓
Generative AI Counseling	✗	✓
Labor Market Analysis	✗	✓
Personalized Roadmap	✗	✓
24×7 Availability	✗	✓
Scalability	Low	High

The comparison demonstrates that the proposed system provides a more comprehensive, intelligent, and personalized approach to career counseling. By integrating AI, Explainable AI, and Generative AI, the framework overcomes several limitations associated with traditional counseling methods.

XV. CASE STUDY

To illustrate the practical application of the proposed system, consider the profile of a higher secondary student with the following characteristics:

- Mathematics: **91%**
- Physics: **88%**
- Chemistry: **85%**
- Logical Reasoning: **Excellent**
- Programming Interest: **High**
- Personality Type: **Investigative**
- Communication Skills: **Good**
- Leadership Skills: **Moderate**

After processing the student's profile through the proposed framework, the recommendation engine generates the following career suitability scores:

Career Domain	Suitability Score
Computer Science Engineering	94%
Artificial Intelligence	92%
Data Science	90%
Cyber Security	89%
Electronics Engineering	84%

The Explainable AI module provides detailed reasoning for these recommendations by highlighting the student's strong analytical abilities, high performance in mathematics, investigative personality traits, and growing demand for AI-related careers. The Generative AI module further assists the student by recommending relevant universities, entrance examinations, certification programs, and a personalized learning roadmap. This case study demonstrates how the proposed framework supports informed and evidence-based career decision-making.

XVI. DISCUSSION

The proposed AI-Powered Digital Career Counseling System addresses several limitations of conventional career guidance by integrating multidimensional student profiling, machine learning, Explainable AI, and Generative AI within a unified framework.

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Unlike traditional systems that rely primarily on academic scores, the proposed approach considers aptitude, personality, interests, extracurricular activities, and labor market trends, thereby providing a more holistic evaluation of each student. The inclusion of Explainable AI enhances transparency by clearly communicating the rationale behind every recommendation, while the Generative AI module enables interactive and personalized counseling experiences.

The modular design of the framework also supports scalability and future enhancement. Educational institutions can incorporate additional datasets, update labor market information, or integrate new machine learning models without major modifications to the overall architecture. Consequently, the framework remains adaptable to evolving educational requirements and technological advancements.

XVII.PRACTICAL IMPLICATIONS

The proposed system offers several practical benefits for different stakeholders.

For Students

- Personalized career recommendations.
- Better understanding of strengths and interests.
- Reduced career confusion.
- Access to 24×7 AI-based career counseling.
- Personalized learning roadmap and skill recommendations.

For Educational Institutions

- Data-driven career guidance.
- Improved student satisfaction.
- Better academic planning.
- Efficient counseling support with reduced manual effort.

For Parents

- Transparent and evidence-based recommendations.
- Improved confidence in career decisions.
- Better understanding of their child's potential and career opportunities.

For Career Counselors

- AI-assisted decision support.
- Reduced workload.
- Faster analysis of student profiles.
- More effective counseling sessions.

The implementation of such a system can significantly improve the quality and accessibility of career guidance, particularly in schools and colleges where professional counseling resources are limited.

XVIII.CONCLUSION

Career selection is one of the most critical decisions in a student's academic and professional life. Traditional counseling methods, while valuable, often face challenges related to accessibility, scalability, personalization, and transparency. Advances in Artificial Intelligence provide an opportunity to transform career guidance into a more intelligent, data-driven, and student-centric process.

This research proposed an AI-Powered Digital Career Counseling System that integrates Machine Learning, Educational Data Mining, Psychometric Assessment, Explainable Artificial Intelligence, Labor Market Intelligence, and Generative Artificial Intelligence into a unified framework. By evaluating multiple dimensions of a student's profile—including academic performance, aptitude, personality, interests, and extracurricular activities—the system generates personalized and evidence-based career recommendations.

The inclusion of Explainable AI enhances trust by providing clear reasoning for each recommendation, while the Generative AI module enables interactive conversations, personalized learning plans, and continuous career support. Compared with conventional approaches, the proposed framework offers greater accuracy, transparency, accessibility, and scalability.

Overall, the proposed system has the potential to assist students, parents, educators, and career counselors in making informed career decisions. It represents a significant step toward the adoption of intelligent technologies in educational guidance and supports the development of future-ready students aligned with evolving industry demands.

XIX.FUTURE SCOPE

The proposed framework can be further enhanced in several directions:

- Integration of real-time national and international labor market data.
- Use of Deep Learning models for improved prediction accuracy.
- Development of multilingual conversational AI for wider accessibility.
- Integration with university admission and scholarship portals.

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- Mobile application for anytime, anywhere career counseling.
- Continuous learning through user feedback and recommendation refinement.
- Incorporation of emotional intelligence and behavioral analytics.
- Expansion to undergraduate and postgraduate career guidance.

These enhancements will further strengthen the framework and enable it to address the dynamic needs of students, educational institutions, and the future workforce.

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