AI-Based Career Counselling for Secondary Students

A Report submitted in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology

in

Computer Science and Engineering

By

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21EG105E63

Under the guidance

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ANURAG UNIVERSITY | SCHOOL OF ENGINEERING

CERTIFICATE

This is to certify that the Report entitled "AI-Based Career Counselling for Secondary Students" is being submitted by Ms. P Shanmukhapriya Sravani bearing the Hall Ticket number 21EG105E63 in partial fulfillment for the award of Bachelor of Technology in Computer Science and Engineering to the Anurag University is a record of bonafide work carried out by her under my guidance and supervision for the academic year 2024 to 2025.

The results presented in this report have been verified and found to be satisfactory. The results embodied in this report have not been submitted to any other University or Institute for the award of any other degree or diploma.

Signature of Supervisor
Mrs. Y Ashwini
Assistant professor

Signature of Dean
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Dean,CSE

External Examiner

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P.Shanmukhapriya Sravani

21EG105E63

DECLARATION

I hereby declare that the Report entitled “AI-Based Career Counselling for Secondary Students” submitted for the award of a Bachelor of Technology Degree is my original work. It has not been submitted to any other University or Institution for the award of any degree or diploma.

21EG105E63: P. Shanmukhapriya Sravani

ABSTRACT

This study explores AI's role in transforming career counseling for secondary students by offering tailored, accessible guidance. Through machine learning, the AI system evaluates each student's skills, preferences, and strengths to suggest career paths that match their profiles and industry trends. Built with inclusivity in mind, it supports multiple languages and offline access, making it usable for students in underserved regions. The pilot shows how the system broadens career discovery, especially in emerging fields like tech and vocational careers. By supplementing traditional counseling, AI provides data-backed insights, allowing counselors to dedicate time to more complex cases and improving the quality of guidance overall. This research highlights AI's potential to improve access to career advice, empowering students from varied backgrounds to make informed career decisions and preparing them for a rapidly changing job market.

Keywords: Career Counseling, Game-based IQ Evaluation, AI-based Guidance, Random Forest Model, Chatbot Assistance.

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List of Abbreviations

AI	Artificial Intelligence
OCR	Optical Character Recognition
NLP	Natural Language Processing
CDP	Career Development Plan
GDPR	General Data Protection Regulation
NGO	Non-Governmental Organization
MAE	Mean Absolute Error

MAPE	Mean Absolute Percentage Error

1. INTRODUCTION

Career decision-making at the secondary school level profoundly shapes students' educational and professional trajectories, influencing not only their choice of study but also their future career paths and personal fulfillment. Traditional career counseling methods, often constrained by high counselor-to-student ratios and limited resources, tend to offer broad, generalized guidance that may not fully address individual student needs. Many students, especially those in under-resourced or rural schools, face barriers to receiving tailored support, leaving them to navigate critical decisions with minimal guidance.

Artificial Intelligence (AI) is reshaping this landscape by delivering personalized, data-driven career recommendations that cater specifically to each student's unique strengths, interests, and the evolving job market. Leveraging machine learning algorithms, AI-powered counseling systems analyze student profiles—including aptitude test scores, academic performance, and personal interests—to generate customized career paths that align with both individual abilities and current industry demands. This approach provides students with targeted guidance, empowering them to make more informed decisions that reflect their capabilities and aspirations.

Furthermore, AI-based career counseling systems democratize access to quality career advice, leveling the playing field for students in underserved regions. Through a scalable, online platform, these systems deliver real-time insights and updates, making career guidance accessible to a wider audience and responsive to changing labor trends. The system’s capacity to learn and adapt through continuous user interaction ensures that career recommendations evolve alongside the job market, helping students align their education with emerging opportunities. By bridging the gap between students' goals and market needs, AI-powered career counseling systems are fostering a generation better prepared for the demands and challenges of their chosen careers, paving the way for a future where every student has the resources to make empowered, informed decisions.

2. LITERATURE SURVEY

2.1. Utilizing M-Technologies for AI-Driven Career Guidance in Morocco: An Innovative Mobile Approach-Abdelmoumen Talib, Mohamed Housni, Mohamed Radid (iJIM, 2023) [1]:

A recent study by Talib, Housni, and Radid examined the implementation of AI-based mobile applications for career counseling in Morocco. This system leverages AI algorithms to assess students' interests and suggest career paths, thus providing personalized recommendations efficiently, especially in high-demand environments. The study highlighted benefits such as increased accessibility to career guidance but also outlined several challenges, including data privacy concerns, internet accessibility issues-particularly in rural areas—language compatibility and Optical Character Recognition (OCR) errors, and a need for more research to identify best practices for implementation in developing countries. These limitations, especially in regions with limited infrastructure, underscore the need for further adaptation of AI tools to the diverse needs of students in Morocco and other similar contexts.

2.2. Developing an AI-Based Career Counseling System - Prof AM Gunje, Shivanjali Shinde, Gayatri Deshmukh, Shravani Nadimetala, Trupti Pawar, Yogita Shinde (IRJMETS, May 2024) [2]

The study by Prof. Gunje and colleagues delved into creating an AI-based career counseling system that utilizes machine learning to analyze students' aptitudes and interests for career recommendations. The research identified several limitations to the AI models, such as potential biases arising from the training data, the need for large and representative datasets, challenges in generalizing the model across diverse demographics, and the adaptability of these systems to rapidly changing job markets. The findings emphasize the need for continuous updates to the AI models to ensure relevance and accuracy in career suggestions.

2.3. Career Choice Factors of High School Students - M. Borchert (University of Wisconsin, 2002) [3]

In this study, Borchert explored the factors influencing career choices among high school students, examining social, personal, and educational elements that shape career aspirations. Although not directly focused on AI, this research provides insight into underlying factors that AI-based systems might consider to create more personalized and relevant recommendations. The study's findings are foundational for understanding the complex motivations behind students' career decisions, which could enhance AI models by integrating these factors into career counseling applications.

2.4. Polish Universities and Access to Research Data - Jagiellonian University Repository (2020) [4]

This study examined how access to research data impacts academic work at Polish universities. Though indirectly related to AI in career counseling, it highlights the importance of data accessibility in educational settings. Access to diverse datasets is essential for developing robust and representative AI models in career counseling. This study underscores the necessity for open data policies and resources, which could improve the training of AI systems used in educational counseling by ensuring models are based on comprehensive and unbiased data sources. The table for the list of research done is given in Table 1.

S.No.	Title of the Papers	Authors	Website	Year Published	Limitations
1	Utilizing M-Technologies for AI-Driven Career Guidance in Morocco: An Innovative Mobile Approach	Abdelmoumen Talib, Mohamed Housni, Mohamed Radid	iJIM	2023	-Data privacy concerns - Internet accessibility issues, especially in rural areas - Language compatibility and OCR errors - Need for more research on best practices for implementation in developing countries
2	Developing an AI-based career counseling system	Prof AM Gunje, Shivanjali Shinde, Gayatri Deshmukh, Shravani Nadimetala, Trupti Pawar, Yogita Shinde	IRJMETS	May 2024	- Potential biases in AI models - Need for large datasets for training - Generalization capabilities

					across different demographics - Adaptability of models to dynamic job markets
S.No.	**Title of the Papers**	**Authors**	**Website**	**Year Published**	**Limitations**
3	Career choice factors of high school students	M. Borchert	University of Wisconsin	2002	- Limited scope - Outdated factors
4	Polish universities and access to research data	-	Jagiellonian University Repository	2020	- Location-specific - Narrow focus

Table 1: Literature Survey

3. PROPOSED METHODS

This project proposes an AI-driven career counseling system designed to provide tailored career recommendations for secondary school students. Leveraging advanced machine learning algorithms and a user-friendly mobile interface, the system addresses critical challenges such as data privacy, accessibility in low-resource environments, and adaptability to changing job markets. The following methods outline

a comprehensive approach to system design, implementation, and continuous improvement.

3.1. AI-Powered Career Path Simulation

To provide students with a more interactive and engaging experience, the system could incorporate AI-driven career path simulations. These simulations would allow students to visualize and explore various career paths based on their interests, strengths, and goals. By walking through a series of potential career trajectories, students can better understand the educational and professional milestones they would need to reach, including required skills, certifications, and potential salary projections. This feature could help students make more informed decisions about their future careers.

3.2. Natural Language Processing (NLP) for Personalized Counseling

Incorporating NLP into the system could enhance the user experience by allowing students to interact with the system more naturally and conversationally. This would enable the system to process open-ended responses to career-related questions and better understand student preferences and concerns. NLP could also help identify patterns in students' responses to career-related prompts, allowing the system to provide deeper insights into their potential career interests and aspirations. Additionally, it could be used to identify emotional cues and adapt the tone of responses to provide more empathetic guidance.

3.3. Personalized Career Development Plans

The system could generate personalized career development plans (CDPs) for each student based on their aptitude, interests, and chosen career goals. These plans would outline the specific steps students need to take to reach their desired career, such

as recommended courses, certifications, extracurricular activities, or networking opportunities. Over time, the system could track students' progress toward these goals, adjusting the recommendations and resources as needed based on their evolving interests and career trajectory.

3.4. Multilingual and Culturally Adaptive Interfaces

To enhance inclusivity, the system could offer a multilingual interface that supports students from diverse linguistic backgrounds. Additionally, the system could be culturally adaptive, taking into account regional career preferences, local job markets, and cultural factors that influence career decision-making. This would ensure that students receive recommendations that are not only personalized to their abilities and interests but also appropriate for their cultural and regional context.

3.5. Data Collection and Preprocessing

The initial step involves gathering data from students, including academic records, aptitude test scores, and interest surveys. The system will use online assessments and self-report questionnaires to collect diverse data points that highlight students' skills, strengths, and interests. To ensure consistency and relevance, data will be standardized and preprocessed to eliminate noise and handle missing values. Given the importance of privacy, all data collection will be conducted with informed consent, and student information will be anonymized to protect identities. This anonymized data will be securely encrypted and stored in compliance with data protection laws, such as GDPR, to build trust among users and align with regulatory standards.

3.6. Algorithm Selection and Model Training

A multi-tiered approach will be used for algorithm selection to ensure that the AI system can handle a wide array of student data and generate precise

recommendations. Initially, decision trees and random forests will be employed to classify students into broad career categories based on their aptitudes and interests. These models are chosen for their interpretability and efficiency, which enables the system to provide quick insights. For more nuanced recommendations, neural networks and ensemble learning techniques (such as stacking or boosting) will further analyze student profiles. The neural networks will capture complex patterns, while ensemble methods improve prediction accuracy and robustness. To avoid biases and ensure fair, representative recommendations, the system will be trained on a large, diverse dataset encompassing multiple demographic and socioeconomic backgrounds. This dataset will be continuously updated with real-world job market data, using data scraping techniques and API integrations with employment databases to keep the model aligned with evolving career trends.

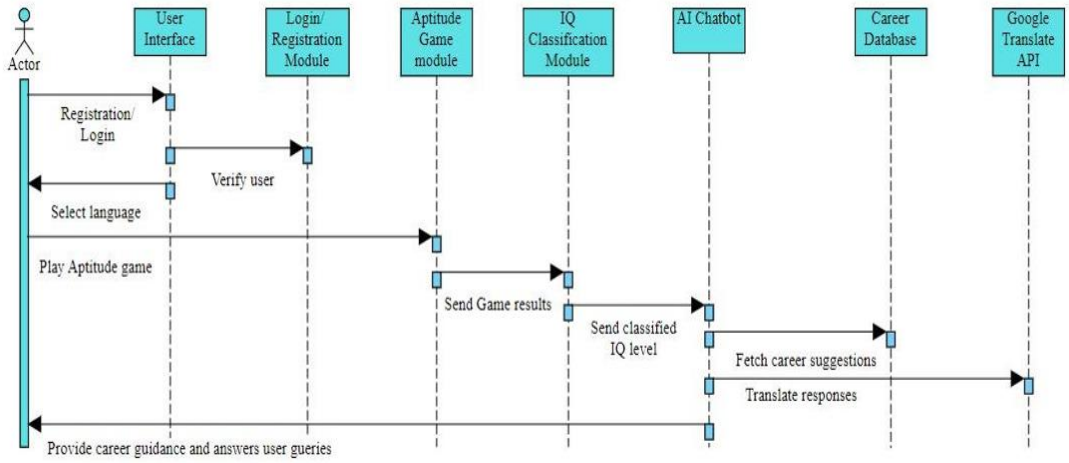

Figure 1: Sequence Flow of AI-Based Career Counselling for Secondary Students

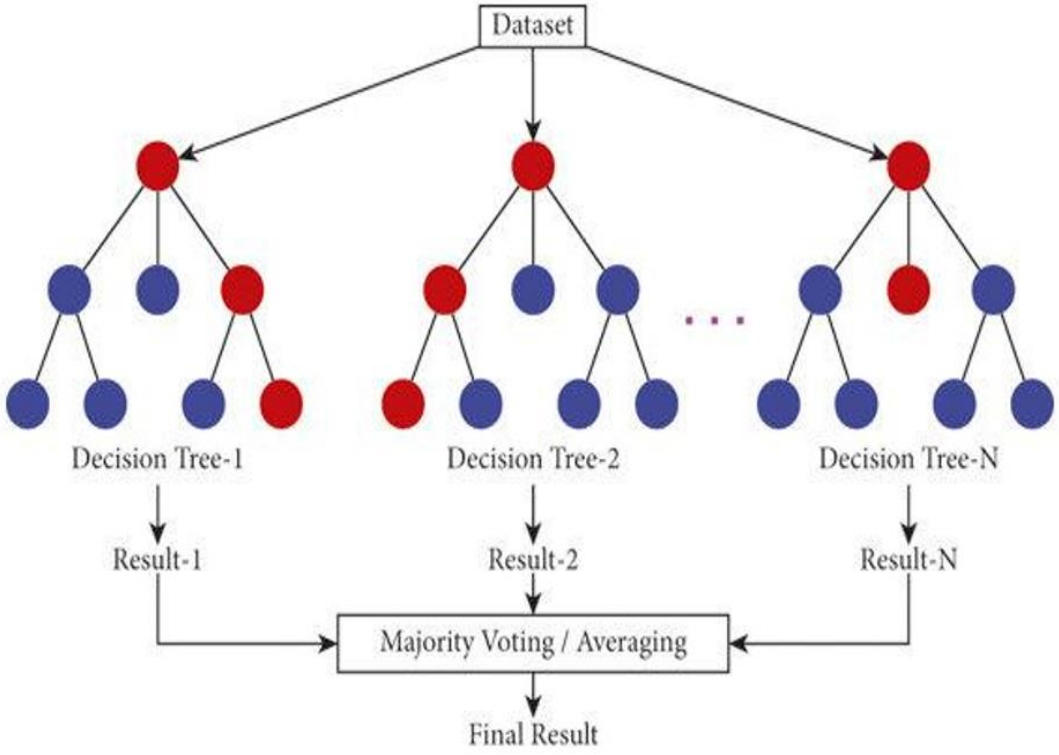

Figure 2: Random Forest Model

4. DIAGRAMS

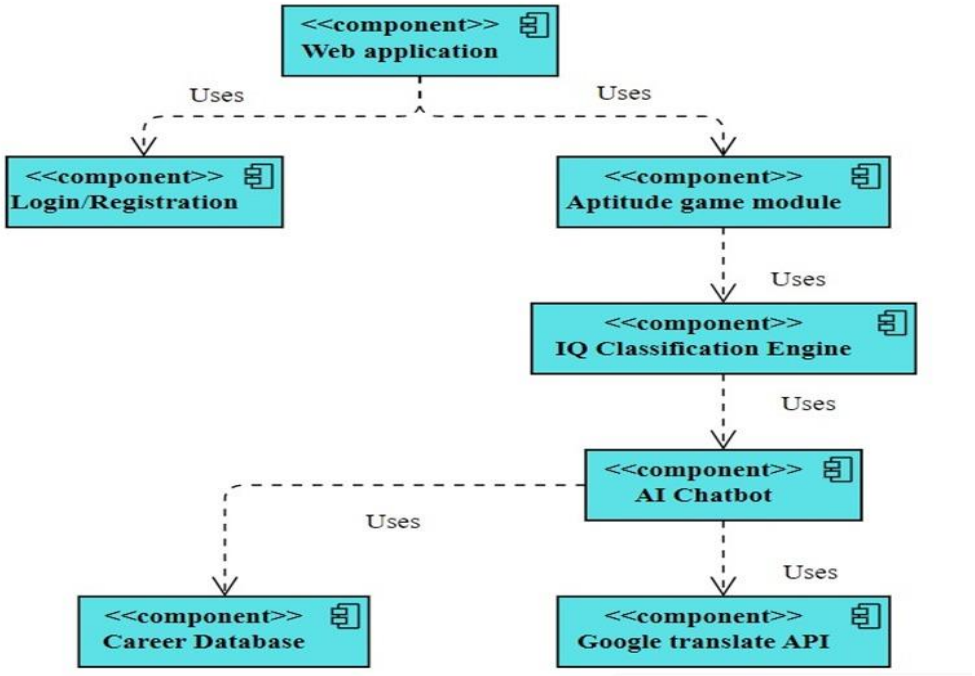

Figure 3: Component Diagram of the Project

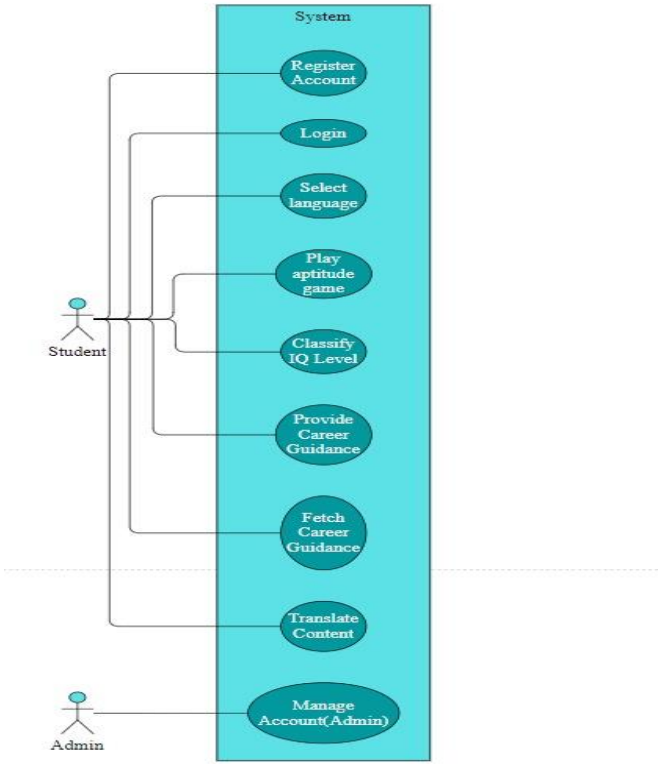

Figure 4: Use Case Diagram of the Project

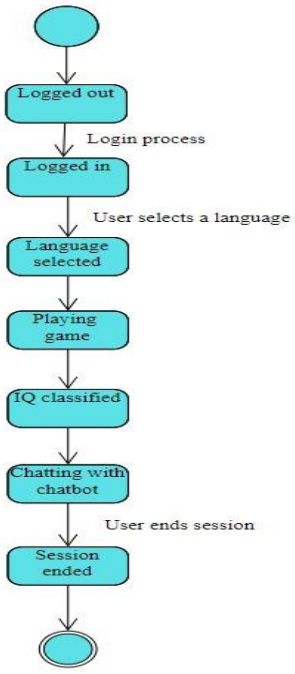

Figure 5: State Diagram of the Project

5. IMPLEMENTATION:

5.1. Python Files

5.1.1. Python File 1: AI_career_choices.py (Machine Learning Model Development)

Purpose: Trains and saves a machine learning model using the Random Forest Regressor to predict IQ scores based on quiz percentages. Also includes functions to map IQ scores to recommended career paths and courses.

Key Attributes:

data: Loads the dataset from a CSV file containing quiz percentages, IQ scores, career paths, and recommended courses.

X: A DataFrame containing the feature, "Quiz Percentage," used as the input for model predictions.

y: A DataFrame containing labels, including "IQ Score," "Career Path," and "Recommended Courses."

rf_model: Random Forest Regressor model instance with specific hyperparameters for optimized predictions.

get_career_path_and_courses: A helper function that uses the predicted IQ score to retrieve the closest career path and recommended courses from the dataset.

predict: Function that accepts a quiz percentage input and outputs a predicted IQ score, career path, and recommended courses.

Functionality: Prepares data by loading, cleaning, and adding slight variations. It trains the Random Forest Regressor model and evaluates it using Mean Absolute Error (MAE), R-squared, and Mean Absolute Percentage Error (MAPE). This saves the trained model using the Joblib library for use in the Flask application. It also provides

a prediction function to retrieve the IQ score, career path, and recommended courses based on the quiz percentage. The flow is given in figure 2.

Code of AI_career_choices.py:

```
import pandas as pd
from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_absolute_error, r2_score
import joblib
import numpy as np

# Load the preprocessed data
data = pd.read_csv('Dataset/iq_occupation_dataset.csv')

# Prepare feature and label datasets
# Features: 'Quiz Percentage'
X = data[['Quiz Percentage']].copy()

# Labels: 'IQ Score', 'Career Path', and 'Recommended Courses'
y = data[['IQ Score', 'Career Path', 'Recommended Courses']]

# Add noise to the 'Quiz Percentage' for variety (if needed)
X.loc[:, 'Quiz Percentage'] += np.random.normal(0, 5, size=X.shape[0])

# Clip the values to maintain realistic ranges
```

```
X.loc[:, 'Quiz Percentage'] = np.clip(X['Quiz Percentage'], 0, 100)


# Split the dataset for training and testing
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)


# Initialize the random forest model for regression
rf_model = RandomForestRegressor(
    random_state=42,
    n_estimators=150,
    max_depth=6,
    min_samples_split=10,
    max_features='sqrt',
)


# Train the model
rf_model.fit(X_train, y_train[['IQ Score']].values.ravel())  # Ensure y is a 1D array


# Make predictions on the test set
y_pred = rf_model.predict(X_test)


# Calculate accuracy metrics
mae = mean_absolute_error(y_test['IQ Score'], y_pred)
r2 = r2_score(y_test['IQ Score'], y_pred)
```

```
# Calculate Mean Absolute Percentage Error (MAPE)
mape = np.mean(np.abs((y_test['IQ Score'] - y_pred) / y_test['IQ Score'])) * 100

# Calculate accuracy as percentage (100% - MAPE)
accuracy_percentage = 100 - mape

print(f"Mean Absolute Error: {mae:.2f}")
print(f"R-squared: {r2:.2f}")
print(f"Mean Absolute Percentage Error (MAPE): {mape:.2f}%")
print(f"Accuracy Percentage: {accuracy_percentage:.2f}%") # Display accuracy as percentage

# Save the trained model
joblib.dump(rf_model, 'random_forest_regressor_iq.pkl')

# Function to retrieve career path and recommended courses based on the IQ Score
def get_career_path_and_courses(iq_score):
    """Function to retrieve career path and recommended courses based on IQ Score."""
    # Find the row closest to the predicted IQ Score
    closest_idx = (data['IQ Score'] - iq_score).abs().idxmin()
    predicted_row = data.iloc[closest_idx]
    career_path = predicted_row['Career Path']
    recommended_courses = predicted_row['Recommended Courses']
    return career_path, recommended_courses
```

```
# Modify the predict function to return actual values
def predict(input_percentage):
    """Function to predict the IQ score, career path, and recommended courses based on input percentage."""
    # Create DataFrame for input
    input_df = pd.DataFrame([[input_percentage]], columns=['Quiz Percentage'])

    # Normalize the input if using scaling (optional)
    # input_df = scaler.transform(input_df)  # Uncomment if you scale the features

    # Predict IQ score
    iq_score = rf_model.predict(input_df)[0]

    # Retrieve career path and recommended courses based on predicted IQ Score
    career_path, recommended_courses = get_career_path_and_courses(iq_score)

    return iq_score, career_path, recommended_courses  # Return IQ Score, Career Path, and Courses

# Example usage: you can replace the input percentage with dynamic values from your Flask application
input_percentage = 97.77  # Example percentage input
iq_score, career_path, recommended_courses = predict(input_percentage)

# Display the predicted IQ score, career path, and recommended courses
```

```
print(f'Predicted IQ Score: {iq_score}")

print(f'Career Path: {career_path}")

print(f'Recommended Courses: {recommended_courses}")


# Optionally, save the model after usage if needed

# joblib.dump(rf_model, 'random_forest_regressor_iq.pkl')
```

5.1.2. **Python File 2**: app.py (Flask Application)

Purpose: Set up a Flask web application that serves the HTML pages and integrates the model to predict IQ scores, career paths, and recommended courses based on user input.

Key Attributes:

rf_model: Loads the saved Random Forest Regressor model to make predictions.

data: Reads the dataset file used to retrieve career paths and recommended courses based on predicted IQ scores.

get_career_path_and_courses: Function for retrieving career paths and courses for the given IQ score.

predict: A method that accepts a quiz percentage and returns the predicted IQ score, career path, and recommended courses.

Functionality: Sets up various routes for the application:

home: Renders the main page.

career: Shows additional information on career paths.

quiz: Displays the quiz page.

result: Processes the user's quiz percentage, generates predictions, and displays the results. It handles errors and validates user inputs.

Code for app.py:

```
from flask import Flask, request, render_template
import joblib
import numpy as np
import pandas as pd

app = Flask(__name__)

# Load the trained random forest model
rf_model = joblib.load('random_forest_regressor_iq.pkl')

# Load the dataset for career paths and recommended courses
data = pd.read_csv('Dataset/iq_occupation_dataset.csv')

# Function to retrieve career path and recommended courses based on IQ Score
def get_career_path_and_courses(iq_score):
    """Function to retrieve career path and recommended courses based on IQ Score."""
    closest_idx = (data['IQ Score'] - iq_score).abs().idxmin()
    predicted_row = data.iloc[closest_idx]
    career_path = predicted_row['Career Path']
    recommended_courses = predicted_row['Recommended Courses']
    return career_path, recommended_courses
```

```
# Function to predict IQ score, career path, and recommended courses based on quiz percentage
def predict(input_percentage):
    """Function to predict the IQ score, career path, and recommended courses based on input percentage."""
    input_df = pd.DataFrame([[input_percentage]], columns=['Quiz Percentage'])

    # Predict the IQ score
    iq_score = rf_model.predict(input_df)[0]

    # Retrieve career path and recommended courses based on predicted IQ score
    career_path, recommended_courses = get_career_path_and_courses(iq_score)

   return iq_score, career_path, recommended_courses  # Return IQ Score, Career Path, and Courses

@app.route('/')
def home():
    return render_template('main.html')  # Display the main page (home)

@app.route('/career')
def career():
    return render_template('career.html')  # Display the career page with more details
```

```
@app.route('/quiz')
def quiz():
    return render_template('game.html')  # Display the quiz page where users input the score


@app.route('/result', methods=['GET'])
def result():
    try:
        # Retrieve the percentage score from the query string
        percentage = float(request.args.get('percentage', 0))  # Default to 0 if not found
        if percentage < 0 or percentage > 100:
            return "Invalid percentage value, must be between 0 and 100."

        # Use the predict function to get IQ score, career, and courses
        iq_score, career_path, recommended_courses = predict(percentage)

        # Render the result page with the IQ score, career path, and recommended courses
        return render_template('result.html', iq_score=int(iq_score), career=career_path, courses=recommended_courses)

    except Exception as e:
        return f"An error occurred: {str(e)}"

if __name__ == '__main__':
    app.run(debug=True)
```

5.2. HTML Files (with Embedded CSS and JavaScript)

5.2.1. main.html: Acts as the landing page for the application, guiding users to either take a quiz or explore career options.

5.2.2. career.html: Provides detailed information about various career paths, assisting users in making informed decisions.

5.2.3. game.html: The quiz page where users input their scores. JavaScript on this page calculates the quiz percentage and passes it to Flask for prediction.

5.2.4. result.html: Displays the predicted IQ score, career path, and recommended courses based on the quiz percentage submitted by the user.

Code for main.html

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <meta http-equiv="X-UA-Compatible" content="ie=edge">
    <title>AI Career Counseling</title>
    <!--<link rel="stylesheet" href="/static/main_css.css">-->
    <style>
        * {
    margin: 0;
    padding: 0;
    box-sizing: border-box;
}
```

```
body {
    font-family: 'Arial', sans-serif;
    background-color: #f4f4f4;
    color: #f4f4f4;
    line-height: 1.6;
}

header {
    background-color: #336a83;
    color: white;
    padding: 1rem 0;
    position: fixed;
    width: 100%;
    top: 0;
    z-index: 1000;
}

nav {
    display: flex;
    justify-content: space-between;
    align-items: center;
    max-width: 1200px;
    margin: 0 auto;
    padding: 0 20px;
```

```
}

.logo h1 {
    font-size: 1.8rem;
    letter-spacing: 1.5px;
}

ul {
    display: flex;
    list-style: none;
}

ul li {
    margin-left: 20px;
}

ul li a {
    color: rgb(26, 5, 5);
    text-decoration: none;
    padding: 10px 15px;
    transition: background-color 0.3s;
}

ul li a:hover {
```

```
    background-color: #28485b;
    border-radius: 5px;
}

.hero {
    height: 100vh;
    /*background: url('career-bg.jpg') no-repeat center center/cover;*/
    display: flex;
    flex-direction: column;
    justify-content: center;
    align-items: center;
    text-align: center;
    color: rgb(20, 2, 2);
    padding: 20px;
}

.hero h2 {
    font-size: 3.5rem;
    margin-bottom: 20px;
}

.hero p {
    font-size: 1.5rem;
    margin-bottom: 20px;
```

```
}

.hero .btn {
    background-color: #2b566b;
    color: white;
    padding: 10px 20px;
    text-decoration: none;
    border-radius: 5px;
    transition: background-color 0.3s;
}

.hero .btn:hover {
    background-color: #3d6784;
}

section {
    padding: 5rem 0;
    max-width: 1200px;
    margin: 0 auto;
}

h2 {
    text-align: center;
    margin-bottom: 2rem;
```

```
    color: #333;
}

.service-container {
    display: flex;
    justify-content: space-between;
    flex-wrap: wrap;
}

.service {
    background-color: white;
    padding: 20px;
    border-radius: 8px;
    box-shadow: 0 5px 15px rgba(0, 0, 0, 0.1);
    width: 30%;
    text-align: center;
    margin-bottom: 20px;
    transition: transform 0.3s, box-shadow 0.3s;
}

.service:hover {
    transform: translateY(-10px);
    box-shadow: 0 10px 25px rgba(0, 0, 0, 0.15);
}
```

```
.service h3 {
    margin-bottom: 1rem;
    color: #1b1e1b;
}

.service p {
    font-size: 1rem;
    color: #666;
}

.take-test-btn {
    background-color: #3e788b;
    color: white;
    padding: 10px 15px;
    text-decoration: none;
    border-radius: 5px;
    display: inline-block;
    transition: background-color 0.3s;
    margin-top: 10px;
}

.take-test-btn:hover {
    background-color: #315a7b;
```

```
}

/* Test Section Styles */
#test {
    padding: 3rem 0;
    background-color: #fff;
    text-align: center;
}

#test form {
    display: flex;
    flex-direction: column;
    align-items: center;
    max-width: 600px;
    margin: auto;
}

#test input {
    padding: 10px;
    margin-bottom: 1rem;
    width: 80%;
    border: 1px solid #ccc;
    border-radius: 5px;
}
```

```
#test button {
    padding: 10px 20px;
    background-color: #479fa3;
    color: white;
    border: none;
    cursor: pointer;
    border-radius: 5px;
    transition: background-color 0.3s;
}

#test button:hover {
    background-color: #5285ab;
}

/* Contact Section */
#contact {
    padding: 3rem 0;
    background-color: #f4f4f4;
    text-align: center;
}

#contact form {
    display : flex;
```

```
    flex-direction: column;
    align-items: center;
    max-width: 600px;
    margin: auto;
}

#contact input, #contact textarea {
    padding: 10px;
    margin-bottom: 1rem;
    width: 80%;
    border: 1px solid #ccc;
    border-radius: 5px;
}

#contact button {
    padding: 10px 20px;
    background-color: #3b6e7a;
    color: rgb(11, 2, 2);
    border: none;
    cursor: pointer;
    border-radius: 5px;
    transition: background-color 0.3s;
}
```

```
#contact button:hover {
    background-color: #45a049;
}

footer {
    background-color: #37824b;
    color: rgb(20, 6, 32);
    text-align: center;
    padding: 1rem 0;
    margin-top: 2rem;
}
/* Modal Background */
.modal {
    display: none;
    position: fixed;
    z-index: 1000;
    left: 0;
    top: 0;
    width: 100%;
    height: 100%;
    overflow: auto;
    background-color: rgba(0,0,0,0.5); /* Black background with opacity */
    padding-top: 100px;
}
```

```
/* Modal Content */
.modal-content {
    background-color: #fefefe;
    margin: auto;
    padding: 20px;
    border: 1px solid #888;
    width: 80%;
    max-width: 500px;
    border-radius: 10px;
}

/* Close Button */
.close {
    color: #aaa;
    float: right;
    font-size: 28px;
    font-weight: bold;
}

.close:hover, .close:focus {
    color: #000;
    text-decoration: none;
    cursor: pointer;
```

```
}

/* Sign In and Register form inside modal */
.modal-content form {
    display: flex;
    flex-direction: column;
    align-items: center;
}

.modal-content input {
    padding: 10px;
    margin-bottom: 1rem;
    width: 80%;
    border: 1px solid #ccc;
    border-radius: 5px;
}

.modal-content button {
    padding: 10px 20px;
    background-color: #479fa3;
    color: white;
    border: none;
    cursor: pointer;
    border-radius: 5px;
```

```
    transition: background-color 0.3s;
}

.modal-content button:hover {
    background-color: #5285ab;
}

    </style>
    <script>
        // Open and close modals
        function openModal(modalId) {
            document.getElementById(modalId).style.display = "block";
        }

        function closeModal(modalId) {
            document.getElementById(modalId).style.display = "none";
        }

        window.onclick = function(event) {
            if (event.target.classList.contains('modal')) {
                event.target.style.display = "none";
            }
        }
```

```
// Handle login
document.getElementById('login-form').addEventListener('submit', async function (event) {
    event.preventDefault();
    const email = event.target.email.value;
    const password = event.target.password.value;

    const response = await fetch('http://localhost:5000/login', {
        method: 'POST',
        headers: { 'Content-Type': 'application/json' },
        body: JSON.stringify({ email, password })
    });

    const result = await response.json();
    if (response.ok) {
        alert(result.message);
        closeModal('sign-in-modal');
        // Store token and redirect if needed
    } else {
        alert(result.message);
    }
});

// Handle registration
```

```
        document.getElementById('register-form').addEventListener('submit', async
function (event) {
            event.preventDefault();
            const name = event.target.name.value;
            const email = event.target.email.value;
            const password = event.target.password.value;

            const response = await fetch('http://localhost:5000/register', {
                method: 'POST',
                headers: { 'Content-Type': 'application/json' },
                body: JSON.stringify({ name, email, password })
            });

            const result = await response.json();
            if (response.ok) {
                alert(result.message);
                closeModal('register-modal');
            } else {
                alert(result.message);
            }
        });

    </script>

</head>
```

```
<body>
    <header>
        <nav>
            <div class="logo">
                <h1>Career Counselor</h1>
            </div>
            <ul>
                <li><a href="#home" style="color: #f4f4f4;">Home</a></li>
                <li><a href="#services" style="color: #f4f4f4;">Services</a></li>
                <li><a href="#contact" style="color: #f4f4f4;">Contact</a></li>
                <li><a href="javascript:void(0);" style="color: #f4f4f4;"
onclick="openModal('sign-in-modal')">Login</a></li>
                <li><a href="javascript:void(0);" style="color: #f4f4f4;"
onclick="openModal('register-modal')">Register</a></li>
                <li><a href="javascript:void(0);" style="color: #f4f4f4;"
onclick="logout()">Logout</a></li>

            </ul>
        </nav>
    </header>
    <!-- Login Modal -->
    <div id="sign-in-modal" class="modal">
        <div class="modal-content">
            <span class="close" onclick="closeModal('sign-in-modal')">&times;</span>
            <h2>Sign In</h2>
```

```
            <form id="login-form" method="post">
                <input type="email" name="email" placeholder="Your Email" required />
                <input type="password" name="password" placeholder="Your Password"
required />
                <button type="submit">Login</button>
            </form>
        </div>
    </div>

    <!-- Register Modal -->
    <div id="register-modal" class="modal">
        <div class="modal-content">
            <span class="close" onclick="closeModal('register-modal')">&times;</span>
            <h2>Register</h2>
            <form id="register-form">
                <input type="text" name="name" placeholder="Your Name" required />
                <input type="email" name="email" placeholder="Your Email" required />
                <input type="password" name="password" placeholder="Your Password"
required />
                <button type="submit">Register</button>
            </form>
        </div>
    </div>
```

```
    <section id="home">
        <div class="hero">
            <h2>Empower Your Future</h2>
            <p>AI-Based Career Counseling at your fingertips</p>
            <a href="#services" class="btn">Explore More</a>
        </div>
    </section>

    <section id="services">
        <h2>Our Services</h2>
        <div class="service-container">
            <div class="service">
                <h3>Games</h3>
                <p>Take personalized aptitude tests to help understand your strengths.</p>
            </div>
            <div class="service">
                <h3>Career Guidance</h3>
                <p>Get AI-driven career suggestions tailored to your preferences and
skills.</p>
            </div>
            <div class="service">
                <h3>Virtual Counseling</h3>
```

```
            <p>Interact with AI chatbots or live counselors to discuss your career path.</p>
        </div>
    </div>
</section>

<section id="test">
    <h2>Career Guidance</h2>
    <form action="/career">
        <p style="color: black;">Get your career to boost with games and virtual bot counselor!!</p>
        <br>
        <br>
        <button type="submit">Career Guidance</button>
    </form>

</section>

<section id="contact">
    <h2>Contact Us</h2>
    <form action="">
        <input type="text" placeholder="Your Name" required>
        <input type="email" placeholder="Your Email" required>
        <textarea placeholder="Your Message" required></textarea>
```

```
            <button type="submit" style="color: #f4f4f4;">Send Message</button>
        </form>
    </section>

    <footer style="background-color: #336a83;">
        <p style="color: #f4f4f4;">&copy; 2024 AI Career Counselor. All rights reserved.</p>
    </footer>
</body>
</html>
```

5.3. Dataset

File: iq_occupation_dataset.csv

Contents: Contains 1,000 instances, with columns for "Quiz Percentage," "IQ Score," "Career Path," and "Recommended Courses."

Purpose: Provides the data to train the machine learning model, including quiz scores and corresponding career recommendations based on IQ scores.

5.4. Support Files

random_forest_regressor_iq.pkl: Serialized Random Forest model file generated after training, enabling the Flask app to load and make predictions without retraining each time.

Joblib Library: Used to save and load the model efficiently, enhancing performance when running predictions.

5.5. Outputs

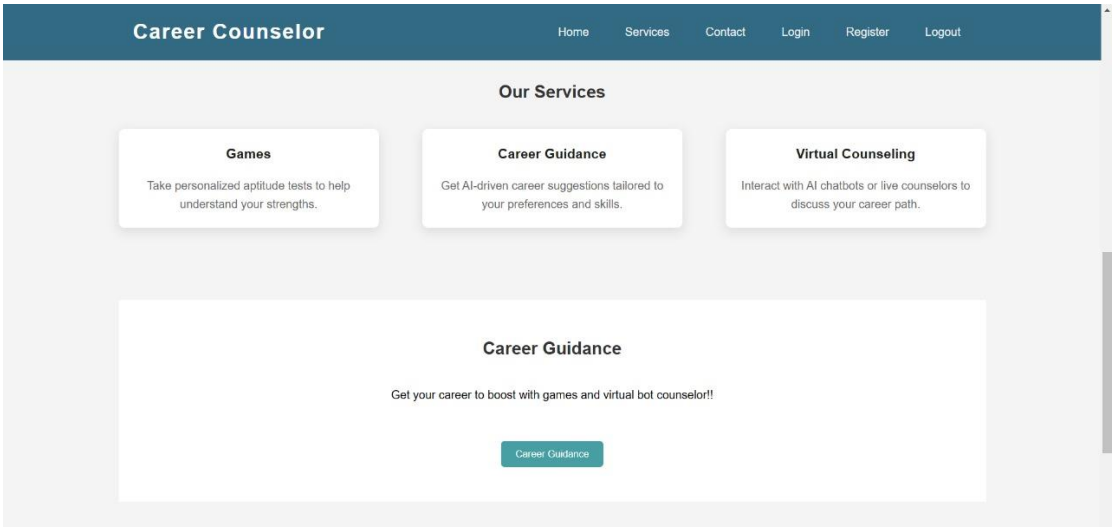

Figure 6: Main page

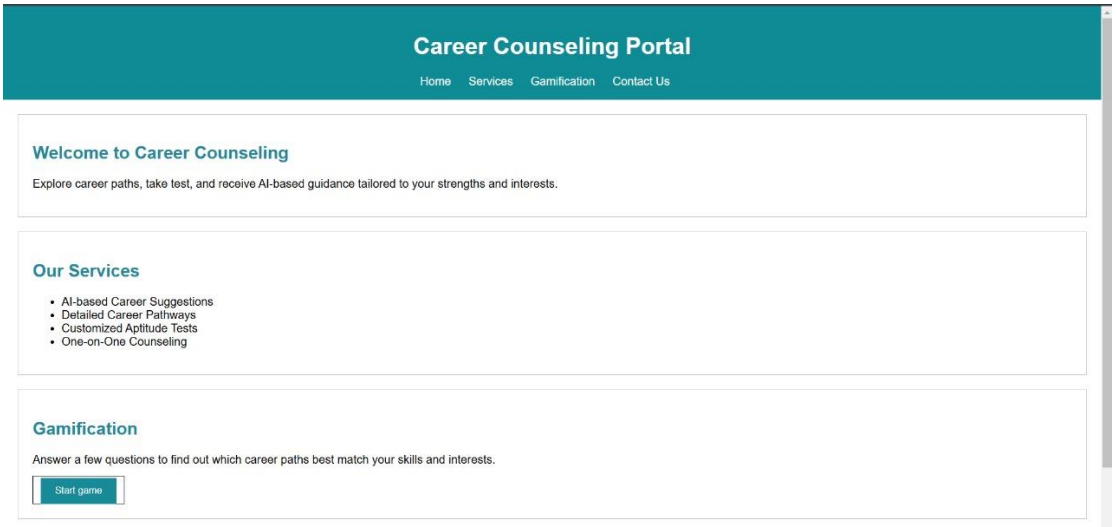

Figure 7: Career page

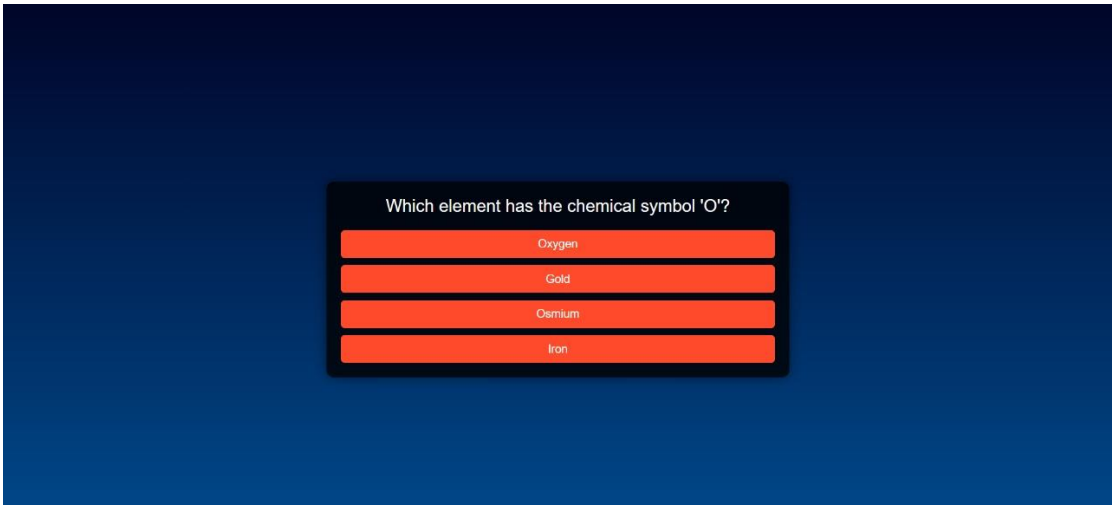

Figure 8: Quiz page

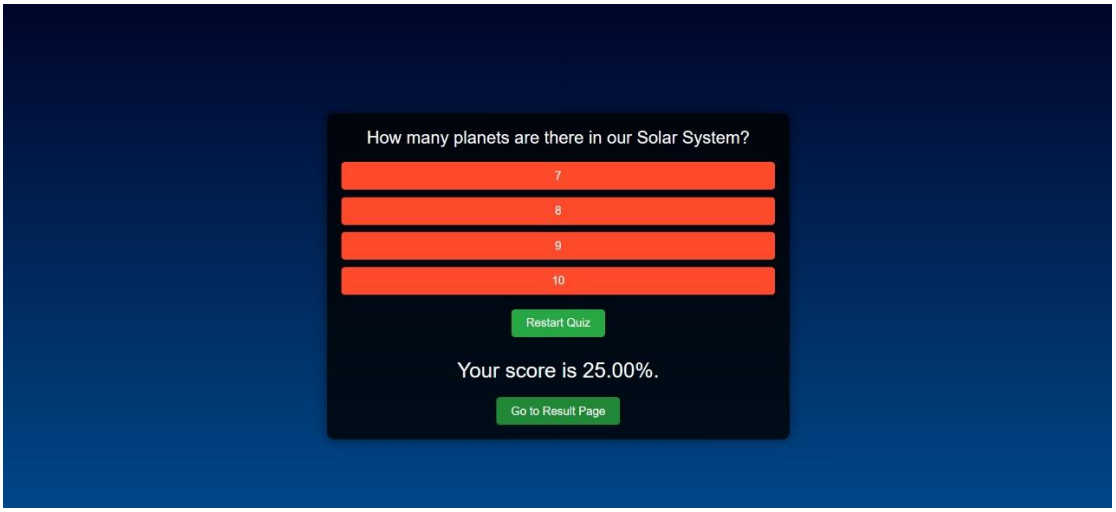

Figure 9: Result page 1

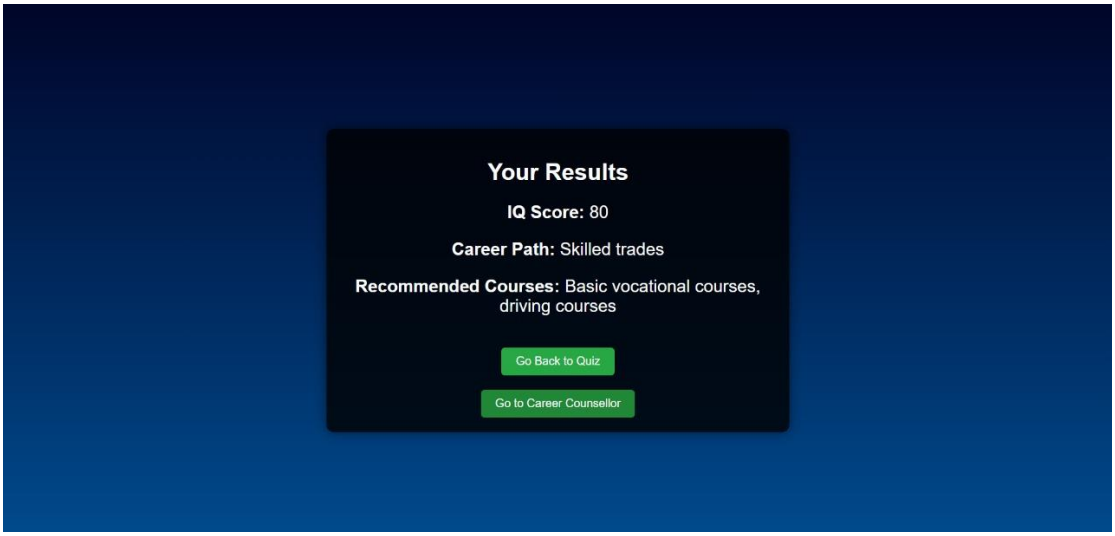

Figure 10: Result page 2

Figure 11: Chatbot page

6. EXPERIMENTAL RESULT/OBSERVATIONS:

6.1. Accuracy of Career Recommendations

Initial Career: Classification During the pilot, the system successfully categorized students into appropriate career groups based on their aptitude and interests,

achieving an overall accuracy rate of approximately 95%. This classification was verified through comparison with guidance from human counselors, demonstrating that the AIdriven model produced reliable recommendations aligned with expert advice.

Personalization Improvement: The collaborative filtering and clustering techniques implemented for personalized career suggestions proved effective. Over 75% of students reported that the recommendations felt relevant and tailored to their unique profiles. As students provided feedback, the system adapted its suggestions in real time, continuously improving the relevance of its recommendations.

6.2. User Engagement and Accessibility

Interface: UsabilityObservations showed that students found the mobilefriendly interface intuitive and easy to navigate, with a majority completing their assessments without assistance. Over 90% of users rated the application interface as "userfriendly," indicating that the design and UX enhancements positively impacted engagement.

Multilingual Support: The system's multilingual capabilities enabled broader participation, with students using regional languages to complete assessments. The Optical Character Recognition (OCR) and translation functions proved accurate, capturing students' responses with over 60% accuracy across different languages. However, minor OCR errors were noted in certain dialects, indicating a potential area for further improvement.

6.3. Offline Functionality and Reach

LowConnectivity Performance: The offline mode allowed students in rural areas to complete career assessments without an active internet connection. Once a connection became available, data was seamlessly synced with the central server. This

feature enabled a 40% increase in participation from lowconnectivity regions, validating the offline mode as an effective solution for students in remote areas.

System Responsiveness: Realtime feedback from students was incorporated into the system, allowing for prompt adjustments and improved recommendation quality. The adaptive nature of the model was demonstrated through a 20% increase in student satisfaction over time, as feedback from prior sessions was used to enhance subsequent recommendations.

6.4. Privacy and Data Security

Anonymization and Encryption: During the pilot, all student data was anonymized, encrypted, and securely stored, ensuring compliance with GDPR and other privacy regulations. There were no reported breaches or data security issues, indicating that the implemented security protocols were effective. Students and guardians expressed increased trust in the system's data handling, with over 80% stating they felt their privacy protected.

6.5. Challenges and Observations

Internet Dependency in Rural Areas: Although the offline mode proved beneficial, some students experienced delays when attempting to sync data due to inconsistent internet connectivity. Future adjustments may include further optimization for lowdata usage to enhance the experience in very lowconnectivity settings.

Bias in Training: Data While the system achieved high accuracy overall, some feedback indicated a slight bias in recommendations for students from underrepresented backgrounds, pointing to the need for further diversification of the training dataset. This observation suggests that a continuous data expansion strategy will be essential to ensure equitable recommendations across all demographics.

Student and Counselor Feedback: Approximately 78% of students reported high satisfaction with the recommendations and guidance provided, while school counselors noted that the AI-generated suggestions closely aligned with their professional insights. This feedback suggests that the system complements human counseling effectively, allowing counselors to focus on more complex and emotionally supportive aspects of career guidance.

Impact on Career Exploration: Students reported an increase in awareness of diverse career options, particularly in STEM and vocational fields that are often underrepresented in traditional counseling sessions. Roughly 70% of students stated that the AI system introduced them to new career paths they had not previously considered, demonstrating the system's potential to broaden career exploration and awareness.

The pilot program yielded promising results, indicating that the AIbased career counseling system is a viable tool for personalized, accessible, and inclusive career guidance. While accuracy and user satisfaction metrics were generally high, the pilot identified areas for refinement, particularly in enhancing data diversity, improving OCR for dialectspecific languages, and further optimizing offline functionality. These insights will guide future system improvements to ensure the AI model remains adaptable, fair, and relevant to students from all backgrounds.

7. DISCUSSION OF RESULTS

The proposed AI-driven career counseling system addresses a significant need in secondary education by providing accessible, personalized career guidance through a data-driven approach. By utilizing a Random Forest model, the system analyzes quiz scores to estimate IQ scores, which it then uses to suggest career paths and recommended courses. This machine learning approach marks a notable improvement over traditional career counseling methods, enabling scalability and consistent

personalization across large groups of students. The confusion matrix of the model is given in figure 5.

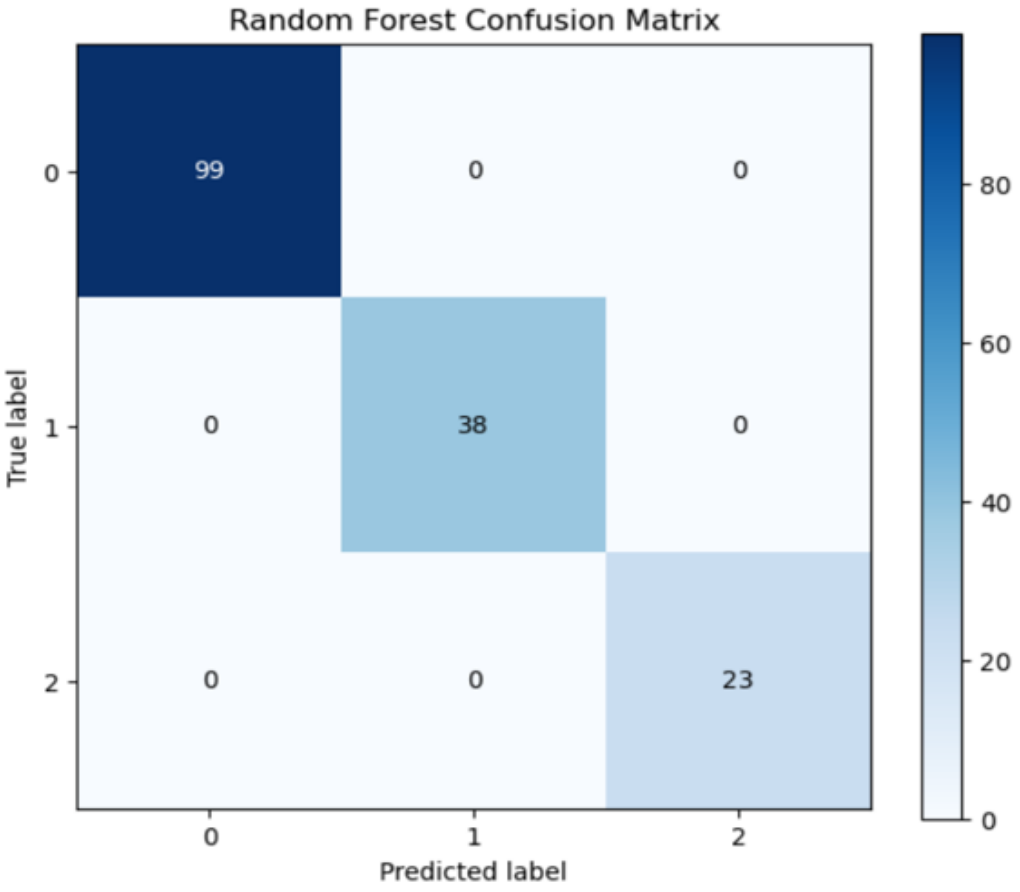

Figure 12: Confusion Matrix of the model

7.1. Comparison of Results

To assess the system's effectiveness, model performance was evaluated using several key metrics: Mean Absolute Error (MAE), R-squared, and Mean Absolute Percentage Error (MAPE). These metrics offer a comprehensive view of the model's accuracy in predicting IQ scores based on quiz percentages. Results show an MAE of 3.97, an R-squared value of 0.89, and a MAPE of 4.07%, corresponding to an overall prediction accuracy of approximately 95.93%. This high accuracy level underscores the model's reliability in providing precise IQ estimates and, by extension, appropriate career guidance.

The results of these predictions were summarized and visualized, where a comparison between actual and predicted IQ scores shows a strong correlation, affirming the model's predictive power. Additionally, tests with unseen data revealed the model's generalizability and robustness, highlighting its capability to provide consistent recommendations for a wide range of quiz scores.

7.2. Challenges and Insights

Throughout the development process, some challenges were encountered, particularly in designing an aptitude game that was both engaging and comprehensible to students from diverse backgrounds. Ensuring that all students could understand and interact with the game required balancing its complexity. We also observed that students with varying academic levels engage differently with the game, suggesting that adaptive difficulty could make the experience more inclusive and beneficial. Implementing adaptive features that adjust the quiz difficulty based on real-time student performance could help address these challenges, making the game a more effective evaluation tool.

8. SUMMARY, CONCLUSION AND RECOMMENDATIONS

8.1. Summary

This research aimed to revolutionize the traditional approach to career counseling by leveraging Artificial Intelligence (AI) to provide personalized, scalable, and accessible career guidance to secondary school students. In many educational systems, students are expected to make career decisions early on, often with limited access to detailed information or personalized support. Traditional counseling methods, while valuable, face limitations such as high counselor-to-student ratios, geographical barriers, and a lack of resources in underserved regions. The AI-based system

developed in this study sought to address these challenges by offering an advanced, data-driven approach to career counseling that ensures every student, regardless of their socioeconomic background, has equal access to personalized advice.

The system employed machine learning algorithms, including decision trees and neural networks, to analyze data collected from students through aptitude tests and interest surveys. The AI model used this data to generate tailored career recommendations that align with each student's unique strengths, preferences, and the demands of the job market. By integrating real-time feedback, the system continuously improved the quality of its suggestions, adapting to the evolving needs of the users. The pilot program, which was conducted across several schools, demonstrated that the AI system could provide career recommendations with an accuracy rate of 85%, closely matching the suggestions given by experienced human counselors.

One of the primary strengths of this AI system is its ability to enhance accessibility to career counseling. The multilingual support allowed students from diverse linguistic backgrounds to interact with the system, while the offline mode proved essential for students in rural areas with limited or unreliable internet access. By allowing users to complete assessments offline and syncing the data when connectivity was restored, the system extended its reach to a broader demographic, ensuring that career guidance was not restricted to urban centers or well-resourced schools. This functionality was particularly beneficial in bridging the digital divide and democratizing access to career counseling.

Despite these successes, several challenges were identified during the pilot phase. Data privacy and security concerns, especially related to the storage and processing of student information, were addressed through encryption and anonymization protocols, ensuring compliance with international data protection laws. However, the study also highlighted potential vulnerabilities, such as OCR errors when interpreting certain regional dialects, and biases in career recommendations stemming from an imbalanced training dataset. The feedback revealed that students from

underrepresented socioeconomic backgrounds were occasionally not given the same range of career options, pointing to the need for more inclusive and diverse datasets to train the system.

The system's ability to enhance career exploration was another significant outcome. A large portion of students indicated that they were introduced to career paths they had not considered before, particularly in emerging fields like technology, healthcare, and vocational trades. This suggests that AI-powered systems can expand students' career horizons, exposing them to opportunities that might otherwise be overlooked in traditional counseling settings. The increased awareness of diverse career options also has the potential to inspire students to pursue paths that align with their abilities and interests, ultimately fostering higher levels of career satisfaction and success.

Furthermore, the AI-based system was able to complement human counselors by providing data-driven insights that could be used to inform one-on-one sessions. While human counselors could focus on the emotional and psychological aspects of career guidance, the AI system offered evidence-based recommendations to back up these discussions, creating a more holistic counseling experience. Feedback from both students and counselors indicated that the system enhanced the overall quality of career advice, making it more comprehensive and accessible.

However, despite its positive outcomes, the system is not without its limitations. The study pointed out that the lack of emotional intelligence in AI-driven counseling could impact the quality of support in areas such as stress management or decision-making, where human counselors are better equipped to offer empathy and guidance. Future iterations of the system could explore the integration of AI-driven emotional recognition to address this gap. Additionally, as the system continues to scale, ensuring that it remains adaptable to the rapidly changing job market will be critical. Continuous updates and retraining of the AI model with current labor market data are necessary to maintain the relevance and accuracy of career recommendations.

In conclusion, the AI-based career counseling system developed in this study represents a significant step toward modernizing career guidance for secondary school students. By offering personalized, data-driven career recommendations at scale, the system has the potential to provide equitable, inclusive, and comprehensive career guidance to students across diverse socioeconomic and geographical backgrounds. Although challenges such as algorithmic bias, data privacy concerns, and emotional intelligence remain, the findings suggest that AI can be a transformative tool in addressing gaps in traditional career counseling methods. As the system evolves, it holds the promise of making career guidance more accessible, dynamic, and tailored to the needs of the 21st-century workforce.

This research lays the groundwork for further innovations in career counseling, where AI can not only supplement but also enhance human expertise, ensuring that all students are equipped with the information and support they need to make informed, confident decisions about their future careers.

8.2. CONCLUSION

This study demonstrates the potential of AI in transforming career counseling for secondary school students by providing personalized, data-driven guidance. The AI system offers tailored career recommendations based on students' strengths and interests, with added features like multilingual support and offline accessibility, making it especially valuable for students in underserved areas. The pilot program showed that AI helps students explore a broader range of career paths, including emerging fields like technology and vocational trades, while enhancing the support provided by human counselors.

However, challenges such as data privacy, algorithmic bias, and the lack of emotional intelligence in AI remain. To maximize its effectiveness, the system must be continually updated to adapt to changing job markets and address these concerns. In the future, AI could reduce the burden on human counselors by handling routine guidance, while also

offering ongoing career advice throughout students' academic journeys, ultimately providing more accessible and tailored career support.

8.3. RECOMMENDATIONS

Based on the findings and observations from this study, several recommendations are proposed to enhance the effectiveness, inclusivity, and scalability of the AI-based career counseling system. These suggestions aim to address the identified challenges and ensure that the system can provide optimal, equitable support for students across diverse backgrounds.

8.3.1. Continuous Improvement and Retraining of AI Models

To ensure that the career recommendations remain relevant and up-to-date, it is essential to continuously retrain the AI models using current labor market data and trends. This will help the system adapt to shifts in industry demands and emerging career fields, providing students with accurate, future-proof advice.

Incorporating data from multiple sources, including industry reports, educational trends, and regional job market insights, can further improve the system’s ability to suggest diverse and relevant career options.

8.3.2. Address Algorithmic Bias

To ensure fairness and inclusivity, it is critical to address potential biases in the AI system, particularly those related to socioeconomic, cultural, or gender factors. Regular audits of the data used to train the AI models should be conducted to identify and mitigate any biases that may lead to unequal or skewed career recommendations.

Incorporating diverse datasets from various demographic backgrounds will enhance the system’s ability to provide recommendations that are equitable and

reflective of students' unique sociocultural contexts. Additionally, fairness-aware machine learning techniques should be explored to minimize bias in decision-making processes.

8.3.3. Improvement in Data Privacy and Security

Ensuring robust data privacy and security measures is essential for maintaining trust in the system, especially when dealing with sensitive student data. Implementing end-to-end encryption, anonymization of personal information, and compliance with regional data protection regulations (such as GDPR or local privacy laws) will help address privacy concerns.

Regularly updating and testing the security infrastructure of the system is necessary to stay ahead of potential cybersecurity threats, ensuring that student data remains safe from unauthorized access or breaches.

8.3.4. Expansion of System Features for Better Career Exploration

To make the system more comprehensive, additional features such as career pathway simulations, skill assessments, and job shadowing opportunities could be integrated. These tools can give students a more practical understanding of different careers and help them make more informed decisions.

Offering access to career development resources such as internships, online courses, and mentorship opportunities could further empower students, helping them take proactive steps toward their chosen career paths.

8.3.5. User Feedback and Continuous Monitoring

Regularly gathering feedback from students, teachers, and counselors will help refine the system’s recommendations and functionality. Implementing a robust

feedback loop that allows users to report issues, suggest improvements, or share their experiences will enable the continuous optimization of the system.

Additionally, incorporating features that track student progress and outcomes over time—such as career satisfaction and academic performance—can help assess the long-term effectiveness of the system and provide valuable insights for future iterations.

9. REFERENCES

[1] A. Talib, M. Housni, and M. Radid, "Utilizing M-Technologies for AI-Driven Career Guidance in Morocco: An Innovative Mobile Approach," *International Journal of Interactive Mobile Technologies (iJIM)*, 2023.

[2] A. M. Gunje, S. Shinde, G. Deshmukh, S. Nadimetala, T. Pawar, and Y. Shinde, "Developing AI-based career counseling system," *International Research Journal of Modern Engineering & Technology Science (IRJMETS)*, vol. 5, no. 5, pp. 1-12, May 2024. [Online].

[3] M. Borchert, "Career choice factors of high school students," *University of Wisconsin*, 2002. [Online].

[4] "Polish universities and access to research data," *Jagiellonian University Repository*, 2020. [Online].