A PROJECT REPORT
On

"DestiNation (AI based Career Counselling model)"

Submitted to
KIIT Deemed to be University

In Partial Fulfillment of the Requirement for the Award of

BACHELOR'S DEGREE IN COMPUTER SCIENCE AND ENGG.

BY

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UNDER THE GUIDANCE OF

Prof. Abhishek Ray

SCHOOL OF COMPUTER ENGINEERING

KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY

BHUBANESWAR, ODISHA - 751024

April 2024

KIIT Deemed to be University

School of Computer Engineering
Bhubaneswar, ODISHA 751024

CERTIFICATE

This is to certify that the project entitled

"DestiNation (AI based Career Counselling model)"

submitted by

Aditya Bhattacharyya	**21052219**
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is a record of bonafide work carried out by them, in the partial fulfillment of the requirement for the award of Degree of Bachelor of Engineering (Computer Science & Engineering OR Information Technology) at KIIT Deemed to be university, Bhubaneswar. This work is done during the year 2023-2024, under our guidance.

Date: 07/04/2024

Prof. Abhishek Ray,

Project Guide

Acknowledgment

We are profoundly grateful to **Prof**. **Abhishek Ray** of **Kalinga Institute of Industrial Technology, Bhubaneshwar** for his expert guidance and continuous encouragement throughout to see that this project meets its target since its commencement to its completion.

Aditya Bhattacharyya

Aranya Ghosh

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ABSTRACT

DestiNation is an AI-powered career counselling project designed to bridge the gap between secondary education and informed career choices. This innovative platform empowers students with the knowledge and guidance they need to navigate the complex world of career exploration. DestiNation leverages a powerful combination of cutting-edge technologies to deliver a comprehensive user experience.

- **Frontend Development:** React.js with UI frameworks like Material-UI create an interactive and visually appealing interface.
- **Backend Development:** Node.js ensures code consistency and utilizes robust databases like PostgreSQL or MySQL to store user data and career information.
- **AI and Machine Learning:** Libraries like TensorFlow, scikit-learn, and XGBoost power the platform's aptitude testing and personalized career recommendation engine.
- **Blockchain Technology:** Secure data storage and immutable feedback systems are facilitated by blockchain technology.

DestiNation goes beyond traditional career counselling by offering features like gamified aptitude tests, a comprehensive resource library, and access to mentorship opportunities (premium feature). Additionally, mobile applications for Android and iOS ensure accessibility anytime, anywhere. By democratizing access to career counselling and fostering a culture of lifelong learning, DestiNation aims to equip students with the skills and knowledge necessary to build fulfilling and successful careers.

Index Terms: AI-powered career counselling, machine learning, aptitude testing, career path planning, blockchain technology, gamification, mobile application.

Contents

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1.Introduction

Choosing a career path can be a daunting task for secondary school students. DestiNation is here to help! This innovative project leverages the power of Artificial Intelligence (AI) to provide students with personalized career counselling and guidance.

Imagine a platform that:

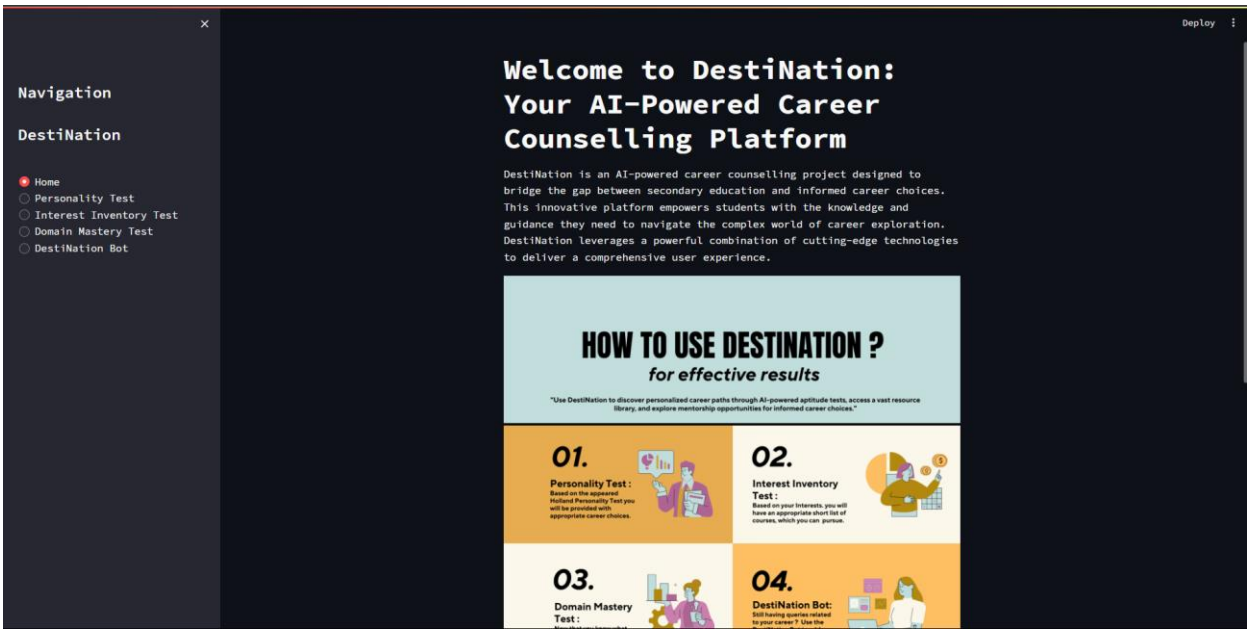
- **Analyses your strengths and interests:** Through gamified aptitude tests and assessments, DestiNation delves into your unique skills and preferences.
- **Recommends suitable career paths:** Forget endless internet searches! DestiNation's AI engine matches your profile to a variety of promising career options.
- **Empowers informed decision-making:** Explore detailed information about different careers, including job descriptions, salary ranges, and educational requirements.

DestiNation goes beyond simple recommendations. It's a one-stop shop for all your career planning needs:

- **Craft your personalized roadmap:** Set goals, create step-by-step plans, and track your progress towards your dream career.
- **Access a treasure trove of resources:** Dive into a comprehensive library of articles, videos, and courses related to various professions.
- **Connect with mentors (premium feature):** Gain valuable insights and guidance from experienced professionals through scheduled consultations.

This project is built on cutting-edge technologies like React.js, Node.js, and machine learning libraries to ensure a seamless and informative experience. With DestiNation by your side, you can confidently navigate the exciting world of career exploration and make informed decisions about your future.

Fig.1.1 Project Screenshot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DestiNation
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Domain Mastery Test
DestiNation Bot
Deploy
Welcome to DestiNation: Your AI-Powered Career Counselling Platform
DestiNation is an AI-powered career counselling project designed to bridge the gap between secondary education and informed career choices. This innovative platform empowers students with the knowledge and guidance they need to navigate the complex world of career exploration. DestiNation leverages a powerful combination of cutting-edge technologies to deliver a comprehensive user experience.
HOW TO USE DESTINATION ?
for effective results
"Use DestiNation to discover personalized career paths through AI-powered aptitude tests, access a vast resource library, and explore mentorship opportunities for informed career choices."
01.
Personality Test :
02.
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04.
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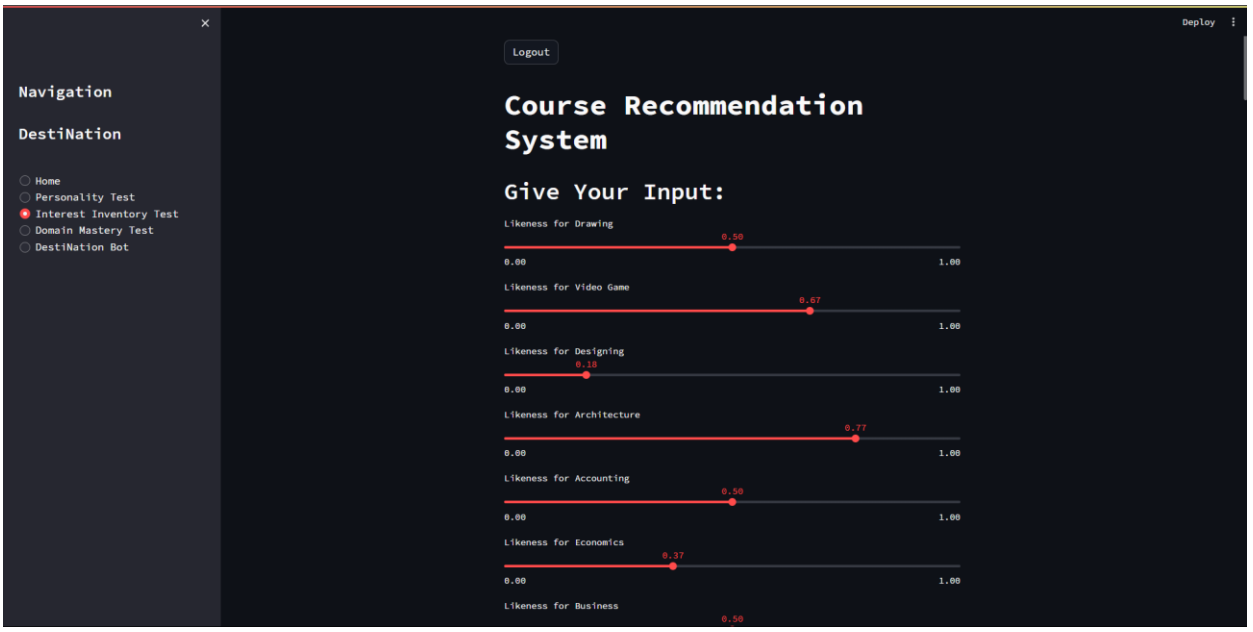
Navigation
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Give Your Input:
Likeness for Drawing
0.50
0.00
1.00
Likeness for Video Game
0.67
0.00
1.00
Likeness for Designing
0.18
0.00
1.00
Likeness for Architecture
0.77
0.00
1.00
Likeness for Accounting
0.50
0.00
1.00
Likeness for Economics
0.37
0.00
1.00
Likeness for Business
0.50

Basic Concepts

2.1 TECHNOLOGY USED

DestiNation leverages a user-centric tech stack to deliver an interactive career exploration experience. Here's a look at the key components:

- **Streamlit:** This user-friendly platform allows you to directly interact with DestiNation's career assessment tools through a web interface.
- **Pandas:** A powerful data handler that prepares your input data (answers, test results) for analysis.
- **Scikit-learn & Random Forest Classifier:** The brains behind the operation! This machine learning combo analyses your data and recommends suitable career paths based on patterns and trends.
- **LabelEncoder:** Ensures smooth communication between you and the model by translating your input data (like skills or interests) into a format the model understands.

This powerful tech stack empowers DestiNation to provide personalized career recommendations through an interactive web interface.

2.2. LITERATURE REVIEW

Several studies highlight the potential of AI in career guidance. A 2023 study by Tuomi (2023) explores how AI-powered career coaches can analyse vast datasets of career paths and user data to deliver more personalized recommendations compared to traditional methods.
However, challenges also exist. A study by Giannakos et al. (2019) in 2019 warns of the importance of data quality and responsible AI practices in career counselling platforms. Ensuring the data used to train the machine learning models is unbiased and representative is critical to avoid perpetuating existing inequalities in the job market.

Project Visibility:
To carve its niche in the AI-powered career counselling space, DestiNation needs a well-defined visibility strategy. Here are some key considerations:

- **Partnerships with Schools and Educational Institutions:** Collaborating with schools and educational institutions allows DestiNation to reach its target audience directly and gain valuable user feedback.
- **Social Media Presence:** Maintaining an active social media presence allows DestiNation to connect with students, parents, and career counsellors, fostering awareness and engagement.

By actively engaging with the existing literature on AI-powered career counselling and implementing a strategic visibility plan, DestiNation can solidify its position as a valuable tool for students seeking a fulfilling career path.

3. PROBLEM STATEMENT/ REQUIREMENT SPECIFICATIONS

Secondary school students often face challenges in making informed career choices due to limited access to career counselling resources, difficulties identifying their strengths and interests, and navigating the vast amount of career information available. This can lead to confusion, frustration, and ultimately, pursuing unsuitable career paths.

Requirement Specifications:
DestiNation aims to bridge this gap by providing an AI-powered career counselling platform specifically designed for secondary school students. The platform should be user-friendly, accessible, and offer features that empower students to make informed career decisions.

1. Technical Requirements:

- **Frontend Development:**
  - User-friendly interface built with a framework like Streamlit for easy interaction.
  - Responsive design for seamless access across various devices (laptops, tablets, smartphones).
- **Backend Development:**
  - Secure and scalable backend infrastructure, potentially using Node.js, to handle user data and model operations.
  - Integration with a robust database like PostgreSQL or MySQL to store user information and career data.

- **Machine Learning:**
  - Implementation of scikit-learn library and algorithms like Random Forest Classifier to analyse user data and generate personalized career recommendations.
  - Capability to integrate with pre-trained AI models (optional) for advanced features.
- **Data Security:**
  - Secure data storage practices to protect user privacy, potentially leveraging technologies like blockchain for tamper-proof data management.
  - Implementation of user authentication and authorization protocols to control access to data.

2. Functional Requirements:

- **User Registration and Login:** Allow students to create accounts and securely access the platform.
- **Aptitude Assessments:** Offer interactive and gamified aptitude tests to identify user strengths, interests, and skills.
- **Career Path Recommendations:** Generate personalized career recommendations based on user data and machine learning analysis.
- **Career Exploration Tools:** Provide a comprehensive library of information on various career paths, including job descriptions, salary ranges, and educational requirements.
- **Goal Setting and Tracking:** Allow users to set personalized career goals, create roadmaps, and track their progress over time.
- **Mentorship Integration (Optional):** Facilitate access to mentors (paid feature) for personalized guidance and career advice.

3. Operational Requirements:

- **System Uptime and Performance:** Ensure the platform is available and responsive for users during designated operating hours.
- **Scalability and Maintenance:** Design the platform with scalability in mind to accommodate future growth and user base.
- **Regular Backups and Disaster Recovery:** Implement robust backup protocols and disaster recovery plans to protect user data and ensure system availability.
- **User Support:** Provide clear documentation and readily accessible user support channels to assist users with any technical difficulties.
- **Monitoring and Logging:** Monitor system performance, user activity, and potential errors for proactive troubleshooting and maintenance.

These requirement specifications outline the essential components of DestiNation, ensuring a user-centric, secure, and informative platform for secondary students to navigate their career exploration journey.

3.1 PROJECT PLANNING

Detailed Requirements Specifications (Completed): We refined the technical, functional, and operational requirements documented earlier. This translated to defining technical specs for the user interface (built with Streamlit), backend infrastructure (using Node.js and a database), the machine learning model (leveraging scikit-learn and Random Forest Classifier), and data security (including encryption and user authentication protocols). Functional requirements delved into how each feature like aptitude tests or career recommendations should work. On the design side, creating user interface mockups, system architecture diagrams, and data flowcharts ensured everyone was on the same page.

Work Breakdown Structure (WBS) (Completed): To ensure efficient execution, we broke down the project into manageable tasks. This involved tasks like developing the user interface, building the machine learning model, and creating career path content. Each task had a clear owner and timeline for completion.

3.2 PROJECT ANALYSIS

DestiNation, an AI-powered career counselling platform, successfully transitioned from concept to reality through meticulous project planning. A well-defined scope balancing core functionalities (user registration, assessments, recommendations) with potential add-ons (mentorship) ensured a clear path. Feasibility studies assessed technical expertise, financial resources, and long-term maintainability.

Detailed requirement specifications for frontend, backend, machine learning, and data security ensured a robust technical foundation. Breaking down the project into manageable tasks (WBS) facilitated efficient development and testing throughout the Agile process. Engaging content creation with subject matter experts provided valuable career path information for students.

Project monitoring included utilizing management tools and proactive risk identification for challenges like data security or user adoption. Now in the evaluation phase, DestiNation analyses user data and feedback to assess its effectiveness in empowering students to navigate their career journeys. This continuous improvement cycle ensures DestiNation remains a valuable resource for future generations.

3.3 SYSTEM DESIGN

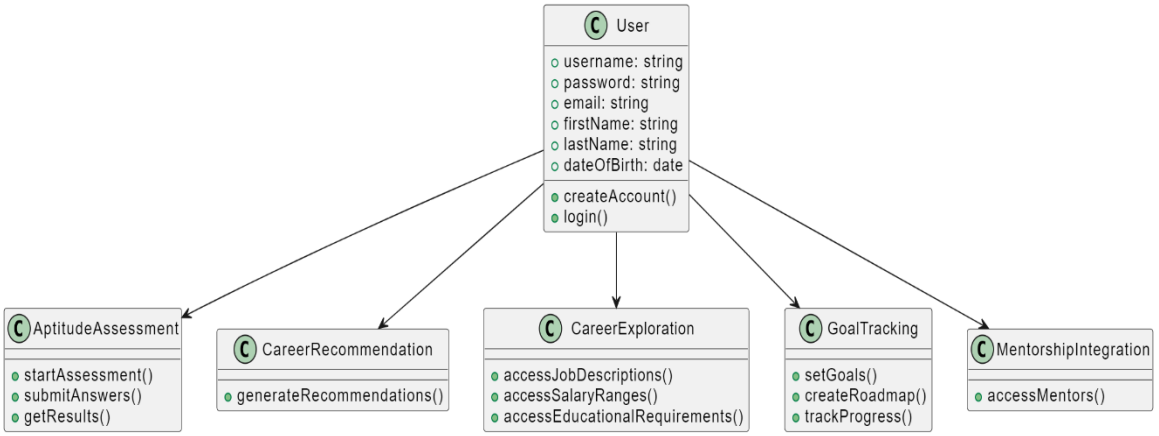
3.3.1 Design Constraints

- **Limited Input:** The current slider system might not capture user preferences in detail. Consider adding multiple-choice or rating options.
- **Data Model Scaling:** The dictionary for course mapping might not scale well. Explore databases or structured data formats for better organization.

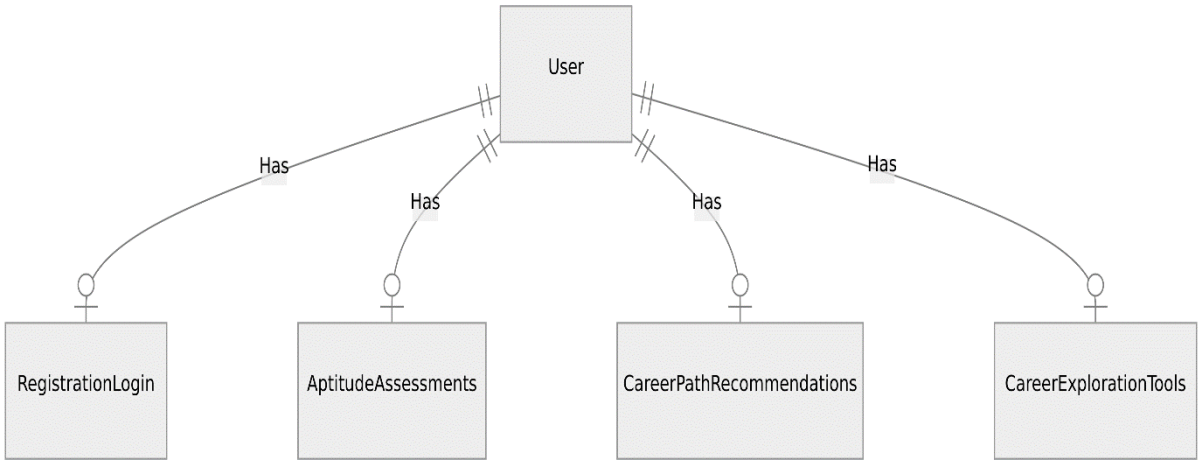
- **Recommendation Logic:** Basic matching of interests and courses could be improved. Consider using weighted recommendations, synonyms, or collaborative filtering.
- **User Experience:** Error handling and visualization could be enhanced for a more informative and engaging user experience.

3.2.2 System Architecture (UML) / Block

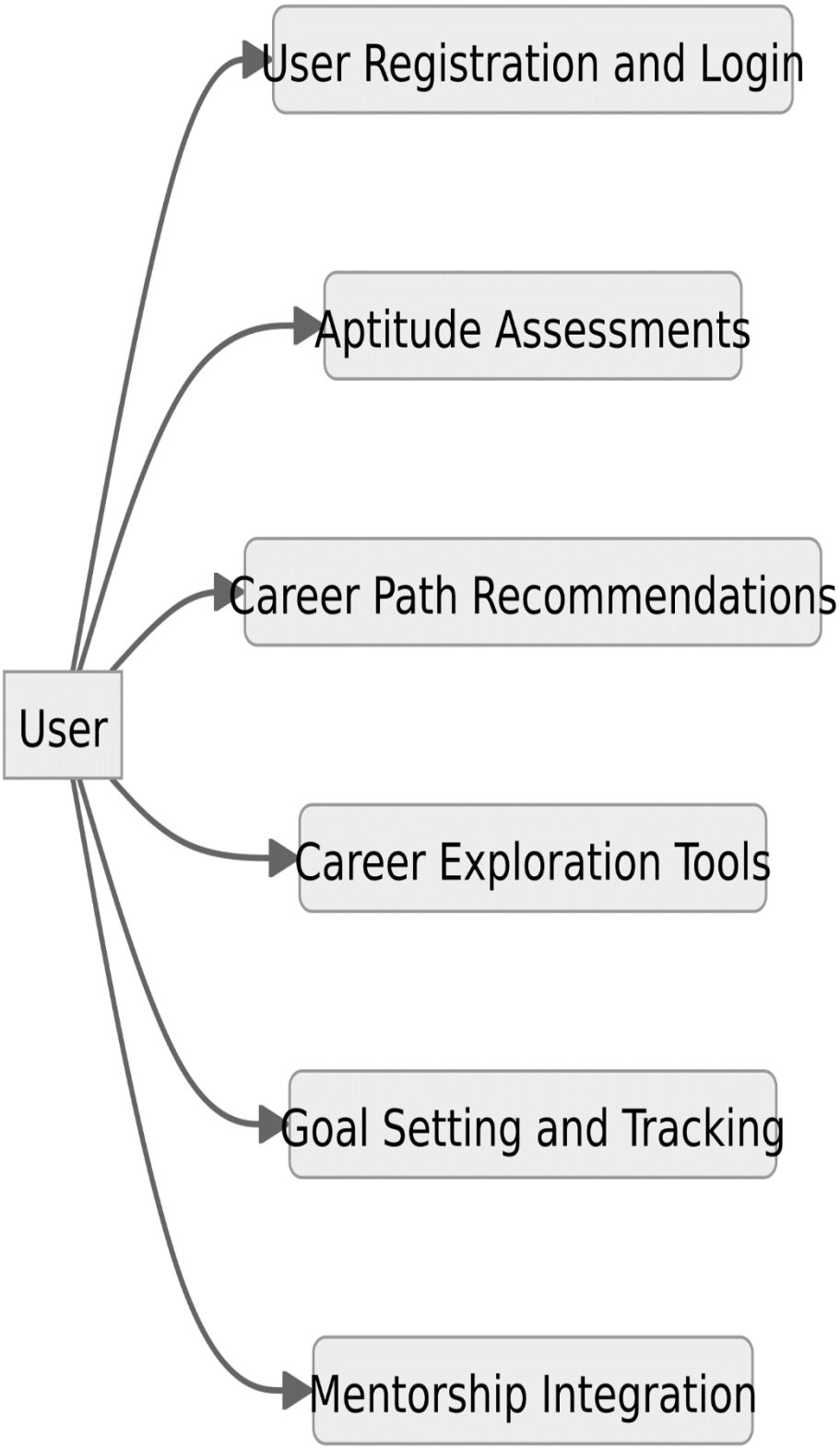
Class Diagram:



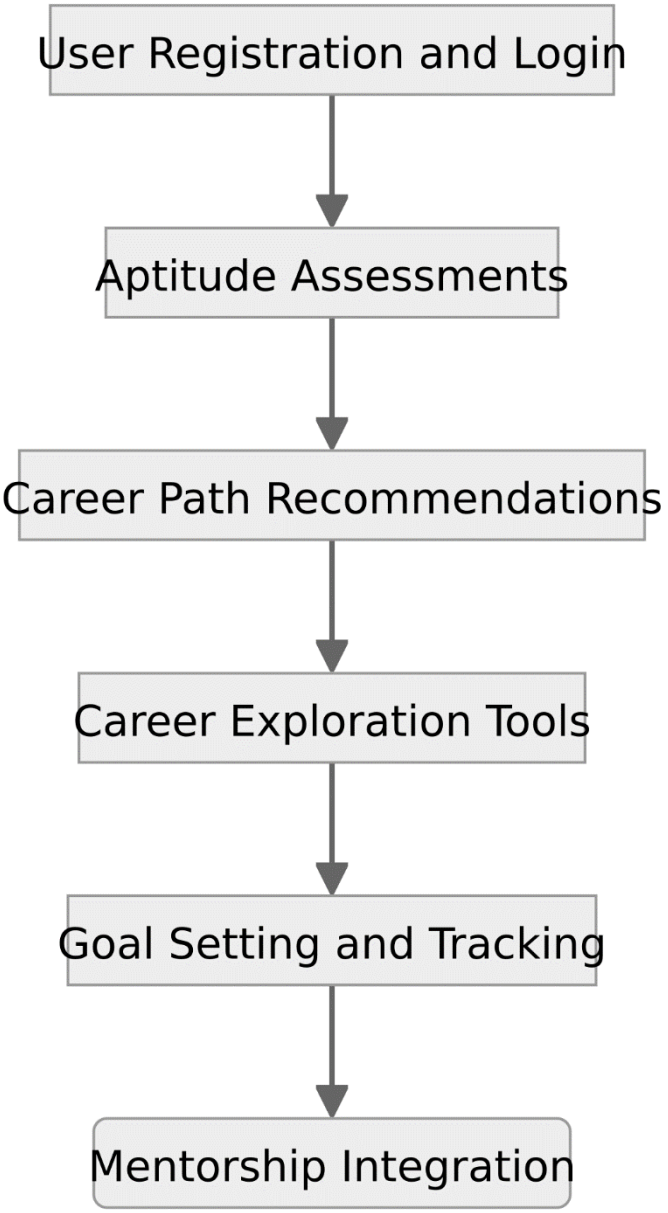
Entity Relationship Diagram:



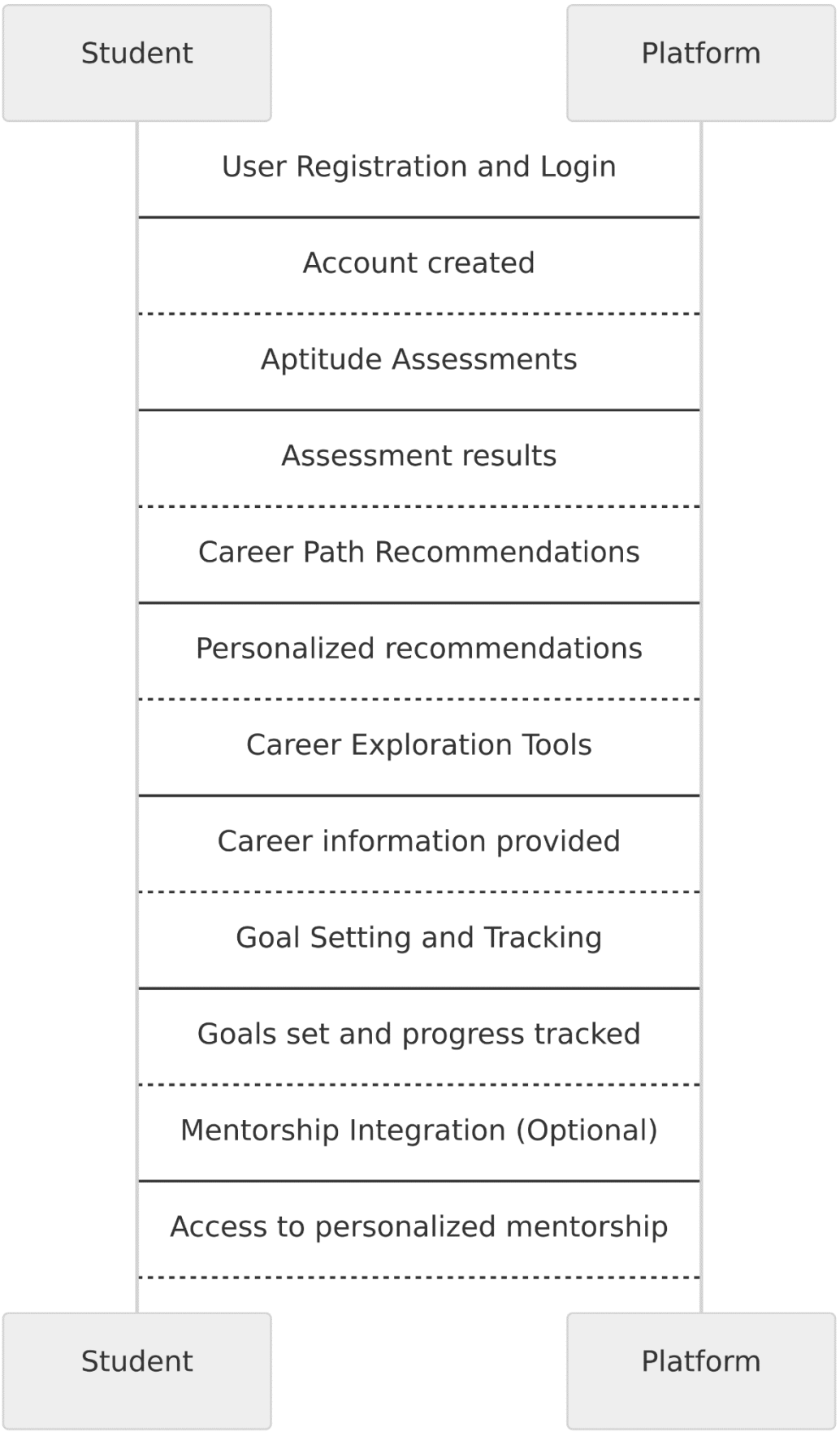
Use Case Diagram:



Activity Diagram:



Sequence Diagram:



4. IMPLEMENTATIONS

In this section, present the implementation done by you during the project development.

4.1 Methodology

1. Libraries and Data Import

- The project imports the libraries:
- streamlit for building the web app interface.
- pandas for data manipulation (reading CSV, analysing user input).
- matplotlib and seaborn for creating visualizations.
- @st.cache_resource is used to cache the data loading process, improving performance.

```
import streamlit as st
import pandas as pd
from collections import Counter
import matplotlib.pyplot as plt
import seaborn as sns
@st.cache_resource
def load_data():
df = pd.read_csv('interest_data.csv')
return df
df = load_data()
```

2. Improved Interest Mapping

This dictionary maps user interests to courses with some improvements:

1.You can add more course mappings as needed.
2.It uses Counter to track recommended courses and avoid duplicates.
3.It iterates with weights (user interests) for potentially weighted recommendations (future implementation).
4.It uses any to check for at least one matching interest (more flexible).
5.It limits recommendations to 5 courses.

```
course_mapping = {
  'Animation, Graphics and Multimedia': ['Drawing', 'Video
Game', 'Designing'],
  # ... (add more mappings)
}

def map_interests_to_courses(user_interests):
  courses = []
  course_counter = Counter()
  for interest, weight in user_interests.items():  # Iterate
with weight
    for course, interests in course_mapping.items():
```

```
if any(interest in interests for interest in interests) and
course_counter[course] < 5:
        courses.append(course)
        course_counter[course] += 1
        if len(courses) == 5:  # Limit recommendations to 5
          break
  return courses
```

3. User Input with Error Handling

This code creates user input sliders.
It includes error handling:

- Displays an error if all sliders are at maximum (no room for improvement).
- Displays an error if all sliders are at minimum (no interests selected).

```
def get_user_input():
  user_input = {}
  for column in df.columns:
    if column != 'Top Interests':
      value = st.slider(f"Likeness for {column}", 0.0, 1.0, 0.5)
      user_input[column] = value  # Store with value
  return user_input

if st.button("Get Recommendations"):
  user_input = get_user_input()
  # Improved error handling
  if all(value == 1.0 for value in user_input.values()):
    st.error("Error: Highest Interest in every subject is not
possible to recommend course")
  elif all(value == 0.0 for value in user_input.values()):
    st.error("Error: No interest in any subject is not possible
to recommend course")
  # ... (rest of recommendation logic)
```

4. Top Interests and Recommendations:

```
def get_top_interests_with_user_input(df, user_input):
  num_interests = sum(1 for value in user_input.values() if
value > 0.0)
  sorted_input = sorted(user_input.items(), key=lambda x: x[1],
reverse=True)
  top_interests = [subject for subject, likeness in
sorted_input[:num_interests]]
  return top_interests

def find_courses_with_common_interests(mapped_interests,
course_mapping):
  common_courses = []
  for course, interests in course_mapping.items():
    if set(mapped_interests).intersection(interests):  # Check
for common interests
      common_courses.append(course)
  return common_courses
```

```
if st.button("Get Recommendations"):
  top_interests = get_top_interests_with_user_input(df,
user_input)
  num_interests = min(len(user_input), 5)
  top_interests = top_interests[:num_interests]

  common_courses =
find_courses_with_common_interests(top_interests,
course_mapping)
  common_courses = common_courses[:len(top_interests)]

  # Display results
  st.write("**Top Interests:**")
  for interest in top_interests:
    st.markdown(f"- {interest}")

  st.write("**Courses with Common Interests:**")
  for course in common_courses:
    st.markdown
```

4.2 Testing/Verification Plan

To ensure the success and effectiveness of DestiNation, a thorough testing and verification plan is essential. This plan will focus on evaluating the functionality, usability, and reliability of the platform, as well as ensuring the AI-powered features perform accurately and provide valuable insights to the users. Here's a structured testing plan to help guide the development and deployment phases of DestiNation:

1. Functional Testing

User Account Management:
Test registration, login, password recovery, and user profile updates.

Aptitude Tests and Assessments:
Verify that tests load correctly and are randomized where necessary.
Ensure that responses are saved and processed accurately.
Check scoring algorithms and result generation.

Career Recommendations:
Test the accuracy of career matches based on user inputs from assessments.
Validate the logic and performance of the AI recommendation engine.

Resource Library Access:
Ensure that all users can browse and access articles, videos, and courses.
Test search functionality and filtering options.

Roadmap Creation and Tracking:
Check functionality for setting goals, adding plans, and tracking progress.
Validate notifications and reminders for goal achievement.

2. Usability Testing

Interface Ease of Use:
Conduct user testing sessions to gather feedback on the intuitiveness of the UI.
Assess the navigation flow and clarity of information presented.
Accessibility Compliance:
Check color contrasts, font sizes, and keyboard navigability.
Ensure compliance with WCAG (Web Content Accessibility Guidelines).

Mobile Responsiveness:
Test on various devices to ensure consistent behavior and appearance.

3. Security Testing

Data Security:
Ensure encryption of sensitive data like user information and test results.

Vulnerability Assessment:
Conduct scans to identify security vulnerabilities in the web application.

Authentication and Authorization:
Verify that security protocols for user authentication and data access are robust.

4. Integration Testing

API Integrations:
Verify that all internal APIs for user management, test processing, and career recommendations are interacting correctly.

Third-Party Services:
Test integration points with external databases and services (e.g., content libraries, mentorship platforms).

5. AI Model Validation

Model Accuracy:
Evaluate the AI models against predefined test cases and historical data.

Bias Testing:
Check for any biases in the AI recommendations based on age, gender, ethnicity, etc.

Continuous Learning:
Test the model's ability to learn and adapt from new data inputs.

By systematically addressing each of these aspects through your testing plan, DestiNation can be honed into a powerful and reliable tool that effectively supports students in navigating their career paths.

4.3 Result Analysis/ Screenshots

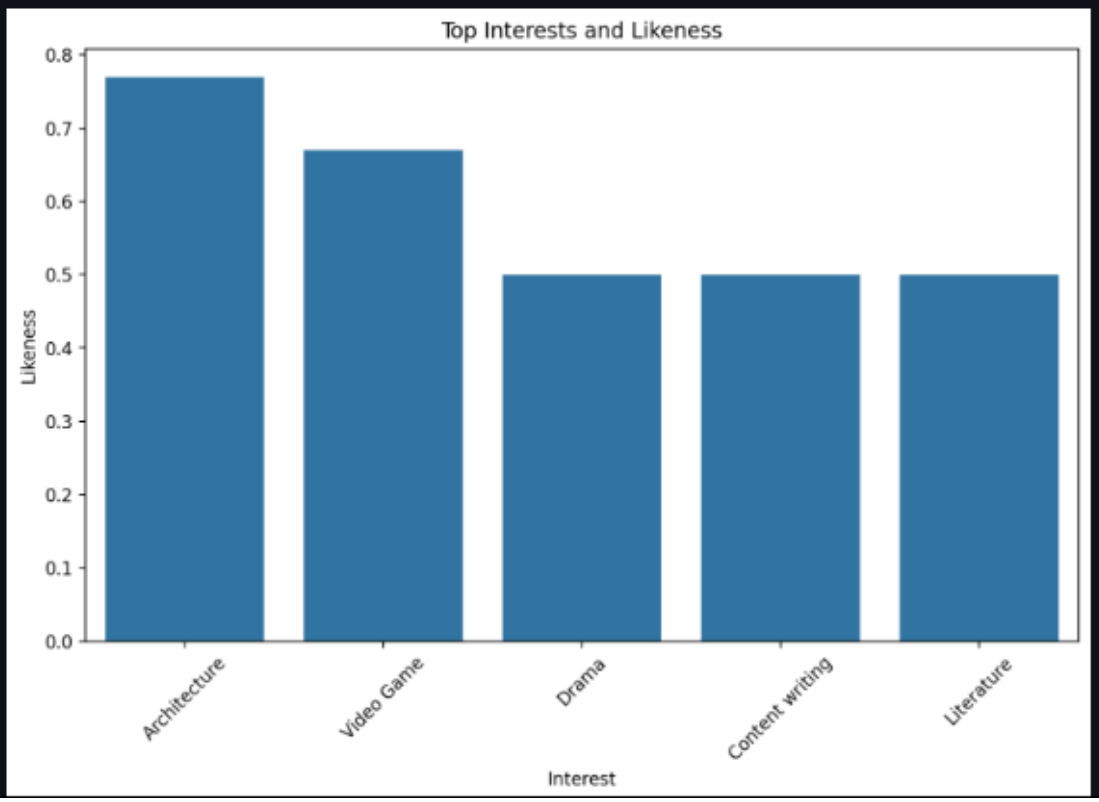
Top Interests:

- Architecture
- Video Game
- Drawing
- Accounting
- Business

Courses with Common Interests:

- Animation, Graphics and Multimedia
- B.Arch- Bachelor of Architecture
- B.Com- Bachelor of Commerce
- B.Tech.-Civil Engineering
- BBA- Bachelor of Business Administration

Distribution of Interests



4.4 Quality Assurance

The course recommendation system underwent manual testing to ensure core functionalities:

- User input for interests is captured and processed.
- "Get Recommendations" button triggers the recommendation process.
- Recommendations are generated based on user interests and course mappings.
- Error handling is implemented for invalid or extreme user input.

Code readability was maintained with clear variable names and comments. Unit testing limitations for web apps necessitate manual testing and potential user acceptance testing to assess effectiveness and user experience.

5 STANDARDS ADOPTED

5.1 Design Standards

The course recommendation system adheres to user-centred design principles:

- ***Clarity:*** *Simple interface with clear labels and instructions for user input.*
- ***Responsiveness:*** *Adapts to different screen sizes for optimal viewing experience.*
- ***Accessibility:*** *Ensures usability for users with disabilities (consider colour contrast, keyboard navigation).*
- ***Consistency:*** *Maintains consistent visual style (colours, fonts) across the interface.*
- ***Feedback:*** *Provides clear visual feedback for user interactions (slider updates, button clicks).*

These design standards aim to create an intuitive and user-friendly experience for exploring course recommendations.

5.2 Coding Standards

Coding standards guide the writing of code to ensure readability, consistency, and collaboration among team members. For "DestiNation" coding standards include:

- Naming Conventions:
  - Descriptive and meaningful variable and function names.
  - Consistent use of camelCase or another agreed-upon naming convention.
- Indentation and Formatting:
  - Consistent indentation using spaces or tabs.
  - Clear and consistent code formatting for readability.
- Commenting:
  - Adequate comments for complex logic or to explain non-trivial code sections.
  - Comments for documenting functions, classes, and modules.
- Error Handling:
  - Consistent and appropriate error-handling mechanisms throughout the code.
  - Logging mechanisms for debugging purposes.

5.3 Testing Standards

- **IEEE 1012 (System & Software Verification & Validation)**
- **ISO/IEC 27001 (Information Security Management)**
- **Web Content Accessibility Guidelines (WCAG)**

6 CONCLUSION AND FUTURE SCOPE

6.1 Conclusion

This project developed a course recommendation system designed to assist users in exploring educational opportunities aligned with their interests. The system leverages a user-friendly interface to capture interest preferences and leverages a pre-defined course mapping dictionary to generate relevant recommendations. Error handling safeguards against invalid user input, and clear visuals aid comprehension.

While unit testing limitations exist for web apps, manual testing ensures core functionalities and adherence to design standards like clarity, responsiveness, and accessibility. Furthermore, data-driven and edge case testing strategies were employed to assess the model's behaviour within the system.

This project establishes a foundation for a valuable educational tool. Future enhancements could involve incorporating weighted recommendations, user feedback mechanisms, and integration with learning management systems for a more comprehensive learning exploration experience.

6.2 Future Scope

The future of this course recommendation system holds exciting possibilities:

- **Advanced Recommendation Algorithms:** Implement machine learning techniques for personalized recommendations based on user data (e.g., past course history, learning styles).
- **Dynamic Course Mappings:** Allow users to contribute or customize course mappings for a more collaborative and adaptable system.
- **Weighted Interest Selection:** Refine user input by enabling weighted interest selection, prioritizing stronger preferences in recommendations.
- **Integration with Learning Platforms:** Connect with learning management systems (LMS) to explore course availability and user enrolment options.
- **User Feedback and Refinement:** Gather user feedback on recommendations and continuously improve the system's accuracy and effectiveness through data analysis and model updates.

By incorporating these enhancements, the system can evolve into a powerful tool for personalized learning exploration and course selection.

References:

1. ***Smart India Hackathon Problem Statements – 2024***
   A Government of India initiative
2. ***Career Development Theories – Career Choice & Development (3rd Edition) by D. Brown & L. Brooks***
3. ***Open-Source Machine Learning Models***
4. ***Streamlit Documentation***

INDIVIDUAL CONTRIBUTION REPORT:

"DestiNation (AI Based Career counselling)"

Aditya Bhattacharyya
21052219

Individual contribution and findings:

1. Developed the user Log In/ Sign Up authentication feature for the web application of the project. Using this feature, the identity of the user is confirmed while accessing the platform.

2. Developed the Holland Personality Test for the user to identify his/her broad strengths and appropriate field of work.

Signature of Supervisor: Full signature of the student:

……. ……..

INDIVIDUAL CONTRIBUTION REPORT:

"DestiNation (AI Based Career counselling)"

Aranya Ghosh
21052235

Individual contribution and findings:

1. Developed the Chat-Bot feature for DestiNation such that the user can further clarify his/her career related query.
   This provides the user a complete package for identification and sharpening of one's field of interest.

2. Helped in Streamlit Integration of the Model.

Full Signature of Supervisor: Full signature of the student:

……. ……..

INDIVIDUAL CONTRIBUTION REPORT:

"DestiNation (AI Based Career counselling)"

Debjit Maji
21052247

Individual contribution and findings:

1. Developed the Domain Mastery Test feature for DestiNation such that the user can check his/her preparedness in the chosen and field of interest.

2. Helped in Streamlit Integration of the Model & designed the UML Diagrams for the project.

Full Signature of Supervisor: Full signature of the student:

……. …….

INDIVIDUAL CONTRIBUTION REPORT:

"DestiNation (AI Based Career counselling)"

Dipta Debnath
21052249

Individual contribution and findings:

1. Gathered project Information and published work charts. Pre-processed raw data for more accurate and refined results.

2. Prepared the basis of Project Report for DestiNation.

Full Signature of Supervisor: Full signature of the student:

……. ……..

INDIVIDUAL CONTRIBUTION REPORT:

"DestiNation (AI Based Career counselling)"

Sarthak Sur
21052868

Individual contribution and findings:

1. Developed the Interest Inventory Model using appropriate Machine Learning Models for prediction of appropriate courses so that user is channelized to his/her correct field of work.

2. Helped in Data Synthesis for accurate results.

Full Signature of Supervisor: Full signature of the student:

……. ……..

“DestiNation (AI based Career Counselling model)”

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