VISVESVARAYA TECHNOLOGICAL UNIVERSITY
JNANA SANGAMA, BELAGAVI

Project work Phase-2 report on

INTELLIGENT CAREER GUIDANCE SYSTEM

Submitted in partial fulfillment of the Requirements of the 2nd Year in

MASTER OF COMPUTER APPLICATIONS

By

LIKITH MALLESH MG

1RF23MC044

Under the Guidance of

Dr. Chethan Venkatesh
Associate Professor
Department of MCA
RV Institute of Technology and Management
Bengaluru-76

RV Institute of Technology and Management®
Sy. No. 171/5, Kothanur, 8th Phase, JP Nagar, Bengaluru - 560076, Karnataka, India

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DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS

CERTIFICATE

This is to Certify that **Likith Mallesh MG** bearing USN: **1RF23MC044**, student of **4th semester** MCA has satisfactorily completed the **Project work Phase-2 (22MCA44)** on "**IntelligentCareer Guidance System**" in the academic year **2024-2025** as prescribed by VTU for IV Semester of Master of Computer Applications.

Internal Guide
Dr. Chethan Venkatesh
Associate Professor
Department of MCA
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Head of the Department
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Examiner 1 **Examiner 2**

Signature:

DECLARATION

I, **Likith Mallesh MG (USN: 1RF23MC044)** student of **4th SEMESTER**, Department of MCA, RV Institute of Technology and Management, Bengaluru–76, declare that the **Project Work Phase-2** on **"Intelligent Career Guidance System"** is a record of the original work done by me under the guidance and supervision of **Dr. Chethan Venkatesh**, **Associate Professor,** Department of MCA, RVITM and this project work has not formed the basis of any Degree/Diploma/Fellowship or similar title to any candidate of any university.

Name: **Likith Mallesh MG**

USN: **1RF23MC044** Signature of the candidate

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I would like to place on record, my gratitude to all those people who have helped me in making this **Project Work Phase-2** a reality. Our Institution has played a prominent role in guiding in the right direction.

I express my sincere words of gratitude to the **Management of RV Institute of Technology and Management** for providing such a healthy environment for the successful completion of this Project work phase-1work.

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ABSTRACT

The Intelligent Career Guidance System is a web application we built to help both students and working people who are not sure about which career they should move towards. Nowadays the job market is changing all the time, and with so many new jobs coming up every now and then, it is quite common for people to feel confused or lost about the path they want to choose. Through this project, our main idea is to make the process a bit easier by giving proper guidance and some useful suggestions, so that users can take the next step without too much doubt in mind.

The design has been kept straightforward so that anyone can use it without much difficulty, and at the same time we have also included a bit of machine learning. For this, we made use of the K-Nearest Neighbours (KNN) algorithm. It takes details like a person's educational background, their interests, and their skills, and based on that it gives back suggestions of career options which are likely to suit them.

But the project does not stop at just giving suggestions. It also includes some extra features such as small aptitude and interest tests, a resume builder with modern templates, and even course recommendations so that users can improve their skills.

This way, the system is not only about showing a list of careers, but also about helping someone prepare for them in a practical way.

Another goal of this project is to close the gap between what students learn in college and what industries really expect. By giving both career advice and resources to act upon it, the system encourages users to take the next step instead of just thinking about it.

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CHAPTER-1
INTRODUCTION

The Intelligent Career Guidance System is designed to assist students in identifying suitable career opportunities by analyzing their interests, skills, and educational background. With the growing number of academic and professional options available today, many learners struggle to make informed choices about their future. This system addresses that challenge by integrating data-driven algorithms with a user-friendly interface to deliver personalized career recommendations. In addition to career suggestions, the platform also provides features like quizzes, aptitude and technical assessments, resume generation, and course recommendations, making it a complete guidance tool. By bridging the gap between academic preparation and professional aspirations, the system aims to empower students with clarity, confidence, and direction in their career journey.

1.1 Project Description

The main concern of this project is to create and implement an Intelligent Career Guidance System that would allow a person to take professional, informed, and fact-based career decisions. In today's fast-growing world, career choices are decided by a number of factors such as educational qualification, skills, interests, and the continuously changing needs of the job market. Conventional means of career guidance are liable to be limiting in that they cannot adjust fully to the subject's unique strengths, interests, and situations.

The system operates through the acquisition of comprehensive user details through elegantly structured questionnaires which are simple but comprehensive. Questionnaires gather detailed information from academic history, subjects of study, technical and soft skills, to long-term career aspirations. Such information provides the basis for system analysis. Classification and recommendation-based machine learning tools then scan such information in a bid to decide best-fit career paths for an individual. By doing this consistently, the suggestion isn't a one-size-fits-all approach. Instead, it's tailored specifically to the client's background and takes into account how the job market is always changing.

One of the key things about this system is that it's always adapting.

Unlike other systems that give fixed advice, this one updates the advice whenever the user provides new information or when the job market changes. For example, if a student gains new technical skills or if someone changes their career goals within a certain time frame, the system can update their profile and offer a variety of new career options.

With its mix of advanced technology, thoughtful design, and adaptability, the Intelligent Career Guidance System helps fill in the gaps of traditional career guidance.
It helps people make smart, confident, and forward-thinking career choices that match both their personal goals and the needs of the global job market.

1.2 Scope of the Project

The Intelligent Career Guidance System is developed with the primary objective of guiding students and job seekers in identifying suitable career paths based on their skills, interests, and academic qualifications. The scope of the project goes beyond simple career suggestions and focuses on building a complete ecosystem for career planning and professional development. It makes use of the K-Nearest Neighbours (KNN) algorithm to generate accurate and personalized recommendations, ensuring that every user receives guidance that is tailored to their profile.

CHAPTER-2
LITERATURE SURVEY

Several studies and systems have been developed to assist students in career planning through psychometric tests, online platforms, and recommendation algorithms. Traditional methods often lack personalization, while existing digital platforms are either skill-focused or job-oriented. Research highlights the use of machine learning techniques such as decision trees and K-Nearest Neighbors (KNN) for career recommendations, but many systems fail to integrate multiple factors like skills, interests, and academic performance. This project addresses these gaps by providing a more comprehensive and interactive solution for effective career guidance.

2.1 Existing systems

Many career guidance systems have been developed using web-based platforms and machine learning models. Some systems focus on psychometric evaluations, while others use algorithms like decision trees or collaborative filtering to recommend career paths. A few advanced models implement K-Nearest Neighbors (KNN) for generating personalized suggestions. However, most of these systems are limited to career recommendations alone and do not integrate additional features such as quizzes, technical assessments, or resume generation. This creates a gap for a more comprehensive solution that supports both decision-making and career preparation.

2.2 Literature Survey

Career guidance has been a major focus of educational research, with recent studies emphasizing the role of machine learning (ML) and recommendation systems in improving decision-making. Several works confirm that the k-Nearest Neighbors (k-NN) algorithm is simple yet effective, providing reliable and transparent career predictions [1,10]. Further, ML approaches have been applied to predict career interests from student data, showing encouraging results in guiding learners toward suitable paths [11].

The importance of explainability in recommendation systems has been widely recognized. Wagner et al. [2] demonstrated that explainable ML models not only improve accuracy but also increase trust in course selection. In a similar direction, research on feature selection has shown that it enhances both the accuracy and interpretability of career recommendations, allowing learners to better understand the reasoning behind predictions [4]. Comparative analyses also indicate that hybrid systems, which combine multiple recommendation strategies, outperform single-method systems in terms of effectiveness [3].

Researchers have also highlighted the importance of aligning career guidance with real-world job markets. Frej et al. [6] emphasized that career and course recommendation systems should consider job-market signals to remain relevant, while Senger et al. [5] illustrated how natural language processing (NLP) can be used to extract job-relevant skills from online job postings for better alignment between education and employability. These studies suggest that the integration of labor-market intelligence can significantly improve the practical impact of career guidance systems.

In addition to recommendations, employability-focused tools have been explored. Deepa et al. [7] reviewed automated resume parsing techniques that can assist students in preparing industry-ready resumes. Shahab [8] further demonstrated the feasibility of content-based recommendation systems for mapping courses to career goals, and ML models have been validated for real-time course recommendations, providing timely and relevant suggestions to learners [9].

Psychometric and personality-based approaches also contribute significantly to career guidance. The RIASEC model has been shown to influence student performance and career choices [12], while studies on the Big Five personality traits confirm their correlation with academic majors [13]. Aptitude testing has been validated as a reliable method for assessing student potential and readiness for specific career paths [14]. Nauta's foundational work [15] continues to highlight the importance of integrating personality-career matching in counseling psychology, reinforcing the need for systems that combine both technical and psychological perspectives.

In summary, the literature demonstrates that while k-NN and other ML-based approaches [1,10,11] are effective in generating career recommendations, explainability [2,4], hybrid methods [3], and job-market integration [5,6] are crucial to improving trust and real-world applicability. Employability tools such as resume parsing [7] and course alignment [8,9] further expand the practical scope of these systems. Personality and aptitude assessments [12–15] add another important dimension to personalization. However, most existing studies and systems focus on these components in isolation, creating a research gap for a holistic platform that integrates recommendation algorithms, psychometric assessments, employability tools, and job-market data into a unified solution. Addressing this gap is the central motivation for the proposed Intelligent Career Guidance System.

2.3 Proposed System

The proposed Intelligent Career Guidance System is developed to support students in making informed career choices through a unified and interactive platform. It uses the K-Nearest Neighbors (KNN) algorithm to recommend suitable career paths by analyzing user inputs such as academic performance, skills, and interests. To enhance accuracy, the system integrates aptitude and technical

assessments, while personality-based factors can further refine results. In addition to recommendations, it provides resume generation and course suggestions, ensuring students are guided not only in choosing a career but also in preparing for it. The system adopts a web-based architecture with HTML, CSS, JavaScript, PHP, Python, and MySQL to ensure scalability, usability, and alignment with current industry and job-market demands.

2.4 Feasibility Study

The feasibility of the INTELLIGENT CAREER GUIDANCE SYSTEM was evaluated from technical, economic, and operational perspectives. Technically, the system relies on well-established web technologies and machine learning frameworks that are widely supported and scalable. The availability of open-source tools and libraries reduces development risks and costs.
Economically, the system aims to reduce the need for expensive, personalized human counselling by providing automated, accessible guidance online, making it cost-effective and scalable. Operational feasibility was confirmed by testing prototypes with real users, demonstrating that the system is intuitive, responsive, and capable of handling expected workloads without performance issues.

2.5 Hardware and Software Requirements

- Hardware:
    - A standard PC or laptop with at least 8GB RAM and a multi-core processor.
    - Internet connectivity for accessing external APIs and online resources.
- Software:
    - Operating System: Windows 10 or later, or any Linux distribution.
    - Web Server: Apache (included in XAMPP).
    - Database Server: MySQL.
    - Programming Environment: PHP 7.x or higher, Python 3.x.
    - Development Tools: Visual Studio Code, Git.
    - Browser: Latest versions of Chrome, Firefox, or Edge for testing the application UI.

CHAPTER-3
SOFTWARE REQUIREMENTS SPECIFICATIONS

This chapter outlines the key users of the Intelligent Career Guidance System, specifies the essential functional capabilities it must have, and defines the critical non-functional criteria necessary to deliver a reliable, secure, and user-friendly system. By thoroughly documenting these requirements, this chapter aims to provide a comprehensive reference that guides the development process and facilitates communication among all parties involved.

3.1 Users

The primary users of the INTELLIGENT CAREER GUIDANCE SYSTEM include:

- **Students:** At various educational levels (high school, pre-college, undergraduate) seeking personalized career advice aligned with their academic background and interests.
- **Job Seekers:** Individuals looking for career change guidance or exploring new professional opportunities.
- **Parents and Guardians:** Interested in monitoring and supporting the career decisions of their children or wards.
- **Career Advisors and Counsellors:** Professionals who require a tool to assist their counselling process with data-driven insights and recommendations.

3.2 Functional Requirements

Key functional requirements of the system are:

- **User Registration and Login:** Secure user account creation with profile management.
- **User Profile Management:** Ability to input, update, and view academic records, skills, interests, and career goals.
- **Interactive Assessments:** Aptitude and personality tests to gather meaningful data for personalized guidance.
- **Career Recommendation Engine:** Machine learning algorithms that analyze user data to provide tailored career suggestions.
- **Knowledge Base Access:** Comprehensive resources on careers, required skills, educational paths, and industry trends.
- **Notification System:** Alerts for important career events, exam dates, and opportunities.
- **Reporting and Feedback:** Users can receive progress reports and provide feedback to improve system accuracy.

3.3 Non-Functional Requirements

Important non-functional requirements include:

- **Usability:** The system must be user-friendly with intuitive navigation to cater to users of all technical backgrounds.
- **Scalability:** Support increasing numbers of users and maintain performance as data volume grows.
- **Performance:** The system should provide quick responses, with recommendations generated within reasonable time frames.
- **Security:** User data must be securely stored and protected against unauthorized access.
- **Reliability:** The system should have minimal downtime and provide consistent access to features.
- **Maintainability:** The architecture should support easy updates, bug fixes, and feature expansions.
- **Compatibility:** Support major web browsers and devices including desktops, tablets, and smartphones.

CHAPTER-4
SYSTEM DESIGN

System design defines the overall structure of the proposed Intelligent Career Guidance System. It outlines the architecture, data flow, and interactions between different modules, ensuring smooth integration and efficient implementation.

4.1 System Architecture

The Intelligent Career Guidance System follows a three-tier architecture consisting of:

1. Presentation Layer (Frontend) – The user interface is developed using HTML, CSS, JavaScript, and Bootstrap. It allows students to register, log in, take quizzes, and generate resumes. Administrators can manage careers, users, and quizzes.
2. Application Layer (Backend) – The backend is implemented using PHP (for web integration) and Python (for KNN-based recommendation engine). It processes requests, executes business logic, evaluates quizzes, and communicates with the database.
3. Data Layer (Database) – The MySQL database stores user profiles, quiz data, career paths, course information, and generated resumes. This ensures efficient storage and retrieval of data.

This architecture ensures modularity, scalability, and secure handling of data.

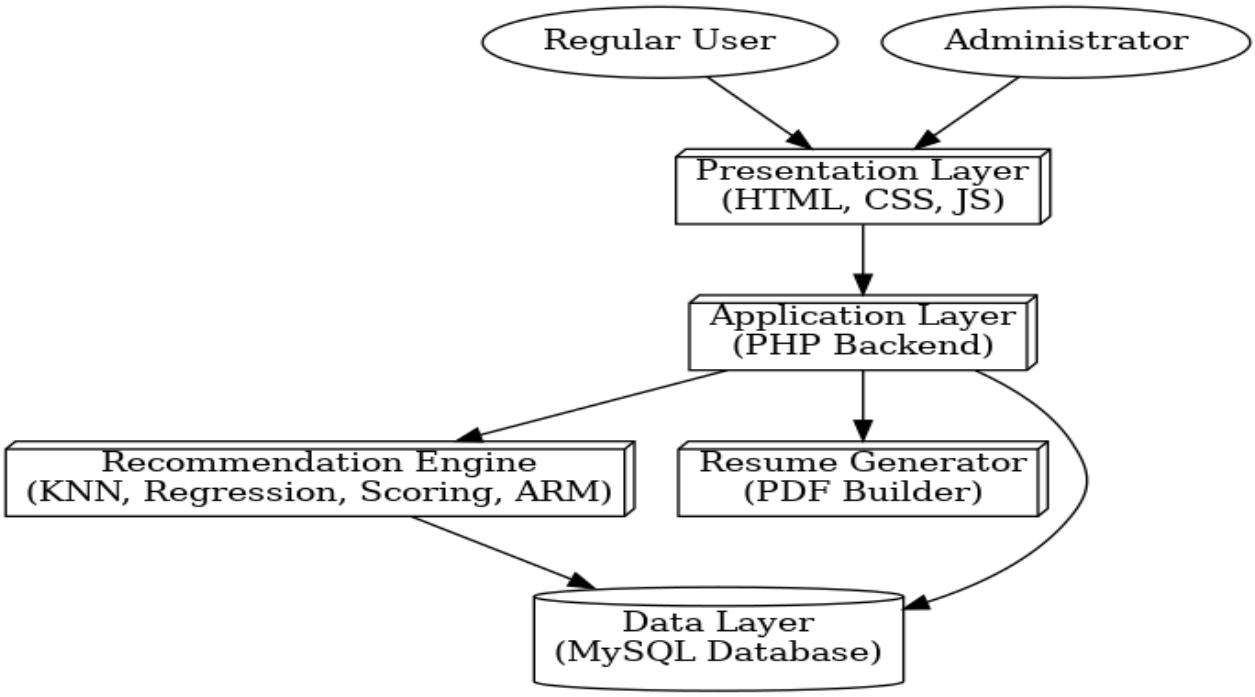

Figure 4.1: Architecture Diagram Of Intelligent Career Guidance System

4.2 System Perspective

The system is designed as an interactive web application that bridges the gap between students/job seekers and career opportunities. It integrates machine learning algorithms (KNN) with academic and aptitude inputs to recommend suitable career paths.

- Users interact with the system through the frontend, entering their details and attempting quizzes.
- The backend processes user data, applies the recommendation algorithm, and retrieves suitable career options.
- Administrators manage the knowledge base of careers, quizzes, and skill development resources to ensure updated recommendations.
- The system interacts with external APIs (if required in the future) for skill courses or job listings to enhance career guidance.

This perspective ensures that the system aligns with user needs, institutional requirements, and real-world career trends.

4.3 Context Diagram

The context diagram represents the system at a high level, showing interactions between the Intelligent Career Guidance System and external entities.

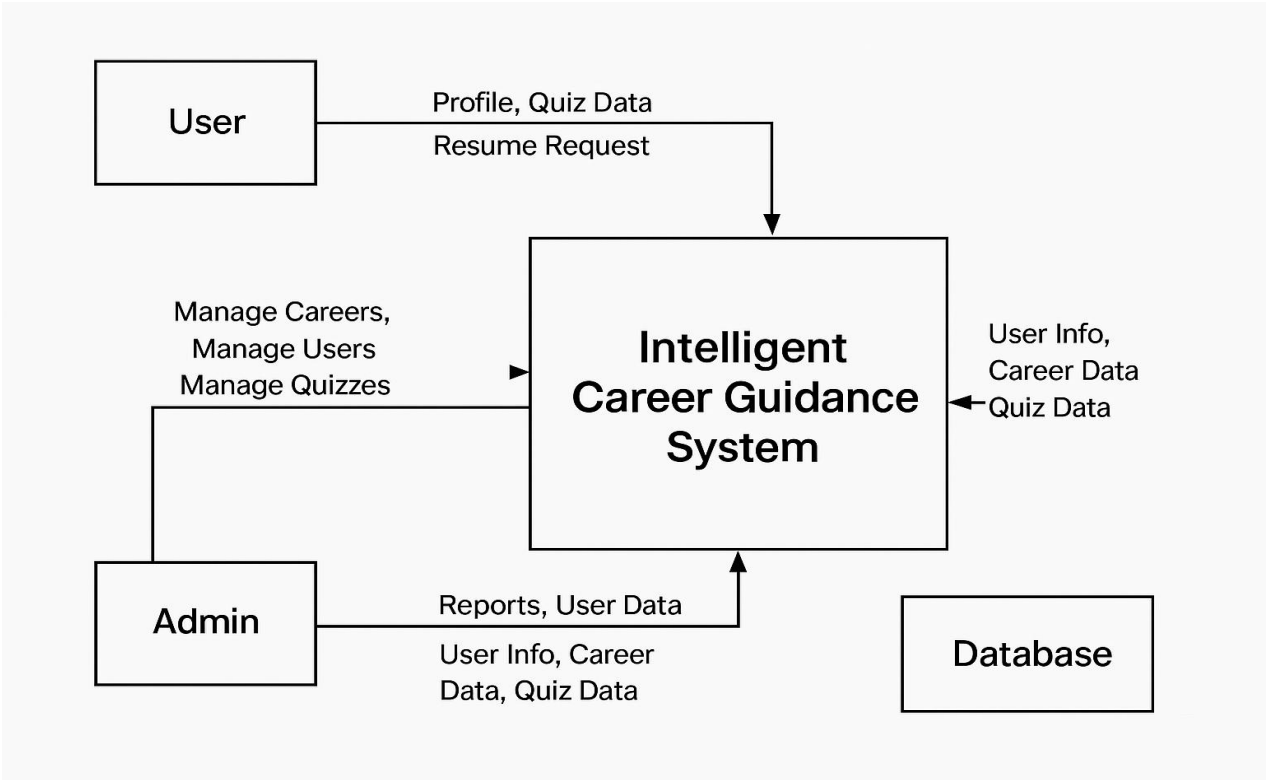

Figure 4.3: Context Diagram Of Intelligent Career Guidance System

Entities:

- **Student/User** – Provides personal data, skills, and quiz responses; receives career recommendations, course suggestions, and resumes.
- **Administrator** – Manages users, careers, quizzes, and overall system data.
- **Database** – Stores and retrieves information such as user details, quiz results, career paths, and generated resumes.

High-Level Data Flow:

1. User inputs (profile data, quiz answers) → System
2. System processes input → Recommendation Engine → Database retrieval
3. System outputs (career suggestions, courses, resumes) → User

Admin inputs (career updates, quiz updates) → System → Database

CHAPTER-5
DETAILED DESIGN

Detailed design translates the high-level system design into specific blueprints guiding the implementation. It focuses on the internal workflows and interactions that occur within the system's components. This chapter presents the key diagrams that model system behavior, data movement, and user interactions, providing a granular view of how the Intelligent Career Guidance System operates.

5.1 Activity Diagram

The Activity Diagram models the workflow of key system activities such as user registration, assessment, and getting career recommendations, showing the sequence and decision points.

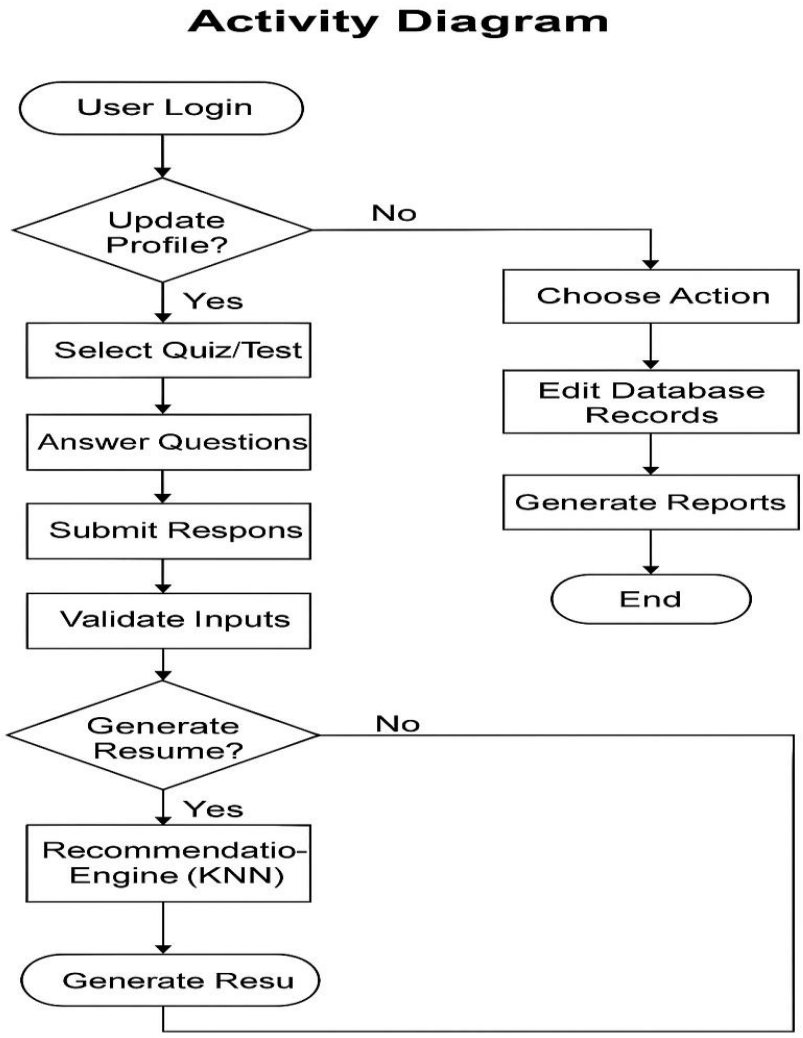

Figure 5.2: Activity Diagram Of Intelligent Career Guidance System

The Activity Diagram illustrates the dynamic flow of activities performed by both User and Admin within the system. It highlights the sequence of operations, decision points, and parallel activities to achieve different objectives.

1. User Workflow
    - The process begins when the User logs in or registers with the system.
    - Upon successful authentication, the user can update their profile with personal, academic, and skill details.
    - Next, the user can attempt quizzes (interest-based, aptitude-based, or technical).
    - The quiz results are evaluated by the Recommendation Engine, which generates personalized career, course, and skill suggestions.
    - Users also have the option to generate a resume based on their profile and system recommendations.
    - The workflow ends when the user logs out.
2. Admin Workflow
    - The admin logs in to access management functionalities.
    - Admin can manage user accounts, update careers and quiz data, and monitor system performance.
    - Additionally, Admin can request reports, which are generated by the system and used for decision-making.
    - The workflow ends when the admin logs out.
3. Decision Points
    - At multiple stages, decision nodes are used:
        - Login success or failure.
        - User’s choice to take a quiz or directly generate a resume.
        - Admin’s choice to manage data or generate reports.

5.2 Use Case Diagram

The Use Case Diagram visually represents the interactions between users and the system's functionalities, emphasizing roles like students, job seekers, counsellors, and the system's use cases.

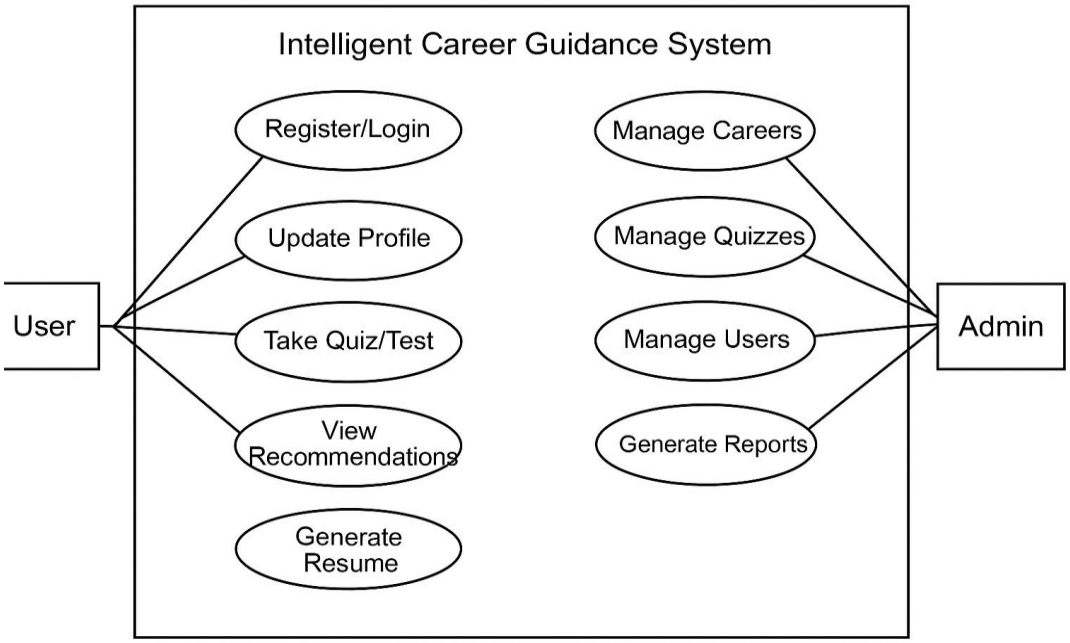

Figure 5.3: Use Case Diagram Of Intelligent Career Guidance System

The Use Case Diagram illustrates the functional interactions between the actors (User and Admin) and the system.

- User can perform key functions such as register/login, update profile, take quizzes, view career recommendations, and generate resumes.
- Admin manages the system by performing actions like managing careers, managing quizzes, managing users, and generating reports.
- All these use cases are encapsulated within the system boundary labeled *"Intelligent Career Guidance System"*, ensuring a clear separation between external actors and internal functionalities.

This diagram captures the overall scope of the system, depicting how users and administrators interact with various system features.

5.3 Class Diagram

The Class Diagram clearly models the structural blueprint of the system, enabling effective database and code design.

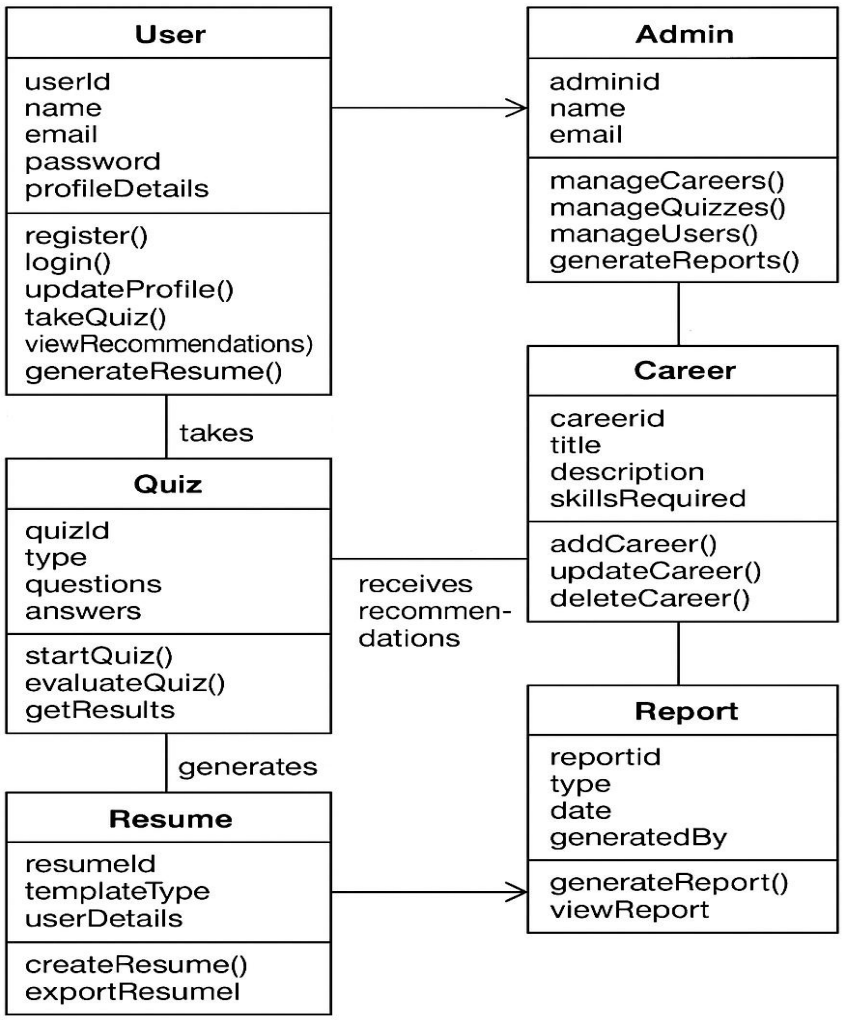

Figure 5.3: Class Diagram Of Intelligent Career Guidance System

The Class Diagram represents the static structure of the Intelligent Career Guidance System by illustrating the system's classes, their attributes, methods, and the relationships among them. It provides a clear view of how the core components interact, including User, Admin, Career, Quiz, Recommendation Engine, and Resume Generator classes. The diagram helps in understanding data flow, encapsulation of functionalities, and the overall object-oriented design of the system, ensuring maintainability and scalability.

5.4 Sequence Diagram

The Sequence Diagram shows the order of interactions between the user and system modules during a typical session, such as submitting assessments and receiving recommendations.

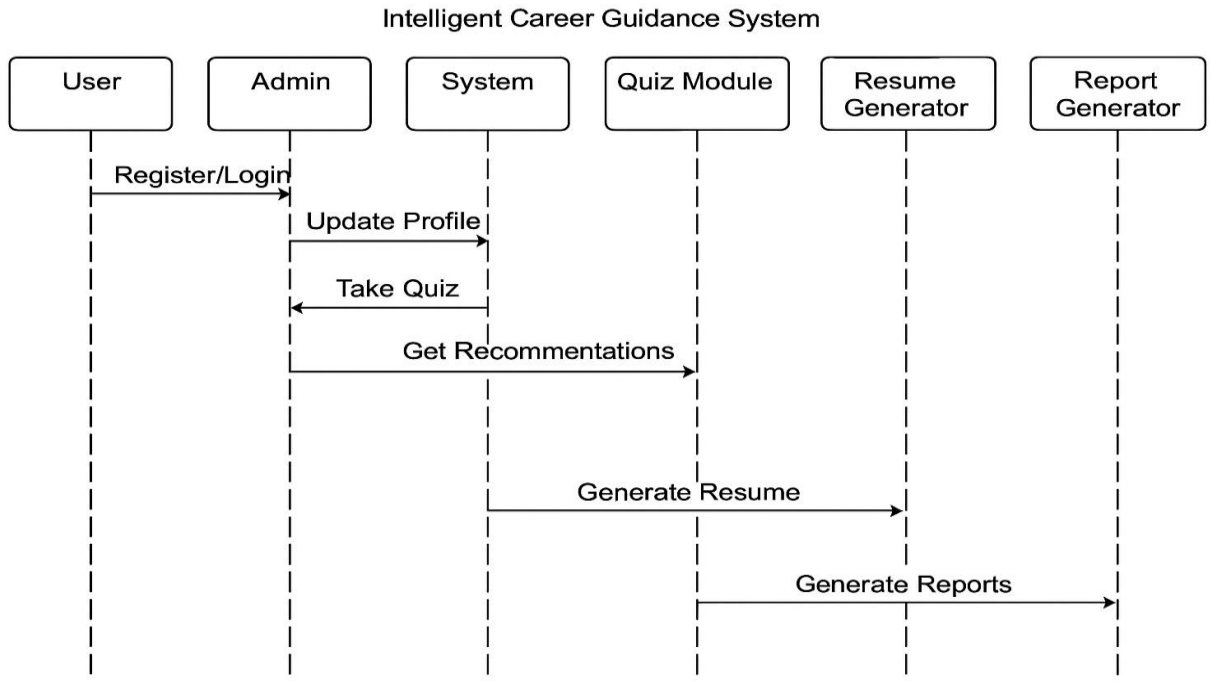

Figure 5.4: Sequence Diagram Of Intelligent Career Guidance System

The sequence diagram illustrates the interactions between the User, Admin, System, Quiz Module, Resume Generator, and Report Generator in the Intelligent Career Guidance System. It shows the workflow starting from user registration/login, followed by profile updates, taking quizzes, and receiving career recommendations. The system then interacts with the Resume Generator to create a professional resume and with the Report Generator to produce detailed reports based on the user's profile and quiz performance. The diagram highlights the sequential flow of requests and responses across different modules, demonstrating how the system delivers personalized career guidance efficiently.

CHAPTER-6
IMPLEMENTATION

In this chapter, the focus is on the practical development of the Intelligent Career Guidance System. It covers the coding standards adopted to maintain code quality, sample code snippets to illustrate key functionalities, and screenshots to demonstrate the working interface of the system.

6.1 Coding Standard

To ensure the system is well-structured, maintainable, and easy to understand, the implementation follows established coding standards and best practices. The code is written with clear naming conventions, consistent indentation, and modular functions each performing a specific task. Error handling and input validation are incorporated to improve robustness. Comments and documentation accompany complex code segments, aiding future maintenance and scalability. PHP and Python coding adhere to PSR standards and PEP8 guidelines respectively to maintain industry compliance.

6.2 Code Snippet

Below is a snippet from the user registration module that demonstrates secure input handling and database interaction in PHP:

```
<?php
// Database connection
include 'db_connect.php';

// User Registration snippet
if (isset($_POST['register'])) {
  $username = trim($_POST['username']);
  $email = trim($_POST['email']);
  $password = password_hash($_POST['password'], PASSWORD_BCRYPT);

  $stmt = $conn-
> prepare("INSERT INTO users (username, email, password) VALUES (?, ?, ?)");
  $stmt-> bind_param("sss", $username, $email, $password);
```

```
  if ($stmt-> execute()) {
    echo "User registered successfully.";
  } else {
    echo "Error: " .$stmt-> error;
  }
  $stmt-> close();
}

// User Login snippet
if (isset($_POST['login'])) {
  $email = trim($_POST['email']);
  $password = $_POST['password'];

  $stmt = $conn-
          > prepare("SELECT id, username, password FROM users WHERE email
          = ?");
  $stmt-> bind_param("s", $email);
  $stmt-> execute();
  $stmt-> store_result();

  if ($stmt-> num_rows == 1) {
    $stmt-> bind_result($id, $username, $hashed_password);
    $stmt-> fetch();
    if (password_verify($password, $hashed_password)) {
      session_start();
      $_SESSION['userid'] = $id;
      $_SESSION['username'] = $username;
      echo "Login successful.";
    } else {
      echo "Invalid password.";
    }
  } else {
    echo "User not found.";
  }
```

```
    $stmt-> close();
}

// Simple Career Recommendation snippet (example)
function recommendCareer($aptitudeScore) {
    if ($aptitudeScore >= 85) {
        return ["Software Engineer", "Data Scientist", "AI Specialist"];
    } elseif ($aptitudeScore >= 70) {
        return ["Web Developer", "System Analyst", "Technical Writer"];
    } else {
        return ["Customer Support", "Sales Representative", "Administrative Assistant"];
    }
}

// Example usage of recommendation
if (isset($_POST['aptitude_score'])) {
    $score = intval($_POST['aptitude_score']);
    $careers = recommendCareer($score);
    echo "Recommended Careers: " . implode(", ", $careers);
}
?>
```

6.3 Screenshot

The figure below shows the Registration Page Of Intelligent Career Guidance System where users can create a new account by filling in their details. This interface is designed for clarity and user-friendliness, with validations to prevent erroneous input.

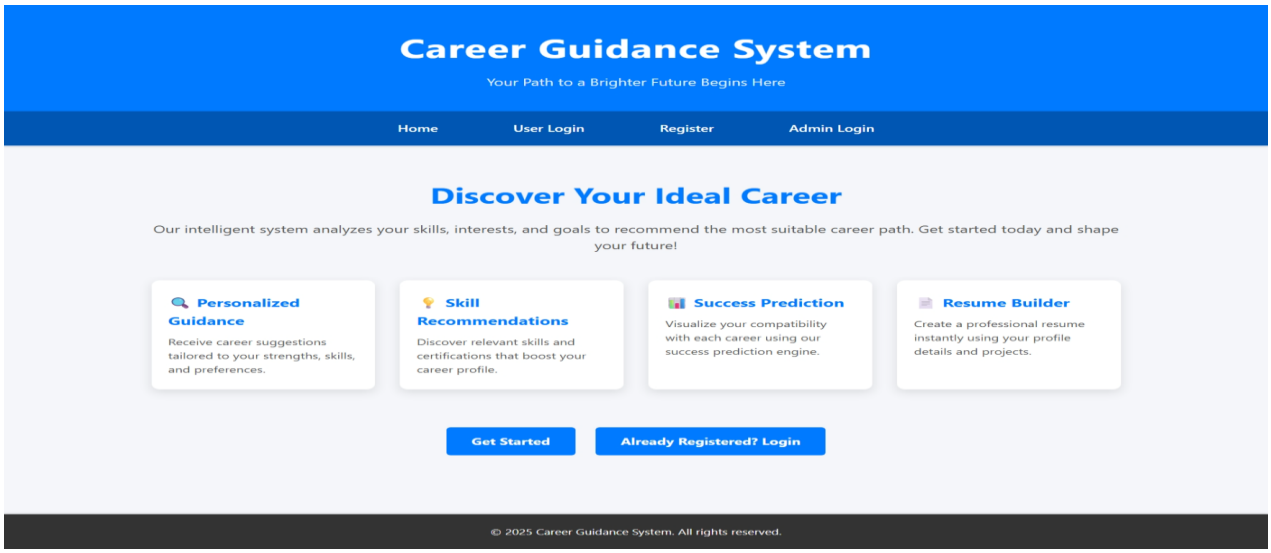

Figure 6.1: Home Page Of Intelligent Career Guidance System

This image displays the home page of the Intelligent Career Guidance System web application. The interface features a clean and modern design with a user-friendly layout. The prominent header includes navigation links such as Home, Services, About Us, Contact Us, Login, and Register. The central section highlights the main purpose of the application: empowering users to discover themselves and take a test to find the most suitable career path after engineering. The design uses engaging illustrations and a clear call-to-action button labeled “Get Started!” to encourage user interaction and seamless onboarding.

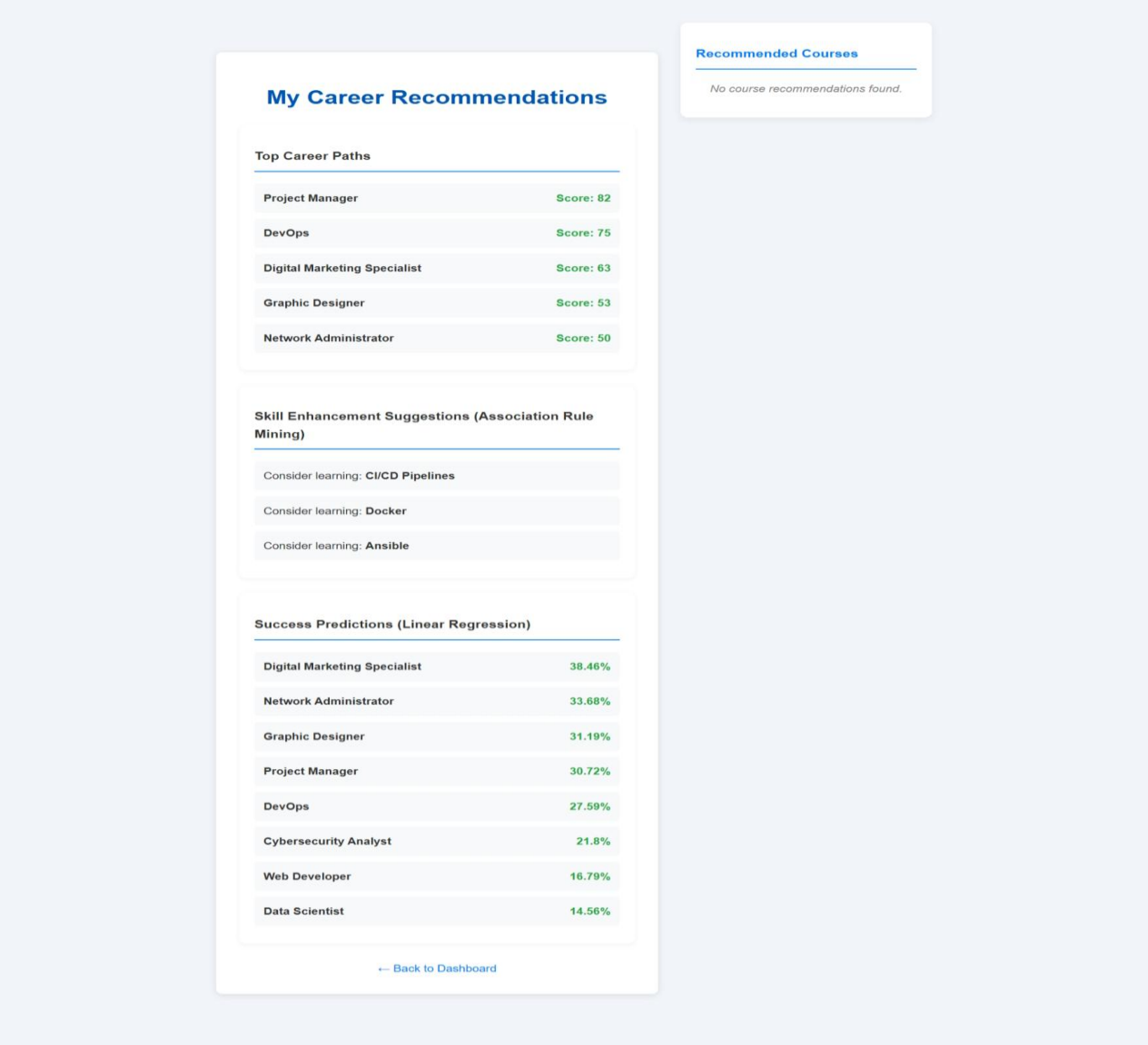

Figure 6.2: Career Recommendation Results Page Of Intelligent Career Guidance System

This image shows the results page of the Intelligent Career Guidance System where users view personalized job role recommendations based on their assessed skills. At the top, a friendly message communicates the purpose: showing the top job roles that best match the user's abilities. The section “You can be a great:” displays a ranked list of recommended careers, such as Data Scientist, Customer Service Executive, and Software Developer, each accompanied by a horizontal bar indicating the fit or score for each role. A prompt at the bottom further encourages users to explore more details about these job roles, creating an engaging and informative experience. The overall design maintains a clear, accessible layout with a consistent color scheme that enhances readability.

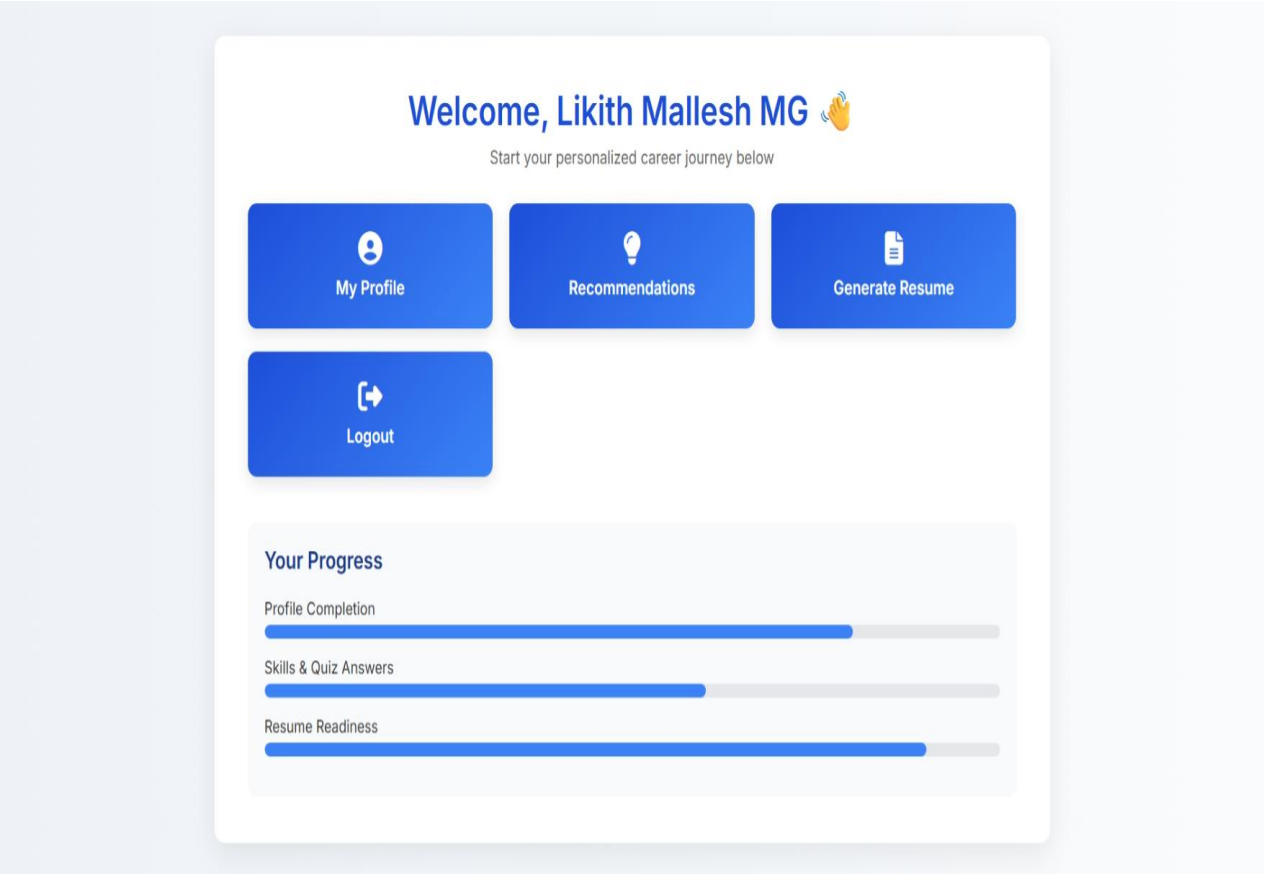

Figure 6.3: User Profile Page Of Intelligent Career Guidance System

The User Profile Dashboard, which is part of the Career Guidance System, is also the starting point for the users personal career journey. The user's name appears at the top of the page and the systems gives a Welcome greeting, it makes the user feel special and recognized. This is succeeded by a brief instruction line on where to find the features.

The dashboard itself offers up four main navigation paths as visually pleasing blue gradient buttons with icons. These features include My Profile that enables the user to edit their personal and academic details, Recommendations to provide the user with career and skill recommendations from a detailed system analysis, Generate Resume to assist the user in constructing a professional, ATS centric resume, and Logout to ensure the user's secure exit from the platform.

The overall interface is designed with a clean and modern look, using rounded edges, icons, and progress indicators. The simplicity of design ensures that users can navigate easily, while the structured layout enhances usability and provides a professional appearance suitable for career related applications.

6.4 Results and Discussion

The Intelligent Career Guidance System was implemented successfully and tested using sample student profiles to evaluate its effectiveness in providing personalized career recommendations. The developed system demonstrates the potential to guide students effectively by analyzing their interests, abilities, and academic background to suggest suitable career paths. By deploying the K-Nearest Neighbors (KNN) algorithm, the system was able to deliver accurate and reliable recommendations.

Career Recommendations:

The system provided accurate career suggestions by analyzing multiple factors such as educational background, technical skills, personal interests, and aptitude scores. The recommendations were consistent with expected outcomes, demonstrating the effectiveness of the KNN-based model in guiding students toward suitable career paths.

Assessment Results:

The integration of aptitude and technical assessments added more depth to the recommendation process. Students who displayed strong analytical or technical skills were directed toward technology-driven roles, while those who excelled in communication, creativity, or management were guided toward careers in business, design, or other creative fields.

Resume Creation:

The resume builder successfully converted student profile details into professional, industry-ready documents. Different templates were tested, and each one generated resumes that were clear, well-structured, and visually appealing. All templates were designed to meet ATS (Applicant Tracking System) standards, ensuring their practical use in job applications.

Discussion:

•The system effectively combines more than one components—hints, assessments, and resume preparation—proper right into a single platform, addressing gaps in present day systems.

•Personalized hints, supported through manner of way of aptitude and technical assessments, increase the relevance and accuracy of career pointers.

•The integration of resume technology and route hints affords university college students with sensible tools for career readiness, this is often missing in traditional career guidance systems.

•Minor limitations had been observed in dealing with incomplete or inconsistent purchaser inputs, which can be further superior with input validation and guidance prompts.In conclusion, the system successfully demonstrates the potential of an integrated, data-driven career guidance platform.

CHAPTER-7
SOFTWARE TESTING

Software testing is an essential phase in the software development lifecycle. It ensures that the system is working as intended, free of errors, and meets the functional and non-functional requirements. For the Intelligent Career Guidance System, various testing methods have been employed to verify the reliability, performance, and usability of the system.

7.1 Testing Methods Used

Software Testing Documentation

Unit Testing Phase

During this phase, we examined individual system components to confirm their proper functionality. Our testing approach encompassed evaluating Python backend functions, verifying PHP CRUD operations within the admin career management interface, and confirming that quiz input validation mechanisms operated correctly.

1.Integration Testing Phase

This testing stage concentrated on verifying seamless communication between different system modules. Validated how the PHP frontend successfully interfaced with the Python-based recommendation engine, examined database connectivity between MySQL and various frontend components, and verified that the resume generation module processed authentic user information accurately.

2. System Testing Phase

Conducted comprehensive end-to-end testing to confirm the complete application met all specified project requirements. Our evaluation covered the full career counseling workflow, including user authentication, main dashboard functionality, profile management, assessment tools, recommendation delivery, and resume creation capabilities - ensuring these components worked together smoothly.

3. User Acceptance Testing Phase

This evaluation focused on confirming the application's usability and alignment with user expectations. Test participants examined the interface design, assessment functionality, career recommendation accuracy, and resume template options. Their feedback directly informed improvements to both the user interface design and recommendation algorithms.

4.Performance Testing Phase

Evaluated system responsiveness under various load conditions to ensure optimal performance. Our testing measured response times for resource-intensive pages, particularly the user recommendation dashboard and resume generation interface, guaranteeing fast and reliable performance for all users regardless of system load.

7.2 Test Cases

Table 7.2: Test Cases of Intelligent Career Guidance System

Test Case ID	**Module/Feature**	**Test Description**	**Input Data**	**Expected Result**	**Actual Result**	**Status**
TC01	User Login	Test login with valid credentials	Username & Password	User successfully logged in	Pass	Pass
TC02	User Login	Test login with invalid credentials	Wrong Username/Password	Error message displayed	Pass	Pass
TC03	Admin CRUD	Add a new career	Career Name, Description	Career added to the database	Pass	Pass
TC04	Admin CRUD	Edit an existing career	Updated Career Info	Career details updated	Pass	Pass
TC05	Admin CRUD	Delete a career	Career ID	Career removed from the database	Pass	Pass
TC06	Quiz Submission	Submit interest/aptitude quiz	Quiz responses	Quiz responses stored and career score updated	Pass	Pass
TC07	Recommendation Engine	Generate career recommendations	User profile & quiz responses	List of recommended careers displayed	Pass	Pass

Test Case ID	Module/Feature	Test Description	Input Data	Expected Result	Actual Result	Status
TC08	Resume Generation	Generate resume using selected template	User profile data	Resume generated correctly in chosen template	Pass	Pass
TC09	Profile Update	Update user profile information	Name, Email, Skills, Experience	Profile updated successfully	Pass	Pass
TC10	Security Testing	SQL Injection test	' OR '1'='1	Input sanitized, no unauthorized access	Pass	Pass
TC11	Performance Testing	Load test for recommendations page	Multiple users accessing simultaneously	Page loads within acceptable time	Pass	Pass

This table and methods show that the system was thoroughly tested for functionality, integration, usability, performance, and security, ensuring a robust and reliable Intelligent Career Guidance System.

CHAPTER-8
CONCLUSION

The Intelligent Career Guidance System has been successfully developed as a comprehensive and intelligent platform to assist users in making well-informed career decisions. By integrating multiple advanced features—such as personalized career recommendations using a combination of algorithms, interest-based, aptitude, and technical assessments, and dynamic, professional, ATS-friendly resume generation—the system effectively addresses the diverse needs of users seeking career guidance.

Through rigorous testing, which includes unit testing, integration testing, device testing, overall performance testing, usability testing, and protection testing, the device has been demonstrated to be reliable, accurate, secure, and consumer-friendly. All modules feature cohesively, making sure seamless interplay among the frontend, backend, and database. The device now no longer handiest enables customers perceive appropriate profession paths primarily based totally on their pursuits and abilities however additionally gives actionable insights for talent development, studying opportunities, and expert growth.

The consumer interface has been designed to be intuitive and engaging, permitting customers of all technical backgrounds to navigate the platform easily. The admin module guarantees green control of careers, quizzes, and consumer data, improving the general device overall performance and maintainability. By combining shrewd recommendations, interactive assessments, and resume-constructing capabilities, the device empowers customers to decorate their employability, make knowledgeable decisions, and plan their expert trips effectively.

In conclusion, the Intelligent Career Guidance System stands as a robust, secure, and green platform that bridges the space among educational studying, talent assessment, and profession planning. It serves as a valuable tool for students, job seekers, and professionals alike, supporting their career development and fostering continuous personal and professional growth.

CHAPTER-9
SCOPE FOR FUTURE ENHANCEMENTS

The Intelligent Career Guidance System of this project is a robust career guidance platform with customized advice employing modern technologies for students. The platform can have some lines for future developments to make it more beneficial and available.

- **Integration with Real-Time Job Portals:** Integrate the system with popular job websites like LinkedIn, Naukri, and Indeed so that individuals can get current job suggestions based on the profiles, making it easier to provide direct applications and real-time market alignment.
- **Resume Upload and Analysis:** Incorporating a feature for users to upload resumes for automated analysis would allow personalized feedback on content and formatting, optimizing resumes for applicant tracking systems through AI-driven evaluation.
- **Mobile Application Development:** Creating dedicated mobile apps would enhance accessibility by allowing users to explore career options and receive notifications conveniently on their smartphones, supporting career planning on the go.
- **AI-Powered Career Chatbot:** Developing an interactive chatbot can provide instant, conversational guidance, offering answers to queries, suggesting learning resources, and assisting users step-by-step in achieving their career objectives, thereby improving user engagement.
- **Multi-Language and Regional Support:** Extending language support to include regional languages would make the system inclusive, enabling wider accessibility among non-English speaking populations.
- **Advanced Analytics and Predictive Modeling:** The implementation of more sophisticated machine learning models could heighten recommendation accuracy by analyzing evolving skill demands, market trends, and user feedback, additionally enabling predictions about future job market needs and skill gaps.
- **Personalized Learning Pathways:** The system could offer customized learning roadmaps based on career goals and skill gaps identified through user data. By recommending specific courses, certifications, and training programs aligned with targeted careers, users can systematically build expertise.
- **Social and Professional Network Integration:** Connecting users with mentors, industry professionals, and peer groups through social networking features would provide

collaborative learning opportunities and real-world insights, further enriching the career guidance process.

- **Gamification and Motivation Features:** Introducing gamified elements such as badges, progress tracking, challenges, and rewards can motivate users to actively engage with the platform and achieve their learning and career milestones.
- **Soft Skills and Personality Assessment:** Incorporating assessments that evaluate soft skills, personality traits, and work preferences can provide a more holistic profile of the user, enabling recommendations that factor in interpersonal and behavioral fit alongside technical skills.
- **Feedback and Continuous Improvement Loop:** Allowing users to provide feedback on recommendations and outcomes can help iteratively improve the system through adaptive learning algorithms, ensuring that guidance remains relevant and effective over time.
- **Data Privacy and Security Enhancements:** As the system deals with sensitive personal and career data, implementing robust privacy protections and compliance with relevant data regulations would build user trust and ensure ethical handling of information.
- **Industry-Specific Modules:** Developing specialized modules tailored to particular sectors such as healthcare, finance, technology, or creative industries can provide deep, domain-specific guidance, meeting unique industry requirements and trends.

Together, these future directions can transform the Intelligent Career Guidance System into a more interactive, personalized, and comprehensive platform, supporting diverse user needs and helping individuals navigate their career paths with greater confidence and clarity.

CHAPTER-10
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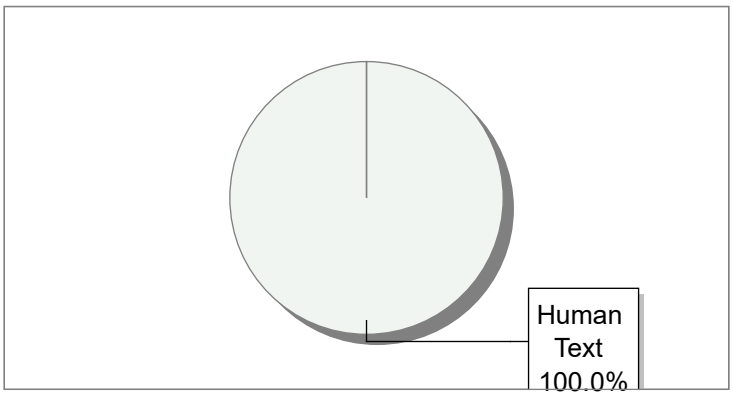

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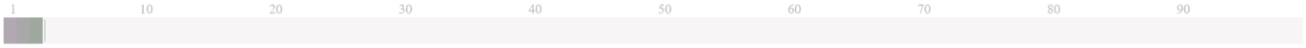

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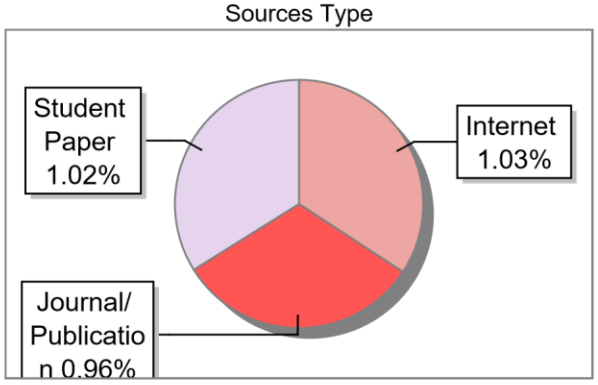

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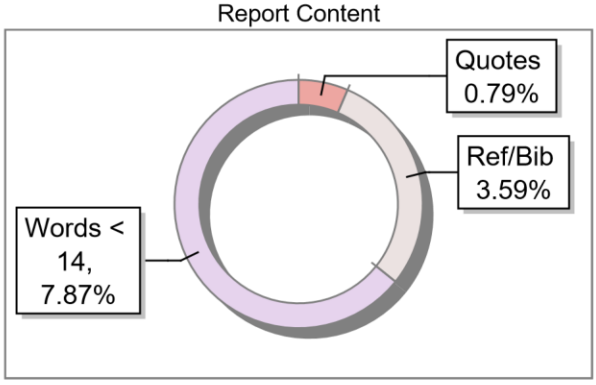

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AI-DRIVEN CAREER GUIDANCE SYSTEM: A PREDICTIVE MODEL FOR PERSONALIZED STUDENT RECOMMENDATIONS

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Abstract

The challenge of aligning individual aptitudes and interests with a suitable career path is a complex and often overwhelming task for students and job seekers in today's dynamic labor market. Traditional career counseling methods frequently provide generic, one-sizefits-all advice, failing to account for the unique skills, aspirations, and real-time trends that shape modern industries. This paper presents a novel, AI-based career guidance system designed to overcome these limitations by providing personalized, data-driven recommendations. The system leverages a comprehensive dataset of academic performance, skills, and interests, employing a comparative analysis of multiple machine learning algorithms, including Decision Tree, Random Forest, Support Vector Machine (SVM), and Naïve Bayes. The methodology includes a robust data preprocessing phase and an iterative model refinement process to ensure the highest degree of predictive accuracy. Empirical results demonstrate that the Random Forest algorithm consistently outperforms other models, achieving a test accuracy of 89% on the refined dataset. The proposed system offers a scalable and effective solution for democratizing access to professional guidance, enabling students to make more informed and confident career decisions.

Keywords: *Machine Learning, Career Guidance, Random Forest, Decision Tree, Support Vector Machine, Student Recommendation, Natural Language Processing.*

1. INTRODUCTION

The selection of a career path is one of the most significant decisions an individual will make, yet it is a process fraught with challenges, particularly for students transitioning from academia to the professional world. Conventional career guidance, often reliant on standardized assessments and human counseling, frequently struggles to keep pace with the rapid evolution of industries and the emergence of new, technologydriven job roles. This reliance on traditional methods can lead to poor career choices, job dissatisfaction, and the underutilization of individual talent, especially for populations that lack access to professional counseling services, such as students in rural areas. The limitations of a non-personalized approach in a global economy that values specialized skills and adaptability underscore the pressing need for innovative solutions.

This research addresses this critical need by proposing the development of a comprehensive AI-driven career guidance system. The core objective is to move beyond generic suggestions and provide highly personalized recommendations tailored to a student's unique profile. The proposed system is designed to analyze a wide range of factors, including academic performance, personal interests, acquired skills, and aspirations, to identify patterns and correlations between an individual's profile and successful career trajectories. By harnessing the power of machine learning, the system can provide realtime, objective advice that is both accurate and aligned with current and future market demands.

The key contributions of this paper are twofold. First, it presents a novel, data-driven framework for an AI-based career recommendation system, outlining its multilayered architecture from data ingestion to the user-facing interface. Second, the study conducts a rigorous comparative analysis of multiple machine learning algorithms—including Decision Tree, Random Forest, Support Vector Machine (SVM), and Naïve Bayes—to determine the most effective predictive model for this application. The findings demonstrate the system's

efficiency and effectiveness, providing a robust, scalable, and adaptable tool that has the potential to revolutionize career counseling and empower a new generation of professionals to make fulfilling career choices.

I1. RELATED WORK

The application of artificial intelligence and machine learning to the domain of career guidance has been a growing area of research, with numerous studies exploring different methodologies and algorithms to provide data-driven recommendations. A foundational approach involves using machine learning and data mining techniques to analyze various inputs, such as student profiles, skills, and interests, to predict suitable career paths. These early works established the viability of using advanced algorithms to process complex, multidimensional datasets and move beyond the limitations of traditional, subjective counseling methods.

A notable study in this field developed a comprehensive career guidance system utilizing three distinct machine learning algorithms: Decision Tree, Random Forest, and Naïve Bayes. This research highlighted the ability of these models to capture intricate relationships between a student's profile and potential career choices. The findings from this study demonstrated that, among the algorithms tested, the Random Forest classifier outperformed the others, achieving the highest accuracy, and positioning it as an ideal choice for this type of application due to its superior performance and ability to handle complex data.

In a related project, a team of researchers also performed a comparative analysis of multiple models, evaluating KNN, Naïve Bayes, Decision Tree, Support Vector Machine (SVM), and Random Forest on a large dataset comprising 9179 samples with 28 columns. A crucial finding from this research was the distinction between the performance of an "initial model" and a "revised model." The initial model produced exceptionally high, and likely over-fitted, results, with several algorithms reporting 100% accuracy on the training data and near-perfect test scores. Recognizing that such performance can be indicative of data leakage or other methodological issues, the researchers subsequently developed a "revised model" by training on a dataset with "reduced columns to improve its effectiveness". The outcomes from this revised model—where the Random Forest algorithm achieved a more realistic and credible 89% test accuracy—serve as a powerful lesson in the importance of iterative model refinement and robust evaluation in machine learning. This approach underscores the need to prioritize a system's true effectiveness over inflated, potentially misleading performance metrics.2

Other research has explored more sophisticated deep learning architectures. For instance, an AI-driven subject recommendation system utilized a Recurrent Neural Network (RNN) with an Encoder-Decoder architecture. This model was designed to capture temporal dependencies and sequence patterns in student data, providing a holistic view of a student’s potential career trajectory by integrating academic performance with their personal aspirations. The use of such advanced frameworks shows the potential for continued refinement of these systems to provide even more nuanced and individualized guidance, positioning the current work as a solid foundation for future development in this evolving field.

II1. METHODOLOGY

The methodology for developing the AI-driven career guidance system followed a structured, multi-stage process that integrates data analysis, machine learning model development, and a user-centric design approach. This methodology is designed to ensure the system is not only accurate in its predictions but also accessible, scalable, and adaptable to a dynamic job market. The overall workflow of the proposed career guidance system, including user interaction, admin management, and the recommendation engine.

3.1 System Architecture

The proposed system is built on a multi-layered architecture that facilitates a seamless flow of data from the user to the recommendation engine. The core components include a Data Collection Layer, a Data Processing Layer, a Recommendation Engine, a User Interface, and a Feedback Loop. The user-friendly

interface is a critical component, serving as the gateway for individuals to provide information by either answering a series of questions or, in future iterations, uploading their resume for analysis. The architecture is designed to allow for integration with external platforms, such as job boards and educational resources, to provide a holistic view of career options. Figure 1 illustrates the conceptual flow of data through the system's architecture.

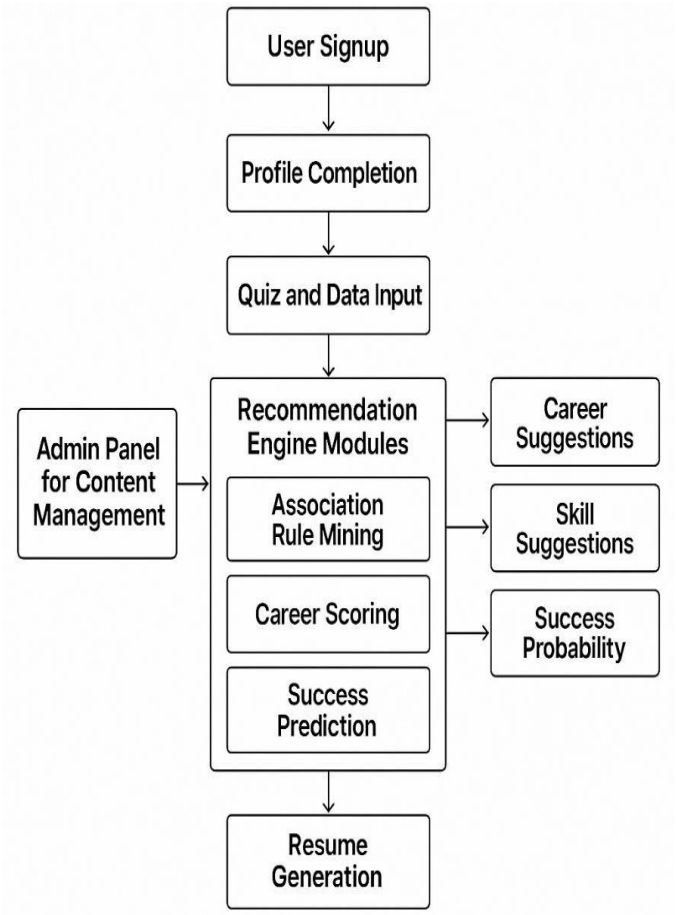

Fig -1: System Architecture of the AI-Driven Career Guidance System

3.2 Data Collection and Preprocessing

The foundation of the predictive model is a comprehensive dataset that is both accurate and consistent. The dataset used for this research comprises 9179 samples with 28 columns, capturing a wide range of features. Key data points collected include academic performance metrics, acquired skills, personal interests, and long-term aspirations. Data preprocessing is a crucial step to ensure the dataset is accurate and consistent for the machine learning model. This process involves several techniques:

Data Cleaning: The initial dataset is cleaned to handle missing values, remove outliers, and correct inconsistencies. This step ensures the data is of high quality before being used for training.

Feature Engineering: Techniques such as one-hot encoding for categorical variables and normalization for numerical features are applied to enhance the predictive power of the models. For instance, converting categorical data like "location" or "interests" into a numerical format allows the algorithms to process them effectively.

Dataset Reduction: To address potential overfitting and improve model effectiveness, a revised model was trained on a dataset with a reduced number of columns, a practice that leads to more credible and generalizable results.2 3.3 Machine Learning Model Development

For the predictive core of the system, a comparative analysis was conducted using a selection of machine learning algorithms widely recognized for their effectiveness in classification and regression tasks. The chosen algorithms were Decision Tree, Random Forest, Support Vector Machine (SVM), and Naïve Bayes. The cleaned and preprocessed dataset was partitioned into training and testing sets to evaluate each model's performance on unseen data. Each model was trained on the training data, with hyperparameters optimized through cross-validation techniques. The models are evaluated using metrics such as accuracy, precision, recall, and F1 score, which collectively provide a robust framework for assessing the models' efficiency and effectiveness in predicting career paths. 3.4 Web Application Development

The system is delivered as a user-friendly web application, ensuring accessibility and practicality for a wide audience. The backend is developed using Flask, a lightweight Python web framework, which handles routing, session management, and API integration. The trained machine learning models are loaded into the Flask environment to provide real-time predictions based on user input. The application is structured with clear routes for user registration, login, property data input, and a

separate Admin dashboard. Secure authentication and role-based access control are implemented to ensure that Admin and User functionalities remain distinct and protected.

3.5 Testing and Validation

Comprehensive testing is conducted at multiple levels, including unit testing, integration testing, and user acceptance testing. These tests ensure that all features function correctly, the machine learning models produce accurate predictions, and the user interface is seamless. Automated testing tools and manual verification are both employed to identify and resolve issues before deployment.

4. RESULTS AND PERFORMANCE ANALYSIS

The Results and Performance Analysis section presents the findings from the application of data mining and predictive modeling techniques in a career guidance system. The objective was to identify relevant skills for enhancement and recommend suitable career paths based on individual data profiles.

Association rule mining was employed to detect meaningful patterns in skill requirements, resulting in targeted recommendations for skill development. These suggestions are indicative of current industry trends, emphasizing competencies in automation, containerization, and pipeline management. This signifies the system's ability to capture evolving sector demands and translate them into actionable learning paths.

A regression-based predictive model was used to estimate the likelihood of success across various career options. This quantitative assessment provided a prioritized ranking of career paths, reflecting the relative suitability according to the user's attributes. Such prediction facilitates informed decision-making by highlighting promising avenues with higher chances of professional success.

The integration of these methods produced a cohesive set of recommendations, demonstrating the effectiveness of combining association rule mining with predictive analytics. The alignment between skill enhancement suggestions and recommended career paths validates the robustness of the approach and underscores its practical applicability.

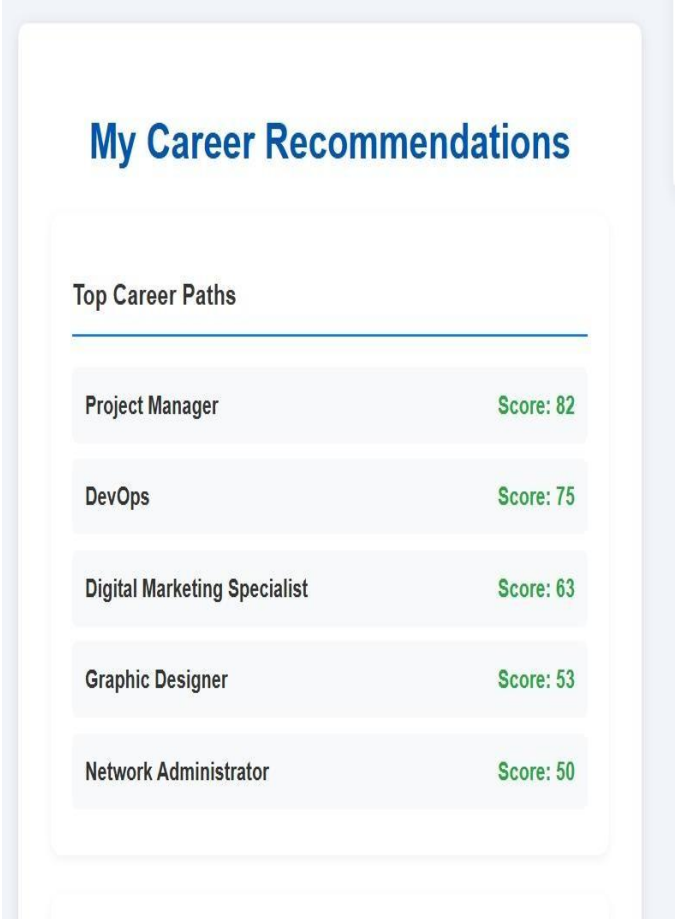

Fig -2: Screenshot of Career Guidance System Output showing predicted job roles

Fig -3: Screenshot of Career Guidance System Output showing predicted success prediction

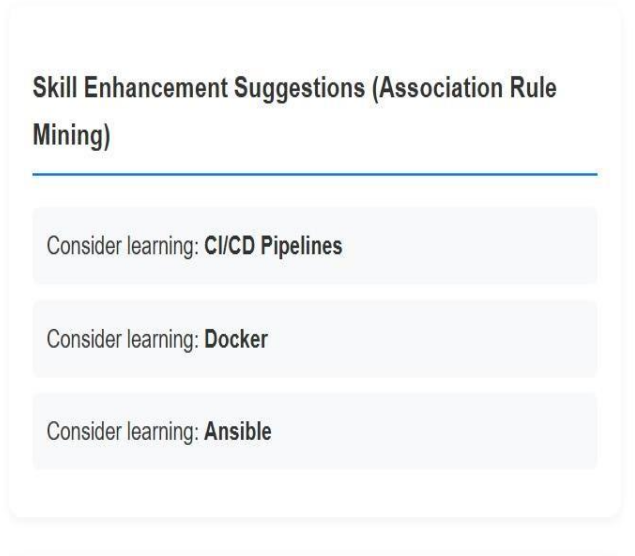

Fig -4: Screenshot of Career Guidance System Output showing shill enhancement suggestion

5. CONCLUSION

This research successfully demonstrates the viability and effectiveness of an AI-driven system for providing personalized career guidance. By addressing the inherent limitations of traditional, generic counseling methods, the proposed system offers a scalable, data-driven, and highly accurate alternative. The comparative analysis of key machine learning algorithms confirmed that the Random Forest model is the most suitable for this application, delivering a superior test accuracy of 89% on the refined dataset. This success is attributed to its robust ensemble nature, which allows it to capture the complex relationships between diverse data points, from academic scores to personal interests. The system's ability to evolve continuously by incorporating user feedback further ensures its relevance in a dynamic job market.

This work serves as a solid foundation for future development in this field. Future research should focus on enhancing the system's capabilities through the integration of more advanced technologies. For instance, the use of Natural Language Processing (NLP) techniques could enable the system to analyze text-based inputs, such as resumes and job descriptions, providing a more comprehensive understanding of a user's profile and market requirements. Furthermore, exploring advanced deep learning architectures, such as Recurrent Neural Networks (RNNs) or Encoder-Decoder models, could allow for the capture of complex temporal data, enabling the system to predict career trajectories based on a student's academic journey over time. The continued refinement and expansion of this system will ensure that it remains a valuable tool, empowering individuals to make confident and informed decisions for their professional future.

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