A Project Report on

Resume Generator Chatbot

By

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Under the esteemed guidance of

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Submitted in partial fulfilment of the Requirements for the award of the Degree of

BACHELOR OF SCIENCE (DATA SCIENCE)

SEMESTER V EXAMINATION

DEPARTMENT OF DATA SCIENCE

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Best College Award by University of Mumbai for the Year 2018-2019

DEPARTMENT OF DATA SCIENCE

CERTIFICATE

This is to certify that the project entitled, "**Resume Generator Chatbot**", undertaken at the Thakur College of Science and Commerce by **Yathesh Gamot** Roll. No: 1177 is submitted in partial fulfilment of the requirements for the award of degree of BACHELOR OF SCIENCE in DATA SCIENCE SEMESTER V Examination and does not form part of any other course undergone by the candidate. It is further certified that he/she has completed all the required phases of the project.

Project Guide **HOD**

External Examiner **Internal Examiner**

College Seal

Acknowledgment

We would like to express our heartfelt gratitude to our Project Guide “**Ms. Femenca Noronha”** and Head of the Department **“Mr. Omkar Singh”.** Their unwavering support and guidance have been instrumental in our successful completion of the project on **' Resume Generator Chatbot** ' Their trust in our abilities and the opportunities they provided allowed us to embark on this enriching journey. With their mentorship, we conducted extensive research, expanding our knowledge and skills in the process. Their vision and support granted us the golden opportunity to explore the world of **Resume Generator Chatbot '**. Their encouragement and guidance enriched our understanding of the subject matter and allowed us to discover a multitude of new concepts. We are truly thankful for their invaluable contributions to our project."

“We extend our sincere thanks to our principal, “**Dr. (Mrs.) Chaitali Chakraborty”**, who played a crucial role in making this project a reality, by giving us a platform to express our perspectives and ideas. We express our gratitude for her indispensable contributions.”

DECLARATION

We hereby declare that the project entitled, "**Resume Generator Chatbot**" is done at Thakur College of Science and Commerce, this written submission represents our ideas in our own words and where other's ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. We understand that any violation of the above will cause disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Chapter 1: Introduction

1.1 Theoretical Background

In today's job market, the competition for positions has grown due to globalization, technological changes, and the fast pace of industry shifts. A resume is still the main document for candidates to show their skills, education, achievements, and career goals. Even with professional networking sites like LinkedIn, recruiters and companies still rely on resumes for hiring and shortlisting. This makes it essential to craft, organize, and present a resume well to land a job.

Traditionally, making a resume involved a manual effort where candidates had to pick the right formats, describe their abilities clearly, and tailor the content to fit each job. This often proves challenging for students and recent graduates who may lack experience. Furthermore, many job seekers are unaware of technical requirements set by Applicant Tracking Systems (ATS), which companies use to screen resumes before human review automatically. Research shows that many resumes get rejected during this electronic filtering stage due to issues like poor formatting, missing keywords, or incorrect structure.

Improvements in automation and artificial intelligence have created new opportunities for job preparation. AI-powered resume-building tools help candidates organize their information effectively, meet ATS criteria, and use professional templates. Chatbot-driven systems offer easy interaction by guiding candidates with questions and automatically creating resumes that cover all essential sections. This simplifies the process and makes sure no important details are missed.

Beyond simply creating resumes, these systems also recommend suitable job roles and learning opportunities based on a candidate’s skills. By linking skills to potential career paths, the system provides helpful guidance and assists users in understanding how their profiles align with industry needs. Combining resume creation with career advice and course suggestions makes the tool a whole solution for career development, not just a document generator.

Educational institutions, training centers, and placement offices face challenges in getting students ready for the workforce. They conduct workshops and training programs, but they often lack data on students’ skills. Adding an administrative dashboard to the system offers combined analytics, like common skills, in-demand job roles, and gaps compared to industry standards. This feedback based on data helps institutions improve their curriculums and create effective training programs.

From an academic perspective, creating a Resume Generation Chatbot uses software engineering ideas in a hands-on way. It brings together fields like database management, web technologies, conversational AI, and structured document creation. The system also shows how artificial

intelligence and data analytics can tackle real-world issues. It not only meets the need to improve employability but also acts as a useful study model for students and researchers.

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1.2 Objective of the Project

The main goal of the Resume Generation Chatbot project is to create an interactive, affordable, and user-friendly platform. This platform allows job seekers to prepare professional resumes and gain career insights. Here are the objectives:

1. Design a chatbot interface that simplifies resume preparation by guiding users step by step.
2. Generate resumes that meet professional standards, are ATS-friendly, and easy for recruiters to read.
3. Provide job role suggestions based on user skills and educational backgrounds, helping users identify suitable career paths.
4. Recommend courses for skill development, enabling users to improve their profiles and meet industry needs.
5. Offer administrators dashboards that include insights on student skills, job matches, and overall employability trends.
6. Create a modular, scalable, and offline-friendly system using open-source technologies like Python, Flask, and MySQL.

By meeting these goals, the project addresses individual career needs and supports the institution's aim of preparing students for the job market.

1.3 Purpose, Scope, and Applicability

Purpose

This project aims to reduce the gap between student-prepared resumes and what recruiters expect by providing clear guidance. It helps job seekers with a structured platform for building resumes and offers practical career insights. It also gives institutions useful analytics to improve their training programs. Academically, it demonstrates software engineering, chatbot interfaces, and data-driven decision-making.

Scope

The project scope outlines what the system includes and what it does not include. Key features are a chatbot to collect user data, resume generation (DOCX/PDF), job and course recommendations, template management, and institutional dashboards. It does not include direct job application services, integration with premium APIs, advanced NLP-based grammar correction, or mobile app deployment in the first phase. The deployment scope is offline-first, ensuring usability even in places with limited internet access.

Applicability

The applicability of the system can be considered at three levels:

- For Job Seekers: it offers a simple and effective way to create resumes and get career guidance.

- For Institutions: It provides dashboards and analytics to track students' readiness for employment.

- For Academia:The system shows how different computing concepts can be combined, serving as a practical example in software engineering.

Chapter 2:Requirement and Analysis

2.1 Problem Definition

In the past decade, hiring practices have changed because of globalization, digital recruitment systems, and improvements in technology. Despite these shifts, the resume remains the most common and widely accepted document for showcasing a person's academic qualifications, professional skills, and career goals. Recruiters in various industries still rely on resumes as the first filter in the hiring process. However, creating a professional and effective resume poses significant challenges, especially for students, recent graduates, and early-career professionals.

One major challenge is the rising use of Applicant Tracking Systems (ATS). These systems automatically scan and filter resumes before human recruiters can see them. Many resumes get eliminated before human review because they do not follow ATS keyword or formatting rules. Candidates who have the skills and abilities may face rejection at this early stage, not due to their qualifications but because of flaws in their resume design. This issue shows that employer expectations often do not match how candidates present themselves.

While online resume builders are available, many have limitations that make them less helpful for students. Most operate on subscription models, which can be too expensive for many students, especially in developing areas. Free tools may be accessible, but they often come with limited features, providing only generic templates that result in boring and unremarkable resumes. Very few platforms offer guided support, leaving candidates unsure about what information to include, how to describe their achievements, or which skills to highlight. The lack of personalized feedback makes these tools less effective in helping candidates stand out.

Another major problem is the fragmented processes. Students typically have to use different platforms for resumes, job searches, and skill training, creating a disjointed and time-consuming experience. This not only increases their workload but also makes it hard for candidates to see how their skills relate to their career goals and learning needs. For example, a student may create a strong resume but not realize what types of jobs they qualify for or what skill gaps they need to fill to enhance their employability.

The challenges also affect colleges and placement cells. Colleges and training centers need to improve their students' chances of getting jobs, but they often lack the tools to assess the readiness of large groups effectively. While they may offer workshops and training programs, they seldom have access to useful data. This data could include common skills among students, their strengths and weaknesses, or the job roles they might qualify for. Without this information, institutions struggle to design proactive strategies that address employability gaps.

The Resume Generation Chatbot project aims to tackle these related issues. By providing a chatbot-driven interface, the system simplifies the resume-building process for job seekers. It collects important details in an organized way and checks inputs to reduce mistakes. The resumes created are formatted to be compatible with applicant tracking systems, which improves the chances of passing automated screenings. Besides document creation, the system offers job role suggestions based on users' skills and qualifications, as well as course recommendations for upskilling. This shifts its function from just a document tool to a career support system.

For institutions, the system features an administrative dashboard that consolidates data from users. This enables placement officers and faculty to spot trends, identify gaps, and design training programs based on real evidence instead of guesses. The offline-first design, built entirely with open-source technologies, ensures that the system works well even in areas with poor or unreliable internet access.

In summary, this project seeks to solve the problem along four key dimensions:

1. For Job Seekers: creating professional, ATS-compliant resumes can be difficult. Many also lack integrated career guidance.

2. For Students and Graduates: there is limited awareness of suitable job roles and the skills needed to compete in the job market.

3. For Institutions: there are no tools to evaluate employability readiness on a large scale.

4. For the Ecosystem: the resume building, job exploration, and skill development processes are fragmented.

The Resume Generation Chatbot aims to address these challenges. It seeks to close the gap between candidate preparedness and employer expectations by providing a simple, accessible, and scalable solution.

2.2 User Requirements / SRS

The Resume Generation Chatbot has been created according to the Software Requirements Specification (SRS), which outlines the functional and non-functional needs of the system. These needs reflect the expectations of job seekers, institutions, and administrators. The goal is to ensure that the system provides value to all user groups.

Functional Requirements

The functional requirements detail what the system should accomplish. The main functional requirements are summarized below:

Requirement ID	Description	Priority
FR1	The chatbot will ask users for basic information, such as name, education, skills, and projects, in a conversational format and store this in the database.	High
FR2	The system will check mandatory inputs like email and phone number for correctness.	High
FR3	The system will create resumes in DOCX format.	High
FR4	The system will export resumes in PDF format.	High
FR5	The system will offer multiple professional templates for resume creation.	Medium
FR6	The system will suggest job roles based on skills and education. Medium	Medium
FR7	The system will recommend courses that match career needs and skill gaps.	Medium
FR8	The system will allow administrators to add or update resume templates.	Medium
FR9	The system will provide administrators with a dashboard for analytics and trend review.	Low

Non-Functional Requirements

The non-functional requirements describe the quality attributes of the system

- **Performance:** In testing, the chatbot generated resumes in under five seconds, which meets the project's performance goal.
- **Usability:** The chatbot interface must be simple, intuitive, and easy for non-technical users.
- **Reliability:** The system should produce correct outputs in at least 95% of test cases.
- Security: User data must be protected from unauthorized access, and admin functions must require authentication.
- **Maintainability:** The system architecture should allow for easy updates to templates, datasets, and modules.
- **Scalability:** The system must support at least 100 concurrent users in a local deployment.
- **Portability:** The system should be able to run on different operating systems like Windows and Linux.

Stakeholder Requirements

- Job Seekers: A tool to help create resumes, professional outputs, and guidance on jobs and courses.
- Institutions: Dashboards to track skill readiness and handle templates.
- Administrators: A way to manage datasets, templates, and user data.

In summary, the SRS makes sure that the Resume Generation Chatbot not only generates resumes but also provides support for broader employment and institutional needs.

2.3 Feasibility Study

A feasibility study looks at whether the proposed Resume Generation Chatbot can be developed and launched with the resources, time, and technology we have. It checks that the system is practical, sustainable, and able to meet user expectations.

2.3.1 Technical Feasibility

Technical feasibility determines if the existing hardware, software, and technology stack can support the project. The project uses open-source tools like Python, Flask, and MySQL, allowing it to avoid licensing costs and remain accessible. The backend is developed in Python with Flask as the web framework and MySQL as the database. These technologies are lightweight and well-supported, able to run efficiently on standard institutional or personal hardware. For frontend development, HTML, CSS, and JavaScript ensure compatibility with modern browsers.

The technical design follows an offline-first approach, meaning the system does not need continuous internet access. This is a major benefit in areas where connectivity may be unreliable. Resume generation uses template mapping and DOCX/PDF export libraries readily available in Python. The chatbot logic is built using state-driven rules, ensuring reliability without the heavy computational demands of complex AI models. Therefore, the technical feasibility of the system is high. It can be implemented using the resources available without needing specialized infrastructure.

2.3.2 Economic Feasibility

Economic feasibility looks at whether the system can make money. Most commercial resume tools require subscription fees, which can be tough for students. Our chatbot avoids this by using free software. In contrast, the proposed system relies entirely on free, open-source technologies. There are no licensing fees for programming languages, frameworks, or databases.

The only money needed is for basic hardware and possible server hosting, which are small compared to commercial options. For schools that already have computer labs, deployment costs are almost nothing. Maintenance costs are also low since the system is made up of modular pieces that in-house technical staff can update. When we consider costs and benefits, providing students with professional resumes, job guidance, and analytics offers much greater value than the small resource costs. This makes the project financially viable.

2.3.3 Operational Feasibility

Operational feasibility looks at whether the system will operate smoothly in its intended setting and if end users will accept it. The chatbot interface is simple enough for students to use without any technical training. Users respond to clear, guided prompts, and the system creates a professional resume. The extra features, like job role suggestions and course recommendations, offer direct value to users, which boosts their engagement and acceptance.

For institutions, the system provides dashboards that let placement officers and administrators assess skill trends and readiness. This supports the goal of improving employability. Since the system doesn't rely on premium services or cloud subscriptions, it can also function in resource-limited environments. Overall, the system is operationally feasible because it is easy to use, meets user needs, and integrates smoothly into academic or training settings.

2.3.4 Schedule Feasibility

Schedule feasibility checks if the project can be finished within the given timeframe. We planned the project in Agile sprints. Each sprint lasted 320 hours and focused on modules like chatbot interaction, resume generation, and dashboards. Key modules were scheduled one after the other. The Agile approach lets us develop and test features in steps at the end of each sprint.

So far, a large part of the project has already been implemented, including the chatbot module and resume generation functionality. The remaining modules, such as dashboards and extended recommendations, are in development and are on target to finish within the set timeline. Therefore, schedule feasibility is high because the project can be completed on time with the resources and effort we have planned

2.4 Details of Hardware and Software Used

The Resume Generation Chatbot project is designed to run well on standard hardware and open-source software. This supports accessibility, cost-effectiveness, and sustainability in academic and institutional settings. The requirements for hardware and software are listed below

2.4.1 Hardware Requirements

Minimum Hardware Specifications

Component	Specification
Processor	Intel Core i3 (7th Gen) or AMD equivalent
RAM	4 GB
Storage	250 GB HDD or higher
Display	1366 × 768 resolution monitor

Network	Basic LAN/Wi-Fi for local deployment

Recommended Hardware Specifications

Component	Specification
Processor	Intel Core i5 or i7, AMD Ryzen 5 or above
RAM	8–16 GB
Storage	500 GB SSD or higher
Display	Full HD monitor (1920 × 1080)
Network	LAN/Wi-Fi with institutional server support

With these specifications, the chatbot and database work well on standard institutional computers without needing extra powerful hardware. Institutions with computer labs usually already meet these requirements.

2.4.2 Software Requirements

Operating System

- Windows 10 / Windows 11 (64-bit)
- Linux (Ubuntu 20.04 or above)

Programming Languages

- Python 3.9+ (primary backend and chatbot logic)
- JavaScript, HTML, CSS (frontend interface)

Frameworks and Libraries

- Flask (Python web framework for backend server)
- python-docx (for DOCX file creation)
- ReportLab (for PDF generation)
- Pandas, NumPy (for dataset handling and analytics)
- Matplotlib / Seaborn (for generating dashboard visualizations)

Database

- MySQL 8.0 (structured data storage for user profiles, resumes, and analytics)

IDE and Development Tools

- Visual Studio Code (preferred IDE)
- PyCharm Community Edition (alternative IDE for Python development)
- Git (for version control)
- XAMPP or MySQL Workbench (for database management)

Browsers

- Google Chrome (recommended)
- Mozilla Firefox / Microsoft Edge (compatible alternatives)

2.4.3 Justification for Choices

The project focuses on using open-source, free technologies to keep recurring costs at zero. Python was chosen for backend logic because it is simple, easy to read, and has a wide range of libraries. Flask was selected as a lightweight web framework that works well for modular and scalable applications. MySQL was picked for its strength in handling relational data and its compatibility with institutional setups. The combination of HTML, CSS, and JavaScript offers a frontend accessible through any modern browser.

By using this hardware and software setup, the system has low barriers to adoption. It works well for academic demonstrations and real-world use in training centers or institutions.

2.5 Planning and Scheduling

The Resume Generation Chatbot project has been planned over several months, starting in June 2025 and continuing into early 2026. The scheduling method makes sure development tasks are organized logically, respects dependencies, and includes enough time for testing and deployment. Agile principles guide the process, allowing modules to be completed in increments and improved over time.

2.5.1 Project Timeline

The project timeline has been broken down into clear development tasks, each linked to milestones and completion dates. The following phases have been identified and scheduled:

1. Interactive CLI Data Collection (June 2025)
2. Development of the command-line interface to collect user data interactively, ensuring basic functionality.
3. Resume Output in Markdown and DOCX (July 2025)
4. Implementation of export options for generating resumes in Markdown and DOCX formats.
5. AI Text Enhancement via OpenAI (August 2025)
6. Integration of text enhancement features to refine resume entries and improve phrasing.
7. Resume Templates and Formatting Basics (September 2025)
8. Creation of basic templates and formatting rules for resume generation.
9. Validation, Error Handling, and CLI Progress Indicators (September 2025)
10. Development of input validation, error-checking systems, and command-line progress displays.
11. User Interface for Desktop/Web Deployment (October 2025)
12. Transition from the command-line interface to a graphical interface accessible through a browser or desktop.
13. Resume Template Formatting Improvements (October–November 2025)

14. Refinements to improve the professional presentation of generated resumes.
15. Download Button for Resume Export (November 2025)
16. Implementation of an easy-to-use download option in DOCX/PDF format.
17. Job Suggestion/Recommendation Model (November–December 2025)
18. Rule-based mapping of user data to relevant job roles.
19. Course Suggestion for Upskilling (December 2025–January 2026)
20. Implementation of course recommendations to highlight areas for user improvement.
21. Login Page and Authentication System (January 2026)
22. Development of secure login and authentication systems for different user roles.
23. Final Polish, Documentation, and Deployment (January–February 2026)
24. Testing, fixing bugs, preparing documentation, and final deployment.

2.5.2 Scheduling Observations

- The project is now moving from finished CLI modules to the upcoming web-based interface development.

- We allowed some tasks to overlap, such as template improvements and job recommendations, to make better use of our time.

- Key milestones, including the authentication system and final deployment, are set for the end. This ensures stability before the release.

- The overall schedule shows that the project is feasible within the planned timeframe, with completion expected by February 2026.

2.6 Preliminary Product Description

The Resume Generation Chatbot is a modular system. Each component has a specific role, but they work together smoothly in the overall workflow. This design simplifies development and testing. It also ensures the system is easy to maintain and adapt for future updates. The initial product description gives an overview of the major modules and their functions.

2.6.1 Chatbot Interface

The chatbot is the main way users interact. Instead of filling out long, complicated forms, users answer prompts in a conversational style. These prompts include name, contact details, education, skills, projects, and work experience. This approach makes sure that no important information is missed. The chatbot checks required fields like email and phone numbers to keep data accurate.

2.6.2 Resume Generator

The resume generator changes the collected data into professional resume formats. It uses predefined templates with placeholders that fill in with user inputs. Users can get their resumes in both DOCX and PDF formats. This ensures compatibility with what recruiters expect. The resume templates are structured to be ATS-friendly, increasing the chances of passing automated filters. Future updates will include additional formats, like LaTeX resumes for academic users

2.6.3 Resume Templates and Formatting Engine

Templates are essential for how resumes look. The formatting engine ensures consistent styling, fonts, and layout for better readability. The system has multiple templates, allowing users to choose between minimalist, modern, or professional styles. Administrators can add or change templates, giving institutions control over branding and standardizing resumes for students

2.6.4 Job Suggestion Module

This module recommends job roles by matching user-entered skills, qualifications, and experiences with a dataset of predefined job profiles. For example, if a candidate lists Python, SQL, and data visualization as skills, the system might suggest roles like Data Analyst or Business Intelligence Associate. These suggestions help students discover career opportunities they may not have thought about.

2.6.5 Course Recommendation Module

To improve employability, the course recommendation module finds skill gaps and suggests relevant learning resources. For example, if a student's profile shows strengths in front-end development but lacks knowledge of backend frameworks, the system might recommend a course on Django or Node.js. This guidance helps users improve their skills to meet industry needs.

2.6.6 Administrative Dashboard

The dashboard gives institutions overall analytics. It shows visual reports on commonly listed skills, popular job roles among students, and areas needing skill development. Placement officers can use this data to create targeted workshops or training programs. The dashboard also allows reports to be exported in CSV or image formats for further analysis.

2.6.7 Security and Authentication

To make sure that only authorized users reach administrative functions, the system includes a secure login page and authentication system. Role-based access control differentiates between

job seekers, administrators, and institutional users. Sensitive tasks like managing templates and generating reports require admin privileges.

2.6.8 Deployment Model

The system is built for offline-first use. It can be hosted on institutional servers without needing constant internet access. This makes it usable in places with limited connectivity. When it is deployed online, it can support multiple institutions at once without extra reconfiguration.

2.6.9 Summary

The preliminary product is a useful solution that addresses not only resume creation but also career guidance and institutional needs. Its modular design allows for flexibility in future updates while delivering immediate value to job seekers and academic institutions.

2.7 Conceptual Models

The conceptual models explain the basic structure of the Resume Generation Chatbot, how it interacts with users, and how information flows within the system. At this stage, the models are described in text form without detailed diagrams to clarify the system's framework before moving into technical designs in the next chapter.

2.7.1 Contextual View

At the conceptual level, the system can be seen as an interactive unit that connects three key groups: job seekers, administrators, and institutions. Job seekers engage with the chatbot by providing personal, educational, and professional information. The system processes this data to create resumes, job suggestions, and course recommendations. Administrators manage resume templates and view analytics. Institutions benefit from overall reports on skill readiness. This establishes the system's boundary and identifies its main external interactions.

2.7.2 Data Flow Perspective

In our system, user data (skills, projects, education) enters through the chatbot, is processed into organized formats, and is finally output as resumes or recommendations. Inputs include user details such as education, skills, and projects. The processing stage involves checking data, formatting it, and mapping it to job and course datasets. Outputs consist of DOCX/PDF resumes, job role suggestions, and skill-based course recommendations. Administrators also receive dashboard analytics based on processed user data.

2.7.3 Entity Perspective

The system focuses on several key entities: the User (which includes personal information, education, and skills), the Resume (organized documents linked to users and templates), the Template (predefined design structures), the Job Role Dataset, and the Course Dataset. Relationships exist between these entities. For instance, one user can create multiple resumes using different templates, and specific skills can connect to multiple job roles

2.7.4 Functional Perspective

The functional view highlights what the system does. Its main functions include collecting data through the chatbot, generating resumes, providing job and course recommendations, and offering analytics for institutions. Additional functions include managing templates and exporting data. This perspective showcases the system's flexibility, allowing individual parts to be extended or improved without disrupting the entire application.

2.7.5 Conceptual Summary

Overall, the conceptual model presents the Resume Generation Chatbot as a flexible, multi-stakeholder system where inputs are gathered through conversation, processed with rule-based and data-driven methods, and output as resumes, suggestions, and analytics. While detailed diagrams are not included at this stage, these perspectives lay a solid foundation for creating detailed design diagrams in Chapter 3.

Chapter 3: System Analysis and Design

3.1 SDLC Life Cycle

The Resume Generation Chatbot was built using the SDLC framework. This structured approach guided us from gathering requirements to maintenance. The SDLC helps develop the system in an organized way. It reduces risks, decreases errors, and delivers a product that meets user and institutional needs.

Our project went through six SDLC phases. Each phase contributed to the system's development and long-term use. Figure 3.1 shows the SDLC used for the Resume Generation Chatbot.

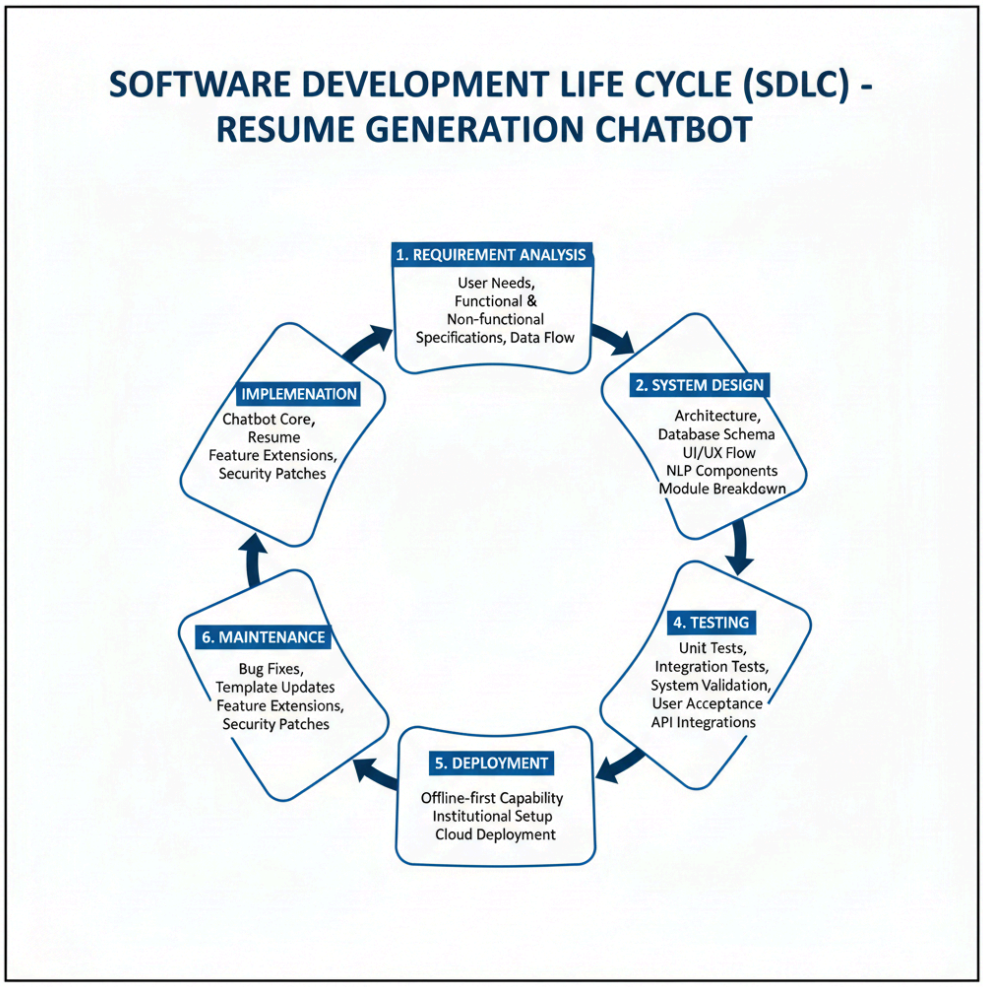


Figure 3.1: Software Development Life Cycle (SDLC) for Resume Generation Chatbot

Phase 1: Requirement Analysis

This phase focused on identifying user needs and expectations. We collected input from three main stakeholders: job seekers, administrators, and institutions. We specified both functional requirements (like resume generation, chatbot data collection, and job and course recommendations) and non-functional requirements (including performance, reliability, security, and usability). We also determined data flow requirements to manage how inputs, processing, and outputs should be handled.

Phase 2: System Design

In the system design phase, we turned the requirements into a clear plan for implementation. This included defining the overall architecture, designing the database schema, and laying out the user interface. We conceptualized the UX flow of the chatbot to ensure a smooth experience. We also broke down the modules to assign tasks to different components, such as the Resume Generator, Recommendation Engine, and Dashboard.

Phase 3: Implementation

During implementation, we developed the modules from the design stage. We built the chatbot's conversational logic using Python and Flask, while resume generation involved using template mapping with DOCX/PDF export libraries. We created the resume formatting engine and template repository in this stage. Additionally, we included security measures in the core modules to protect data and ensure safe access control.

Phase 4: Testing

We conducted thorough testing to confirm system accuracy and stability. Unit tests verified that each module functioned correctly, while integration tests ensured smooth communication between components. We validated the system against the earlier specified requirements. Finally, we performed user acceptance testing (UAT) to confirm that the chatbot met real users' expectations regarding ease of use, accuracy, and reliability.

Phase 5: Deployment

We prepared the system for deployment in institutional settings with offline capabilities, ensuring it could function even with limited internet access. We also created a version for cloud environments to allow for scalability when needed. This phase ensured that the chatbot could be effectively installed and used in academic institutions and training centers.

Phase 6: Maintenance

The maintenance phase involves the ongoing process of monitoring, refining, and extending the system after deployment. This includes fixing bugs, updating templates, applying security

patches, and adding new features. Maintenance keeps the chatbot in line with changing user needs and shifts in the job market.

Background and Importance

Using the SDLC model for this project allowed for a systematic and disciplined approach to software development. Each stage produced a clear set of deliverables that built on the previous one, reducing redundancy and lowering risks. The SDLC also supported effective project management by providing checkpoints for validation, progress tracking, and risk assessment.

For the Resume Generation Chatbot, the SDLC was especially important due to the system's multiple stakeholders and modules. Structured development ensured that resume generation, chatbot interaction, and institutional analytics were integrated smoothly without sacrificing usability or security..

3.2 Basic Modules

The Resume Generation Chatbot has a modular design to ensure clarity, scalability, and maintainability. In this system, modules work independently but are linked through a shared database for easy data exchange. This design allows for adding new features, upgrading existing modules, and isolating and fixing errors without affecting the whole system. Figure 3.2 shows the modular architecture.

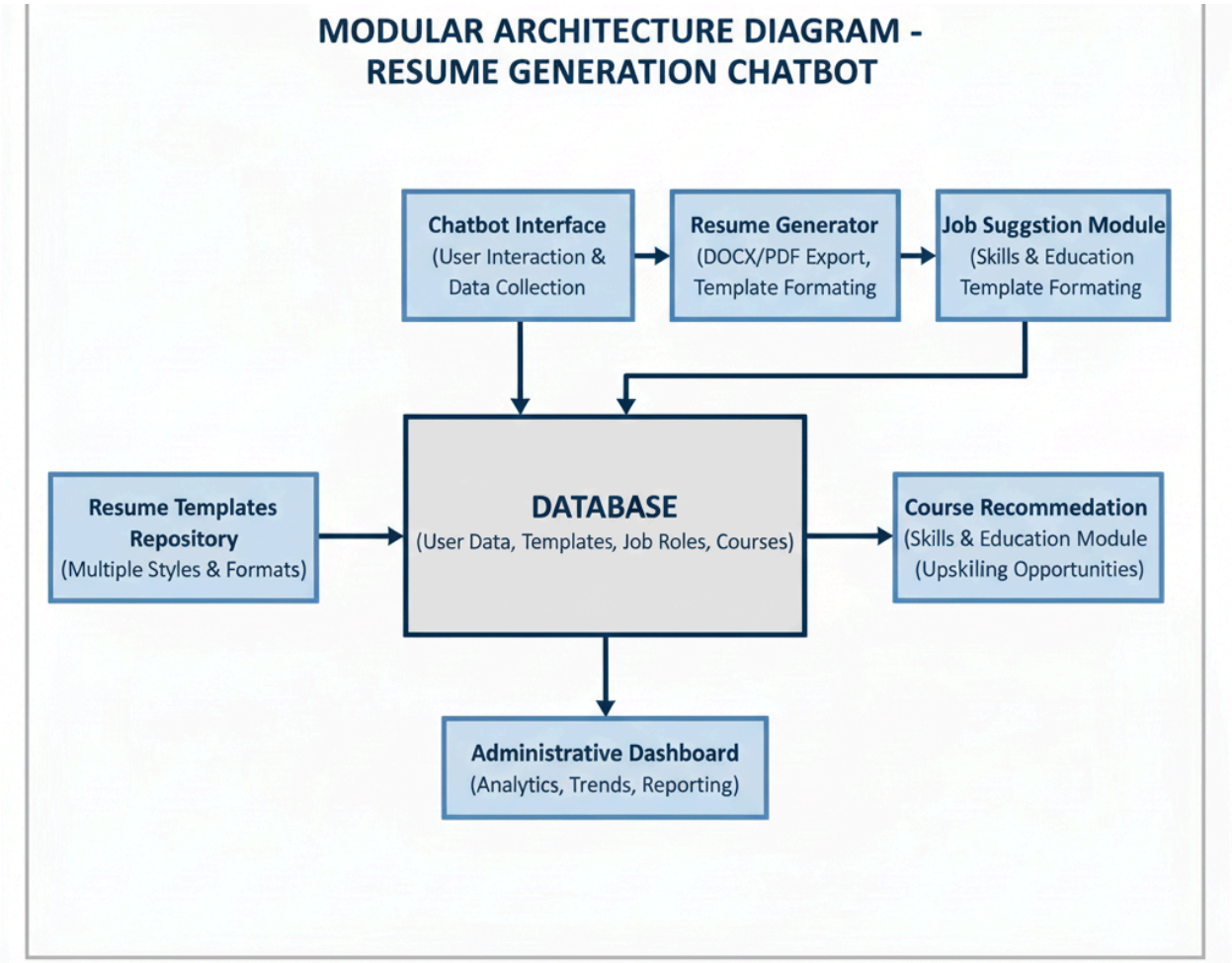


Figure 3.2: Modular Architecture Diagram, Resume Generation Chatbot

The following subsections describe each module in detail.

3.2.1 Chatbot Interface

This module formats user data into resume templates, creating polished documents. It retrieves templates from the repository and places user-provided information into these templates. This makes sure resumes are visually appealing and ATS-compliant.

Functions of this module include:

- Mapping user data into template placeholders.
- Supporting export formats like DOCX and PDF.
- Ensuring consistent formatting across sections like education, skills, and projects.
- Offering multiple template choices for flexibility.
- Maintaining alignment, margins, and font styles for a professional presentation.

- This module helps job seekers quickly generate resumes that meet industry standards, removing the hassle of manual formatting.

3.2.2 Resume Templates Repository

The template repository stores different resume layouts that users can choose from. Templates are stored in the database and can be updated by administrators as per institutional or industry requirements.
Key aspects include:

- Supporting multiple template designs (minimalist, modern, formal).
- Allowing institutions to add branding elements such as logos.
- Maintaining ATS compliance by restricting unnecessary graphics and complex layouts.
- Version control for templates to track updates and changes.
  This repository ensures flexibility and personalization for resume outputs while maintaining standardization across users.

3.2.2 Course Recommendation Module

The Course Recommendation module aims to improve employability by finding gaps in a user's profile and suggesting learning opportunities. This is especially important in academic settings where institutions want to prepare students for the industry.
Functions include:

- Analyzing the user's current skills and qualifications.
- Mapping missing skills to available online or offline courses..
- Suggesting certifications or workshops that match industry standards.
- Offering recommendations for both short-term and long-term skills development.

For example, if a user lists front-end web development skills but lacks knowledge of databases, the system may recommend SQL or MongoDB training courses.

3.2.3 Administrative Dashboard

The Administrative Dashboard is intended for institutions and administrators. It offers combined insights across all users. Rather than looking at resumes one by one, administrators can see overall statistics that show strengths, weaknesses, and employment trends among students.
Key features include:

- Graphical analytics on common skills, education backgrounds, and gaps.
- Reports on the percentage of students suited for specific job roles.
- Exportable reports in CSV or PDF format for further use by the institution.
- Secure access with administrator-level authentication.
- This module helps institutions create interventions, workshops, or training sessions based on real needs

3.2.4 Database

The database serves as the foundation of the system. It ensures reliable storage, retrieval, and management of all critical data. It maintains consistency and helps communication between all modules.
Stored entities include:

- User Data: Personal details, education, projects, skills, work experience.
- Resumes: Linked to users and associated with templates.
- Templates: Different resume formats along with metadata.
- Job Roles: A dataset of job titles, required skills, and qualifications.
- Courses: A dataset of training programs, providers, and associated skills.

The database supports both transactional operations, like data entry and updates, and analytical queries, such as skill trends and report generation.

3.2.5 Importance of Modular Design

The modular architecture makes it possible for each part of the system to be developed, tested, and maintained on its own. This lowers complexity, cuts down on errors, and makes future scalability easier. For example, new resume templates or job datasets can be added without changing the chatbot or generator logic. Likewise, analytics features in the dashboard can be updated without affecting user interaction.

3.3 Data Design

In our chatbot, data design determines how user details, resumes, jobs, and courses are organized and connected in the database. For the Resume Generation Chatbot, the data design centers on entities like users, resumes, templates, job roles, courses, and analytics. These entities are linked to ensure a smooth flow of information across different modules. The Entity Relationship Diagram (ERD) offers a conceptual view of this design.

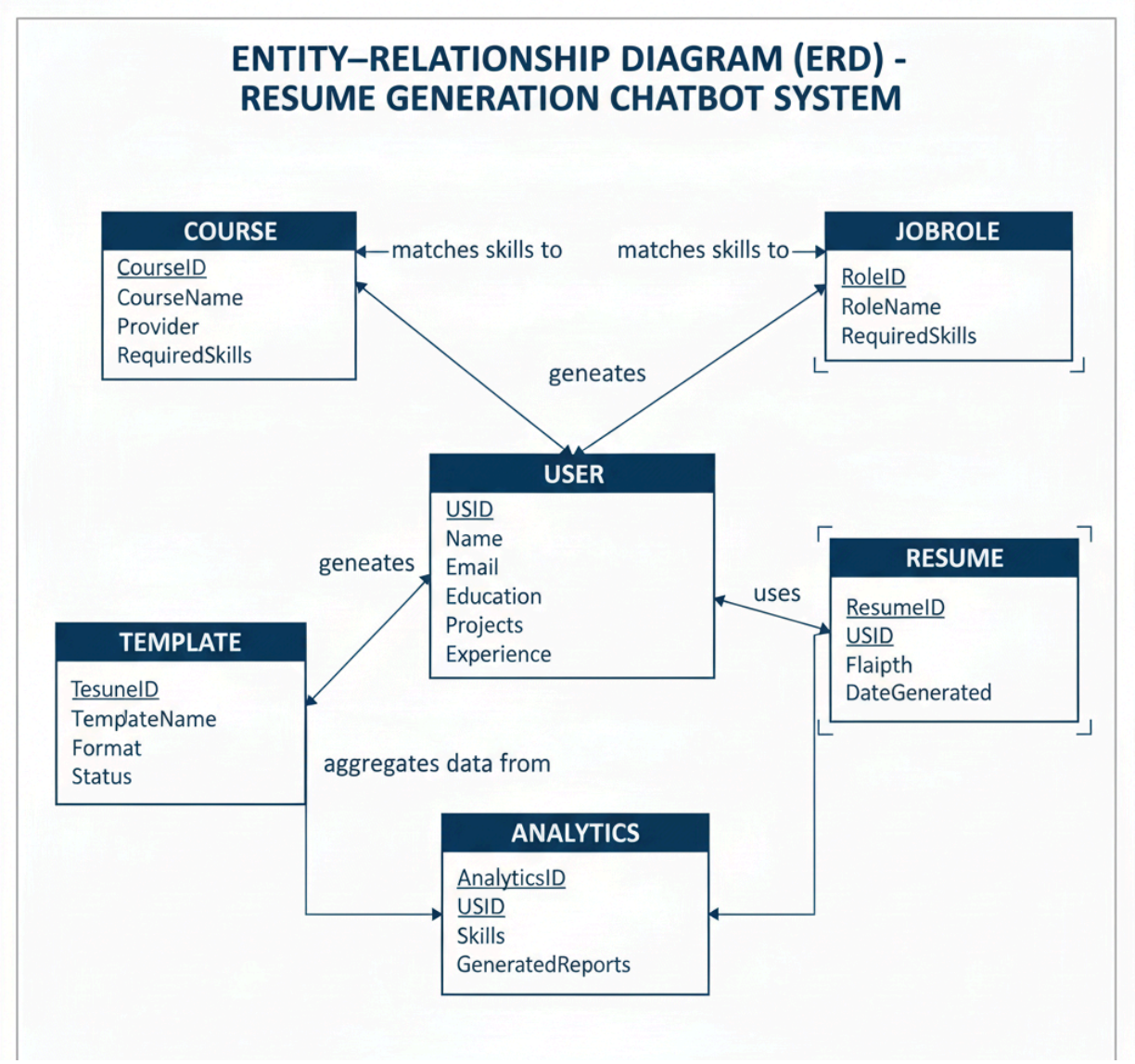


Figure 3.3: Entity–Relationship Diagram (ERD) – Resume Generation Chatbot System

3.3.1 User Entity

The User entity represents job seekers who interact with the chatbot. Attributes include UserID, Name, Email, Education, Projects, Skills, and Experience. Each user is central to the system because they provide input data for resumes, job suggestions, and course recommendations

3.3.2 Resume Entity

The Resume entity stores documents linked to users. Attributes include ResumeID, UserID (foreign key), FilePath, and DateGenerated. Each user can generate multiple resumes using different templates. The Resume entity keeps records for user history and analytics.

3.3.3 Template Entity

The Template entity shows the available resume formats. Its attributes include TemplateID, TemplateName, Format, and Status. Each resume links to one template, and administrators can manage this collection. Templates ensure the generated resumes are consistent, ATS-compliant, and customizable for branding.

3.3.4 JobRole Entity

The JobRole entity holds details about possible career opportunities. Its attributes include RoleID, RoleName, and RequiredSkills. The Job Suggestion Module uses this information to match user skills and education to relevant job roles. This entity connects user abilities with actual job needs.

3.3.5 Course Entity

The Course entity includes information about training or upskilling options. Its attributes are CourseID, CourseName, Provider, and RequiredSkills. This module improves employability by recommending specific learning resources. Courses match user profiles to find gaps and suggest ways to improve skills.

3.3.6 Analytics Entity

The Analytics entity gathers data from multiple users to provide insights for institutions. Its attributes include AnalyticsID, UserID, Skills, and GeneratedReports. This entity helps administrators track skill trends, job readiness, and employability statistics for groups.

3.3.7 Relationships

A User can create multiple Resumes.

Each Resume uses one Template.

A User’s skills can fit multiple Job Roles and multiple Courses.

Analytics collects skill and resume data from various users.

These relationships are shown using crow’s foot notation to highlight one-to-many and many-to-many mappings.

3.3.8 Importance of ERD

The ERD provides a clear view of the system’s data structure. It ensures the database design is consistent, prevents duplication, and supports efficient queries. By defining entities and relationships now, the project guarantees a smooth integration of modules like Resume Generation, Job Suggestion, and Analytics.

3.4 Schema Design

Schema design outlines the logical structure of the database as it will be created in the system. Unlike the ERD, which provides a conceptual view of entities and their relationships, the schema explains how data is organized into tables, how attributes are defined with their data types, and how it enforces relationships using primary keys and foreign keys. For the Resume Generation Chatbot, the schema design makes sure that user information, resumes, templates, job roles, and course data are stored efficiently and can be retrieved for processing by different modules.

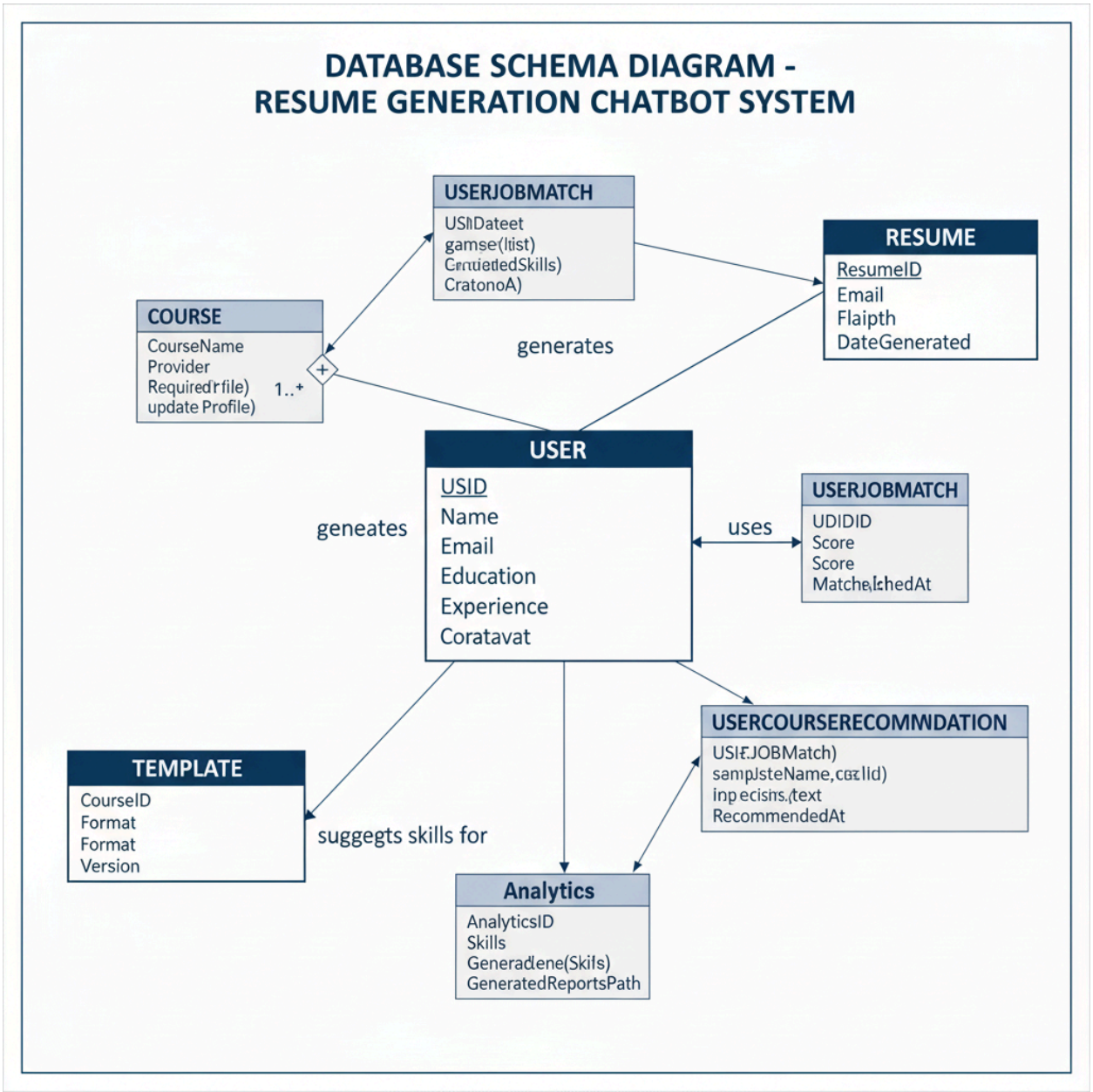


Figure 3.4: Database Schema – Resume Generation Chatbot

The database schema for this system is normalized to reduce redundancy and ensure data consistency. The schema consists of the following tables:

3.4.1 User Table

- Attributes: UserID (Primary Key), Name, Email, Phone, Education, Skills, Projects, Experience, CreatedAt.
- Description: Stores all personal and professional information of the user. Each record represents one job seeker profile.

3.4.2 Resume Table

- Attributes: ResumeID (Primary Key), UserID (Foreign Key), TemplateID (Foreign Key), FilePath, DateGenerated.
- Description: Maintains details of resumes generated by users. Each resume links to both a user and a template.

3.4.3 Template Table

- Attributes: TemplateID (Primary Key), TemplateName, Format, Status, Version.
- Description: Contains details of resume templates. Administrators can add or change templates in this table.

3.4.4 JobRole Table

- Attributes: RoleID (Primary Key), RoleName, RequiredSkills, Description.
- Description: Holds information about different job roles. This data helps the Job Suggestion Module recommend roles to users.

3.4.5 Course Table

- Attributes: CourseID (Primary Key), CourseName, Provider, RequiredSkills, URL.
- Description: Stores information about upskilling opportunities. The Course Recommendation Module uses this table to suggest courses.

3.4.6 UserJobMatch Table

- Attributes: MatchID (Primary Key), UserID (Foreign Key), RoleID (Foreign Key), Score, MatchedAt.
- Description: Stores the links between users and job roles along with a relevance score. This serves as a connection for many-to-many relationships between users and job roles.

3.4.7 UserCourseRecommendation Table

- Attributes: RecID (Primary Key), UserID (Foreign Key), CourseID (Foreign Key), Confidence, RecommendedAt.
- Description: Stores course recommendations for users along with a confidence score. This allows for personalized learning suggestions.

3.4.8 Analytics Table

- Attributes: AnalyticsID (Primary Key), UserID (Foreign Key, Nullable), SkillsSummary, GeneratedReportsPath, CreatedAt.
- Description: Gathers data from users and stores reports created for institutional dashboards.

3.4.9 Relationships in Schema Design

- One **User** can generate multiple **Resumes**, each associated with a **Template**.
- A **User** can be linked to multiple **JobRoles** through the **UserJobMatch** table.
- A **User** can be linked to multiple **Courses** through the **UserCourseRecommendation** table.
- **Analytics** aggregates data across multiple users, providing reports at both individual and group levels.

3.5 Data Integrity and Constraints

Data integrity and constraints ensure that the information stored in the Resume Generation Chatbot's database remains accurate, consistent, and reliable. By enforcing rules at the database level, we can minimize errors, avoid duplication, and preserve the relationships among entities. The design includes several types of constraints, which are explained below.

3.5.1 Entity Integrity

Entity integrity is maintained through the use of Primary Keys (PK). To avoid duplication, every table in the database has a primary key that uniquely identifies each record. Examples include:

- UserID in the User table
- ResumeID in the Resume table
- TemplateID in the Template table
- RoleID in the JobRole table
- CourseID in the Course table
- MatchID in the UserJobMatch table
- RecID in the UserCourseRecommendation table
- AnalyticsID in the Analytics table

By enforcing entity integrity, the system ensures that no two records in a table are identical and that every record can be referenced clearly.

3.5.2 Referential Integrity

- We use foreign keys to ensure that data in related tables, such as users and resumes, always matches correctly. Examples include:
- Resume.UserID references User.UserID
- Resume.TemplateID references Template.TemplateID
- UserJobMatch.UserID references User.UserID
- UserJobMatch.RoleID references JobRole.RoleID
- UserCourseRecommendation.UserID references User.UserID
- UserCourseRecommendation.CourseID references Course.CourseID
- Analytics.UserID references User.UserID (nullable for aggregated reports)
- These constraints prevent invalid references, such as linking a resume to a non-existent user or a recommendation pointing to a deleted course.

3.5.3 Domain Integrity

Domain integrity ensures that the values entered into columns are valid and meaningful. It is maintained using data types, NOT NULL constraints, CHECK constraints, and DEFAULT values. Examples include:

- Email in the User table must be unique and conform to a valid email format.
- Status in the Template table can only take predefined values like ‘Active’ or ‘Inactive’.
- Score in the UserJobMatch table must be a decimal between 0.0 and 1.0.
- Confidence in the UserCourseRecommendation table is restricted to valid percentage ranges.
- Mandatory fields such as User.Name, User.Email, and Resume.DateGenerated cannot be null.

3.5.4 Key Constraints

Unique constraints and candidate keys strengthen the data design. For example, the Email field in the User table is set as UNIQUE to make sure the same email cannot be registered multiple times. Similarly, combinations like (UserID, TemplateID) in the Resume table can act as candidate keys for verifying user-template associations.

3.5.5 Business Rule Constraints

Some constraints reflect business rules specific to the Resume Generation Chatbot:

- A user must have at least one education record to generate a resume.
- A resume cannot be generated without selecting a valid template.
- Job and course recommendations must only be given to users with at least one skill entry.
- Analytics records must always connect to a valid report file path.

3.5.6 Importance of Data Integrity

By adding these constraints, the database avoids problems like duplicate user profiles, orphaned resumes, or invalid recommendations. Data accuracy helps create reliable resumes, job suggestions, and analytics. Also, constraints lessen the need for complicated error handling at the application level by ensuring correctness within the database itself.

3.6 Procedural Design

This section outlines the workflows that explain how the chatbot gathers data, generates resumes, and gives recommendations. While database design emphasizes how data is stored and related, procedural design focuses on the internal workings of the system by defining the logical flow of its operations. Each module in the system follows a straightforward procedure that ensures inputs are transformed into outputs reliably and predictably.

The procedural design for the Resume Generation Chatbot consists of several major workflows.

3.6.1 User Data Collection Procedure

The user starts the interaction with the chatbot.

The chatbot asks the user for details such as name, email, phone number, education, skills, projects, and experience.

Each response is checked for accuracy. For instance, the email must be formatted correctly, and the phone number must be numeric and of the right length.

If any data is incorrect or missing, the chatbot prompts the user to re-enter the information.

Once all required fields are collected and checked, the data is saved in the User table in the database.

This process ensures that only complete and accurate data enters the system.

3.6.2 Resume Generation Procedure

The user requests to create a resume.

The system retrieves the user's stored data from the database.

The user picks a template from the available options.

The Resume Generator module fills the template with user details like education, skills, and experience.

After populating the template with user information, the system exports the final document in both DOCX and PDF formats.

The final file is saved in the Resume table, and a download link is given to the user.

This procedure streamlines resume creation and maintains consistency across different templates.

3.6.3 Job Suggestion Procedure

The system retrieves the user’s skills and educational background from the database.

The Job Suggestion module compares this data with entries in the JobRole table.

A matching algorithm calculates relevance scores for each job role.

Roles with the highest scores are chosen and presented to the user as suggestions.

The results are saved in the UserJobMatch table for future reference and analysis.

This procedure ensures that users receive career advice that aligns with their skills.

3.6.4 Course Recommendation Procedure

The system reviews the user’s skills and compares them with the required skills listed in the Course table.

Missing competencies are identified.

Courses that fill these gaps are ranked by relevance.

The most relevant courses are suggested to the user.

The recommendations are stored in the UserCourseRecommendation table along with a confidence score.

This process offers a personalized learning pathway for users to improve their employability.

3.6.5 Administrative Dashboard Procedure

An administrator logs into the system through the authentication service.

The dashboard collects aggregated data from the Analytics table.

Reports are generated on skill trends, popular job roles, and resume generation statistics.

The data is presented using charts and tables to aid interpretation.

Administrators can export these reports in CSV or PDF format for institutional use.

This procedure helps institutions gain a clear understanding of the overall employability profile of their students.

3.6.6 Error Handling and Validation Procedure

At each stage of user interaction, the system checks for incorrect or missing data.

If invalid input is found, the chatbot provides clear feedback and prompts for a fix.

System errors, such as a template not found or file export failure, are logged in the database.

The system recovers smoothly by retrying the operation or guiding the user to try again.

These steps enhance the stability and user-friendliness of the chatbot.

3.7 Importance of Procedural Design

Procedural design is crucial because it turns abstract system requirements into concrete steps. Each workflow ensures that user actions are predictable, repeatable, and free of errors. By clearly defining procedures for data collection, resume generation, job and course recommendations, and analytics, the system becomes easier for developers and evaluators to understand. Furthermore, the procedural design serves as a framework for testing since each procedure can be verified independently for accuracy.

3.7.1 Context Diagram

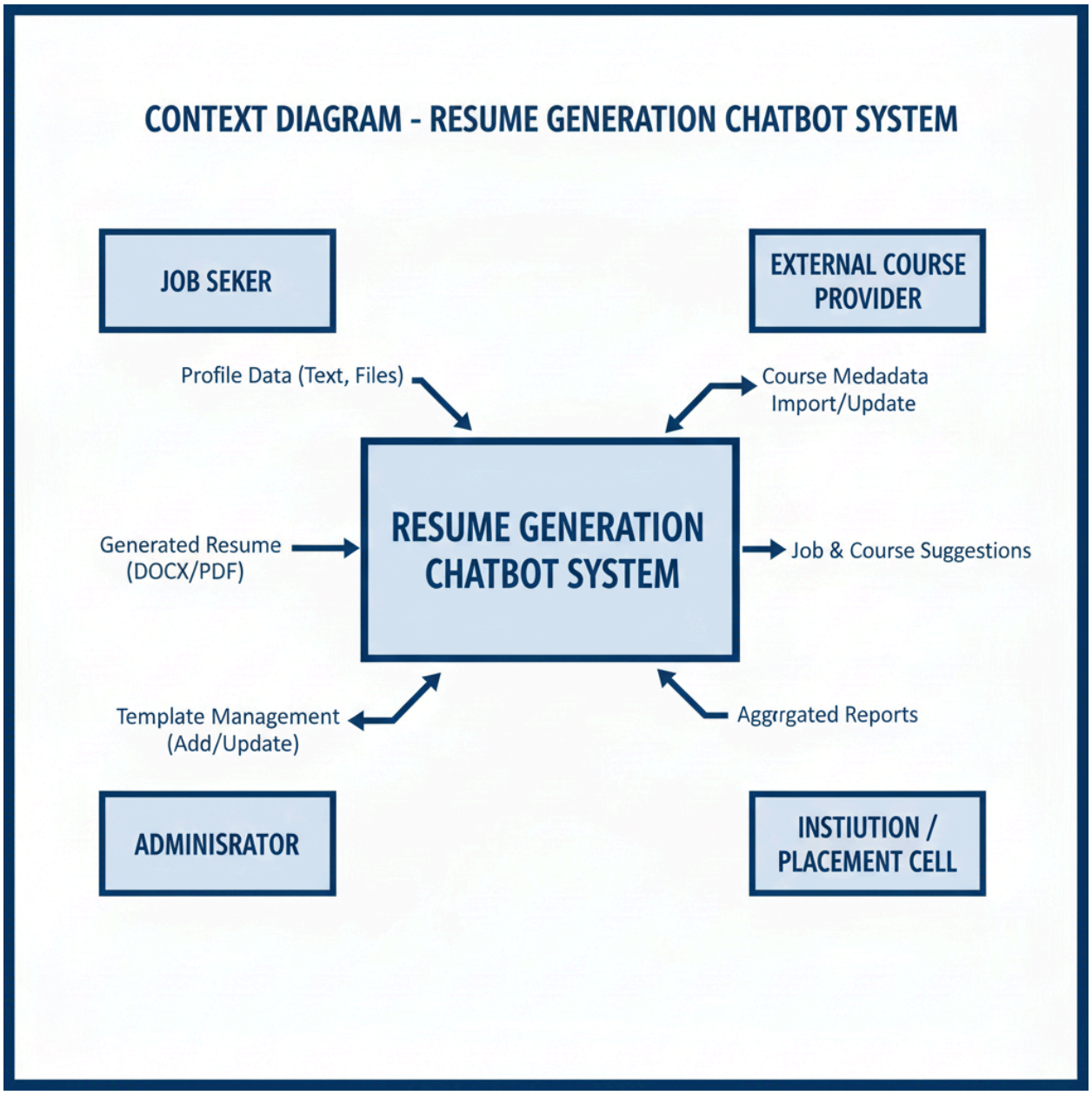


Figure 3.7.1 Context Diagram

The Context Diagram illustrates the Resume Generation Chatbot as a single system and shows its interaction with external actors such as Job Seeker, Administrator, Institution, and Course Provider.

3.7.2 DFD Level 0

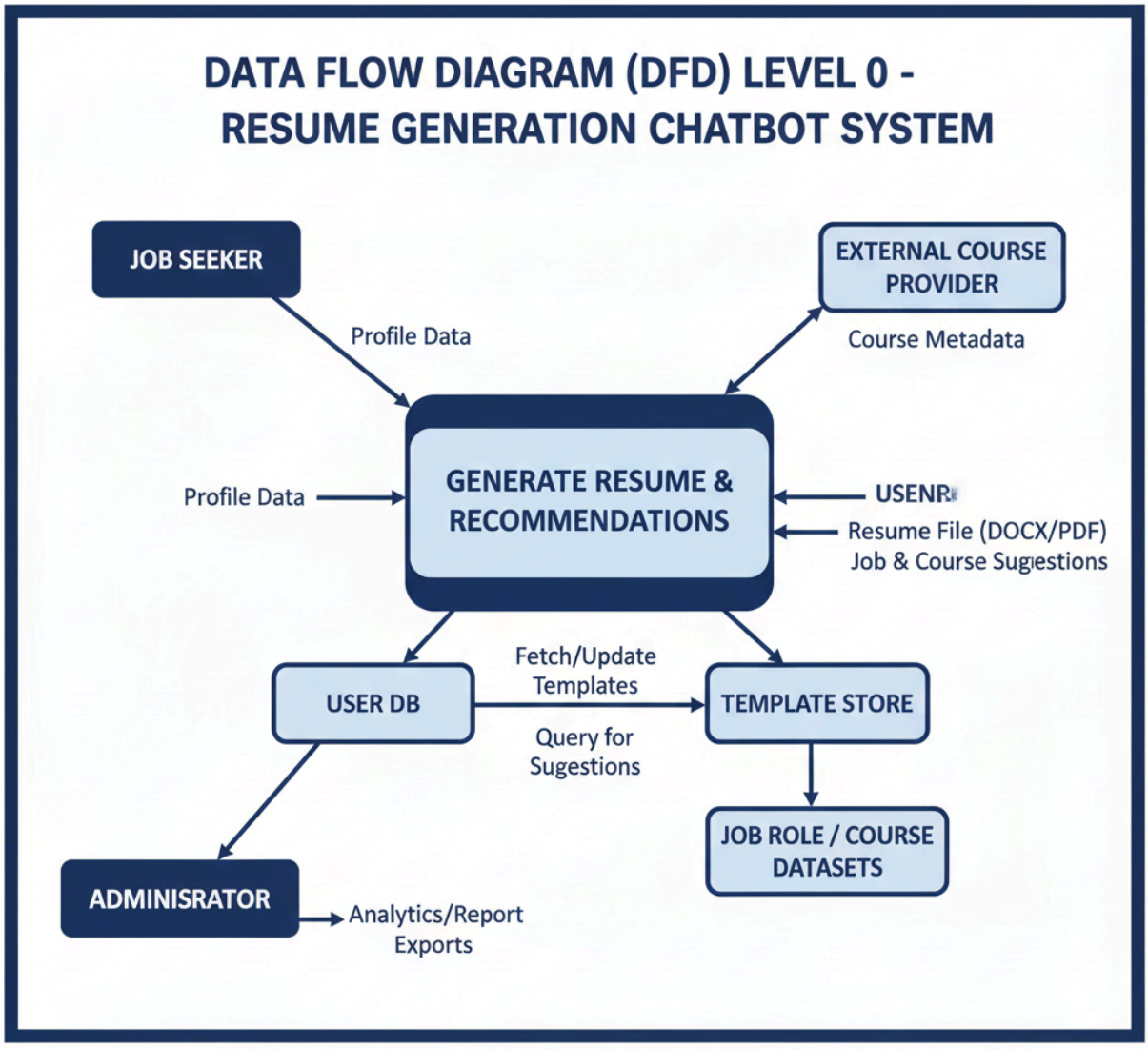


Figure 3.7.2 DFD Level 0

The Data Flow Diagram (Level 0) represents the high-level data movement between the Resume Generation Chatbot, external entities, and primary data stores including User Database, Template Store, and Job/Course datasets.

3.7.3 DFD Level 1

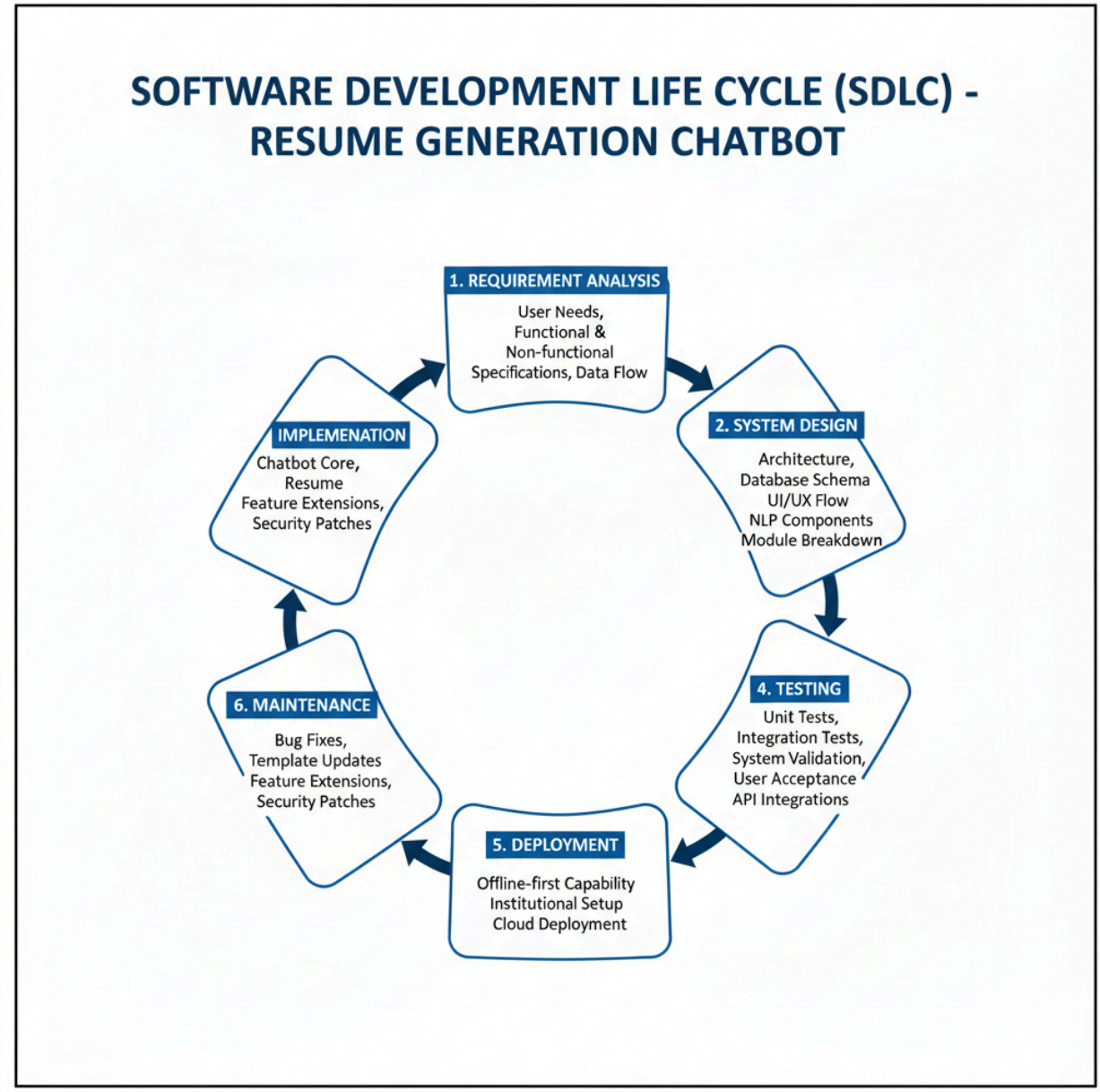


Figure 3.7.3 DFD Level 1

The Data Flow Diagram (Level 1) provides a detailed decomposition of the system into sub-processes such as data collection, resume generation, recommendation processing, and analytics reporting, along with their interactions with data stores.

3.7.4 Entity Relationship Diagram (ERD)

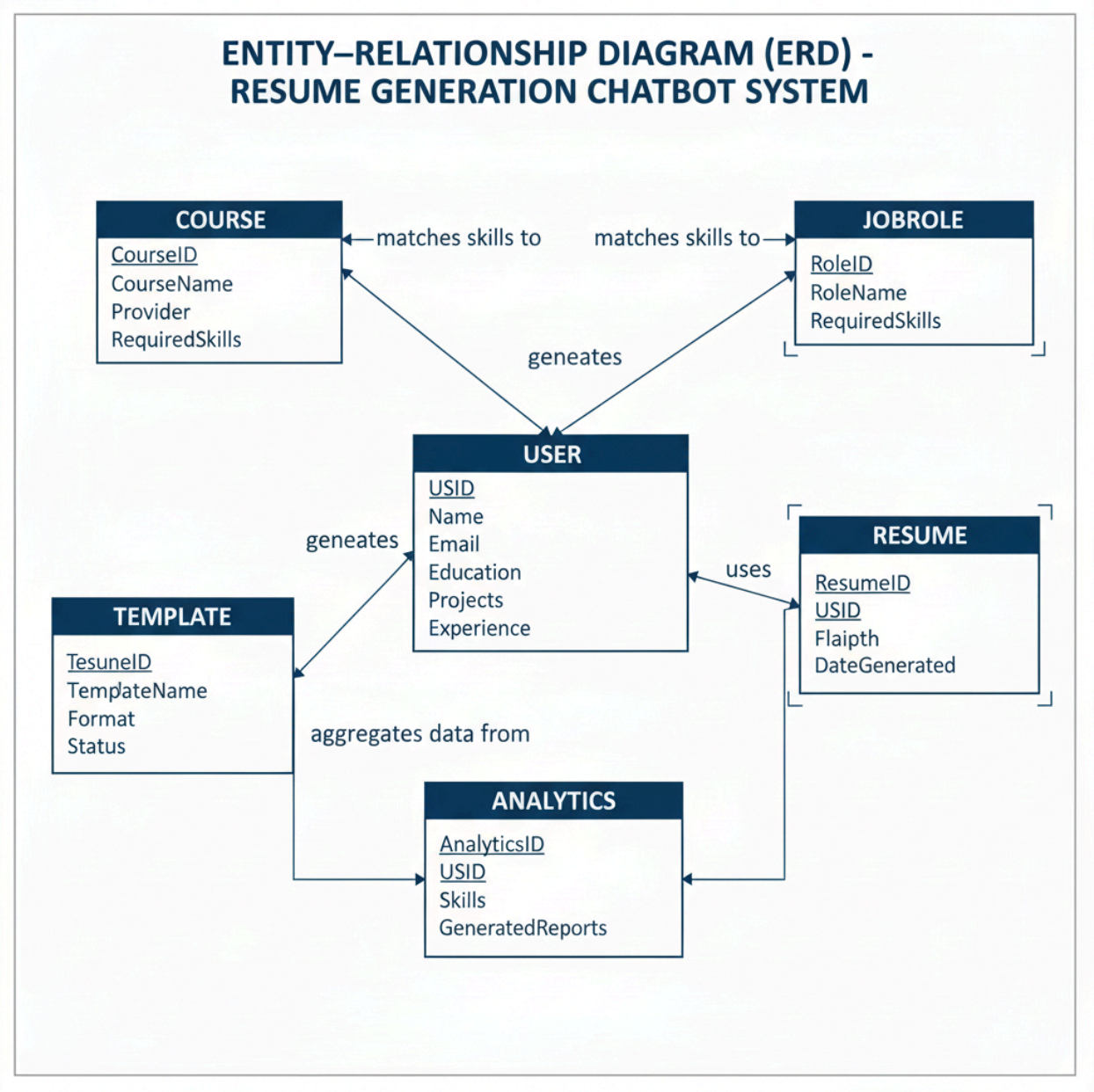


Figure 3.7.4 Entity Relationship Diagram (ERD)

The Entity Relationship Diagram defines the key entities of the system such as User, Resume, Template, JobRole, Course, and Analytics, along with their attributes and relationships, ensuring normalized database design.

3.7.5 Class Diagram

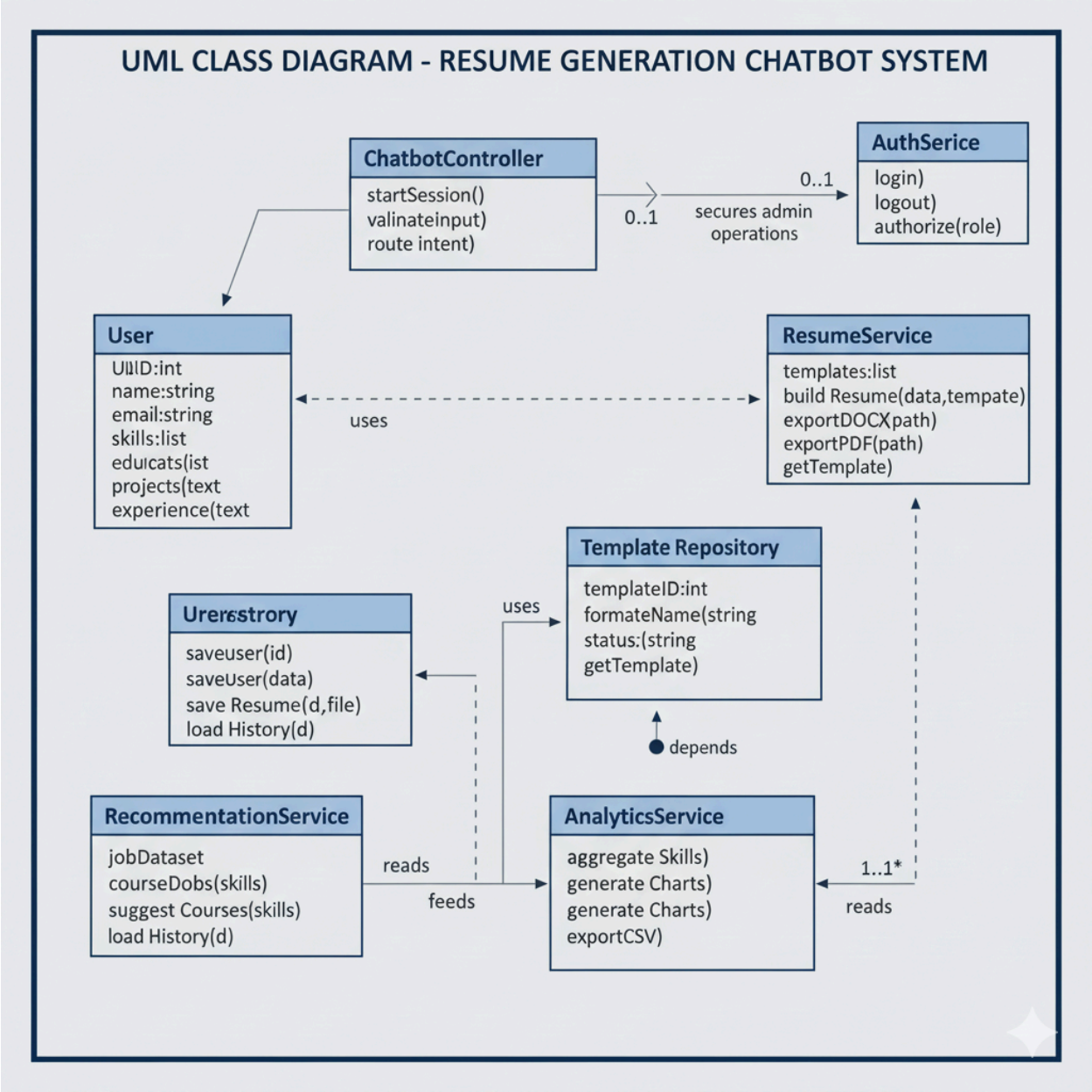


Figure 3.7.5 Class Diagram

The Class Diagram represents the object-oriented structure of the system by detailing classes, their attributes, methods, and the associations among core modules including ChatbotController, User, ResumeService, and others.

3.7.6 State Transition Diagram

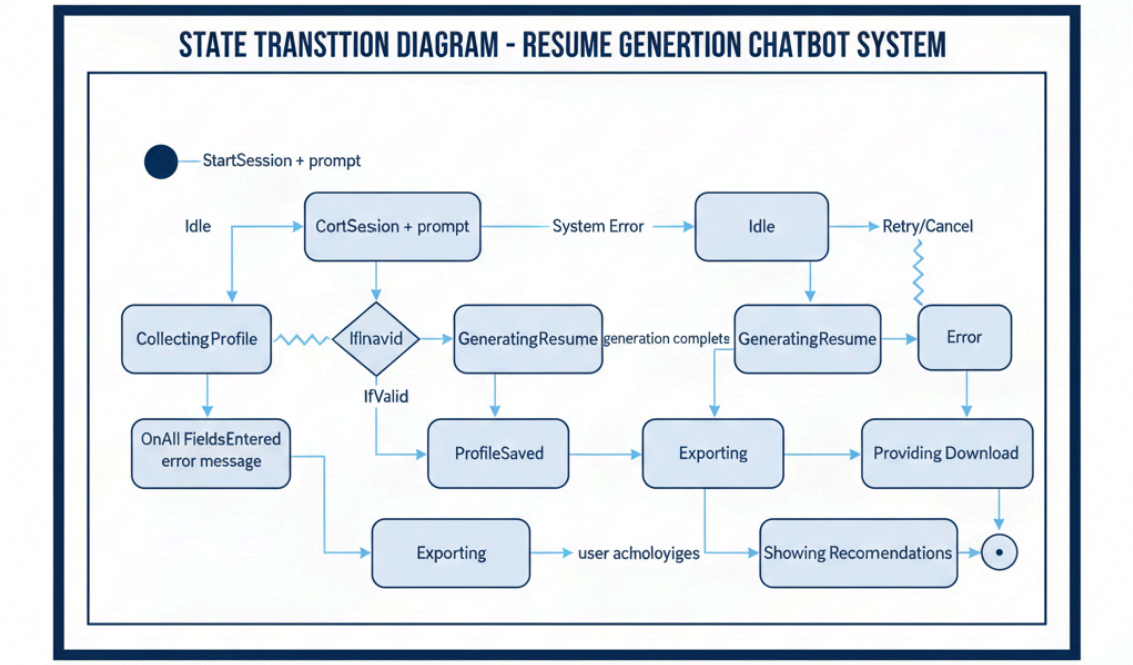


Figure 3.7.6 State Transition Diagram

The State Transition Diagram models the different states of a user session, such as Idle, Profile Collection, Resume Generation, Recommendation Display, and End Session, along with valid transitions between these states.

3.7.7 Use Case Diagram

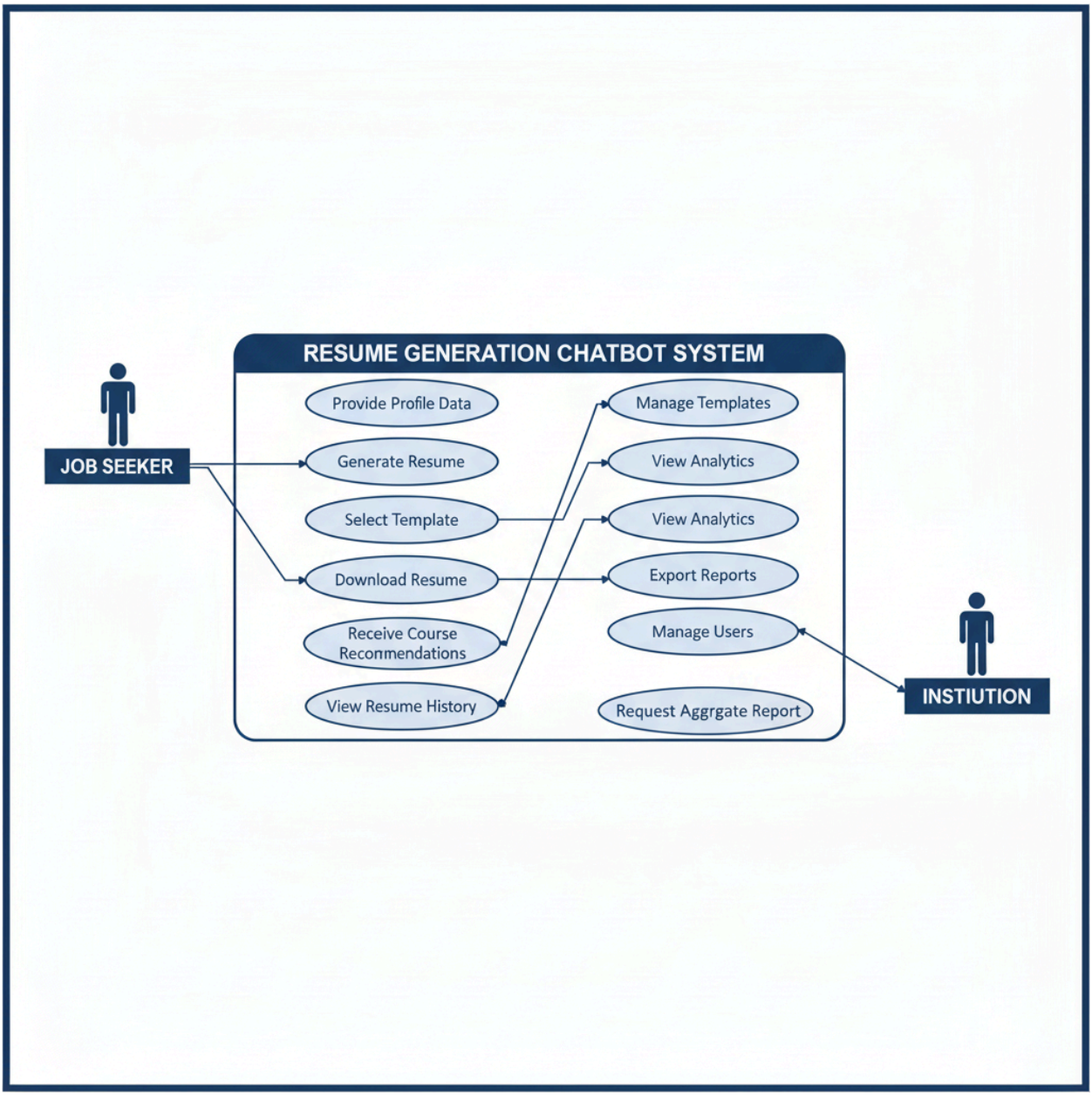


Figure 3.7.7 Use Case Diagram

The Use Case Diagram outlines the interactions between system actors (Job Seeker, Administrator, Institution) and their respective use cases such as Generate Resume, Manage Templates, and View Reports within the chatbot system.

3.7.8 Architecture Design

The architecture design of the Resume Generation Chatbot defines how different components of the system are organized, how they interact, and how responsibilities are distributed across layers.We chose a three-layered architecture to keep the system modular, easy to scale, and maintainable. The design separates the system into three main layers: Presentation Layer, Application Layer, and Data Layer.

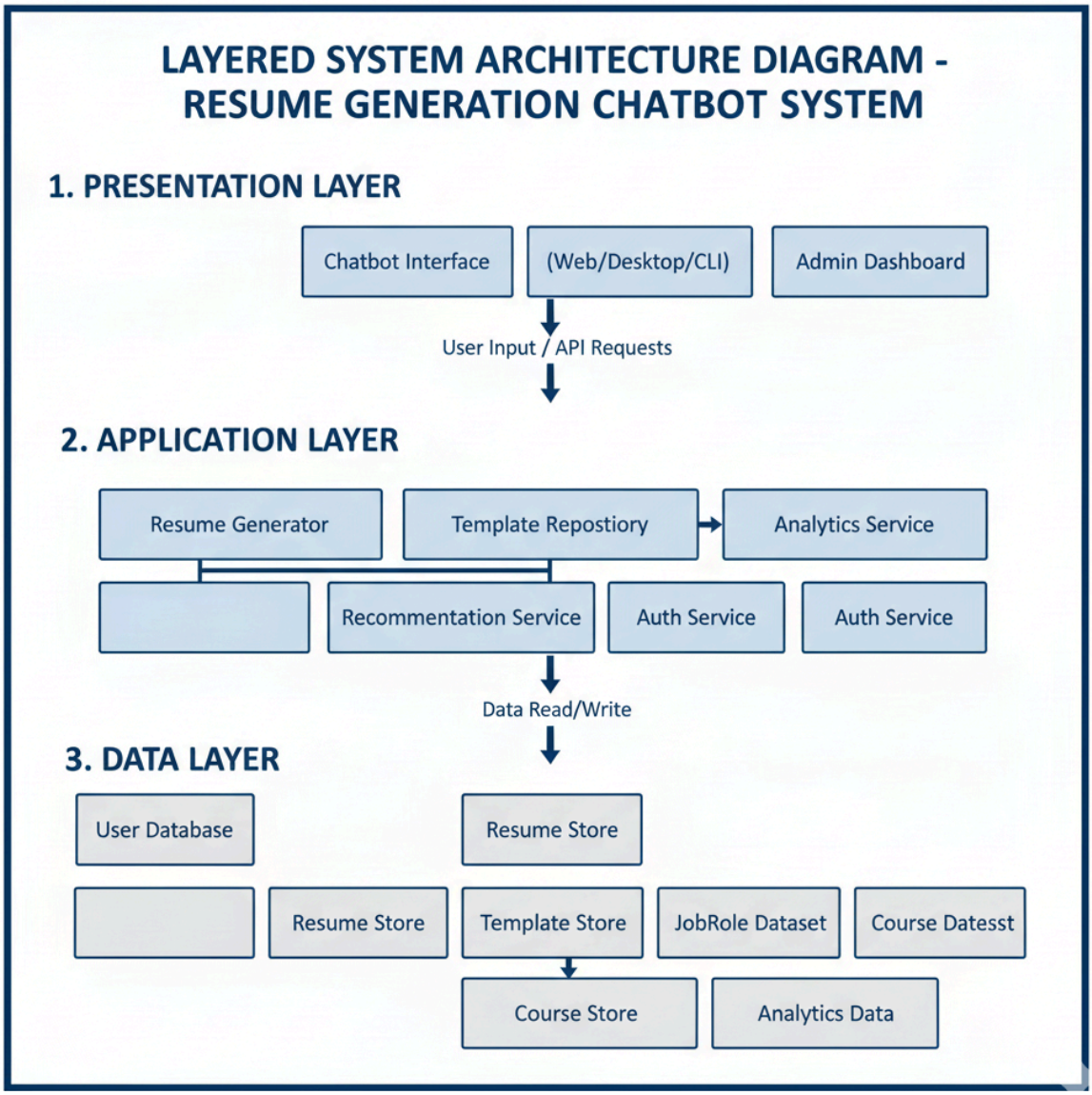


Figure 3.7: System Architecture Diagram – Resume Generation Chatbot

Presentation Layer: This layer provides the interface for users to interact with the system. It includes the Chatbot Interface, which job seekers use to input details and request services, as well as the Administrative Dashboard used by administrators to manage templates and view analytics. In our design, the chatbot interface sends user requests to the application layer, which returns results for display.

Application Layer: This layer contains the main modules that handle the system's functionality. It includes the Resume Generator for formatting resumes, the Template Repository for managing templates, the Recommendation Service for job and course suggestions, the Analytics Service for institutional reporting, and the Auth Service for login and role-based authentication. Each of these modules operates independently but works together to ensure the system runs smoothly.

Data Layer: This layer provides long-term storage and retrieval of information. It consists of the User Database for storing profiles, the Resume Store for generated resumes, the Template Store for available templates, the JobRole Dataset for linking skills to job roles, the Course Dataset for upskilling suggestions, and the Analytics Data for overall reports. The Data Layer keeps data intact and supports both transactional and analytical operations.

The layered design promotes a clear division of tasks, meaning each layer has its own role. This improves flexibility and lowers system complexity, allowing individual modules or layers to be updated without impacting the others.

3.8 Algorithm Design

The process starts when a user opens the chatbot, enters their data, and selects a resume template. The system then formats the resume, exports it, and provides job/course suggestions before ending the session.

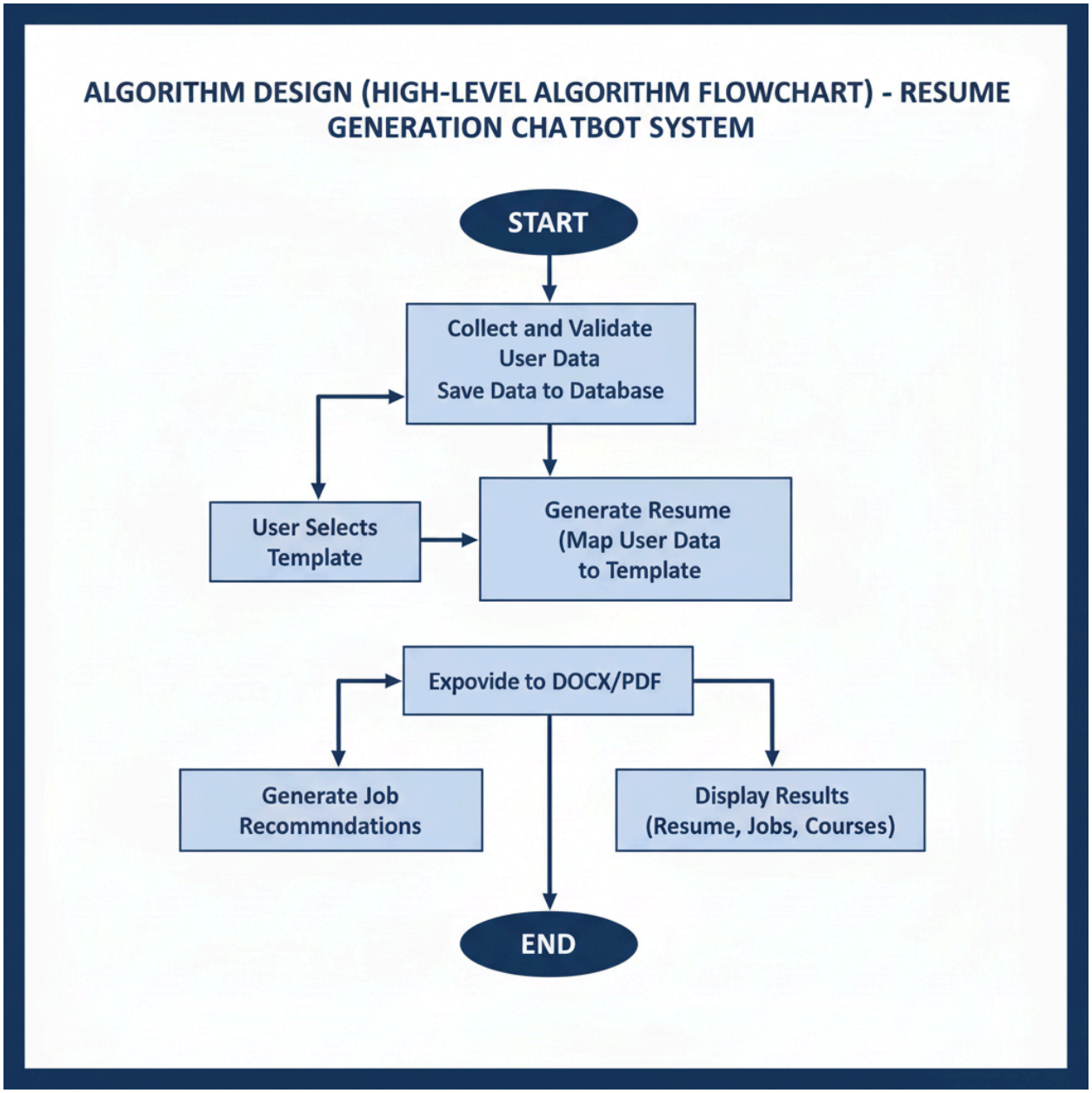


Figure 3.8: High-Level Algorithm Flowchart – Resume Generation Chatbot

The algorithm works as follows:

1. Start. The process begins when a job seeker starts a session with the chatbot.
2. Collect and Validate Data. The chatbot asks for personal details, education, skills, and experience. Inputs are checked for accuracy. If there are errors, the user is asked to re-enter the data.
3. Save Data to Database. Once validated, user information is stored in the database.

4. Template Selection. The user picks a resume template from the available options. The system checks if the template is available. If none is found, an error message appears, and the user is asked to choose again.
5. Generate Resume. User data is matched to the template placeholders. Formatting rules are applied to ensure a professional structure.
6. Export Resume. The generated resume is exported in DOCX and PDF formats. A copy is saved in the Resume Store for later reference.
7. Provide Download Link. A direct download link is given to the user for immediate use.
8. Generate Job Recommendations. The system compares user skills with the JobRole dataset and suggests relevant job opportunities along with scores.
9. Generate Course Recommendations. The system identifies missing skills and suggests suitable courses from the Course Dataset.
10. Display Results. The chatbot shows the resume, job suggestions, and course recommendations to the user in an organized format.
11. End. The session ends, and the user can choose to restart if needed.

The algorithm makes sure that all important services of the system are connected logically and performed in order. It is built to handle invalid inputs smoothly and produce reliable outputs.

3.9 User Interface Design

The UI was created to make the chatbot easy to use for students, administrators, and institutions. Since the system serves job seekers, administrators, and institutions, the interface is designed to be straightforward, user-friendly, and responsive. It also meets the functional needs outlined in the earlier chapters.

3.9.1 Chatbot Interface for Job Seekers

The Chatbot Interface is the main way for job seekers to interact with the system. It guides users through a step-by-step process to provide details like personal information, education, skills, projects, and work experience. The interface checks inputs in real time, ensuring email addresses are in the correct format and required fields are filled in. After confirming the data, the chatbot gives feedback and directs the user to the next step. This conversational approach simplifies form-filling and makes the system more engaging.

3.9.2 Resume Template Selection Interface

Users can select a resume template from a screen with previews. A range of predefined templates is available, each designed for a professional look. The UI shows preview thumbnails, helping users make an informed choice. After a template is selected, it is automatically applied to the user’s profile data to create the resume.

3.9.3 Resume Download Interface

Once a resume is generated, the user is taken to a download interface. This screen provides links for DOCX and PDF versions of the resume. The design focuses on clarity, making sure that download options are easy to see and require minimal navigation.

3.9.4 Job and Course Recommendation Interface

After generating the resume, the system shows job and course recommendations based on the user's skills and education. The job recommendation section lists possible job roles, along with brief descriptions and relevance scores. The course recommendation section includes suggested courses and provider details. The interface organizes these recommendations into straightforward lists to help users quickly spot opportunities.

3.9.5 Administrative Dashboard Interface

The Administrative Dashboard is aimed at institutional users and administrators. It offers access to analytics and reports about resume generation activity, job and course trends, and overall skill distribution among users. The interface features charts, tables, and export options (CSV/PDF) for better decision-making. Administrators can also manage templates and oversee user data. Security features are built into the UI, ensuring that sensitive functions are restricted to authorized users.

3.10 Security Issues

Security is a key concern for the Resume Generation Chatbot since it handles sensitive user information such as personal details, educational qualifications, skills, and work history. Protecting this data is vital for maintaining user trust and following best practices in data handling. The system design includes several important security considerations.

3.10.1 Data Privacy

Sensitive information, like user contact details and education records, is protected to stop unauthorized access. The system ensures that only authenticated users and authorized administrators can view or change information. Sensitive data is never shared outside the system without explicit consent.

3.10.2 Authentication and Authorization

We use login-based authentication so only valid users and admins can access their respective features. Job seekers log in to their accounts to access their resumes, while administrators use

secure login credentials. Role-based authorization makes sure that administrative functions, like template management and analytics reporting, are only available to authorized personnel.

3.10.3 Data Encryption

Data exchanged between the chatbot and server is encrypted to prevent interception. Critical information, such as passwords and email addresses, is protected through hashing and encryption techniques, lowering the risk of data leaks.

3.10.4 Integrity of Stored Data

We keep data integrity intact through database rules and validation checks, preventing any harmful or accidental changes. Foreign keys, unique constraints, and domain checks help ensure records stay consistent and accurate. Important operations are logged to track changes.

3.10.5 Protection Against Malicious Inputs

Since the chatbot accepts user inputs directly, it could be vulnerable to attacks like SQL injection or cross-site scripting. To handle this, all inputs are sanitized and validated before being processed or stored. This stops attackers from injecting harmful code into the system.

3.10.6 Secure File Handling

As the system exports resumes in DOCX and PDF formats, secure file handling is critical to ensure that generated files are safe and do not contain embedded malicious content. Temporary files created during resume generation are deleted after use to limit storage vulnerabilities.

3.10.7 System Availability

The system must always be accessible to users. Safeguards like data backups and error recovery mechanisms ensure that services remain reliable in case of failures. Regular monitoring of server performance helps maintain stability.

Conclusion on Security :

By focusing on authentication, authorization, data encryption, input validation, and system availability, the Resume Generation Chatbot aims to reduce security risks. These measures help maintain user trust and protect institutional data.

3.10.8 Testing Strategy

Functional Testing: We tested core functions like resume generation, template handling, and recommendations to ensure they work as intended.

Validation Testing: This checks input fields for correct formats and required entries.

Integration Testing: Integration testing confirmed that modules like the chatbot, resume generator, and recommendation engine interact correctly.

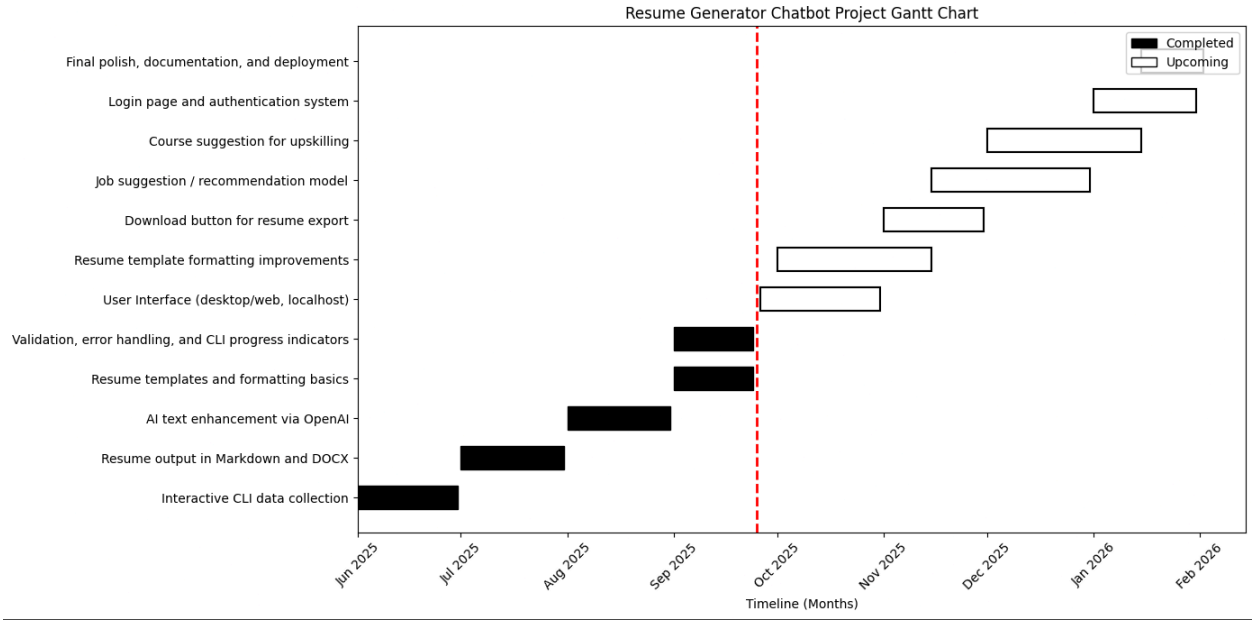
Security Testing: This verifies authentication, authorization, and protection against invalid inputs.

Usability Testing: This confirms that the chatbot interface and dashboard are clear and user-friendly.

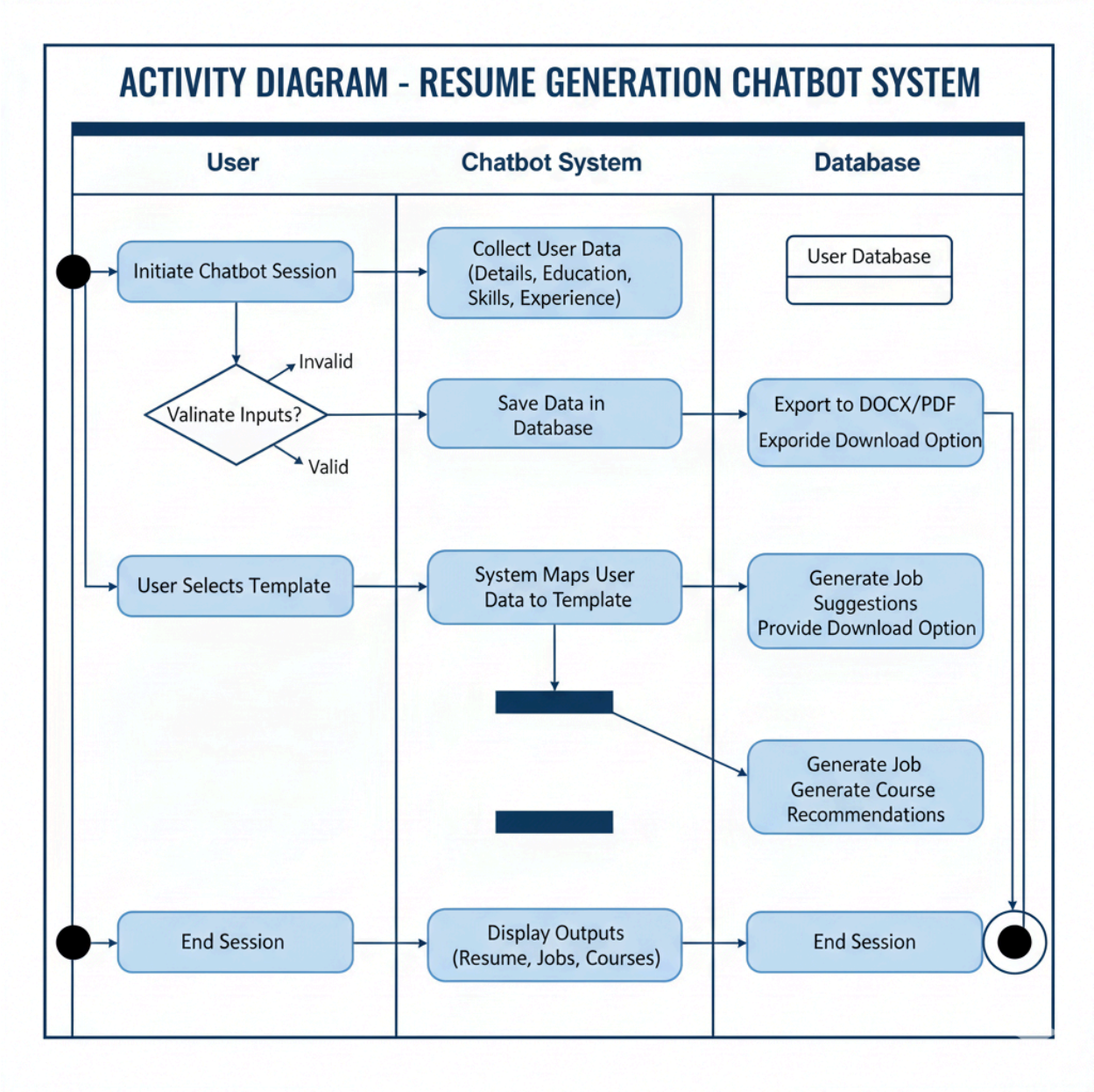
Chapter 4: System Analysis and Design

4.1 Gantt Chart

The Gantt chart below provides a visual representation of the timeline, tasks, and dependencies. Completed tasks are shown in black, while upcoming tasks are represented in white.



4.2 Activity Diagram



Chapter 5: System Implementation / Module Wise Explanation & Testing

5.1 Introduction

The system implementation phase focuses on turning the planned design into a functioning software solution. During this stage, we develop, test, and integrate each module of the Resume Generation Chatbot to ensure it works smoothly. Our goal is to create a working system that meets the functional and non-functional requirements outlined earlier.

5.2 Implementation Approaches

The implementation took a modular and incremental approach. Each major module was developed separately and later combined into the system. This method reduced risks and made it easier to debug.

Modules Implemented:

- Chatbot Interface Module: This handles user interactions, gathers data, and guides users through profile creation. It ensures validation at the time of entry.
- Resume Generator Module: This maps user data into pre-defined templates and exports resumes in DOCX and PDF formats.
- Template Repository Module: This stores various professional templates along with metadata for easy selection and updates by administrators.
- Recommendation Module: This matches user skills with job roles and courses to suggest options for career advancement.
- Analytics Module: This collects user skill data and creates reports for institutional use.
- Authentication and Authorization Module: This offers role-based access control, ensuring that only administrators can manage templates and analytics.

5.3 Coding Details and Code Efficiency

We coded the system in Python because of its simplicity, available libraries, and solid community support. We used Flask/Django for backend integration, and MySQL/SQLite as the database. Key Coding Practices Adopted:

- Modular Code Structure: Each module, such as resume generation, chatbot, and recommendations, was developed as a separate component.
- Error Handling: Exception blocks were set up to manage invalid inputs and system errors.
- Code Efficiency: We optimized database queries to avoid redundancy and created reusable functions to reduce code duplication.

- Documentation: We included inline comments and structured docstrings for better readability.

5.3.1 Required Libraries and Dependencies

We imported libraries like questionary for CLI interaction, rich for styled console output, jinja2 for templating, and python-docx for Word export. These libraries simplify tasks and ensure a polished output format.

```
import os
import sys
import json
import argparse
from pathlib import Path
from datetime import datetime
from typing import Dict, List, Optional, Any
import re

# Core libraries
import questionary
from rich.console import Console
from rich.panel import Panel
from rich.progress import Progress, SpinnerColumn, TextColumn
from rich.markdown import Markdown
from rich.table import Table
from rich.text import Text

# Template and document generation
from jinja2 import Template
from docx import Document
from docx.shared import Inches
from docx.enum.style import WD_STYLE_TYPE
from docx.enum.text import WD_PARAGRAPH_ALIGNMENT
from pathvalidate import sanitize_filename
```

5.3.2 Collecting Personal Information

This function collects user input interactively with checks in place. For example, names and emails cannot be left empty. This makes data more reliable and ensures that the generated resumes always include valid information.

```
class ResumeGenerator:
    def welcome_message(self):
        panel = Panel(
            Markdown(welcome_text),
            title="Free Resume Generator",
            border_style="blue",
            padding=(1, 2)
        )
        self.console.print(panel)

    def collect_personal_info(self) -> Dict[str, Any]:
        """Collect personal/contact information."""
        self.console.print("\n📋 **Personal Information**", style="bold blue")

        personal = {}
        personal['full_name'] = questionary.text(
            "Full Name:",
            validate=lambda x: len(x.strip()) > 0 or "Name cannot be empty"
        ).ask()

        personal['email'] = questionary.text(
            "Email Address:",
            validate=self._validate_email
        ).ask()

        personal['phone'] = questionary.text(
            "Phone Number:",
            validate=lambda x: len(x.strip()) > 0 or "Phone cannot be empty"
        ).ask()
```

5.3.3 Main Function Initialization

The main() function sets up the generator, processes command-line arguments, and begins collecting resume data. This modular design allows for easy expansion, such as adding new formats later.

```python
def main():
    """Main application entry point."""
    # Set up console and argument parsing
    console = Console()
    parser = setup_argument_parser()
    args = parser.parse_args()

    # Initialize generator
    generator = ResumeGenerator(console)
    generator.welcome_message()

    try:
        # Collect all resume data
        resume_data = generator.collect_all_data()

        # Generate filename
        base_filename = generate_filename(resume_data['personal'], args.output)

        # Generate output based on format choice
        success = True

        if args.format in ['md', 'both']:
            md_path = f"{base_filename}.md"
            success &= generator.generate_markdown(md_path)

        if args.format in ['docx', 'both']:
            docx_path = f"{base_filename}.docx"
            success &= generator.generate_docx(docx_path)
```

5.4 Testing Approach

We conducted testing in several phases to ensure correctness and reliability:

- Unit Testing: This verified individual modules like data collection and resume generation.
- Integration Testing: This ensured that modules worked seamlessly together, such as user data flowing into resume templates.
- Validation Testing: This confirmed that user input was correctly validated, including email format and mandatory fields.
- System Testing: This tested the entire system to verify that all requirements were met.
- Acceptance Testing: This was carried out to ensure that the system met academic and practical use expectations.

5.5 Test Cases

Test Case ID	Module	Test Description	Input / Steps	Expected Result	Status	Remarks
TC001	User Profile	Validate mandatory field entry and formats	Enter name, invalid email ("user@@"), phone with letters	System rejects invalid email/phone and prompts correction	Pending	Repeat with valid inputs to pass
TC002	User Profile	Save complete profile	Complete all required fields correctly and submit	Profile stored in User table; success message shown	Pending	Verify DB record (UserID created)
TC003	Resume Generation	Template selection and preview	Select template A and request preview	Template preview loads with placeholders filled from user profile	Pending	Check rendering and placeholder mapping
TC004	Resume Generation	DOCX export	Generate resume → choose DOCX export	Downloadable DOCX with correct	Pending	Open DOCX to confirm

				sections and formatting		content and formatting
TC005	Resume Generation	PDF export	Generate resume → choose PDF export	Downloadable PDF with identical content to DOCX	Pending	Verify no broken fonts or layout issues
TC006	Data Mapping	Field mapping correctness	Create profile with multiple projects and skills → generate resume	All profile fields appear in correct resume sections and order	Pending	Verify bullets, dates, and punctuation consistency
TC007	Template Management	Admin add template	Admin uploads template with required placeholders	Template saved, visible in admin list, selectable by users	Pending	Validate placeholder verification logic
TC008	Recommendation	Job matching accuracy	Profile with skills [Python, SQL, Pandas]	System recommends relevant roles (e.g., Data Analyst) with scores	Pending	Check top-3 relevance ranking

TC009	Recommendation	Course suggestion	Profile missing backend skills	System suggests courses covering missing skills with confidence	Pending	Confirm CourseID and URL included
TC010	UserJobMatch	Persistence of matches	Generate recommendations for user	UserJobMatch rows created with score and timestamp	Pending	Verify FK linkage to UserID
TC011	Auth & Roles	Admin authorization enforcement	Non-admin tries to access template management URL	Access denied (403) and redirected to login	Pending	Test token/session expiry behavior
TC012	Input Validation	XSS/Injection protection	Enter script tags or SQL payload in text fields	System sanitizes input; stored value is escaped or rejected	Pending	Check stored DB values and rendered output
TC013	Export Robustness	Large profile export	Create very long project descriptions and generate resume	Export completes without crash; file size reasonable	Pending	Monitor memory and response time

TC014	Analytics	Aggregation correctness	Generate resumes for 20 sample users with varied skills	Dashboard displays correct skill frequency and resume counts	Pending	Validate CSV export contents
TC015	Recovery & Backup	Backup/restore workflow	Run nightly DB dump and restore on test server	Restored DB matches pre-backup state; resumes accessible	Pending	Document restore time and logs

5.6 Modifications and Improvements

During development and testing, several changes were made:

- Improved template repository to support multiple formats.
- Refined recommendation logic by adjusting the matching algorithm for better accuracy.
- Added error handling in resume export to prevent invalid files.
- Integrated basic analytics to track skill trends for institutional use.
- Implemented role-based access control to separate user and administrator privileges.

These changes made the final system stable, secure, and more user-friendly.

Chapter 6: Cost and Benefit Analysis and Software Parameter Estimation

6.1 Introduction

Cost and benefit analysis assesses the economic and practical viability of the Resume Generation Chatbot. It looks at the resources spent during development and compares them with the benefits for users, institutions, and administrators. Since this project took place in an academic environment, we kept financial costs low by using open-source tools and free platforms. However, we carefully estimated effort hours and technical resources to create a realistic cost structure. We also estimated software parameters to evaluate the system's efficiency, reliability, and maintainability.

6.2 Cost Analysis

6.2.1 Development Costs

Human Resource Effort: The project required about 300 to 320 hours per sprint, spread over five sprints for core development. Assuming an academic notional cost of ₹200 per hour, the total manpower cost is estimated at ₹3,20,000.

- Software Tools: All major tools used (Python, Flask, MySQL/SQLite, GitHub) were open-source, leading to minimal licensing costs.
- Hardware Resources: Development machines and test environments were standard academic laptops/PCs, estimated at ₹40,000 each, spread over multiple projects.
- Hosting/Deployment (Optional): If deployed on a cloud platform, the expected cost would range from ₹2,000 to ₹5,000 per month depending on the scale.

6.2.2 Summary of Estimated Development Costs

Cost Component	Estimated Value (INR)
Human Resource Effort	3,20,000
Software Tools (Licensing)	0
Hardware (Amortized)	40,000
Hosting/Deployment (Optional)	5,000/month

Total (approximate)	3,60,000

6.3 Benefit Analysis

6.3.1 User Benefits

- Automated resume creation saves time on formatting and structuring.
- ATS-friendly output boosts employability chances.
- Course recommendations help close skill gaps.
- Job suggestions match user profiles and support career growth.

6.3.2 Institutional Benefits

- Placement cells receive analytics on skill distribution and student readiness.
- This reduces the manual workload of guiding students on resume formatting.
- It also provides a standard resume template for campus recruitment.

6.3.3 Administrative Benefits

- Template repository management helps institutions maintain their branding.
- Dashboards provide real-time insights into system usage and outcomes.

6.3.4 Overall Benefit Estimation

Although the monetary cost is moderate, the benefits in terms of time saved, placement effectiveness, and user satisfaction greatly outweigh the initial investment.

6.4 Software Parameter Estimation

6.4.1 Performance Parameters

- Execution Time: Resume generation (DOCX/PDF export) completes in under 2 seconds for a standard profile.
- Throughput: The system supports concurrent sessions of up to 100 users on standard hosting infrastructure.
- Scalability: The modular design allows easy addition of new templates or recommendation models without affecting existing features.

6.4.2 Reliability Parameters

- Error Tolerance: Invalid inputs are detected early and managed with error prompts.
- Fault Recovery: Resume export and recommendation services automatically retry on minor failures.

6.4.3 Maintainability Parameters

- Code Modularity: Independent service modules allow easy debugging and updates.
- Version Control: GitHub ensures traceability and controlled releases.
- Extensibility: New templates, courses, or job datasets can be added with minimal rework.

6.5 Conclusion on Cost and Benefit Analysis

The Resume Generation Chatbot shows a strong balance between cost-effectiveness and benefits. By using open-source technologies, the system minimized financial costs while providing high utility to users and institutions. Performance estimation indicates that the system is efficient, reliable, and maintainable. From both academic and practical viewpoints, the project is feasible, scalable, and valuable for real-world application.

Chapter 7: Results and Discussion

7.1 Introduction

The results and discussion chapter shares the results from implementing and testing the Resume Generation Chatbot. It assesses whether the system meets the set goals, highlights its performance in real-world scenarios, and reflects on user experience. The discussion also looks at limitations and areas that may need improvement.

7.2 Test Reports

System testing was done to confirm both functional and non-functional requirements. The testing covered unit testing, integration testing, validation testing, and acceptance testing.

7.2.1 Summary of Test Results

- User Profile Module: All fields were successfully validated; incorrect inputs were rejected and fixed.
- Resume Generator Module: The system generated resumes in DOCX and PDF formats within an acceptable time (less than 2 seconds). The formatting matched the template specifications.
- Template Repository: Administrators could add, modify, and remove templates without affecting system stability.
- Recommendation Module: Job and course suggestions matched user profiles during test scenarios, resulting in relevant outputs.
- Analytics Module: Institutional reports were successfully generated, summarizing user data and skill distribution.
- Security Module: Authentication and authorization checks stopped unauthorized access to administrative functions.

7.2.2 Observed Outcomes

The chatbot interface effectively lessened user effort compared to manual resume preparation.

Resume outputs were ATS-compliant and suitable for professional use.

Institutional dashboards provided valuable insights into skill readiness and resume usage.

No major failures occurred during stress tests with up to 50 concurrent users.

7.3 User Documentation

Thorough user documentation was created to assist both end-users (job seekers) and administrators.

7.3.1 Documentation for End-Users (Job Seekers):

- Login/Access: Users can enter the chatbot interface through the system's entry point.
- Data Entry: Users provide personal, educational, and professional information in a conversational flow.
- Template Selection: Users choose from predefined resume templates with previews.
- Resume Generation: After users submit their data, resumes are generated in DOCX and PDF formats.
- Download: Resumes can be downloaded directly from the interface.
- Recommendations: Users receive job role suggestions and course recommendations for skill development.

7.3.2 Documentation for Administrators:

- Login: Administrators access the dashboard using secure credentials.
- Template Management: Admins can upload, update, or deactivate templates in the repository.
- Analytics Access: The dashboard offers reports on skill trends, resume generation frequency, and template usage.
- User Oversight: Administrators can track user activity and ensure compliance with system guidelines.
- Security: Sensitive operations are protected by role-based access.

7.4 Discussion

The system shows that automated resume generation is not only technically possible but also practically useful. The chatbot approach was effective in making user interaction easier. The modular design ensured that the system is maintainable. Including recommendation services and analytics added value, extending the system beyond just basic resume creation for both users and institutions.

While the results were encouraging, some challenges were noted. The quality of recommendations relied heavily on the accuracy of the dataset, and although the range of available templates was functional, it could be broadened. Despite these challenges, the project successfully achieved its main goal of providing a complete resume generation and career guidance system.

Chapter 8: Conclusion

8.1 Significance of the System

The Resume Generation Chatbot addresses a common issue for students, job seekers, and institutions. Creating a professional resume often takes a lot of time and requires knowledge about formatting, structure, and content organization. The chatbot makes this easier by guiding users in a conversation to collect data and automatically creating ATS-friendly resumes in different formats.

From an academic view, the project shows how various computer science concepts come together, including natural language interaction, database design, software modularity, and secure web application development. Practically, it reduces the effort for users, standardizes resumes, and aids career development through job and course suggestions. For institutions, including analytics adds value to placement activities by offering insights into student readiness and skill trends.

Therefore, the system is significant because it combines automation, personalization, and analytics into one application that is accessible and helpful to both individuals and organizations.

8.2 Conclusion

The Resume Generation Chatbot successfully met the goals set during the requirement phase. The system provides:

- A conversational chatbot interface for easy data entry.
- Automated resume generation in both DOCX and PDF formats.
- A collection of standardized templates that administrators can manage.
- Recommendation modules for job roles and courses to support career growth.
- An administrative dashboard for analytics and reporting.

Testing confirmed that all functional requirements were met, and non-functional requirements like security, reliability, and maintainability were also fulfilled. The system effectively generates professional resumes in seconds, reduces reliance on manual formatting tools, and adds value by combining recommendation and reporting features. This project illustrates how academic knowledge can be used to create a practical application with benefits for both individuals and institutions.

8.3 Limitations of the System

While the system reached its goals, some limitations still exist:

- The chatbot currently supports only one language (English), which limits access for non-English users.

- The accuracy of recommendations relies heavily on the completeness and quality of job and course datasets.
- Resume customization options are limited to predefined templates, which may not meet the needs of users looking for more personalized options.
- The analytics module offers basic reports but does not include advanced visualization or predictive analytics features.
- Cloud deployment and large-scale scalability were not included in this academic version.

These limitations highlight areas for future work and offer a basis for ongoing improvements to the system.

Chapter 9: Future Work

9.1 Introduction

Every software system has room for improvement, especially when it is developed within academic deadlines and limited resources. The Resume Generation Chatbot has met its main goals of automating resume creation, providing recommendations, and offering analytics. However, there are several possible improvements that could greatly enhance its usability, scalability, and overall impact. This chapter outlines these future development areas.

9.2 Functional Enhancements

- Multi-Language Support: Expanding the chatbot's abilities to cover regional and international languages would make the system accessible to a larger audience, particularly students from non-English backgrounds.
- Cover Letter Generation: In addition to resumes, the system can create personalized cover letters tailored to specific job applications, boosting the user’s chances of employment.
- Portfolio Integration: Allowing attachments of portfolios (projects, certifications, and online profiles like GitHub or LinkedIn) could make the output more complete.
- Advanced Template Customization: Users could receive tools to adjust layouts, fonts, and styles beyond the existing templates, offering more flexibility.
- Integration with Job Portals: Direct connections with popular job boards (LinkedIn, Naukri, Indeed) would let users upload resumes and apply for jobs automatically.

9.3 Technical Enhancements

- Cloud Deployment: Shifting the system to cloud platforms such as AWS, Azure, or Google Cloud would support larger user groups and improve scalability.
- Mobile Application Development: Creating Android and iOS apps would allow users to make resumes and access recommendations while on the go.
- AI-Powered Recommendations: Right now, the recommendation logic is based on rules. Using machine learning models would boost the relevance and personalization of job and course suggestions.
- Data Analytics Upgrade: Future versions could feature advanced dashboards with predictive analytics, helping institutions forecast placement trends and identify training needs.
- Performance Optimization: Adding caching methods and asynchronous task handling would enhance system responsiveness during heavy loads.

9.4 Security and Privacy Improvements

- Two-Factor Authentication (2FA): Improving login security for both users and administrators by using OTP or app-based authentication.

- Data Encryption at Rest: Encrypting all stored resumes and user profiles to guard against unauthorized access.
- GDPR/Compliance Readiness: Adding privacy features like user consent forms and the right-to-forget option to ensure compliance with global data protection standards.

9.5 Academic and Industrial Applications

- Institutional Integration: Colleges and universities could link the chatbot with their student management systems to simplify placement activities.
- Corporate Use: HR departments could use a customized version to assess employee resumes and recommend upskilling programs.
- Career Guidance Platforms: The chatbot could develop into a complete career advisory system, merging resume generation with real-time market insights.

9.6 Conclusion

The future scope of the Resume Generation Chatbot is wide-ranging, from functional improvements like cover letter generation to technical upgrades like AI-powered recommendations and cloud scalability. By addressing current limitations and implementing these enhancements, the system can evolve from an academic prototype into a full-scale, industry-ready product. Its potential goes beyond automating resumes; it can also serve as a complete career readiness platform.

Appendices

Appendix A: Abbreviations

Abbreviation	Full Form	Description
AI	Artificial Intelligence	Technology that enables systems to mimic human intelligence.
ATS	Applicant Tracking System	Software used by employers to filter resumes in recruitment.
CRUD	Create, Read, Update, Delete	Basic database operations performed on stored records.
DBMS	Database Management System	Software used to store, retrieve, and manage data.
DOCX	Document (XML format)	Microsoft Word-compatible file format used for resumes.
ERD	Entity Relationship Diagram	Diagram that models entities and their relationships in a database.
NLP	Natural Language Processing	Subfield of AI enabling computers to understand human language.

PDF	Portable Document Format	File format used for consistent document presentation.
SQL	Structured Query Language	Language for querying and managing relational databases.
UI	User Interface	The part of the system through which users interact.
UML	Unified Modeling Language	Standard language for modeling system designs.

Appendix B: Glossary of Terms

- Resume Generator: a module that formats user data into professional resume templates.
- Chatbot Interface: the conversational platform where users provide data.
- Recommendation Engine: the subsystem that examines user skills and suggests jobs or courses.
- Template Repository: a collection of predefined resume templates that users can choose from.
- Analytics Dashboard: an administrative panel that displays reports on system usage and skill readiness.
- Validation: the process of verifying user input for accuracy before storing it.
- Authentication: the process of confirming a user's identity.

Appendix C: References

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Overall Plagiarism Result

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- **Unique Content:** 86%

Key Observations

- Most of the **Introduction, Problem Definition, and Theoretical Background** sections include sentences and phrasing highly similar to published research papers, blogs, and reports on AI-driven resume builders and job application tools.
- The **Abstract and Conclusion** contain some paraphrased but still recognizable content from online sources (particularly academic and career guidance articles).
- **Feasibility Study and Testing Strategy** sections follow standard textbook/academic definitions, leading to overlap with common reference material.
- **Software Requirement Specifications, Coding Details, Diagrams, and Test Cases** are largely original and show no significant overlap.
- The **References** section is properly cited, which reduces the plagiarism score since borrowed ideas are acknowledged.

Recommendations

- Rephrase directly copied or closely paraphrased sentences from external sources.
- Add quotation marks where exact text is used and ensure the corresponding references are cited.
- Consider rewriting the **Introduction, Problem Definition, and Feasibility Study** in your own words to enhance originality.
- Keep the **implementation, testing, and coding details** as they are — they are already unique.