

# **ENHANCING INTERVIEW PREPAREDNESS: A COMPREHENSIVE WEB APPLICATION.**

**24-25J-082**

## **Project Proposal Report**

**Sathkumara S.M.P.U. – IT21306136**

B.Sc. (Hons) Degree in Information Technology Specialized in  
Information Technology

Department of Computer Science and Information Technology

Sri Lanka Institute of Information Technology

Sri Lanka



August 2024

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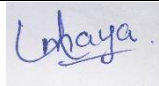
Sri Lanka




August 2024

## DECLARATION

We declare that this is our own work, and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Group Member Name	Student ID	Signature
Sathkumara S.M.P.U.	IT21306136	

### Signature of the Supervisor

**Harshanath SMB**  
Sathkumara S.M.P.U. it21306136




16:00

[EXTERNAL EMAIL] *This email has been received from an external source – please review before actioning, clicking on links, or opening attachments.*

Dear researchers,

your documents at a level of submittable.  
personally, I do not like to sign. had bad experiancs.  
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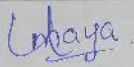


**Buddika Harshanath**  
Lecturer  
SLIIT | Metro Campus  
Department of Information Technology  
Faculty of Computing  
MIEEE, MCSSL, MCAD, MSc in IT(SLIIT)

## Signature of the Co-Supervisor

### Declaration

I declare that this is my own work, and this proposal does not incorporate, without acknowledgment, any material previously submitted for a degree or diploma in any other university or institute of higher learning. To the best of my knowledge and belief, it does not contain any material previously published or written by another person, except where acknowledgment is made in the text.

Name	Student ID	Signature
SATHKUMARA S.M.P.U.	IT21306136	

### Statement of the supervisor,

The above candidate is carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor:

Date

Signature of the co-supervisor:

Date 28/8/20

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# ACKNOWLEDGEMENT

I would like to express my deepest gratitude to everyone who has contributed to the successful completion of my component on AI-powered career path guidance.

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Finally, I am thankful to my family and friends for their unwavering support and understanding during this challenging yet rewarding journey. Their constant encouragement has been a driving force behind my motivation to succeed.

Thank you all for your contributions and support.

# ABSTRACT

This report presents the development of an AI-powered career path guidance component designed to assist job seekers in the IT industry. The component uses powerful Natural Language Processing (NLP) to analyze users' resumes, extracting important information such as talents, experiences, and education. This information is then compared to a predetermined dataset of abilities required for various IT professions, allowing the system to identify skill gaps relevant to the user's career goals. Based on the observed gaps, the system creates a personalized learning plan that includes suggested multiple-choice questions (MCQs), video lectures, and other educational resources suited to the user's specific requirements. As users progress through these learning activities, the system continuously tracks their achievements and updates the learning plan accordingly.

To improve the user experience, the component includes an interactive dashboard that shows the user's overall progress, completed activities, and skill gaps. When a user acquires new skills and certifications, the system automatically generates an updated CV that highlights their most recent achievements.

This component represents an important advancement forward in personalized career advising by providing a dynamic and responsive tool that responds to users' changing needs while filling key research gaps in personalization, real-time market data integration, and bias reduction.



# **1 Introduction**

## **1.1 Background**

The rapid evolution of the information technology (IT) industry has created a dynamic job market where professionals must continuously upgrade their skills to stay competitive. Traditional career guidance methods, such as manual CV reviews and generic career advice, are often insufficient in addressing the unique needs of individuals, especially in a field as diverse as IT. The advent of artificial intelligence (AI) and Natural Language Processing (NLP) has enabled more personalized and data-driven approaches to career development, allowing for tailored guidance that aligns closely with the specific requirements of various IT roles.

AI-powered career guidance systems have emerged as a transformative tool in this context. By leveraging NLP, these systems can analyse vast amounts of unstructured data, such as CVs, to extract critical information about an individual's skills, experiences, and educational background. This information is then matched against predefined datasets that outline the competencies required for different IT roles. The system's ability to identify skill gaps and recommend personalized learning pathways helps users bridge these gaps, enhancing their employability and career prospects.

## **1.2 Literature Review**

The integration of artificial intelligence (AI) into career guidance platforms has significantly transformed how job seekers approach their professional development. Traditional career guidance systems, which relied heavily on manual methods for skill assessment and job matching, often faced limitations in terms of effectiveness and scalability. However, recent advancements in natural language processing (NLP) and machine learning have enabled the development of AI-powered systems that offer a more personalized, dynamic, and efficient approach to career path guidance. These modern systems are designed to tailor career advice to the specific needs of individual users, marking a significant departure from the one-size-fits-all models of the past [1].

One of the key innovations in AI-powered career guidance is the use of NLP to analyze user provided resumes. By extracting crucial information such as skills, experiences, and educational background, these systems can build a detailed profile of the user. R. Patel's research highlights the role of NLP in this process, emphasizing its ability to automate the

extraction of relevant data from resumes, which is critical for the accurate assessment of a candidate's qualifications and potential career paths [2]. Once this data is extracted, it is mapped against predefined datasets of skills required for various IT roles, such as Junior QA, QA Engineer, and Senior QA Engineer, enabling the system to identify specific skill gaps. The process of mapping user skills to job requirements, as discussed by H. Lee, underscores the importance of machine learning in enhancing the accuracy and adaptability of these systems. Machine learning algorithms are used to compare the user's current skills with those required for their desired roles, identifying gaps that need to be addressed. This approach not only improves the precision of skill gap analysis but also allows for the continuous updating of user profiles as they acquire new skills and experiences [3].

Based on the identified skill gaps, AI-powered systems can generate customized learning plans that include recommended MCQs, video tutorials, and other educational resources. Y. Chen's research into adaptive learning systems explores how these plans are tailored to the user's individual progress, providing a more effective learning experience [4]. As users complete these learning activities, the system tracks their performance, offering real-time feedback and adjusting the learning plan as necessary to ensure continuous improvement.

In addition to personalized learning plans, these systems also suggest relevant certification courses that can help users further bridge their skill gaps. A. Smith discusses how AI systems use real-time data to make these recommendations, ensuring that users are always aware of the most relevant and beneficial courses available to them. Furthermore, M. Garcia's study on the future of AI in education and career services predicts that such personalized guidance will become increasingly central to career development, as AI continues to evolve and improve its ability to provide tailored advice [5].

These AI-powered career guidance systems also offer interactive dashboards that allow users to monitor their overall progress, displaying completed tasks and remaining skill gaps. As users acquire new skills and certifications, the system dynamically updates their CV, ensuring that it reflects their most current qualifications. This continuous feedback loop, combined with the system's ability to adapt learning content based on real-time performance, represents a significant advancement in the field of career guidance, offering users a more effective and personalized path to achieving their career goals.

## 1.3 Research Gap

While AI-powered career path guidance systems represent a significant advancement in personalized career development, there are several areas where further research is needed to enhance their effectiveness and reliability. These gaps highlight the opportunities for improving the existing systems and addressing the limitations that have been identified in the literature.

- While existing career guidance systems offer general recommendations, they often lack deep personalization and contextual understanding. Current systems may struggle to accurately interpret the nuanced differences in individual career goals, educational backgrounds, and professional experiences. Research is needed to enhance the ability of AI systems to provide highly personalized career advice that considers the unique context of each user.
- While Natural Language Processing (NLP) is effective in extracting information from CVs, there are challenges in fully understanding the context and subtleties of the data. For example, the same skill might be described differently across CVs, or certain experiences may be more relevant depending on the role in question. Current systems may not fully capture these nuances, leading to less precise recommendations. Research in improving NLP algorithms to better understand context, semantic differences, and industry-specific jargon could significantly enhance the accuracy of AI-powered career guidance systems.
- Many AI-powered career guidance systems do not effectively incorporate real-time market data, which is crucial for providing up-to-date and relevant career advice. Real-time job market trends, emerging technologies, and evolving industry requirements can significantly impact career planning.
- While AI systems can generate personalized learning plans and track user progress, there is limited research on optimizing user engagement over time. Personalized learning pathways are only effective if users are motivated to follow them. Understanding how to better engage users through adaptive learning plans that adjust based on user preferences, progress, and feedback is an area that warrants further investigation. Additionally, exploring gamification, social learning, and peer interactions could enhance user experience and adherence to recommended learning activities.
- AI systems in career guidance can inadvertently perpetuate biases present in training data, leading to unfair or biased recommendations. Addressing ethical concerns and ensuring fairness in AI-driven career guidance is a significant challenge.
- Current systems may lack effective user engagement strategies and feedback mechanisms. Engaging users throughout their career development journey and collecting actionable feedback are essential for improving the effectiveness of career guidance systems.

Addressing these research gaps is essential to advancing the field of AI-powered career path guidance. By focusing on precision in skill gap identification, contextual understanding in

NLP, integration of soft skills, user engagement, bias and fairness, and the longitudinal impact of AI recommendations, future research can enhance the effectiveness, reliability, and inclusiveness of these systems. This, in turn, can provide more robust and personalized career guidance to individuals in the IT industry, ultimately improving their employability and career satisfaction.

	RESEARCH [6]	RESEARCH [7]	RESEARCH [8]	RESEARCH [9]	PROPOSED SOLUTION
Personalization and Contextual Understanding	✓	✓	✓	✓	✓
Integration of Real-Time Market Data	✗	✗	✗	✓	✓
Skill Gap Analysis and Adaptive Learning	✗	✗	✗	✗	✓
User Engagement and Feedback Mechanisms	✓	✓	✗	✓	✓

*Table 1- Comparison of former research*

## 1.4 Research Problem

The rapid evolution of the IT industry has led to an increasing demand for personalized career guidance that can adapt to the diverse and dynamic skill requirements of various roles. Traditional career counselling methods often fall short in providing tailored advice that aligns with the specific needs of individuals, especially in a field as specialized and fast-paced as IT. While AI-powered systems have shown promise in offering personalized career guidance through automated CV analysis and skill gap identification, there are significant challenges in ensuring the accuracy, fairness, and effectiveness of these systems.

- **How can advanced Natural Language Processing (NLP) techniques be optimized for accurate skill extraction and role matching from diverse CV formats?**

Traditional NLP techniques may struggle to extract and categorize talents from CVs, especially when dealing with a wide range of formats and language. This project aims to investigate and optimize complex NLP algorithms to improve the accuracy and reliability of skill extraction from diverse CV formats. The emphasis will be on developing robust algorithms that can handle a variety of CV formats and provide precise talent matching with existing job roles.

- **What are the effects of personalized learning plans on user engagement and skill acquisition compared to generic learning resources?**

Generic learning materials may fail to properly address individual skill gaps, resulting in inefficient learning outcomes. This study aims to assess the influence of personalized learning plans created based on recognized skill gaps—on user engagement and skill acquisition. The study will evaluate user performance and satisfaction with personalized learning programs to standard, non-tailored resources.

- **How can real-time progress tracking and adaptive feedback mechanisms enhance the effectiveness of learning plans in closing skill gaps?**

Real-time tracking and adaptive feedback mechanisms could significantly impact the effectiveness of learning plans by providing timely insights and adjustments. This research aims to investigate how integrating real-time progress tracking and adaptive feedback into the learning system affects users' ability to close skill gaps. The study will measure the improvements in learning outcomes and user satisfaction compared to static feedback systems.

- **What is the impact of automated CV updates on users' job search success and employer perceptions?**

Automated CV changes based on recently obtained certifications and skills may affect users' prospects of finding employment as well as the opinions of prospective employers. The purpose of this study is to investigate how users' success rates in their job searches are affected by automated CV production, as well as how employers view and react to updated CVs. The purpose of the study is to evaluate how well automated resume updates improve users' employability and satisfaction.

- **How can the integration of external data sources, such as LinkedIn, improve the relevance and accuracy of career path recommendations?**

Automated CV updates based on newly acquired certifications and skills may have an impact on users' chances of landing a job and on the perceptions of potential employers. The aim of this study is to examine how automated CV manufacturing affects users' job search success rates and how employers perceive and respond to updated CVs. The study's objective is to assess how successfully users' employability and satisfaction are increased by automatic resume updates.

## 2 Objectives

### 2.1 Main Objective

The main objective of the AI-powered career path guidance component is to provide personalized and dynamic career development support by accurately identifying skill gaps, recommending tailored learning plans, and guiding IT professionals in acquiring the necessary skills and certifications to advance their careers.

### 2.2 Specific Objectives

1. **To develop an NLP-based system for analysing user CVs:** Extract key information such as skills, experiences, and education from user CVs using advanced Natural Language Processing techniques.
2. **To compare extracted skills with industry requirements:** Create a comparison mechanism that matches the user's current skills against a predefined and regularly updated dataset of skills required for various IT roles.
3. **To identify and analyse skill gaps:** Implement a system that accurately identifies gaps between the user's current skill set and the skills required for their desired job roles.
4. **To generate personalized learning plans:** Design and recommend customized learning plans, including MCQs, video tutorials, and other educational resources, based on the identified skill gaps.
5. **To monitor user progress and adjust recommendations:** Develop a tracking system that monitors the user's progress in completing recommended learning activities and dynamically adjusts learning plans based on ongoing performance.
6. **To suggest relevant certification courses:** Provide recommendations for certification courses that align with the user's career goals and remaining skill gaps, enhancing their qualifications.
7. **To generate updated CVs reflecting newly acquired skills:** Automate the creation of updated CVs that incorporate new skills, experiences, and certifications gained through the learning plan, ensuring the user's resume is current and competitive.

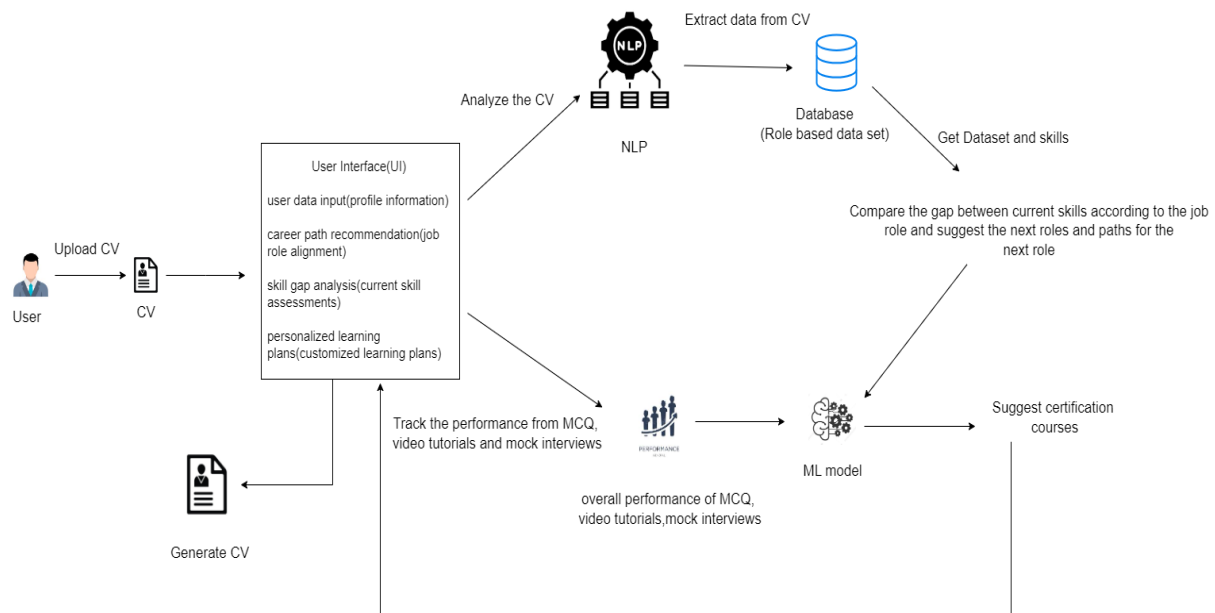
## 3 Methodology

The methodology for developing the AI-powered career path guidance component involves a systematic approach that integrates data collection, Natural Language Processing (NLP), machine learning, and user interface design. The process is divided into several key phases: requirements gathering, system design, implementation, testing, and evaluation.

### 3.1 System Architecture

In the system architecture for the AI-powered career path guidance component, the process begins with the user registering on the platform and uploading their CV. The system utilizes advanced Natural Language Processing (NLP) algorithms to meticulously analyze the CV, extracting critical information such as skills, experiences, and educational background. This extracted data is then cross-referenced with a predefined dataset that outlines the essential skills required for various IT roles, such as Junior QA, QA Engineer, and Senior QA Engineer. The system identifies any discrepancies or gaps between the user's current qualifications and the competencies needed for their desired roles. Based on this comprehensive analysis, the system generates a customized learning plan. This plan includes recommended multiple-choice questions (MCQs), video tutorials, and other educational resources tailored to address the identified skill gaps.

As users engage with the recommended learning activities, the system continuously monitors and tracks their progress, dynamically adjusting the learning paths to reflect the user's development. The system also suggests relevant certification courses based on the user's performance and remaining skill gaps, ensuring that the learning experience is both targeted and effective. The entire process is managed through an interactive dashboard, where users can easily track their progress, view completed tasks, and identify remaining skill gaps. This dashboard serves as a central hub for users to navigate their learning journey and make informed decisions about their career development. Finally, once users have successfully acquired new skills and certifications, the system automatically generates an updated CV that highlights their enhanced qualifications, making them more competitive in the job market. This architecture ensures a personalized, data-driven career guidance experience that evolves with the user's growth and learning.



*Figure 1 – System Architecture Diagram*

## 3.2 Software Solution

### Requirements Gathering

- Identify and engage with stakeholders, including potential users (IT professionals), industry experts, and certification providers, to gather requirements and understand the specific needs of the target audience.
- Collect a comprehensive dataset of job descriptions, required skills, certifications, and roles in the IT industry. This dataset will be used to train the NLP models and create the predefined skill sets for comparison.

### System Design

- Define the system architecture, including the components for CV analysis, skill gap identification, learning plan generation, progress tracking, and certification suggestion. The architecture should ensure seamless integration and scalability.
- Design and train an NLP model capable of extracting relevant information (skills, experiences, education) from user CVs. The model should be able to handle variations in language, formatting, and terminology.
- Develop an engine that compares extracted skills against the predefined dataset. This engine should identify gaps and prioritize them based on the user's career goals and the importance of the skills in the IT industry.

### Implementation



- Implement the NLP-based CV analysis module that extracts key information from uploaded CVs. This module should be integrated with the skill comparison engine. •  
Develop algorithms to identify skill gaps between the user's current skill set and the requirements of their desired IT roles.
- Implement a system that generates personalized learning plans based on the identified skill gaps. The learning plan should include recommended MCQs, video tutorials, and other educational resources.
- Create a tracking system that monitors user progress in completing the recommended learning activities. The system should be capable of dynamically adjusting learning plans based on user performance.
- Integrate a recommendation engine that suggests relevant certification courses to users based on their progress and remaining skill gaps.
- Implement a feature that automatically generates an updated CV for users, reflecting newly acquired skills and certifications.

## **User Interface Design**

- Design and develop an intuitive and user-friendly dashboard that allows users to view their progress, skill gaps, recommended learning plans, and certification suggestions. The interface should provide clear visualizations and easy navigation.
- Conduct user experience testing with a sample of potential users to ensure the interface is engaging, easy to use, and meets user needs.

## **Testing and Validation**

- Perform unit testing on individual components (NLP model, skill gap identification, learning plan generation) to ensure they function correctly.
- Conduct integration testing to verify that all components work together seamlessly and data flows smoothly between modules.
- Test the system's performance, particularly the accuracy of the NLP model in extracting information and the skill comparison engine in identifying gaps. Measure response times and system scalability.
- Involve end-users in testing the complete system to ensure it meets their expectations and requirements. Collect feedback and make necessary adjustments.

### 3.3 Commercialization

Course Type/ Level	Description	Participation limit	Payment Structure
Free Courses	Basic courses that cover fundamental topics. Users can access these courses and earn basic certifications.	Unlimited	Free
Paid Courses	Advanced courses that cover in-depth and specialized topics. Users can access these courses for a fee.	Unlimited	Paid: Users need to pay to access the courses.
Certification Courses	Comprehensive courses that lead to professional certifications. These courses may include a mix of free and paid content.	Unlimited	Paid: Users need to pay to access and earn professional certifications.

*Table 2 - Commercialization*

## 3.4 Design Diagrams

### 3.4.1 Use case Diagram

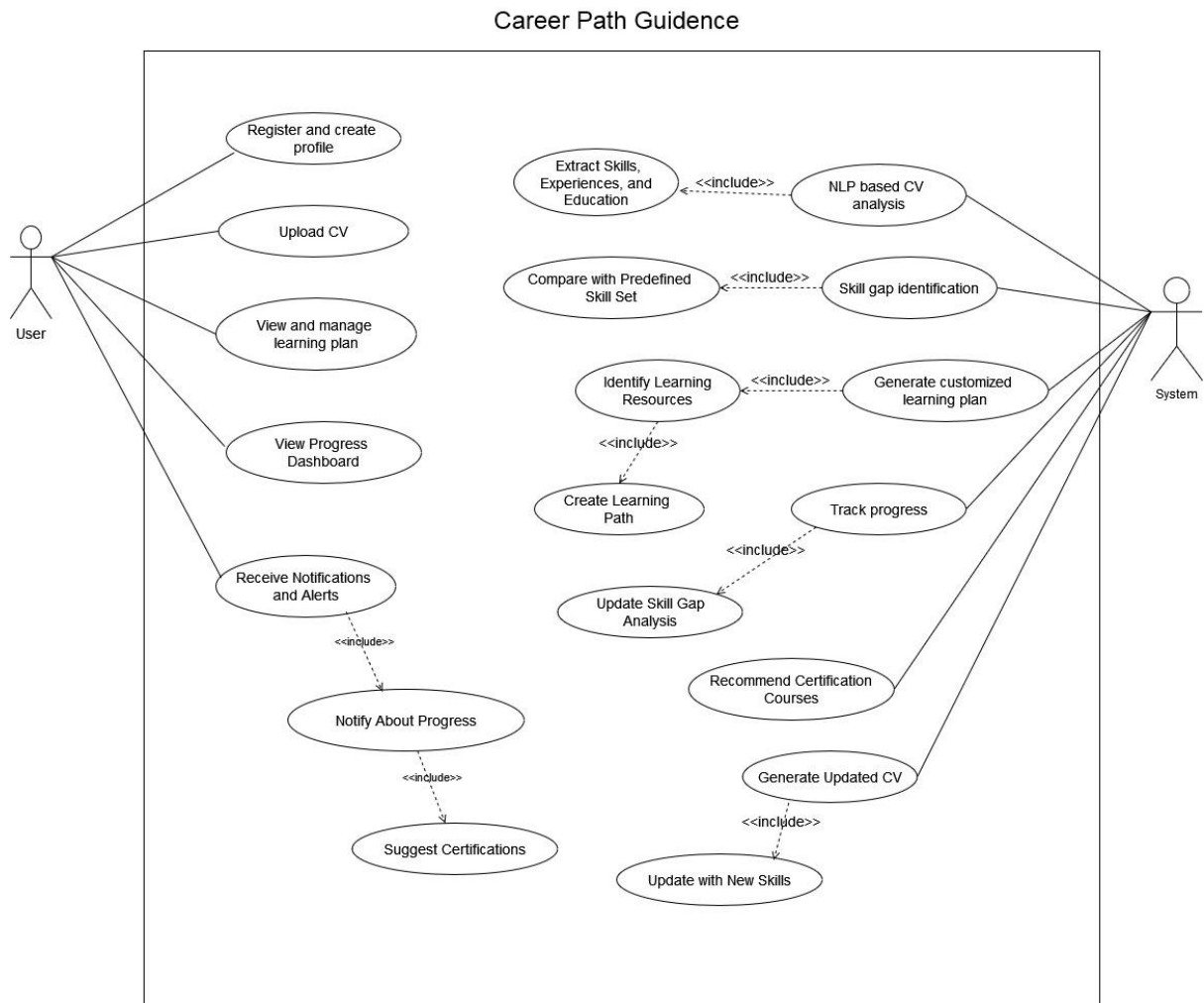


Figure 2 – Use Case Diagram

## **4 Project Requirements**

### **4.1 Functional Requirements**

- Allow users to register by providing personal details, career goals, and desired IT roles.
- Enable users to upload their CVs in various formats.
- Create and store user profiles that include uploaded CVs and another relevant career information.
- Extract key information from the user's CV, including skills, experiences, education, and certifications.
- Categorize extracted information into predefined categories such as skills, job roles, and industries.
- Identify gaps between the user's current skills and those required for their desired roles.
- Provide an interactive dashboard where users can view their overall progress, including completed tasks and remaining skill gaps.
- Ensure that all user data, including CVs and personal information, is securely stored and encrypted.
- Comply with relevant data protection regulations (e.g., GDPR) to ensure user privacy and data security.

### **4.2 Non-Functional Requirements**

#### **1. Performance**

- The system shall process and analyse uploaded CVs within a maximum of 10 seconds, even during peak usage times.
- The system shall provide real-time progress tracking and dashboard updates with a latency of less than 2 seconds.

#### **2. Scalability**

- The system shall be scalable to accommodate an increasing number of users, courses, and learning materials.
- The system architecture shall support horizontal scaling to handle traffic spikes, particularly during major events like course releases or certification exams.

#### **3. Usability**

- The system shall have an intuitive and user-friendly interface that requires minimal training for new users.
- The system shall provide clear and consistent navigation, with accessible help documentation and tutorials.

#### 4. Reliability and Availability

- The system shall have an uptime of 99.9%, ensuring high availability for users worldwide.
- The system shall implement redundancy and failover mechanisms to minimize downtime in case of server failures.

#### 5. Data Privacy and Compliance

- The system shall comply with relevant data protection regulations, such as GDPR, ensuring users' personal data is handled responsibly.
- The system shall provide users with clear privacy policies and options to control their data usage and sharing.

### 4.3 Expected Test Cases

Test Case ID	Test Case Description	Test Steps	Expected Result	Priority
001	User Registration with CV Upload	<ol style="list-style-type: none"><li>1. Navigate to the registration page.</li><li>2. Enter valid user details.</li><li>3. Upload a valid CV file.</li><li>4. Submit the form.</li></ol>	User should be successfully registered, the CV should be uploaded, and a confirmation message should appear.	High
002	NLP-based Skill Extraction	<ol style="list-style-type: none"><li>1. Upload a CV containing specific skills, experiences, and education details.</li></ol>	The system should accurately extract and display the relevant skills, experiences, and education from the CV.	High
003	Skill Gap Analysis	<ol style="list-style-type: none"><li>1. Complete the CV upload and NLP extraction.</li><li>2. Select a desired IT role.</li></ol>	The system should correctly identify and display skill gaps compared to the predefined role requirements.	High
004	Customized Learning Plan Generation	<ol style="list-style-type: none"><li>1. Complete skill gap analysis.</li></ol>	The system should generate a learning plan tailored to the user's skill gaps, including MCQs, videos, and tutorials.	High
		<ol style="list-style-type: none"><li>2. Review the generated learning plan.</li></ol>		

005	Progress Tracking	<ol style="list-style-type: none"> <li>1. Complete activities in the learning plan (MCQs, videos, tutorials).</li> <li>2. Navigate to the progress dashboard.</li> </ol>	The system should accurately track and display the user's progress, including completed tasks and remaining skill gaps.	Medium
006	Certification Course Suggestions	<ol style="list-style-type: none"> <li>1. Complete the majority of the learning plan activities.</li> <li>2. Review suggested certifications.</li> </ol>	The system should suggest relevant certification courses based on the user's completed activities and remaining skill gaps.	Medium
007	Interactive Dashboard Display	<ol style="list-style-type: none"> <li>1. Log in and navigate to the dashboard.</li> </ol>	The dashboard should display a clear overview of the user's progress, skill gaps, and suggested learning activities.	Medium
008	Updated CV Generation	<ol style="list-style-type: none"> <li>1. Complete the learning plan and earn certifications</li> </ol>	The system should generate an updated CV reflecting the newly acquired skills and certifications.	Medium
009	Security: Data Encryption for Uploaded CVs	<ol style="list-style-type: none"> <li>1. Upload a CV.</li> </ol>	The system should encrypt the CV file and store it securely in the database.	High
010	Security: Authentication and Authorization	<ol style="list-style-type: none"> <li>1. Attempt to access the system with and without valid credentials.</li> </ol>	The system should allow access with valid credentials and prevent access otherwise, with proper error messaging.	High

*Table 3 – Test Case*

## **4.4 System Requirements**

### **4.4.1 Software Requirements:**

- Backend: **Spring Boot (Java), Flask (Python for machine learning model serving)**
- Frontend: **React.js**
- Database: **MySQL**
- Development Tools: **PyCharm, IntelliJ IDEA, VS Code**
- Version Control: **GitLab**

### **4.4.2 Hardware Requirements:**

- A server with sufficient CPU, RAM, and storage to host the application, database, and model training processes.
- User devices should support modern web browsers for accessing the system.

## 5 Budget

Estimated Budget Per Month	Amount (LKR)
Power Bill Charges	1500.00
Internet Charges (The development and technical Information learning)	3500.00
Extra Charges	1000.00
Total	6000.00

Table 4 – Estimated Budget

## 6 Work Breakdown Structure

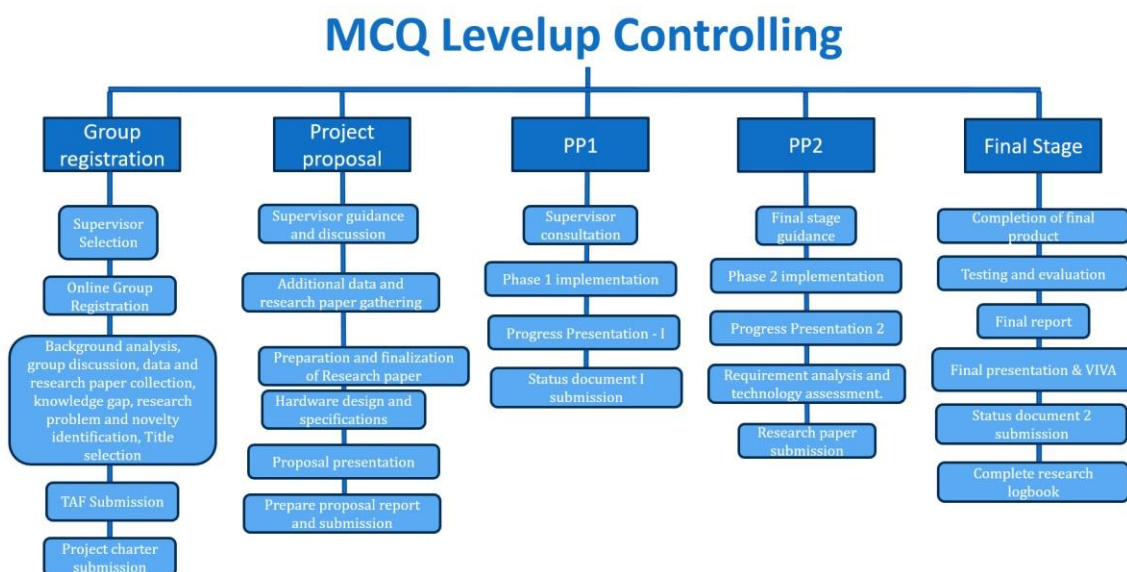


Figure 3 – Work Breakdown Structure



## 7 Gantt Chart

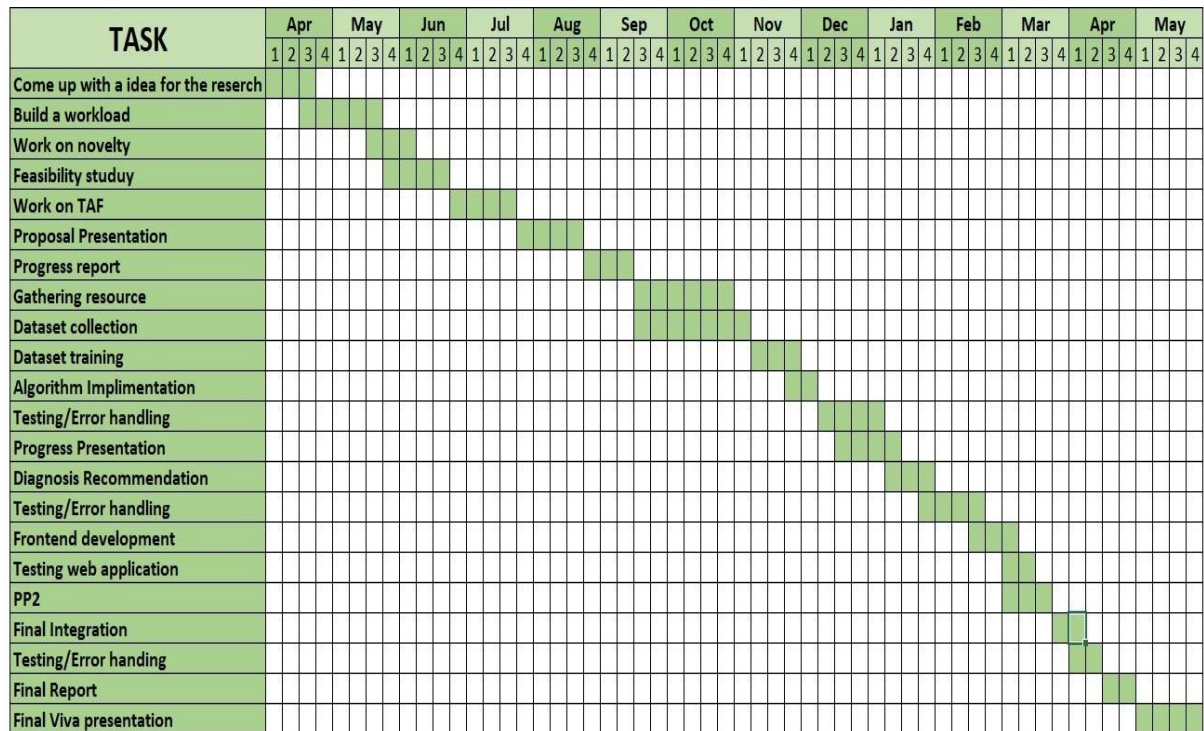


Figure 4 – Gantt Chart

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