IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

GenAI Skill Analyser And Personalized Learning Path Recommendation

AI-Based Skill Gap Analysis and Career Recommendation System

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Abstract: This paper proposes an intelligent Career Bridge Platform that bridges the gap between academic education and industrial needs by offering personalized skill assessment, learning paths, and career recommendations. The architecture of the platform is composed of a FastAPI backend with PostgreSQL database management for handling users' profile information, job history, and technical knowledge. The proposed framework utilizes Google Gemini (Generative AI) to assess users' skills and knowledge based on resume data, GitHub portfolio, LinkedIn profile, and eLearning records. From the assessment results, the Career Bridge Platform offers adaptive technical quizzes and constructs a personalized learning roadmap consisting of Foundation, Intermediate, and Advanced stages. The framework also incorporates the use of Adzuna Job Search API to offer users real-time job recommendations based on their domain, competencies, and learning roadmap topics. A mixed job matching method that employs both keyword matching rules and generative AI models to assign scores to candidates enhances the accuracy of job recommendation. Some of the other innovative capabilities of this platform include project-based learning, follow-up quiz , performance analytics, and remote proctoring.

Index Terms - Artificial Intelligence, Career Recommendation System, Skill Gap Analysis, Personalized Learning, Generative AI, FastAPI, PostgreSQL, Job Recommendation, Resume Analysis, Adaptive Quiz System, Learning Roadmap Generation, Proctoring System, Web-Based Application

I. INTRODUCTION

With time, technological developments have been taking place in many sectors of today's economy at a rapid pace. As a result, many sectors require highly qualified specialists in particular areas, for instance, data science, artificial intelligence, web programming, and cloud services. However, one of the problems faced by students and individuals seeking jobs is the lack of match between their skills and competencies expected from them by the industry sector. Regular training and education methods are not personalized and thus provide insufficient directions for bridging the skill gap in question.

In order to solve the problem, the use of intelligent systems that can help assess the skill gap, personalize education programs, and link jobs with learning has become crucial. In connection with career counseling, the incorporation of Artificial Intelligence technologies into career advising systems helps analyze users' profiles, find out their skill gap and suggest personalized learning programs. Despite the availability of

many platforms offering online courses, few of the systems can establish the linkage between learning and employment needs.

In this paper, we propose an AI-based Career Bridge Platform that can cater to all the needs of a career development ecosystem. The platform uses Generative AI Models to perform data analysis on users' resume, GitHub profile, linkedin accounts and the learning path followed. The result is an adaptive test which assesses the user's existing skills and generates a multi-layered personalized learning roadmap for him. These layers comprise foundation, intermediate, and advanced modules respectively.
In addition to personalized learning roadmaps, this system can fetch real-time job data from the external job search API and recommend jobs that match users' domains, skills and learning progress in a better way through a hybrid matching strategy that combines both rule-based systems and AI-assisted scoring. The proposed system also utilizes project based learning and follow-up assessments alongside performance analytics for continuous improvement of skills. Moreover, the platform also makes use of a proctoring mechanism to avoid cheating on tests and quizzes.

II. LITERATURE SURVEY

Due to the fast-paced development of artificial intelligence and data technologies, there have been numerous researches concerning the mismatch between educational programs at schools and the competences required by industries. The research shows that current educational systems pay special attention to theoretical knowledge while industries require practical skills especially in machine learning and artificial intelligence [1]. The problem resulted in the creation of automated competence assessment tools and employability-focused learning programs. Many studies have been conducted concerning the effectiveness of online learning platforms and MOOCs as efficient skill-building resources. However, there is evidence proving that though MOOCs can be helpful for gaining certain knowledge, they fail to give adequate assessment of learner competences and their suitability for the labor market [2]. Thus, people usually finish MOOCs without any proof of their skills and become uncertain about their employability. Besides, due to lack of systematic support, students tend to waste time and drop out of courses.
The skill gap analysis has gained importance as an essential research domain to ensure compatibility between the abilities of the learners and the needs of the industries. Several strategies employ resume analysis and keyword matching approaches to detect skill gaps [4]. The recent developments make use of NLP techniques to obtain skills from unstructured documents like resumes, LinkedIn, and professional profiles [5]. Despite these developments in skill detection, these strategies often ignore the dynamic nature of skills by not capturing real-time learning activities. Furthermore, machine learning algorithms, including logistic regression, support vector machines, and decision trees, have been employed to categorize learners based on their assessment scores and profile attributes [6]. Even though these techniques yield accurate results, they depend solely on the assessment process, thereby ignoring external factors like projects and professional work, leading to a less accurate assessment process.
Personalized learning paths also became a subject of research as it helps increase learning efficiency. It was found that the recommendation system that offers learners learning resources that help address their weaknesses increases their interest and productivity significantly [7]. Still, existing systems offer linear recommendations without visual maps or roadmaps, which would allow users to comprehend them better. Progress verification and assessment are necessary steps in ensuring that learners make proper progress in learning new skills. According to scholars, continuous progress verification and periodic assessments improve responsibility and competence measurements [8]. However, few solutions combine progress verification and job readiness assessment in a single system. Job recommendation systems use similarity metrics or machine learning algorithms to identify a fit between candidates' skills and the requirements stated in job descriptions [9]; still, they function separately from learning applications and do not account for learners' progress. Thus, there is no comprehensive solution that combines all of the processes mentioned above.

III. EXISTING METHOD

The existing approaches for skill assessments and career guidance focus mainly on traditional and semi-automatic methods that are not adaptive and personalized enough. The most widespread one includes career counseling carried out manually by experts who recommend certain careers to students depending on their academic performance and preferences. Even though the approach yields positive results in some cases, it is not efficient in the long term since it relies heavily on human expertise.

Static assessment platforms also make up an approach that includes the evaluation of users using predefined questionnaires and aptitude tests to classify them in particular domains based on their scores. Still, such systems fail to account for practical skills, project experience, and ever-changing needs of the modern world. There is also an approach based on keyword analysis when resumes of the user are being processed to check if the set of skills matches a certain position. This system is rather quick but does not have any semantic capabilities to analyze the context of skills.

Recommendation systems using machine learning have recently been implemented for career planning and providing learning recommendations for users. Machine learning analyzes available user information and makes assumptions about appropriate roles based on identified patterns. Large amounts of training data are needed for their development, and recommendation systems find difficulty processing unstructured data, like GitHub repository, LinkedIn profiles, or activity on online learning platforms. Job recommendation systems also typically use keyword-matching techniques for identifying similarities in user skills and desired jobs. Job recommendation systems fail to recognize any relationship between skill set, work experience, and required job competencies; thus, the accuracy of matching decreases significantly.

Modern platforms offering personalized learning also exist, and they depend on preferences chosen by the user as inputs for personalized paths. Moreover, the mentioned systems lack assessment tools, like tests, quizzes, or continuous monitoring of personal development, which make tracking any improvements impossible.

IV. PROPOSED METHOD

The suggested model provides an all-in-one AI-enabled platform that aims to close the existing gap between student abilities and industry needs by employing a structured yet flexible approach. First, the model relies on collecting information about users, their resume, GitHub profile, LinkedIn account, chosen skills, and links to the learning platform. Such data will be analyzed via NLP and AI technologies to draw conclusions in terms of technical abilities, strengths, weak spots, and skills proficiency. In contrast to conventional approaches, the suggested approach allows integrating several sources to create one comprehensive representation of user abilities.

According to the analysis of the profile, the initial quiz will be generated by the system based on the skills of the user. It will have multiple-choice questions, programming questions, and conceptual questions aimed at assessing both theoretical and practical skills. Assessment results will allow detecting skill gaps precisely, which will then act as a basis for developing a personal learning path for the user. The learning path can be divided into three tiers, i.e., beginner, intermediate, and advanced, and will include resources, AI notes, and projects. Then the follow up quiz will be generated based on the learning path and questions are difficult compared to initial quiz to find learning accuracy.

In order to increase the effectiveness of the learning program, the system is equipped with an automatic job recommendation tool that fetches live information about the jobs available from the third-party application programming interfaces (APIs) and matches the skills of the users to determine whether they are suitable for applying for a certain position. The matching process is achieved by utilizing keyword-based matching as well as semantic matching algorithms assisted by AI. With each progression through the learning road map and project completion, the system updates the skill information of the users and recommends relevant jobs accordingly.

4.1 ADVANTAGES OF THE PROPOSED METHOD

1. Provides comprehensive skill analysis based on Resume, Github, LinkedIn, and others learning platforms.
2. Provides quizzes to assess true knowledge
3. Gives results using AI
4. Designs an individualized learning plan for each user
5. Monitors users' progress systematically
6. Tailors learning plan according to user progress
7. Uses live APIs to identify actual job opportunities
8. Identifies job roles that match skills more precisely
9. Ensures seamless integration of learning and employment processes
10. Completely automated system (does not require any manual intervention)
11. User-friendly platform with an interactive dashboard
12. Comprehensive service from skill analysis to learning to job

V. FLOWCHART

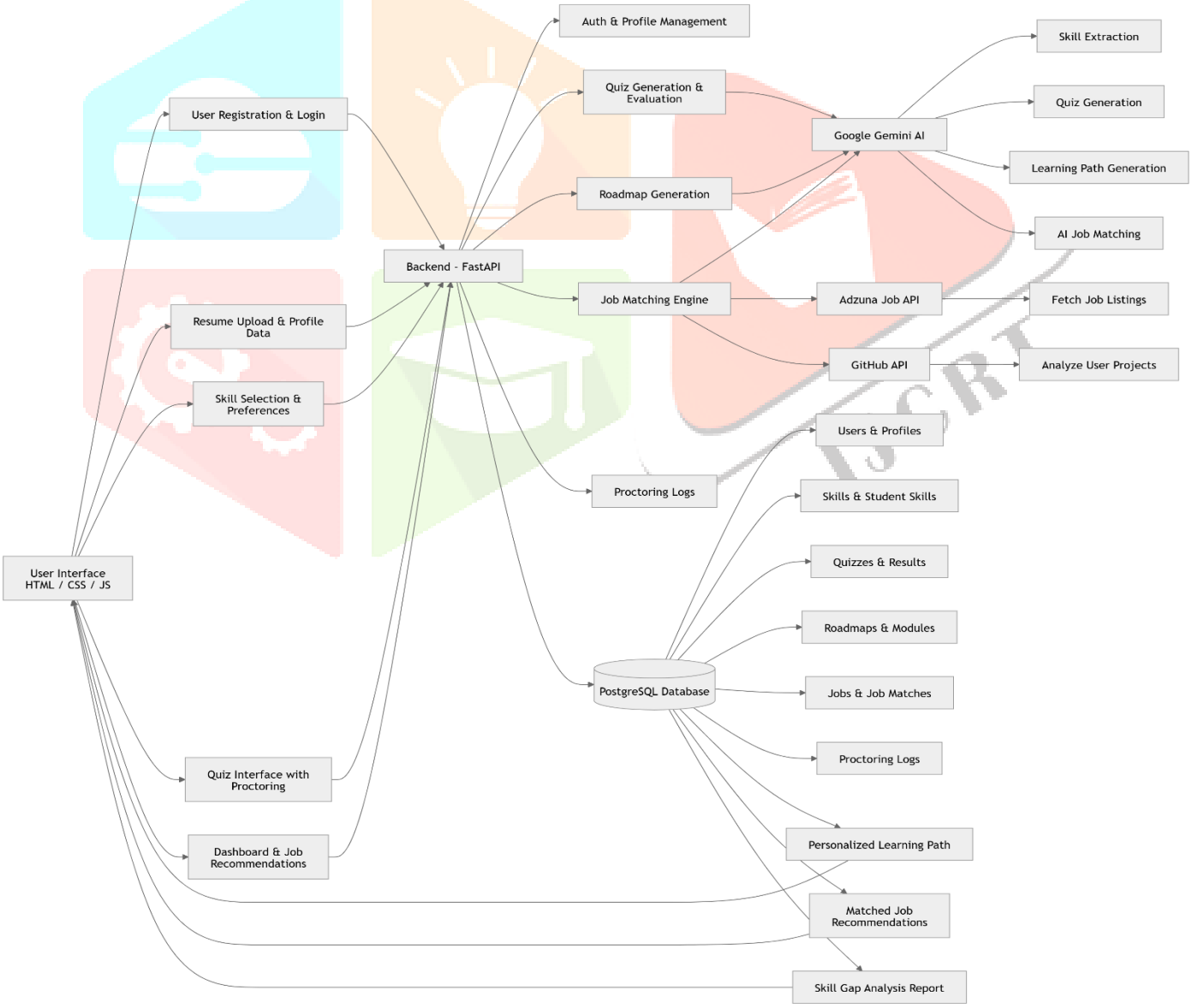

Fig.1

VI. WORKING MODEL OF PROJECT

The working of the GenAI Skill Gap Analyzer and Personalized Learning Path Recommender System model begins in a smart and systematic way, beginning from the interaction of the user through the web interface. It serves as a central hub where users can perform skill analysis, assessments, undertake personalized learning paths, undertake projects, and look for job opportunities. It can be run on localhost for development purposes and ultimately placed on cloud servers to operate in real-time.

6.1User Authentication

Upon accessing the web application, the user will be redirected to the login and registration page. The system allows role-based authentication, i.e., User and Admin roles. The user credentials will be securely validated at the server level via the backend database. Only authorized users will have access to the main dashboard, and in the case of incorrect login credentials, the system will display an error message.

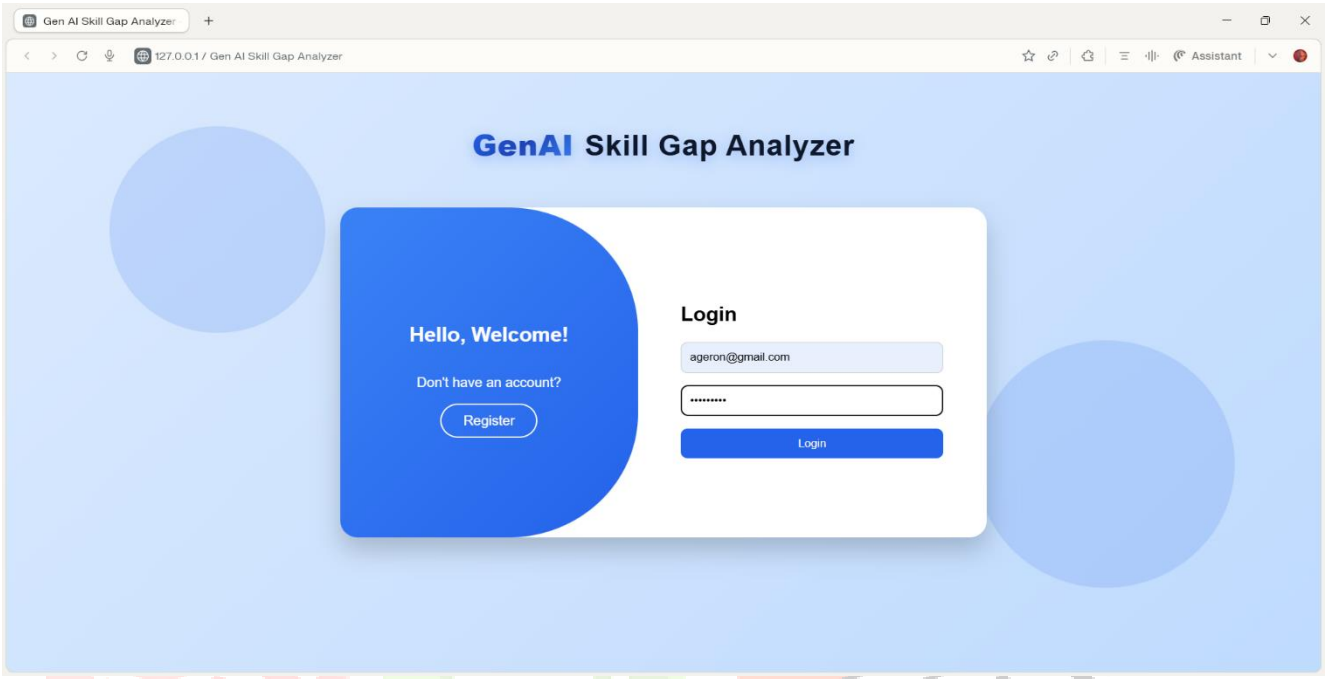

Fig.2

6.2 Dashboard Access and User Flow Control

Once successfully logged in, the user will be redirected to the dashboard, which is essentially the central control system for everything. Modules include profile analysis, quiz, roadmap, projects, follow-up quiz, job opportunities, and performance analysis. Access to the modules is sequential, meaning users have to proceed according to a specific learning sequence.

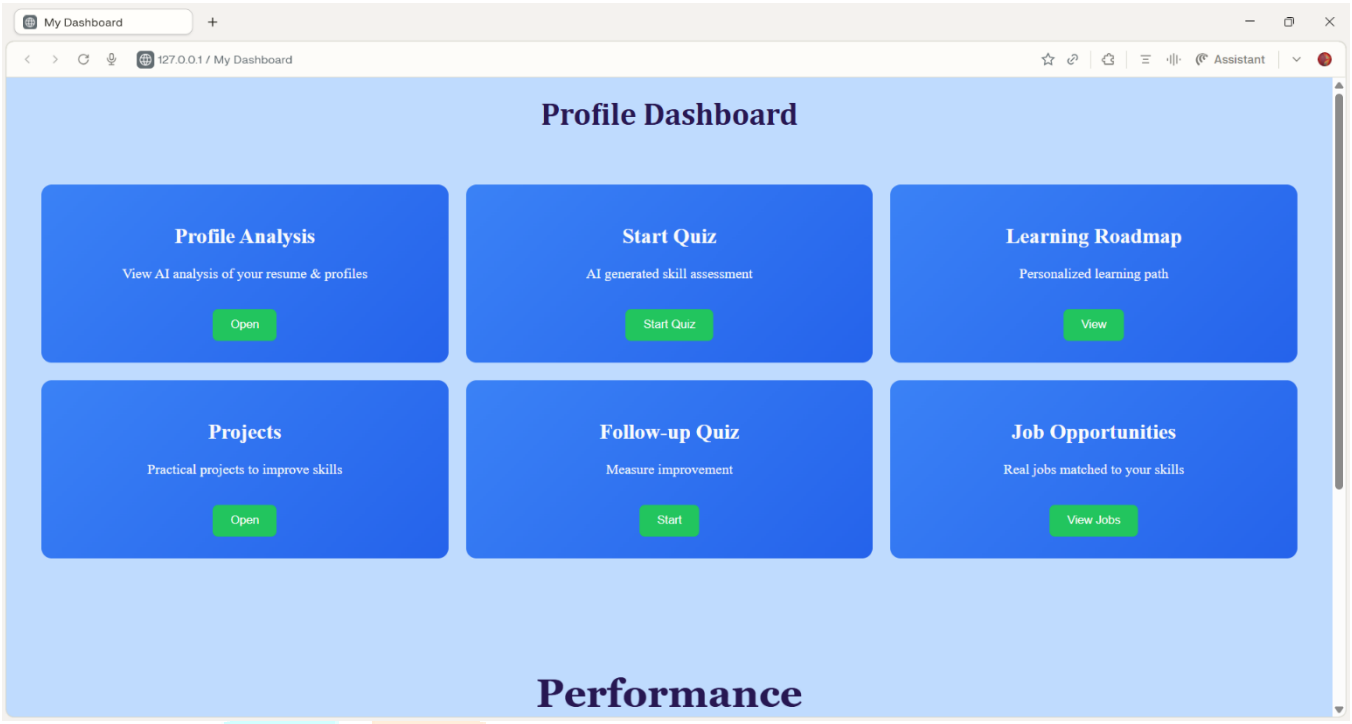

Fig.3

6.3 Profile Data Collection and AI Analysis

Once the user is logged in, The user provides inputs like resume, GitHub profile, LinkedIn profile information, selected skills, and links to learning platforms are provided by the user. With the help of artificial intelligence (AI) and natural language processing (NLP) algorithms, the input data is analyzed to generate technical skills, strength and weakness assessment, and skill level analysis.

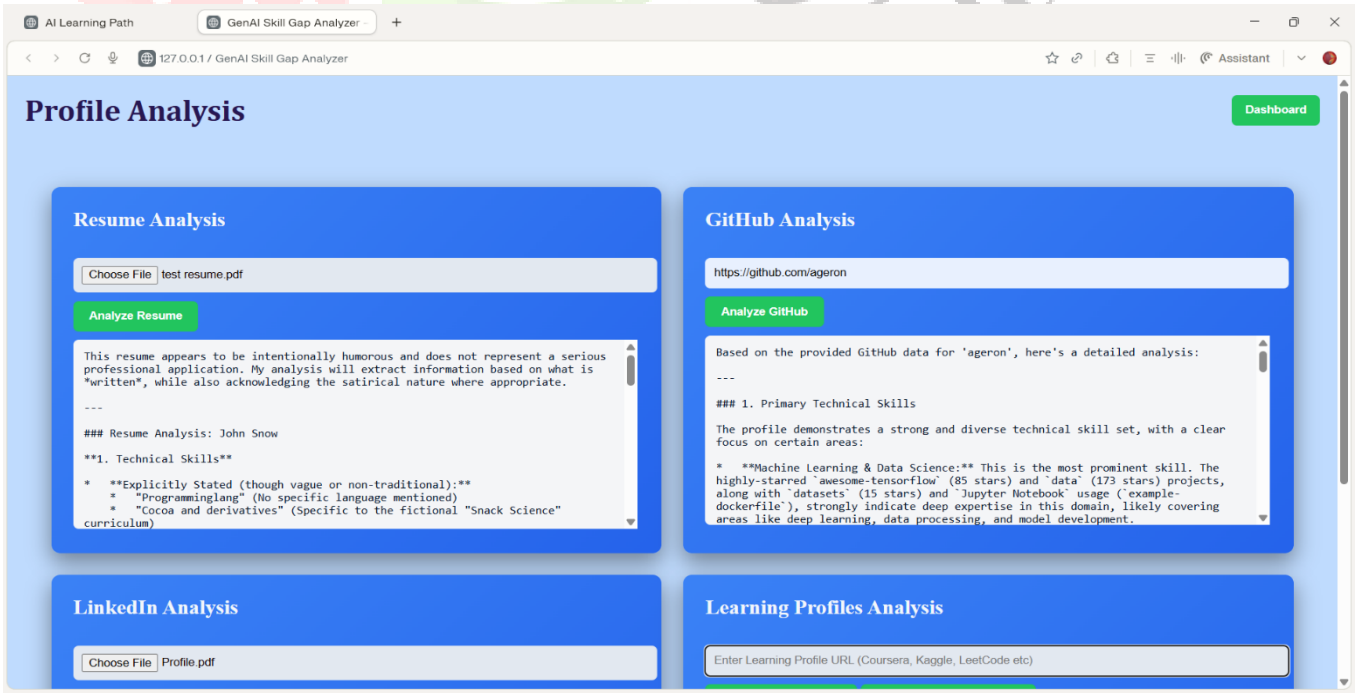

Fig.4

6.4 Initial Skill Assessment (AI Quiz Generation)

After the profile analysis process, an AI-based proctoring system is utilized at the initial quiz for evaluation fairness purposes. Once the quiz begins, camera activation and face detection are triggered to verify the presence of the user. Further, tab switching and leaving of the quiz page by the user are checked. The questions in the quiz are the foundation questions that are based on the skills that the user possesses

Moreover, screen sharing is enabled with no ability for copy, pasting, right-clicking, and accessing developer tools. Malicious behavior, including lack of use of the camera, tab switching, and discontinuation of screen sharing, is recorded. If any malpractice takes place, then users are taken back to the foundation level.

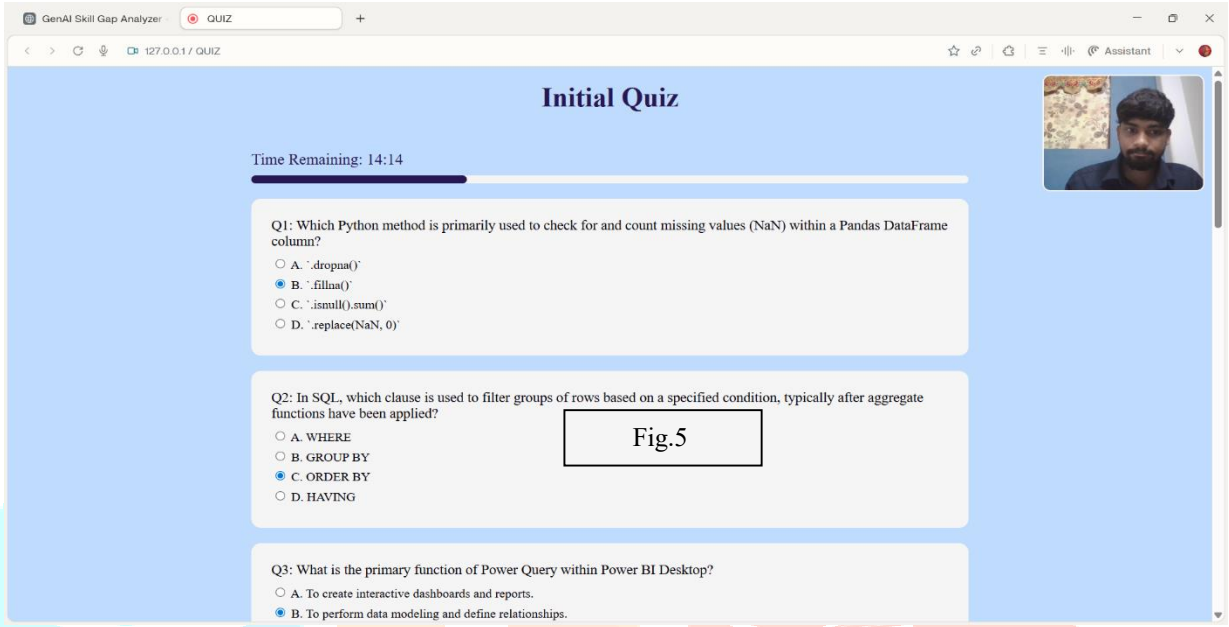

Fig.5

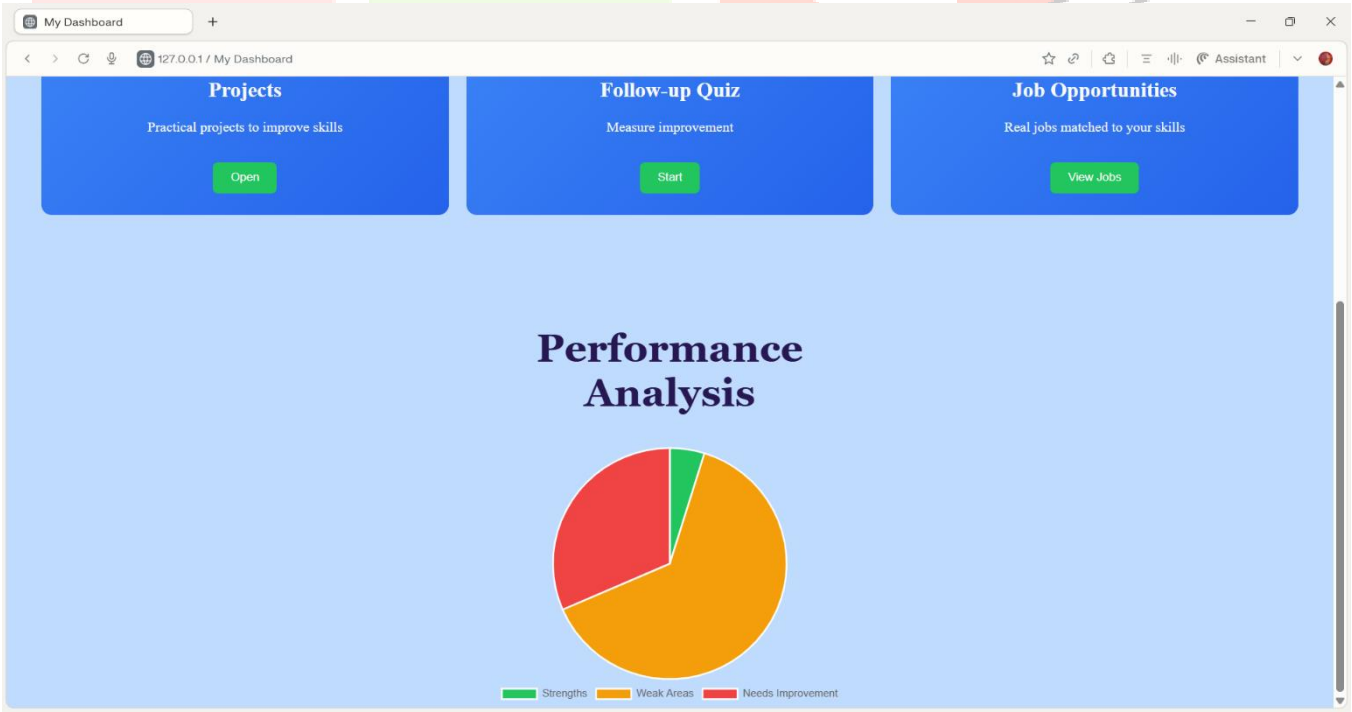

Fig.6

6.5 Personalized Learning Roadmap Generation

The system creates a learning plan for each individual based on their performance in the test and their weaknesses. There are three levels that constitute the roadmap, namely; beginner level, intermediate level, and advanced level. Each of these levels has modules with learning materials and AI-based notes.

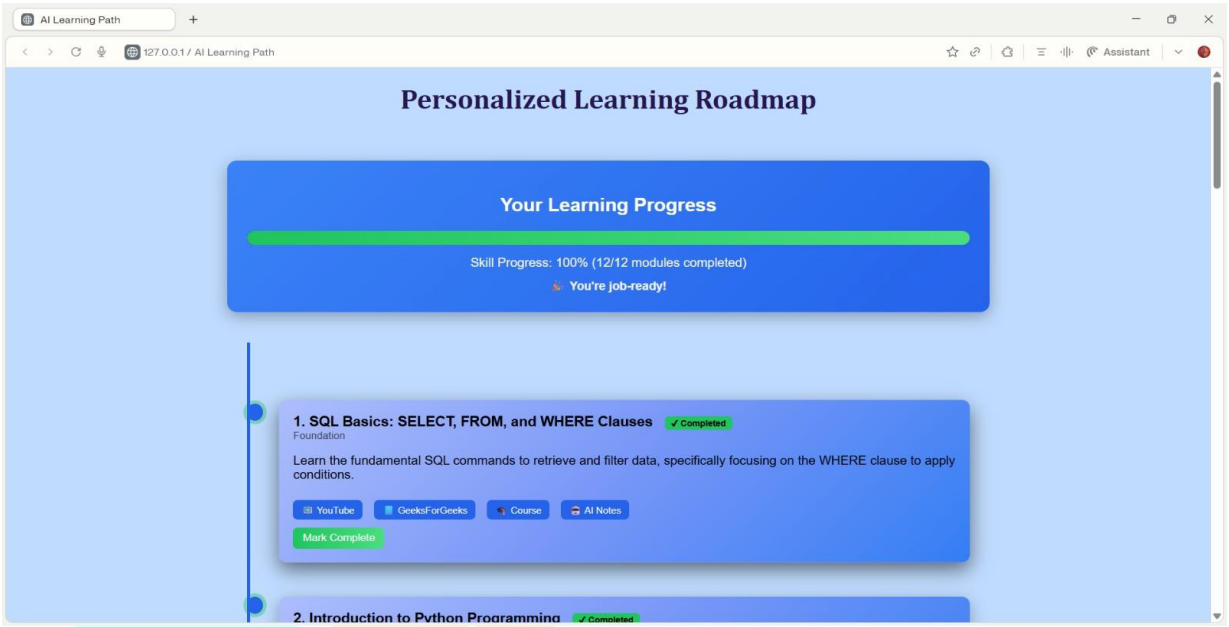

Fig.7

6.6 Learning Progress Tracking and Module Completion

With the user moving along through the map, the process records what modules have been completed and automatically updates the progress made. Such visual representation helps the user keep track of his or her performance in terms of learning.

6.7 Project-Based Learning Implementation

After covering major portions of the roadmap, projects in the real world are assigned to the user depending on their area of expertise. This helps them gain practical exposure in the field, making them ready for work in industries.

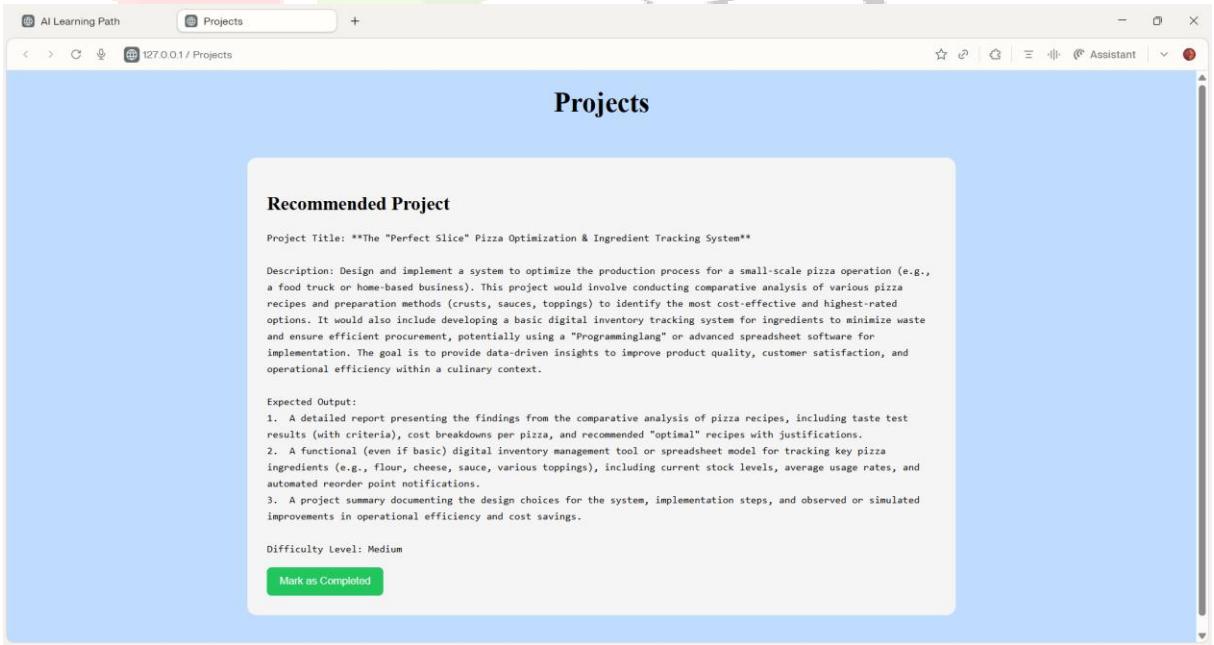

Fig.8

6.8 Follow-Up Quiz (Skill Re-evaluation)

After the learning phase and the completion of the project, there is a follow-up test conducted by the program. The test at hand is of a much higher level compared to the first test but as same format as initial test. It aims at assessing any improvements in the skills of the user.

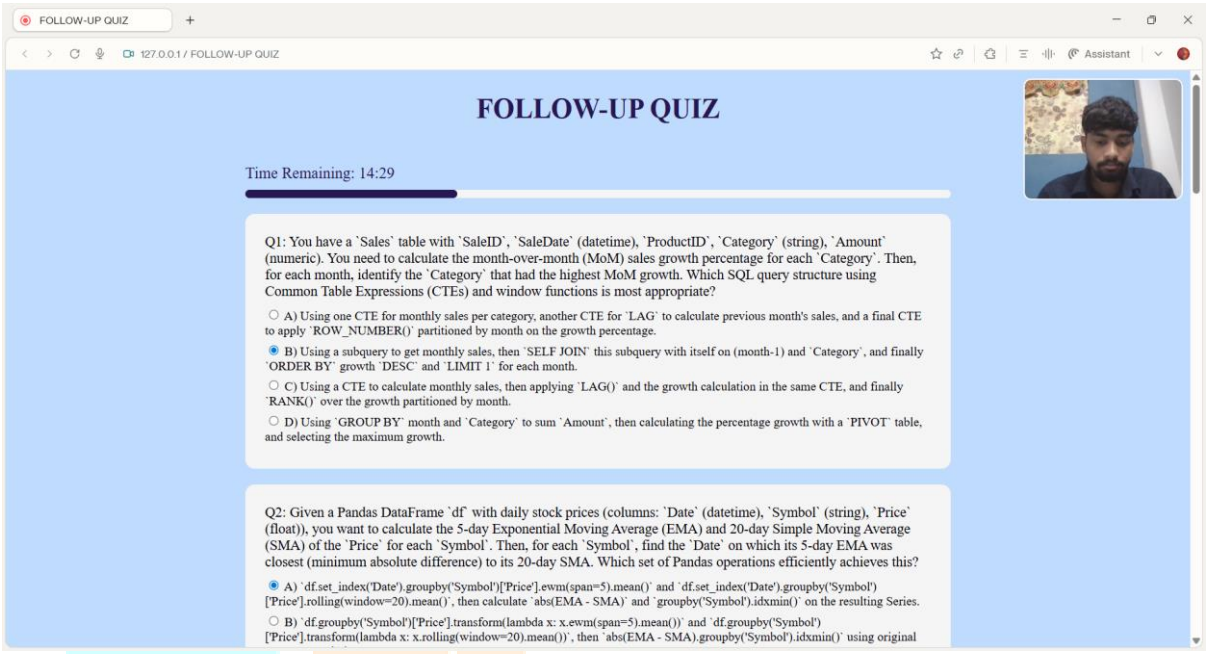

Fig.9

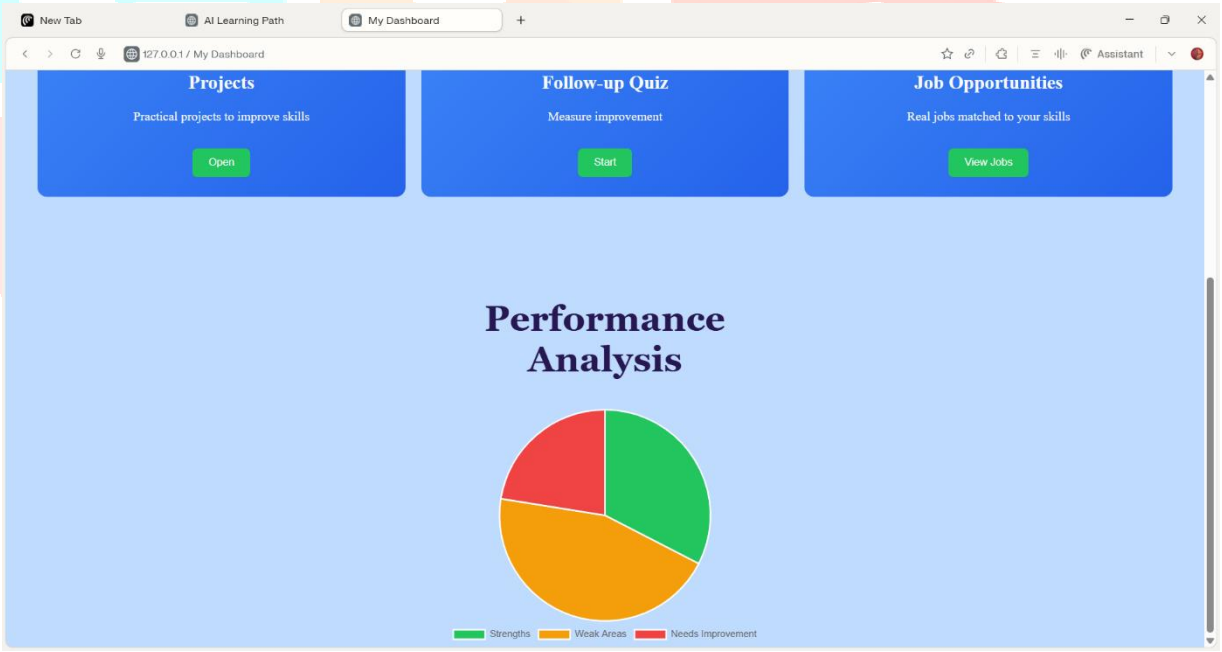

Fig.10

6.9 Job Recommendation and Skill Matching

This system retrieves job information in real-time by using third-party API services and compares the obtained information against the latest skills profile of the user. This process follows a hybrid model that involves keyword matching and artificial intelligence analysis for increased accuracy. The output consists only of relevant jobs based on users' skills.

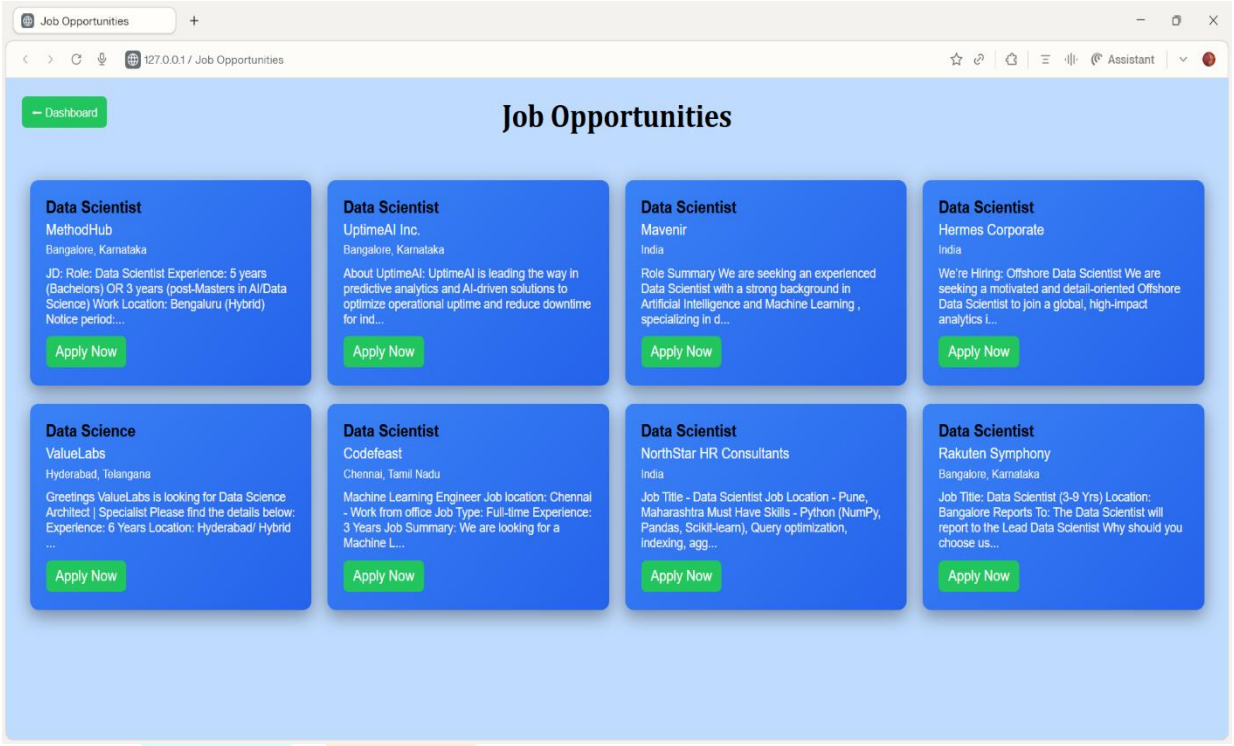

Fig.11

6.9 Deployment (Localhost / Cloud)

It can be implemented in a local environment for development and testing. In an actual environment, the implementation can be done using cloud computing platforms for scalable and concurrent processing of requests from different users.

VII. RESULT &CONCLUSION

The successful development and testing of the system proved that the GenAI Skill Gap Analyzer and Personalized Learning Path Recommender is an effective tool that helps users identify skill gaps and become job-ready. Firstly, the system performs user profile analysis using multiple data sources (resumes, GitHub, LinkedIn, and learning platforms). As a result, personalized quizzes, learning paths, and projects are generated. Also, follow-up quizzes and progress tracking are provided. Secondly, the system fetches the latest jobs based on user skills. Thus, the user will have an opportunity to find suitable employment. Therefore, a set of features offered by the proposed platform enables users to identify their skills, develop them, and search for employment

In conclusion, the proposed GenAI Skill Gap Analyzer and Personalized Learning Path Recommender System was analyzed through multiple user inputs such as resume data, GitHub data, LinkedIn profile data, and learning activities on the platform. The system exhibited high proficiency in assessing user skills and recognizing areas of strength and weakness through AI-powered tools. The quizzes produced were highly effective in testing both theoretical and practical knowledge while the personalized learning roadmap offered a clear guide for developing skills. Project-based learning and subsequent follow-up quizzes helped measure improved performance of the users. Finally, the job recommendations module successfully obtained job data from the market and matched it with user skills to provide suitable job openings.

The current research offers a comprehensive AI-enabled framework that combines the process of analyzing user skills, assessing theoretical knowledge and practical skills, recommending personalized learning pathways, measuring progress, and suggesting jobs based on user skills and experience. The system is completely automated and can be scaled up without significant difficulties as it does not require any additional infrastructure other than what is used for the training process.

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