TalentBridgeX: An AI-Powered Unified Platform for Student Skill Development, Career Readiness, and Opportunity Matchmaking

Aalok Aage[1], Aarya Raut[2], Tanishka Aher[3], Sarthak Kadam[4], Jayant Jagtap[5]
Mr. Pradip nimbalkar[6]
[1,2,3,4,5]*Department of First Year Engineering Science AISSMS Institute of Information Technology Pune, Maharashtra, India*
[6]*Guide, Department of First Year Engineering Science AISSMS Institute of Information Technology, Pune, Maharashtra, India*

***Abstract*—With the ever-evolving digital era, learners face challenges of being unable to satisfy industry demands after graduating successfully. One of the primary factors responsible for causing these challenges is the lack of correlation between education received in class and the preparedness to work in the industry. There exist many technological platforms that provide learners with different services like coding practice, internship placements, and courses, but most do not consolidate all these services. Therefore, TalentBridgeX is the suggested platform that would help learners develop their skills through skill evaluation, personalized learning experience, career readiness, and opportunity discovery. Some of the primary problems faced by learners, which the suggested system intends to solve include lack of awareness regarding skills deficiencies, lack of structured learning pathways, inability to acquire internships, lack of personalization in learning, and poor peer networking systems. Technologies employed in the suggested platform include machine learning, recommendation engines, and conversational AI, which allow learners to enjoy customized services like learning pathways, skill evaluation, personalized progress monitoring dashboard, internship opportunities, and peer networking among others. The platform employs up-to-date web-based tools such as React.js and Tailwind CSS on the front-end side, Node.js and Django for back-end tasks, MongoDB Atlas for database management, and Firebase for authentication and real-time messaging. AI system uses different smart technologies to help users learn and improve their skills. First, it checks what skills a person already has and finds the "skill gaps". TalentBridgeX wants to create a connected platform where students, educational institutions, and industries work together. The main goal is to help students become more employable by giving them the right skills, guidance, and opportunities. It also aims to reduce the difference between what students learn in education and what companies actually need in the workplace.**

***Index Terms*—Artificial Intelligence, Adaptive Learning, Career Readiness, Skill Gap Assessment, Recommendation Engine, EdTech Platform, Internship Matching, React.js, Django, MongoDB**

I. INTRODUCTION

The constant advancements made in the field of technology have greatly impacted industry requirements for graduates. Present day organizations look for candidates with not just knowledge but also skills, flexibility, communication and project management capabilities. Unfortunately, a large number of students who have completed engineering and technology programs find themselves lacking in terms of moving from academia to the workplace.

Various online platforms already exist for aiding in student learning. Platforms like Coursera and Udemy offer online courses while portals designed for internships deal largely with job openings. Coding assessment platforms test coding abilities but pay no heed to other aspects related to career growth. As all these are independent platforms, students need to utilize each separately.

TalentBridgeX aims to eliminate this drawback by integrating various functions such as learning, assessing, tracking, mentoring and opportunities into an integrated AI-based system. By adopting the

concepts of accessible and inclusive education, TalentBridgeX ensures that students receive personalized career assistance and training regardless of their financial situation.

The main objectives of the system proposed are:

- Development of an AI-based technique to assess the skill gap in students.
- Developing adaptive learning routes based on individual performance.
- Provision of graphical dashboards to track academic and skill development.
- Implementation of intelligent techniques to recommend internships and opportunities.
- Facilitating collaboration among peers through community-based learning.
- Development of a scalable and economical system design with open-source tools.

II. LITERATURE REVIEW

The design of the system is based on findings obtained from research in areas of adaptive learning technologies, recommendation systems, skill gap analysis, and collaborative learning techniques.

2.1. Adaptive Learning Technologies

The research done by Albert T. Corbett and John R. Anderson described the approach of knowledge tracing that is based on probabilistic modelling of student knowledge. The researchers found that personalized instruction is more efficient than conventional static instruction. Further research introduced techniques of deep knowledge tracing based on neural networks and sequence learning algorithms, providing more accurate predictions of learner's progress and allowing adaptive educational systems.

2.2. Recommendation Engines in Education Technology

Recommendation engines first became prominent in entertainment-related web-sites but were soon introduced to the sphere of edtech. Approaches like collaborative filtering and matrix factorization gained popularity in predicting user preference for educational materials. Among the challenges faced by recommendation engines is cold start problem when the algorithm cannot provide correct recommendations to new users due to absence of interaction history. This problem is addressed by TalentBridgeX through initial assessment of skills and capabilities.

2.3 Skill Gap Analysis

There have been various applications of Natural Language Processing in resume analysis as well as matching candidate qualifications to job requirements. Presently, there are NLP tools that can be used to identify gaps as well as analyze semantic connections of skills within the industry. TalentBridgeX uses an approach where a structured taxonomy of skills is analyzed using artificial intelligence to identify weak spots among students.

2.4 Collaborative Learning

Learning theories stress that individuals are better equipped to absorb knowledge via communication and cooperation. Peer-based learning promotes knowledge sharing, problem-solving abilities, and effective communication skills. Nevertheless, unorganized peer groups may, at times, disseminate inaccurate knowledge. TalentBridgeX has solved this problem by introducing moderated discussion forums that verify information and interactions within them.

2.5 Research Gap

Learning theory emphasizes that people are more capable of acquiring knowledge through communication and collaboration. Learning among peers helps improve knowledge sharing, problem-solving skills, and good communication.

However, disorganized groups of peers can, at times, provide wrong knowledge. This issue has been sorted out by TalentBridgeX through discussion forums which help verify the knowledge and interaction among people.

III. PROPOSED SYSTEM

The concept of TalentBridgeX can be described as an overall platform that provides its services throughout the entire education and preparation stage of learners. The platform will mainly target the students and newly graduated learners with the help of mentoring and administration functions.

In the platform, users will have the ability to:

- Sign up and take AI-powered skills assessment.
- Get personalized learning recommendations.
- Study lessons, take quizzes, code, etc.
- Track their progress via analytics.
- Find internship and freelance jobs.
- Take part in forums and communities.
- Converse with AI-powered virtual mentors.

The process starts with the registration process and skills evaluation through AI technologies. The recommendation engine will be used to personalize the pathway for users based on assessment results. As the learning process continues, users' profiles will get updated for even more relevant recommendations.
In the future, the project could be improved by adding a mobile app so users can access it easily on phones, connecting with platforms like GitHub and LinkedIn to show users' skills and professional profiles, and using more advanced AI technologies to provide smarter recommendations, better analysis, and improved user support.

IV. SYSTEM ARCHITECTURE

TalentBridgeX is designed using different layers, where each layer has a specific job. One layer handles user interaction (what users see and use), another manages backend services (processing requests and system functions), another stores and manages data in the database, and the AI layer handles smart features like recommendations and analysis. Separating these layers makes the system more organized, secure, and easier to maintain or improve.

4.1 Frontend Design

The app's user interface (frontend) will be built using React.js and Tailwind CSS. React.js helps create interactive and dynamic web pages, while Tailwind CSS is used to design the app with a modern and attractive look. Together, they ensure the application works smoothly on different devices like mobiles, tablets, and computers, giving users a responsive and engaging experience. The next section will describe the main frontend parts or modules of the application.

- Home page
- User registration page
- Dashboard for individual students
- Learn module view pages
- Progress tracking pages
- Internships listings pages
- Community discussion forums

The application is designed to automatically adjust and work properly on different devices such as desktop computers, tablets, and mobile phones, so users get a smooth and user-friendly experience on any screen size.

4.2 Backend Infrastructure

The backend of the system is divided into two main parts. The first part uses Node.js and Express.js to handle things like user login, security, managing user accounts, and connecting the app with different features through APIs. The second part uses Django and Python to manage AI-related features such as giving recommendations and running the chatbot. The frontend and backend communicate with each other using RESTful APIs, which allow them to send and receive information smoothly.

4.3 Database Layer

MongoDB Atlas is the main cloud-based database used in the system to store and manage data. It is a NoSQL database, which means it stores information in a flexible format instead of traditional tables. Different types of data are organized into collections, such as user details, courses, skills, recommendations, and chatbot data.

- User data
- Learning courses
- Skill level achievements
- Internships
- User forum posts

The system is designed in a way that it can easily grow in the future and support new features or more users without major changes or problems.

4.4 AI and Real-Time Services

Firebase is used to manage user login and security (authentication) and to send instant updates or notifications to users in real time. The AI features of the system are powered by machine learning models and GPT-based chatbots, which help provide smart suggestions, answer questions, and guide users like a virtual assistant.

V. METHODOLOGY

The software is built step by step instead of all at once. It follows an Agile-like approach, where the work is divided into small phases. After each phase, the system is reviewed and improved based on feedback. This makes development more flexible, so changes and improvements can be added easily throughout the process.

Phase 1 (Research & Requirement Gathering), the team studied the market, reviewed existing information, and understood what students actually need.

Phase 2 (System Design), they planned how the system would look and work by creating wireframes (basic screen designs), database structure, overall system architecture, and flow diagrams.

Phase 3 (Prototyping), they started building a working version by developing the user interface (frontend) and some parts of the backend and AI features.

Phase 4 (Testing and Optimization), they tested the system to find and fix bugs, checked APIs, improved the user interface, and made the system faster and more efficient.

Phase 5 (Documentation & Deployment), they prepared all reports and documents, planned how to launch the system, and completed the final delivery.

Overall, the project was developed using an Agile-like approach with GitHub for code management, feature branches for working on different parts separately, and teamwork (collaborative programming) to build the system together efficiently.

VI. EXPERIMENTAL RESULTS AND ANALYSIS

The prototype (first working version of the system) was checked to see how well it works in different areas. They tested whether all features were working properly (functionality), whether the app works smoothly on different devices (responsiveness), how fast and efficient the backend system is (backend performance), and whether the AI features like recommendations and chatbot are properly working and ready to be used (AI integration readiness).

6.1 Frontend Evaluation

The frontend (what users see and interact with) was successfully built with all the main screens and features, such as dashboards, learning sections, analytics pages, and discussion forums. The design works well on different devices and screen sizes, and it is easy for users to move around and use the system without confusion.

4.2 Backend Performance

The backend system built with Node.js worked properly. It managed user login and security (authentication), performed basic data operations like creating, reading, updating, and deleting information (CRUD), and connected smoothly with the MongoDB Atlas database to store and retrieve data. The APIs (which allow communication between frontend and backend) were tested using Postman, and they worked correctly by giving consistent and reliable responses.

4.3 AI Module Evaluation

The AI features that check a user's skills and suggest improvements were successfully created in a basic working form (prototype). Early tests showed that the system can actually understand what skills a student is missing (skill-gap identification) and can suggest a personalized learning path, meaning it can recommend what the student should learn next based on their current level.

4.4 Testing Strategy

The system was checked in many different ways to make sure everything works properly.

- Unit testing was done to test small parts of the frontend and backend separately to ensure each part works correctly.
- API testing was done using Postman to check if the frontend and backend are communicating properly.
- Integration testing checked the whole system together to see if all parts work smoothly as one complete application.
- AI testing was done using sample student data to see if the AI features like recommendations and skill analysis are working correctly.
- User acceptance testing was done by asking real users (volunteers) to try the system and give feedback on how easy and useful it is.
- Through this testing method, several usability and integration problems could be identified.

VII. ADVANTAGES OF TALENTBRIDGEX

The system provides several important advantages:

- It combines learning, assessments, and job opportunities in one single platform, so everything is available in one place.
- It uses a smart recommendation system that suggests learning content based on a student's current skills.
- It helps match students with internships and projects using artificial intelligence.
- It includes tools that track student progress in real time so they can see how they are improving.
- It provides a learning community where students can interact and learn together.
- It is cost-effective because it uses open-source software, which reduces development costs.
- The system is scalable, meaning it can easily grow and support more users or features in the future.
- It also follows accessibility goals, making it more usable for different types of learners, including those with special needs.

VIII. FUTURE SCOPE

In the future, the system will be improved in a few ways:

A mobile app may be developed using React Native, so users can easily access the platform on their smartphones.

- The AI system will become more advanced by adding "AI mentors" that can remember past interactions. This means the AI will be able to give more personalized guidance over time, based on what the student has learned and discussed earlier.
- Integration with LinkedIn and GitHub accounts.
- Badges and leaderboards in gamification
- Premium plans for mentorship and certification programs.
- Dashboards for institutions such as colleges and training organizations.
- An advanced NLP-powered system to match resumes and descriptions of job positions.

All these future upgrades will contribute greatly to the success of the platform.

IX. CONCLUSION

TalentBridgeX suggests a novel approach to dealing with the growing disparity between academic learning and industry requirements. It proves that technologies of today, including AI-based learning solutions, recommender systems, cloud-based computing, and adaptive systems can be combined into one system, which would focus on preparing students for their future careers.

This research has found out that the application of personalized learning systems improves the quality of education, while recommendation systems boost engagement and retention. Integrating these proven concepts into one system makes the project highly valuable in the field of educational technologies.

The developed prototype proves its capabilities in terms of developing responsive interfaces, scalable backend services, applying AI features, and providing support for collaboration in learning. With further development and implementation, the presented system may become a powerful tool for helping learners.

ACKNOWLEDGEMENT

It is our honour to extend our sincere thanks to our Guide Mr. Pradip Nimbalkar for his continuous guidance, helpful suggestions, and support during the development of the TalentBridgeX project. His motivation and technical advice helped us a lot during this research.

Our deep sense of gratitude is due to Head of the department, Dr. M.P. Gajre and all the faculty members of the Department of First Year Engineering Science, AISSMS Institute of Information Technology, Pune, who have provided us with all the means to complete this project successfully. The main motivating element behind this project was that of our esteemed Principal Dr. P.B. Mane, whose dedication to quality education still motivates us. We thank the open-source communities of React.js, Node.js, Django, MongoDB, Firebase and scikit-learn who made this project practically possible and economically feasible for us. We are also thankful to our friends and family members for their motivation and cooperation.

REFERENCES

[1] A. T. Corbett and J. R. Anderson, "Knowledge tracing: Modeling the acquisition of procedural knowledge," User Modeling and User-Adapted Interaction, vol. 4, no. 4, pp. 253–278, 1994.

[2] C. Piech, J. Bassen, J. Huang, S. Ganguli, M. Sahami, L. Guibas, and A. Ng, "Deep knowledge tracing," in Advances in Neural Information Processing Systems (NeurIPS), vol. 28, 2015.

[3] Y. Koren, R. Bell, and C. Volinsky, "Matrix factorization techniques for recommender systems," Computer, vol. 42, no. 8, pp. 30–37, 2009.

[4] S. Sinha, A. Rao, and M. Thakur, "Job-resume matching using BERT-based NLP models," in Proc. Int. Conf. on Computational Intelligence and Data Science (ICCIDS), 2020.

[5] L. S. Vygotsky, Mind in Society: The Development of Higher Psychological Processes. Cambridge, MA, USA: Harvard University Press, 1978.

[6] D. W. Johnson and R. T. Johnson, Cooperation and Competition: Theory and Research. Edina, MN, USA: Interaction Book Company, 1989.

[7] Coursera, "Global Skills Report 2023," Coursera Inc., 2023. [Online]. Available: https://www.coursera.org/skills-report

[8] Firebase Documentation, "Firebase Realtime Database Guide," Google LLC, 2024. [Online]. Available: https://firebase.google.com/docs/database

[9] OpenAI, "GPT-3.5-turbo API Documentation," OpenAI Inc., 2023. [Online]. Available: https://platform.openai.com/docs

[10] MongoDB, "MongoDB Atlas Documentation," MongoDB Inc., 2024. [Online]. Available: https://www.mongodb.com/docs/atlas

[11] React Documentation, "React Official Documentation," Meta Inc., 2024. [Online]. Available: https://react.dev/

[12] Node.js Documentation, "Node.js Runtime Environment," OpenJS Foundation, 2024. [Online]. Available: https://nodejs.org/

[13] Django Software Foundation, "Django Documentation," 2024. [Online]. Available: https://docs.djangoproject.com/

[14] Vercel Inc., "Vercel Deployment Platform," 2024. [Online]. Available: https://vercel.com/

[15] scikit-learn Developers, "scikit-learn: Machine Learning in Python," 2024. [Online]. Available: https://scikit-learn.org/