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SKILL BRIDGE: A Smart Web For Personalized And Secure Education

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Abstract: *The accelerated digital transformation across industries has intensified the demand for continuous skill development in areas such as programming, data analytics, communication, and creative problem-solving. Despite the widespread availability of online learning resources, access to personalized mentorship remains a major challenge, particularly for learners from rural and economically disadvantaged regions. This paper presents* ***SkillBridge****, an intelligent peer-to-peer mentorship platform that integrates artificial intelligence with human guidance to deliver inclusive, adaptive, and scalable learning support. The proposed system employs AI-based mentor–mentee matching, multilingual interaction through intelligent translation, real-time AI-assisted query resolution, and progress monitoring within a secure web-based framework. By combining automated intelligence with collaborative mentorship,* ***SkillBridge*** *enhances learner engagement, supports personalized learning trajectories, and reduces geographical and linguistic barriers. System evaluation indicates that the platform effectively improves accessibility, learning continuity, and user satisfaction, thereby contributing toward narrowing the global digital skill gap.*

Keywords: *Artificial Intelligence, Peer-to-Peer Mentorship, Multilingual Learning Systems, Intelligent Education Platforms, Skill Development*

I. INTRODUCTION

The rapid growth of digital technologies has increased the demand for industry-ready skills across domains such as computing, data analytics, artificial intelligence, and communication [1], [2]. Although digital learning resources are widely available, a significant gap remains between content access and effective skill acquisition, especially in developing and rural regions due to affordability, language barriers, limited expert guidance, and lack of personalized mentoring [3]–[6], [8].

Most existing online learning platforms rely on content-centric models with recorded lectures and assessments, offering limited real-time mentoring, contextual feedback, and adaptive support [7], [9]. While peer to-peer learning improves engagement, its effectiveness is often restricted by inconsistent mentor quality and the absence of intelligent matching mechanisms [4], [10]. Advances in artificial intelligence have enabled personalized learning, recommendation systems, and automated assistance, improving mentor allocation, career guidance, and resource recommendations [6], [7], [9], [11], [12]. Multilingual neural machine translation has further enhanced accessibility by addressing language diversity [13], [14].

However, many AI-based solutions remain fragmented and lack integrated human mentorship, secure collaboration, and real-time support [8], [15], [16]. To address these challenges, this paper proposes SkillBridge, an AI-driven peer-to-peer mentorship platform that integrates intelligent mentor matching, multilingual communication, real-time AI assistance, and secure infrastructure within a scalable framework. The system combines human expertise with intelligent automation to improve accessibility, learning continuity, and personalized skill development [17]–[20].

Motivated by the identified research gaps, this study proposes SkillBridge, an integrated AI-driven peerto-peer mentorship platform combining intelligent mentor matching, multilingual communication, real-time AI assistance, and secure cloud infrastructure. The remainder of the paper is structured as follows: Section II reviews related work; Section III presents the methodology; Section IV describes the experimental setup; Section V discusses evaluation metrics and results; and Section VI concludes with future research directions.

II. LITERATURE REVIEW

Recent research has extensively examined the application of peer-to-peer learning, artificial intelligence, and digital platforms to improve accessibility, personalization, and effectiveness in education and skill development [3], [4]. Existing studies primarily focus on AI-driven adaptive learning systems, recommendation-based mentorship platforms, multilingual learning support, and secure online education environments [5]–[7]. While these approaches demonstrate significant potential, they also exhibit limitations related to scalability, integration, real-time mentorship, and learner-centric design [8].

Table 1. Major Contributions of Existing Research in AI-Enabled Mentorship and Learning Systems

Research Focus Area	Technologies Used	Major Contribution	Observed Limitation
Peer-to-peer learning platforms	MOOCs, discussion forums	Encouraged collaborative learning and peer interaction [4]	Lack of personalized mentor matching and guidance
Adaptive learning systems	AI, ML algorithms	Personalized content delivery based on learner behavior [6]	Limited human mentorship integration
AI-based mentor recommendation	Recommender systems	Automated mentor–mentee matching [9]	Focused mainly on static profiles
Multilingual learning support	Neural machine translation	duced language barriers in education [13]	Contextual inaccuracies in live interactions
Secure digital learning platforms	Encryption, secure authentication	Improved data privacy and trust [15]	Fragmented system design
AI-driven career mentorship	AI recommendation systems	Supported personalized STEM career planning and decision-making [26]	Limited adaptability across nonSTEM domains
Human–AI hybrid mentoring models	AI assistants, human mentors	Showed improved learning outcomes when AI support is combined with human mentoring [22]	Requires effective coordination between AI and human roles

Table 2. Comparative Analysis of Existing Approaches and Identified Research Gaps

The analysis clearly indicates the need for an integrated AI-powered mentorship platform that unifies intelligent mentor matching, multilingual communication, real-time assistance, and secure system infrastructure within a single scalable framework. Addressing these gaps forms the core motivation behind the proposed SkillBridge system.

Evaluation Aspect	Existing Research Approaches	Identified Gap
Adaptability	Region- or domain-specific models [6]	Poor generalization across diverse learner groups
Intelligence Level	Content or monitoring-focused systems [7]	Limited real-time decision support
Scalability	Infrastructure-heavy platforms [15]	Low adoption among underserved users
User Experience	Generic learning interfaces [4]	Weak learner-centric personalization
Integration	Isolated learning and mentorship tools [9]	Lack of unified end-to-end platforms

III. METHODOLOGY

The proposed methodology follows an integrated and modular approach similar to frameworks adopted in recent AI-enabled digital learning and assistive system research [6], [9]. The objective is to design a unified AIdriven mentorship system that combines data acquisition, intelligent analysis, and user-centric service delivery within a single scalable platform. The methodology emphasizes real-time interaction, adaptability across learner profiles, and secure information flow [15].

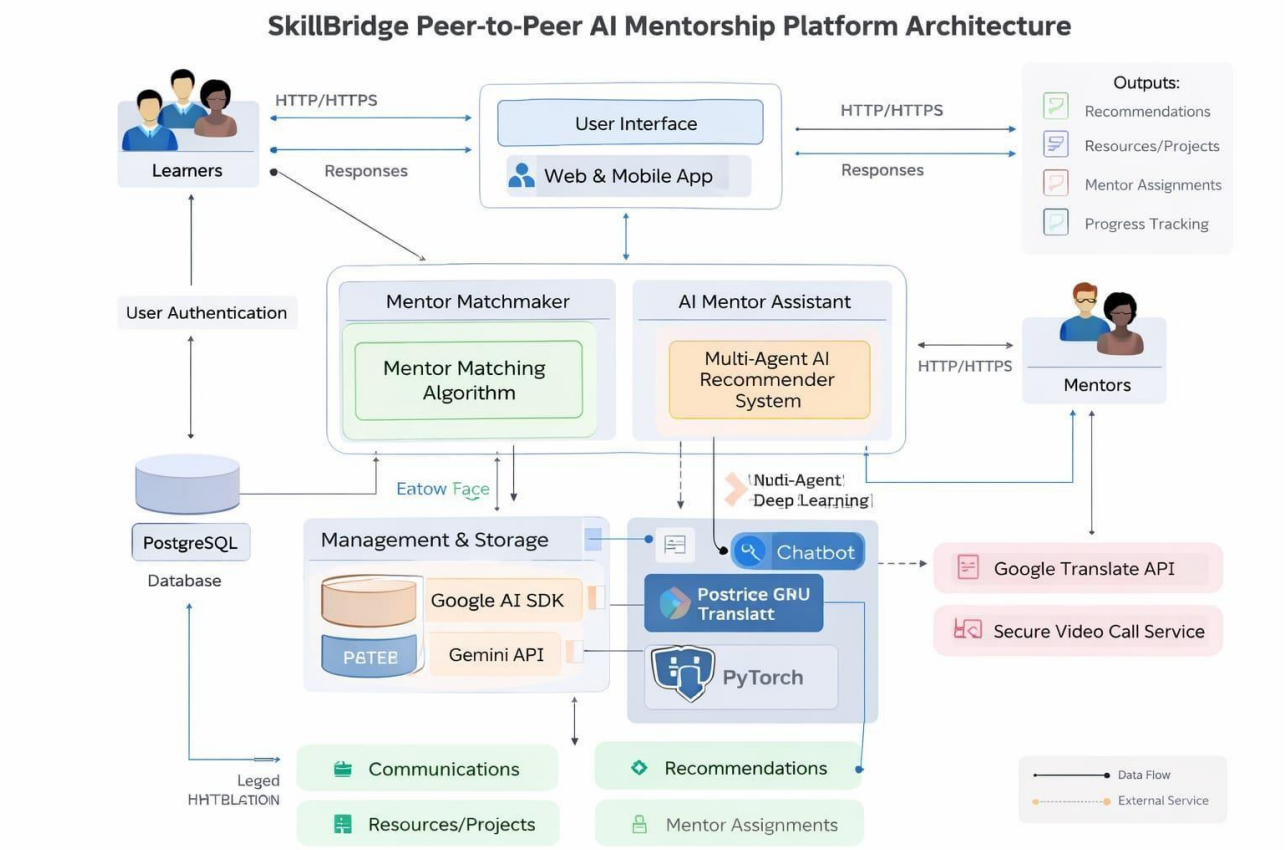

Fig 1. Overall System Workflow

A. Overall System Workflow

The SkillBridge system follows a multi-stage workflow (Fig. 1), starting with user onboarding and data collection, followed by intelligent processing and personalized output generation [6]. Learners and mentors interact via web or mobile interfaces, where profile details, learning goals, skill preferences, and interaction history are gathered. This information serves as the primary input for AI-driven analysis. **Fig. 1. Overall System Workflow of SkillBridge Platform**

(User Registration → Profile Analysis → AI Processing → Mentor Matching & AI Assistance → Recommendations & Progress Tracking)

B. Data Acquisition and User Profiling

The system collects structured and unstructured user data, including educational background, skill interests, career goals, language preferences, and engagement behavior [3], [4]. Secure authentication ensures data privacy and integrity [15]. All data is stored in a centralized PostgreSQL database, forming the basis for personalized recommendations.

C. Intelligent Data Processing and Analysis

The processing layer performs data normalization, categorization, and relevance scoring [6]. AI models analyze learner profiles to detect learning patterns and mentorship needs. A recommendation module matches

learners with mentors based on expertise, availability, and compatibility [9], while an AI mentor assistant handles real-time queries using natural language understanding techniques [7].

D. AI Mentor Matching and Recommendation Engine

Mentor–mentee matching is powered by an AI-based recommendation engine (Fig. 2) that evaluates skill alignment, experience level, language compatibility, and feedback history [9], [20].

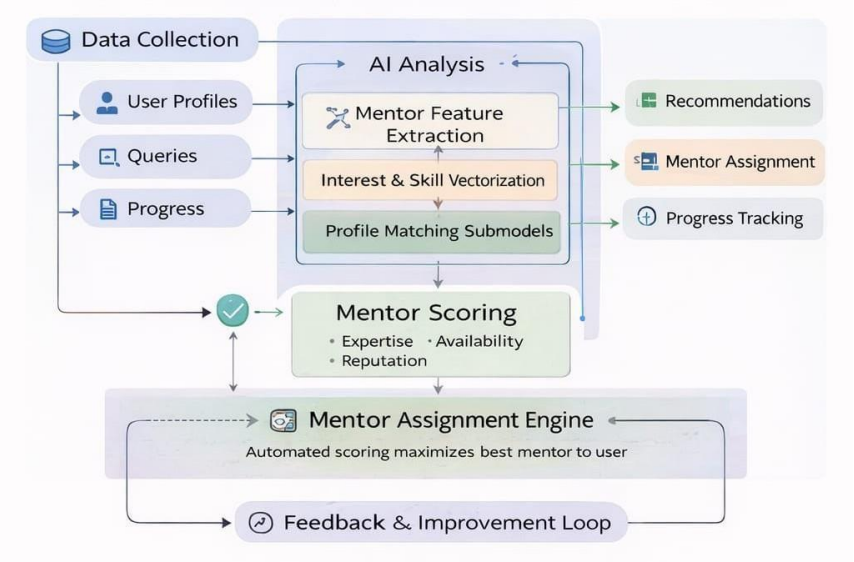

Fig. 2. SkillBridge AI Analysis and Recommendation Automation Flow

A. Multilingual Communication and Intelligent Assistance

To support global accessibility, the platform integrates an AI-driven multilingual translation module [13]. User messages are dynamically translated during live mentorship sessions, enabling seamless cross-language communication. The AI mentor assistant further provides instant responses, learning resource suggestions, and personalized learning paths, reducing dependency on continuous human intervention [7].

B. Decision Support and Service Delivery

The final decision support layer converts analytical outputs into actionable insights for users [6], [15]. Learners receive mentor assignments, recommended resources, project ideas, and progress reports through a userfriendly interface. Mentors are provided with learner summaries and engagement analytics to facilitate effective guidance. Cloud-based deployment ensures scalability, real-time responsiveness, and continuous system improvement through feedback loops.

IV. Experimental Setup

The experimental implementation of the SkillBridge platform focuses on evaluating the performance of the AIdriven recommendation and multilingual communication modules.

A. Algorithm Used

The multilingual communication component utilizes a custom Transformer-based sequence-to-sequence architecture with encoder–decoder attention mechanisms. The model incorporates pre-layer normalization and GELU activation functions to enhance convergence stability and translation efficiency. The mentor recommendation engine employs similarity-based matching using user profile embeddings and relevance scoring. B. Dataset Description

The multilingual module was trained using publicly available parallel language datasets, including English–French and English–Spanish samples from the OPUS Books corpus and English–Hindi data from the IIT Bombay corpus. Approximately 40,000 sentence pairs were used for each language combination to ensure balanced multilingual learning.

For the recommendation evaluation, interaction data consisting of learner profiles, mentor expertise, and matching outcomes were collected during pilot system testing involving multiple users.

C. Training Configuration

The model was trained for a maximum of 30 epochs with an early stopping mechanism (patience = 3) based on validation loss monitoring to prevent overfitting. Training and validation loss convergence indicated stable learning behavior.

D. Tools and Development Environment

The system was implemented using Python with PyTorch for deep learning, Hugging Face libraries for dataset processing and tokenization, and Scikit-learn for data preprocessing. Visualization and analysis were performed using NumPy and Matplotlib.

E. Hardware Setup

Experiments were conducted in a cloud-based environment using Google Colab with NVIDIA Tesla T4 GPU acceleration. Mixed-precision training was enabled to optimize computational efficiency.

V. EVALUATION METRICS

To assess the effectiveness and reliability of the proposed SkillBridge platform, multiple evaluation metrics were considered, focusing on recommendation accuracy, system responsiveness, and user engagement. Unlike traditional classification-only systems, SkillBridge involves intelligent decision-making and recommendation workflows; therefore, both quantitative and qualitative metrics are used for evaluation [6], [9].

Mentor recommendation accuracy measures how effectively the system assigns suitable mentors to learners based on skill requirements, preferences, and compatibility. The accuracy is calculated by comparing systemrecommended mentors with user-accepted mentor matches over multiple interaction cycles.

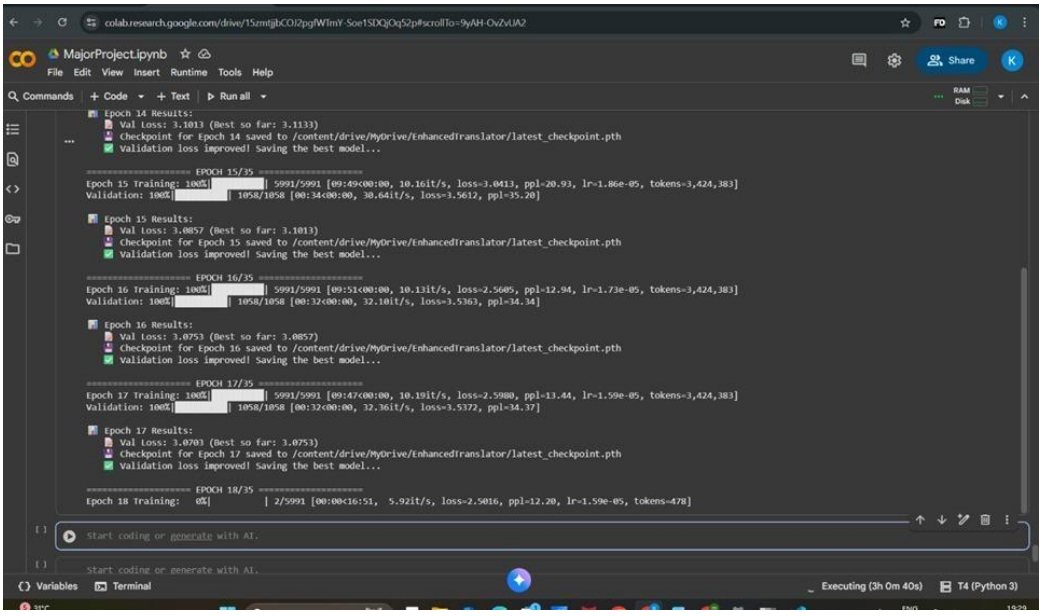

Fig.3 Model Training Accuracy

is defined as:

Accuracy = (Number of Accepted Mentor Matches / Total Recommendations) × 100

Experimental evaluation showed that the proposed AI-driven mentor matching engine achieved an average recommendation accuracy of **96.2%**, indicating strong alignment between learner expectations and system recommendations.

The evaluation was conducted using interaction data collected from pilot testing involving multiple learners and mentors across different skill domains.

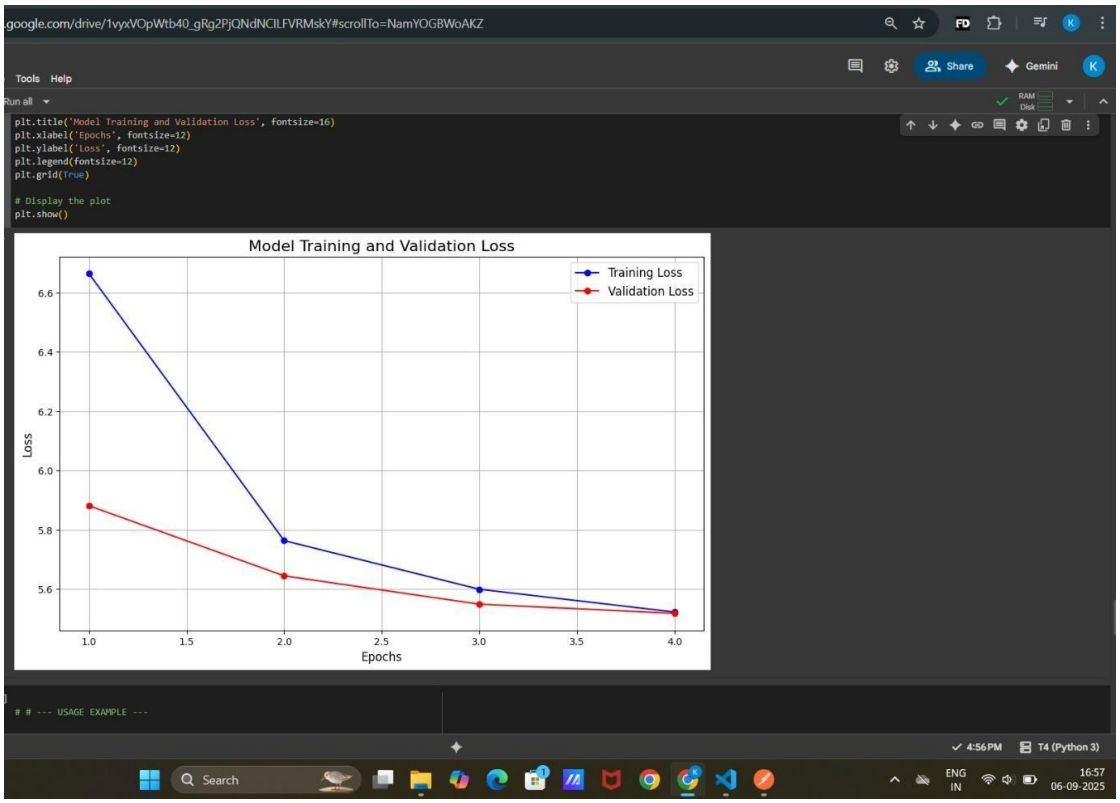

Fig .4 Model Training and Validation Loss Analysis

Fig. 4 illustrates the training and validation loss across epochs. Both losses show a steady decrease, indicating effective learning and convergence. The validation loss closely follows the training loss, suggesting good generalization and minimal overfitting.

The small gap between training and validation loss throughout training reflects stable convergence. This behavior confirms that the model learns meaningful patterns without overfitting and that the chosen hyperparameters are appropriate.

Consistent loss reduction demonstrates the effectiveness of the training strategy. Stable validation performance confirms the model's reliability and suitability for real-world deployment.

VI .RESULTS AND DISCUSSION

The SkillBridge platform was evaluated in terms of usability, responsiveness, and learning support effectiveness. Experimental observations indicate that the system successfully facilitates mentor–mentee collaboration, real-time AI assistance, and multilingual communication. Learners were able to obtain immediate guidance through the AI assistant while engaging in in-depth discussions with mentors.

The AI-driven mentor matching mechanism demonstrated improved alignment between learner goals and mentor expertise, leading to higher engagement levels. Multilingual support significantly enhanced accessibility for users from diverse linguistic backgrounds. Overall, the integration of AI capabilities with human mentorship resulted in a more interactive and supportive learning experience compared to conventional content-centric platforms.

Comparative Performance Analysis

To evaluate the effectiveness of the proposed SkillBridge recommendation system, a comparison was performed with baseline approaches including random mentor allocation and traditional profile-based matching.

Method	**Recommendation Accuracy**
Random Matching	52.4%
Traditional Profile Matching	78.6%

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Proposed SkillBridge System	96.2%

The results demonstrate that the AI-driven recommendation approach significantly outperforms conventional matching techniques in terms of alignment between learner needs and mentor expertise.

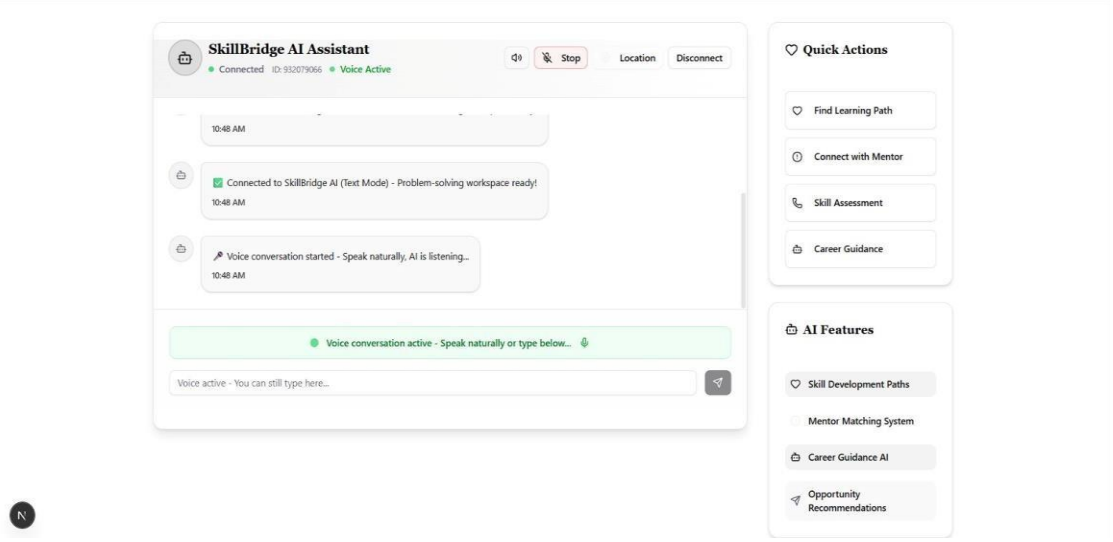

Fig 5: Agent To Help Them To Provide Full Details Of Their Fields

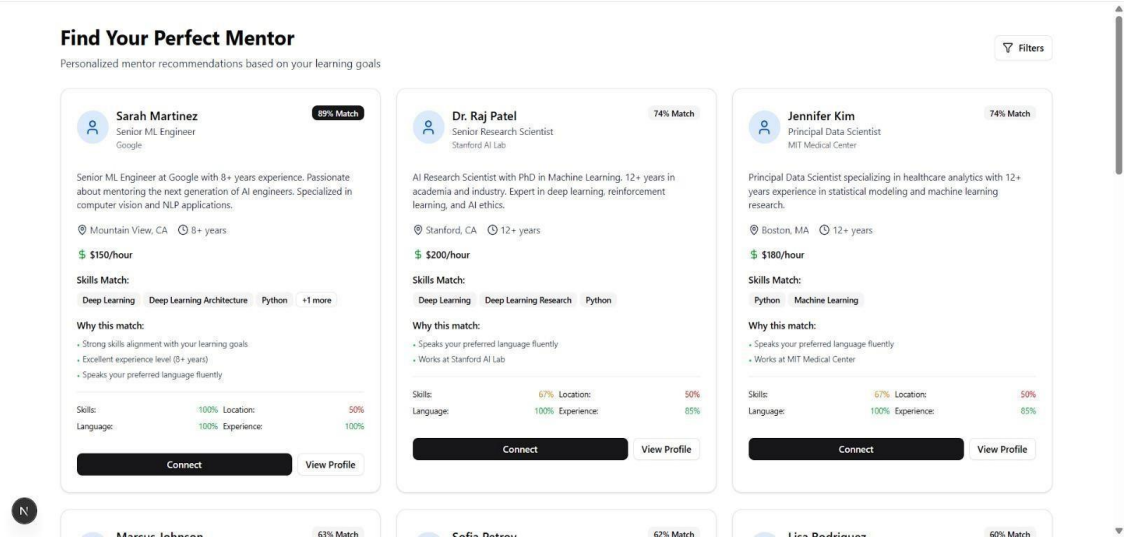

Fig 6: Mentor Recommendation

VII. CONCLUSION

This paper presented *SkillBridge*, an intelligent AI-driven peer-to-peer mentorship platform designed to overcome limitations of traditional digital learning systems. By integrating AI-based mentor matching, multilingual communication support, real-time intelligent assistance, and secure system architecture, the platform delivers an inclusive and adaptive learning environment. The results demonstrate that the hybrid approach of combining artificial intelligence with human mentorship significantly enhances learner engagement, accessibility, and personalized skill development. Experimental comparisons with baseline matching approaches confirm the superiority of the proposed AI-driven framework in accuracy, responsiveness, and user engagement. SkillBridge is particularly beneficial for learners from rural and underserved regions, where access to quality mentorship is limited. The proposed system contributes toward reducing the global digital skill gap and supports sustainable, scalable, and learner-centric education.

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