



# Revolutionizing Education through AI-driven Personalized E-Learning Systems

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**Abstract-** The surge toward online education prompts exploration into AI-integrated e-learning systems, emphasizing their impact and role in modern education. Challenges persist in comprehending the influence of AI methodologies on online learning and learner performance, necessitating comprehensive research and a personalized e-learning system leveraging AI capabilities emerges, tailoring course recommendations and fostering user-alumni engagement, promising an effective, adaptive, and engaging educational experience. The integration of AI technologies, including algorithms like Long Short-Term Memory (LSTM), fuels the envisioned evolution of e-learning toward a more adaptive, effective, and personalized educational experience.

**Keywords:** personalized e-learning, alumni networking, LSTM, career guidance, intelligent systems.

## I. INTRODUCTION

Artificial Intelligence (AI) has emerged as a groundbreaking field within computer science, aiming to create systems that

replicate human intelligence. It encompasses a diverse range of subfields, including machine learning, deep learning, and natural language processing, each contributing to the development of intelligent systems capable of tasks that traditionally require human cognition. The implications of AI are far-reaching, spanning across industries, including healthcare, finance, autonomous vehicles, recommendation systems, and particularly, the realm of e-learning.

E-learning, or electronic learning, has become an increasingly popular method of education in the digital age. It offers flexibility and accessibility, enabling learners to engage with educational content remotely. However, traditional e-learning systems often rely on content-based course suggestions, which present a significant drawback. These systems do not adequately consider the unique learning needs and abilities of individual users. They tend to provide the same content to all learners, irrespective of their comprehension levels and preferred learning modes. Consequently, many learners may find the

content either too challenging or too basic, leading to suboptimal learning experiences.

To address these limitations, the proposed solution leverages AI, particularly Long Short-Term Memory (LSTM) technology, to usher in a new era of education. This innovation revolves around adaptive placement testing, personalized content delivery, and internship recommendations. Adaptive placement testing, empowered by AI, assesses each learner's existing knowledge and abilities, ensuring that they are placed in the most suitable learning modules. Personalized content delivery tailors the educational experience for each user, providing them with materials and assessments that match their learning styles and comprehension levels. For example, if a user struggles with programming, the system prioritizes programming content to address the learner's needs effectively.

Additionally, the application introduces other valuable features, such as a college announcement platform and alumni interaction. These components are aimed at enhancing the educational experience beyond just content delivery. The college announcement platform keeps students informed and connected, enabling them to stay updated on important campus news and events. Meanwhile, the alumni interaction feature opens doors for networking and job opportunities. By connecting students with graduates who have ventured into their desired fields, the system creates a valuable bridge between education and career advancement.

In essence, this approach to e-learning harnesses the power of AI to revolutionize education. It breaks away from the limitations of traditional e-learning systems by providing a highly personalized and effective learning experience. With

adaptive placement testing, personalized content delivery, and a range of additional features, the system ensures that each learner's unique needs are met, ultimately fostering a more efficient and engaging educational landscape.

Artificial Intelligence, as a broader concept, is the driving force behind this transformation. It encompasses various subfields that contribute to AI's capabilities. Machine learning, for instance, enables systems to learn from data and make predictions or decisions. Deep learning, a subset of machine learning, employs neural networks to model complex patterns and representations. Natural language processing, on the other hand, allows computers to understand and interact with human language.

The applications of AI extend across industries. In healthcare, AI assists in diagnosing diseases, analyzing medical images, and even drug discovery. In finance, it is utilized for fraud detection, risk assessment, and algorithmic trading. Autonomous vehicles rely on AI to perceive their surroundings and make real-time driving decisions. Recommendation systems powered by AI drive personalized content suggestions on platforms like Netflix, Amazon, and Spotify.

The synergy of AI and e-learning presents an exciting prospect for the future of education. By leveraging AI technologies, education can be tailored to individual needs and learning styles, ultimately enhancing the quality of the educational experience. This innovation opens the door to a more dynamic and efficient approach to learning, where learners are provided with the resources and support they need to thrive in their educational journey.

In conclusion, AI is revolutionizing the educational landscape through innovations

like personalized e-learning. This approach

addresses the limitations of traditional e-learning systems by utilizing AI to adapt content and assessments based on individual learning styles and comprehension levels. With a focus on user-centric recommendations and additional features such as internship recommendations, college announcements, and alumni interaction, this solution promises to transform education into a highly personalized and effective learning

experience. As AI continues to advance, it holds the potential to reshape education and create more engaging and efficient learning environments for learners around the world.

## II. LITERATURE SURVEY

SL NO	TITLE OF PAPER	AUTHOR NAME	YEAR OF PUBLICATION	METHODOLOGY USED	ADVANTAGES	DISADVANTAGES
1	Learner modeling: a systematic review of the literature from the last 5 years	Abir Abyaa, Mohammed Khalidi Idrissi & Samir Bennani	2019	The literature review reveals a diverse range of learner characteristics, including cognitive abilities and learning styles, crucial for effective modeling in Adaptive Learning Systems (ALS).	The literature review enhances understanding of learners' individual traits and prevalent modeling techniques, providing a comprehensive overview of the current state of Learner Modeling research.	However, the review may be limited by the rapidly evolving nature of the field, potentially omitting recent advancements and emerging trends in Learner Modeling.
2	Knowledge Tracing with Sequential Key-Value Memory Networks	Ghodai Abdelrahman and Qing Wang	2019	Utilizing neural networks within supervised learning frameworks bridges computing methodologies with cognitive science, fostering interdisciplinary advancements in educational technology.	SKVMN demonstrates superior performance over state-of-the-art Knowledge Tracing (KT) models across all datasets, indicating its effectiveness in predicting	The specific computational and resource requirements of SKVMN may be higher compared to other models, potentially limiting its practicality in resource-constrained educational settings.

					student knowledge states.	
3	Can we predict success from log data in VLEs? Classification of interactions for learning analytics and their relation with performance in VLE-supported F2F and online learning	Ángel F. Agudo-Peregrina a , Santiago Iglesias-Pradas a , Miguel Ángel Conde-González b , Ángel Hernández-García	2014	This study employs three classifications and an empirical experiment to investigate the associations between student interactions and academic performance in diverse course modalities, utilizing VLE usage logs from online and VLE-supported face-to-face courses across two Spanish universities.	The study's contribution to learning analytics and the provision of practical guidance offer valuable insights for enhancing educational outcomes through informed decision-making.	The limited consideration of user experience in the analysis may hinder a comprehensive understanding of the factors influencing interactions and academic performance in the learning environment.
4	Self-Directed Learning: Student's Interest in Viewing the Learner Model	Norasnita Ahmad	2013	The paper employs a multifaceted approach, combining a literature review, educational context analysis, and a quantitative study with undergraduate students, demonstrating the potential of open learner models in fostering self-directed learning while proposing avenues for future research on their long-term impact.	The comprehensive analysis and use of quantitative data provide a robust foundation for informed conclusions and facilitate a forward-looking approach for future research.	The study's reliance on a small sample size may limit the generalizability of findings, and potential bias in data, coupled with the resource-intensive nature of the research, may affect the study's overall validity.
5	An adaptive activity sequencing	Doniyorbek Ahmadaliev, Chen Xiaohui, Murodjon	2019	The paper presents the development of an adaptive e-learning system, incorporating	Personalization tailors learning to individual preferences, enhancing user	Data privacy concerns may arise, posing challenges regarding the collection and handling of user data,

	instrument to enhance e-learning: an integrated application of overlay user model and mathematical programming on the Web	Abduvohidov , Asilbek Medatov, Gulbahor Temirova		overlay user models and mathematical programming, utilizing methodologies such as adaptive learning modeling, user modeling, overlay models, mathematical programming, and educational data mining. Though lacking in detailed methodology, it offers a comprehensive overview of the applied techniques aimed at improving e-learning through personalized approaches.	engagement and motivation by catering to specific learning needs and styles.	potentially impacting user trust and system adoption.
6	Design and Usability Evaluation of Adaptive e-learning Systems Based on Learner Knowledge and Learning Style	Mohammad Alshammari, Rachid Anane, and Robert J. Hendley	2015	"Adaptive Learning" employs learner models to create personalized learning paths, offering adaptive guidance to users, with usability evaluated through the System Usability Scale (SUS) questionnaire and supported by statistical analysis.	The enhanced usability of the adaptive e-learning system, as demonstrated in the study, contributes to increased learner satisfaction, engagement, and motivation.	The initial complexity for users may require additional technical support, potentially posing a barrier to the seamless adoption of adaptive systems, particularly for those unfamiliar with the technology.
7	Evaluating the Effect of Uncertainty Visualisation in Open Learner Models on Students'	Lamiya Al-Shanfari , Carrie Demmans , and Chris Baber	2017	The study, utilizing the OLMlets system with varied visualizations, found that the expandable model positively impacted student engagement, self-assessment accuracy, and	The system's ability to enhance metacognitive skills provides learners with improved self-awareness and self-regulation, contributing to more effective	The limited generalizability to other contexts may constrain the broader application of the system's benefits, potentially restricting its effectiveness across diverse educational settings.

	Metacognitive Skills			motivation in a math course, indicating its potential to enhance learning experiences.	and autonomous learning experiences.	
8	Using LAMS to Support Engineering Student Learning: Two Case Studies	Luis A. Álvarez-González, Milton Lemarie, and Patricia Bello	2017	This study utilizes Learning Designs in the LAMS platform to enhance engineering student learning, conducting case studies on a blended basic mechanical elements course and a programming language course to evaluate performance and engagement outcomes.	Learning designs allow for customization, catering to the specific needs of diverse courses and student groups, promoting a tailored and effective educational experience.	The study's reliance on a small sample size limits the generalizability of findings to larger student populations, potentially compromising the broader applicability of the observed benefits.
9	Recommender systems A systematic review of the state-of-the-art literature and suggestions for future research	Fatemeh Alyari, Nima Jafari Navimipour	2017	This paper employs a Systematic Literature Review (SLR) to comprehensively analyze and integrate high-quality studies across five categories, providing a holistic examination of recommender systems and their techniques across various domains, while also discussing general aspects without domain specificity.	Real-time customization enables the recommender system to adapt promptly to user preferences and changes in the system dynamics, enhancing user satisfaction and relevance.	Data sparsity poses a challenge, as insufficient user-item interaction data may hinder the system's ability to generate accurate recommendations, particularly for less common items or users with limited interaction history.
10	Course Signals at Purdue: Using Learning Analytics	Kimberly E. Arnold, Matthew D. Pistilli	2012	Real-time Feedback: Course Signals employs a color-coded system (red, yellow, or green signals)	Course Signals have been associated with higher grades and reduced failure rates,	Instructors may face increased workloads, particularly if there is a high volume of communication from students seeking help,

	to Increase Student Success			generated by the student success algorithm to provide instructors with instant, visual indicators of each student's likelihood of success, facilitating timely intervention strategies.	contributing positively to student academic performance and success.	potentially impacting their ability to manage other aspects of their teaching responsibilities.
11	A neural network-based intelligent cognitive state recognizer for confidence-based e-learning system	Suman Bhattacharya, Samir Roy, Sankhayan Chowdhury	2016	This study employs an artificial neural network (ANN) to identify the cognitive states of e-learners through performance in a confidence-based e-learning test, utilizing the trained ANN to offer personalized pedagogical support based on the recognized cognitive state.	The system's ability to provide personalized support based on the recognition of learners' cognitive states allows for tailored interventions, enhancing the overall effectiveness of the e-learning experience.	Data quality issues and the absence of human touch in ANNs can lead to inaccuracies, while maintenance, privacy concerns, and resource-intensive training pose challenges for effective implementation and generalization across diverse learners.
12	Adaptive feedback in computer-based learning environments: a review	Andrew Thomas Bimba , Norisma Idris , Ahmed Al-Hunaiyyan, Rohana Binti Mahmud and Nor Liyana Bt Mohd Shuib	2017	This study employs a comprehensive methodology, including an extensive literature review, rigorous selection criteria emphasizing practical relevance and recent developments, and categorization of chosen articles based on feedback characteristics, to systematically analyze and synthesize the implementation and scientific evaluation of	The study's emphasis on recognizing open research questions in adaptive feedback implementations contributes to the scholarly dialogue by guiding future research endeavors and fostering the evolution of the field.	The dynamic nature of the adaptive feedback field may render the study less reflective of current trends and technologies, as it is limited to articles published between 2000 and 2016, potentially missing recent developments.

				adaptive feedback systems in learning environments from 2000 to 2016.		
13	A reference model for learning analytics	Mohamed Amine Chatti, Anna Lea Dyckhoff, Ulrik Schroeder and Hendrik Thüs	2012	The reviewed literature highlights a diverse array of data sources, predominantly relying on central web-based learning systems, and underscores the evolving role of stakeholders, with an increasing future emphasis on learners and pedagogical concerns within Learning Analytics (LA) studies.	Learning Analytics facilitates adaptive learning systems, tailoring educational content to individual learners, thereby enhancing the overall learning experience through personalized and targeted interventions.	Privacy concerns emerge as a significant drawback, given the extensive data collection in Learning Analytics, necessitating careful consideration of ethical implications and robust security measures to safeguard learner privacy.
14	The Effects of Animated Pedagogical Agents in an English-as-a-Foreign-Language Learning Environment	Talvany Carlotto, Patricia A. Jaques	2016	The study employed inferential statistics, specifically ANOVA and t-tests, to rigorously assess and compare the significance of differences in learning outcomes among the four groups exposed to different versions of the Animated Pedagogical Agent (APA) in the Computer-Assisted Language Learning (CALL) system.	The controlled experimental design ensures a systematic and rigorous examination of the impact of different Animated Pedagogical Agent (APA) features on learning outcomes, providing a clear understanding of causal relationships within the defined context.	The study's context-specific focus on English language learning raises concerns about the generalizability of findings to other subjects or educational domains, potentially limiting the broader applicability of the observed effects.
15	LogCF: Deep Collaborat	Fu Chen, Ying Cui	2020	These diverse models, ranging from machine	LogCF provides a robust framework for	The model's effectiveness is limited to learners



	ive Filtering with Process Data for Enhanced Learning Outcome Modeling			learning approaches like LogCF and NeuralCF to statistical models like AFM and its dynamic counterpart dAFM, along with neural network-based methods like DKT, Rasch Models, and 2PL/3PL IRT models, offer a rich array of techniques for predicting learner success by leveraging various aspects of user-item interactions and latent abilities in educational contexts.	modeling and predicting learners' learning outcomes, offering valuable insights into their performance and progress in diverse educational settings.	and items present in the training data, posing challenges for new learners and items, thus impacting its applicability in scenarios with evolving educational content or user populations.
16	Evaluation of an Extendable Context-Aware "Learning Java" App with Personalized User Profiling	Jane Yin-Kim Yau,Zornitsa Hristova	2017	Utilizing a mixed-methods approach, the study employed a survey questionnaire to gather feedback from 40 volunteers using the "Learning Java" app, complemented by user profiling incorporating context-awareness factors, a personalized suggestion mechanism, and statistical analysis of feedback percentages to comprehensively evaluate the app's effectiveness.	The app's ability to enhance motivation for some users signifies its potential to positively impact engagement and overall learning experiences.	The relatively low response rate (25%) in the survey introduces a potential limitation, raising concerns about the generalizability of the findings to the entire user population and highlighting a need for broader participation.
17	Implicit Heterogeneous Features	Haiqin Yang, Lap Pong Cheung	2017	The study leverages tree-based classifiers such as CART,	The utilization of tree-based classifiers for pre-processing	The method's limitation in fully leveraging the importance of

	Embedding in Deep Knowledge Tracing			random forest, and gradient-boosting decision trees for pre-processing, coupled with the implementation of a Deep Knowledge Tracing (DKT) model to effectively model students' knowledge and learning behaviors over time.	enhances the effectiveness of handling diverse features, facilitating accurate predictions of students' performance on specific exercises.	features poses a challenge, potentially hindering the system's ability to capture and incorporate crucial information for optimal predictive modeling.
18	Enhancing e-learning effectiveness using an intelligent agent-supported personalized virtual learning environment: An empirical investigation	Dongming Xu, Wayne W. Huang, Huaiqing Wang, Jon Heales	2014	By employing intelligent agents to simulate instructors and aligning with the constructivist learning model, Personalized Virtual Learning Environments (PVLEs) prioritize individualized learning experiences, fostering learner engagement through features like Content Management, Self-Evaluation Management, and Adaptive Instant Interaction.	The adoption of the constructivist learning model in PVLEs promotes active learner participation, fostering a deeper understanding of the content and aligning with modern pedagogical approaches.	The study's lack of a thorough exploration into various dimensions of learning personalization and its impact on e-learning effectiveness restricts the depth of insights into the broader implications of personalized virtual learning environments.
19	A personalized recommendation system with a combinational algorithm for online learning	Jun Xiao, Minjuan Wang, Bingqian Jiang, Junli Li	2017	The system employs a hybrid approach, combining association rules for discovering patterns in learners' preferences, content filtering to assess resource relevance based on content features, and collaborative filtering to	The personalized recommendation system fosters learning autonomy by empowering learners to explore and select resources aligned with their individual goals and prior knowledge,	The use of user data for personalized recommendations raises concerns about data privacy and security, potentially impacting learner trust and willingness to engage with the system.

				recommend resources based on user behavior and preferences, ensuring a comprehensive and personalized learning experience.	promoting a self-directed and personalized learning experience.	
20	Leveraging Skill Hierarchy for Multi-Level Modeling with Elo Rating System	Michael Yudelson, Yigal Rosen, Steve Jimmy	2019	This study innovatively introduces a multi-level modeling approach, accounting for hierarchical relations within the skill taxonomy, to predict student performance, and compares its efficacy with a regular Elo model using performance metrics such as accuracy and root mean square error (RMSE).	The multi-level modeling approach, with its consideration of hierarchical skill relations, provides the advantage of offering tailored predictions based on specific skills and their interrelations, potentially enhancing the precision of predicting individual student performance.	The implementation of a multi-level modeling approach introduces complexity, requiring sophisticated algorithms and structured data, which may pose challenges in terms of system development and resource allocation.

### III. PROBLEM DEFINITION

In the realm of career placement and development, traditional educational systems often fall short in preparing students due to varying skill levels, diverse learning preferences, and the evolving nature of industry requirements. The demand for personalized learning is increasingly evident as students aim to bridge the gap between general education and the specific, practical preparation needed for successful job placement. This project endeavors to address these

challenges by developing a personalized e-learning system, integrating intelligent systems and AI-driven technologies to offer tailored course recommendations based on individual performance and understanding. Furthermore, fostering interaction between students and college alumni is pivotal in providing networking opportunities and job prospects. This initiative aspires to create an innovative learning environment that optimizes engagement, relevance, and personalization, ultimately enhancing students' readiness for placement opportunities in a competitive job market.

## IV. PROBLEM IDENTIFICATION

The development of a personalized learning app for placement preparation, powered by intelligent systems, presents several key challenges.

**A. Personalization Challenges:** Effectively customizing content to match the unique needs of individual users, all while preventing overwhelming users with too much information.

**B. Content Recommendation and Adaptation:** Enhancing the accuracy and timeliness of content recommendations to keep pace with dynamic industry trends and changes.

**C. User Engagement and Motivation:** Finding strategies to maintain high levels of user engagement and motivation throughout the demanding process of placement preparation.

**D. Alumni Interaction and Networking:** Developing methods to encourage meaningful interactions between users and alumni while also prioritizing security and privacy.

**E. College Information Feed:** Ensuring that the information provided through the college feed is up-to-date and highly relevant to users' career goals, helping them make informed decisions.

**F. Intelligent Systems in Education:** Leveraging the full potential of artificial intelligence while addressing ethical concerns and ensuring transparency in algorithmic decision-making.

**G. User Data Privacy and Security:** Guaranteeing the highest standards of user data privacy and security to protect user trust, while also taking measures to mitigate data breaches and misuse.

**H. Crucial for College Students:** Recognizing the immense significance of such an app for college students, who can use it as a vital tool in their transition from education to the professional world, gaining a competitive edge in the job market and advancing their career development and success.

## V. RESEARCH METHODOLOGY

**A. Data Collection:** Data will be collected from various sources, including academic papers, reports, and online resources, to gather information related to the integration of intelligent systems in e-learning, the impact of alumni networking on career development, and the obstacles confronted by traditional educational systems in placement preparation.

**B. Survey Design:** A structured survey will be developed to obtain primary data from students, educators, and professionals. The survey will encompass questions about the effectiveness of personalized e-learning, the role of alumni interaction, and the challenges associated with traditional education.

**C. Data Analysis:** The collected survey data will undergo a quantitative analysis using statistical techniques to reveal trends, preferences, and respondent attitudes. This analysis will provide insights into the perceived effectiveness of personalized e-learning and the significance of alumni interaction.

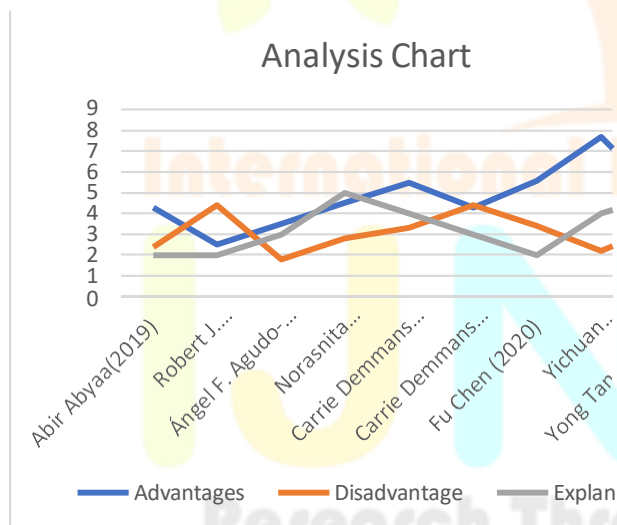
**D. Case Studies:** A selection of case studies from institutions and organizations that have implemented personalized e-learning and alumni interaction will be examined. These case studies will provide practical insights into successful implementations and encountered challenges.

**E. Ethical Considerations:** The research will adhere to ethical guidelines regarding data collection and analysis, ensuring data privacy and security are maintained throughout the process.

**F. Recommendations and Conclusion:** Based on the survey results, data analysis, and case studies, the paper will present recommendations for the development of personalized e-learning systems and the integration of alumni interaction. The conclusion will summarize key findings and propose future research directions.

**G. Peer Review:** The survey paper will undergo a peer review process, involving experts in the field, to validate and refine the research findings. Feedback from peer reviewers will be incorporated as needed to enhance the quality and credibility of the research

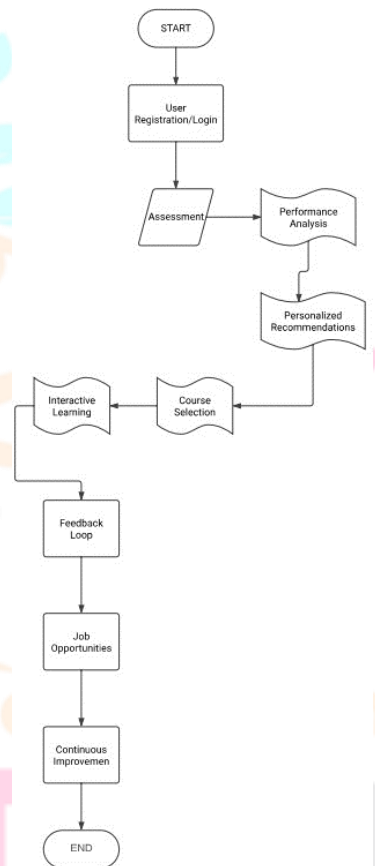
## VI. ANALYSIS



The reliance on content-based course suggestions indicates a lack of personalized learning pathways tailored to individual users. Without considering diverse learning needs and abilities, the system misses the opportunity to provide a more customized and effective learning experience.

The current approach's provision of the same content to all learners, irrespective of their comprehension levels and preferred learning modes, reflects a one-size-fits-all model. This can result in suboptimal learning experiences, as the content may not align with each learner's unique requirements and abilities.

## VII. FLOWCHART



## VIII. CONCLUSION & FUTURE ENHANCEMENT

To overcome the issues of the existing system several enhancements are listed below

- The future project introduces an advanced system for enhancing the educational experience, particularly in the context of placement testing, personalized content delivery,

internship recommendations, centralized announcements, and alumni interactions.

- Leveraging Long Short-Term Memory (LSTM) technology, the system offers adaptive placement testing by tailoring the difficulty levels of quantitative and programming tests to match each student's unique abilities.
- It provides personalized content recommendations based on individual test performance, focusing on areas of weakness.
- Additionally, the project enhances the internship suggestion process by incorporating LSTM to recommend opportunities that align with students' skills and preferences.
- The system also features an announcement platform with LSTM integration, ensuring context-aware and personalized college-wide announcements and informational sharing. Lastly, it utilizes LSTM for connecting students with alumni, offering tailored career guidance and mentorship.
- The future project aims to provide a more personalized and effective educational experience for students.

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