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VidyarthiVerse: Bridging Academic Gaps through AI-Augmented Collaboration and Predictive Career Insights - Empowering Students with Productivity Tools

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Abstract: *In the modern academic landscape, students often struggle to navigate fragmented learning tools, inconsistent collaboration platforms, and a lack of real-time academic support. To address these challenges, we propose VidyarthiVerse — a unified, AI-driven learning and collaboration ecosystem designed to empower students holistically. This platform integrates intelligent academic assistance through conversational AI, dynamic peer collaboration features, personalized skill tracking, and machine learning-based career path prediction. Moreover, it embeds gamified productivity tools such as the Pomodoro timer, Eisenhower matrix, and focus tree to encourage effective task management. Built using modern web technologies and trained on real-world educational datasets, VidyarthiVerse bridges the gap between academic needs and scalable, smart support systems. This paper presents the system architecture, core functionalities, machine learning methodology, implementation details, and outcomes from student interactions on the platform. The proposed system demonstrates how technology can be leveraged to enhance student productivity, engagement, and career clarity in an increasingly digital education environment.*

Keywords: AI in Education, Student Collaboration, Career Path Prediction, EdTech, Skill Tracking, Productivity Tools

I. INTRODUCTION

The rapid transformation in the educational ecosystem, particularly in the post-pandemic era, has highlighted the limitations of traditional learning models and the growing need for intelligent, student-centric platforms. As learners increasingly engage with digital environments, challenges such as fragmented academic support, poor collaboration mechanisms, lack of personalized guidance, and ineffective time management tools continue to persist. While various EdTech solutions offer modular functionalities — like course delivery, coding practice, or content sharing — very few platforms are designed to provide an integrated, seamless, and dynamic academic ecosystem dedicated to holistic student development. To bridge this critical gap, we introduce VidyarthiVerse: a unified learning and collaboration platform augmented by Artificial Intelligence and Machine Learning technologies. It is specifically designed to empower students across domains by combining intelligent study assistance, real-time peer collaboration, resource sharing, productivity enhancement tools, and career-oriented insights into a single digital ecosystem. Unlike conventional platforms that cater to isolated needs, VidyarthiVerse functions as a complete academic workspace that supports students throughout their educational journey — from daily learning tasks to long-term career planning. This research paper presents the conception, development, and implementation of VidyarthiVerse in detail. It outlines the architectural design of the system, explains the methodology adopted for feature integration, and discusses the use of machine learning models for predicting suitable career paths based on student profiles. Furthermore, it highlights how the platform employs AI-driven components, such as the conversational assistant VidyaMitr, to deliver contextual academic guidance and boost user engagement. The inclusion of gamified productivity tools and collaborative modules also reflects the platform's aim to improve focus, peer learning, and task efficiency.

Through this study, we aim to demonstrate how VidyarthiVerse effectively addresses existing shortcomings in educational technology and proposes a scalable, student-first solution that is adaptable, interactive, and intelligent. The paper further evaluates the system's performance, student usability feedback, and discusses the future scope of enhancement, making it a significant contribution to the field of AI-enhanced education platforms.

II. LITERATURE SURVEY

The integration of Artificial Intelligence (AI) into educational systems has significantly evolved over the past decade, redefining the landscape of teaching, learning, and student engagement. Various studies emphasize that AI-powered tools such as intelligent tutoring systems, adaptive learning platforms, and conversational agents have shown remarkable improvements in providing personalized learning experiences, automating routine academic tasks, and increasing overall student motivation. However, despite these advancements, most existing platforms remain limited in scope — targeting either content delivery, course completion, or specific technical upskilling — without offering a unified, holistic academic environment.

Lijia Chen et al. [1] highlight how AI has progressed from rule-based systems to sophisticated tutoring platforms capable of analyzing student performance and adapting content delivery accordingly. Their findings suggest that intelligent systems significantly reduce instructor workload and enhance academic personalization. Boštjan Šumak and colleagues [2] reinforce this by demonstrating that adaptive dashboards and learning analytics tools promote inclusivity, especially among differently-abled or underrepresented students. These systems, however, often operate in isolation and lack collaborative components.

Emerging platforms have also experimented with socially interactive technologies. Nuraini Jamil et al. [3] explored the role of ChatGPT and social robots in education, concluding that such tools improve student engagement and provide emotional support during self-learning. However, ethical challenges related to trust, bias, and data handling persist. Gabriela Dorfman Furman [4] takes this further by assessing the application of machine learning in engineering education for personalized assessments, yet notes that the lack of transparency and fairness in model predictions can affect trustworthiness and adoption.

Pedro Francesc and team [5] examined AI-driven education systems in developing nations, emphasizing how tools like Education Management Information Systems (EMIS) and AI tutors helped bridge the digital divide. Nevertheless, scalability, infrastructure, and student-centricity continue to be concerns. Moreover, studies like those of VanLehn [6] and Dillenbourg [8] underline the importance of collaborative learning platforms but reveal a scarcity of AI- augmented environments that support real-time teamwork and discussion forums tailored to students' academic contexts.

These gaps illustrate the need for an educational platform that not only enables students to learn independently but also empowers them to collaborate, stay focused, track progress, and receive context-aware support. This is where VidyarthiVerse positions itself — as a unified, AI- powered learning ecosystem that bridges multiple academic gaps. By combining collaboration features, an intelligent chatbot, machine learning-driven career guidance, and embedded productivity tools, VidyarthiVerse represents the next generation of EdTech — one that is modular, intelligent, and student-first.

III. PROBLEM STATEMENT

The educational technology landscape currently lacks a unified platform that comprehensively addresses the diverse academic, collaborative, and career guidance needs of students. Most existing systems are fragmented, offering content delivery, doubt resolution, or skill-building tools in isolation.

This separation limits students' ability to manage their learning holistically, collaborate effectively with peers, and prepare for their careers in a structured and seamless manner. To overcome these challenges, VidyarthiVerse was developed as an all-in-one, AI- powered platform that integrates academic support, peer collaboration, productivity enhancement, and career prediction features within a single cohesive ecosystem.

The primary objectives of VidyarthiVerse include creating a unified digital space where students can collaborate, track their skills, and share academic resources efficiently. The platform integrates an AI assistant powered by the Gemini API to provide real-time academic support. It fosters dynamic peer groups and interactive forums that encourage doubt-solving and teamwork. Additionally, a machine learning-based career prediction system was implemented to guide students toward suitable career paths. Productivity tools such as Pomodoro timers and task matrices are included to support effective time management. The platform also ensures secure user authentication and employs a modular, scalable backend architecture. All these objectives were successfully realized through the development and deployment of the VidyarthiVerse platform.

IV. PROPOSED METHODOLOGY

The VidyarthiVerse platform is developed following an iterative, modular, and student-centric methodology aimed at delivering scalable, adaptable, and personalized educational solutions. This methodology integrates best practices from software engineering, artificial intelligence, and educational psychology to create a robust and user-friendly system tailored to the needs of diverse learners. The platform employs a modular architecture where each feature, such as peer collaboration, AI-powered study assistance, and career forecasting, is designed as an independent, self-contained module. This approach promotes flexibility, simplifies maintenance, and allows focused enhancement of individual components, all while keeping the student experience at the centre of the design.

Development follows the Agile software development lifecycle, organized into short, incremental sprints. Each sprint delivers a minimum viable version of a feature, which is continuously refined based on student feedback. This iterative process ensures the platform remains adaptive to evolving user requirements and technological advancements.

User experience design is driven by comprehensive research focused on creating intuitive, accessible, and engaging interfaces. The platform minimizes technical barriers and maximizes ease of use across features such as the skill tracker and AI-powered tools, making it approachable for students from diverse backgrounds.

To ensure scalability and maintainability, VidyarthiVerse applies Component-Based Software Engineering (CBSE) principles. Core components like Authentication, Study Assistant, Forums, Career Predictor, and Resource Sharing are developed independently and integrated progressively, resulting in a fault-tolerant and modular system.

Communication between the frontend and backend is managed through RESTful APIs, providing a standardized and efficient interface. This architecture enables seamless data exchange, supports mobile and third-party integrations, and simplifies future platform expansions. A key feature of VidyarthiVerse is its machine learning-powered career prediction module. Utilizing algorithms such as XGBoost and Random Forest, this module analyzes student profiles—including skills, academic performance, and interests—to generate personalized career recommendations. It guides users toward learning paths that align with their potential career opportunities, empowering informed decision-making.

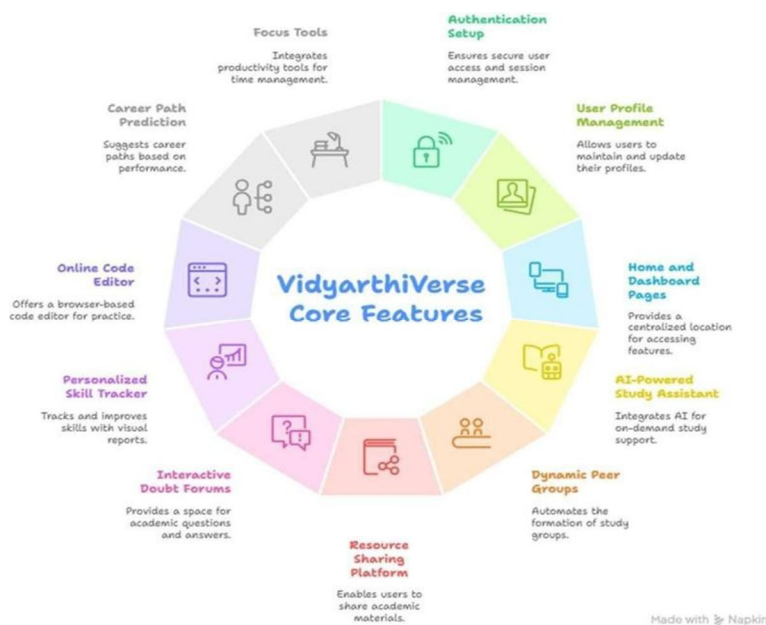


FIG 01: CORE FEATURES

V. IMPLEMENTATION

The VidyarthiVerse platform is constructed using a robust three-tier architecture comprising the frontend, backend, and database layers. The frontend is developed using standard web technologies, including HTML, CSS, and JavaScript, providing a responsive and mobile-friendly user interface. This interface encompasses various components such as dashboards for skill tracking, interactive discussion forums, embedded code editors, and productivity tools, all designed to offer seamless real-time interactivity and optimal load performance.

The backend logic is implemented with Node.js and Express.js, facilitating secure API routing, data management, and user authentication. Security is a key focus here; user passwords are encrypted using bcrypt.js, and session management is handled via JWT tokens to enforce secure login sessions and role-based access control. The database layer employs MongoDB, a flexible NoSQL database chosen for its scalability and efficient data handling. Mongoose is used as the Object Data Modelling library, ensuring structured schema definitions, validation, and smooth CRUD operations for storing diverse data, including user profiles, forum posts, messages, skills, and shared resources.

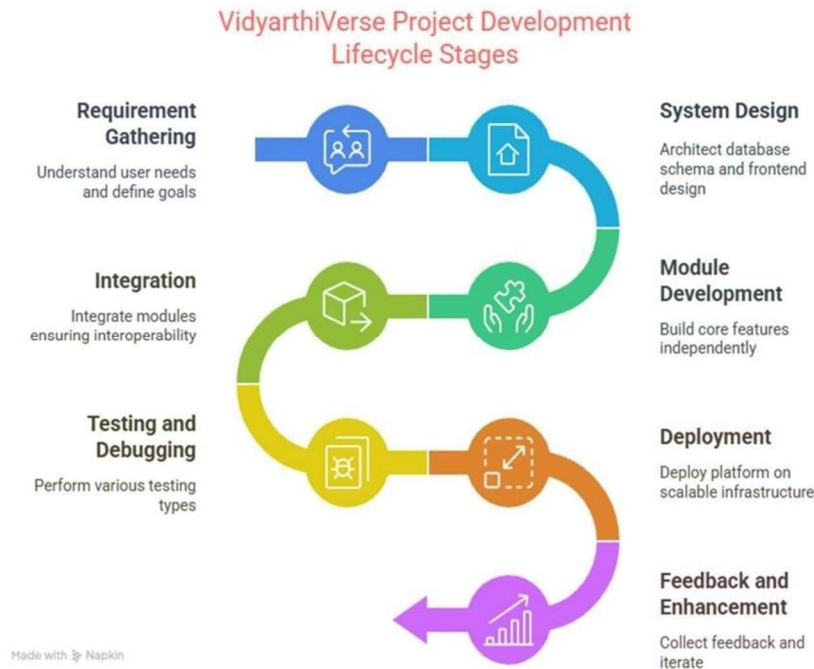


FIG 02: DEVELOPMENT LIFECYCLE

To develop the Career Path Recommendation system within VidyarthiVerse, a merged dataset was created by combining two publicly available sources: a student technical profiles dataset from GitHub and the “Career Recommendation Dataset” from Kaggle. This combined dataset, named merged_career_data.csv, enhances data diversity and feature richness, resulting in a robust foundation for model training. It contains 9,179 records with 37 features, where the target variable is the Career Role, representing the recommended career path. The dataset includes a balanced mix of quantitative metrics such as logical quotient ratings, coding skill levels, and hackathon participation, alongside qualitative attributes like interests, preferred reading materials, and technical exposure.

Logical qu	hackathon coding skill	public spee	self-learn	Extra-cour	certificati	workshop	reading an	memory c	Interested	interested	Type of co	Taken incl	Interested	Managem	hard/smar	worked in	Introvert	Database I	Computer	Distribut	Cyber Secu	
5	0	6	2	yes	no	informatic	testing	poor	poor	programm	testing	BPA	no	Series	Managem	smart wor	yes	no	Profession	Not Intere	Not Intere	Not Intere
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2	6	3	5	no	yes	r program	database s	excellent	poor	networks	testing	Testing an	yes	Guide	Managem	smart wor	yes	yes	Profession	Average	Not Intere	Not Intere
2	0	3	4	yes	no	distro mak	game deve	excellent	medium	Software I	system de	BPA	no	Health	Technical	hard work	yes	no	Profession	Intermedi	Not Intere	Not Intere
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9	1	9	1	yes	yes	machine le	system de	medium	excellent	cloud com	testing	Cloud Serv	no	Anthology	Technical	smart wor	no	yes	Profession	Not Intere	Poor	Poor
9	0	6	1	no	no	machine le	hacking	medium	poor	parallel co	developer	BPA	no	Dictionar	Technical	smart wor	no	no	Profession	Poor	Poor	Poor
1	1	1	4	yes	yes	full stack	game deve	excellent	excellent	programm	Business p	SaaS serv	yes	Prayer boc	Technical	smart wor	yes	yes	Profession	Beginner	Poor	Poor
6	5	4	2	no	yes	machine le	cloud com	excellent	poor	networks	system de	SaaS serv	no	Art	Managem	hard work	yes	yes	Profession	Average	Poor	Poor
6	0	8	9	no	yes	full stack	data scien	poor	medium	IOT	developer	Web Serv	yes	Journals	Managem	hard work	no	no	Profession	Intermedi	Poor	Poor
9	6	3	7	yes	no	informatic	web techn	poor	medium	parallel co	Business p	Finance	no	Encyclope	Managem	smart wor	yes	no	Profession	Excellent	Poor	Poor
4	4	6	5	no	yes	hadoop	hacking	excellent	medium	networks	Business p	Sales and I	no	Religion-S	Managem	smart wor	yes	no	Profession	Not Intere	Beginner	Beginner
8	0	9	6	yes	yes	shell progr	cloud com	poor	poor	Computer	security	Sales and I	no	Action and	Managem	smart wor	no	no	Profession	Poor	Beginner	Beginner
1	0	3	4	no	yes	hadoop	cloud com	medium	medium	Software I	cloud com	Product bi	no	Comics	Managem	hard work	yes	no	Profession	Beginner	Beginner	Beginner
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6	2	3	9	no	yes	informatic	game deve	excellent	excellent	hacking	testing	Testing an	yes	Dictionar	Managem	hard work	no	yes	Profession	Excellent	Beginner	Beginner
2	0	8	7	no	no	informatic	database s	excellent	poor	data engin	cloud com	Product bi	no	Health	Technical	smart wor	no	yes	Profession	Not Intere	Average	Average

FIG 03: DATASET SNAPSHOT

Additional features capture learning behaviors (e.g., self-learning capability, certifications), technical proficiencies across domains like AI, data science, and cybersecurity, as well as personality traits and soft skills such as teamwork experience and communication ability. The Career Role target encompasses 12 distinct categories, including Software Engineer, Data Science Engineer, Web Developer, Network Security Engineer, UX Designer, Systems Security Administrator, and Mobile Applications Developer, among others.

A key innovation within VidyarthiVerse is the integration of an AI-powered assistant named Vidyamitr, which utilizes Google's Gemini API to enable natural language understanding and speech-to-text capabilities. This AI assistant offers real-time study support by responding to user queries, suggesting relevant academic resources, and providing motivational prompts through both text and speech, enhancing engagement and personalized learning. To facilitate collaborative learning, the platform incorporates a peer group feature where users can create or join study groups using unique room codes. Real-time messaging within these groups is enabled through Socket.io, supporting synchronous discussions, file sharing, and cooperative academic work, fostering an active learning community. Complementing this is a resource-sharing system that allows users to upload and download study materials such as notes and guides. These files are managed with secure metadata and benefit from a community-driven upvote/downvote mechanism that helps surface the most valuable content to the wider user base.

The platform also features an interactive doubt forum where students can post academic questions and receive peer answers and comments. This system promotes collaborative problem-solving and peer mentoring, with all interactions governed by user verification and vote limitations to maintain content quality and relevance. For personalized learning tracking, VidyarthiVerse offers a skill tracker that allows users to add new skills, set proficiency levels, and visualize progress over time through dynamic charts on their dashboard. This functionality supports student self-assessment and encourages continuous growth. Another valuable component is the integrated online code editor, which supports HTML, CSS, and JavaScript programming directly within the browser. The editor renders live outputs via iframes and includes features such as code downloading and resetting, while built-in security measures prevent the execution of unsafe scripts, ensuring a safe coding environment.

To enhance time management and productivity, VidyarthiVerse incorporates several tools, including a Pomodoro Timer, Eisenhower Matrix, and Tree Timer. These are implemented using JavaScript and store session data either locally or in MongoDB, allowing students to track and reflect on their productivity patterns over time. Finally, a machine learning-based career prediction module is integrated into the platform to guide students in making informed decisions about their futures. This module is built using Python, Flask, and Scikit-learn and trained on a merged dataset to classify and predict suitable career paths based on students' skills, academic scores, and interests. The model is connected to the main platform via RESTful APIs, enabling real-time delivery of personalized career recommendations along with the associated skill sets required, thereby empowering students with actionable insights to plan their educational and professional journeys.

VI. RESULTS

The VidyarthiVerse platform has been successfully developed and deployed as a fully functional prototype that effectively integrates multiple facets of student support into a single cohesive system. This includes personalized academic assistance, intelligent peer collaboration features, productivity enhancement tools, and AI-driven career guidance. A comprehensive evaluation of the platform was carried out through rigorous feature-level functionality testing, ensuring that all modules operate reliably and as intended. Usability assessments were conducted to measure the platform's accessibility, user-friendliness, and engagement, particularly focusing on the diversity of the student user base. In addition, user feedback sessions involving a representative sample of students provided qualitative insights into the platform's real-world applicability and impact. The findings confirm that VidyarthiVerse is technically robust, with seamless integration between components and secure, efficient data handling. Moreover, the platform's design and features are pedagogically relevant, as evidenced by positive user reception and improved user engagement with academic content and career planning tools.

The Career Path Prediction Model was evaluated using an 80:20 train-test split and assessed with standard performance metrics, including accuracy, F1-score, and AUC score. Among the tested algorithms—Random Forest, Gradient Boosting, and XGBoost—the XGBoost model was selected for its superior performance, achieving a training accuracy of 93.2% and a test accuracy of 87.3%. It also attained an F1-score of 0.86 and an AUC score of 0.88, indicating strong predictive capability and balanced precision-recall performance. The model demonstrated a top-3 career recommendations accuracy of 92%, validating its effectiveness in generating relevant career suggestions for students. Additionally, the average response time for predictions was approximately 0.48 seconds, confirming the model's efficiency for real-time application within the platform.

Overall, the model successfully identified meaningful career directions by analyzing input vectors that included students' academic scores, interests, and technical skill levels, thereby providing personalized and actionable guidance to support informed career decision-making.

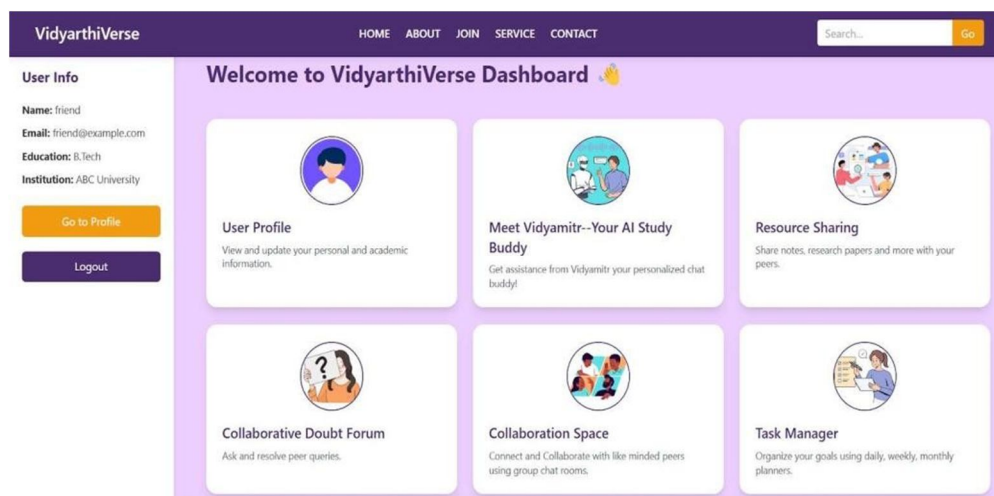


FIG 04: HOME PAGE SNAPSHOT

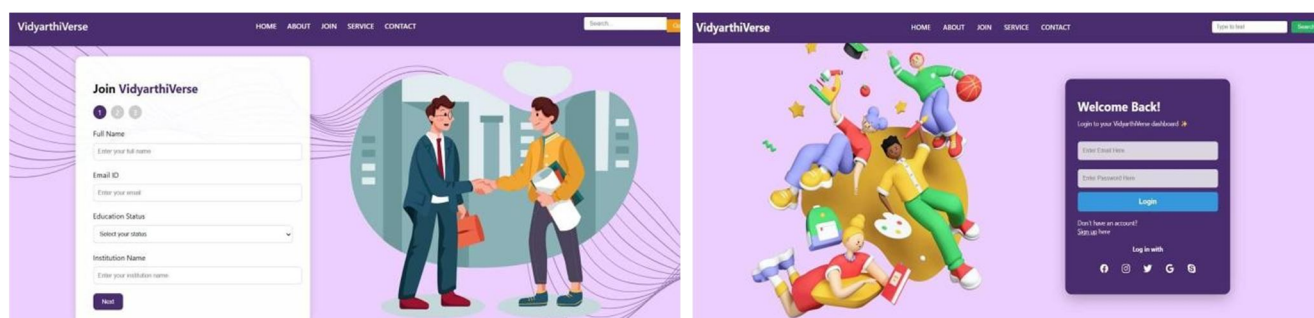


FIG 05: SIGN UP AND LOGIN PAGES

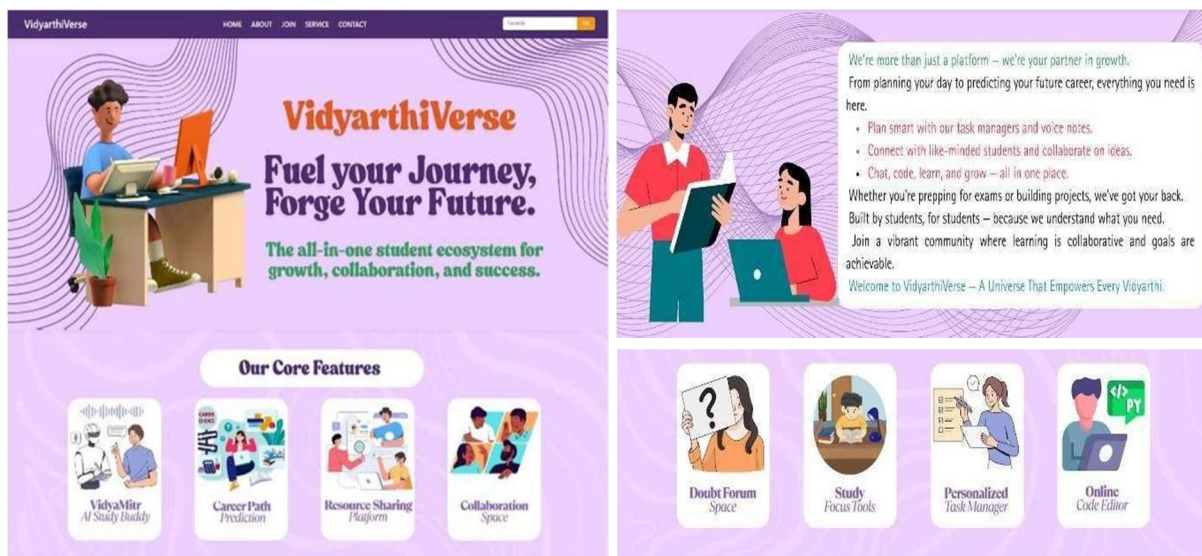


FIG 06: DASHBOARD SNAPSHOTS

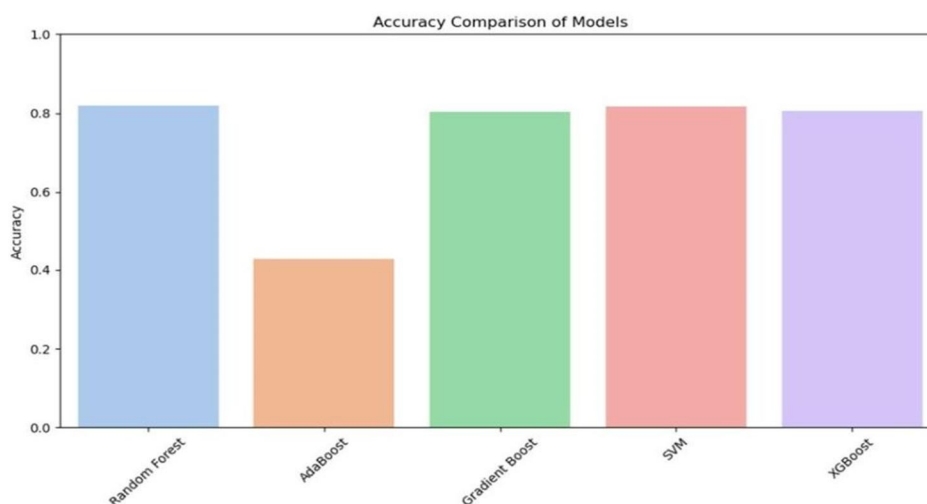


FIG 07: ACCURACY COMPARISON OF CAREER PATH PREDICTION MODELS

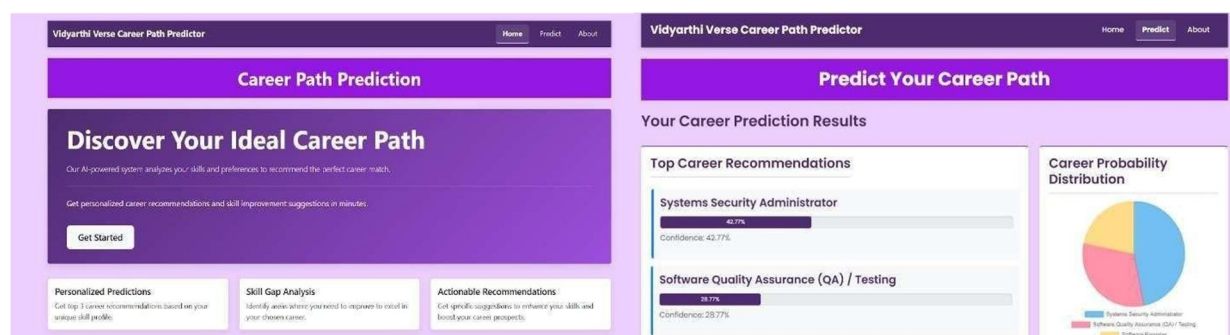


FIG 08: CAREER RECOMMENDATIONS PAGE

VII. FUTURE SCOPE

VidyarthiVerse holds tremendous potential for future growth and innovation as a student-centric digital ecosystem. Beyond the current core features of collaboration, learning support, and productivity tools, the platform can expand by integrating advanced AI-powered career counselling, real-time chat and video communication, and mobile applications to enhance accessibility. Additional enhancements such as gamified learning, internship marketplaces, mentorship networks, and LMS integration would further enrich the user experience and foster stronger connections between students, educators, and industry. Multilingual support and seamless third-party tool integrations can broaden VidyarthiVerse's reach and utility, making it a truly inclusive and versatile educational platform.

VIII. CONCLUSION

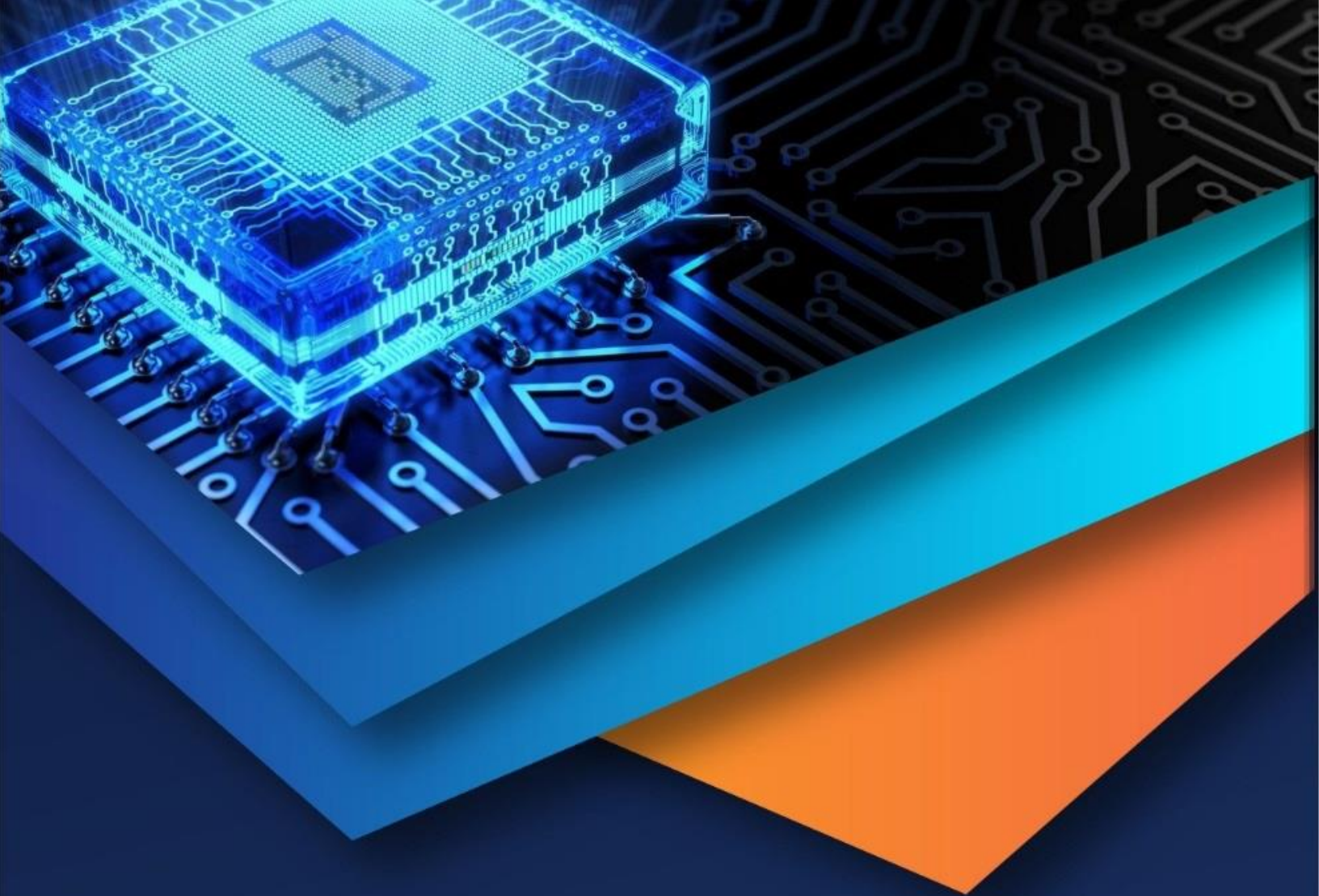
VidyarthiVerse represents a significant step forward in redefining digital education by offering an all-encompassing, intelligent platform tailored to the multifaceted needs of today's students. By seamlessly integrating personalized academic support, collaborative learning environments, productivity tools, and AI-driven career guidance, the platform not only enhances the learning experience but also prepares students for real-world challenges. Its scalable and modular architecture ensures adaptability to future advancements, while its user-centric design makes it accessible and engaging for diverse learners. Ultimately, VidyarthiVerse is more than just a technological solution — it is a transformative ecosystem that empowers every student to unlock their potential, fostering lifelong learning, meaningful connections, and career success in an ever-evolving academic landscape.

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