

AskNLearn - AI-Powered Educational Platform

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ABSTRACT

AskNLearn is an AI-powered educational platform designed to improve the learning and revision process through intelligent content generation, adaptive practice, and performance analytics. Traditional study methods often require students to use multiple disconnected tools for notes, quizzes, and progress tracking, resulting in reduced efficiency and fragmented learning experiences.

The proposed system provides a unified platform where users can upload or enter study material in multiple formats, including text, documents, images, audio, video, and URLs. The system processes the input using OCR, transcription, and AI-based content extraction techniques to generate structured learning resources such as summaries, flashcards, multiple-choice questions, and memory maps. The platform also includes subject-wise quiz practice, adaptive learning support, dashboard analytics, gamification features, and secure authentication mechanisms.

AskNLearn is developed using React.js, Node.js, Express.js, FastAPI, MySQL, and AI model APIs such as Gemini/OpenAI. The architecture follows a dual-backend approach, separating application services from AI-processing tasks to improve scalability, maintainability, and system performance.

The implementation demonstrates that integrating artificial intelligence with modern full-stack technologies can significantly improve revision efficiency, personalized learning, and student engagement. The proposed platform reduces the manual effort involved in study preparation while encouraging continuous learning through personalized practice, analytics-driven feedback, and interactive educational tools.

Overall, the system demonstrates the practical application of artificial intelligence in enhancing digital education and building intelligent learning environments suitable for modern students and educational institutions.

Keywords: AskNLearn, Artificial Intelligence, Adaptive Learning, Educational Platform, Quiz Analytics, FastAPI, AI-Based Learning, Smart Education.

1 INTRODUCTION

Education is increasingly shifting toward digital and intelligent learning environments. Traditional study methods often require students to manually prepare notes, summaries, and practice questions using multiple disconnected tools. This process is time-consuming, inefficient, and difficult to manage consistently. Students also face challenges in tracking learning progress, identifying weak topics, and organizing study resources effectively.

Recent advancements in Artificial Intelligence, web technologies, cloud computing, and educational analytics have created opportunities to improve digital learning systems. AI-powered educational platforms can automatically generate summaries, quizzes, flashcards, and other learning resources from raw study material. Modern technologies such as OCR and speech transcription further allow systems to process images, scanned documents, audio lectures,

and video content.

AskNLearn is an AI-powered educational platform developed to improve learning, revision, and performance tracking through intelligent automation and adaptive learning techniques. The platform allows users to upload study material in multiple formats including text, PDF documents, images, audio, video, and URLs. The system processes the content using OCR, transcription, and AI-based Natural Language Processing techniques to generate structured learning resources such as summaries, flashcards, multiple-choice questions, and memory maps.

The platform is implemented using React.js, Node.js, Express.js, FastAPI, MySQL, and AI model APIs such as Gemini/OpenAI. The system follows a dual-backend architecture where application services and AI-processing services are handled separately for improved scalability and maintainability.

AskNLearn also includes adaptive quizzes, dashboard analytics, gamification features, secure authentication, and community learning support. These features help students practice effectively, monitor progress, identify weak topics, and maintain continuous learning habits.

The objective of this research paper is to present the design, implementation, and evaluation of AskNLearn as an intelligent educational platform that combines Artificial Intelligence, adaptive learning, analytics, and modern full-stack technologies to improve digital learning experiences.

Figure 1: Smart Learning Workflow

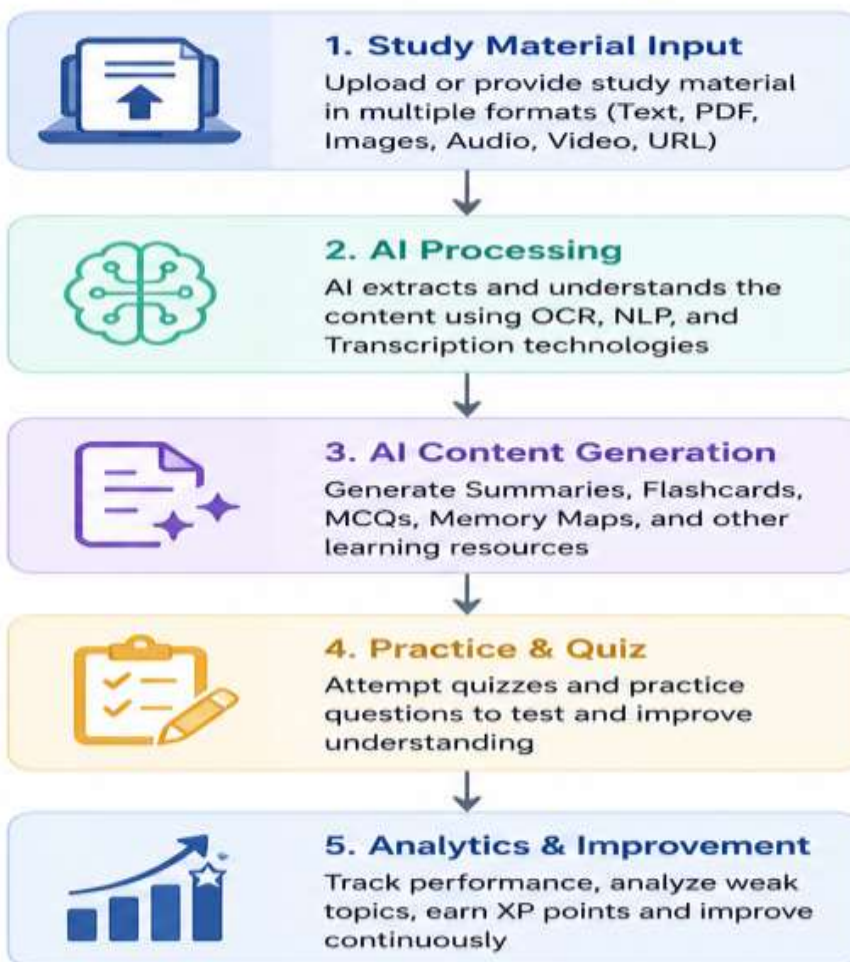


Figure 1: Smart Learning Workflow

1.1 Motivation

In The motivation behind AskNLearn comes from the growing challenges faced by students in managing study material, revision, and performance tracking using multiple disconnected platforms. Many students spend significant time creating notes, preparing practice questions, organizing revision schedules, and searching for learning resources instead of focusing on actual learning. Existing educational platforms often provide only limited functionality, such as static notes or basic quizzes, without offering personalized learning support or intelligent analytics.

With the advancement of Artificial Intelligence and adaptive learning technologies, there is an opportunity to build systems that can automate content generation, provide targeted practice, and help students identify weak areas more effectively. Modern learners require platforms that are interactive, accessible, and capable of supporting continuous learning across multiple devices and content formats.

The increasing use of AI models, cloud technologies, OCR systems, and real-time analytics inspired the development of AskNLearn as a unified educational platform. The project aims to simplify the learning workflow by integrating study material generation, quiz practice, analytics, gamification, and secure user management into a single system. The motivation is to create a smart and scalable platform that improves revision efficiency, learning consistency, and student engagement.

1.2 Contribution

The following are the major contributions of this project and research work:

- To design and develop an AI-powered educational platform that integrates study material generation, quiz practice, analytics, and performance tracking into a single unified system.
- To provide support for multiple study input formats, including text, PDF documents, Word files, PowerPoint presentations, images, audio, video, and URL-based content.
- To implement AI-based content generation capable of producing summaries, flashcards, multiple-choice questions (MCQs), fill-in-the-blanks, true/false questions, yes/no questions, WH questions, and memory maps.
- To develop a multimodal content extraction pipeline using OCR, document parsing, and transcription technologies for processing different types of educational content.
- To implement an adaptive quiz and practice system that analyzes user performance and focuses on weaker topics for personalized learning improvement.
- To provide detailed dashboard analytics including scores, topic-wise performance, XP points, streak tracking, heatmaps, and leaderboard rankings for continuous progress monitoring.
- To implement secure authentication and account management features using JWT-based authentication, bcrypt password hashing, OTP-based password recovery, and role-based access control mechanisms.
- To develop a dual-backend architecture using Node.js and FastAPI, separating core application services from AI-processing tasks for improved scalability and maintainability.
- To integrate real-time communication features using Socket.IO for collaborative learning and community-based interaction.
- To design a responsive and user-friendly interface that supports both desktop and mobile accessibility for better learning convenience.
- To ensure reliable data storage and synchronization using MySQL database integration for user data, quiz history, AI-generated content, and analytics records.
- To analyze the implementation, performance, usability, challenges, and future opportunities of AI-powered adaptive learning systems using modern full-stack technologies.

2 Literature Survey

The field of AI-powered educational technology has gained significant attention due to the increasing demand for intelligent, personalized, and efficient learning systems. Traditional learning methods often require manual preparation of notes, quizzes, and revision material using multiple disconnected platforms, resulting in fragmented workflows and reduced learning efficiency.

Researchers have explored AI-based educational systems capable of generating summaries, quizzes, flashcards, and personalized learning resources automatically using Natural Language Processing (NLP), OCR, speech transcription, and adaptive learning techniques. Modern platforms also integrate dashboard analytics, gamification, and real-time learning support to improve engagement and performance tracking.

Cloud computing and modern web technologies further improve accessibility, scalability, and collaborative learning. However, many existing systems still suffer from limited personalization, weak analytics, poor integration between modules, and dependency on manual workflows.

Therefore, there is a growing need for intelligent and integrated educational platforms such as AskNLearn that combine AI-powered content generation, adaptive learning, analytics, secure authentication, and collaborative learning within a unified system.

2.1 AI-Powered Educational Platforms Based on Different Technologies

2.1.1 Web-Based AI Learning Systems

Traditional learning systems often require students to use separate tools for notes, quizzes, and revision. Web-based AI learning systems combine these features into a centralized digital platform using Artificial Intelligence, cloud technologies, and adaptive learning support.

A) Related Work

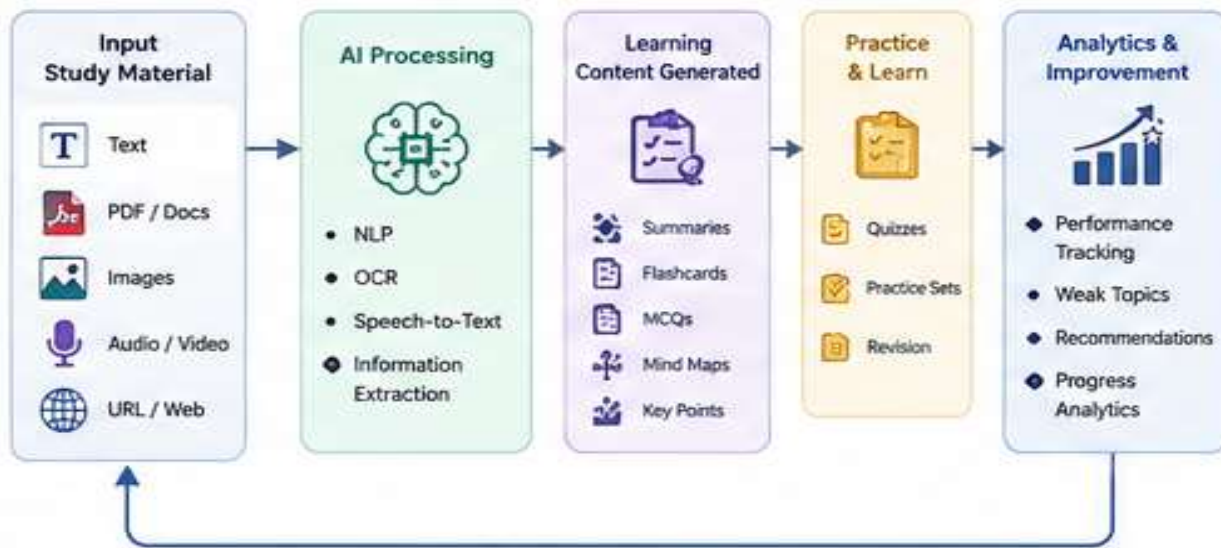
Several Research shows that AI-powered educational systems help:

- Reduce study preparation time, Improve revision efficiency, Support adaptive learning, & Provide analytics-driven feedback

Many systems also integrate:

- OCR processing, AI-generated summaries, MCQ generation, & Dashboard analytics

Figure 2.1.1 AI Learning Workflow



B) Methodology

The workflow includes:

- User registration and login
- Study material upload
- AI processing and generation
- Quiz practice
- Dashboard analytics

C) Results

The results show that AI-powered educational systems improve learning efficiency, personalization, and engagement compared to traditional learning methods.

2.1.2 Adaptive Quiz and Personalized Learning Systems

Adaptive learning systems dynamically adjust quiz difficulty and recommendations based on user performance, weak topics, and learning behavior.

A) Related Work

Research shows adaptive quiz systems improve:

- Learning efficiency
- Topic retention
- Revision quality
- Student engagement

Gamification features such as streaks, badges, and leaderboards are also widely used.

2.1.2 Adaptive Quiz Flow



B) Methodology

The system workflow includes: Quiz attempt, Performance analysis, Weak-topic identification, Personalized recommendation, & Analytics generation.

C) Results

Adaptive systems provide personalized learning experiences and improve long-term learning outcomes through targeted practice and analytics support.

2.1.3 AI-Based Content Generation Systems

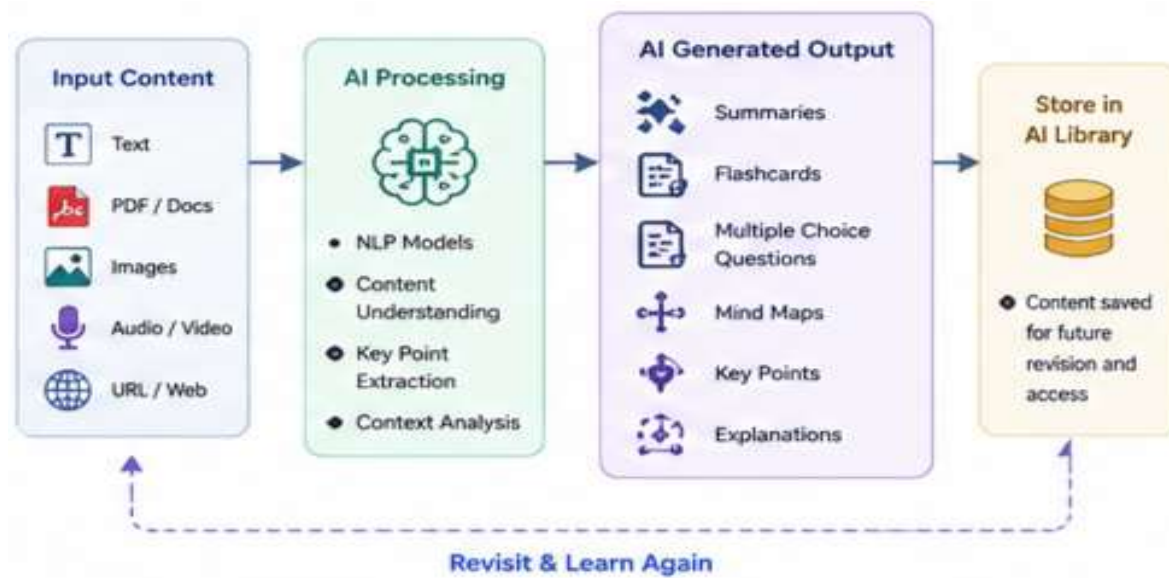
AI-based educational systems automatically generate structured learning resources from raw educational content using NLP and AI models

A) Related Work

Research shows AI-generated content helps:

- Reduce manual preparation effort
- Improve revision speed
- Increase accessibility
- Support personalized learning

Figure 2.1.3: AI-Based Content Generation Workflow



B) Methodology

The workflow includes:

- Content upload
- OCR and transcription processing
- AI analysis
- Summary and quiz generation
- Storage in user library

C) Results

The results show that AI generation systems improve learning flexibility and reduce study preparation time significantly.

2.1.4 OCR and Transcription Based Learning Systems

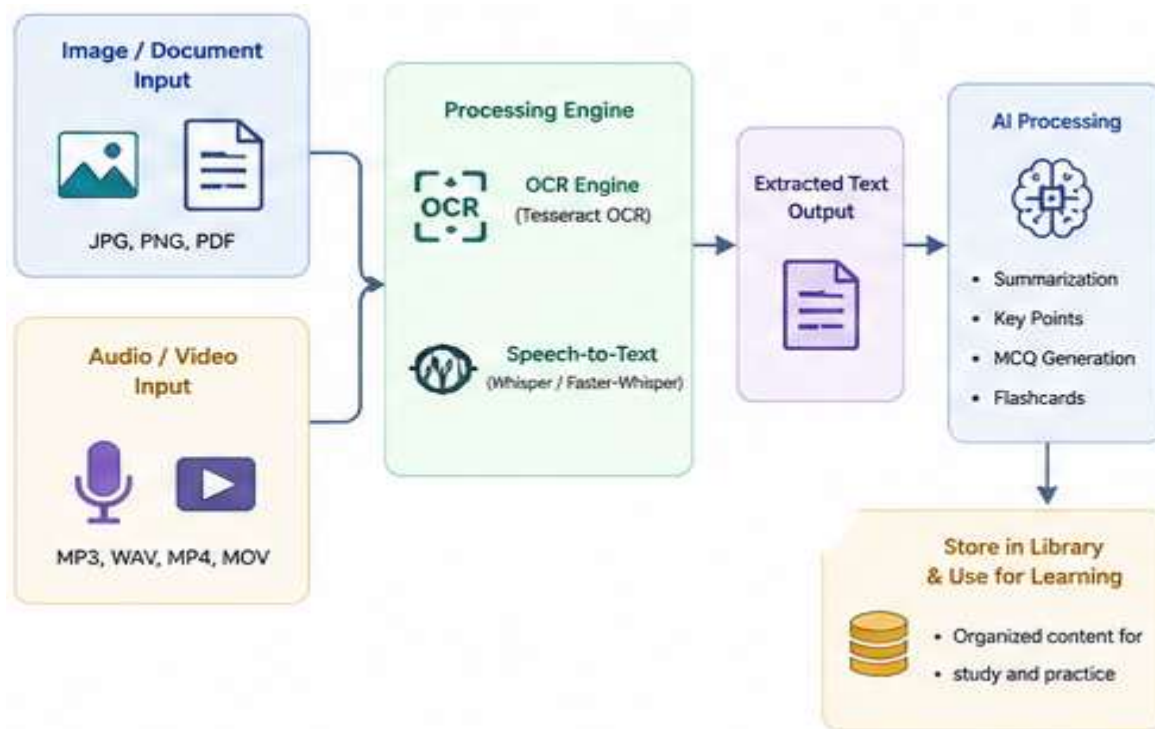
OCR and transcription systems allow educational platforms to process images, scanned documents, audio, and video-based learning content.

A) Related Work

Research shows OCR and transcription systems:

- Improve accessibility
- Support multimedia learning
- Reduce manual typing effort
- Enable faster content digitization

Figure 2.1.4: OCR + Transcription Pipeline



B) Methodology

The workflow includes:

- Content upload
- OCR processing
- Speech transcription
- AI preprocessing
- Learning content generation

C) Results

These systems improve multimodal learning and help students use multiple forms of educational content effectively.

2.1.5 Dashboard Analytics and Gamification Systems

Dashboard analytics and gamification systems improve learning engagement through performance tracking and motivational features.

A) Related Work

Research shows these systems help:

- Improve engagement
- Increase consistency
- Support self-evaluation
- Improve motivation

Figure 2.1.5: Dashboard Analytics Diagram



B) Methodology

The workflow includes:

- Activity collection
- Performance analysis
- Analytics generation
- XP and streak calculation
- Feedback visualization

C) Results

Dashboard analytics and gamification improve learning consistency and provide meaningful progress insights.

2.1.6 Security and Authentication in Educational Platforms

Educational platforms require secure authentication and data protection mechanisms to safeguard user accounts and learning data.

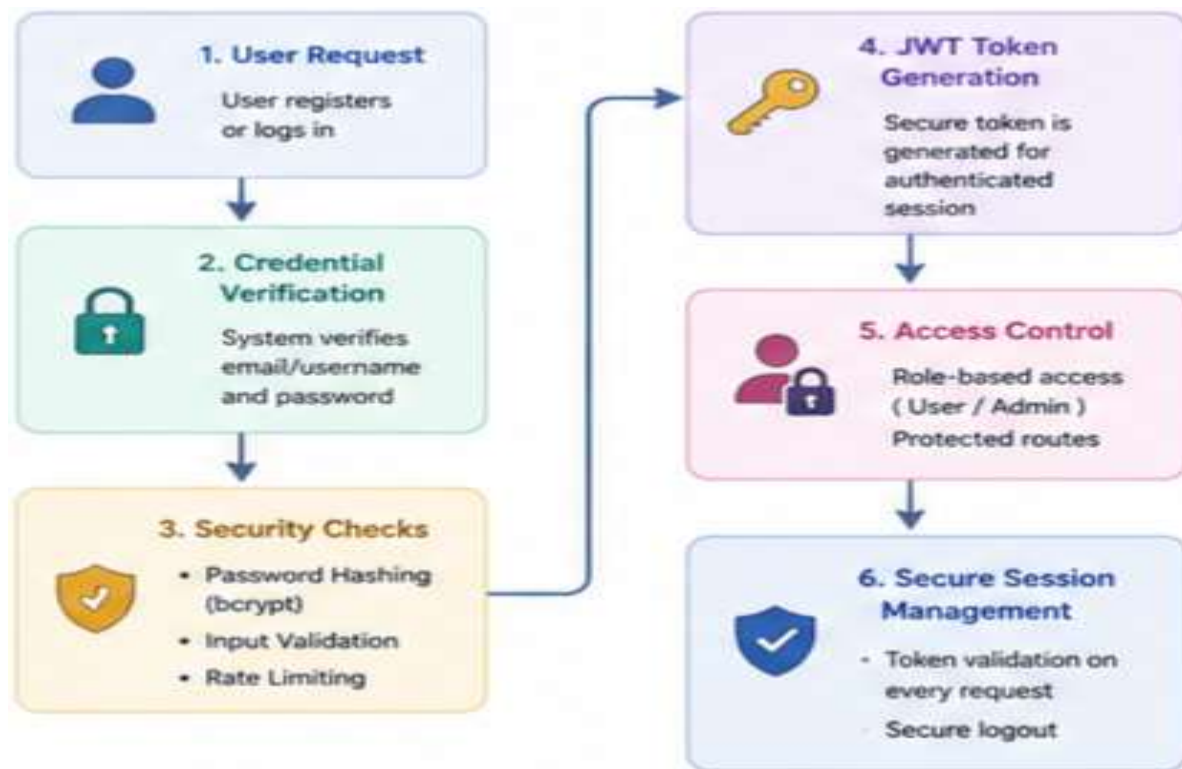
A) Related Work

Modern systems commonly use:

- JWT authentication
- Password hashing

- OTP verification
- Role-based access control

Figure 2.1.6: Authentication Workflow



B) Methodology

The workflow includes:

- User registration
- Secure login
- Token verification
- OTP recovery
- Protected API access

C) Results

Secure authentication systems improve user safety, protect educational data, and reduce unauthorized access risks.

2.2 Comparative Analysis of Existing Systems

Traditional educational platforms and existing AI-based learning systems provide useful features such as online quizzes, note management, and learning resources. However, many systems focus only on specific functionalities and lack complete integration between AI content generation, adaptive practice, analytics, and secure user management.

Some platforms provide quiz systems without intelligent content generation, while others support AI summaries but lack adaptive learning analytics or personalized recommendations. Many educational tools also fail to support multimodal

learning inputs such as images, audio, video, and scanned documents. In addition, several systems provide limited gamification features and weak authentication mechanisms.

AskNLearn attempts to overcome these limitations by integrating AI-powered content generation, adaptive quizzes, dashboard analytics, OCR and transcription support, gamification, and secure authentication within a single unified platform.

Table 1: Comparative Analysis of Existing Systems and AskNLearn

Features	Traditional Learning Systems	Existing AI Learning Platforms	AskNLearn
AI-Based Content Generation	Limited	Available in some systems	Fully Integrated
Adaptive Quiz Support	Basic	Partial	Advanced Adaptive Practice
OCR & Transcription Support	Not Available	Limited	Supported
Dashboard Analytics	Basic	Moderate	Advanced Analytics
Gamification Features	Minimal	Partial	XP, Streaks, Leaderboards
Multi-Format Input Support	Limited	Moderate	Text, PDF, Image, Audio, Video, URL
Secure Authentication	Basic	Moderate	JWT + OTP + bcrypt
Real-Time Features	Rare	Limited	Community Chat Support
Unified Learning Workflow	Not Available	Partial	Fully Integrated
Personalized Learning	Limited	Moderate	Adaptive Learning Support

Results of Comparative Analysis

The comparative analysis shows that AskNLearn provides a more integrated and feature-rich learning environment compared to traditional educational systems and many existing AI-based platforms. The combination of AI generation, adaptive learning, analytics, gamification, multimodal support, and secure authentication makes the system more suitable for modern digital learning requirements.

3 Proposed Methodology

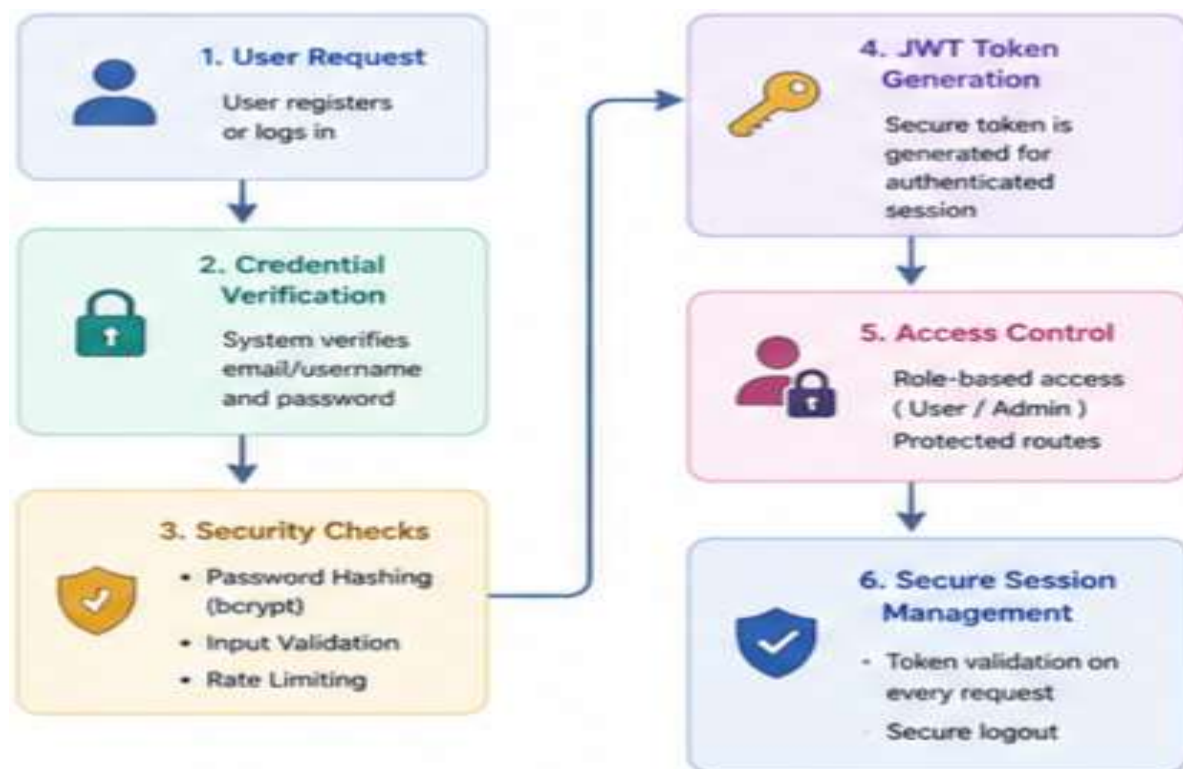
AskNLearn is a full-stack AI-powered educational platform designed to improve the learning and revision process through intelligent content generation, adaptive quiz practice, analytics-driven feedback, and secure user management. The system provides a centralized learning environment where students can upload study material, generate structured learning resources, practice quizzes, monitor progress, and improve weak areas through adaptive learning techniques.

The proposed system aims to reduce the manual effort involved in preparing summaries, flashcards, quizzes, and revision material by using Artificial Intelligence and Natural Language Processing technologies. Unlike traditional learning systems that require multiple disconnected tools, AskNLearn integrates AI generation, quiz practice, analytics, gamification, and authentication modules within a single platform.

The platform supports multiple study input formats such as text, PDF documents, Word files, PowerPoint presentations, images, audio files, video files, and URLs. OCR and transcription technologies are integrated to process non-textual educational content and convert it into machine-readable form. The extracted content is processed through AI models to generate summaries, flashcards, multiple-choice questions, fill-in-the-blanks, true/false questions, memory maps, and other revision-friendly learning resources.

The system follows a dual-backend architecture. The Node.js and Express.js backend manages authentication, quiz APIs, dashboard analytics, profile management, and database communication, while the Python FastAPI backend handles AI-based processing tasks such as OCR, transcription, content extraction, and AI generation workflows. This separation improves scalability, maintainability, and overall system performance.

Figure 3 : AskNLearn System Architecture



AskNLearn also includes adaptive quiz systems that analyze user performance and identify weaker topics for personalized practice recommendations. Dashboard analytics provide insights such as topic-wise performance, quiz history, XP points, streak tracking, leaderboard rankings, and activity monitoring. Gamification features are integrated to improve engagement and encourage continuous learning habits.

The platform implements secure authentication mechanisms using JWT-based session handling, bcrypt password hashing, OTP-based password recovery, and role-based access control. These security features help protect user accounts and educational data while ensuring safe access to system resources.

Overall, the proposed system combines Artificial Intelligence, adaptive learning, analytics, OCR technologies, and secure web technologies to provide a scalable, intelligent, and user-friendly educational platform suitable for modern digital learning environments.

3.1 User Authentication and Account Management

The platform provides secure user registration, login, JWT-based authentication, password hashing, OTP-based password recovery, and role-based access control.

The authentication process includes:

- User registration
- Secure login
- JWT token generation
- Password reset
- OTP verification
- Protected route access

3.2 Study Material Input and AI-Based Content Generation

Users can upload study material in multiple formats. The system processes the content using OCR, transcription, and AI-based NLP techniques to generate:

- Summaries
- Flashcards
- MCQs
- Memory maps
- Practice questions

Figure 3.2: AI-Based Study Material Generation Workflow

3.3 Data Processing and Storage

The backend validates and processes uploaded content before storing educational data, quiz history, generated resources, and analytics records in the MySQL database.

The processing stage includes:

- Input validation, OCR processing, & AI generation
- Database storage
- User library management

3.4 Adaptive Quiz and Personalized Learning

The platform includes adaptive quiz systems that analyze user performance and recommend topic-focused practice for weaker areas.

The adaptive workflow includes:

- Quiz attempt
- Score evaluation
- Weak-topic analysis
- Personalized recommendation
- Progress tracking

Figure 3.3: Adaptive Learning Workflow

3.5 Dashboard Analytics and Gamification

Dashboard analytics provide:

- Subject-wise performance
- XP points
- Streak tracking
- Heatmaps
- Leaderboards
- Activity monitoring

Gamification features improve student engagement and learning consistency.

Figure 3.4: Dashboard Analytics and Gamification System

3.6 Real-Time Communication and Community Support

The The platform integrates Socket.IO-based communication features for:

- Real-time chat
- Community learning
- Live interaction
- Collaborative discussion

3.7 Security and Performance Evaluation

The system is evaluated based on:

- Functionality
- Security
- Response time
- AI generation performance
- API reliability
- Scalability
- User experience

Figure 3.5: Authentication and Security Workflow

3.8 Final Deployment System

After testing, the platform is deployed as a web-accessible educational system supporting AI generation, adaptive learning, analytics, secure authentication, and collaborative learning features.

The final deployed system provides a scalable and intelligent solution for modern AI-assisted education.

4 Implementation and Results

The AskNLearn platform was successfully implemented as an AI-powered educational system that combines intelligent content generation, adaptive learning, analytics, gamification, and secure authentication within a unified digital environment. The system was developed using React.js, Node.js, Express.js, FastAPI, MySQL, OCR tools, transcription technologies, and AI model APIs.

The implementation supports:

- AI-based study material generation
- Adaptive quizzes
- Dashboard analytics
- Secure authentication
- Real-time communication
- Gamification features

The platform was tested under multiple conditions to evaluate functionality, usability, AI generation capability, security, and performance reliability

4.1 AI Generation Results

The AI generation module successfully converts educational content into structured learning resources using OCR, transcription, and AI-based NLP processing.

Generated outputs include:

- Summaries, Flashcards, MCQs, & Memory maps

The system supports:

- Text input, PDF files, Images, Audio/video & URLs

Figures

- Figure 8: AI Summary Generation
- Figure 9: Flashcard Generation
- Figure 10: MCQ Generation

4.2 Quiz and Practice Results

The quiz module allows users to practice subject-wise and AI-generated quizzes. The system evaluates quiz attempts, calculates scores, stores responses, and updates topic-wise performance data.

Adaptive learning support helps identify weaker topics and recommends additional practice accordingly. Quiz history and performance analytics improve long-term learning tracking.

Figures

- Figure 11: Quiz Interface
- Figure 12: Quiz Result Screen

4.3 Dashboard and Analytics Results

The dashboard module provides analytics-based learning insights using quiz history, generated content activity, XP systems, and streak tracking.

The dashboard displays:

- XP points, Streak count, Subject-wise performance, Performance heatmaps & Leaderboard rankings

These analytics help students identify weak areas and monitor learning progress more effectively.

Figures

- Figure 13: Dashboard Analytics
- Figure 14: Performance Heatmap
- Figure 15: Leaderboard System

4.4 Security Results

The platform implements secure authentication and authorization mechanisms using JWT-based session handling and bcrypt password hashing. OTP-based password reset and role-based access control improve account security.

Security features include:

- JWT authentication
- bcrypt password hashing
- OTP password recovery
- Protected routes
- Role-based access control

Figure

- Figure 16: Authentication Workflow

4.5 System Performance

The AskNLearn platform uses a dual-backend architecture where Node.js manages application APIs and FastAPI handles AI-processing tasks. This separation improves scalability and maintainability.

System performance was evaluated based on:

- AI response time
- Database operations
- API reliability
- Scalability
- Content processing speed

The platform performs efficiently under normal operating conditions and supports multiple learning workflows successfully.

4.6 User Experience

The platform provides a responsive and user-friendly interface for both desktop and mobile users. Smooth navigation, clean dashboard layouts, and simplified workflows improve usability and accessibility.

Major UI/UX features include:

- Responsive design
- Mobile support
- User-friendly forms
- Dashboard navigation

- Smooth interaction flow

Figures

- Figure 17: Mobile Interface
 - Figure 18: Dashboard UI
-

4.7 Limitations

Although the system successfully achieves its primary objectives, some limitations remain:

- AI output quality depends on input quality
- OCR accuracy may reduce for unclear images
- Audio/video transcription requires additional processing time
- AI generation depends on external APIs
- OTP is currently console-based in development mode

Despite these limitations, the platform provides a strong foundation for future AI-powered educational systems.

5 Challenges and Limitations

Although AskNLearn successfully implements an AI-powered educational platform, several challenges and limitations still exist.

The system depends on internet connectivity and external AI APIs for generating summaries, flashcards, quizzes, and other learning resources. API downtime or quota limitations may affect AI generation functionality.

The quality of generated content also depends on input quality. Unclear documents, low-quality scanned images, or noisy audio/video files may reduce OCR and transcription accuracy.

Media processing requires additional time and resources, especially for audio and video transcription. Large files may increase backend workload and response time.

Security is another important concern because the platform stores user accounts, quiz records, generated content, and analytics data. Although JWT authentication, bcrypt hashing, OTP verification, and route protection are implemented, stronger security mechanisms are still required for production deployment.

Adaptive learning recommendations may also be less accurate during early usage stages due to limited quiz history and user interaction data.

In addition, the current OTP recovery system is console-based and suitable mainly for testing purposes. Production deployment would require email or SMS-based OTP delivery.

Despite these limitations, AskNLearn provides a strong foundation for future AI-powered educational systems and intelligent digital learning platforms.

6 Future Scope

AskNLearn has strong future potential in the field of AI-powered education and adaptive digital learning systems. With the continuous advancement of Artificial Intelligence, Natural Language Processing, cloud technologies, and educational analytics, the platform can be expanded into a more intelligent, scalable, and production-ready learning environment.

Future development can focus on advanced adaptive learning and recommendation systems. Machine learning

algorithms can analyze user behavior, learning patterns, weak topics, and quiz history to provide more personalized study plans and intelligent revision recommendations.

The platform can also be improved in several ways:

- Add advanced AI tutoring and conversational learning assistants
- Improve recommendation accuracy using machine learning models
- Introduce voice-based learning and AI tutor interaction
- Enable offline study mode for downloaded learning material
- Add faculty and classroom analytics dashboards
- Integrate Learning Management Systems (LMS)
- Improve OCR and transcription accuracy using advanced AI models
- Introduce multilingual learning support
- Add proctored examination features
- Increase scalability using cloud-native microservices architecture

Mobile application development is another important future enhancement. Dedicated Android and iOS applications can improve accessibility and support continuous learning across devices.

Security can also be improved using:

- Multi-factor authentication
- Email/SMS OTP integration
- Advanced encryption mechanisms
- Secure audit logging & Cloud security monitoring

Future research can additionally focus on Explainable AI (XAI) in educational systems, where AI-generated recommendations and learning analytics can be explained more transparently to students and educators.

Thus, future advancements in Artificial Intelligence and educational technologies can significantly transform AskNLearn into a more intelligent, scalable, secure, and personalized educational platform suitable for modern digital learning environments.

7 Conclusion

Crime Education and learning management have become increasingly dependent on digital technologies, intelligent automation, and personalized educational systems. Traditional learning methods often involve manual preparation of notes, fragmented study workflows, limited analytics, and inefficient revision processes. Therefore, the integration of Artificial Intelligence and modern web technologies into educational systems has become an important area of development.

This research paper presented a comprehensive study of AskNLearn, an AI-powered educational platform developed using modern full-stack technologies, Artificial Intelligence, OCR systems, transcription tools, and adaptive learning techniques. The platform provides a centralized learning environment where students can upload study material, generate structured learning resources, practice adaptive quizzes, track progress, and access analytics-driven educational insights.

The study also discussed important modules such as secure authentication, AI-based content generation, OCR and

transcription processing, adaptive quizzes, dashboard analytics, gamification systems, and real-time community learning support. These features improve revision efficiency, personalized learning, student engagement, and accessibility of educational resources.

The implementation results show that the developed system performs efficiently under normal operating conditions. Core modules such as AI generation, quiz systems, analytics dashboards, and secure authentication demonstrated reliable performance and positive user experience. The project proved that Artificial Intelligence combined with modern web technologies can significantly improve digital learning workflows and educational productivity.

Although the platform achieved successful results, challenges such as AI dependency, OCR limitations, scalability requirements, media processing delays, and security considerations still remain. These limitations can be addressed through future enhancements such as advanced AI recommendation systems, cloud-native deployment, mobile applications, and stronger security mechanisms.

In conclusion, AskNLearn provides a practical, scalable, and intelligent solution for AI-assisted education and adaptive digital learning. With continuous advancements in Artificial Intelligence and educational technologies, such platforms can play an important role in building smarter, more personalized, and more efficient learning environments for students and educational institutions.

8 References

- [1] T. Brown, B. Mann, N. Ryder et al., “Language Models are Few-Shot Learners,” *Advances in Neural Information Processing Systems (NeurIPS)*, vol. 33, pp. 1877–1901, 2020.
- [2] A. Vaswani, N. Shazeer, N. Parmar et al., “Attention Is All You Need,” *IEEE Transactions on Neural Networks and Learning Systems*, pp. 5998–6008, 2017.
- [3] J. Devlin, M. Chang, K. Lee, and K. Toutanova, “BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding,” *Proceedings of NAACL-HLT*, pp. 4171–4186, 2019.
- [4] OpenAI, “GPT Models and AI-Based Educational Applications,” Available: <https://openai.com>, Accessed: 2026.
- [5] Google, “Gemini API Documentation,” Available: <https://ai.google.dev>, Accessed: 2026.
- [6] R. Smith, “An Overview of the Tesseract OCR Engine,” *Proceedings of the International Conference on Document Analysis and Recognition*, pp. 629–633, 2007.
- [7] A. Radford, J. Kim, T. Xu et al., “Robust Speech Recognition via Large-Scale Weak Supervision,” *OpenAI Whisper Research Paper*, 2022.
- [8] Facebook Inc., “React.js Documentation,” Available: <https://react.dev>, Accessed: 2026.
- [9] FastAPI, “FastAPI Framework Documentation,” Available: <https://fastapi.tiangolo.com>, Accessed: 2026.
- [10] Oracle Corporation, “MySQL Reference Manual,” Available: <https://dev.mysql.com/doc>, Accessed: 2026.
- [11] P. Brusilovsky and E. Millán, “User Models for Adaptive Hypermedia and Adaptive Educational Systems,” *The Adaptive Web*, Springer, pp. 3–53, 2007.
- [12] Y. Bengio, A. Courville, and P. Vincent, “Representation Learning: A Review and New Perspectives,” *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 35, no. 8, pp. 1798–1828, 2013.

- [13] I. Sutskever, O. Vinyals, and Q. V. Le, "Sequence to Sequence Learning with Neural Networks," *Advances in Neural Information Processing Systems (NeurIPS)*, vol. 27, pp. 3104–3112, 2014.
- [14] D. Bahdanau, K. Cho, and Y. Bengio, "Neural Machine Translation by Jointly Learning to Align and Translate," *International Conference on Learning Representations (ICLR)*, 2015.
- [15] J. Dean and S. Ghemawat, "MapReduce: Simplified Data Processing on Large Clusters," *Communications of the ACM*, vol. 51, no. 1, pp. 107–113, 2008.
- [16] M. Wooldridge, "Artificial Intelligence in Education and Learning Systems," *AI Magazine*, vol. 42, no. 2, pp. 15–25, 2021.
- [17] H. Drachsler and W. Greller, "Privacy and Analytics in Educational Technology," *Journal of Learning Analytics*, vol. 3, no. 1, pp. 1–19, 2016.
- [18] S. Graf and Kinshuk, "Advanced Adaptivity in Learning Management Systems by Considering Learning Styles," *International Conference on Advanced Learning Technologies*, pp. 235–239, 2007.
- [19] M. Al-Smadi, O. Qawasmeh, and F. Al-Ayyoub, "Automatic Text Summarization Using Natural Language Processing Techniques," *International Journal of Computer Applications*, vol. 179, no. 32, pp. 25–31, 2018.
- [20] K. Verbert, E. Duval, J. Klerkx, S. Govaerts, and J. L. Santos, "Learning Analytics Dashboard Applications," *American Behavioral Scientist*, vol. 57, no. 10, pp. 1500–1509, 2013.