Journal Homepage: www. ijarpr.com ISSN: 3049-0103 (Online)

International Journal of Advance Research Publication and Reviews

Vol 02, Issue 09, pp 808-814, September 2025

NextGen EduSummarize: AI-Powered Personalized Learning

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ABSTRACT

NextGen EduSummarize: AI-Powered Personalized Learning is a unique platform that utilizes AI to provide customizable pedagogies for the pupils. The platform is structured into two main components - Admin and User. The Admin Module enables admins to manage the learning content by uploading, amending, and deleting topics that consist of videos and a full description. Admins also have the privilege of viewing the opinions of users to redefine the learning experience. The User Module facilitates the registration, login, and participation of students in various learning topics. They can also receive customized versions of videos and use them to control the videos via hand gestures. The day after, users can also give feedback to the system to refine their future experiences. The system offers a compelling way to engage students by allowing them to control the length of the videos and use their dominant hand for intuitive control over the media.

Keywords—AI learning systems, customizable learning environments, hand gesture video control, video feedback systems, admin system management, interactive educational content, user engagement systems.

I. Introduction

The use of videos in education is now commonplace in teaching and learning as part of digital education. In contrast, locked systems face issues like learner retention and disengagement stemming from passivity in content consumption. Students often have complex issues in understanding and retention when they face videos in an unorganized manner, while creators and administrators face problems in classifying and managing relevant educational materials. The lack of interactivity and personalization results in disengagement, an inadequacy boosted by the lack of personalization and interactive options.

NextGen EduSummarize: AI-Powered Personalized Learning System addresses all of these issues by providing an interactive AI platform to transform antiquated forms of video learning into active and real-time personalized systems. The system is built with advanced real-time video summarization AI, gesture recognition control, and participants have thumbs systems to speed up content and information to actively study these materials. The system simplifies engagement through personalized video summaries and structured user feedback and video control, subsequently improving understanding and enhancing engagement with the learning materials.

On the other hand, the system possesses a two-module structure with Admin and User functionalities. The admin module streamlines the users' content management, facilitating administrators' ability to add, modify, or delete content and user activity logs, and then utilize analytics to refine the educational materials. The Users Permit learners to gesture to control the video, receive AI-generated summaries, and give feedback to improve the ecosystem.

This demonstrates the use of artificial intelligence in education to develop custom, wide-ranging, and dynamic courses. The incorporation of intelligent video summarization, gesture-based system user controls, and content management systems in the Nextgen Edusummarize system serves to illustrate the capabilities of the platform in bridging the learning video gap from passive to active, educator-user-controlled education.

II. RELATED WORK

A. Personalized Video Summarization

Personalized video summarization is essential for the tailored learning experience since it changes video content based on an individual user's preferences. Saquil et al. [1] proposed a new framework that uses multiple pairwise ranking networks for generating personalized video summaries, thus enhancing video summaries for each user. Mirzas Leiman et al. [4] also proposed a method for real-time personalized summarization based on streaming submodular optimization, which allows for real-time modification of videos. Chen et al. [10] further advanced the field with a multimodal approach to video summarization by video understanding, where they utilized multiple data sources to generate summaries personalized to a single user. All these works demonstrate that adding personalization for users is necessary to boost the user's engagement and understanding when watching videos during learning.

B. Artificial Intelligence and Deep Learning Methods

Deep learning techniques have emerged as powerful tools for automated video summarization across diverse domains. Mohan [3] proposed a domain-agnostic approach for video summarization by using transfer learning, which can be effectively utilized in a video summarization model across different educational spheres using convolutional neural networks (CNNs). Ansari et al. [6] A summary on deep learning techniques demonstrates the effectiveness of those techniques in content extraction and curation for an educational purpose. Vora et al. [7] developed an AI video summarization system that used deep learning for content retrieval and management. The system illustrates the use of AI to enhance educational platforms available in bulk. Reddy et al. [5] used unsupervised domain adaptation with masked pre-training, which allows summarization models to work in different video domains without needing a lot of labeled data, a crucial factor for large-scale educational resources.

C. Hand Gesture-based Interaction

The implementation of gesture controls in learning environments provides an added layer of sophistication to the learning experience, which learners are very likely to respond to positively. Peng et al. [2] developed a hand gesture control system that allows users to categorize images within 3D virtual environments, expanding the use of gesture-based interaction for educational purposes. Dhumal et al. [8] examined the effectiveness of different machine learning techniques for the recognition of hand gestures through electromyographic signals, developing responsive control systems for gesture-based interactions. gesture recognition systems offer researchers an opportunity to increase user interaction with the system.

D. Content Management and Scalability

Implementing AI-driven education platforms requires efficient content management and system scalability. Singh and Kumar [9] performed a thorough investigation on crowd video summarization techniques and provided valuable scalable summarization techniques for summarizing vast educational material. These techniques highlight responsive and scalable system requirements for multiple user loads and large virtual video repositories in real-time teaching scenarios.

E. Multimodal and Hybrid Approaches

Summarizing videos with richer context is made possible by including multiple forms of data integration. A multimodal video understanding framework is constructed by Chen et al. [10] that formulates video with rich visuals, audio, and several contextual logs for offering highly personalized and enriched summaries. These hybrid techniques enhance video

summarization accuracy and render more engaging and user-centered learning activities, which is one of the aims of the Nextgen Edusummarize system.

F. Thorough Syntheses and Emerging Directions

Having broader surveys is beneficial, as they support system architecture and integration. In Singh and Kumar 9, and Ansari et al. 6 provided a systematic review of deep learning approaches, detailing their applicability and effectiveness for video summarization, while Singh and Kumar 9 analyzed crowd summarization techniques, suggesting new approaches for scalable e-learning systems.

G. Privacy-Preserving Video Summarization

As the personalization of video summarization in education becomes more important, user privacy becomes a pressing issue. Yang et al. [13] used federated learning to develop summarization models on separate devices without sharing sensitive data on learners, achieving both personalization and privacy.

TABLE I. Comparison of security based on biometrics

Feature / System	***Deepfake Defense Systems***	***XAI-Enabled Biometrics***	***Proposed Work***
Primary Paradigm	Static video playback with manual navigation	Automated AI video summarization	AI summarization, plus hand gesture control and admin analytics hybrid
Learning Interactivity	Low (passive viewing)	Medium (summary viewing only)	High (gesture-based playback control, feedback loop)
Personalization	None or minimal (generic content)	Moderate (personalized summaries)	High (topic-wise summaries, adaptive playback, user feedback integration)
Content Management	Manual upload and curation	AI Generated summaries only	Admin tools integration for topic/video CRUD and engagement tracking
Feedback & Analytics	View counts and basic user feedback	Engagement limited metrics	Comprehensive user feedback, refinement on engagement scores over time
Gesture Support	None	Hand motions for summarization	High, summarization with transfer-learning for diverse educational content.)

III. Proposed Methodology

The next few pages define the platform's informatics, including theory and key design features of the Nextgen Edusummarize platform. Merging AI video summarization, hand gesture recognition, and content audio and video synchronization facilitates learner-customized, highly interactive content. The AI model uses transfer learning based deep neural networks to summarize capturable video highlights on each defined topic. At the same time, real-time gesture recognition enables users to touch less and increases video playback to enhance their learning experience. The integrated admin dashboard is used to perform topic/video user CRUD operations, user-based feedback summation, and engagement analytics, which support the optimization of the playback summaries and recommendation system.

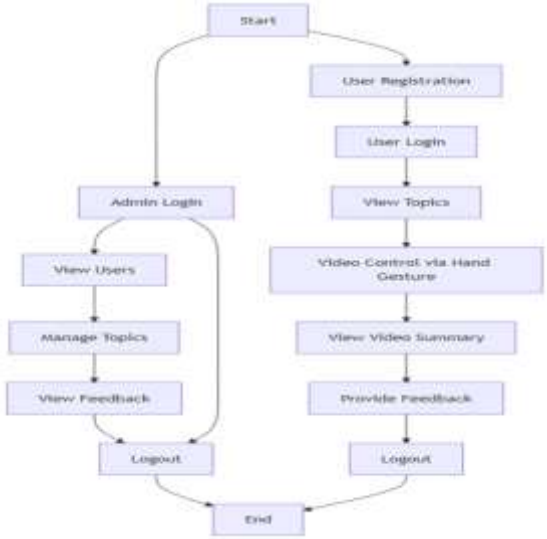

Fig.1. Flowchart

A. User and admin feature integration

The system provides dual-mode functionalities for admin and user workflows. Admin takes into account the logs and user activities. He manages topics and views feedback. Users register, log in, explore topics, control videos with hand gestures, and provide feedback. The dual integration provides complementary oversight (admin perspective) and interactivity (user perspective).

B. Strength of system control

The architecture strengthens the system's resilience from misuse by role boundary access. Admin can monitor system activities and control system content. Users have significantly restricted and lower-tier functionalities, such as video gesture control and topic exploration. This role division greatly mitigates privilege escalation as well as security risks from unauthorized access.

C. Decision support and user interaction

The system augments decision support through interaction monitoring. Admin decisions are informed by user activity and feedback records. Users are provided with clear navigation (login, topic, and video summary). This increased interpretability and user flow system guarantees that audits (admins and users) that the process is trusted.

D. Privacy and Local Control

The workflow suggests that activities deemed sensitive (login, feedback, videos) are controlled within system boundaries. The admin manages topics and feedback without assistance from third-party services. User video gesture controls, video feedback, and all other associated processes are handled locally.

IMPLEMENTATION

The innovative part of this proposition is the inclusion of the modular structure of Admin Control and User Learning Workflow in the Proposed Integrated Educational System. Usability, security, and learning efficiency are complemented uniquely by gesture-based interaction, an adaptive content system, and local processing. It provides two modules for its implementation: Admin Module and User Module.

A. Admin Module

This module takes the Blended Learning System to a new level. It monitors User System Activities and the overall reliability and system module by managing platform content.

Login: Auth and Admin session integrity is preserved by secure login mechanisms.

Manage Topics: Admin roles can be aptly created to include Edit and Deletion roles. Admins are responsible for ensuring that broken or outdated content (video and text description) is accurate and relevant.

View Feedback: Admins can analyze user responses and track their level of engagement with the educational material to improve the delivery.

View Users: Admins are responsible for monitoring a set of registered users for their level of system engagement as well as their compliance with platform policies.

Logout: Unauthorized account access and data simulation is avoided by secure logout mechanisms.

This module provides a balanced approach, allowing substantive content governance alongside user activity monitoring for the betterment of the system.

B. User Module

The User Module focuses on facilitating self-directed learning through gesture-controlled videos along with structured content immersion.

Register: New users can set up an account and unlock platform functionalities by providing some basic information.

Login: Users can log in securely and get personalized dashboards where they can see their progress.

View Topics: Learning can access various topics along with comprehensive and video tutorials. Video Control via Hand

Gesture: Users can engage with the content of videos by controlling them via twitching their hands in certain ways and this increases usability and interaction.

Video Summarization: Users can get video lectures instantly and in the form of summaries, which help them capture the central idea without rewatching the entire material. Provide

Feedback: Constructive feedback is given by users, which helps in the progress of the platform.

Logout: Users can terminate their sessions without hassle, which keeps their account secure and their learning progress hidden from the public domain.

This module enables users to access information instantly while engaging them with videos and gestures, along with sending feedback to the admins

IV. CONCLUSION

The Nextgen EduSummarize: AI-Powered Personalized Learning system rethinks education using interactivity, including hand gesture video control and content summarization. It enables fluid engagement with educational material on both the administrator and user sides. Admins can manage content, analyze user feedback, and customize learning pathways with a system driven by feedback loops. Users appreciate the system for effortless engagement with videos to facilitate quick

mastery of essential concepts via summarization. The fusion of personalized flexible learning with feedback tools and content management systems improves retention and makes the learning experience more interactive and comprehensive

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