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# **Edutube: A Virtual Tutor**

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**ABSTRACT**: Edutube is an educational video streaming platform aimed at redefining digital learning by providing a distraction-free, user-centric environment. It facilitates immersive learning through high-quality, ad-free video content without requiring premium subscriptions. Edutube enhances user engagement with interactive elements like quizzes and supports offline access to bridge digital divides. This paper details the platform's architecture, implementation strategies, and features such as API integration and background playback, ensuring scalability, inclusivity, and learner satisfaction. Through Edutube, we address current educational platform gaps, offering a holistic, accessible, and modern virtual tutor experience.

Keywords: Virtual Tutor, Educational Video Streaming, API Integration, Ad-Free Learning, Edutube.

#### I. INTRODUCTION

In today's digital era, learners demand platforms that offer flexible, engaging, and uninterrupted educational experiences. Traditional classroom models are limited in scalability and adaptability to diverse learner needs. Existing e-learning solutions often fall short due to high costs, intrusive ads, and inconsistent content quality.

Edutube, our proposed solution, is a virtual tutor designed to eliminate these challenges. It offers ad-free, premiumlevel content for free, featuring background playback, intuitive navigation, and subject-wide video coverage. The platform's API-driven architecture ensures scalability and real-time interactivity, making it a promising solution for modern education.

#### **II. LITERATURE SURVEY**

Kumar et al. [1] review cloud video streaming, covering technologies like adaptive streaming, CDNs, and AI/ML, alongside challenges such as security and legal issues. The paper provides a broad overview but lacks novel solutions or deep experimental validation.

Qiu and Cui et al. [2] analyzed user behaviour on MSN video (2007-2008), identifying patterns like jumps and replays using an FSM model. They found behaviour linked to video popularity and prior user actions, though the data's age and single-platform focus limit current applicability.

Chalaby et al. [3] uses Global Value Chain theory to analyze the TV industry's shift to streaming, examining platform monetization (SVoD/AVoD), supply chains, and ownership. While providing a strong theoretical framework, the study lacks detailed empirical analysis of specific GVCs and focuses mainly on Western platforms.





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Rahamathunnisa and Saravanan et al. [4] survey TCP for video streaming, comparing it with UDP and reviewing TCPfriendly congestion control algorithms like AIMD and TFRC. The 2013 paper advocates for TCP's reliability but is dated regarding newer protocols and techniques.

Evens et al. [5] investigate user preference for streaming platforms over traditional TV using the MAIN model and a Belgian study. They find affordances like customization and control drive preference, but findings may be limited by the specific demographic and location.

West [6] discusses the evolution of video streaming and digital content delivery around 2014, covering the IP transition, IoT, and spectrum needs. It highlights the need for regulatory adaptation but lacks deep technical detail and is dated given subsequent advancements.

Spilker and Colbjørnsen [7] propose a typology for the evolving concept of streaming based on five dimensions (e.g., professional vs. user-generated, live vs. on-demand). Their historical overview provides a valuable conceptual framework but lacks deep empirical analysis of dynamics within these dimensions.

#### III. PROPOSED METHODOLOGY AND DISCUSSION

#### 3.1 System Architecture:

The Edutube platform is designed with scalability, accessibility, and performance in mind to serve diverse learners across digital devices. The architecture follows a cloud-first, API-driven, modular design that ensures efficient video streaming, content delivery, and learner engagement.



Figure 1: Architecture of Edutube

- The video playback system leverages React Player and fetches video data through API, enabling smooth, high-quality streaming directly within the platform.
- A sidebar navigation module organizes content by category, allowing users to explore topics with minimal effort.
- The search module dynamically fetches and displays relevant video results based on user queries using the YouTube API.
- A related videos section appears alongside each video, encouraging continued learning by showing content contextually linked to the currently viewed material.
- The entire platform is ad-free by design, enhancing focus and maintaining uninterrupted learning sessions.

#### 3.2 Process Flow

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The Edutube platform is designed for easy and open access to educational content without requiring login or registration. When a user accesses the platform via a web browser on any device, the homepage displays categorized educational videos.

Users can either:

- Search for specific content using the search bar, which fetches results from the YouTube API, or
- Directly select a video from the featured or categorized list on the homepage.

Once a video is selected, the system retrieves video details and related videos using the YouTube API. The selected video then plays through an embedded player in an ad-free environment.

Users can continue watching related videos, return to the homepage, or initiate a new search at any time, ensuring a seamless and distraction-free learning experience.



Figure 2: Process Flow Diagram of Edutube

#### 3.3 Methodology

#### 3.3.1 Technologies Used

- To build a straightforward and interactive virtual tutoring platform, the following technologies were used:
- Frontend: React.js with TypeScript, HTML5, CSS3, Tailwind CSS for building a responsive and clean user interface
- Backend: Node.js with Express.js and APIs for managing content delivery
- Video Playback & Screen Sharing: Native HTML5 video elements combined with custom screen capture and sharing functionality implemented via Web APIs

#### 3.3.2 Development Process

- Developed a modular React frontend with Tailwind CSS ensuring intuitive navigation and responsiveness across devices.
- Implemented backend APIs in Node.js solely for serving educational video content and coordinating screen sharing sessions.
- Used built-in browser APIs to implement screen sharing and video playback features, allowing live demonstration and interaction.
- Ensured minimal complexity by avoiding any persistent storage, authentication, or thirdparty dependencies.

#### 3.3.3 Testing

The platform was tested using a mix of manual and automated methods to ensure functionality and usability:





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- Unit Testing: Verified UI components such as video player, screen sharing controls, and navigation buttons functioned correctly.
- **Integration Testing:** Tested complete user flows including loading video content, starting/stopping screen sharing, and navigating between lessons.
- **Performance Testing:** Assessed smooth video playback and low-latency screen sharing across typical network conditions.
- **Cross-browser Testing:** Conducted tests on major browsers (Chrome, Firefox, Edge) for compatibility and consistent behavior.
- User Testing: Performed usability testing with target users to gather feedback on interface intuitiveness and media quality.

#### 3.4 Implementation

This platform is implemented as a modular, user-centric video education system designed for seamless and distraction-free learning. It integrates dynamic video fetching, keyword-powered search, ad-free playback, and interactive engagement tools to enhance the educational experience. The system is optimized for fast loading, intuitive navigation, and high user engagement.

- Video Library module provides categorized access to educational videos for easy discovery.
- Search & Navigation powered by keyword indexing and filtering to deliver relevant results.
- Ad-Free Engine ensures an uninterrupted viewing experience by blocking ads during playback.
- Interactive Layer enables quiz participation and discussion below videos for active learning.
- Analytics Module tracks user activity and engagement metrics to optimize content delivery.

#### **IV. EXPERIMENTAL RESULTS**

#### 4.1 Home page

The landing page displays category-based content suggestions tailored for educational exploration. It was tested for quick load time and visual responsiveness across devices.



Figure 1: Home Page of Edutube

#### 4.2 Content Page

Presents a selected educational video with description, metadata, and interactive features like quizzes and discussions. Verified for accurate content rendering and engagement functionality.



Figure 2: Content Page of Edutube





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#### 4.3 Search Results page

Lists videos matching user queries using keyword-based indexing and filters. Confirmed for efficient query processing and real-time result updates



Figure 3: Search Results of Edutube

#### 4.4 Creator profile page

Displays videos grouped by content creators or channels, supporting exploration of topic-specific content. Tested for seamless channel-based navigation and layout clarity.



Figure 4: Creator profile page of Edutube

#### 4.5 Video Player Page

Streams selected videos without ads and includes video metadata, description, and related content suggestions. Validated for distraction-free playback and smooth transition between video details.

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Figure 5: Video Player of Edutube





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#### V. CONCLUSION AND FUTURE WORK

The Edutube platform demonstrates the effectiveness of using API-driven architecture to deliver dynamic, accessible, and user-focused educational content. By integrating real-time video metadata retrieval, keyword-based search, and personalized content suggestions, the platform creates a responsive and intuitive learning environment. Its modular design, ad-free playback, and interactive features such as quizzes and discussions contribute to high user engagement and satisfaction. Overall, Edutube provides a modern, efficient solution for digital education, enabling learners to explore diverse topics seamlessly through a clean, distraction-free interface.

Future developments for Edutube include expanding the content library to cover a wider range of academic subjects and educational levels. Plans also involve integrating advanced analytics to create personalized learning journeys based on user behavior and preferences. Enhancing collaborative features such as group discussions and shared playlists will foster peer learning. Further, incorporating immersive technologies like Augmented Reality (AR) and Virtual Reality (VR) could offer deeper, more engaging educational experiences. By continuously embracing innovation, Edutube aims to evolve into a comprehensive digital learning ecosystem for global users.

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