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CODOX: A Real-Time Collaborative Document Editing Platform

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Abstract: In today's digital-first world, effective collaboration on documents is essential. While tools like Google Docs exist, they may not offer the flexibility, performance, or affordability that startups and custom platforms require. CODOX addresses these gaps by providing a real-time collaborative document editing tool built with React, Next.js, Tiptap, Liveblocks, Clerk, and Convex. It offers smooth synchronization, an intuitive user interface, and secure login mechanisms. Designed to be scalable and lightweight, CODOX is an ideal fit for educational institutions and professional teams seeking tailored solutions. This paper explores the design, development, testing and prospects of the platform.

Key Words: Real-time Collaboration, Document Editor, Scalability, User Authentication, Custom Solutions.

1. INTRODUCTION

As remote work and digital operations grow, the need for real-time collaborative document editing tools has surged. Despite the presence of robust platforms like Google Docs, limitations in backend access, lack of customization, and high costs often make them unsuitable for startups or educational use. CODOX offers a modern, scalable, and secure alternative that developers can easily customize and integrate.

1.1 Problem Statement

Many existing online document editors present issues such as lag in performance, rigid features, and a poor collaborative experience. Platforms are either too simple to be useful or too restricted for customization. Additionally, secure and seamless authentication often proves challenging due to tightly controlled environments. Problems such as synchronization delays, version mismatches, and real-time editing lags disrupt workflow and user productivity. CODOX addresses these problems with a flexible and scalable solution that supports conflict-free collaboration using Liveblocks, secure authentication through Clerk, and reliable backend storage with Convex. It is tailored to meet modern demands for real-time, safe, and integrated document collaboration in diverse environments.

1.2 Objectives

The primary objective is to build CODOX — a collaborative web-based document editor.

- Enable real-time multi-user document editing.
- Provide secure login and user authentication.
- Ensure document versioning and autosave features.
- Deliver a responsive and intuitive user interface.
- Offer modularity for easy customization and integration.

2. LITERATURE SURVEY

1. **Gartner Research (Oct 2024)**
   Highlights the increased reliance on collaborative platforms post-pandemic, emphasizing the role of real-time document tools in boosting productivity.
2. **IEEE Access Journal (May 2023)**
   It focuses on the technical challenges in real-time editing, such as latency and conflict resolution, and suggests the use of efficient real-time APIs.
3. **ACM Digital Library (Mar 2024)**
   Discusses the drawbacks of mainstream editors and recommends using customizable frameworks like React and Tiptap for better flexibility.

4. **Dev.to Community (Aug 2024)**
   Describes how developers are using Liveblocks, Tiptap, and Next.js to create modern, responsive editors, comparing new tools with legacy platforms.
5. **Forbes Technology Report (Jan 2024)**
   Reports on AI integration in document tools and the rising demand for intelligent collaboration features, especially in enterprise settings.

3. EXISTING SYSTEM REVIEW

1. **Google Docs**: Reliable collaboration, but lacks customization.
2. **Notion**: Easy-to-use interface, but not ideal for intensive editing.
3. **Etherpad**: Open-source, but has outdated visuals.
4. **OnlyOffice**: Enterprise-grade features, but requires heavy resources.

3.1 Proposed System

- Liveblocks for real-time collaboration
- Clerk for secure authentication
- Convex for document storage and management
- Vercel for global deployment
- Modular architecture for ease of scalability

3.2 System Requirements

Functional Requirements:

- Real-time multi-user collaboration
- Secure login and access control
- Rich text and media support
- Version control and autosave
- Admin dashboard
- Live user indicators

Non-Functional Requirements:

- High scalability and performance
- Data encryption and HTTPS
- User-friendly interface
- Modular code structure
- Global deployment with Vercel

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3.3 METHODOLOGY

- Frontend: React.js, Next.js, Tailwind CSS
- Backend: Node.js, Express.js
- Database: Convex
- Authentication: Clerk
- Collaboration: Liveblocks
- Deployment: Vercel
- Browser Support: Chrome, Firefox, Edge (latest)

4. ADVANTAGES & DISADVANTAGES

Advantages:

- Supports real-time editing
- Secure login system
- Cloud-hosted and scalable
- Modular and customizable
- Responsive UI using Tailwind
- Works on desktop and mobile
- Autosave and version history

Disadvantages:

- Requires constant internet access
- No offline editing functionality
- Lacks native mobile apps
- Advanced features like AI are not yet implemented
- Integration setup may be complex for beginners

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5. E-R DIAGRAM

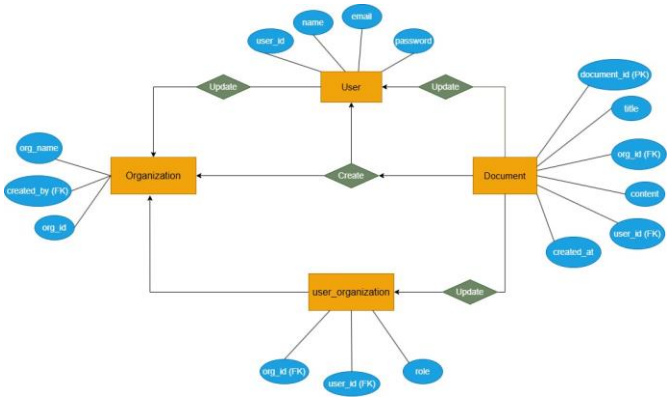

Fig.5.1 E-R Diagram

6. IMPLEMENTATION

The CODOX platform uses a modern tech stack to deliver robust functionality. The frontend is built with React and Next.js, while the backend leverages Convex for seamless storage. Tiptap powers editor functionalities and user login is managed using Clerk.

The application is deployed via Vercel, ensuring fast access globally.

6.1 Testing

Multiple testing methods ensure system reliability:

- **Unit Testing**: Tools like Jest and Mocha
- **Integration Testing**: Using Postman
- **System Testing**: Automated with Selenium, Cypress
- **Types Used**: White-box and black-box testing.

Test cases included login, UI responsiveness, collaboration, and error handling.

7. RESULTS

The CODOX platform successfully demonstrated real-time collaborative editing. Secure user authentication, smooth document editing, and data handling worked as intended. The system passed all functional tests and offered a clean, responsive user experience across browsers and devices. It fulfilled the project goal of building a collaborative, customizable editor suited for modern teams.

8. CONCLUSION

CODOX serves as a robust, scalable solution for collaborative content creation. By integrating modern, modular tools, the platform offers a reliable and secure document editing experience that can adapt to evolving digital collaboration needs.

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