System Design Document

Project- Messaging Service Web App
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Github Repo Link- https://github.com/sohumbansal/ChatApp
Demo Video- Demo video

Overview

This document describes the **system design** for a messaging service app named ChatApp, which is made in Next Js and allows users a **real-time** text chat experience. Users are required to sign up/sign in using their **email** and **password**. The app provides a simple, easy-to-use UI. The database and authentication are handled in **Firebase**.

This document lists all the technologies and dependencies and explains their use. It provides a detailed description of the processes, data handling, and design principles.

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Design Principles

- The App is made in next.js. Next.js provides the ability to split a website into small parts called components and reuse them.

- The Styling is done in CSS. Sass lets us write structured CSS codes and converts that code into CSS used for styling.

- This web app has one main folder -Src. The src folder has an app folder divided into different folders for accessible and reusable code.

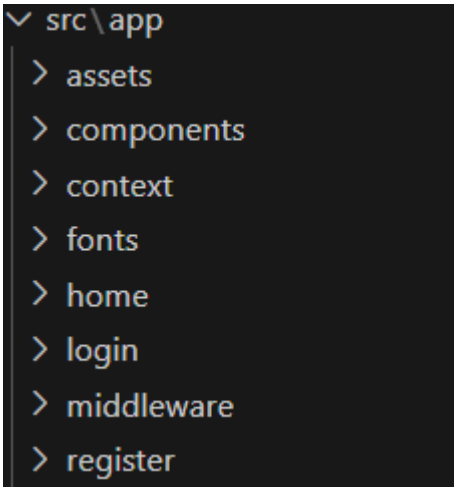
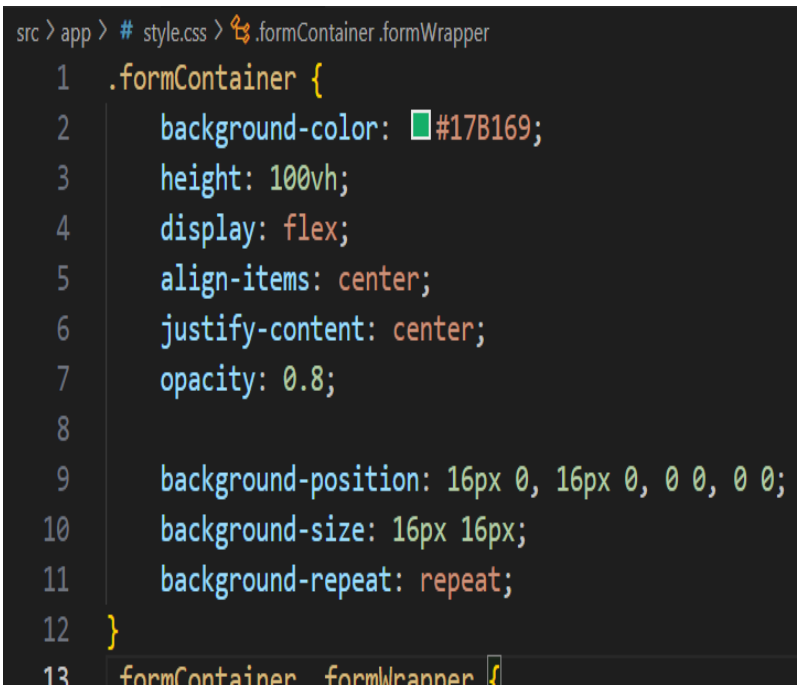


Fig: project structure

The app folder is divided into -

1. Components - Each page is divided into small react components interacting with the user.
2. Context - React context to use a value as a global value in the whole app.
3. Pages- The home, login, and register pages consist of pages.js for that particular use.
4. Each page has been written in a structured way. For example-

   Parent: AuthContextProvider
   Child: ChatContextProvider
   Child: Form (input, button)
5. A snippet of the style.css file which has also been written in a structured manner.



System Architecture

The system uses Next.js to provide a server-side rendering framework with React components. Each component serves a specific purpose, allowing interaction with the user interface.

The web app consists of several pages, components, and contexts, organized as follows:

- **Pages-**

1. **Register**:
    - Users create an account with an email and password.
    - If the email already exists, the system prevents duplicate account creation.
2. **Login**:
    - After account creation, users log in using their credentials.
    - Once logged in, the user is redirected to the homepage.
3. **Home**:
    - Accessible only after logging in.
    - Displays all the user's chats and provides real-time chat functionality, divided into a sidebar and chat window.

- **Components**

1. **Sidebar**:
    - The left pane of the home page displaying user details, a list of all users who have existing chats, and a search bar.
    - The sidebar is divided into **Navbar**, **Search**, and **Chats** components.
2. **Chat**:
    - Displays the current conversation along with input fields for sending new messages.
    - Divided into **Messages** and **Input** components.
3. **Navbar**:
    - Part of the sidebar, showing the logged-in user's details and a sign-out option.
4. **Search**:
    - Allows users to search for other users by name.
5. **Chats**:
    - Displays a list of users with whom the current user has existing conversations.
6. **Messages**:
    - Shows the current conversation between two users. The chat updates in real-time as messages are sent and received.
7. **Input**:
    - Provides an input field for typing messages, with a button to send them.
8. **Message**:
    - Each message contains details like sender, receiver, and content.

- **Contexts**

1. **AuthContext**:
    - Tracks whether the user is logged in.
    - If the user is authenticated, their details are stored and available globally within the app.
2. **ChatContext**:
    - Tracks whether two users have previous chat history.
    - Loads and displays the chat history if available.

Database

This solution uses **Firebase Firestore**, a NoSQL cloud database, to store users and chat data. Firestore offers **real-time synchronization**, ensuring chat messages are instantly updated across all users. Its **scalable, flexible** structure—using documents and collections—makes it ideal for dynamic chat applications.

Firebase Cloud Functions are employed to handle server-side logic like real-time updates or interactions with Firestore.

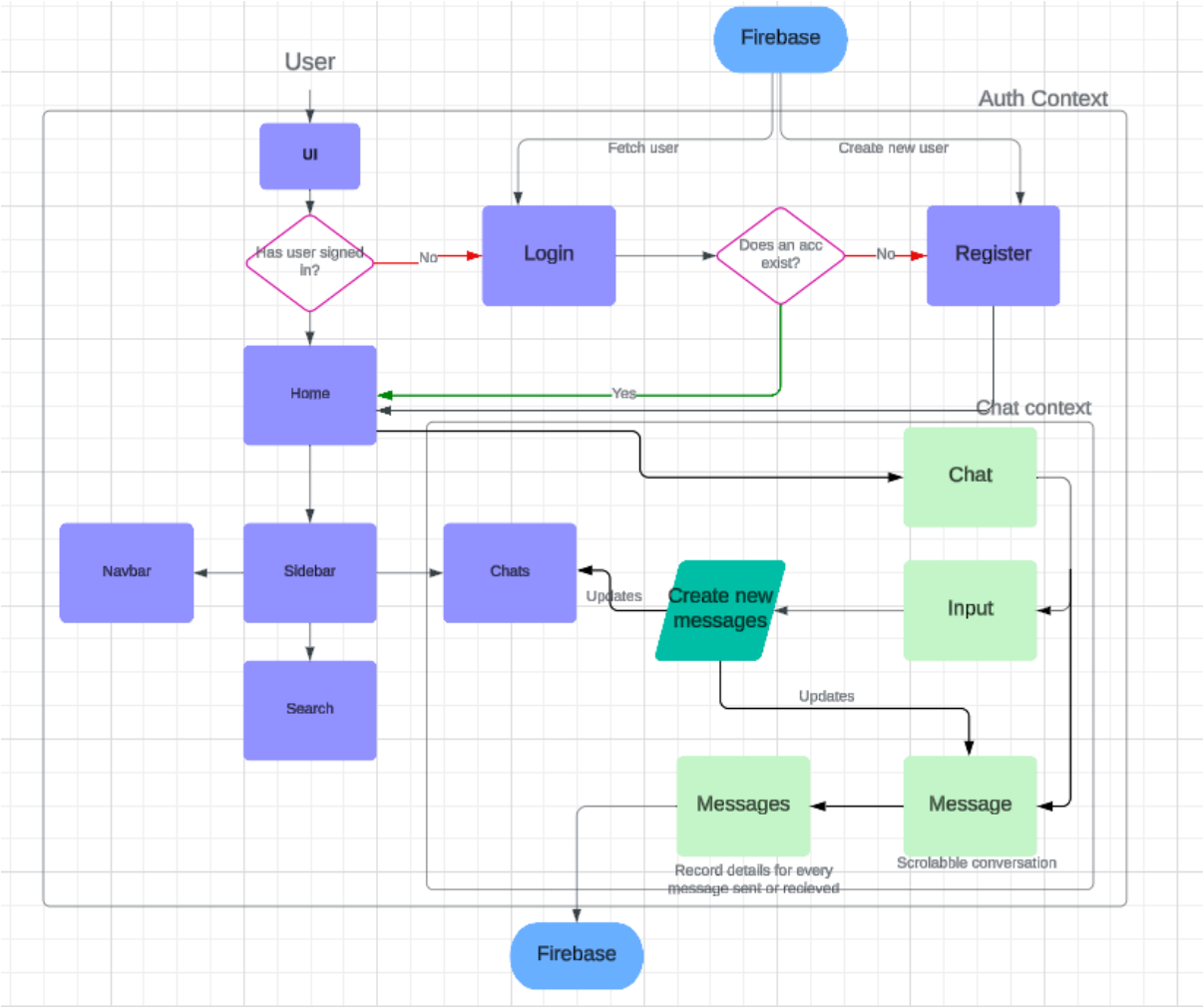
Firestore's key benefits include real-time data sync, **scalability** and seamless integration with other Firebase services. Its document-oriented NoSQL model allows for efficient, dynamic data handling.

Dependencies

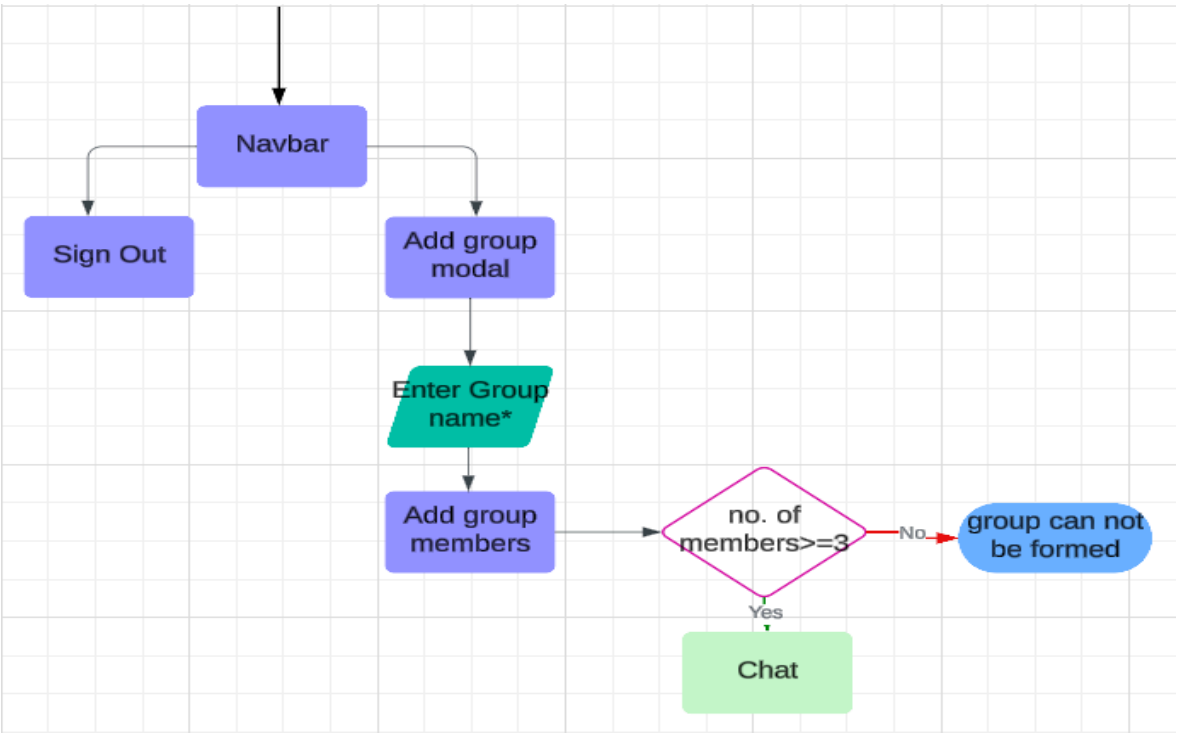
- Next.js: The server-side rendering, routing, and static page generation framework.
- Firebase: To handle user authentication, real-time data sync with Firestore, and file storage.
- React: The core React library used with Next.js.
- React-dom: For rendering React components in the browser.
- React-icons: For using icons like send, camera, and attach.
- Next-router: For client-side routing and navigation between different pages in Next.js.
- CSS: Used for styling the application.

Workflow-

Given below is the workflow of a one-to-one chat-



Continued from the above flowchart is the group chat functionality -



Use Cases

The following are some of the use cases for the messaging service app:

- A user can signup/sign in using their email and password
- A user can search for other users.
- A user can start a chat conversation with another user as well as multiple users at a time(group)
- A user can send and receive text messages in real time.

Future Developments:

The following are some of the features that are planned for future development:

- Option to attach file of any format.
- Voice and video calls.
- AI chatbot integration.
- Availability status.
- Message forwarding and deletion.
- Privacy features

Thank you

For any further assistance or queries, please contact Sohum Bansal at sohumbansal147@gmail.com