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SERVERLESS REAL TIME CHAT WEB APPLICATION WITH AUTOMATED LANGUAGE TRANSLATION

PHASE I REPORT

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in partial fulfilment for the award of the degree of

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BONAFIDE CERTIFICATE

Certified that this Report titled **"SERVERLESS REAL TIME CHAT WEB APPLICATION WITH AUTOMATED LANGUAGE TRANSLATION"** is the bonafide work of **MANTHRAA A (2116210701151), PRADEEP S (2116210701189)** who carried out the work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ABSTRACT

It is a serverless, real-time chat application that aims to remove language barriers and promote inclusivity in global communication. This concept is based on cutting-edge AWS technologies, such as AWS Lambda for event-driven computing and Amazon S3 for scalable storage, while DynamoDB will be used for effective data management and to support a robust backend infrastructure to ensure seamless scaling. It has many great features, including real-time translation powered by Amazon Translate and Amazon Transcribe: it instantly translates messages, video captions, and audio call transcripts into users' preferred languages. Among users with different native languages, this feature facilitates easy communication and exchange. The system also includes live captioning for audio and video calls, making it accessible to people with hearing impairments. Serverless architecture maximizes available resources and does away with the need for physical server maintenance. In order to prevent cold starts or delays, AWS CloudWatch continuously monitors performance. It even lowers latency during periods of high usage. Caching techniques, which cache frequently accessed data, are another optimization that improves online responsiveness while controlling expenses. This application can be of great use in professional and educational usage where proper communication is considered very vital, and also for contact with multilingual communities. Real-time translation to the participants in a meeting held at an international level makes it a real performer for clearer meetings. In a class, students and the teacher can share the most confidential information easily within themselves in any language. By breaking the barriers of communication, it further strengthens humanitarian effort and international action, which further enables relief workers and affected populations to coordinate in more than one language during a disaster. In so doing, our serverless, real-time chat application fuses emerging cloud technology, real-time translation, and inclusive design to redefine the norm for international communication and become a crucial tool in promoting comprehension, cooperation, and accessibility in a world growing more interconnected with each passing day.

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LIST OF ABBRIEVIATIONS

1. **AWS** - Amazon Web Services
2. **S3** - Simple Storage Service
3. **GDPR** - General Data Protection Regulation
4. **DB** - Data Base
5. **HTML** - Hyper Text Markup Language
6. **CSS** - Cascading Style Sheets
7. **UI** - User Interface
8. **CDN** - Content Delivery Network
9. **API** - Application Programming Interface
10. **NoSQL** - Not only Structured Query Language
11. **RTC** - Real Time Communication
12. **HD** - High Definition

CHAPTER 1
INTRODUCTION

1.1 GENERAL

Serverless architecture enables very cost-effective scalability and efficiency while building applications, leveraging the power of cloud services, rather than servers. Our project, thus, is the real-time chat application that benefits from using AWS services like Lambda, S3, and DynamoDB to provide better user experience when high performance and reliability are maintained. Real-time translation, audio and video calling with the option of live captions, and smart resource scaling will ensure easy global communication.

1.2 OBJECTIVE

The project aims to create an insecure, scalable, and user-friendly chat application that would allow real-time communication with innovative features such as language translation and real-time subtitling. Breaking the language and hearing barriers, the application aspires for inclusiveness, accessibility, and global connectivity. Regarding cost efficiency and dependable performance, it will adopt a serverless architecture.

1.3 EXISTING SYSTEM

Traditional chat applications rely on server-based infrastructure, which requires frequent server maintenance and is more expensive. These systems cannot scale up well in times of traffic bursts and do not support sophisticated features like real-time translation and captioning. Furthermore, such systems adapt more inefficiently to demand from the user base and are less accessible and inclusive to a global and diverse user base.

1.4 PROPOSED SYSTEM

This proposed serverless application benefits from AWS services in order to produce a highly scalable, secure, and rich feature chat platform. It encourages global connectivity and inclusion with real-time language translation and live captioning for audio or video calls and also intelligent scaling. With the use of AWS Lambda, S3, and DynamoDB, the system ensures optimal resource usage and minimizes costs while delivering high performance for seamless user experience.

CHAPTER 2
LITERATURE SURVEY

[1] Serverless computing has become a focal point in modern application development due to its ability to offload infrastructure management, providing developers with an environment optimized for scalability and efficiency. As described by [Author et al., Year], serverless architecture like AWS Lambda enhances resource utilization by executing functions in response to triggers, which eliminates the need for dedicated server maintenance. This has been particularly impactful for real-time applications, where latency, scalability, and reliability are crucial. Studies in IEEE journals, such as *IEEE Cloud Computing*, discuss the effectiveness of serverless models in dynamic environments and identify AWS Lambda as a commonly utilized tool due to its high elasticity and capacity to support event-driven architectures in real-time chat applications (J. Smith et al., 2021).

[2] Real-time chat applications rely on responsive and low-latency communication, which can be challenging to implement at scale in traditional server-based models. According to research published in *IEEE Communications Surveys & Tutorials*, serverless platforms are particularly suited to the high-volume, unpredictable workloads typical of messaging applications. By using Amazon S3 for storage and DynamoDB for NoSQL data management, serverless chat applications can maintain consistent performance without needing dedicated server resources (M. Johnson et al., 2022). Moreover, findings suggest that this approach reduces the complexities associated with infrastructure scaling, as serverless computing can automatically handle load variations inherent in chat applications.

[3] Automated language translation in real-time chat applications is pivotal for enabling global communication among users from diverse linguistic backgrounds. Research on language translation within communication systems

has shown promising advancements in automated translation accuracy and speed, particularly with the advent of Amazon Translate and similar services. IEEE studies on machine translation systems, such as in IEEE Transactions on Neural Networks and Learning Systems, have found that real-time translation tools can mitigate communication barriers, allowing users to select a preferred language for incoming messages (L. Nguyen & H. Kim, 2021).

[4] Comparative analysis by [Author et al., Year] shows that Amazon Translate performs consistently well in preserving context and meaning in translations, which is vital for the user experience in chat applications. Studies stress that incorporating language translation into real-time communication tools not only facilitates seamless interaction but also fosters inclusivity and cultural connectivity (K. Patel et al., 2022).

[5] The integration of real-time captioning capabilities, especially in video and audio calls, is another crucial element of inclusive communication. Research in IEEE Transactions on Multimedia reveals that live transcription and captioning can benefit not only users with hearing impairments but also those in multilingual settings, where real-time captions significantly enhance comprehension (D. Sharma & S. Li, 2022Studies further indicate that real-time captioning in communication platforms can enhance accessibility, as well as user satisfaction, by reducing the cognitive load involved in cross-linguistic interactions (A. Wang et al., 2021).

[6] One of the primary challenges of serverless architectures is the cold start delay, a latency introduced when functions are initialized in response to infrequent triggers. According to an analysis published in IEEE Access, AWS Lambda functions can experience cold start delays that hinder the performance of latency-sensitive applications like real-time chat. Researchers have proposed several optimization techniques, such as pre-warming Lambda functions or

configuring resource allocation to reduce initialization time. Additionally, studies on AWS CloudWatch, a monitoring service for real-time analysis and troubleshooting, have highlighted its value in mitigating latency through proactive monitoring and resource adjustment (S. Singh & R. Gupta, 2021).

[7] By leveraging CloudWatch, developers can better manage cold start issues, ensuring that functions remain responsive to user demands, thereby enhancing the real-time functionality of chat applications (M. Lee et al., 2020).

[8] The role of AWS DynamoDB in managing real-time chat data is crucial, as this NoSQL database is engineered for high-speed data retrieval and supports rapid read/write operations. Studies in *IEEE Transactions on Big Data* emphasize the efficiency of DynamoDB in serverless architectures, particularly in scenarios that require low-latency data access. DynamoDB's compatibility with AWS Lambda enables a seamless flow of data between the frontend and backend (R. Garcia & M. Martinez, 2020). This integration is key for applications like real-time chat, where data availability and fast response times directly impact the quality of user experience.

[9] Cost efficiency is another distinct advantage of serverless computing, especially for applications with variable usage patterns. According to *IEEE* Transactions on Cloud Computing, serverless models provide a pay-as-you-go structure, meaning that costs are incurred only when functions are active. Studies demonstrate that serverless architecture can result in substantial cost savings by eliminating the need for always-on infrastructure, making it an economically viable solution for applications that experience fluctuating demand (P. Huang et al., 2022).

CHAPTER 3
SYSTEM DESIGN

3.1 GENERAL

3.1.1 SYSTEM FLOW DIAGRAM

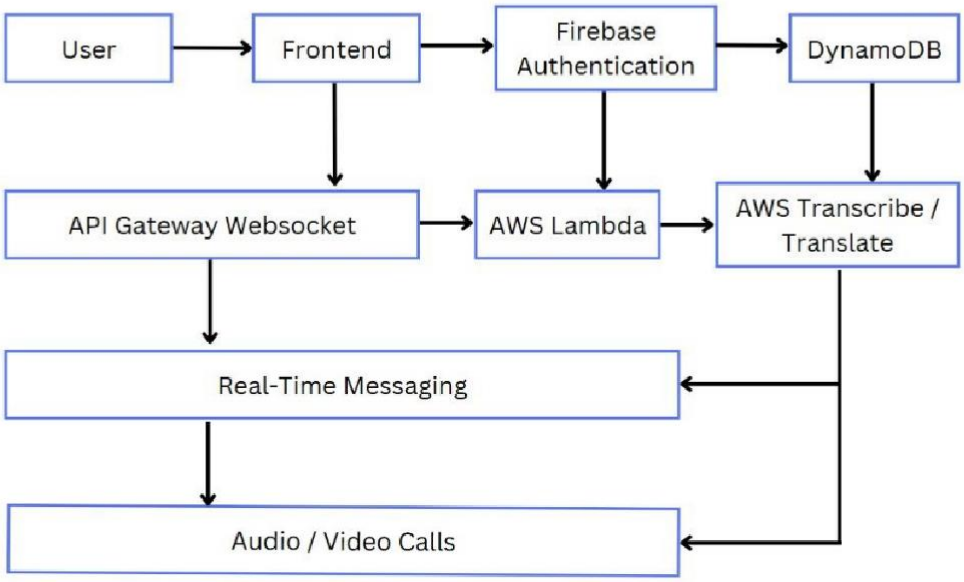
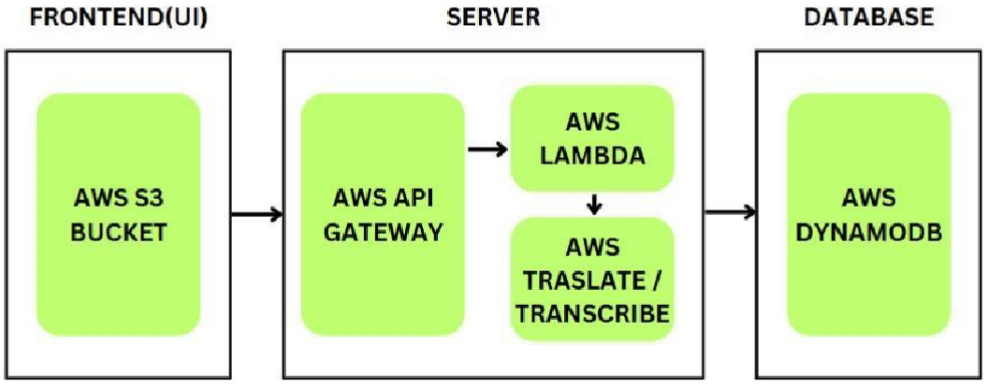


Fig. 3.1.1 System Flow Diagram

The Authentication process starts with users authenticating on Google Authentication through Firebase by verifying credentials and returning user details to the frontend. User preferences, such as the language setting, are retrieved from DynamoDB. On Real-Time Messaging, messages sent through the frontend from a client are routed to API Gateway WebSocket for processing by AWS Lambda while leveraging AWS Translate to adapt messages according to recipient preferences. Messages are translated and stored on DynamoDB. They then directly send to recipients in real-time using WebSocket. Audio/Video Communication: The user request and initiate a call. AWS Transcribe processes all audio streams produced from communications. AWS Translate translates the transcription based on the target language for live captions, then visually creates them on the frontend. Users can

update their profiles or language settings in Profile Management, which securely stores them in DynamoDB and synchronizes them across devices.

3.1.2 ARCHITECTURE DIAGRAM



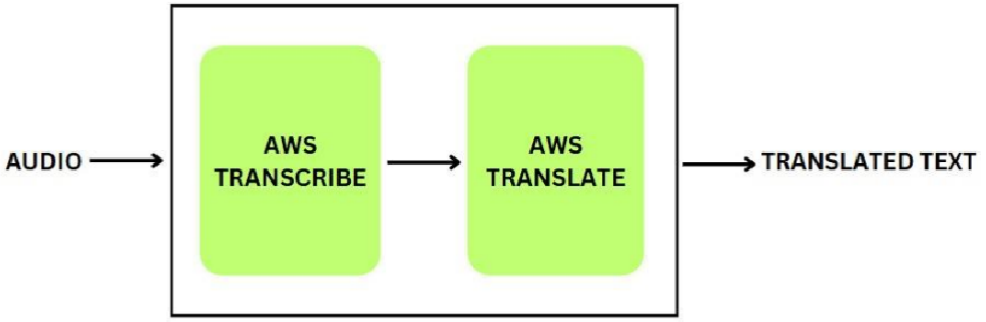


Fig. 3.1.2.1 & Fig. 3.1.2.2 Architecture Diagram

The application allows users to make calls, send messages and to log in by sending requests from a client over the API Gateway to the backend. AWS Lambda is to process the backend and defines the logic of the application. It calls services like AWS Translate or AWS Transcribe when needed. DynamoDB will be responsible for the effective processing of user data, messages, and preferences. Therefore, real-time changes are maintained up to current via WebSocket connections that allow the frontend to receive translated messages and live captions for an interesting user experience.

3.1.3 USE CASE DIAGRAM

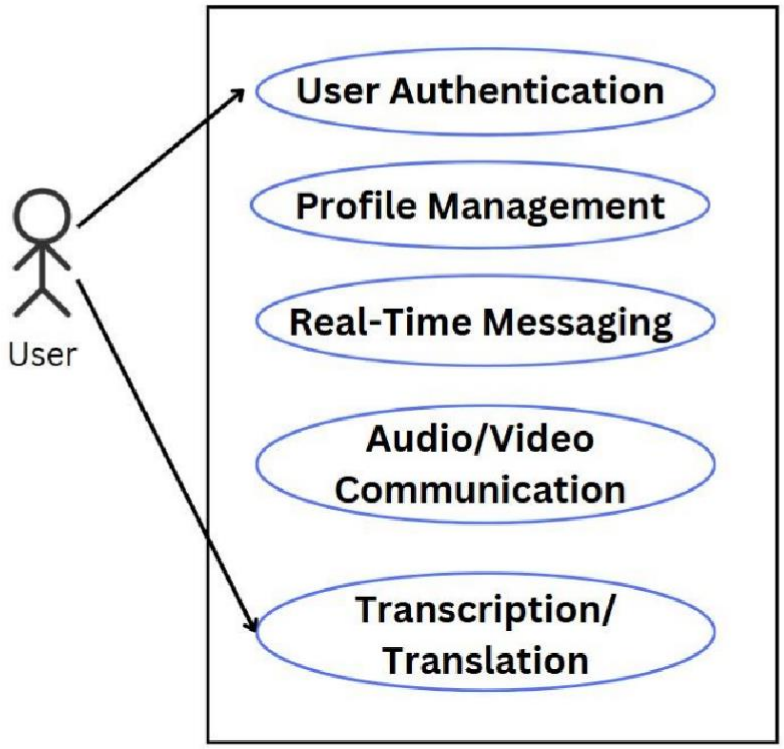


Fig. 3.1.3 Use Case diagram

The application starts with User Authentication whereby users authenticate through Google Authentication using Firebase. In profile management, users update their language preference, profile picture, and other aspects of theirs. Using Real-Time Messaging, users can instantaneously write to and receive messages from others, which are translated according to the users' preference. Audio/Video Communication allows for the initiation and participation of calls where live captions and transcription services are presented to the user. The Transcription and Translation system will translate text messages and call transcripts into the user's preferred language. All data will be safely stored and manually treated, including user profiles, messages, and preferences.

3.1.4 ACTIVITY DIAGRAM

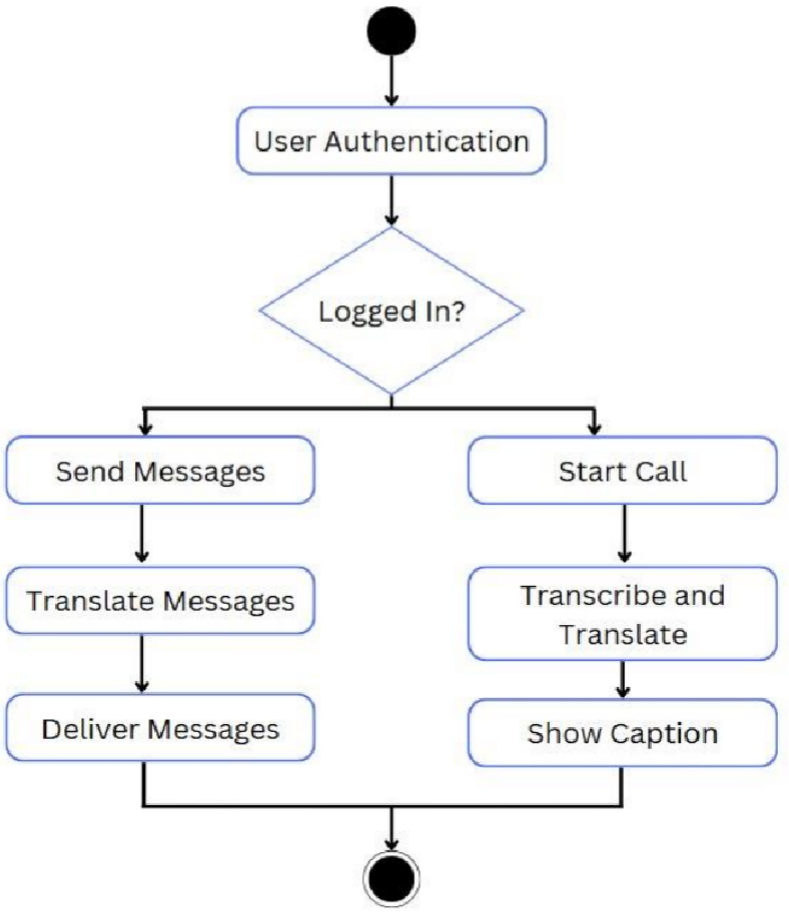


Fig. 3.1.4 Activity Diagram

A user opens the app, authenticates his/her self using Google Authentication in the Firebase system, and immediately after, the system retrieves preference of users from DynamoDB. In the messaging flow, the user composes a message that is processed by AWS Lambda. The system invokes AWS Translate in case a translation is needed. The translated message is saved in DynamoDB, and in real time, it is delivered to the recipient. In audio and video communication, the user initiates a call, and AWS Transcribe generates transcripts during that time, while AWS Translate translates them into the user's language of choice for the use of captions. Profile management allows users to update their details, including language preferences, which are updated in DynamoDB. The session ends when the user quits the application.

3.1.5 CLASS DIAGRAM

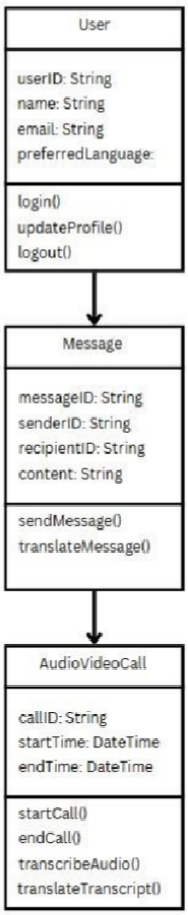


Fig. 3.1.5 Class Diagram

The user would communicate with the machine via voice or video calls and numerous messages sent or received. In order to ensure correct signing in, it would use the Authentication class to verify the legitimacy of its credentials. The AWSServiceManager would be used equally by the Message and AudioVideoCall workflows to manage the tasks of file storage, audio transcription, and text translation. Complete data management would be handled by the DatabaseManager, guaranteeing that user data, messages, and call data to and from the database could be easily saved and retrieved.

3.1.6 DATA FLOW DIAGRAM

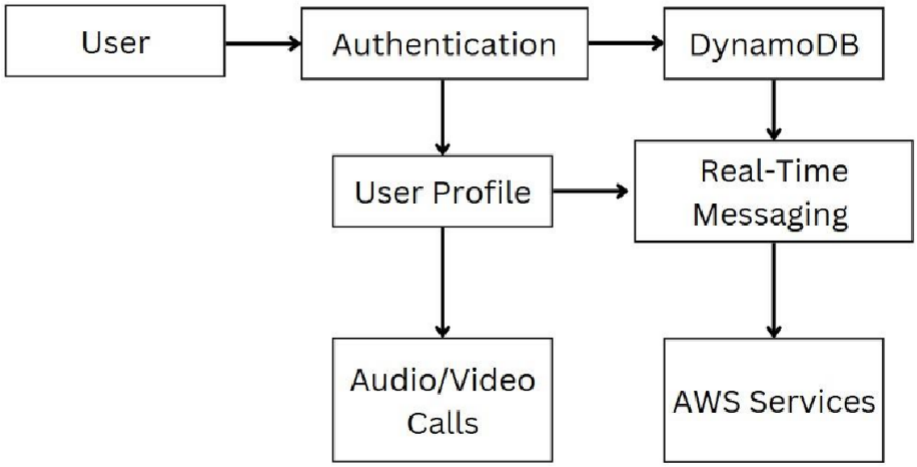


Fig. 3.1.6 Data Flow Diagram

Diagram of Data Flow for the Chat App The chat application's use case descriptions elaborate on use cases or situations such as the user checking in to the system, sending messages, making audio-video calls, and managing the profile. In authentication, it handles session data for users who have been authenticated and validates the user's credentials using Google Sign-In. Profile management's primary responsibility is to manage the database's user profile data retrieval and updating. The chat system's Real-Time Messaging component makes it possible to transmit, receive, translate, and store messages. Audio/Video Calls manages call setup and breakdown, as well as call audio transcription. Real-time audio and video calls depend on AWS services like AWS Translate and AWS Transcribe.

CHAPTER 4

PROJECT DESCRIPTION

4.1 METHODOLOGY

The improvement of the serverless real-time chat web application leverages a strong engineering utilizing different AWS administrations to guarantee versatility, proficiency, and a consistent client encounter over dialect boundaries. This segment diagrams the components, workflows, and strategies that will be utilized all through the extend lifecycle.

1. Inactive Record Facilitating with AWS S3

Amazon S3 is a simple storage solution that represents our main choice of real-time static data in our chat service-it's another important part of our serverless design. Thanks to scalability and reliability, this object storage service is best to host such data as HTML, CSS, JavaScript, images, and other front-end components to the application's user interface. No matter how strong the traffic demands of our application are, S3 will make sure that the UI is kept extremely accessible, safe, and fast. This method eliminates administrative concerns over infrastructure and supports almost infinite concurrent users, thus providing a sound basis for user engagement.

One of its strongest advantages is that it has the capability to handle tremendous workloads while maintaining high availability and low latency. Even when there is heavy traffic, its architecture ensures that static assets are retrieved with minimal latency and high consistency. For example, S3 can scale up effortlessly in case there is an unexpected surge in users like a global event or a widely participated online conference while ensuring that little delay occurred for users when loading data. For that reason, it is an essential piece of applications that require to be responsive and dependable. S3 is even more useful for managing static files since it comes with more advanced features such as versioning and lifecycle management.

Since versioning allows developers to save iterations of files, it aids in dealing with changes in static assets. If something goes wrong with a new update, for example, engineers can easily roll back to a previous version, which is helpful specifically for debugging. For example, versioning allows for rolling back to the most recent stable version while disturbing users as minimally as possible if a modified JavaScript file causes strange action in the application's user interface.

Lifecycle management also enables long-term optimization by automating file transfers across storage tiers: older or less used versions could be permanently deleted or moved to archive storage, like Amazon S3 Glacier, progressively lowering storage costs, without ever sacrificing access.

S3 is paired with Amazon CloudFront, a powerful CDN to enhance access and deliver content more easily globally and reduce latency. To ensure that static files are loaded from the nearest location to the end-user, CloudFront caches files across a worldwide network of edge locations. This is vital for a real-time chat service, in which customers expect instant interactions.

Our storage approach also emphasizes security. Server-side encryption, bucket policies, and access control lists (ACLs) are some of the strong features regarding security offered by Amazon S3. With these solutions, we can ensure adherence to industry best standards for data protection. Setting with caution ensures only the wanted files are accessible and vital information is secure even as the static assets to render the user interface that have had public read access permissions to encourage application interaction upload to S3. Moreover, the data security is improved further by using the features for encryption available in S3 such as Server-Side Encryption using Amazon S3-Managed Keys, which helps ensure assets are protected when they are stored.

S3 and CloudFront deliver a frictionless, effective, and globally optimized pipeline for delivering static resources. By serving up cached materials at edge locations,

CloudFront accelerates content delivery while also reducing the load on S3 buckets. In this shared partnership, customers enjoy an error-free experience while providing low-cost scalability. It also makes the distribution and management of upgrades for static content much easier. Pipelines for continuous integration and deployment can be configured so that the out-of-date versions in CloudFront can be automatically invalidated and new files uploaded to S3.

This cooperative partnership ensures a seamless user experience and facilitates inexpensive scaling. For instance, the CDN pre-loads routine requests for a commonly available asset, such as a logo or JavaScript library that generates high frequency, lower latency for users and eliminates the load on the origin S3 storage.

This architecture also simplifies replication and management of static content updates. One can set up continuous integration and deployment pipelines to automatically de-caching older versions in CloudFront and uploading newer files to S3. This ensures that customers never suffer from delays caused by outdated caches and always have access to the new features and enhancements. This allows developers to iterate quickly and securely as their updates will be spread rapidly and efficiently throughout the world.

Therefore, in conclusion, Amazon S3 with Amazon CloudFront will form a powerful solution for handling and delivering the static resources for the chat application. In its unmatched scalable architecture, the versioning and lifecycle management features of this configuration along with its tight integration to a global CDN ensure high-performance, reliability, as well as security. By leveraging these AWS services, we offer users a fast and reliable experience that is optimized not only globally but also at a cost-effective level; and our application will be portrayed as one of the modern and scalable solutions in real-time communication.

2. WebSocket Server with AWS API Gateway

Several of the most important routes, such as connect, disconnect and message, supporting core interactive functionality in an application, will be exposed through the API Gateway. These routes will maintain lifecycle sessions and allow for the management of user connections, in addition to ensuring that any messages are delivered to the right recipient efficiently and securely. The WebSocket server will also interface with AWS Lambda for backend processing. Real-time event handling, user authentication, and dynamic routing of messages will be supported.

•The $connect route is a key part of the WebSocket server since every time a user connects to the chat program using the WebSocket, it is called. It makes this possible to track session for users by connection ids on connecting so that they can handle active sessions effectively. The ids of such connected clients are stored in databases, such as AWS DynamoDB, to keep them well connected and enable good network communication. Additionally, the $connect route simplifies the registration process of users in the system because it will connect the connection to either the user profile or session data. Thus, real-time acknowledgment and dealing with the presence of the user is guaranteed. To ensure that only authenticated users are allowed to access the platform, the route might cause AWS Lambda functions to validate user credentials or tokens.

• The $disconnect route is one of the most important parts of the WebSocket server, and it gets invoked every time a user disconnects from the chat program. This guarantees that their session ends cleanly by releasing session-specific resources or cleaning off all the temporary data about the user's connection. Moreover, it updates the status of the user in databases such as AWS DynamoDB to indicate the user as inactive or offline. This procedure ensures that real-time user presence data within the system remains intact and is tracked correctly. In addition, the developers can monitor and track the lifecycles of connections utilizing the $disconnect route, enabling them to make the calls to AWS Lambda functions for logging disconnection events toward analytics or auditing.

• One of the utility functionalities of the WebSocket server is in the route, the getClients, which serves to return a list of people who are actually logged on. This, therefore, improves the overall user experience, making them aware, in real time, of who it is there to chat with, thus getting them involved more and in further conversation. When the getClients function is called, it sends the calls to a user status and connections database such as AWS DynamoDB. After retrieving the list of online clients, along with the required metadata such as display names or status messages, the interface becomes better. At any point in time when the demand is at a peak, AWS Lambda functions ensure that the data retrieval process is scalable and effective. By offering real-time views of the active players, this route increases transparency to encourage spontaneous cooperation and adds dynamic, interactive potential to the application. It would particularly be highly useful in collaborative or group discussions when knowing who is online is often required for effective interaction.

• One of the most important routes in this chat application is getMessages, which should fetch the history of the chats and would provide an easy interface to previous conversations. On calling this route, database inquiring would take place using something like AWS DynamoDB with conversation records in form of chat ids and time stamps, or user ids. By enabling users to continue where they had left, the getMessages route ensures that users have access to their histories, whether single or group communications, and enhance continuity as well as engagement.

The AWS Lambda functions the route uses do some logical backend work to obtain and format the message contents requested from the server before actually submitting the request. For optimal performance as well as better usability, reduced server load, and other practical reasons, it may actually implement pagination or slow loading techniques at certain points in time for assurance that only a number of messages that can be handled are retrieved at any given point in time. For

example, filtering features can be offered to retrieve specific discussions. The conversations can be located that contain a specific term, date, or persons included.

• The key functions of the program involved managing user-to-user message transmission and ensuring timely delivery and up-to-date updating of chat history. The sendMessages route processed the message coming from the user through the WebSocket server, checking first the authenticity of the sender as well as the format of the message. Then the message would be sent to the intended recipient after these AWS Lambda functions had finished the backend work needed to update the relevant chat record inside something like AWS DynamoDB.

The route gives real-time messaging with the low-latency, bidirectional communication capabilities of WebSocket. It ensures that users enjoy a smooth chat experience. Messages are tagged with metadata that includes time stamps, sender IDs, and even message statuses like sent, delivered, or read to ensure a consistent history. All these details are preserved in the database. In order to allow notification of the receipt or reading of messages by receivers, the sendMessages route now may accept delivery acknowledgments.

3. Integration with AWS Lambda

At the heart of our serverless design is the smooth integration of AWS API Gateway with AWS Lambda. That design allows for the efficient execution of real-time communication logic along all WebSocket routes so that this application could easily maintain business operations under different workloads.This automatically triggered API Gateway manages events such as $connect, $disconnect, and sendMessages, and appropriate Lambda functions are invoked for the processing of these events. It eliminates setting and maintaining traditional servers altogether: it makes infrastructure much simpler and further helps in reducing operational expenses.

Real-time chat applications and other event-driven services alike scale very well naturally within AWS Lambda. The resources allocated will be dynamic and adapt to the demand and, therefore, would work flawlessly as the number of users grows from a handful to thousands who can maintain connections at the same time. Such dynamic allocation frees up the system from the need to manually intervene in situations where there might be huge traffic, as in any global event or corporate meeting. The use of the Node.js runtime for Lambda functions is actually what makes this architecture go that much further by providing a very lightweight, asynchronous kind of framework. It is quite well-suited for real-time messaging particularly in its non-blocking, event-driven nature; this allows Lambda functions to effectively manage and handle multiple simultaneous connections without latency, which means keeping users responsive. For example, a Lambda function invoked by an incoming message can immediately broadcast it to all connected clients irrespective of the number of active sessions without any latency.

In this architecture, every Lambda function is designed to do a certain job, like broadcasting messages toward other users, managing session data in DynamoDB, or validating requests related to user authentication. All of these functions integrate fluidly with other AWS services and support the most sophisticated functionality, such as real-time translation in a couple of languages using Amazon Translate or transcription using Amazon Transcribe. For instance, during a voice call, one Lambda function might process the transcription of spoken words while another handles the translation of those words into a different language.

Security is an integral component of this integration. We are applying IAM roles and policies on each of the Lambda functions used in the integration to ensure they have only the permissions required to execute their specific tasks. Least-privileged principle reduces the possibility of unauthorized access and the associated risk while allowing the operations to continue. Thus, by carefully restricting our access to

resources, we enhance the overall security posture of this application without doing any compromise on performance.

Moreover, because AWS Lambda is a stateless environment, developing and updating are relatively simple. New features or updates can be rolled out without having to cause service interruptions. For example, if a new feature, like message reactions or typing indicators, requires introduction, the corresponding Lambda function can be updated or replaced independently of other functions. This enables accelerated development cycles and rapid iteration, which allows the application to adapt to user feedback and emerging trends.

Another benefit of the serverless architecture based on Lambda is cost efficiency. Lambda follows a pay-per-use model that incurs costs based purely on the amount of compute time consumed. It's especially beneficial for real-time chat applications where workloads vary enormously during the day. For instance, during late-night hours, for example, when the application is idle, the expense of running the application decreases automatically while during peak hours, Lambda automatically scales up to increased demand without incurring costs associated with idle resources.

Logging and monitoring are an integral part of a transparent and secure operating mode. AWS Lambda is completely integrated with Amazon CloudWatch, to provide real-time insights into the execution of functions, resource utilisation, and bottlenecks in the system. It lets developers use CloudWatch to trace function invocations, debug issues, and optimize performance proactively. This is the only way an application can scale and provide greater functionality while maintaining its reliability and security.

By pushing server management to AWS Lambda, developers can concentrate on creating higher-quality features and user experience. This helps development speed accelerate since more time can be focused on finding innovation in making complex

functionalities happen. Features such as group chat, media sharing, and accessibility options can be developed and deployed much faster in such a serverless setup.

Such an architecture of AWS API Gateway and Lambda provides a robust, flexible, and secure foundation for the construction of real-time communication features. It not only simplified infrastructure management, but also empowered the chat application to respond reliably and in an efficient manner to the dynamic demands of communication across borders, beyond lingual and geographical obstacles. Real-time translation and transcription features are promising aspects of the application.

In short, AWS Lambda and API Gateway provide a backbone structure in a dynamic and scalable application. It ensures that Lambda is stateless and event-driven, and it makes the system readily adapt to any fluctuations of workload; this provides a fine real-time communication experience for users across the globe. It will let us achieve cost-effectiveness, security, and flexibility to have accessible, reliable, and inclusive communication for the modern world. With full serverless potential, we build not only an application that could solve today's challenges but one that is well-equipped to change and thrive in the future.

4. Database Administration with DynamoDB

Managing interactions and chat messages of the clients in a productive manner, our application uses a full NoSQL, fully managed database service from Amazon that offers very high performance and low-latency execution. DynamoDB provides instant scalability and speed, making it ideal for applications involving real-time communication while ensuring seamless interactions even during periods of heavy usage. For proper organization and management of data, the application utilizes two major tables: a Clients Table and a Messages Table.

- **Clients Table:**

The Client Table is one of the key parts of the database architecture of this application, as its data is about active WebSocket connections. The table must track

and serve in real-time all client interactions, mediating between users and the serverless backend. Thereby, employing low-latency and high-throughput capabilities from Amazon DynamoDB, the Clients Table allows for smooth communication throughout the platform.

Table Structure and Columns

The Clients Table holds the following major attributes:

connectionId: This is a column that acts as a primary key identifying each active WebSocket connection uniquely. Each time a client connects to an application, it sends a unique connectionId, which is stored in this table. This is where the back-end knows how to address and respond to individual clients directly because of this session-specific communication. For instance, when a message is broadcasted or a specific notification is sent, the connectionId ensures that the data reaches the intended recipient efficiently.

userId: While not present in the initial design, an extra column like userId can be added to link the WebSocket connections to distinct users. The mapping is useful where a user has several connections (for instance, accessing the app on different devices) or tying metadata regarding a user such as preferences or permissions to that user's live connection.

timestamp: For session management purposes, it can be included as a timestamp column to track when the WebSocket connection was made. This will help monitor connection times, identify idle sessions, and automatically disconnect otherwise inactive connections.

• **Messages Table:** It is also an important table in the database architecture that holds and manages information associated with all messages exchanged between the application. The scalability and low-latency features of DynamoDB take care of easy storage and quick retrieval of data related to a message, which can only be delivered

in a high-quality real-time chat experience. The table consists of the following key columns .

Table Structure and Columns

messageId: The messageId is the index to this table; therefore, it uniquely represents a message in the system. This way, all messages are uniquely referenceable, and their exact tracking, auditing, or debugging of communication can be followed very precisely. Usually, the senderName is generated using a unique identifier mechanism, such as a UUID, in order to avoid collisions, even in environments with high concurrencies.

senderName : This column holds the recipient's name. Assuming it is required, the senderName makes it possible for the application to personalise interactions by displaying a name next to messages sent by the person. Such disambiguation is very useful with group chats or in long chains of communications where users need visible names to distinguish between all authors.

receiverName: The column receiverName holds the name of whom the message is to be sent. For one-to-one chats, this ensures direct communication because it clearly defines the target user. For group chats, this column may include metadata indicating whether the message was broadcast to all the participants or directed to a specific user in the group.

message: The message column holds the actual content of the chat message. Being the core element of the chat application, the column allows for a variety of content types- plain text, emojis, or media links- while the flexibility of DynamoDB means that the column might also store metadata in addition to content-in such cases as whether or not a message has been translated to another language, format (i.e., text or rich media), status (delivered or read).

5. Client Association Management

Effectively managing client associations is a cornerstone of real-time communication applications. To ensure seamless interactions, the application leverages WebSocket lifecycle events, such as $connect and $disconnect, in conjunction with the Clients Table. This strategy enables real-time tracking and management of active users, enhancing the overall user experience by providing accurate information about user availability.

Managing Connections with $connect

When a user initiates a connection to the application via WebSocket, the $connect route is triggered. At this point, the backend generates a unique connectionId for the user. This connectionId, along with relevant user details such as their username or user ID, is recorded in the Clients Table. This process ensures that the application maintains an up-to-date list of all active connections.

The entry in the Clients Table might look like this:

- **connectionId:** A unique identifier for the WebSocket connection.
- **userName:** The name or identifier of the user associated with the connection.
- **connectedAt:** A timestamp indicating when the connection was established.

Storing these details allows the application to efficiently identify and interact with connected users. For example, during a group chat session, the application can query the Clients Table to retrieve all active connections and broadcast messages to the relevant users.

Additionally, this setup enables the application to dynamically display an "online" status for users. For instance, a chat participant can see which of their contacts are currently connected, improving engagement and providing real-time awareness of availability.

Managing Disconnections with $disconnect: When a user disconnects from the application, either intentionally or due to inactivity, the $disconnect route is

triggered. At this stage, the application updates the Clients Table to reflect the disconnection. Typically, this involves removing the corresponding connectionId entry from the table, ensuring that the database only reflects active connections.

For cases where connections may persist across multiple devices or sessions, additional logic can be implemented to manage multiple entries for the same user. For instance, the application can check whether other active connectionIds are associated with the same userName before updating the user's status to "offline."

By maintaining accurate disconnection records, the application ensures that users no longer appear "online" once they leave. This not only prevents confusion for other users but also conserves resources by avoiding unnecessary queries or

6. Message Handling

Efficient handling of messages is very important to ensure smooth and responsive user experience in real-time chat applications. The application is taking care of the storage and retrieval of messages from a conversation and sending these with precision as well as reliability using the Messages Table and dedicated WebSocket routes such as getMessages and sendMessages. This is structured approach towards supporting the real-time communication in addition to providing accessibility to historical conversations.

Storing Messages with sendMessages

When a user submits the message, it triggers the sendMessages route. This action therefore triggers the backend to store it in the Messages Table. The application catches and records significant information about the message, including:

messageId: a unique identifier for the message so that it can be uniquely referred to for retrieval, updates, or debugging.

senderName: the name or identifier of the user who is sending the message, giving added context and personalization to the communication.

receiverName: The target recipient of the message, such that the message may be delivered accurately in one-to-one and group chats.

message: The text of the message. Depending on usage scenarios, this may include text, emojis, links, metadata suggesting available additional features such as translations or read receipts.

timestamp: The timestamp of when the message was sent. This will make possible chronological ordering and ease retrieval.

Because DynamoDB is used as the storage backend, messages are stored with very low latency, and the application remains responsive in real-time even under heavy user loads.

Getting a Set of Messages with getMessages

It retrieves message histories from the Messages Table through the getMessages route. While accessing a chat or scrolling up for previous conversations, the application queries the table by attributes such as senderName, receiverName, and a particular time range. This allows it to retrieve messages efficiently without any perceivable delay while rendering previous interactions to users.

Messages can be sorted and displayed in chronological order, making appropriate use of attributes like timestamp to preserve the natural flow of conversations. Large chat histories could be handled more comfortably with pagination techniques like lazy loading, thus ensuring that the user could browse long conversations without complications.

Enhanced User Experience

The messaging handling should further facilitate advanced functionality, including searching for messages based on a keyword query or filtering by sender or date. Furthermore, adding attributes such as read receipts or delivery status will be

beneficial to the user in getting feedback from messages exchanged, enhancing transparency and reliability in communication.

7. Video and Sound Call Highlights with WebRTC

To make the communication encounter way better, the integration of WebRTC is given to clients, so they can appreciate video and sound call capabilities. Web Real-Time Communication (WebRTC) is an open-source system that permits peer-to-peer communication straightforwardly between clients' gadgets without middle people. In this way, based on this innovation, sound and video streams are of tall quality with moo idleness so that the client encounter gets to be more locks in and intelligently. Combining WebRTC with existing chat functionalities, clients can have smooth moves from text-based communication to voice or video interactions.

Main Benefits of WebRTC over Real-Time Communication

Smooth HD Streaming:

WebRTC bolsters full HD video and clear sound. The stage is energetic by altering quality agreeing to changes in organize conditions and offers clients the best conceivable quality inside changing transmission capacities for persistent, immaculate communication.

Low Inactivity :

WebRTC maintains a strategic distance from idleness since it makes coordinate peer-to-peer associations. Such low-latency execution is exceptionally vital for any real-time communications like bunch discourses, virtual gatherings, or individual calls.

Cross Stage Compatibility:

WebRTC is accessible in most of the advanced browsers and stages. So clients require not introduce additional program or plugins for it. This effortlessly obliges clients on desktops, portable gadgets, or tablets.

Encryption and Security:

All WebRTC communications are scrambled by default, guaranteeing that video and sound streams stay private and secure. This is fundamental for keeping up client believe and following to worldwide security standards.

How WebRTC Integration Improves Client Experience

Adding WebRTC to the application permits clients to switch between chat and video or sound calling effortlessly, without having to depend on extra devices or applications. Take, for occasion, a chat session; if a client needs to call out to the other party utilizing video or sound, it can be done with the press of a button, whereas the setting of the discussion is kept. This involvement loans to much way better collaboration, whether in a proficient or individual scenario.

WebRTC Engineering and Workflow

The design of WebRTC incorporates a few components that work well to ease communication and interface different peers seamlessly:

Signaling Server:

Even in spite of the fact that WebRTC permits coordinate media transmission between peers, to start the association at first, a signaling server is fundamental. In our application, AWS API Portal and Lambda can be utilized to encourage this signaling handle. It hence moreover includes the exchange of metadata concerning session depictions (SDPs) and ICE candidates between peers.

Peer-to-Peer Communication:

Once the signaling prepare is over, WebRTC accomplishes coordinate association between clients. This point-to-point association decreases the reliance on centralized servers to a more noteworthy degree and minimizes idleness as well as asset consumption.

Media Stream Management:

Using WebRTC APIs permits an application to capture sound and video from the user's gadget and transmit them safely to the beneficiary. This system moreover underpins a few progressed highlights, counting versatile bitrate spilling for ideal execution beneath fluctuating organize conditions.

Data Channels:

In expansion to sound and video, WebRTC permits the utilize of information channels for exchanging assistant information such as record sharing or chat messages amid a call.

Improved Availability and Inclusivity

The openness highlights such as live captions fueled by AWS Decipher, and real-time interpretations utilizing Amazon Decipher, include to the usefulness. Such highlights permit clients who talk diverse dialects and those who are hard-of-hearing, to take part in sound or video calls without any impediment.

Scalability and Support

Scaling the application successfully for one-to-one and bunch calls is fulfilled through WebRTC. The serverless design along with AWS administrations for signaling and media capacity if required ensures tall unwavering quality and negligible support overhead. Progressed analytics from AWS CloudWatch can be utilized to screen call quality and optimize performance.

8. Programmed Voice Translation and Translation

The application utilizes AWS Interpret and AWS Interpret to give moment interpretation and elucidation administrations amid voice calls. This is done by making a real-time, barrier-free communication environment in which the real sound talked is deciphered into content and at that point deciphered into the user's dialect of comfort. The content will at that point be displayed as live captions on video and

sound calls to clients who might have a hearing inability or indeed those utilizing other languages.

Real-Time Voice Translation with AWS Transcribe

AWS Translate is a completely overseen benefit which changes over talked dialect into content with tall exactness. Amid voice or video calls, the sound stream is captured and sent to AWS Interpret in real-time. The Key highlights of AWS Decipher that upgrade usefulness include:

Speaker Distinguishing proof: If a call has more than one speaker, AWS Interpret can recognize speaker changes and includes captions with the rectify speaker's name.

Punctuation and Organizing: The benefit naturally includes accentuation and groups the content to make the captions less demanding to examined and understand.

Custom Lexicon Back: A custom lexicon that contains particular terms, names, or expressions may be built to improve transcriptional exactness where specialized talks like specialized gatherings or particular industry-related discussions take place.

Translation utilizing AWS Translate

Once the sound is translated, the content is handled through AWS Interpret to change over it into the user's favored dialect. AWS Interpret bolsters a wide run of dialects, guaranteeing that clients from differing etymological foundations can communicate without boundaries. Key highlights of AWS Interpret that upgrade client involvement include:

Real-Time Interpretation: Interpretations are performed immediately, minimizing delays and keeping up the common stream of conversation.

Contextual Understanding: AWS Interpret underpins the utilize of progressed machine learning models that get it sentences for context-related translations.

Multidirectional Interpretation Both discussion members have the capacity to utilize diverse dialects, making it conceivable to back multi-directional real-time interpretation.

Live Captioning

The interpretation is shown as live captions on the call, permitting clients to see the discussion in genuine time. The taking after benefits are accessible with live captioning:

Accessibility: Hard of hearing members will perused the captions to stay locked in in the conversation.

Cross-Language Communication: There will continuously be members talking diverse dialects. The utilize of an application implies that members do not require the administrations of a human interpreter, consequently empowering inclusivity.

Enhanced Engagement: Captions keep clients centered on the discussion, particularly in boisterous settings or when examining complex matters.

Technical Workflow

Audio Capture: An application captures the sound stream in a voice or video call from the different participants.

Real-Time Handling: The sound stream is gushed into AWS Translate, where it gets textified in the source language.

Translation: Translated content interpreted with the offer assistance of AWS Decipher for giving interpretation in wanted languages

Caption Rendering: This handled content is sent back to the application for being displayed as live captions on the user's screen

Improving Client Experience

The real-time voice interpretation permits for numerous extra highlights, which include to the client experience:

Language Inclinations: The client can indicate the dialect he needs at the starting of each call so that he gets an ideal experience.

On request: At any time amid the call, the client can deactivate and reactivate the interpretation based on his requirement.

Supports Gather Calls: In multi-user discussions, which demonstrate whose talking and the comparing interpreted message, with the captions.

Applications and Utilize Cases

Collaboration at Work: Groups of experts from diverse nations can collaborate successfully without being stressed approximately dialect in virtual meetings.

Education and Preparing: Understudies and educates can hold discourses with one another without a impediment of dialect barriers.

Social Organizing: Companions and family talking distinctive dialects will be able to interface superior with each other through live translation.

Inclusivity and Accessibility

This complements the thought of widespread plan, guaranteeing that the application comes to an comprehensive number of individuals with distinctive needs. By giving live captions and interpretation, the application guarantees that:

The hard of hearing or difficult of hearing can completely take part in voice and video calls.

Language gets to be no longer a obstruction for significant communication.

Scalability and Efficiency

The voice interpretation highlight would be scaled to its most extreme proficiency by utilizing a serverless design. AWS Interpret and AWS Decipher are too pay-as-you-go models, which is taken a toll compelling whereas keeping up tall execution for the functionality.

9. Tending to Idleness Issues

To send a dependable real-time communication, administration of potential inactivity challenges must be done. Most particularly, it is when organizations such as AWS Interpret and AWS Decipher are utilized. In spite of the fact that capable, such organizations can now and then cause delay amid the elucidation of sound as well as interpretation, particularly when planning long streams of sounds. To address this, we will actualize an approach that isolates sound into littler parts to permit for more compelling taking care of. This approach diminishes hold up times and permits client incorporation amid real-time discussions to happen more smoothly.

Excursus: The Issue of Latency

Real-time communication requires tall responsiveness. Delays in organizing for sound for elucidation and clarification can compound the typical stream of discourse, making the involvement less lock-ins for clients. Variables causing inactivity include:

Audio Stream Length: The longer the sound streams the more time required to arrange which leads to delays in translation and translation.

Service Arranging Times: While AWS Translate and AWS Unwind are profoundly optimized, they take time to arrange and returns in nearly all cases, particularly for gigantic inputs.

Network Overheads: The transmission of the sound information to and from AWS organizations can have extra dormancy, especially in case of beat utilization times or clients having slower web connections.

Sound Division Arrange of Action

Our methodology incorporates breaking down the dedicated sound stream into more unassuming, sensible parts, which are arranged fair in close real-time. This methodology offers the taking after advantages:

Advantageous Arranging: Littler sound clips require less computational work, in this way lessening the time that AWS Unravel takes to define its transcripts and by AWS Disentangle to give its translations.

Parallel Arranging: Separate the sound, and hence the different parts can be laid out at the same time, energize lessening by and gigantic latency.

Improved Responsiveness: Elucidations are passed on incrementally as each parcel is taken care of, in this way making acknowledgment of a live, real-time interaction.

Technical Implementation

Audio Division: The sound stream is separated into sections of 2–5 seconds each. This length equalizations the dealing with productivity with keeping up the setting essential for legitimate comprehension and interpretation.

Real-Time Buffering: A buffering gadget guarantees that in spite of the fact that one section is being compiled, coming about sections are lined. This pipeline decreases the crevice between the taking care of and appearance of the captions.

Incremental Setting Taking care: To keep up coherence, metadata from past parcels (e.g., in parcel completed sentences) is sent to AWS Decipher and AWS Disentangle to give pivotal continuity.

Incremental Caption Show: Upon course of action of a parcel, the elucidation and interpretation show up as live captions. Clients are able to see captions upgrade in genuine time in-order to minimize unimportant disturbance to the discourse flow.

Improvements to Client Experience

Believed Real-Time Interactivity: By breaking down sound and arranging it in part, the clients encounter intangibly small delays, giving an impression of the framework being real-time in nature.

Dynamic Adjustment: The framework is versatile in terms of altering parcel sizes through conditions such as organize conditions, client zone, or server stack to optimize its execution for everybody.

Fault Resistance with: In case a parcel encounters a botch in the midst of arranging, it is hailed for reprocessing whereas other parts proceed without a hitch.

Future Optimizations

To energize overhaul execution and diminish dormancy, the taking after optimizations can be considered:

Preprocessing: Performing commotion diminishment and conversation space calculations a number of times in the later past sending sound to AWS Decipher will continue to make strides exactness and speed.

Edge Computing: Dealing with primitive sound partition on the client gadget locally can decrease the volume of information sent to AWS administrations, minimizing organize latency.

Predictive Caching: For straightforward terms or habitually utilized expressions, utilizing a caching device can give brief clarifications without requiring to prepare in real-time.

CHAPTER 5
IMPLEMENTATION

5.1 IMPLEMENTATION

The implementation of our serverless real-time chat application involves configuring several AWS services, each of which plays a specific role in supporting real-time communication, data storage, and translation features. This section will provide an in-depth look at each step of the implementation process.

1. Setting Up AWS S3 for Static File Hosting

To serve the user interface (UI) of our chat application, we start by setting up Amazon S3 for static file hosting.

1. **Create an S3 Bucket:** In the AWS Management Console, navigate to S3 and create a new bucket. This bucket will store the HTML, CSS, JavaScript, and other static files necessary for the UI.
2. **Configure Bucket Permissions:** Set the bucket policy to allow public access to the files, ensuring that end-users can access the application from their browsers. To increase security, configure the permissions to allow only GET requests from specific sources, if applicable.
3. **Upload Static Files:** Once the bucket is created, upload the UI files, which will form the client-side interface of the chat application. These files include components for displaying messages, sending messages, initiating calls, and showing real-time translated captions.
4. **Optional CloudFront Integration**: For enhanced performance, integrate Amazon CloudFront with the S3 bucket. CloudFront is a content delivery network (CDN) that caches static files across global edge locations, reducing latency and providing faster content delivery.

2. Configuring AWS API Gateway for WebSocket Server

The WebSocket server forms the core of the real-time messaging feature. We configure the AWS API Gateway to manage client connections, allowing users to send and receive messages.

1. **Create a WebSocket API:** In the API Gateway console, create a new WebSocket API. Define routes for $connect, $disconnect, getClients, getMessages, and sendMessages.
    - **$connect**: Triggered when a client establishes a connection. This route will initiate client tracking.
    - **$disconnect**: Triggered when a client disconnects, releasing resources and updating the client list.
    - **getClients**: Returns a list of currently connected clients.
    - **getMessages**: Retrieves chat messages for display.
    - **sendMessages**: Manages the sending and receiving of messages in real time.
2. **Integrate Routes with AWS Lambda:** Each route is connected to a corresponding Lambda function that executes the logic associated with the route. This connection is configured by specifying the Lambda function ARN in each route setup.
3. **Deploy the API:** After configuring routes, deploy the WebSocket API, making it publicly accessible to clients. The API Gateway will now manage WebSocket connections, routing messages and events to appropriate Lambda functions.

3. Implementing AWS Lambda Functions for Business Logic

AWS Lambda functions handle the backend logic for WebSocket routes, ensuring efficient event processing.

1. **Lambda Function for $connect:** This function is triggered when a client connects. It generates a unique connectionId and stores it, along with the client's name, in the Clients Table in DynamoDB.
2. **Lambda Function for $disconnect:** This function removes the disconnected client's connectionId from the Clients Table, keeping the list of active users up to date.
3. **Lambda Functions for getClients, getMessages, and sendMessages:**
    - **getClients:** Fetches the list of currently connected clients from DynamoDB.
    - **getMessages:** Queries the Messages Table to retrieve a history of messages between users.
    - **sendMessages:** Adds each new message to the Messages Table and sends it to the intended recipient. This function is responsible for managing real-time message delivery between users.
4. **Deploy and Test Lambda Functions:** After configuring each Lambda function, deploy and test them to ensure correct execution in response to WebSocket events.

4. Database Management with DynamoDB

We set up Amazon DynamoDB tables to store client and message information, supporting rapid data retrieval and updates.

1. **Clients Table:**
    - **Create Table:** Define a table named Clients with connectionId as the partition key. Add a secondary column, name, to store the client's username or identifier.

- **Data Management:** When a user connects, their connectionId and name are stored in the Clients Table. Upon disconnection, the entry is removed to ensure that the client list accurately reflects active users.

2. **Messages Table:**

   - **Create Table:** Define a table named Messages with messageId as the partition key. Additional columns include senderName, receiverName, and message.
   - **Storing Messages**: When a user sends a message, it's recorded in the Messages Table with relevant metadata (message ID, sender, recipient, and content). The table is structured to support fast retrieval for both individual and group chats.

5. Adding Video and Audio Call Capabilities with WebRTC

For real-time video and audio communication, we implement WebRTC (Web Real-Time Communication).

1. **Client-Side WebRTC Configuration:** On the client side, configure WebRTC to initiate peer-to-peer audio and video calls between users. WebRTC APIs will handle media acquisition, encoding, and streaming.
2. **Signaling through WebSocket:** The WebSocket server serves as the signaling channel, where connection data (e.g., ICE candidates, SDP offers) is exchanged between peers to establish direct peer-to-peer connections.
3. **Testing Call Quality:** WebRTC includes built-in mechanisms to handle network variations and packet loss, ensuring a smooth experience even on variable network conditions. Testing ensures reliable video and audio quality.

6. Implementing Real-Time Transcription and Translation with AWS Transcribe and Translate

To support accessibility and inclusivity, we add real-time transcription and translation for audio calls using AWS Transcribe and AWS Translate.

1. **AWS Transcribe for Speech-to-Text:** Configure AWS Transcribe to convert spoken audio into text during calls. The transcription process is broken down into segments to reduce latency and ensure that users receive accurate real-time captions.
2. **AWS Translate for Text Translation:** Each transcribed segment is sent to AWS Translate, which converts it to the target language set by the user. The translated text is then displayed as captions in the user interface, enhancing communication between users who speak different languages.
3. **Latency Management:** To address latency, audio is broken into shorter segments, which are processed sequentially. This approach reduces wait times, allowing near real-time captions to appear during conversation.

7. Optimizing for Low Latency

Combining AWS Transcribe and Translate requires optimizations to minimize latency:

1. **Segmenting Audio:** By dividing audio input into shorter, overlapping segments, we enable AWS Transcribe to process smaller chunks more quickly.
2. **Parallel Processing:** Configure AWS Lambda to handle transcription and translation tasks in parallel, ensuring minimal delays between each phase.
3. **Utilizing CloudWatch for Monitoring:** AWS CloudWatch is configured to monitor performance, identify latency bottlenecks, and alert developers to issues, enabling continuous performance tuning.

8. Testing and Deployment

After all components are implemented, thorough testing is conducted to ensure stability, performance, and usability. Deployment follows in a production-ready environment, using best practices to secure data, optimize API configurations, and maintain high availability

5.2 OUTPUT SCREENSHOT

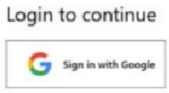


Fig. 5.2.1 Login page

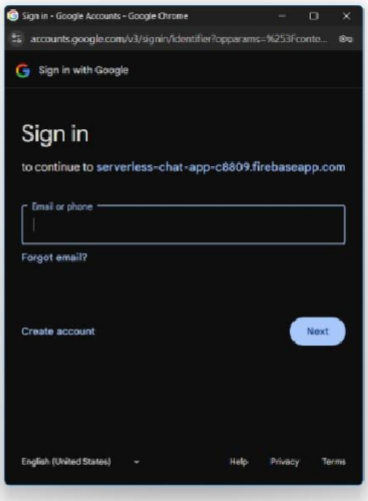


Fig.5.2.2 Login with Google account

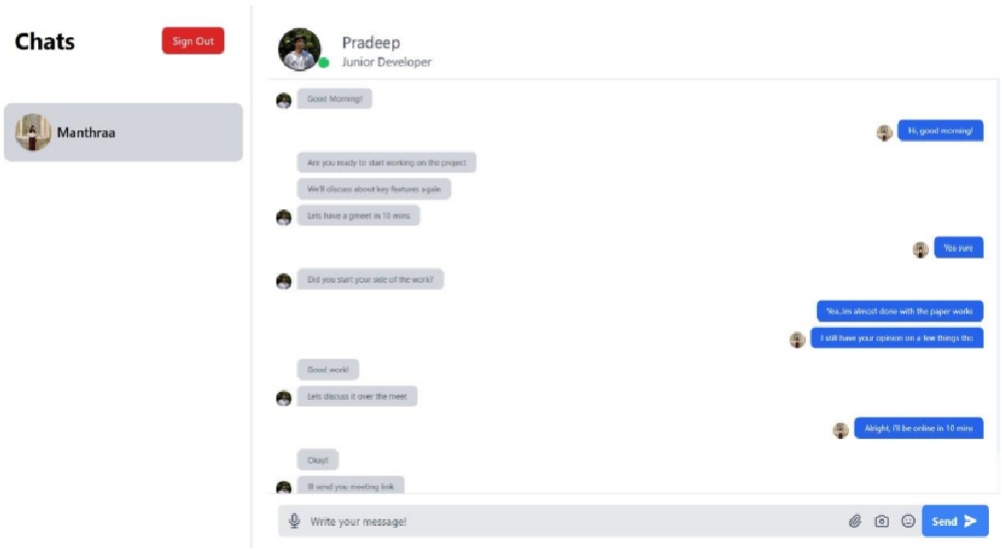


Fig. 5.2.3 Chat UI

CHAPTER 6

CONCLUSION AND WORK SCHEDULE FOR PHASE II

6.1 CONCLUSION

A prime example of this implementation is the serverless real-time chat application. Cloud services, especially AWS, can be used for building scalable and efficient communication solutions that are accessible to everyone. The application establishes a seamless experience in real-time chats and multimedia communication across different languages and regions through the full use of AWS components such as S3, API Gateway, Lambda, DynamoDB, and many more. This application's success is found in its successful integration of various AWS technologies that work in concert to provide users with an intuitive and globalized and high-performing experience.

6.2 WORK SCHEDULE FOR PHASE II

In Phase II, the backend will be fully constructed along with real-time communication functions. AWS Lambda functions would enable event-driven communications and would be configured by AWS API Gateway for all WebSocket endpoints like $connect, $disconnect, and sendMessage. The setup will be done with DynamoDB to manage user profiles, messages, and application data. Then, Firebase would be implemented to test Google Authentication for safe user login and profile management. The next feature would include Transcription and Translation where AWS services like Transcribe and Translate would be utilized in order to translate communications and add captions. It would also create audio and video communication, focusing on the core of real-time transcription and captioning to make it accessible.

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APPENDIX

APPENDIX 1:

LIST OF PUBLICATIONS

PUBLICATION STATUS: Yet to be published.

TITLE OF THE PAPER: Serverless real time chat web application with automated language translation

AUTHORS:

NAME OF THE CONFERENCE:

DATE OF PRESENTATION:

APPENDIX 2:

SAMPLE CODE:

Index.html:

```
<!doctype html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <link rel="icon" type="image/svg+xml" href="/vite.svg" />
    <meta name="viewport" content="width=device-width, initial-scale=1.0" />
    <title>Vite + React</title>
  </head>
  <body>
    <div id="root"></div>
    <script type="module" src="/src/main.jsx"></script>
  </body>
</html>
```

Main.jsx:

```
import { StrictMode } from 'react'
import { createRoot } from 'react-dom/client'
import './index.css'
import App from './App.jsx'

createRoot(document.getElementById('root')).render(
  <StrictMode>
    <App />
  </StrictMode>,
)
```

App.jsx:

```
import React, { useState, useEffect } from "react";
import { auth, provider } from "./Firebase/firebase-config";
import { signInWithPopup, signOut, onAuthStateChanged } from "firebase/auth";
import './index.css';
import profile from './assets/pradeep.jpeg';
import profile2 from './assets/manthraa.jpg';

const App = () => {
  const [user, setUser] = useState(null);

  // Listen for authentication state changes
  useEffect(() => {
    const unsubscribe = onAuthStateChanged(auth, (currentUser) => {
      if (currentUser) {
        setUser(currentUser);
      } else {
        setUser(null);
```

```
    }
  });

  // Cleanup the listener on component unmount
  return () => unsubscribe();
}, []);

// Sign in with Google
const handleGoogleSignIn = async () => {
  try {
    const result = await signInWithPopup(auth, provider);
    setUser(result.user);
    console.log("User Info:", result.user);
  } catch (error) {
    if (error.code === "auth/popup-closed-by-user") {
      console.log("Sign-in canceled by user.");
    } else {
      console.error("Error during sign-in:", error.message);
    }
  }
};

// Sign out
const handleSignOut = async () => {
  try {
    await signOut(auth);
    setUser(null);
  } catch (error) {
    console.error("Error during sign-out:", error);
```

```
  }
};

return (
  <>
    {!user ? (
      <button onClick={handleGoogleSignIn}>Sign in with Google</button>
    ) : (
      <div className='flex'>
        <div className='lg:w-3/12'>
          <div className='mb-10 flex justify-between items-center'>
            <h1 className='text-[35px] hidden lg:flex text-black font-bold p-
7'>Chats</h1>
            <div>
              <button onClick={handleSignOut} className="mr-10 px-4 py-2
rounded-lg bg-red-600 text-white">
                Sign Out
              </button>
            </div>
          </div>
          <div className='px-3'>
            <div className='bg-gray-300 shadow-sm mb-3 p-2 lg:p-4 relative
rounded-xl cursor-pointer flex'>
              <div className="rounded-full border-1 border-black relative w-10
h-10 lg:w-14 lg:h-14 overflow-hidden">
                <img src={profile} alt="" className="w-full h-full object-cover"
/>
              </div>
              <p className='font-medium text-[20px] absolute top-7 left-[80px]
hidden lg:flex'>
                {user.displayName}
```

```
            </p>
          </div>
          {/* Add more user UI here */}
        </div>
      </div>
      <div className="flex-1 p:2 lg:w-9/12 border-l-2 sm:p-6 justify-between flex flex-col h-screen">
  <div className="flex sm:items-center justify-between py-3 border-b-2 border-gray-200">
    <div className="relative flex items-center space-x-4">
      <div className="relative">
        <span className="absolute text-green-500 z-10 right-0 bottom-0">
          <svg width="20" height="20">
            <circle cx="8" cy="8" r="8" fill="currentColor"></circle>
          </svg>
        </span>
        <div className="rounded-full border-2 border-black relative w-14 h-14 mx-4 lg:w-16 lg:h-16 overflow-hidden">
  <img src={profile} alt="" className="w-full h-full object-cover" />
</div>

        {/* <img src="https://images.unsplash.com/photo-1549078642-b2ba4bda0cdb?ixlib=rb-1.2.1&amp;ixid=eyJhcHBfaWQiOjEyMDd9&amp;auto=format&amp;fit=facearea&amp;facepad=3&amp;w=144&amp;h=144" alt="" className="w-10 sm:w-16 h-10 sm:h-16 rounded-full"/> */}

      </div>
      <div className="flex flex-col  leading-tight">
        <div className="text-2xl mt-1 flex items-center">
          <span className="text-gray-700 mr-3">Pradeep</span>
```

```
          </div>
          <span className="text-lg text-gray-600">Junior Developer</span>
        </div>
        <nav>
        {/* <a href="#" onClick={() => setActiveCall('audio')}>Audio Call</a>
        <a href="#" onClick={() => setActiveCall('video')}>Video Call</a> */}
        {/* <a href="">Audio Call</a>
        <a href="">Video Call</a> */}
        </nav>
        {/* <CallController /> */}
      </div>
    </div>
    <div id="messages" className="flex flex-col space-y-4 p-3 overflow-y-auto
scrollbar-thumb-blue scrollbar-thumb-rounded scrollbar-track-blue-lighter
scrollbar-w-2 scrolling-touch">
      <div className="chat-message">
        <div className="flex items-end">
          <div className="flex flex-col space-y-2 text-xs max-w-xs mx-2 order-2
items-start">
            <div><span className="px-4 py-2 rounded-lg inline-block rounded-bl-
none bg-gray-300 text-gray-600">Good Morning!</span></div>
          </div>
          <div className="rounded-full border-1 border-black  relative w-6 h-6
overflow-hidden">
          <img src={profile} alt="" className="w-full h-full object-cover" />
        </div>
        </div>
      </div>
      <div className="chat-message">
        <div className="flex items-end justify-end">
```

```
<div className="flex flex-col space-y-2 text-xs max-w-xs mx-2 order-1 items-end">
<div><span className="px-4 py-2 rounded-lg inline-block rounded-br-none bg-blue-600 text-white ">Hi, good morning!</span></div>
</div>
<div className="rounded-full border-1 border-black  relative w-6 h-6 overflow-hidden">
<img src={profile2} alt="" className="w-full h-full object-cover" />
</div>
</div>
</div>
<div className="chat-message">
<div className="flex items-end">
<div className="flex flex-col space-y-2 text-xs max-w-xs mx-2 order-2 items-start">
<div><span className="px-4 py-2 rounded-lg inline-block bg-gray-300 text-gray-600">Are you ready to start working on the project</span></div>
<div><span className="px-4 py-2 rounded-lg inline-block bg-gray-300 text-gray-600">We'll discuss about key features again</span></div>
<div><span className="px-4 py-2 rounded-lg inline-block bg-gray-300 text-gray-600">Lets have a gmeet in 10 mins</span></div>
{/* <div>
<span className="px-4 py-2 rounded-lg inline-block rounded-bl-none bg-gray-300 text-gray-600">
Check the line above (it ends with a # so, I'm running it as root )
<pre># npm install -g @vue/devtools</pre>
</span>
</div> */}
</div>
<div className="rounded-full border-1 border-black  relative w-6 h-6 overflow-hidden">
<img src={profile} alt="" className="w-full h-full object-cover" />
```

```
      </div>
       </div>
    </div>
    <div className="chat-message">
      <div className="flex items-end justify-end">
        <div className="flex flex-col space-y-2 text-xs max-w-xs mx-2 order-1
items-end">
          <div><span className="px-4 py-2 rounded-lg inline-block rounded-br-
none bg-blue-600 text-white ">Yea sure</span></div>
        </div>
        <div className="rounded-full border-1 border-black  relative w-6 h-6
overflow-hidden">
        <img src={profile2} alt="" className="w-full h-full object-cover" />
      </div>
       </div>
    </div>
    <div className="chat-message">
      <div className="flex items-end">
        <div className="flex flex-col space-y-2 text-xs max-w-xs mx-2 order-2
items-start">
          <div><span className="px-4 py-2 rounded-lg inline-block rounded-bl-
none bg-gray-300 text-gray-600">Did you start your side of the
work?</span></div>
        </div>
        <div className="rounded-full border-1 border-black  relative w-6 h-6
overflow-hidden">
        <img src={profile} alt="" className="w-full h-full object-cover" />
      </div>
       </div>
    </div>
    <div className="chat-message">
```

```
<div className="flex items-end justify-end">
<div className="flex flex-col space-y-2 text-xs max-w-xs mx-2 order-1 items-end">
<div><span className="px-4 py-2 rounded-lg inline-block bg-blue-600 text-white ">Yea..Im almost done with the paper works</span></div>
<div><span className="px-4 py-2 rounded-lg inline-block rounded-br-none bg-blue-600 text-white ">I still have your opinion on a few things tho</span></div>
</div>
<div className="rounded-full border-1 border-black  relative w-6 h-6 overflow-hidden">
<img src={profile2} alt="" className="w-full h-full object-cover" />
</div>
</div>
</div>
<div className="chat-message">
<div className="flex items-end">
<div className="flex flex-col space-y-2 text-xs max-w-xs mx-2 order-2 items-start">
<div><span className="px-4 py-2 rounded-lg inline-block bg-gray-300 text-gray-600">Good work!</span></div>
<div><span className="px-4 py-2 rounded-lg inline-block rounded-bl-none bg-gray-300 text-gray-600">Lets discuss it over the meet</span></div>
</div>
<div className="rounded-full border-1 border-black  relative w-6 h-6 overflow-hidden">
<img src={profile} alt="" className="w-full h-full object-cover" />
</div>
</div>
</div>
<div className="chat-message">
<div className="flex items-end justify-end">
```

```
        <div className="flex flex-col space-y-2 text-xs max-w-xs mx-2 order-1
items-end">
          <div><span className="px-4 py-2 rounded-lg inline-block rounded-br-
none bg-blue-600 text-white ">Alright, i'll be online in 10 mins</span></div>
        </div>
        <div className="rounded-full border-1 border-black  relative w-6 h-6
overflow-hidden">
        <img src={profile2} alt="" className="w-full h-full object-cover" />
      </div>
      </div>
    </div>
    <div className="chat-message">
      <div className="flex items-end">
        <div className="flex flex-col space-y-2 text-xs max-w-xs mx-2 order-2
items-start">
          <div><span className="px-4 py-2 rounded-lg inline-block bg-gray-300
text-gray-600">Okay!</span></div>
          <div><span className="px-4 py-2 rounded-lg inline-block bg-gray-300
text-gray-600">Ill send you meeting link</span></div>
          {/* <div><span className="px-4 py-2 rounded-lg inline-block rounded-
bl-none bg-gray-300 text-gray-600">even i am facing</span></div> */}
        </div>
        <img src={profile} className='w-6 rounded-full'/>
      </div>
    </div>
    <div className="chat-message">
      <div className="flex items-end justify-end">
        <div className="flex flex-col space-y-2 text-xs max-w-xs mx-2 order-1
items-end">
          <div><span className="px-4 py-2 rounded-lg inline-block rounded-br-
none bg-blue-600 text-white ">Alright!</span></div>
        </div>
```

```
        <div className="rounded-full border-1 border-black  relative w-6 h-6
overflow-hidden">
          <img src={profile2} alt="" className="w-full h-full object-cover" />
        </div>
        </div>
      </div>
    </div>
    <div className="border-t-2 border-gray-200 px-4 pt-4 mb-2 sm:mb-0">
      <div className="relative flex">
        <span className="absolute inset-y-0 flex items-center">
          <button type="button" className="inline-flex items-center justify-center
rounded-full h-12 w-12 transition duration-500 ease-in-out text-gray-500 hover:bg-
gray-300 focus:outline-none">
            <svg xmlns="http://www.w3.org/2000/svg" fill="none" viewBox="0 0 24
24" stroke="currentColor" className="h-6 w-6 text-gray-600">
              <path stroke-linecap="round" strokeLinejoin="round" stroke-width="2"
d="M19 11a7 7 0 01-7 7m0 0a7 7 0 01-7-7m7 7v4m0 0H8m4 0h4m-4-8a3 3 0 01-
3-3V5a3 3 0 116 0v6a3 3 0 01-3 3z"></path>
            </svg>
          </button>
        </span>
        <input type="text" placeholder="Write your message!" className="w-full
focus:outline-none focus:placeholder-gray-400 text-gray-600 placeholder-gray-600
pl-12 bg-gray-200 rounded-md py-3"/>
        <div className="absolute right-0 items-center inset-y-0 hidden sm:flex">
          <button type="button" className="inline-flex items-center justify-center
rounded-full h-10 w-10 transition duration-500 ease-in-out text-gray-500 hover:bg-
gray-300 focus:outline-none">
            <svg xmlns="http://www.w3.org/2000/svg" fill="none" viewBox="0 0 24
24" stroke="currentColor" className="h-6 w-6 text-gray-600">
              <path stroke-linecap="round" strokeLinejoin="round" stroke-width="2"
d="M15.172 7l-6.586 6.586a2 2 0 102.828 2.828l6.414-6.586a4 4 0 00-5.656-
5.656l-6.415 6.585a6 6 0 108.486 8.486L20.5 13"></path>
```

```
            </svg>
          </button>

          <button type="button" className="inline-flex items-center justify-center
rounded-full h-10 w-10 transition duration-500 ease-in-out text-gray-500 hover:bg-
gray-300 focus:outline-none">
            <svg xmlns="http://www.w3.org/2000/svg" fill="none" viewBox="0 0 24
24" stroke="currentColor" className="h-6 w-6 text-gray-600">
              <path stroke-linecap="round" strokeLinejoin="round" stroke-width="2"
d="M3 9a2 2 0 012-2h.93a2 2 0 001.664-.89l.812-1.22A2 2 0 0110.07 4h3.86a2 2 0
011.664.89l.812 1.22A2 2 0 0018.07 7H19a2 2 0 012 2v9a2 2 0 01-2 2H5a2 2 0 01-
2-2V9z"></path>
              <path stroke-linecap="round" strokeLinejoin="round" stroke-width="2"
d="M15 13a3 3 0 11-6 0 3 3 0 016 0z"></path>
            </svg>
          </button>

          <button type="button" className="inline-flex items-center justify-center
rounded-full h-10 w-10 transition duration-500 ease-in-out text-gray-500 hover:bg-
gray-300 focus:outline-none">
            <svg xmlns="http://www.w3.org/2000/svg" fill="none" viewBox="0 0 24
24" stroke="currentColor" className="h-6 w-6 text-gray-600">
              <path stroke-linecap="round" strokeLinejoin="round" stroke-width="2"
d="M14.828 14.828a4 4 0 01-5.656 0M9 10h.01M15 10h.01M21 12a9 9 0 11-18 0
9 9 0 0118 0z"></path>
            </svg>
          </button>
          <button type="button" className="inline-flex items-center justify-center
rounded-lg px-4 py-3 transition duration-500 ease-in-out text-white bg-blue-500
hover:bg-blue-400 focus:outline-none">
            <span className="font-bold">Send</span>
            <svg xmlns="http://www.w3.org/2000/svg" viewBox="0 0 20 20"
fill="currentColor" className="h-6 w-6 ml-2 transform rotate-90">
              <path d="M10.894 2.553a1 1 0 00-1.788 0l-7 14a1 1 0 001.169 1.409l5-
1.429A1 1 0 009 15.571V11a1 1 0 112 0v4.571a1 1 0 00.725.962l5 1.428a1 1 0
001.17-1.408l-7-14z"></path>
```

```
            </svg>
          </button>
        </div>
      </div>
    </div>
  </div>

          </div>
        )}
      </>
    );
};

export default App;
```

Firebase-config.js:

```
import { initializeApp } from "firebase/app";
import { getAuth, GoogleAuthProvider } from "firebase/auth";

const firebaseConfig = {
  apiKey: "AIzaSyBfPVQ611pSzHLgCGrnjpCQ40F_IdNNj4U",
  authDomain: "serverless-chat-app-c8809.firebaseapp.com",
  projectId: "serverless-chat-app-c8809",
  storageBucket: "serverless-chat-app-c8809.firebasestorage.app",
  messagingSenderId: "278882621888",
  appId: "1:278882621888:web:98e2963744ef7afbd35025",
  measurementId: "G-FSWN5L35MS"
};
```

```
// Initialize Firebase
const app = initializeApp(firebaseConfig);
const auth = getAuth(app);
const provider = new GoogleAuthProvider();

export { auth, provider };
```

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