A Project Report on

Video Call Application

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Submitted to

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as a part of

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With sincere regards,

A.L.Dayakar.

V.Chiranjeevi.

D.Revanth.

Certificate

This is to certify that the report entitled "**Video Call Application**" submitted by A L Dayakar,V Chiranjeevi,D Revanth reddy partial fulfillment of the requirement for the award of Bachelor of Technology in Computer Science and Engineering is a bonafide work carried out by them under my supervision and guidance.

The report hasn't been submitted previously in part or in full to this or any other university or institution for the award of any degree.

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Declaration

I mr.dayakar,revanth reddy,chiranjeevi here by declare that this report entitled " **Video Call App**" submitted by us under the guidance and supervision of Mr.NSatyanandaram, is a bonafide work. we also declare that it has not been submitted previously in part or in full to this university or other university or institution for the award of any degree or diploma.

Date: 30-04-2022

Place: RK Valley

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Abstract

Random Video Chat application helps people connect with each other randomly and can communication Through audio or video of their choice.The users are connected directly with each other with out the need Of central server for data exchange.So that users can feel safe for their data security.This application is built using a technology named WebRTC for real Time communication between users.

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I.Introduction

We are stuck with technology when what we really want is just stuff that works. With the current paradigm shift in technological field, there is an need to embrace and appreciate the power of technology. This Mobile Application helps students, employees,Companies to be productive in their work.

This system helps to connect random users with each other and users can communicate using audio or video.The users need not to worry about their data being held in the server as this application does not use server for user data transfer.

Random Video Chat is an Mobile application developed using Mobile development techniques and based on public and social media.

Mobile App Development :

Mobile app development is the building and maintenance of apps; it's the work that happens behind the scenes to make a website look great, work fast and perform well with a seamless user experience

Real lifeMobile applications :

E-Commerce :

E-commerce is the buying and selling of goods or services via the internet, these all buying and selling orders will be performed by using a website. Few of the famous e-commerce mobile apps which provides online shopping are Amazon, Flipkart, AliExpress,etc..

Transportation :

Web apps are used in transportation sector for booking train or bus tickets in public or Private transportation system. We can also book flight tickets by using websites. Some of the Ticket booking apps are IRCTC, APSRTC, REDBUS, MAKEMYTRIP , etc..

For transportation within cities we regularly use cab services for that cab service booking Aslo we can use apps like OLA, GOIBIBO, UBER, etc..

Education :

In education sector we use apps very frequently for doubts clarifications and for learning Resources. Now a days all the teaching is being done through online only, for that teaching also schools Are using online teaching apps like ZOOM, GOOGLE MEET, MICROSOFT TEAM, etc..

For preparing competetive exams and self learning there few apps like KHAN ACADAMY, BYJUS, W3schools,etc..

Social Media :

Social Media are different mobile apps that are used for interacting with others , for sharing Of information ,images or videos etc.. over internet. Most used and famous websites around internet are social media sites,few of them are YOUTUBE, FACEBOOK, INSTAGRAM, TWITTER, LINKEDIN, WHATSAPP, etc..

Daily almost every internet user will visit youtube for entertainment or educational purpose, and also Uses FB,INSTAGRAM to interact with friends, WhatsApp for communication with family and relatives and like This apps are part of our life.

II.Approach

Mobile Frameworks:

A Mobile framework or web application framework is a software framework that is designed to support the development of mobile applications including android framework, flutter, and react native. Mobile frameworks provide a standard way to build and deploy web applications on the World Wide Web.

Mobile frameworks are playing a major role in the creation of today's most compelling mobile applications, because they automate many of the tedious tasks, allowing developers to instead focus on providing users with creative and powerful features.

- **Database** – Today nearly all web development frameworks are database driven. They provide support to multiple databases like NoSQL, Firebase, Oracle, and others. Every dynamic application facilitates the end-user to add, delete, and maintain records.

- **Rest APIs** - REST is an acronym for Representational State Transfer Sharing data between two or more systems has always been a fundamental requirement of software development. A REST API is a way for two computer systems to communicate over HTTP in a similar way to web browsers and servers. Similar to REST, you may encounter CORBA, SOAP, or XML-RPC e.t.c which usually establish strict messaging rules.

- **User Management** – One of the most prominent features of frameworks is user management i.e. it supports user logins with users being assigned roles and limitations placed on their access.

HTTP communication:

A web server provides support for HTTP (H yper t ext T ransfer P rotocol). As its name implies, HTTP specifies how to transfer hypertext (i.e., linked web documents) between two computers.

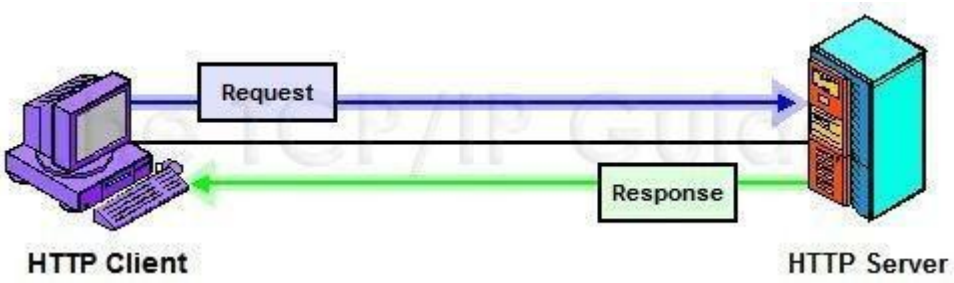


Fig - HTTP Communication

A Protocol is a set of rules for communication between two computers. HTTP is a textual, stateless protocol. HTTP provides clear rules for how a client and server communicate. Only clients can make HTTP requests, and then only to servers . Servers can only respond to a cent 's HTTP request.

- When requesting a file via HTTP, clients must provide the file's URL.
- The web server must answer every HTTP request, at least with an error message.

Dynamic Content:

"Dynamic" means that the server processes the content or even generates it on the fly from a database. This solution provides more flexibility, but the technical stack becomes more difficult to handle, making it dramatically more complex to build the mobile app.

Java, XML & Kotlin:

An overview:

Java is a general purpose, class-based, Object-oriented Programming language designed for having lesser implementation dependencies. It is a computing platform for application development.Java is fast, secure and reliable

Therefore. It is widely used in developing Java applications for laptop, Mobile, data centers, gaming consoles

XML stands for Extensible Markup Language. It is a text-based markup language derived from Standard Generalized Markup Language (SGML).

XML is used to control presentation, formatting, and layout .

Kotlin is a cross-platform, statically typed, general-purpose programming language with type inference. Kotlin is designed to interoperate fully with Java, and the JVM version of Kotlin's standard library depends on the Java Class Library, but type inference allows its syntax to be more concise.

Android

Android is an open source and Linux-based Operating System for mobile devices such as smartphones and tablet computers. Android was developed by the *Open Handset Alliance*, led by Google, and other companies.

Android offers a unified approach to application development for mobile devices which means developers need only develop for Android, and their applications should be able to run on different devices powered by Android.

The first beta version of the Android Software Development Kit (SDK) was released by Google in 2007 where as the first commercial version, Android 1.0, was released in September 2008.

- Advantages of using Android development

  - **Low Investment & High ROI:** Android comparatively has a low barrier to entry. Android provides freely its Software Development Kit (SDK) to the developer community which minimizes the development and licensing costs.

  - **Open Source:** Get the open source advantage from licensing, royalty-free, and the best technology framework offered by the Android community. The architecture of the Android SDK is open-source which means you can actually interact with the community for the upcoming expansions of android mobile application development.

  - **Easy to Integrate:** The entire platform is ready for customization. You can integrate and tweak the mobile app according to your business needs. Android is the best mobile platform between the application and processes architecture. Most of the platforms allow background processes helping you to integrate the apps

III.Technologies and Softwares

Technologies :

- Android SDK
- Kotlin
- XML
- WebRTC
- FireStore

Softwares :

- Android studio
- Adobe XD

Android SDK

Android SDK stands for Android Software Development Kit which is developed by Google for Android Platform. With the help of Android SDK, we can create android Apps easily.

About Android SDK

Android SDK is a collection of libraries and Software Development tools that are essential for Developing Android Applications. Whenever Google releases a new version or update of Android Software, a corresponding SDK also releases with it. In the updated or new version of SDK, some more features are included which are not present in the previous version. Android SDK consists of some tools which are very essential for the development of Android Application. These tools provide a smooth flow of the development process from developing and debugging. Android SDK is compatible with all operating systems such as Windows, Linux, macOS, etc.

Android SDK Tools

- Required libraries.
- Debugger.
- An emulator.
- Relevant documentation for the Android application program interfaces (APIs).
- Sample source code.
- Tutorials for the Android OS.

XML

Android layouts are written in eXtensible Markup Language, also known as XML. Much like HTML (or HyperText *Markup Language*), XML is also a markup language. It was created as a standard way to encode data in internet-based applications. However, *unlike* HTML, XML is case-sensitive, requires each tag is closed properly, and preserves whitespace.

Much like creating an HTML layout and later altering it with jQuery, we can create XML layouts in Android, and later alter them using Java logic.

Android XML layouts are also part of a larger umbrella of Android files and components called resources. Resources are the additional files and static content an application needs, such as animations, color schemes, layouts, menu layouts.

Anatomy of Android XML Layouts

Each layout file must contain one (and only one!) root element. Linear Layouts, Relative Layouts, and Frame Layouts (see Root Views section below) may all be root elements. Other layouts may not be. All other XML elements will reside within this root object.

A **View** is simply an object from Android's built-in View class. It represents a rectangular area of the screen, and is responsible for displaying information or content, and event handling. Text, images, and buttons are all Views in Android.

A **ViewGroup** is a subclass of View, and is essentially an 'invisible container' that holds multiple Views or ViewGroups together, and defines their layout properties.

WebRTC

WebRTC (Web Real-Time Communication)

Supports applications for voice calling, video chat, and P2P file sharing without plugins.

Open source project Released by Google.

With WebRTC, you can add real-time communication capabilities to your application that works on top of an open standard. It supports video, voice, and generic data to be sent between peers, allowing developers to build powerful voice- and video-communication solutions.

The technology is available on all modern browsers as well as on native clients for all major platforms. The technologies behind WebRTC are implemented as an open web standard and available as regular JavaScript APIs in all major browsers. For native clients, like Android and iOS applications, a library is available that provides the same functionality.

The WebRTC project is open-source and supported by Apple, Google, Microsoft and Mozilla, amongst others. This page is maintained by the Google WebRTC team.

Key features

1. Media Streams (aka getUserMedia), access to and control of the user camera and microphone

2. PeerConnection, negotiate and connect clients in order to allow direct communication

3. DataChannels, peer to peer data exchange

Pros and Cons

Pros :

No licenses or other fees are needed to start with it

The end user doesn't have to download and install additional software

Integration is performed using standard API accessed by JavaScript

Cons :

The support is partial and the documentation is very fragmented

Steps to show streaming

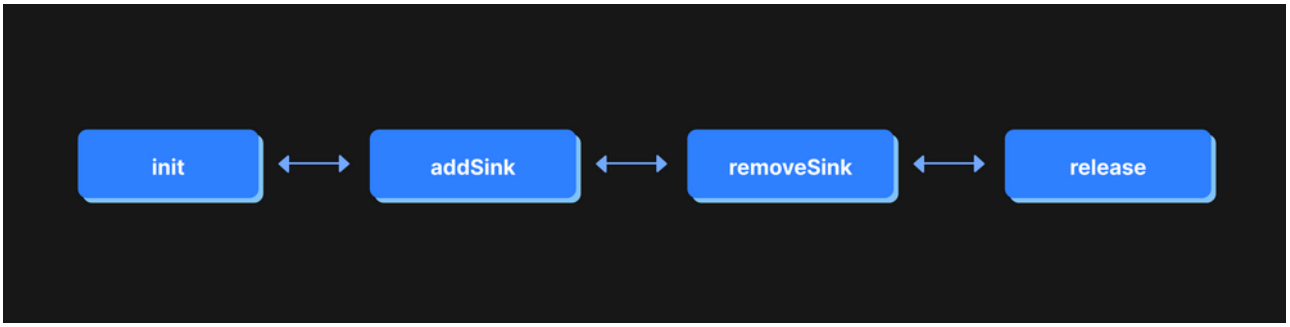
1. Set up video on a <org.webrtc.SurfaceViewRenderer> element provided by webrtc.

2. Access local devices: camera, microphone

3. Display a/v from local or remote peer
CreateObjectURL

4. Connect to remote peers
PeerConnection API

About SurfaceViewRenderer:



Once you create the SurfaceViewRenderer, you need to initialise it before it can be used at all. This kicks off a render thread.

addSink should be called after this. Where is addSink you ask? Well it's not on the SurfaceViewRenderer, it's a method on the VideoTrack you want to add to it.

removeSink should only be called when you're done showing the video and now it's time to either destroy the view (or recycle it), this stops downloading data from the peer's video too. Another function that's only on the VideoTrack, not the SurfaceViewRenderer though it takes the SurfaceViewRenderer as a parameter.

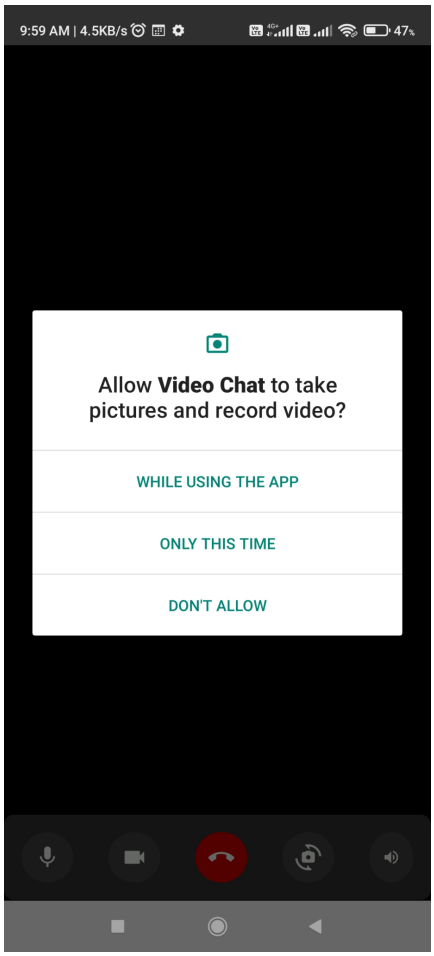
Finally release so the render thread can stop.

Accessing local hardware components in android:

For video:

```
(ContextCompat.checkSelfPermission(this, CAMERA_PERMISSION)
        != PackageManager.PERMISSION_GRANTED)
```

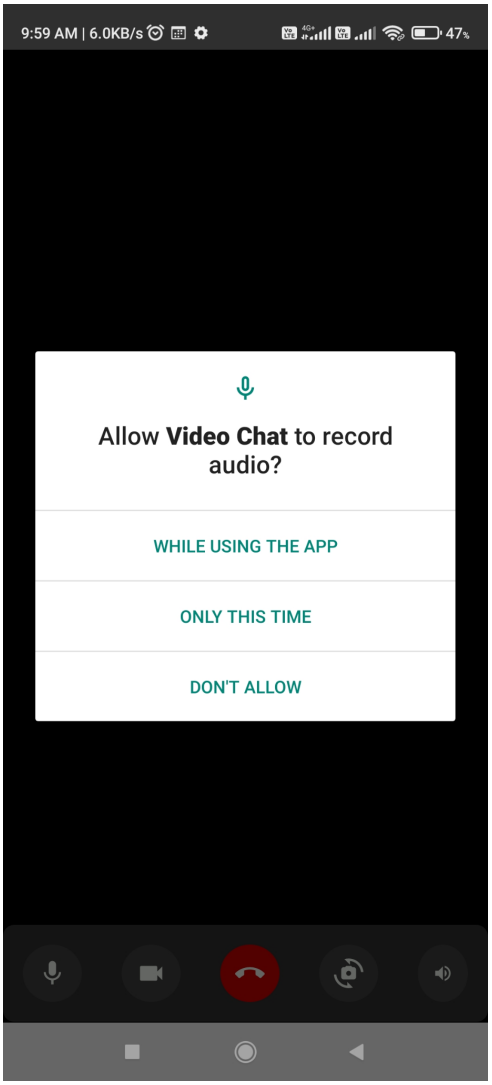
In the application it asks as,



For Audio:

```
(ContextCompat.checkSelfPermission(this,AUDIO_PERMISSION)
        != PackageManager.PERMISSION_GRANTED)
```

In the application it asks as,



Signaling in WebRTC

The users should know the type of session(audio,video..) and should know their addresses or public facing ip addresses to get connected and to get communicated.

For this,

1.SDP(Session Description Protocol)s required.

2.ICE(Interactive Connectivity Establishment) candidates required.

STUN and ICE

ICE (Interactive connection Establishment) is a frameworks for connecting peers in our case two users connecting for video call.

STUN (Session traversal utility for NAT) is a standard set of methods and network protocols to allow a host to discover its public ip address if its located behind firewalls.

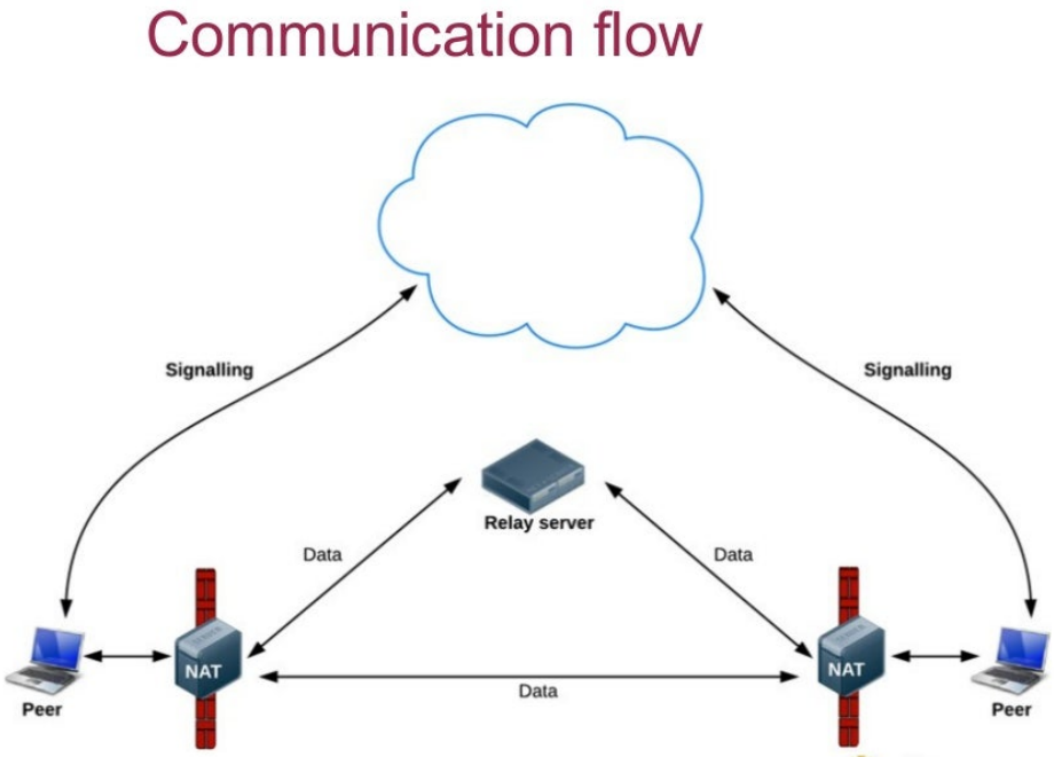
ICE Candidates

. Initially, ICE tries to connect peers directly, with lowest possible latency

. If UDP fails ICE tries TCP first http and https.

. If direct connection fails due to NAT or Firewalls then ICE uses TURN Server.

Communication flow using WebRTC



Firebase — Cloud Firestore

Cloud Firestore is the service provided by Firebase specifically for client applications and which is deeply integrated with other firebase products including Google's cloud functions serverless platform — Let's explore what it is and how it is easy to set it up for your next android application.

It is still a little bit of trouble to develop the application by setting up the server, managing the application data and sync data with low latency.

If you want to quickly develop and release the quality apps with value to the user then Cloud Firestore gives you a great solution

Overview :

Cloud Firestore is a serverless cloud hosted and fully managed NoSQL database introduced by Google. It allows us to create a database in a few minutes, No need to worry about managing servers and scalability and moreover we can build high-performance service using Firestore.

Cloud Firestore is the successor to the firebase real-time database with more flexibility and scalability. Cloud Firestore is used for mobile, web and IoT apps development to sync data instantly across the devices by using real-time listeners. By using native SDKs provided by firebase, mobile, web and IoT apps can directly access the database

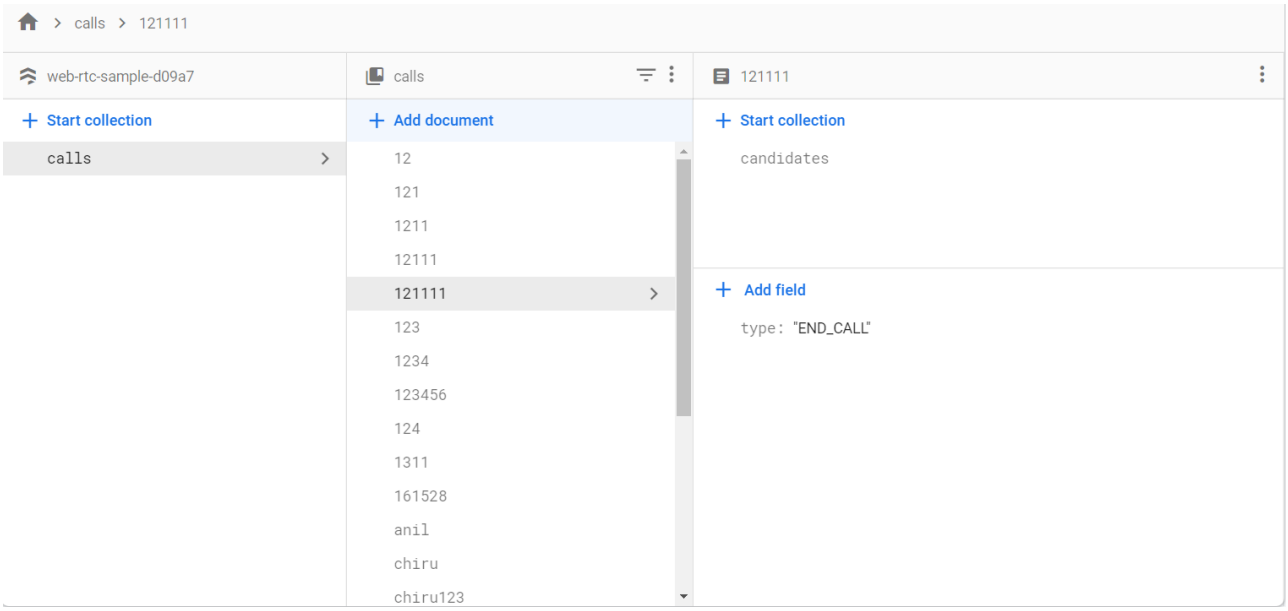
Data Model :

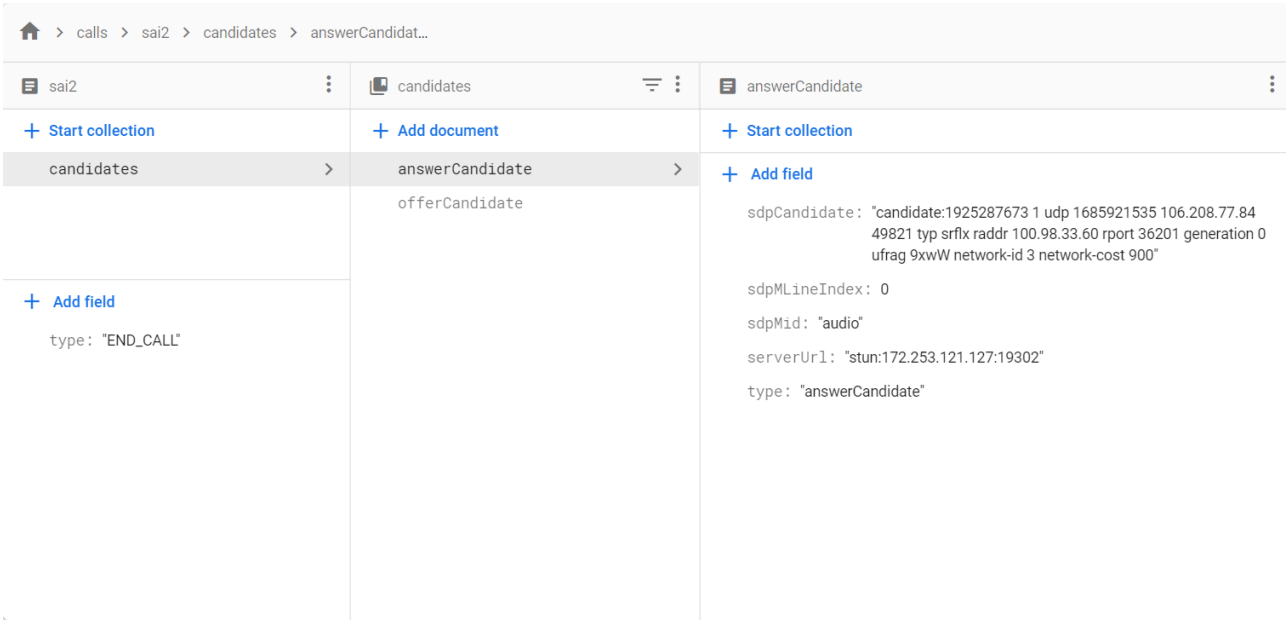
Documents and Collections :

- Cloud Firestore uses “Document and Collection” based structure to store the data and it does not contain any rows and tables.
- Data will be stored in documents that are organized into collections. Document supports key-value pairs (field can be any primitive data type ex: int, string etc), complex and nested objects (called maps).
- All documents must be stored in collections and we can create sub-collections in documents depending on your data model
- We can not create a document inside a document and same with the collection.
- A document can not exist independently and it always belongs to a collection.
- We can easily refer to any document or collection in a database by its unique name.
- A collection only contains documents and it can not contain any key-value pairs or sub-collections.
- If you are trying to add a document to a non-existent collection it creates the collection for you.
- If you delete all the documents inside a collection then the respective collection will be deleted automatically.

Video Call App

Firebase Console Data:





IV.Features of the project

I.Key Features :

Random video call and get connected to random users directly with them without the need of a central server for transferring data between them.

II.What's in our App :

One can get connected with people who are using this app randomly and audio or video chat with them.

X. step-by-step-implementation

1) Collected data required for developing the project

Firstly we started collected information about the technologies we need to use for the requirements of our application.Like for real time data transferring we need to gather and research about WebRTC which is the major need technology required for our application.

2) Started designing and implementing the UI designs for the projects

Giving users a good experience with design and application flow is a crucial task. We implemented good and simple UI designs for the sake of users.

3) Preparing database

Modeled the database which has a collection named calls and this collection containing separate document for each call which has its fields describing both Connected users session descriptions protocols.

4) Constructed backend

Finally we connected our application with Firebase firestore as a database for the application.Cloud Firestore is a NoSQL document database that lets us easily store, sync, and query data.

5) Tested each and every features

For every project the testing is very important.we tested each and every features of the application to0. check whether it is working properly or not before bringing it to the customers.

VIII.Existing system and its challenges

EXISTING SYSTEM :

This Mobile Application helps students, people to communicate with each other. This system uses server only to let users to know each others session description protocols and ice candidates to establish connection between them.After that the Data transfers between users without the need of this application server.so that Users can feel safe and need to worry about their data privacy and all that stuff.

CHALLENGES :

1. In case of firewalls webRTC uses turn server which may take more time for the system to detect the network.

2. Strict rules should be proposed as some users might behave inappropriately.

VIII.proposed system and it’s advantages

PROPOSED SYSTEM :

This Mobile Application helps students, people to communicate with each other. This system uses server only to let users to know each others session description protocols and ice candidates to establish connection between them.After that the Data transfers between users without the need of this application server.

ADVANTAGES :

1. Chat with high quality media content
2. Chat using only audio or video
3. No server involved in transferring of data
4. Optimal resource allocation
5. Highly secure

X.Future scope of the project

I would like to take it to Production grade full fledged App by random group meets based on Interested topics. Also add reputation points for each user.Report feature to report users if In case of inappropriate behavior. Creating an admin panel to do all Operations on this software if any emergency he can use his powers. Making this app much more.

XI.References

Introduction to Android Development

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WebRTC

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Get Started with first Android app

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