A WEB-BASED VIDEO CONFERENCING APPLICATION WHICH CONNECTS TEACHERS AND STUDENTS INTERACTIVITY

Bhavika Badjate
Student, BSIOTR
Aurangabad, Maharashtra, 431001

Vaibhavi Jadhav
Student BSIOTR
Latur, Maharashtra, 413512

Ulkesh Wani
Student, BSIOTR
Jalgaon, Maharashtra, 425001

Vishal Deshmukh
Student, BSIOTR
Pune, Maharashtra, 411014

Yogendra Patil
Project Guide, BSIOTR Pune, Maharashtra, 411014

ABSTRACT

About 90% of students say they will join classes and engage in activities or go to bed. 60% of college students in the province have suffered from depression at various levels since the outbreak of Covid-19 and at least 55% of young people pursuing UG and PG courses in arts and science colleges are deeply concerned about their future. - Indian Times.

Creating a visual classroom system to encourage a large number of students to enter the field of Education. It combines the benefits of physical class with the easy use of a virtual 'nonphysical' learning environment, eliminating travel risks and costs. Provides collaborative learning methods for students.

We redefined the classroom world in the visual platform by creating a web-based system that covers all the problems teachers and students face with features such as built-in focus acquisition, and automotive presence algorithm. Teachers can send out student announcements to inform them of changes in their performance and keep them posted. Teachers now have the option to display the questions that arise to look at the students' work situation.

General Terms

WebRTC Realtime Communication Machine Learning Networking Web Application.

Keywords

Online Education, Virtual Classroom, WebRTC, Networking, Machine Learning, Socket io.

1. INTRODUCTION

In the context of the COVID-19 epidemic, the momentum of shifting online teaching has required many teachers, teachers, students, parents, and administrators to rely on video communication systems for interactive communication. This immediate response to physical exhaustion becomes challenging. This extra pressure can frustrate the ingenuity of nurses if they do not know the technology or feel that this type of communication is always a matter of timing. Similarly, readers may misinterpret slower answers or written responses as indifferent or disrespectful.

2. MOTIVATION

Online media creates barriers between faculty and students that are different from traditional classroom setting. We have distributed research on students' attitudes towards online classes and the results were too disappointing

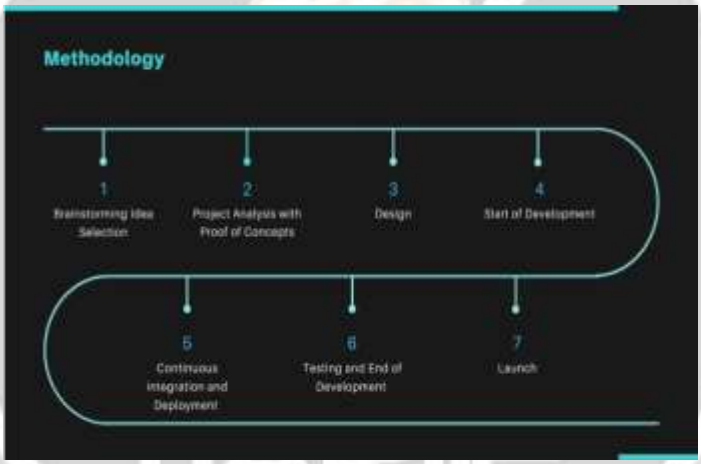
to be true. 91% of students said they would join classes and engage in their activities or instead sleep. This created teacher tensions as they were not satisfied with the students' easy copying during the exams and the negligence of the subjects being spread to the students. All of them wanted their offline mode of classroom so badly and missed the chit chats and jokes they shared with their bench mates while in class. The essentiality to recreate the good old days and make teachers ensure that students were really learning motivated us to create a 'newer' normal to education.

Many online programs offer text-based content and feedback only, which lacks basic social media links. Facial expressions, eye contact, or body language are lacking and oral gestures that highlight important topics or voice fluctuations that express concern and concern.

3. SURVEY

A user survey is a coefficient and simple means of gathering information from customers. User surveys can aid in analysing what it is that's making your customers satisfied. For 47% of respondents, google meet is a widely used conferencing application other than WhatsApp, skype, discord, zoom, etc. most of the customers like the user interface of google meet, but still, most of the customers have the mentality of missing online classes. 80% of respondents are not satisfied with online/distance learning.

4. METHODOLOGY

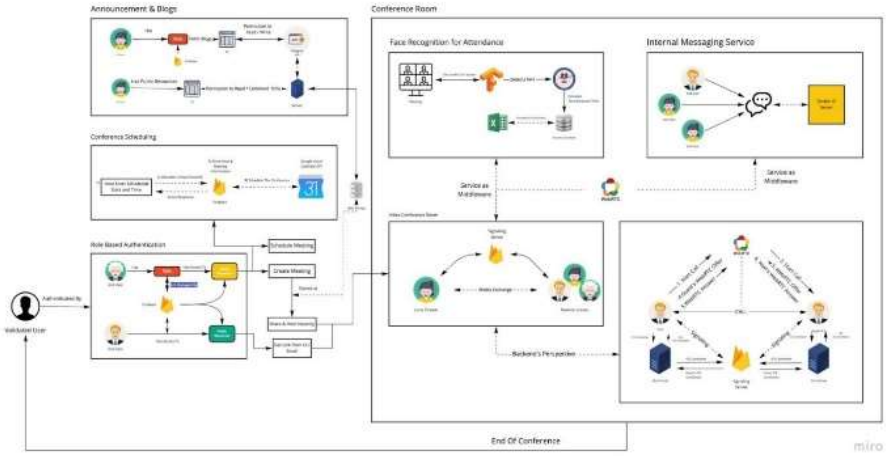


(fig2: Methodology)

A project methodology can outline whatever you want to outline. So, you can have one for the initiation process, which would start with the brainstorming idea selection. The planning process is complex as it initiates with planning, analysis of project charter with proof of concepts, collecting requirements, and the development of scope. User design is an important to step in the methodology of a project. After designing user must start the deployment of the project with continuous integration and continuous deployment method. In the end, deployment testing and launching of the application should be done respectively.

5. ARCHITECTURE

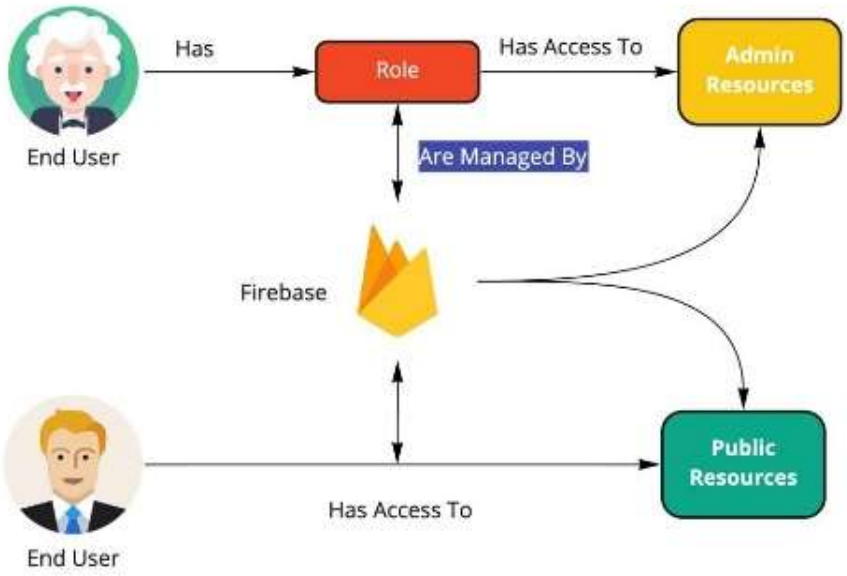
architecture decides the entire flow of execution of the project. from above fig (3) we can see here are mainly five main modules which are main part of the charter as follows:



(fig3: Architecture)

5.1 Role based Authentication

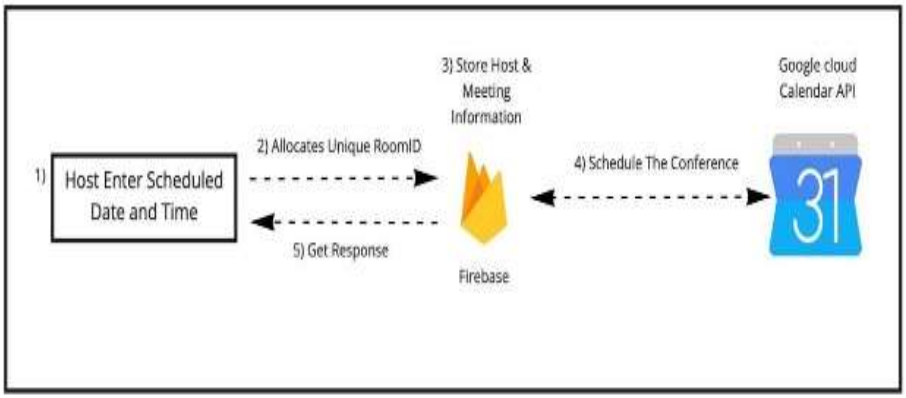
We are Using Firebase Service and Realtime Database to Get the User information and Authenticate Them. With The Help of Permissions and Roles, we can Differentiate students and Teachers. User with Role/permissions (managed By Firebase)
Will have Some Resources to Access



(fig4: Role Based Authentication)

5.2 Conference scheduling

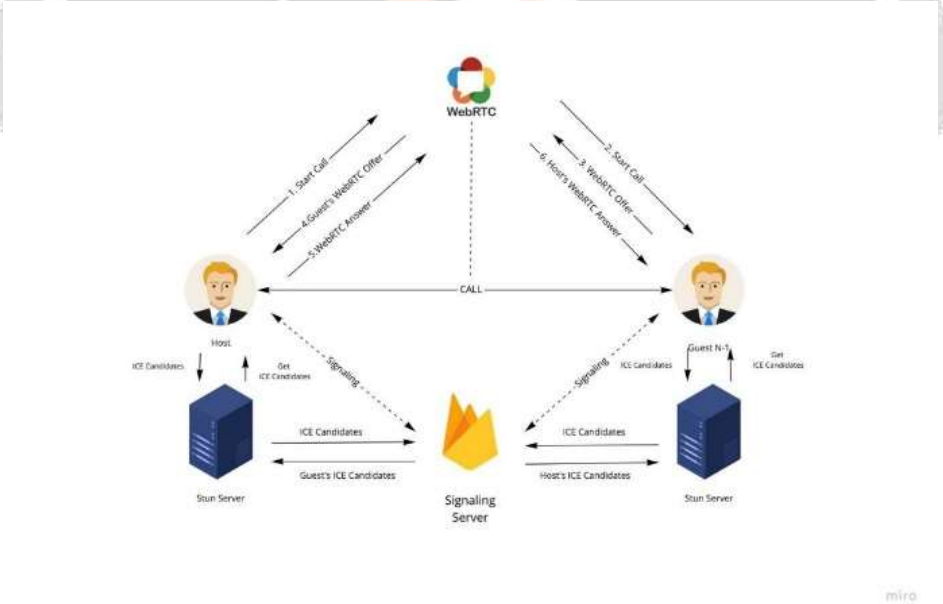
We are using Google Cloud API & firebase's inbuild Email services To Schedule Meetings, Verify Emails and Notify Your Linked Account with Our Platform.



(fig5: Conference Scheduling)

5.3 Video Conference Service

Using WebRTC's Real-time Communication Technology and
Socket IO Peer Connections, We Are Making Video Conference Much Better and with Performance Improvement with the Help of Our Hybrid Network Design (Peer to Peer and SFU). Host Will have some Permissions to managed and handle the user, the ability to ask questions with QNA Module, take attendance using Machine Learning Modules, and Much More.



(fig6: Main Communication Strategy using WebRTC)

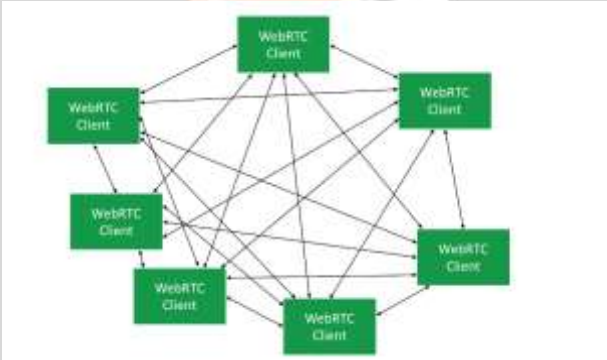
We Are Currently using The WebRTC's Mesh Network technology. When dealing with WebRTC and indicating P2P or mesh, the focus is almost always on media transport. The signalling still flows through servers (single or distributed). For a simple 1:1 voice or video call, WebRTC P2P is an obvious choice.

(fig7: Simple Peer to Peer Connection)

From a WebRTC client perspective, a 1:1 session is similar if it is done using P2P mesh or using a media server

The diagram below shows that from the perspective of the WebRTC client, there is no difference between going through a media server or going P2P – in both cases, it sends out a single media channel and receives a single media channel. In both cases, we'd expect the bitrates to be similar as well.

Making this into a group call in P2P translates into a mesh network, where every WebRTC client has a peer connection opened to all other clients directly.



(fig7: WebRTC's Mesh Network)

Why use WebRTC P2P mesh?

There are two main alluring reasons for vendors to want to use WebRTC P2P mesh as an architectural solution:

1. **It is cheaper to operate**. Since there are no media servers, the media flows directly between the users. With WebRTC, oftentimes, the biggest cost is bandwidth. By not routing media through servers as much as possible (TURN relay will still be needed some of the time), the cost of running the service reduces drastically
2. **It is more private**. Yap. As the service provider you don't have any access to the media, since it doesn't flow through your servers, so you can market your service as one that offers a higher degree of privacy for the end users

CPU challenges in P2P mesh

Then there is the CPU you have to deal with in the WebRTC P2P mesh.

Each video stream from our speaker to viewers has its own dedicated video encoder. For our 10 viewers, that means 10 videos embedded.

A few small ideas here if I could:

If you intend to encrypt H.264 computer hardware, keep in mind that most laptops allow up to 3-4 coded streaming at a time. Everything else will be black screens with the current use of WebRTC

Video coding is a boom in CPU (and memory). Encoding is worse than coding when it comes to CPU resources. Having 10 decoders is hard enough. 10 codecs are cruel

10 or more participants in a video call are difficult to manage with SFU without adding configuration to alleviate client pain and not burn their CPU. And this is where each user has a single codec (or simulcast) to deal with

Your 16 cores Apple MacBook Pro 2019 is not a common device your users will have. If this is what you are checking your WebRTC mesh video call means you are doing 'wrong'

I'm sure you thought using VP9 (or AV1 or HEVC, not really available on WebRTC yet) would save you bandwidth and improve quality. But it consumes more CPU than VP8 or H.264 so it does not happen at all

So. are you going to a group video call ?.

Can we do better?

Probably. A single codec can make the CPU problem too small. It will bring bitrate match headaches to all viewers (each with its own network and device limits).

Using a simulcast in some way here may help, but that is not the way it is intended to be used or how it is made.

Therefore, this method requires someone to make changes to the WebRTC codebase. And for Google to take them.

Other WebRTC P2P mesh alternatives

You can get a group video call to work in WebRTC P2P mesh architecture. It will mean much lower bitrate and reduced video quality. But it will work. At least to some extent.

There are other models that work better, but require media servers and That Increases Cost as well.

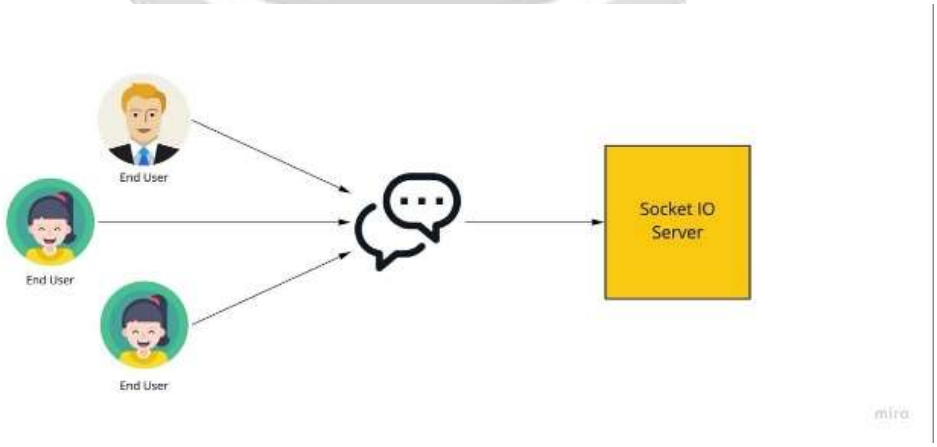
WebRTC provides alternative media server solutions to have space in the form of SFU and MCU

Using the MCU model, we can combine all videos and audio streams into the MCU, ensuring that each participant receives and sends only one stream to the MCU.

With the SFU model, we can stream media between participants while trying to balance their limitations with SFU's media input.

5.4 Internal messaging service

With the Help of Socket IO and WebRTC Technology, it
Provides a Real-time Messaging service to communicate.
Teachers and Students can Interactively Communicate using
Messaging services with ongoing Video calls. Messaging Service will have the Ability to React the messages with the Help of Emojis.



(fig6: Internal Messaging Service Using Socket IO)

5.5 Face Detection and Attendance System

TensorFlow JS is JavaScript Library Helps To use Machine Learning Module in Web Application. Using TensorFlow JS and Face Recognition API we are Determining Percentage of Student Attendance that satisfy some Criteria of Our Algorithm.

(fig6: Attendance System)

6. FEATURES SCOPE

6.1 Features such as ML face detection so that it can analyse if the students are concentrating in the class and accordingly mark the attendance

6.2 Examination mode with face detection and disabled voice channels so that exams can be held in a rightful and efficient way.

6.3 We are also planning to include a feature that shows the network connectivity status of each student.

6.4 An alerting system that alerts teachers to give a break to students from extended screen times. We are also planning to scale our model

7. ADVANTAGES AND DISADVANTAGES

8.1 Advantages

7.1.1 Teachers can send out student announcements to inform them of changes in their performance and keep them posted. They can also send a dashboard of upcoming and ongoing opportunities to show the required details after paragraph-based verification

7.1.2 Teachers now have the option to display pop-up questions to check student status.

7.1.3 Teachers can ensure the availability of students in their classroom with the full screen lock feature of the app.

7.1.4 Screen Sharing, Call Editing, Multiuser Video Call
Inbuilt Interactive chatting Interface

7.1.5 Streaming, Built-in feature easy to use whiteboard. Improved voice channels to avoid interruptions

7.1.6 Teachers do not have to follow the trail because the log will be displayed after each class.

7.2 Disadvantages

7.2.1 Poor network connection leading to host interconnection. At first, most of the team members were sceptical of the technology used.

7.2.2 We came across many bedbugs that ate up a large portion of our time.

8. APPLICATIONS

8.1 Dashboard to display the necessary information to after role based authentication.

8.2 Teachers can post announcements for students to tell some changes regarding their workflows and keep them posted.

8.3 As well they can post upcoming and ongoing opportunities. Teachers now have the option to display pop up questions in order to check the student activity status.

8.4 Screen Sharing.

8.5 Scheduling Calls, Multiuser Video Call. Inbuilt Interactive chatting Interface Broadcast Feature.

8.6 In-built easy to use whiteboard.

8.7 Teachers can ensure the presence of students in their class via the full screen feature of the application.

8.8 Enhanced voice channels to avoid disruptions.

8.9 Teachers do not have to keep track of attendance since the log will be shown after each class.

9. CONCLUSION AND FUTURE SCOPE

9.1 Examination mode with face detection and disabled voice channels so that exams can be held in a rightful and efficient way.

9.2 We are also planning to include a feature that shows the network connectivity status of each student.

9.3 An alerting system that alerts teachers to give a break to students from extended screen times. 9.4 Scalable for multiple users.

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