VIT Vidyalankar Institute of Technology
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Title : Blockmeet

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Abstract

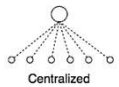
- Our project focuses on the development of a decentralized video conferencing progressive web application (PWA) that leverages WebRTC for real-time communication.
- The application utilizes Ethereum blockchain technology with Solidity smart contracts to enhance security and privacy. By decentralizing the video conferencing infrastructure, our app ensures resilience against single points of failure and offers users greater control over their data.
- Encryption techniques based on blockchain concepts are implemented to safeguard communication channels and protect sensitive information. Through this innovative approach, our decentralized video conferencing app provides a secure, privacy-conscious solution for remote collaboration and communication. For storage we are going to used IPFS.

Introduction

- ❑ The growing reliance on video conferencing necessitates secure and privacy-preserving communication channels. This project tackles following challenges by developing a decentralized video conferencing app.
- Centralized Data Storage: Current applications rely on centralized servers, posing risks to data privacy and security.
- Data Privacy Concerns: Users sensitive information may be vulnerable to breaches or unauthorized access.
- Censorship and Content Filtering: Some regions impose restrictions on communication platforms, limiting users freedom of expression.
- Lack of User Control : Users may have limited control over their data and content, raising concerns about data ownership.
- ❑ To achieve decentralization ,the Ethereum blockchain along with Solidity smart contracts form the backbone of the application along with IPFS as storage service . This eliminates reliance on centralized servers, a potential vulnerability in traditional video conferencing platforms. By incorporating blockchain technology, we aim to enhance security and privacy by leveraging its core features of immutability and transparency.

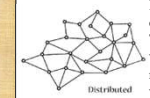
Literature Survey

- **Following Architectures are used**



A centralized overlay network facilitates resource-sharing directly between peers, but relies on a central point for discovery. For example, Napster operated as a centralized overlay network where users shared files directly but relied on the Napster server for file and user discovery . Zoom , Google meet uses this type of architecture.

Super-peer networks is a mix of centralized and decentralized. Super-peers relay messages, acting as hubs for efficient info sharing while keeping peer-to-peer communication.



In a distributed network, there is no central server coordinating communication between devices on the network. The devices themselves handle these tasks, communicating with each other directly. This can make distributed networks more scalable and fault-tolerant than centralized networks, where a central server failure can disrupt the entire network.

- The above displayed are some widely used architecture for video conferencing application ,along with with distributed one which Collected from :

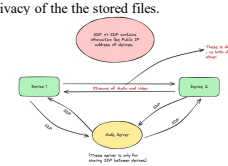
❑ Paper1 : https://ijcaonline.org/archives/volume183/number16/hettiarachchi-2021-ijca-921490.pdf
❑ Paper 2 : https://sci-hub.se/10.1109/ICCIT51783.2020.9392746

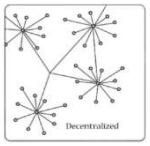
Objectives

- **Decentralized Architecture:** Develop a video conferencing platform that operates on a peer-to-peer network using WebRTC, eliminating reliance on centralized servers for improved security and censorship resistance.
- **Enhanced Security & Privacy:** Leverage Ethereum blockchain and Solidity smart contracts to implement robust encryption for user data and communication, ensuring privacy and protection from unauthorized access.
- **Real-Time Communication:** Utilize WebRTC to enable high-quality, low-latency audio and video communication between participants in real-time.
- **Progressive Web App (PWA):** Design the application as a PWA for seamless accessibility across various devices (desktops, mobiles) without requiring app store installations.
- **User-Centric Design:** Create an intuitive and user-friendly interface that facilitates secure and efficient video conferencing experiences.

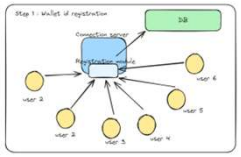
Methodology :

The following are the the technologies,techniques and methods that we planing to use
•The Webrtc protocol : This is widely used protocol for p2p multi media transfer with any central authority.
•Ethereum : The main purpose of using ETH is to make our application more transparent and secure.
•The User Centric super peer decentralized architecture: This helps users to be the owner of their own conference networks.
•IPFS : This Hashed based Decentralized storage system will ensure the data privacy of the the stored files.



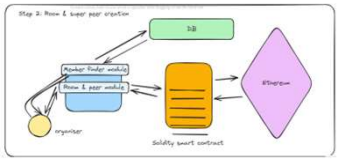


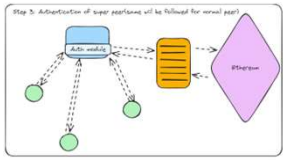
Flow Diagram



The Registration step
- The Users will Register in our application
- They need to create a wallet using services like meta mask, Back packet
- We will be storing this data in our DB so that when a user is trying to add participant in meet they can search them

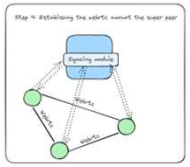
Room creation
- Here user will create the meet , and define the members .
- This is the steps were the user will define which are the other super peers

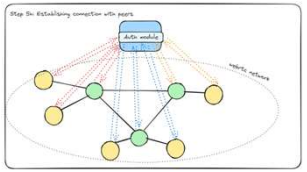




Authentication step
- This diagram shows how the user that request to join the meet are authenticated
- The super peer must join the room to initiate the initial webrtc network

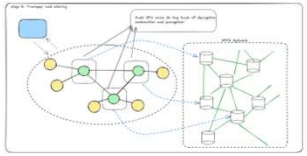
Super peer webrtc network
- This Diagram shows the formation of the final webrtc network which is the core of our decentralized data transfer without the use of centralized SFU like meet and teams
- The Process of formation of this network used the core logic provide by webrtc include SDP and ICE exchange among the peer





Peer Network formation
- This diagram shows how the final state of peer network will look like
- We will make sure that the peers are well distributed as it is essential for smooth functioning of the app.

Recording storage
- The diagram aside shows how the data is stored in the IPFS
- The use of IPFS ensure the decentralized data storage

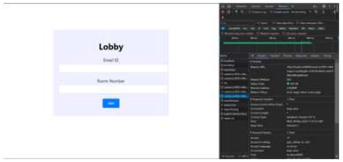


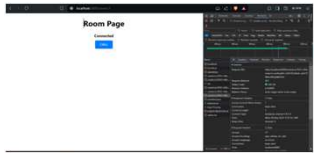
Experimental Details

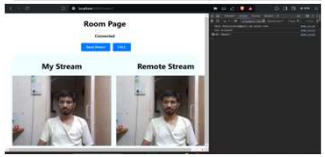
We initially considered a direct mesh architecture for our application, but encountered scalability challenges due to the increasing number of participants. Recognizing this limitation, we explored the idea of a distributed network, only to realize its impracticality for implementation. Subsequently, we investigated the peer-super architecture, where select participants act as super nodes. However, given the limited processing power of these nodes, we strategically minimized the number of connections on each super peer while maintaining a compact mesh structure.

Results

The following diagrams show the webrtc implementation that we have done for our this semesters demo







Conclusion

As a conclusion of this poster we would like to add following points
- Decentralized video conferencing applications and other dApps represent a relatively new branch of software development.
- Much of the research and implementation in this field is still underway.
- Transitioning from the initial architecture to a fully-fledged application poses significant challenges.
- With dedication and innovation, these challenges can be overcome.
- Collaboration and knowledge-sharing within the developer community are essential for driving progress in this emerging field.
- Continuous refinement and adaptation of decentralized technologies will be necessary to address evolving user needs and technological advancements.
- Despite the challenges, the potential benefits of decentralized applications, such as increased security, transparency, and user control, make the effort worthwhile.
- By embracing these challenges and pushing the boundaries of innovation, we can unlock the full potential of decentralized technologies for a wide range of applications.

References

- **Blockchain based Video Conferencing System with Enhanced Data Integrity Protection Auditability:** https://ijcaonline.org/archives/volume183/number16/hettiarachchi-2021-ijca-921490.pdf
- **Blockchainchain based Decentralized video streaming application:** https://sci-hub.se/10.1109/ICCIT51783.2020.9392746
- A protocol for decentralized video conferencing with WebRTC:FULLTEXT01.pdf (diva-portal.se)