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Stranger Video Call Application: A Real-Time Anonymous Communication Platform Using WebRTC and Firebase

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ABSTRACT—

Stranger Video Call Application is an application for video communication over the Internet that allows for anonymous video calls. It does not store any information in its databases, guaranteeing high confidentiality of user data. Stranger Video Call Application utilizes WebRTC to stream audio and video in a secure, peer-to-peer manner. Firebase offers real-time user management, room synchronization, while HB Recorder together with the Media Projection API enables local screen recording. The application enhances user experience through Lottie animations and Google's AdMob as coins are awarded through an incentivized advertisement system. With its modern looks and strong privacy policies, the app serves as a reliable means for users to meet and interact with strangers from different parts of the world.

Index Terms— Real Time Interaction, WebRTC Technology, Anonymous Video Calling, Firebase, Mobile Application Devel- opment, User Engagement, Privacy, Gamification

INTRODUCTION

In the modern world of technology, being connected has become second nature, be it for work, socializing, or just keeping in touch. With the advent of smartphones and internet connectivity, individuals from all over the world can communicate in real-time — bridging borders and time zones within seconds. One such innovation that capitalizes on this connectivity is the Stranger Video Call Application.

This app provides a platform where people can have impromptu video chats with other people they've never met. As opposed to regular calling apps that demand contact lists or booking, this site enables users to plunge into live video conversations with random individuals from across the globe. It brings a level of excitement and surprise — whether one is seeking to meet a new friend, chat casually, or simply kill time.

The central concept of the Stranger Video Call Appli- cation is to promote human interaction in an enjoyable and simple manner. Ensuring user safety and privacy as top concerns, the application is created to maintain respectful and safe interactions. Through a straightforward and interactive user interface, it renders random video chatting easier and more enjoyable than before.

This essay delves into the design, creation, and effects of the Stranger Video Call Application, emphasizing the way it unites individuals in real-time face-to-face digital communication.

LITERATURE REVIEW

Related Work

The concept of randomly pairing people up with each other via video chat has existed for some time. Sites like Omegle and Chatroulette were the pioneers in this niche, providing users with the ability to encounter strangers via one-to-one video calls. Although these sites became popular early on for their novelty, they eventually drew criticism for the absence of content moderation and minimum privacy measures, which tended to make the user experience unstable and insecure.

Conversely, popular video conferencing software like Zoom, Google Meet, and Microsoft Teams are designed for structured communication—business meetings, classes, or formal group chats. These services are stable and feature-rich but not designed for casual interactions or maintaining anonymity. They usually need authentication by the users and personal information, which does not make them ideal for light-hearted, personal conversations with strangers.

Social media such as TikTok Live and Instagram Live throw in one more dimension by inviting simultaneous user interaction using comments, likes, and reactions. These have demonstrated how interactivity can enhance user stickiness, but their emphasis is slightly different with a focus on one-to-many broadcasting as opposed to individual one-on-one relationships.

These current solutions, though strong within their respective areas, leave a very apparent hole in delivering secure, anonymous, and entertaining one-on-one video calls.

Technological Foundations

The Stranger Video Call App is based on a combination of contemporary technologies to provide a smoother and more secure experience than is usually available in the market:

- WebRTC (Web Real-Time Communication): This open-source technology provides real-time, peer-to- peer audio and video communication without the use of third-party plugins. It provides high-quality streaming that adapts to the user's internet condi- tions, making it perfect for seamless video calls.
- Firebase Realtime Database: Firebase offers an cloud- based mechanism to keep the data synchronized in between users instantly. It's implemented here for managing operations like user presence, creating call room, and handling coin transactions in real time.
- HB Recorder and Media Projection API: These offer capabilities to the user to capture the screen when making a call. What renders the setup privacy-friendly is the fact that it saves recordings right on the device of the user—nothing's uploaded online or posted to the server.
- Google AdMob: For monetization, the app features rewarded ads through Google AdMob. This allows users to earn in-app coins by viewing brief, non- intrusive ads, supporting the app and keeping users active.

Gaps in Current Solutions

Although many video chat apps are available, few of them actually cater to the entire range of user needs—particularly with regard to privacy, ease, and en- gagement. Some of the most prevalent issues in current solutions are:

- Lack of Privacy: Most apps ask for login credentials or tie up with social media profiles, which dissuades users who like to remain anonymous.
- Low User Retention: Without features such as re- wards, challenges, or progress indicators, users tend to lose interest very soon.
- Poor Monetization Models: Most of the free applica- tions depend on disruptive advertising that destroys the user experience or paywalls that drive away users.

The Stranger Video Call App does it differ- ently—emphasizing making it anonymous, lightweight, and enjoyable. Through rewarded ads, real-time synchronization, and data storage locally, it seeks to cover up for its predecessors' loopholes.

SYSTEM ARCHITECTURE AND DESIGN

Overview of Application Architecture

The Stranger Video Call App was constructed using a modular framework, such that every significant fea- ture—such as user login, video call establishment, and reward management—was created as an independent, manageable module. This structure not only makes the system simpler to develop and maintain but also enables future updates or new features to be introduced with little disruption.

The application's front end is developed with Java for Android, making it compatible with numerous devices. The user interface is minimal and intuitive, with smooth animations driven by Lottie animations, which assist in making the application responsive and interactive.

In the back end, Firebase is the prime focus. It handles live user activity, including room status changes and coin balances. The utilization of Firebase Realtime Database guarantees that when a user enters or exits a room, all the devices that are currently connected are immediately updated with those changes. This makes it possible to achieve a seamless, real-time experience during video calls.

The actual magic behind video calling is enabled through WebRTC, which is in charge of peer-to-peer video and audio streaming. It maintains latency low and quality high even when the users are on less-than-smart networks.

Module Descriptions

Module Descriptions The app is driven by a number of well-established modules, each serving a specific purpose:

- Authentication Module: These both provide email/password sign-ups and Google sign-ins via Firebase Authentication. The process is optimized to be fast and secure, allowing users to gain access to the app with a bare minimum of friction.
- Video Call Module: Based on WebRTC, this module is responsible for handling real-time audio and video calls between users. It has basic features such as room creation, calling, and in-call features such as muting the video or terminating the session.
- Reward System Module: To ensure users remain en- gaged, a reward system was implemented through Google AdMob. Coins are earned by users upon viewing ads, and these coins are utilized to gain ac- cess to video calls. An entertaining "treasure system" provides an added level of interaction, where users can gain bonus rewards upon undertaking specific actions.
- Screen Recording Module: With HB Recorder and Media Projection API, this module allows users to record video calls on their device. The recordings are locally saved, allowing users to have complete control of their content with privacy.

Database Design

The application's backend heavily relies on Firebase to control user information and app state in real time. The major components are:

- User Data: Firebase securely stores simple user in- formation such as authentication data and coin amounts. This provides a seamless and customized experience upon each user login.

- Room Management: Every video call is associated with a virtual "room." Rooms are created and main- tained in the Realtime Database. Whether a room is idle, waiting for a user, or in use, its status is monitored dynamically to provide accurate pairing and connectivity.
- Coin Transactions: The app keeps a live record of coin activity—coins spent on calls and earned from ads. Each modification is reflected in the user's balance in real time with Firebase's syncing capabilities.

KEY FEATURES AND IMPLEMENTATION

Anonymous Video Calling

One of the fundamental aspects of the Stranger Video Call Application is connecting people using live video calls without identifying themselves. To do this, the application does away with the requirement of extensive personal details upon sign-up. The users can sign up anonymously and be matched with random strangers for live chat.

This is made possible with WebRTC, which is a tech- nology that supports real-time video and audio streaming in a direct peer-to-peer model. WebRTC makes the call take place in a seamless manner with less latency, even at a long distance. The application manages session ne- gotiation and data sharing without a central server for the media, thereby enhancing privacy and minimizing latency.

Coin-Based Reward System

To make the experience more interactive and engaging, the app includes a coin reward system. Users earn coins through watching rewarded video ads, and these coins are utilized to initiate or resume video calls. Coin deductions and earnings logic is controlled in real-time using Firebase Realtime Database.

There is also a game-like feature referred to as the "Treasure System", in which users are given opportunities to redeem bonus coins through random rewards. This in- troduces a fun layer to the app, making it more interactive and increasing engagement duration.

Google AdMob Integration

Revenues are managed via the use of Google AdMob, which is capable of supporting various ad types including rewarded videos and interstitials. When the user watches a rewarded ad, they are rewarded with an allocated amount of coins. The reward logic is directly associated with the user's coin balance utilizing Firebase to ensure real-time updating and the best experience.

AdMob is executed in a manner that doesn't intrude on the central experience—ads are displayed organically in the flow of the app. For instance, coins can be low when someone tries a call, and they're asked to look at an ad to proceed.

Screen Recording Functionality

The app provides the feature of locally recording video call sessions via HB Recorder and the Media Projection API. Users can record their conversations without the need for server-side storage, maintaining confidentiality. The recordings are saved on the user's device alone, providing them with complete control over what is saved and shared.

This feature is especially handy for users who wish to save a record of their calls, or generate content from their calls.

Lottie Animations for UI Optimization

To achieve a smooth and visually pleasant user experi- ence, the app employs Lottie animations. These are light, JSON-based animation files that make transitions, popups, and loading screens more responsive and lively.

Animations are added in a non-intrusive man- ner—utilized primarily during events such as call con- nection, loading ads, or coin collection. This aids in providing a polished and engaging user interface without compromising performance.

METHODOLOGY

The creation of the Stranger Video Call Application was a systematic and organized process, beginning with an understanding of user requirements and moving through design, implementation, and testing stages.

First, the fundamental purpose of the application was established — allowing users to randomly connect with strangers through video call in real-time. From this ob- jective, the system was designed and planned to provide seamless functionality, privacy, and reliability.

For the technical architecture, the project was devel- oped based on Node.js, which was utilized as the backend runtime environment. Express.js was employed to handle server-side routing and middleware, assisting in efficiently managing API requests. HTML, CSS, and JavaScript were used to develop the frontend, with emphasis placed on delivering a clean and responsive user interface.

For handling real-time communication, WebRTC was used as the main technology. WebRTC provided peer- to-peer transmission of video and audio between users directly without the requirement of any external plugins or heavy servers. For supporting the signaling process — required for WebRTC connection establishment — Socket.IO was used. It facilitated the exchange of connec- tion metadata (such as offer and answer signals) between users, providing smooth call initiation and management. Security and user anonymity were also in mind during the development process. Although the application per- mits users to call anonymously, precautions were taken not to save any sensitive information about the user. Additionally, users were allowed to hang up at any point,

having complete control over interactions.

The whole application was performance and func- tionality tested to ensure that users had minimal lag,

seamless video quality, and an easy user experience. This systematic approach enabled the development team to take a simple concept and turn it into a functional, real- time communication platform that facilitates spontaneous social interaction.

RESULT ANALYSIS

Following the completion of the Stranger Video Call Application's development and testing, it was evident in the results that the system proved successful in com- pleting its primary objective — allowing individuals to communicate with strangers through live video calls. The implemented features were seamless in functionality, and overall performance stood up to what had been laid out in anticipation in the planning stages.

The main feature of the app — random video calling

— functioned without delays or interruptions. Employing WebRTC, the infrastructure provided two users with a direct connection to each other, enabling smooth video and audio streaming. The live interaction was additionally complemented by Socket.IO, which effectively processed the signaling process. The integration of WebRTC and Socket.IO was vital in facilitating smooth call establish- ment and maintenance.

Practically, users were able to start and disconnect calls without any constraints. The interface of the applica- tion was simple and user-friendly, such that initiating the process as well as ending the call was simple even for those with limited technical knowledge. Node.js and Express.js-based backend ensured stable request handling and server-side tasks, ensuring smooth operation during the call initiation and termination.

Also, the system did not retain user anonymity during the experience. No login or data submission was required, thus making it safe for spontaneous interaction. The call sessions were transitory and left no stored personal data behind, reinforcing the privacy-oriented design of the application.

Testing on various devices and internet speeds showed the app with a consistent level of functionality. No sig- nificant bugs or performance issues impacted the user experience, proving the chosen platform's effectiveness. These results confirm that the Stranger Video Call Appli- cation is a working, functional platform with the ability to provide its set of intended features with reliability and effectiveness.

FUTURE SCOPE

While the Stranger Video Call Application successfully delivers its core functionality—connecting users randomly for real-time video chats—there remains significant room for future enhancements that could elevate its usefulness, security, and overall user experience.

One of the areas where there could be improvement is by implementing a report or feedback system. Users are currently free to interact and remain anonymous, which encourages openness but also opens up issues about abuse. Having a system through which users can report abuse or provide feedback after a call would help in ensuring a safer and more respectful community. This feature would assist in moderating the site and ensuring a better experience for all participants.

Another potential enhancement is the addition of user verification or authentication options, including tempo- rary guest accounts or optional login. Although anonymity is an appreciated option, providing users with the oppor- tunity to personalize their experience or access call history (without storing data permanently) could make the site more adaptable and interesting.

The feature may also be extended to have language- based or interest-based matchmaking, so that users can be matched with strangers who share their language or common interests. Such an extension would enhance the value of connections and enable more substantial conversations, particularly in a globally expanding user base.

From a technical standpoint, the future might be en- hancing the scalability of the application to handle many more users at once. With growing usage, the backend and server resources need to be optimized to better manage higher traffic in order to sustain performance and reliability.

Finally, there is potential to implement AI-based moder- ation systems that have the ability to automatically iden- tify unsuitable content within calls and act accordingly, adding user security without just depending on reports.

Essentially, though the existing version of the Stranger Video Call Application performs its basic purpose well, such possible future features can enrich the platform significantly. They can facilitate a more secure, interesting, and scalable space, further enhancing it to become even more appealing and sustainable for long-term usage.

CONCLUSION

The Stranger Video Call Application was able to ac- complish its core goal of providing real-time video com- munication among randomly paired users. Through the utilization of contemporary web technologies like We- bRTC, Socket.IO, Node.js, and Express.js, the application provided a seamless and responsive environment in which users were able to anonymously connect via a minimal- istic interface.

During the development, focus was made on providing low latency, a stable peer-to-peer connection, and an user- friendly interface. The system underwent extensive testing and was found effective in offering instant video and audio transmission without prompting users to download extra plugins or install software. The technology choices enabled real-time data exchange as well as minimal sig- naling, resulting in the overall performance and response of the platform.

One of the key strengths of the application is its adher- ence to user anonymity and privacy. No personal details or login were needed, which promoted freer interaction

without the need for a protective barrier. Although de- signed to be lightweight, the system provided stable core functionality and was consistent in its performance under varying network conditions and devices.

To recap, the project achieved its objective successfully and showed that real-time video calling for strangers can effectively be implemented employing open-source web technologies. Building on the solid foundation established today, future feature enhancements like report features, AI moderation, or user preference matching can further raise the usability level and popularity of the platform.

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