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MEDIMUTE: ENABLING DEAF AND MUTE MEDICAL CONSULTATIONS THROUGH VIDEO CALLING

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ABSTRACT

The advancement of technology within the healthcare sector underscores the necessity for inclusive medical platforms designed to tackle the distinct challenges encountered by various communities. Among these, the deaf and mute community often faces significant hurdles in communication during medical consultations. To address this gap, we introduce a novel video calling platform customized to facilitate interactions between healthcare professionals and individuals who are deaf or mute. Concurrently, it transforms spoken words of doctors into text, establishing a robust two-way communication conduit. This innovation pledges to deliver a transformative user experience, ensuring that the deaf and mute community can access healthcare services with the clarity, dignity, and efficiency they rightfully deserve. This initiative highlights the vast potential of technology in promoting inclusivity, comprehension, and superior patient care within modern medical practices. Recent years have witnessed remarkable strides at the intersection of technology and healthcare, fundamentally altering the landscape of patient care. In acknowledgment of this urgent requirement, our team has developed an inventive video calling platform that surpasses conventional telemedicine solutions. By directly addressing the needs of the deaf and mute community, our cutting-edge web application aims to dismantle communication barriers and offer a seamless and efficient channel between patients and healthcare providers.

Keywords: Inclusive Medical Platforms, Sign Language Translation, Transformative User Experience, Cutting-Edge Algorithms, Deaf And Mute Community, Innovative Video Calling Platform, Communication Barriers.

I. INTRODUCTION

The deaf and mute community represents a significant segment of the global population, with communication needs primarily reliant on sign language. Unfortunately, sectors like healthcare often overlook these needs, leading to communication barriers that can result in misdiagnoses and inadequate medical care. Moreover, not all medical professionals are proficient in sign language, and dedicated interpreters are not always feasible due to various constraints. In response to this challenge, we developed an innovative video calling website tailored for deaf and mute individuals. Central to this solution is the real-time translation of sign language into text, facilitating clear communication of patients' medical concerns. Likewise, spoken words from doctors are converted to text to ensure patients comprehend medical advice. This two-way communication channel is crucial in overcoming healthcare barriers faced by this community. The website features intuitive design for easy access by both doctors and patients. Advanced algorithms, potentially utilizing machine learning and artificial intelligence, power the platform's translation capabilities. Security measures, including end-to-end encryption, are rigorously implemented due to the sensitive medical data involved. While the primary focus is on the deaf and mute community, the design also considers inclusivity for other disabilities, reflecting our commitment to universal healthcare access. This initiative represents a blend of cutting-edge technology and compassionate understanding of diverse communication needs, aiming to create a more inclusive healthcare environment.

II. LITERATURE SURVEY

1. Sign Language Recognition Using Machine Learning Algorithm:

In India, the existing voting system is a corner stone of its democratic process. The deaf and mute community primarily relies on sign language for communication. However, there's a prevalent challenge of universal understanding of sign language among the general populace. Algorithms such as K-Nearest Neighbors (KNN), Multi-class Super Vector Machine (SVM), and Convolutional Neural Networks (CNN) have been explored for recognizing hand signs. A comparative study found that CNN yielded the highest accuracy of 98.49%, surpassing KNN's 93.83% and SVM's 88.89%. The study emphasizes the crucial role of data augmentation in deep learning, highlighting CNN's ability to auto-learn features for distinct classes and its computational efficiency. Both KNN and SVM have specific considerations: the choice of 'k' in KNN is influenced by data type and noise tolerance, while the 'gamma' parameter in SVM is pivotal for model fitting. CNN emerges superior given its universal applicability, high accuracy, and minimal loss

2. Hand Configuration in Sign Language Translation:

Real-time identification of hand configurations is essential for effective sign language translation. A notable approach used data gloves equipped with 14 sensors, capturing the bending of finger joints. These inputs were processed at a 100Hz frequency and directed to a classifier predicting hand configurations. The classifier demonstrated high accuracy, endorsing the efficacy of data gloves in capturing intricate hand gestures. However, a challenge persists regarding the classifier's robustness, as its accuracy varies based on the user—particularly if the user has not trained the classifier.

3. Problem Definition:

For the deaf and mute community, effective communication during medical consultations poses a significant challenge. While sign language offers a robust means of communication for these individuals, many medical professionals lack the expertise to comprehend it, leading to communication barriers that can adversely impact the quality of care. The existing gap in communication can result in misunderstandings, misdiagnoses, and a general lack of accessibility to essential healthcare services for the deaf and mute population. Therefore, there's a pressing need for an innovative solution that facilitates seamless two-way communication during medical consultations by translating sign language gestures into text and converting a doctor's voice responses back into text, ensuring clear, effective, and efficient interactions between deaf and mute patients and healthcare providers.

4. Scope Statement:

Our to our endeavor will be the creation of a user interface tailored for both the patient and doctor, backed by a server system equipped to manage live video interactions seamlessly. An integral part of this project will involve integrating sophisticated algorithms for sign language recognition, coupled with voice-to-text conversion capabilities. While we endeavor to ensure comprehensive data protection through encryption and robust privacy measures, certain aspects lie outside our current scope. These include offering training to medical professionals in sign language, incorporating physical hardware like data gloves, developing a mobile app variant, and expanding language support beyond a primary language. As we navigate the course of development, we're bound by certain constraints, including adherence to data protection regulations, ensuring cross-platform compatibility, and abiding by set timelines and budgetary limits. We proceed with the assumption that users have access to a stable internet connection and the necessary tools like webcams and microphones. Additionally, we base our work on the premise that the majority of our deaf and mute user base will employ a standardized form of sign language for communication.

5. System Requirement Specification (SRS):

- **Functional Requirements:**

The platform must allow both patients and doctors to register, creating distinct profiles. Secure authentication mechanisms will be essential, with features for password recovery. Additionally, patients should be able to search for doctors based on various criteria, while both parties can manage and update their profiles. This includes the management of medical histories for patients and consultation timings for doctors. The primary function is to enable seamless video calls. Within these calls, the platform should recognize sign language gestures from the deaf and mute users, translating them into text for the doctor's comprehension. Conversely, spoken words from the doctor must be converted into text for the patient, ensuring two-way communication. The video streaming should be of high quality, with minimal lag, paired with controls to adjust video quality

- **Non–Functional Requirements:**

The platform must operate seamlessly, ensuring that video calls are smooth with minimal lag or delay. It should be capable of handling a large number of concurrent users without compromising the quality of service. Additionally, as the user base grows, the system must be scalable to accommodate increased demand, whether that means more data storage or greater processing capabilities. To ensure continuous medical consultations, the platform must boast high reliability, minimizing downtime. It should offer at least 99% uptime, ensuring that users can access the system whenever they need. Regular backups and a robust disaster recovery plan are vital to maintain data integrity and ensure service availability even during unforeseen circumstances. The platform's design must be user-centric, providing an intuitive interface for both patients and doctors. It should be easily navigable and consistent across different modules. Moreover, given the target audience includes the deaf and mute community, the design should also focus on accessibility features, ensuring inclusivity for all users.

III. METHODOLOGY

1. Google Hand Sign Detection Model:

CNNs are commonly used in computer vision tasks such as object detection and pose estimation. In this model, CNNs are likely employed to process the image data captured from the camera feed, extracting relevant features and detecting the hand within the image. These networks are adept at handling spatial relationships within images, which makes them suitable for tasks like identifying the hand and its gestures.

Pose estimation algorithms, possibly based on key point detection techniques, may be utilized to localize and track specific points of interest on the detected hand. These algorithms help in accurately determining the coordinates of the hand's skeleton, which are crucial for understanding hand gestures.

2. Hand Sign Prediction Model:

RNNs are well-suited for processing sequential data, making them a suitable choice for interpreting the temporal sequence of hand gestures represented by the 42-element array. Given that gestures unfold over time, RNNs can capture the temporal dependencies present in the data, enabling the model to understand the sequential nature of hand signs.

LSTMs are a type of RNN designed to address the vanishing gradient problem, which occurs when training traditional RNNs on long sequences of data. By incorporating memory cells and gating mechanisms, LSTMs can effectively capture long-range dependencies in sequential data. In the context of hand sign prediction, LSTM networks may be utilized to model the temporal dynamics of gestures encoded in the 42-element array.

Overall, the combination of CNNs for hand detection and pose estimation in the first model, along with RNNs or LSTM networks for interpreting sequential hand gestures in the second model, provides a robust framework for accurately detecting and predicting hand signs in real-time applications.

3. WebRTC Integration:

WebRTC is leveraged to facilitate real-time audio and video communication between users directly within the web browser or mobile application. Through WebRTC APIs, your application establishes peer-to-peer connections between users, enabling secure and low-latency video calls without the need for additional plugins or software.

4. Socket.IO for Real-Time Communication:

Socket.IO is used to complement WebRTC by providing real-time signaling and messaging capabilities between clients and servers. It facilitates the exchange of signaling messages required for WebRTC session establishment, such as session initiation, offer/answer exchange, and ICE candidate exchange. Socket.IO also handles other real-time events, such as user authentication, invitation sending, and status updates, ensuring seamless communication throughout the application.

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IV. ANALYSIS USING DIAGRAMS

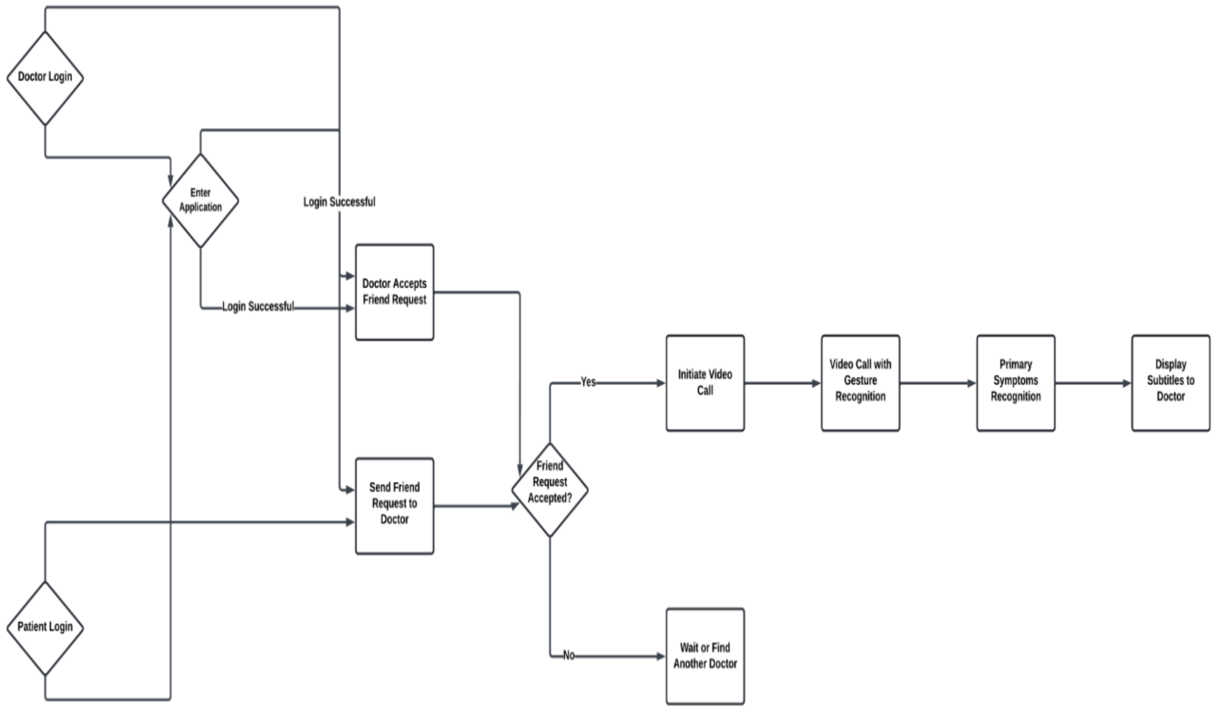

Fig 1 - Architecture Diagram

V. TESTING

After integrating two hand sign recognition models into the video calling application for facilitating communication with deaf and mute individuals, rigorous testing of the entire project was conducted to ensure its effectiveness and reliability. The testing phase involved comprehensive evaluations of various aspects, including the functionality of the video calling platform, accuracy of hand sign recognition, real-time communication performance, and user experience. A series of simulated scenarios and real-world interactions were used to assess the application's responsiveness, robustness, and usability across different devices and network conditions. Additionally, extensive user testing sessions were conducted with members of the deaf and mute community, soliciting feedback on the platform's accessibility, ease of use, and overall satisfaction. Through iterative testing and refinement cycles, any identified issues or inconsistencies were addressed promptly, leading to enhancements in both the user interface and underlying algorithms. The testing process ultimately validated the efficacy of the video calling application in enabling seamless communication between healthcare professionals and individuals with hearing or speech impairments, reaffirming its potential to positively impact patient care and accessibility in the medical domain.

VI. CONCLUSION

In conclusion, the integration of communication bridges between the deaf community and medical professionals represents a transformative leap towards inclusivity and accessibility in healthcare. By eliminating physical barriers, reducing dependency on interpreters, and enabling efficient real-time conversion, these bridges empower deaf individuals to engage directly with healthcare providers, fostering autonomy and independence. The geographical outreach ensures that medical services can reach deaf patients regardless of location, while the training potential enhances the competency of medical professionals in catering to the specific needs of the deaf community. The seamless digital integration and expansion readiness further underscore the adaptability and scalability of this approach, laying a robust foundation for broader community outreach and improved healthcare experiences for the deaf population. Furthermore, the impact of these communication bridges extends beyond immediate accessibility concerns, resonating deeply within the realms of healthcare equity and patient-centered care. The removal of communication barriers not only facilitates clear dialogue between the deaf community and medical professionals but also cultivates a more empathetic and understanding healthcare environment. As these bridges seamlessly integrate with other health apps, they contribute to a more comprehensive and interconnected healthcare ecosystem. The expansion readiness of this initiative speaks to its potential for driving systemic change, promoting inclusivity not just for the deaf community but also laying the groundwork for improved communication strategies across diverse populations.

VII. FUTURE SCOPE

- **Mobile Application:** The development of a mobile application is integral to ensuring accessibility and convenience for users. A mobile platform allows individuals from the deaf and mute community to access the video calling service from their smartphones, providing flexibility and eliminating the constraints associated with traditional computer-based solutions. The application should be designed with a user-friendly interface, considering the unique needs and preferences of the target users, and should be available on popular mobile operating systems for widespread adoption.
- **Medical Record Integration:** To enhance the overall healthcare experience, the video calling platform can be integrated with electronic medical records (EMRs). This integration streamlines the communication process by allowing healthcare professionals to access patients' medical histories and records during consultations.
- **Expand User Base:** To maximize the impact of the platform, efforts should be directed towards expanding the user base. This involves strategic partnerships with healthcare institutions, advocacy groups, and community organizations to promote awareness and encourage adoption. Collaboration with government health agencies can also facilitate the inclusion of the platform in healthcare initiatives, ensuring a broader reach and increased accessibility for the deaf and mute population
- **Voice to Sign Conversion:** Building on the existing capability to translate sign language into text, the platform can be enhanced to include voice-to-sign conversion. This feature allows healthcare professionals who may not be proficient in sign language to communicate verbally. The system then translates their spoken words into sign language on the patient's end, creating a more versatile and inclusive communication channel.

VIII. REFERENCES

[1] Machine Learning-based Hand Sign Recognition by Greeshma Pala, Jagruti Bhagwan Jethwani, Satish Shivaji Kumbhar, Shruti Dilip Patil.

[2] Recognition of hand configuration: a critical factor in automatic sign language translation by Nuno Escudeiro, Paula Escudeiro, Fernando Soares, Orfeas Litos, Marcelo Norberto, Jorge Lopes

[3] Hand Gesture Recognition with Skin Detection and Deep Learning Method by Hanwen Huang , Yanwen Chong, Congchong Nie , Shaoming Pan.

[4] Movement-in-a-Video Detection Scheme for Sign Language Gesture Recognition Using Neural Network by Angela C. Caliwag, Han-Jeong Hwang, Sang-Ho Kim, Wansu Lim

[5] An improved hand gesture recognition with two-stage convolution neural networks using a hand color image and its pseudo-depth image by Jiaqing Liu, Kotaro Furusawa, Tomoko Tateyama, YutaroIwamoto,Yen-Wei Chen

[6] Image pre-transformation for recognition-aware image compression by Nuno Escudeiro, Paula Escudeiro, Fernando Soares, Orfeas Litos, Marcelo Norberto, Jorge Lopes