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SignBridge: Bridging Communication Gaps with a Video Calling App for Inclusive Conversations – Integrating Sign-Language Recognition for the Deaf and Mute

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Abstract: *"SignBridge" is a groundbreaking project aimed at revolutionizing communication enhancing individuals accessibility who hearing or speech impaired community. Our innovative video calling application seamlessly integrates state-of-the-art recognition of hand movements in SL technology, facilitating inclusive conversations like never before. With SignBridge, users can engage in real-time video calls and have their gestures employed in SL accurately interpreted and displayed to their conversation partners. By connecting and facilitating communication between the hearing impaired and the hearing world, SignBridge empowers individuals to convey their thoughts and feelings freely and participate fully in social interactions, education, and professional settings. This project represents a meaningful stride in fostering inclusivity and accessibility society, where all individuals can communicate effectively irrespective of their hearing capabilities.*

Keywords: SignBridge

I. INTRODUCTION

The quest for inclusive communication has long been a hurdle, particularly for individuals with hearing challenges challenges. "SignBridge" emerges as a beacon of hope in this domain, offering a transformative solution to close the divide among deaf and the non-speaking community and the hearing world[1]. Through incorporating cutting-edge identification of SL technology, SignBridge redefines the landscape of video calling applications, making communication accessible and effortless for all.

In today's interconnected world, communication is the cornerstone of human interaction, yet conventional approaches frequently overlook the distinct requirements of deaf and mute individuals population [2][3]. SignBridge acknowledges this disparity and endeavors to address it head-on by providing a platform wherein sign language constitutes not only recognized but seamlessly integrated into the communication process. By doing so, SignBridge not only empowers individuals with hearing challenges express themselves with ease but also fosters a more welcoming atmosphere where all individuals can engage in meaningful conversations regardless of their hearing ability[4][7].

Fundamentally, SignBridge is more than just a technological innovation; it represents a fundamental shift towards a more encompassing society. By embracing diversity and leveraging the power of technology, SignBridge ushers in a future where communication obstacles are dismantled, and every voice is heard[5][6]. Through this project, we embark on a journey towards greater empathy, understanding, and equality, one conversation simultaneously.

II. LITERATURE SURVEY

Advancing Recognizing Sign Language through Machine Learning (ML): I.A. Adeyanju, O.O. Bello, M.A. Adegboye: The study emphasizes integration of intelligent solutions into ASLR systems, presenting insights into feature extraction, classification techniques, and cooperation networks among researchers and institutions within this domain [1][7].

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Advancements within the realm of SL Recognition: A Comprehensive Survey by Ashok K Sahoo, Gouri Sankar Mishra, Kiran Kumar Ravulakollu: Their surveydives into the intricacies of data collection, preprocessing, feature selection, classification, and results, offering perspectives on the present status and future directions of research in this vital field of human-computer interaction. [2][13].

Efficient Recognizing Sign Language via Image and Hand Landmark Fusion using CNN by Refat Khan Pathan, Munmun Biswas, Suraiya Yasmin, Mayeen Uddin Khandaker, Mohammad Salman, Ahmed A. F. Youssef: By integrating hand landmarks with image processing, they achieve a remarkable 98.981% test accuracy, offering a promising solution for efficient human-machine communication systems tailored to the deaf-mute community[3][5].

Deepsign: Bridging Gaps in the Communication with Harnessing DL for Detecting and Recognizing Sign Language by Deep Kothadiya, Chintan B, Krenil S, Kevin P, and A B Gil-González, Juan M. Corchado: a deep learning-based model utilizing LSTM and GRU to discern and recognize Indian SL gestures. Achieving approximately 97% accuracy across 11 different signs, this method shows potential for enhancing accessibility of Communication for each and every one with speech or hearing impairments or disabilities, offering a potential solution to communication barriers through technology-driven means [4][8].

A RSL Recognition System with TensorFlow Object Detection API paper by Sharvani S, Amisha G, R Mishra, Sudhakar Singh: By utilizing transfer learning and webcam data collection, their model achieves significant accuracy, offering a promising solution to facilitate smooth communication among individuals with and without hearing or speech impairments[6][10].

III. EXISTING SYSTEM

The recognizing SL encompasses a range of approaches aimed at enabling individuals communication with speech difficulties or hearing impairments[9]. These systems leverage various methodologies, incorporating machine learning, deep learning, and convolutional neural networks (CNNs). They often involve data-collection & preprocessing, feature-extraction and classification stages to accurately interpret sign language gestures[11]. Techniques such as integration of image and hand landmarks, transfer learning, and real-time processing are utilized to enhance system performance. While some systems focus on stationary and moving gesture recognition, others prioritize real-time detection and translation. Overall, these existing systems represent significant strides towards breaking communication barriers and enabling seamless interaction between individuals with and without hearing or speech impairments[12].

IV. DISADVANTAGE OF EXISTING SYSTEM

One disadvantage highlighted by the literature survey and existing systems is the potential complexity and computational intensity of the solutions proposed. While advancements in machine-learning, deep learning, and convolutional-neural-networks (CNNs) offer promising avenues for sign language recognition, these methods may necessitate substantial computational resources for training and inference. Additionally, the integration of multiple techniques such as data-collection & preprocessing, feature-extraction and classification may introduce complexities in system development and maintenance. Moreover, achieving high accuracy rates, as demonstrated in some studies, may require extensive data annotation and model tuning, which can be consuming some amount of time and resource-intensive. Therefore, scalability and efficiency concerns may arise when implementing these sophisticated recognition systems, particularly in real-world applications where computational resources may be limited[14].

V. PROPOSE SYSTEM

The project strives to create a real-time system for identifying SL utilizing transfer learning and TensorFlow. Initially, the ISL dataset is expected to created through webcam recordings, capturing various ISL gestures including single and double-handed signs. Transfer learning techniques will be employed to fine tune pre trained TensorFlow models on this dataset, enabling effective identification of ISL gestures. The trained model will then be integrated into a real-time recognition system, processing live video feed from a webcam source and accurately identifying gestures in real-time. Recognition results can be displayed on-screen or translated into English text, facilitating seamless communication between users and individuals proficient. Methods like augmentation of data and adaptive adjustment of learning rates will be employed to enhance model performance and generalization. Overall, the suggested system offers a promising

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solution for enhancing access of individuals communication with speech or hearing disabilities, providing a cost-effective and efficient means for identification and translation in real-time.

VI. IMPLEMENTATION

The SL identification system encompasses several key steps. Initially, a varied dataset of SL gestures is collected using a webcam, encompassing a broad array of single and double-handed signs across varying backgrounds and lighting conditions. Following data collection, preprocessing techniques are utilized for extract individual frames extracted from the video data and standardize their format. Transfer learning is then employed to fine-tune pre-trained TensorFlow models, adapting them to the task of SL gesture identification. The dataset is split into training, validation, and test sets, with the models training with the trained dataset while monitoring performance on the validation set to prevent overfitting. Subsequently, a real-time recognition system is developed using OpenCV to capture live video feed from the webcam. Each frame is processed by the trained model to recognize and classify SL gestures in real-time. Finally, the performance of the system is evaluated using the test set, and user feedback is incorporated to refine and optimize the system for practical use. Through these steps, the suggested a SL identification system can be efficiently implemented, providing a valuable tool for enhancing accessibility of communication for each and every individuals with speech or hearing challenges.

VII. METHODOLOGY

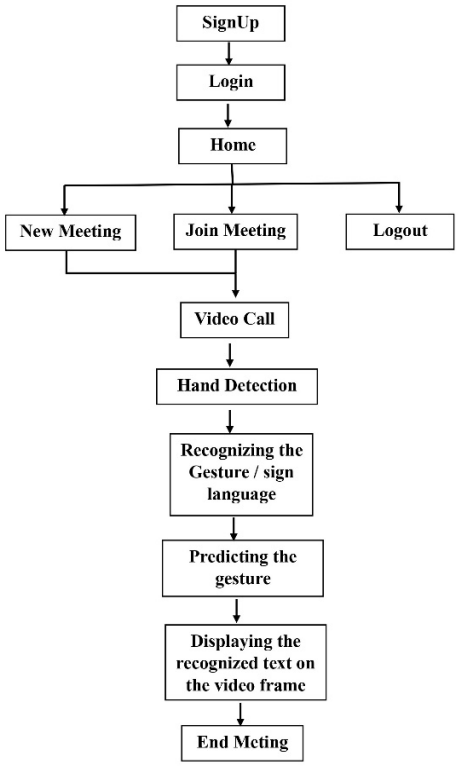

Figure 1: Methodology

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VIII. RESULTS

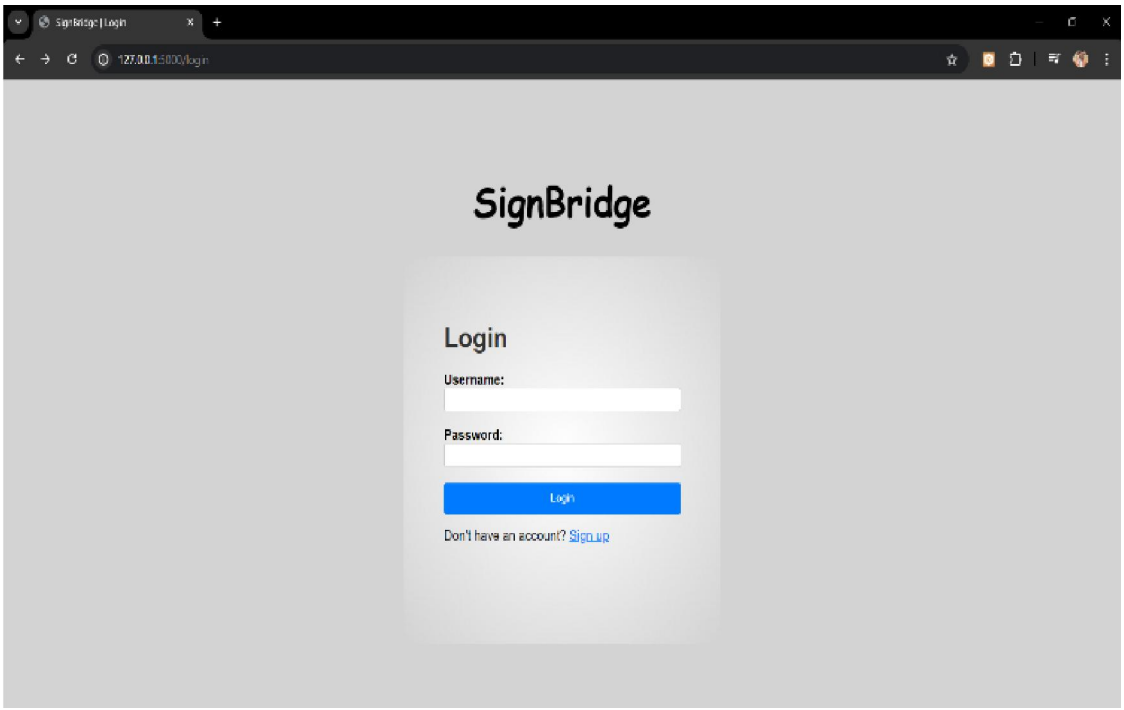

Figure 2: Login Page

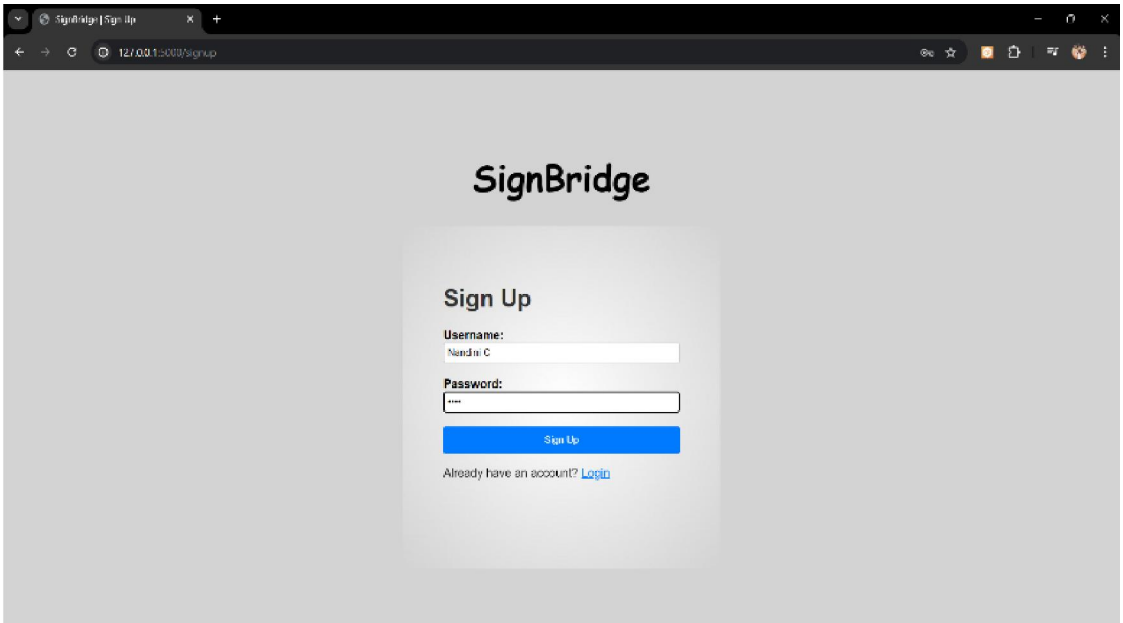

Figure 3: Sign-Up

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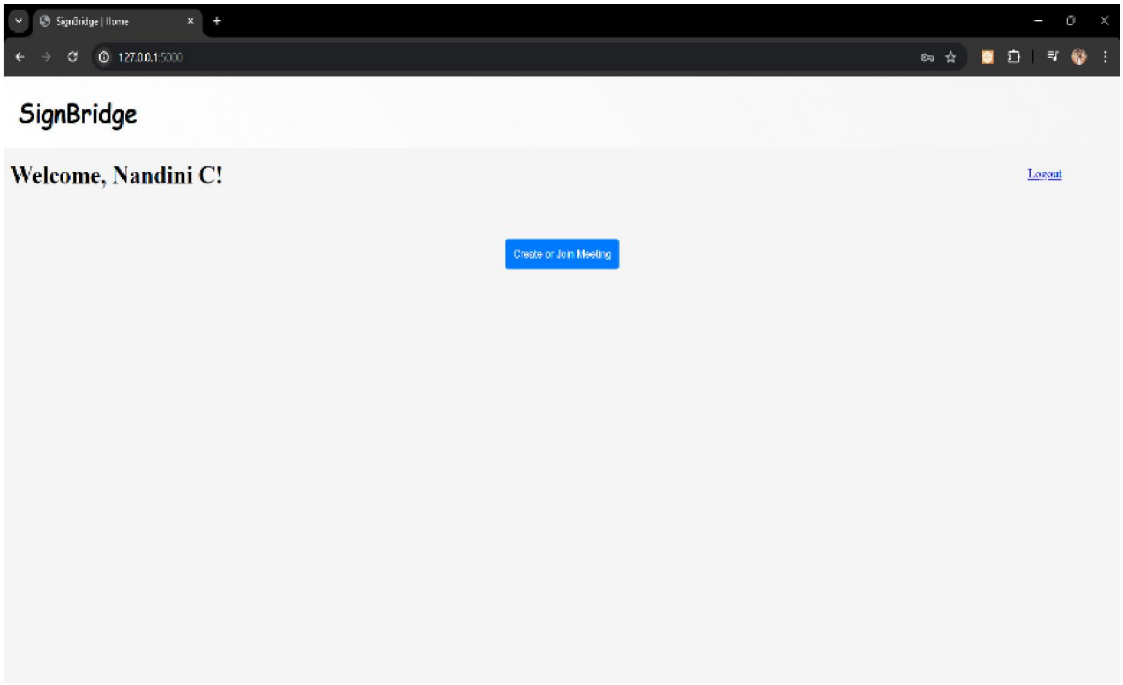

Figure 4: Home Page

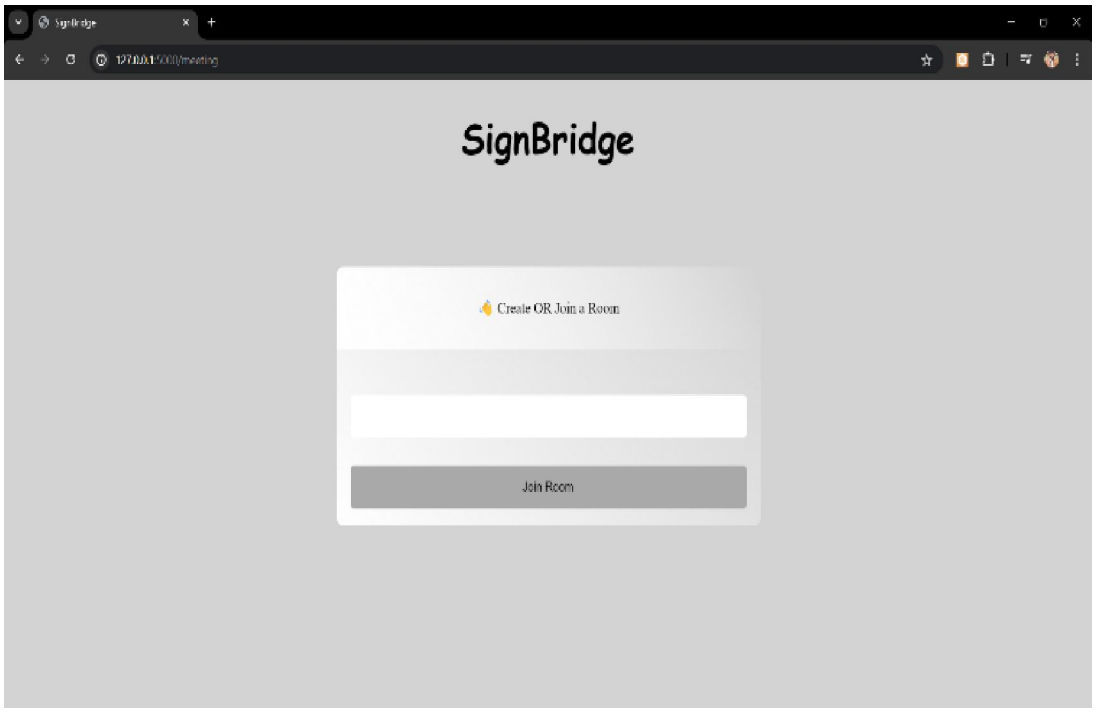

Figure 5: Join or Create meeting

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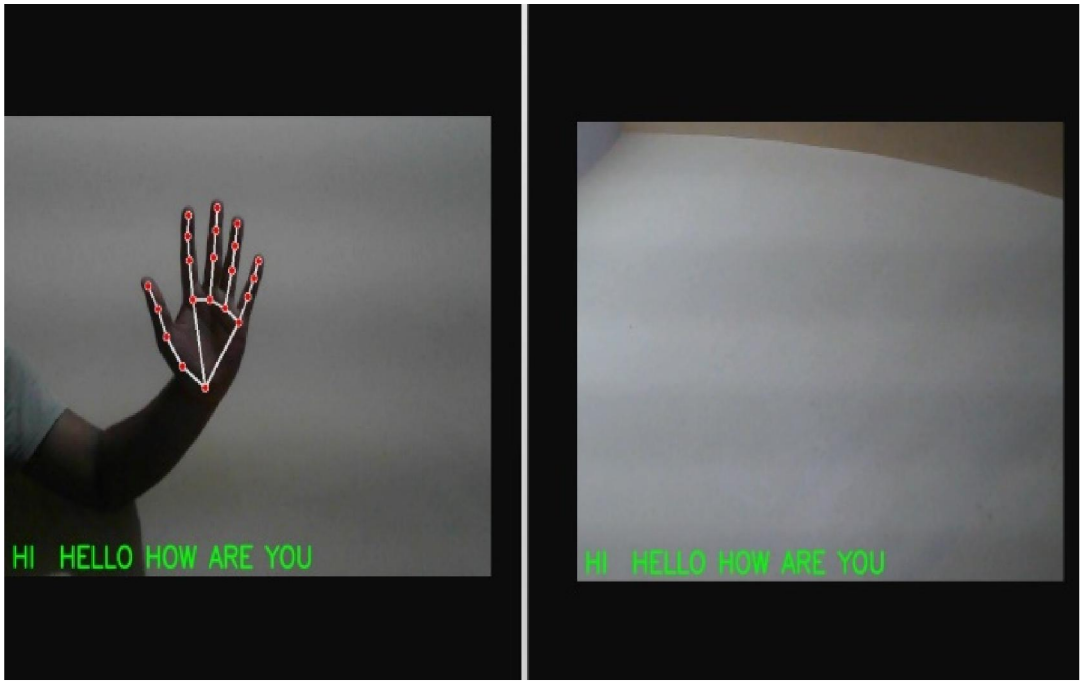

Figure 6: Video Call / Hand Gesture Recognition

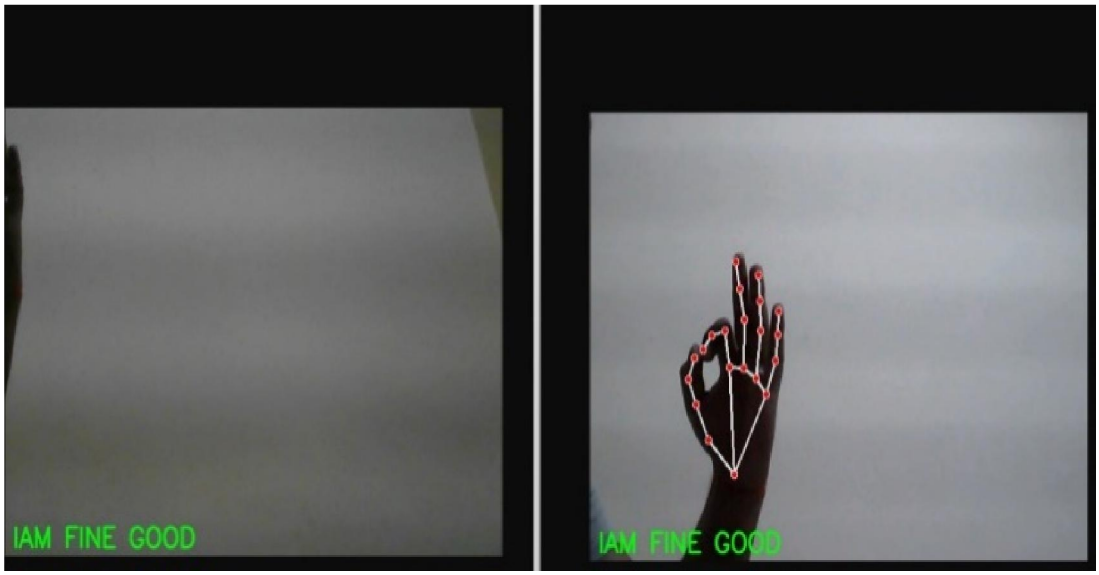

Figure 7: Video Call / Hand Gesture Recognition

IX. CONCLUSION

In conclusion, "SignBridge" represents a significant step forward in bridging communication barriers for the non-speaking and hearing-impaired community. By incorporating identification of SL into a video calling app, SignBridge empowers each and everyone speech-hearing impairments to engage in inclusive conversations with ease. Through real-time detecting and interpreting of SL gestures, SignBridge facilitates seamless communication among the deaf or

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mute users and their hearing counterparts. The project demonstrates the capability of technology to foster inclusivity and accessibility, emphasizing the significance of innovation in meeting addressing a variety of needs of every individuals with disabilities. As SignBridge continues to evolve and improve, it holds promise for creating a more connected and inclusive society where communication knows no barriers.

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