TALKHANDS: COMMUNICATING WITH THE SILENCED USING A MACHINE LEARNING POWERED SIGN LANGUAGE CONVERTER

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Introduction / background

In today's increasingly interconnected world, communication stands as a fundamental human right, yet many face significant challenges in expressing themselves due to various communication barriers. Individuals who are deaf or hard of hearing encounter substantial hurdles in daily interactions, highlighting the need for innovative solutions to bridge this gap. Sign language emerges as a powerful means of communication, offering a rich and expressive language utilized by millions worldwide. TalkHands represents a revolutionary project designed to empower and enhance the lives of individuals who are deaf or hard of hearing by leveraging cutting-edge machine learning technologies. The primary objective of this project is to develop a state-of-the- art Sign Language Converter, facilitating seamless communication between sign language users and those who are not fluent in the language. By creating a tool that bridges the gap between hearing and non-hearing communities, TalkHands aims to amplify silent voices, fostering inclusivity and equality in communication. The comprehensive solution proposed by TalkHands involves the development of a sign language analyzer powered by machine learning. This analyzer, utilizing camera inputanalyzes signs performed by users and matches them to corresponding letters or words in a predefined dataset. Additionally, an intuitive and user-friendly interface will be designed to promote real-time sign language conversion, ensuring seamless communication between users. The project's objectives include designing a user- friendly interface, developing a robust machine learning model for sign language recognition, ensuring accessibility for individuals with varying degrees of hearing impairments and technological proficiency, and planning for scalability and long-term sustainability. Looking ahead, TalkHands aims to revolutionize communication for individuals with hearing impairments by breaking down barriers and enabling effective interaction in diverse social contexts. Through ongoing refinement and expansion, TalkHands strives to create a more inclusive and accessible

communication environment, where every voice is not only heard but celebrated.

Objectives

- To design an intuitive, user-friendly interface for real-time sign language conversion, promoting seamless communication between sign language users and non-sign language speakers.
- To develop a robust machine learning model capable of recognizing and understanding sign language gestures and movements.
- To ensure that the TalkHands is accessible to individuals with varying degrees of hearing impairments and technological proficiency.
- To plan for the scalability and long-term sustainability including considerations for maintenance, updates, and expansion.

Methodology

The methodology, which aims to create a machine learning-powered sign language converter, can be broken down into several key steps. This methodology is designed to facilitate the analysis and conversion of sign language gestures into text and audio. Here's a step-by-step outline of the project's methodology:

Data Collection and Preparation: Collecting a diverse dataset of sign language gestures, signs, and variations. Annotating the dataset with corresponding letters or words for each sign. Preprocessing the data by normalizing hand positions, orientations, and other relevant features. Converting video data into a format suitable for training machine learning models.

Machine Learning Model Development: Using Convolutional Neural Networks (CNNs) machine learning algorithm for sign language recognition. Training the model on the prepared dataset, optimizing it for high accuracy and real-time performance. Implementing a sign language analyser component that can recognize and understand sign gestures from video input.

Real-time Video Analysis: Developing a module for capturing video input from a camera. Ensuring real-time processing of video frames to detect and track sign gestures as they are made.

Sign Language Recognition: Implementing the machine learning model to analyze each frame and recognize sign gestures in real-time. Extracting key features of sign language gestures, such as hand movements to improve recognition accuracy.

Text Generation: Matching recognized sign gestures to their corresponding letters or words from the annotated dataset. Converting the recognized signs into text format, forming sentences or phrases based on the sequence of signs.

Audio Output: Providing an audio output option for the generated text, allowing users to listen to the spoken version of the sign language message.

Testing and Validation: Conducting extensive testing with both sign language users and non-signers to assess the system's accuracy, real-time performance, and usability.

Collecting user feedback and make necessary improvements to the system.

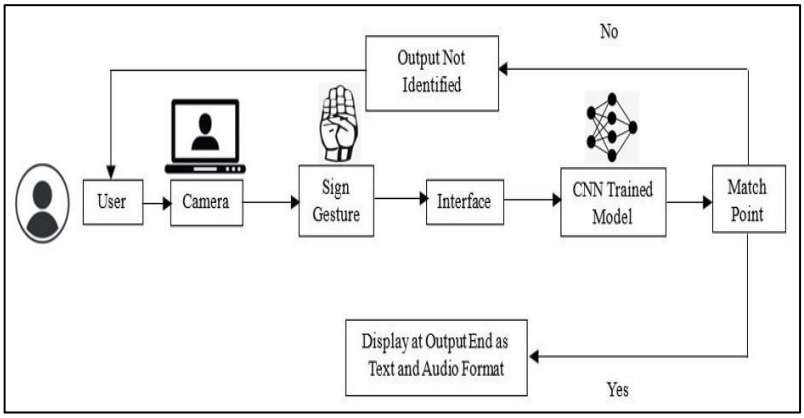

Figure: System Architecture

Results and Conclusions

In conclusion, the development of a comprehensive solution to enhance communication between individuals who are deaf or hard of hearing and those unfamiliar with sign language is paramount for promoting inclusivity and breaking down communication barriers. The proposed solution, integrating a sign language analyzer driven by machine learning, presents a promising avenue for bridging this divide. By leveraging camera input, the system accurately identifies and correlates signs with letters or words in a predefined dataset, facilitating seamless communication.

Snapshot captures the moment when the phrase "Hello World" is seamlessly identified through sign language recognition and promptly displayed on the screen.

What is the innovation in the project?

Machine Learning Integration: Incorporating advanced machine learning

techniques to develop a Sign Language Converter.

Real-time Conversion: Enabling instantaneous conversion of sign language into spoken or written language through camera input.

User-friendly Interface: Designing an intuitive and easy-to-use interface to facilitate seamless communication for both sign language users and non-users.

Accessibility: Ensuring the tool is accessible to individuals with varying degrees of hearing impairments and technological proficiency, promoting inclusivity.

Scalability and Sustainability: Planning for the scalability of the technology and its long-term sustainability to address ongoing communication needs effectively.

Inclusivity and Empowerment: Aiming to amplify the voices of individuals who are deaf or hard of hearing by breaking down communication barriers and fostering inclusivity in diverse social contexts.

Scope for future work

Looking ahead, there are several avenues for future development and enhancement of the proposed solution:

Multi-platform Support: Expanding compatibility to web, mobile, and desktop platforms as an application would enhance accessibility and convenience, ensuring broader reach and usability across devices.

Customizable User Interface: Introducing personalized user interface options, such as adjustable fonts, colors, and layouts, would cater to diverse user preferences and accessibility needs, further improving user experience.

Interactive Features: Incorporating interactive elements such as emojis, gestures, and reactions into the communication platform would enrich video calls, fostering dynamic and engaging interactions between users.

User Feedback Mechanisms: Implementing robust systems for collecting user feedback and insights would enable continuous improvement of the solution's performance and usability, ensuring that it evolves to meet the evolving needs and preferences of its users.

By embracing these future development opportunities, the proposed solution can continue to evolve and adapt, ultimately realizing its potential to revolutionize communication for individuals with hearing impairments and contribute to a more inclusive society.