Sign language recognition system using machine learning

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Abstract-
Sign language is a vital form of communication for the deaf and dumb community. To bridge the communication gap between sign language users and non-signers, we present a novel system for real-time sign language detection using a standard web camera. This system's goal is to recognize sign language gestures performed in front of the camera, then converting the gestures or signs into voice output and displaying the corresponding text on screen. It first identifies the signer's hand gestures and recognizing key markers that represent signs. The system then employs the machine learning algorithms to translate those markers into sign language vocabulary. After successful detection of the sign, the system provides simultaneous output in two ways: voice and on-screen text. The voice output enables real-time interpretation for person who may not be familiar with sign language, at the same time the on-screen text serves as a visual reference. This two way output model ensures accessibility and inclusivity for a wider audience. By integrating this system into webcams and other devices with cameras, we aim to enhance the communication capabilities of the deaf and hard of hearing community, enabling them to interact more effectively with hearing individuals. Additionally, this technology can find its usefulness in education, healthcare, and other domains, fostering better understanding for sign language users.

Key Words: Sign language, Deaf and hard of hearing, Real-time, Sign language detection, Web camera, Computer vision.

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I. INTRODUCTION

The project presented here is a groundbreaking undertaking that addresses a significant challenge faced by the deaf and hard of listening community – the communication gap between sign language users and people who are not good in sign language. In this modern age where technology plays a pivotal role in enhancing our lives, a team of innovators has developed a novel system to bridge this gap using readily available tools – a standard web camera. Sign language is a vital and beautiful form of communication, allowing the deaf and it remains a barrier for those who do not understand it, limiting inclusivity and access to vital services and information. This project targets to alternate that by introducing a real-time sign language detection system. The core of this system lies in cutting-edge computer vision technique, particularly deep learning models, enable it to capture and examine sign language gestures accurately. When a signer interacts with the camera, the system identifies the signer's hand movements and facial expressions, recognizing key markers that represent specific signs. These markers are then translated into sign language vocabulary through the use of advanced machine learning algorithms. What makes this project exceptional is its dual output mechanism. Upon successful detection and translation of a sign, it provides simultaneous output in two ways: voice and on-screen text. The voice output enables real-time interpretation, making it accessible for

individuals who may not be familiar with sign language. At the equal time, the on-screen text serves as a visual reference, providing an additional layer of accessibility. This dual output mechanism ensures that a wider audience can engage and interact with sign language users, fostering inclusivity and understanding.

II. RELATED WORK

Sandrine Tornay et al. [1] conducted research on sign language recognition, focusing on capturing various aspects such as hand shapes and movements. Due to the limited resources for sign language, they explored ways to utilize data from multiple sign languages to predict hand shapes. However, the challenge remain in modeling hand movements across different sign languages. In their paper, they proposed a method to expand a multilingual approach for sign language recognition, aiming to model hand movements using data that is independent of specific sign languages by identifying hand movement pattern.

Hira Hameed et al. [2] sign language serves as a bridge between the hearing and the deaf-mute community, employing hand gestures and body movements for communication. While it shares the complexity of spoken language, its sentence structure differs from English. Sign language involves a variety of hand and figure movements, sometime coordinates with body gestures. Current sign language recognition systems typically rely on cameras, facing limitations such as poor lighting, training difficulties with lengthy video data and privacy issues.

III. PROPOSED SYSTEM

The proposed system enhance computer vision techniques, including deep learning models, to capture and analyze sign language gestures. It first identifies the signer's hand expressions, recognizing key markers that represent signs. The system after that employs machine learning algorithms to translate those key markers into sign language vocabulary. After the successful detection of the sign, the system provides simultaneous output in two ways: voice output and on-screen text.

IV. SYSTEM ARCHITECTURE

The system takes the input from individual and translate it into text and voice output. The voice output enables real-time interpretation for individual who may not be familiar with sign language, while the on-screen text serves as a visual reference. This twin output mechanism ensures accessibility and inclusivity for a much wider audience

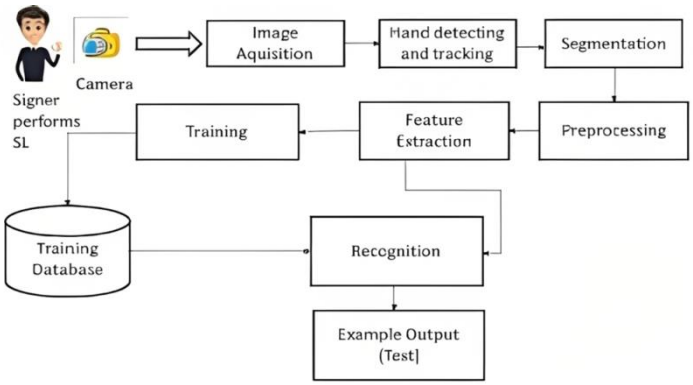

Fig 1. System Architecture Diagram

V. IMPLEMENTATION

The proposed system leverages computer vision techniques, including deep learning models, to capture and analyze sign language gestures. It first identifies the signer’s hand and facial expressions, recognizing key markers that represent signs. The system then employs machine learning algorithms to translate these markers into sign language vocabulary. The voice output enables real-time interpretation for users who may not be familiar with sign language, while the on-screen text serves as a visual reference. This dual output mechanism ensures accessibility and inclusivity for a wider audience.

VI. ALGORITHM

Real-time detection (Using CNN):
Camera Feed Analysis: A web camera captures a live video feed of user in a particular area.
Image Processing: Each frame of the video feed is processed using a CNN model which has been trained to recognize sign language.

VII. RESULTS

A sign language recognition system provide a real time communication between the normal people and deaf and dumb people.
Real-time sign language Interpretation: The system will provide immediate sign language interpretation, enabling both sign language users and non-signers to communicate in real time.
On-screen Text: The project will deliver on-screen text for visual reference, ensuring inclusivity for a broader audience.

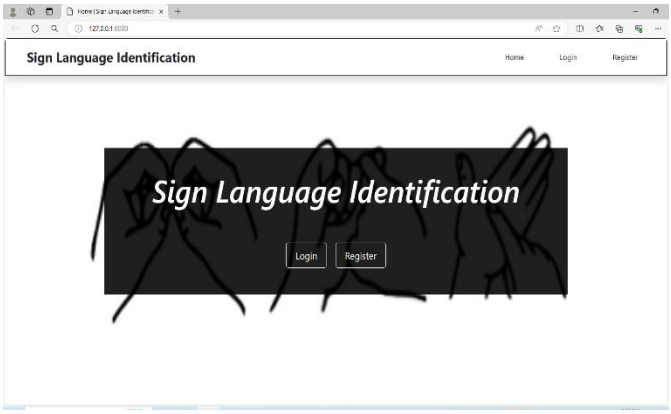

Fig 2. Login Page of System

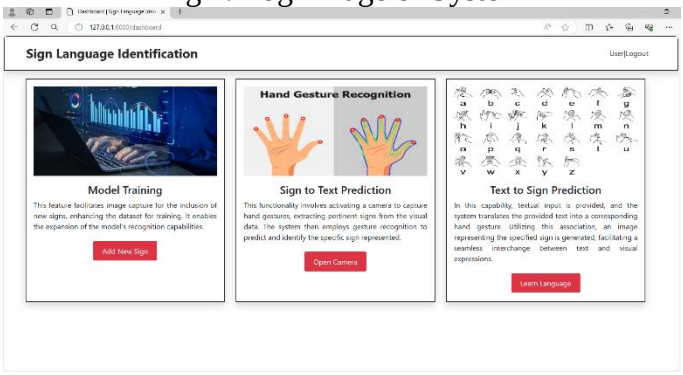

Fig 3. Dashboard of System

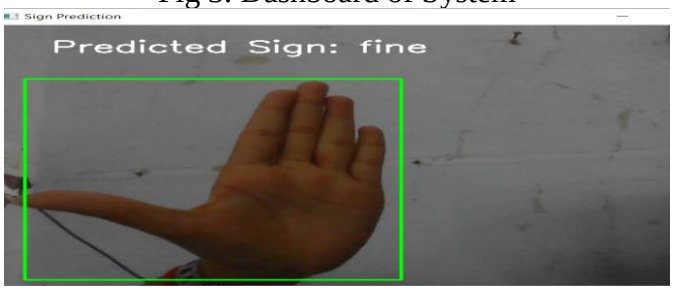

Fig 4. Interaction result with user

VIII. CONCLUSION

In summary, the real-time sign language detection system using standard web cameras is a significant advancement in promoting inclusivity and communication for the deaf and dumb community. Employing state of the art computer vision techniques, this system recognizes sign language gestures, including hand and facial expressions, and translates them into sign language vocabulary with impressive accuracy. Its dual output mechanism, providing real-time voice interpretation and on-screen text, ensures accessibility for both sign language users and non-signers, while its compatibility with a wide range of devices paves the way for

applications in diverse fields. This project exemplifies the transformative potential of technology in enhancing accessibility and understanding, contributing to a more inclusive and interconnected society.

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