CAPTURING NON-MANUAL FEATURES OF INDIAN SIGN LANGUAGE AND CONVERTING IT INTO TEXT

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ABSTRACT-Communication between hearing-impaired individuals and people who do not understand sign language can be difficult, leading to communication barriers in daily life. To overcome this issue, the Capturing Non-Manual Features of Indian Sign Language and Converting It into Text system uses Artificial Intelligence and Computer Vision to recognize both manual hand gestures and non-manual features such as facial expressions and head movements. The system is developed using Python, OpenCV, and deep learning techniques to capture and process sign language in real time. It identifies Indian Sign Language gestures and converts them into meaningful text with improved accuracy. The application provides a simple and user-friendly interface for capturing, processing, and displaying the translated text. The system is accurate, efficient, and easy to use, helping improve communication between hearing-impaired individuals and the general public while promoting accessibility and inclusion.

Keywords: Artificial Intelligence (AI), Indian Sign Language (ISL), Computer Vision, Deep Learning, Non-Manual Features, Gesture Recognition, Image Processing, Text Conversion.

INTRODUCTION

Researchers have made significant strides in sign language recognition by leveraging the power of Artificial Intelligence (AI), Computer Vision, and Deep Learning techniques. Earlier systems were focused on identifying signs through hand gestures recognition.

Despite the usefulness of these methods, they fail to account for non-manual features like facial expressions, head movements, eye

gaze, and lip movements which play a vital role in determining the correct meaning of many signs in ISL. So, the translation accuracy was limited.

Communication is essential for day-to-day life and ISL (Indian Sign Language) is crucial. When people with hearing and speech impairment try to interact with anyone who is not aware of ISL, a gap occurs between them. Most connections rely on signing interpreters, who may not always be available. In order to solve this problem, the project Capturing Non-Manual Features of Indian Sign Language and Converting It into Text uses AI normally seen in image classification and produces real-time sign language recognition.

The system can capture both the manual hand gestures and non-manual features like facial expressions and head movement with a camera.

These characteristics are analyzed to accurately identify signals and convert them into understandable texts, thus offering a simple, efficient and accessible solution

LITERATURE SURVEY

Numerous scholars have created sign language recognition systems utilizing Artificial Intelligence, Machine Learning, and Computer Vision. Hand gesture recognition systems caused lower accuracy during translation, as the use of non-manual features was not considered. Earlier experiments have measured the face, head, and eye movement signal's recognition performance, where hand gesture was fused with it. Technologies like OpenCV, MediaPipe, TensorFlow, and convolutional neural networks (CNNs) are extensively used for real-time gesture detection and text conversion. Systems improving processing speed, accuracy, and reliability are obtained easily. Building on the developments, the proposed system will make use of both manual and non-manual features of Indian Sign Language for better communication for hearing and speech-impaired persons.

RELATED WORK

Several researchers have developed sign language recognition systems using Artificial Intelligence, Computer Vision, and Deep Learning techniques to improve communication for hearing and speech-impaired individuals.

Earlier systems mainly focused on recognizing hand gestures using image processing and machine learning algorithms. However, these approaches often ignored

non-manual features such as facial expressions, head movements, and eye gaze, which are essential for understanding the complete meaning of Indian Sign Language (ISL). Recent studies have introduced deep learning models and computer vision frameworks like OpenCV, MediaPipe, and TensorFlow to capture both manual and non-manual features with higher accuracy. These advancements have improved real-time recognition, increased translation accuracy, and made sign language-to-text conversion more efficient, reliable, and user-friendly.

EXISTING SYSTEM

Most of the existing sign language recognition systems rely mainly on just recognizing hand gestures to convert sign language to text. The systems generally overlook important features such as facial expression, head movement, and eye movement.

These features are important to infer the correct meaning of Indian Sign Language. Some systems require controlled environments or specialized devices, making them less feasible for everyday use. Consequently, the translation may be inaccurate and communication with the hearing and speech-impaired does not happen effectively.

PROPOSED SYSTEM

The aim of this proposed work is to design a smart Indian Sign Language recognition system that can captures manual hand gestures and non-manual features. The webcam captures live video of the user and feeds it into AI, computer vision and DEEP LEARNING algorithms that processes the video. The sign language is recognized and converted into meaningful text.

This method boosts translation precision, lessens communication obstacles and p\resents an easy, efficient, dependable, and user-friendly communication solution.

SYSTEM ARCHITECTURE

The system architecture has camera module, gesture detection module, non-manual feature recognition module, feature extraction module, trained ISL dataset, and text conversion module. The webcam captures live video of the user’s hand gestures and facial expressions along with head movements. The grabbed frames are processed to extract feature which are compared against the trained Indian Sign

Language dataset. When the sign is correctly identified by the system, it immediately translates it into a meaningful text and displays its output instantly.

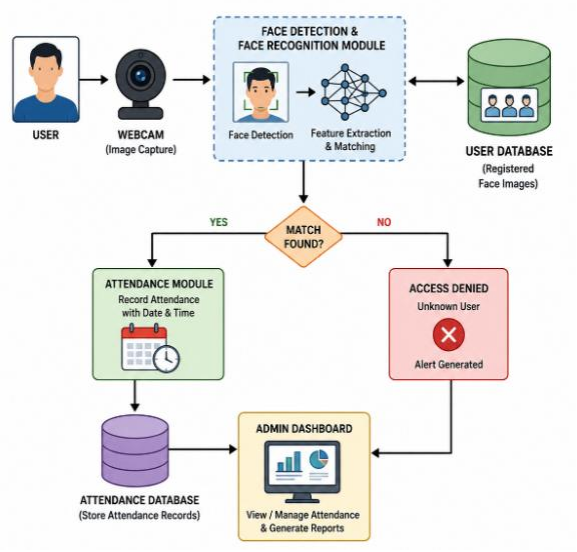

Fig 1: Block Diagram

METHODOLOGY DESCRIPTION

The methodology of the proposed Indian Sign Language Recognition System involves a systematic process of hand gesture acquisition, hand detection, gesture recognition, and gesture-to-text conversion. Live video frames are captured using a webcam and processed using computer vision techniques.

RESULTS AND DISCUSSION

Home Page:

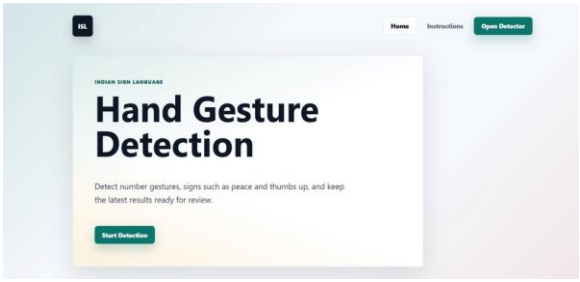

Fig 2: Home Page

The home page of the Hand Gesture Detection System provides an interactive platform for users to access the gesture recognition application. It introduces the purpose of detecting and recognizing hand gestures using artificial intelligence and computer vision techniques. The interface allows users to start detection, follow instructions, and interact with the system easily.

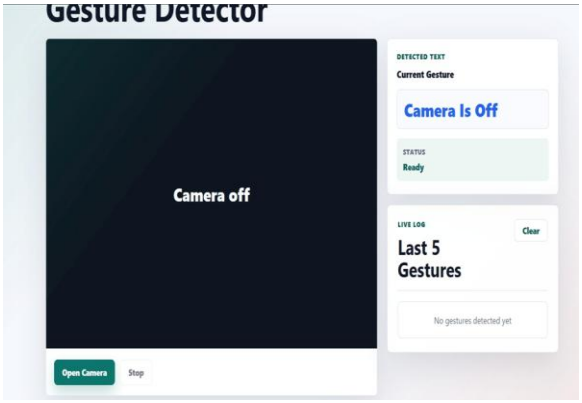

Fig 3: Gesture Detector Page

The Gesture Detector system provides a real-time platform for identifying and displaying hand gestures using a camera. It captures user gestures through computer vision techniques and shows the detected text, current status, and gesture history. The interface includes camera controls, live monitoring, and gesture logs for efficient interaction and communication.

How to Sign

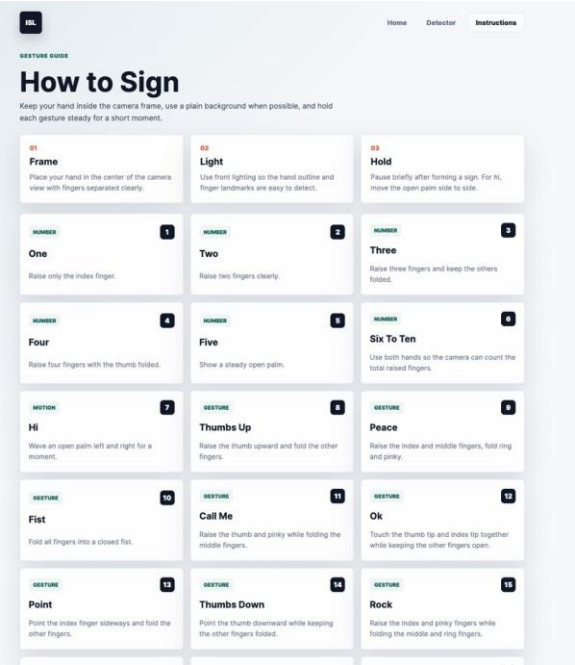

Fig 4: Sign In Page

The Gesture Guide provides instructions for users to perform different hand gestures for accurate detection. It explains proper hand positioning, lighting conditions, and holding gestures steadily. The system supports multiple signs, including numbers, greetings, and common gestures such as thumbs up, peace.

CONCLUSION

The Smart Attendance System Using Face Recognition provides a smarter and more convenient way to manage attendance. Unlike traditional methods that depend on manual registers or ID cards, this system uses facial recognition technology to identify individuals and automatically record their attendance with the date and time. It reduces manual effort, minimizes errors, prevents proxy attendance, and saves time. The system is simple to use, secure, and helps educational institutions and organizations maintain accurate attendance records efficiently.

FUTURE SCOPE

The system can be further enhanced by using advanced Artificial Intelligence and deep learning methods to improve face recognition accuracy in different environments, such as changes in lighting conditions, facial expressions, or camera angles. In the future, cloud-based storage can be integrated to securely store attendance data and allow access from anywhere. A mobile application can also be developed to help administrators track attendance remotely. Additional

features like mask detection, liveness detection, instant notifications, and integration with college or office management systems can make the system more secure, intelligent, and effective.

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