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SIGN LANGUAGE RECOGNITION

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Abstract:

This project takes a unique, practical approach to provide an effective product to help bridge the gap when people meet in varied settings. So this is the purpose for the 1st time ever to take a simple step in bridging a social and communication gap between the general populace and the disabled people. Communication is very important to share or express information, feelings and to bring people closer to each other with better understanding. Natural language makes it harder for disabled person for instance deaf and dumb people to communicate. So, use sign language, to talk with themselves, and to whole world. But ordinary people cannot comprehend sign language as they do not have most of the education and experience in this. Deaf and dumb use sign language for their talking, it means sign language is made of visual gestures and signs. It is a well-governed code gesture, where every sign carries an assigned meaning. So, when talking to other people, they sign to them. This can further be extended to common expressions and also words which can be more useful for handicapped and disabled people.

Keywords: **Sign Language Recognition, Indian Sign Language (ISL), Communication Bridge, Deaf and Dumb Communication, Gesture Recognition.**

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I. INTRODUCTION

One of widely used applications of Sign Language Recognition (SLR) is to facilitate the communication gap between the hearing and deaf munity. Developers can build models that can detect and understand sign language gestures from video or image inputs using Python's potent libraries such as OpenCV, TensorFlow. Typically, it consists of video frame preprocessing, hand and gesture feature extraction, model training by means of machine learning and real-time classification.

II. OBJECTIVE

In this project, we are going to create a sign language recognition system with Python and

without applying any machine learning strategy because we are going to use image processing techniques. It will read video frame in a realtime back to travel some palm gestures used for type of what language or alphabet. The code will parse input video footage using computer vision

libraries, such as OpenCV, to detect and classify defining features of a hand such as shape, position.

III. SYSTEM ANALYSIS

In this project, we will design a Sign Language Recognition System in Python without the use of the ML power. This is not going to employ any deep learning techniques or datasets for training, instead it would use its own algorithms of image processing and computer vision to see what hand shapes are corresponding to the letters/words of a sign language. Well, these gestures will be recognized in real-time and will generate a communication interface between deaf people and speaking people.

System Requirements

- Camera (webcam or any video capture device) for Input

- You can install this on a computer system with minimum 4GB RAM and a decent CPU for Real-time processing.
- Our system was designed for two purposes: the implementation of a human-computer user interface for the visually impaired.

The system will obtain video input from a camera, and process every frame. The software will detect the hand and its properties, namely its shape, orientation and position.

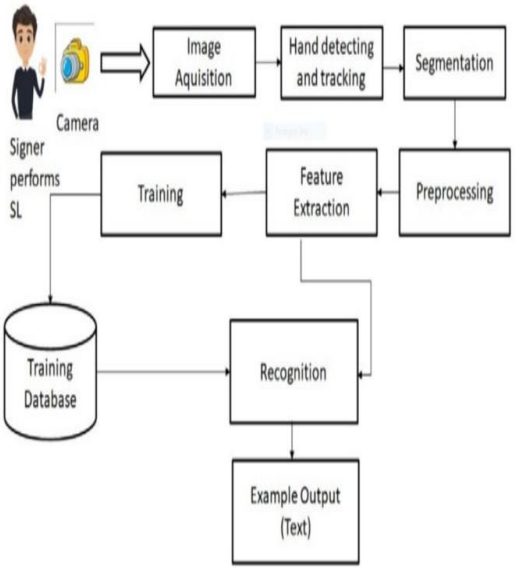
Input: Live video feed (camera)

Output: Detected Characteristics of the hand (coordinates of the location, shape of the hand, movement)

A predefined set of sign language gestures will be defined by the system. The detected hand will then be classified into using image processing techniques (contour detection edge detection color segmentation) After detecting a gesture, the system will give the real-time feedback by showing the sign language letter/word on the screen.

Then, we'll create a simple graphical interface that shows an output on the captured video feed, recognized gestures, and feedback.

IV. SYSTEM ARCHITECTURE



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The Sign Language Recognition System Architecture Overview of Sign Language Recognition System Architecture. In the right block, the process begins with a camera that generates real-time images or video streams of a person executing sign language gestures referred to as image acquisition, which is the image frame

extraction from the stream for the next stage processing. Once acquired, the system first performs Hand Detection and Tracking in order to correctly identify and track the hand of the signer. This process helps filter out hand gestures from the background. After that, the detected hand regions go through Segmentation, which isolates the hands from the environment so that we are only considering the relevant movements.

After the segmentation, the expected display of the hand prints is involved in Preprocessing. Operations like noise removal, resizing, normalization and enhancement fall under this phase to provide better image quality and consistency and make it robust. The system proceeds to Feature Extraction after preprocessing. In this phase, important properties of the hand gestures are focused on and extracted which may include parts like the hand shape, position, orientation, motion, and even articulations of fingers. While feature extraction is critical to the performance of a recognition algorithm since it transforms the input data into a more compact yet meaningful representation. These extracted features are used for two things - Training and Recognition During the training, a Training Database is generated, consisting of a wide range of gestures along with their corresponding labels.

After the training is finished, the model can generalize to recognize novel gestures that were previously not seen during training. In the Recognition phase, the features extracted from a previously unseen gesture are contrasted with the trained model to determine the most likely interpretation.

If the recognition is successful, the system displays an Output in text form, which shows the translated meaning of the recognized gesture. Training with additional transformations (which you send us over simulating a sequence of signs by applying to the captured data) does not give you the expected output, in case you want to show the different possibilities of how to do practical signs.

This entire process has a structured architecture which ensures efficient and accurate translations of sign language gestures. The training database makes the system learn with time and variety of signers. This allows for better representations to achieve high recognition results. At a high level, this architecture serves a communication bridge between sign language users and non-signers using image processing and recognition.

V. MODULES

a. Image acquisition and Hand Detection

- The process begins with capturing images or video frames of a signer performing sign language gestures using camera
- This serves as the initial input.
- The next step involves Hand Detection and Tracking after the images are captured.
- The system distinguishes the hand from other elements in the image and continuously tracks their movements to capture sequence of gestures.

b. Segmentation and Pre-processing

- The hand region is isolated from the background
- Segmentation involves separating the hand from other elements, ensuring the hand gesture is analyzed for gesture recognition.
- After segmentation, noise resolution, scaling or filtering are done to ensure that the captured image is consistent, accurate and high quality.
- Pre-processing helps to standardize the data which helps to recognize accurately.

c. Feature Extraction

- In feature extraction, the primary goal is to transform raw input data.
- The raw input data contains images on video frames of hand gestures.

- The hand images such as hand shapes, position, orientation & motion which are used to differentiate between signs.

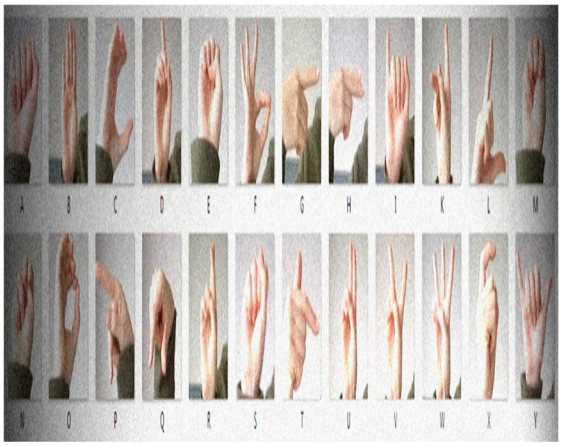
- This step is crucial for commenting visual hand gesture data into a format in which the computer understands.

d. Saved Gesture

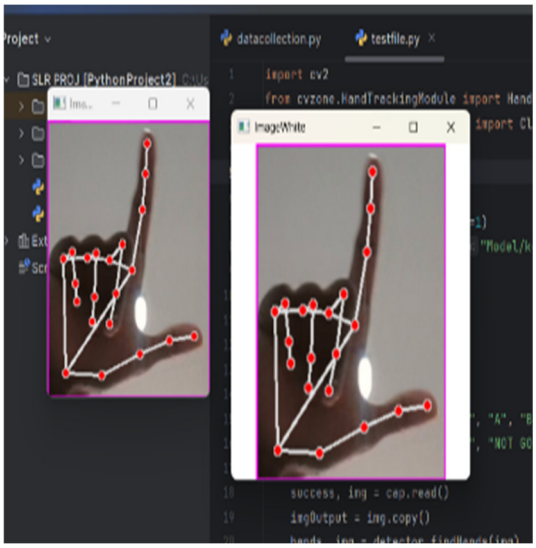
- Stores predefined sign language gestures.
- Each gesture is linked to a specific word or meaning.
- Facilitates quick identification and consistent interpretation of gestures.
- Enables you to create and save a new gesture with specified keyword.

e. Gesture Recognition

- Captures real-time sign language gestures via camera.
- Compares captured gestures with saved gestures for matching.
- Identifies the gesture and translates it into text on speech.
- Enhances accessibility for individuals using sign language.

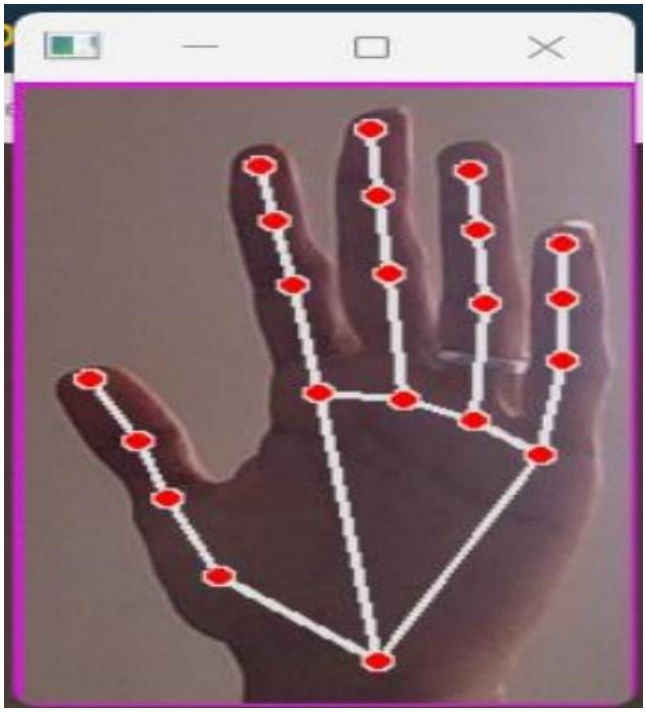


GESTURE IMAGES

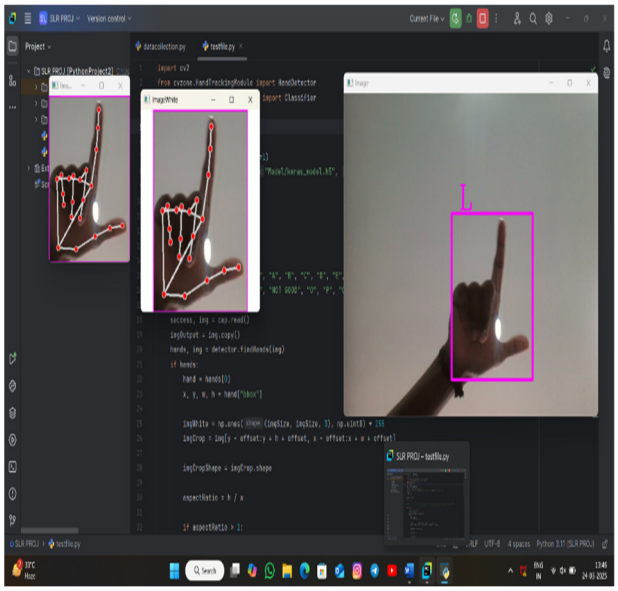


SEGMENTATION & PRE PROCESSING

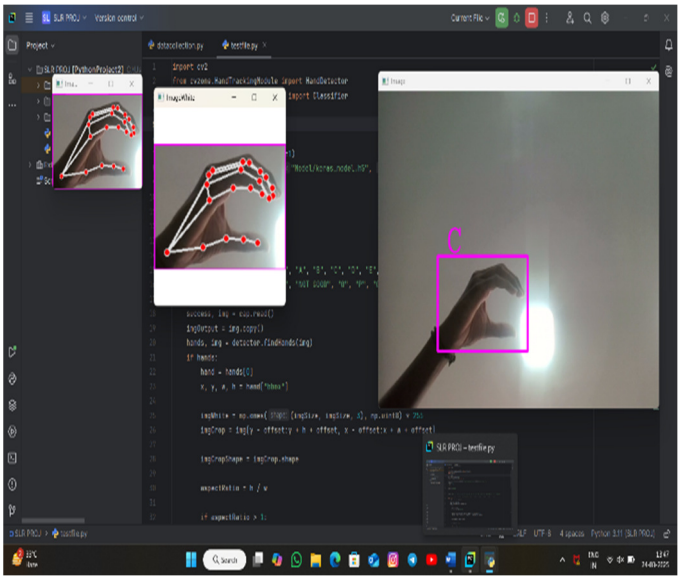
VI. OUTPUT



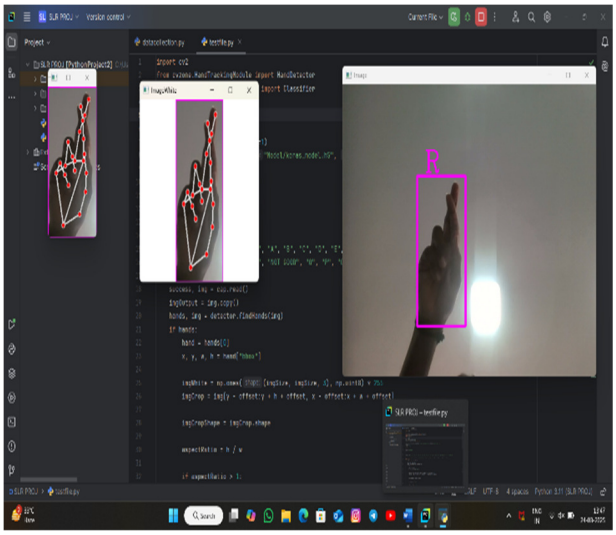
FEATURE EXTRACTION



GESTURE ”L”



GESTURE ”C”



GESTURE ”R”

VII. CONCLUSION

The project enhances communication between deaf, mute, and hearing individuals by recognizing sign language gestures for alphabets and numbers. By providing a practical solution for bridging language barriers, it promotes inclusivity and understanding. The system can be further improved by incorporating common expressions and words, making interactions more seamless and accessible for everyone.

VIII. ACKNOWLEDGMENT

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IX. REFERENCES

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