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Sahayak - Communication Disability Aid : A Comprehensive Project Analysis

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Abstract

Sahayak - Communication Disability Aid research paper presents a comprehensive solution to address the challenges speaking and hearing impaired students face in their day to day life. Communication is the only medium by which we can share our thoughts or convey the message but a person with such a disability faces difficulty in communication with a normal person. By developing an ML based solution, Sahayak aims to provide a web based interface to impaired students through which they can communicate with their instructors and peers. This solution leverages dynamic technology to create a platform with multiple applications.

Introduction

About 80% of the hearing impaired drop out before completing their high school education. Hearing impaired persons reaching up to the level of graduation is not even 1%. In today's fast-paced world, effective communication remains a cornerstone of human interaction. However, for individuals with hearing or speech impairments, traditional communication methods can pose significant challenges. Sahayak, a groundbreaking web and machine learning-based project, aims to bridge these gaps by offering Real-Time Sign Language recognition and an innovative "Air Writing" feature. This technology empowers users to communicate seamlessly, breaking down barriers and fostering inclusivity.

Bridging the Communication Divide :

Communication is fundamental to human interaction, yet millions of people who rely on sign language often face barriers in a predominantly oral and written world. Sahayk aims to dismantle these barriers by leveraging the power of machine learning and real-time processing. By recognizing and interpreting sign language instantaneously, Sahayk empowers users to communicate effortlessly with those who do not understand sign language, thereby fostering a more inclusive environment.

Advanced Machine Learning Capabilities :

At the core of Sahayak is its sophisticated machine learning algorithms. These algorithms have been meticulously trained on extensive datasets of sign language gestures, enabling the system to accurately recognize and translate a wide array of signs. This real-time recognition

capability is crucial, as it allows for fluid and natural conversations without the delays typically associated with traditional sign language translation tools.

User Centric Design :

Sahayak's user-centric design ensures that it is accessible and easy to use for individuals of all ages and technical proficiencies. The intuitive interface guides users through the process of setting up and utilising the system, making it a practical tool for everyday use. Additionally, Sahayak is designed to be compatible with a wide range of devices, ensuring that users can benefit from its features regardless of their preferred technology.

Empowering Inclusivity and Accessibility :

At its core, Sahayak is designed to promote inclusivity and accessibility. By providing a platform that understands and translates sign language, it ensures that individuals with hearing or speech impairments are not left out of conversations. The project reflects a commitment to creating a more inclusive society where everyone has the opportunity to communicate and express themselves freely.

Key Components of Sahayak :

Revolutionising Communication with Real-Time Sign Language Detection

Sahayak leverages the power of Advanced Machine Learning algorithms and Computer Vision to identify and interpret sign language gestures in real time. The system utilises a camera to capture hand movements and facial expressions, which are then analysed by sophisticated neural networks trained on extensive sign language datasets. By translating these gestures into text or speech, Sahayak enables individuals who rely on sign language to communicate effortlessly with those who may not understand it.

Innovative Air Writing Feature

In addition to Sign Language Recognition, Sahayak introduces an innovative "Air Writing" feature. This functionality allows users to write letters, words, or even draw symbols in the air using hand gestures. The system captures these movements and translates them into digital form, which can be displayed on a screen or shared electronically. This feature is particularly beneficial in scenarios where vocal communication is impractical or impossible. The air writing capability of Sahayak opens up new avenues for interaction and creativity.

In conclusion, Sahayak represents a significant advancement in assistive technology, combining the strengths of machine learning and computer vision to facilitate communication for individuals with hearing and speech impairments. Its real-time sign language recognition and innovative air writing feature offer practical solutions to everyday challenges, promoting inclusivity and accessibility. As Sahayak continues to evolve, it holds the promise of

transforming how we interact and understand each other, paving the way for a more connected and empathetic world.

Literature Review

This Literature Review provides an overview of key studies exploring various aspects of Sahayak such as Computer Vision and YOLOv5.

Sign Language Recognition :

Studies by Authors, L. Pigou, S. Dieleman, P.-J. Kindermans, B. Schrauwen (Titled - "Real- time American Sign Language recognition using deep learning") and T. Starner, J. Weaver,
A. Pentland (Titled - "Continuous sign language recognition: Towards large vocabulary statistical recognition systems handling multiple signers"), present a method for real-time American Sign Language (ASL) recognition using convolutional neural networks (CNNs). They explore the application of deep learning techniques to improve the accuracy and speed of sign language detection and discuss the challenges and methodologies for developing systems that can recognize continuous sign language from multiple signers.

Gesture Recognition :

Studies by Authors, R. Wan, S. Prokudin, X. Yang, J. Gall (Titled - "DeepHand: Robust hand pose estimation by completing a matrix imputed with deep features") and R. Rautaray, A. Agrawal (Titled - "A survey on hand gesture recognition techniques, methods and tools"), address robust hand pose estimation, which is critical for both sign language recognition and air writing. The proposed method combines deep learning with matrix completion techniques to improve accuracy. They also cover various techniques and tools used for hand gesture recognition, providing an overview of the state-of-the-art methods that can be applied to sign language and air writing detection.
In conclusion, studies on Sign Language Recognition and Gesture Recognition, are critical in implementing a solution addressing these areas.

Proposed Work

Research and Data Collection

Data Acquisition: Collect extensive datasets of sign language gestures, including various dialects and nuances. This will involve collaboration with sign language experts, communities, and institutions.

Literature Review: Study existing research on sign language recognition, computer vision, and machine learning techniques to identify best practices and potential challenges.

User Interviews: Conduct interviews with potential users, including individuals with hearing impairments, educators, and healthcare professionals, to understand their needs and requirements.

OpenCV and YOLO Integration

OpenCV (Open Source Computer Vision Library) and YOLO (You Only Look Once) can play pivotal roles in the Sahayak project for real-time sign language recognition and air writing. OpenCV, a versatile library for computer vision tasks, can be employed for preprocessing video input, detecting hand and face regions, and tracking gestures. It offers tools for image filtering, contour detection, and feature extraction, essential for preparing data before feeding it into the recognition model. YOLO, a state-of-the-art object detection algorithm, excels in real-time performance and accuracy. It can be utilised to identify and locate hand gestures and facial expressions within video frames efficiently. By leveraging YOLO's capability to detect multiple objects in a single frame at high speed, Sahayak can ensure smooth and responsive recognition of sign language gestures. The integration of OpenCV and YOLO provides a robust foundation for developing an accurate, real-time sign language interpretation system.

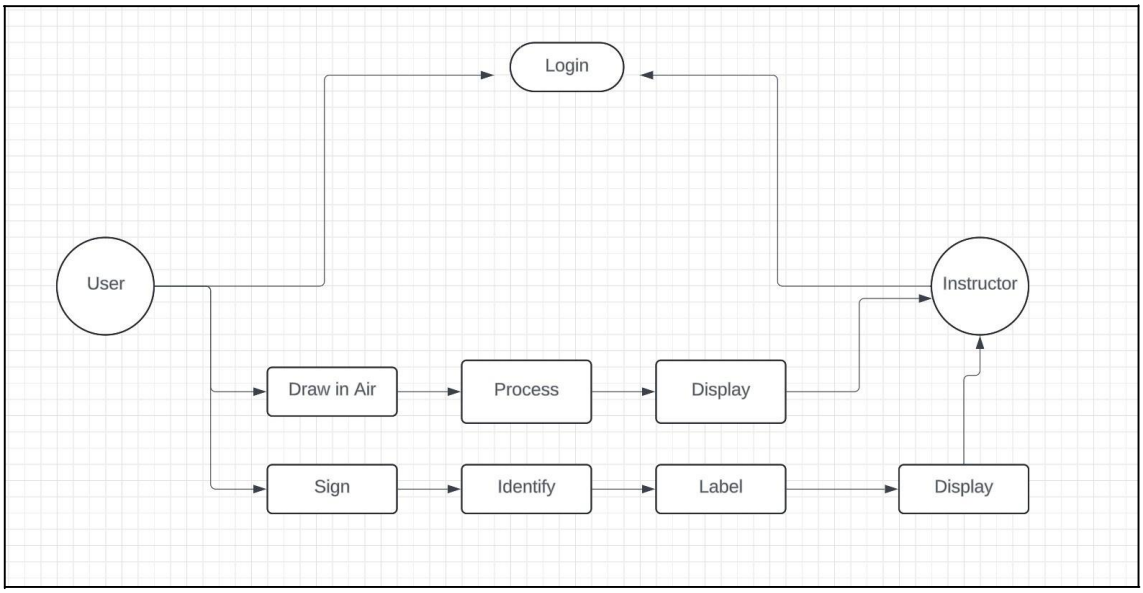

Figure 1 Showing use case diagram of the proposed model

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Result and Conclusion

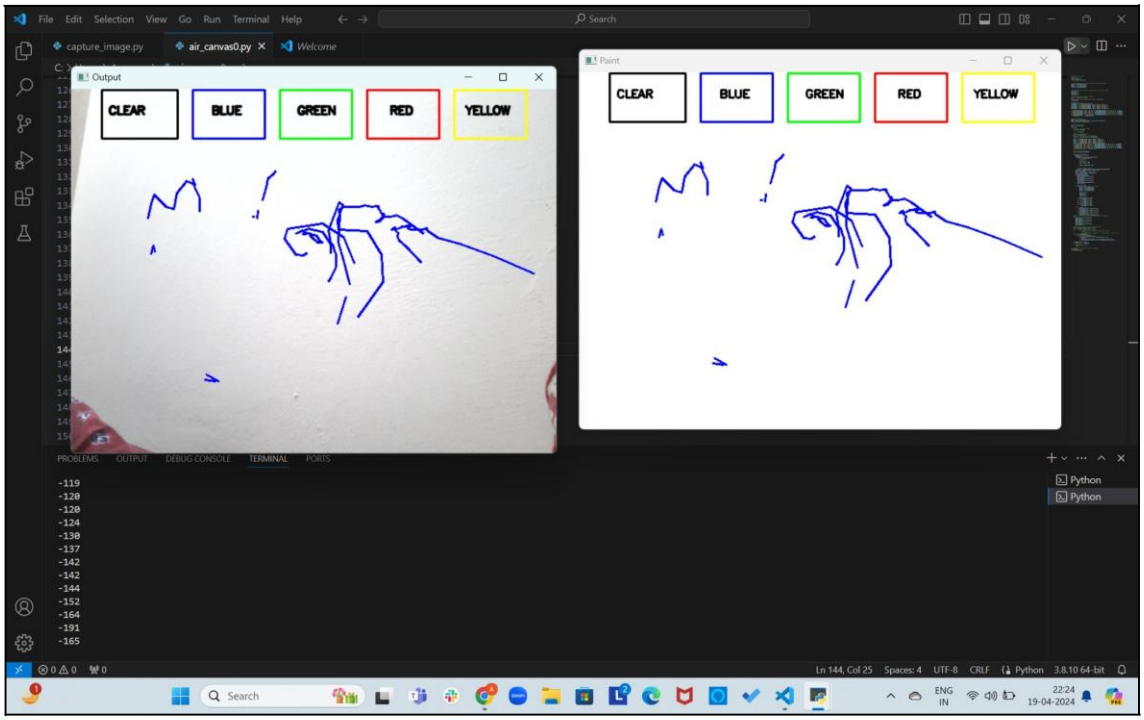

Figure 2 Showing results of Air Writing

In conclusion, Sahayak represents a transformative leap in assistive technology, designed to bridge communication gaps for individuals with hearing and speech impairments. By harnessing the power of machine learning, computer vision, and innovative tools like OpenCV and YOLO, Sahayak offers real-time sign language recognition and an intuitive air writing feature. This project not only facilitates seamless communication but also promotes inclusivity and accessibility across various settings, from education to healthcare. Sahayak's user-friendly interface and robust system architecture ensure high accuracy and performance, making it a valuable tool for enhancing interaction and understanding. As Sahayak continues to evolve, it promises to significantly impact the way we communicate, fostering a more inclusive and connected world where everyone can express themselves freely and effectively.

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