A PROJECT REPORT ON

"SIGN LANGUAGE RECOGNITION"

Submitted to:

Department of Computer Science & Engineering,

Artificial Intelligence and Machine Learning,

in fulfilment of Project Based Learning for the semester-III of academic year 2023-2024

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KOLHAPUR INSTITUTE OF TECHNOLOGY'S

COLLEGE OF ENGINEERING, KOLHAPUR

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CERTIFICATE

This is to certify that, **Onkar Madhavrao Giri** (PRN- **2223000130**), **Viraj Ashok Mulik** (PRN-**2223000406**), **Digvijay Dipak Pawar** (PRN-**2223000399**) & **SHREYA VIVEK CHAVAN** (PRN-**2223000796**), of Class **S. Y. B. Tech (sem III)** Div A / Branch **CSE(AIML)** from KIT's College of Engineering, Kolhapur have completed PBL project successfully in partial fulfilment for the award of degree of B. Tech. (AIML). They worked on "**SIGN LANGUAGE RECOGNITION**" project during **SEM-III, 2023-2024** under the supervision of Ms. Komal Jadhav and Ms. U. P. Gurav.

Place: KIT Kolhapur
Date: dd/mm/2023

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Year 2023-24.

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Finally, we express my indebtedness to all who have directly or indirectly contributed to the successful completion of our project.

Project Overview

Communication is the main channel to interact with each other. Dumb and Deaf people are not able to communicate verbally, they communicate through gestures which is a non-verbal way. Gestures includes movement of hands, head or any other parts of body. Many of the people are not able to understand the gestures as the are not familiar to such language. This creates a barrier between dumb and other normal people.

To overcome such barrier our project aims to develop a camera-based sign language recognition system to bridge communication gaps between people. This system converts sign or gesture made by hand into a text form. The project is in Python language. The System first takes an image of gesture as an input, pre-processes the image, converts the image in binary form, extracts the feature and recognize it, compare the pre-image with image stored the in database, if the image matches it displays it's text form.

KEYWORDS – PYTHON, GESTURE, COMMUNICATION, SIGN LANGUAGE TRANSLATION, DATABASE, SUPERVISED MACHING LEARNING.

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Introduction

PROBLEM STATEMENT:

Many deaf and dumb people faces communication barrier. So, to overcome this condition “Sign Language Recognition System” is developed. The main objective of this is to create a camera - based system capable of recognizing sign language gestures and translate them into text, thus providing a practical solution to this long-standing issue.

PROJECT DEFINITION:

Design a automation system using gesture detection algorithm. This system uses camera to capture then runs the algorithm successfully. This avoids communication barrier.

PROJECT OBJECTIVES:

Develop a camera - based system capable of recognizing sign language gestures and converting them into text, aiming to enhance communication accessibility and inclusivity for deaf and dumb people communities.

PROJECT SPECIFICATIONS:

1) Language used – Python.
2) Module – CV zone, Tensor flow.
3) Requires camera with resolution and good lighting conditions for better camera capturing capability.

Analysis:

EXISTING CASE:

Earlier recognizing hand gestures of dumb by normal people was quite difficult. It may cause miscommunication between people and may lead to small problems.Some Sign language recognition systems may lack real time interpretation. Most of the system faces challenges in accurately detecting the hand gestures.

REQUIREMENT ANALYSIS:

Following are some p analysis for the Sign Language Recognition System:

SOFTWARE REQUIREMENTS:

- Python (Version 3.7.13)
- IDE (PyCharm)
- OpenCV (Cv2) (Version 3.4.2)
- NumPy (Version 1.19.2)
- TensorFlow

HARDWARE REQUIREMENTS:

- Camera: Good quality, 3MP
- Ram: Minimum 8GB or higher
- GPU: 4GB dedicated
- Processor: Intel Pentium 4 or higher

Technology:

COMPUTER VISION:

Computer vision plays vital role in interpreting gestures (Sign) by processing image. Feature extraction mechanism extracts the essential pattern from the images and identifying the desired gesture. TensorFlow is used here which empowers real-time interpretation. Its efficient deployment optimizes the system allowing the users to recognize the gestures with high accuracy. This integration reinforces the project's core objective of communication.

IMAGE PREPROCESSING:

The image preprocessing for Sign Language Recognition includes hand detector module which detects the hand in camera feed and crops the region of hand to isolate it for further processing. After this image is resized for uniformity using OpenCV2. Then the code maintains the ratio of hand region to avoid distortion during resizing. The resized hand is then palced on white canvas to ensure consistent background and it is nothing but image preparation for

model input. After this the pre-processed image is passed through classification model.

GRAPHICAL USER INTERFACE:

GUI allows user to interact with System. The tkinter function creates main window where all GUI elements reside. Video display serves live video feed from camera. Camera initiates and enables hand gesture recognition functionality by accessing camera via OpenCV. We can stop it by feeding camera any disables in recognition process. Continuously updating video process's new image.

MACHINE LEARNING:

The code uses hand detector and tracking (cvzone.HandTrackingModule) module which isolates and extracts the hand region image for further analysis. Classifier module (cvzone.ClassificationModule) is used to classify gestures. This classification includes machine learning models, pre trained modules. This model has learned patterns and features during training phase. The live image is captured in camera, pre-processed, compared with data set and output text (letter) is generated.

Planning schedule:

In this section, we shall show the month wise plan to complete our project:

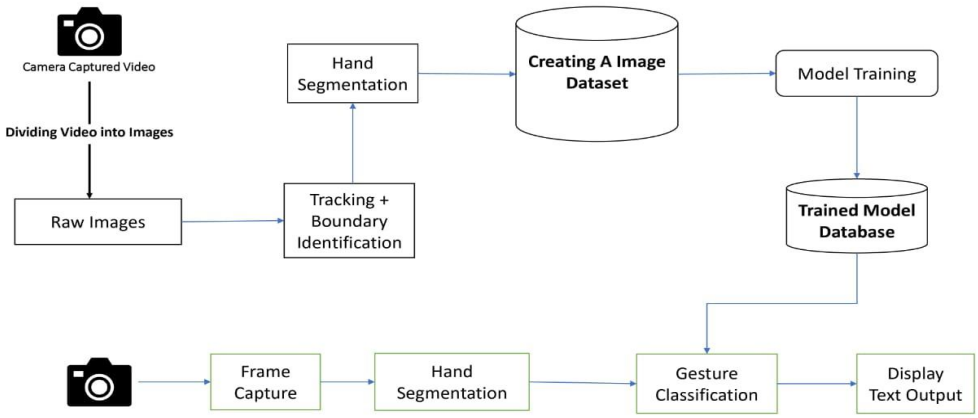
Sr.No	Task to be planned	Time required (in days)
1	Requirement Analysis	2
2	Coding	14
3	Testing	5
4	Training	5

System design:

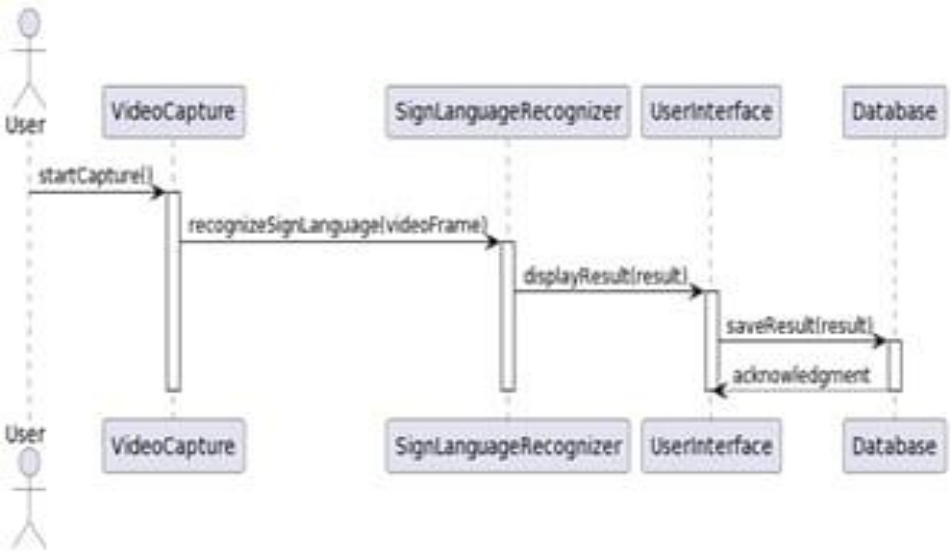
Training The sign language recognition system integrates various real-time interpretation of sign gestures made by hand. It uses OpenCV and modules like hand detector and classifier. The algorithm isolates the hand region and follows preprocessing techniques which are embedded in machine learning model. The GUI developed using tkinter displays the live image and recognize the gestures performed. This system design harmonizes camera integration, image preprocessing, machine learning-driven gesture recognition, and user interaction within GUI, efficient and accessible communication for sign language users.

UML Diagram:

FLOWCHART:



SEQUENCE DIAGRAM:



Methodology:

Objective Definition:

Real-time gesture recognition system uses TensorFlow and neural networks to interprete gestures. It implements machine learning algorithms to refine gestures recognition accuracy. Design an intuitive, user-friendly interface empowering individuals with hearing impairments for effective communication.

Software Modules:

User module provides interface for capturing sign, displaying recognition outcomes and configuring settings in a user-friendly manner. AI system includes modules for image capturing and processing and generation output.

Image Processing Steps:

Image capture and processing module acquires sign language gestures and prepares image for accurate recognition by AI system. The sign recognition module utilizes AI algorithm to analyze and recognize the hand gestures.

Applications:

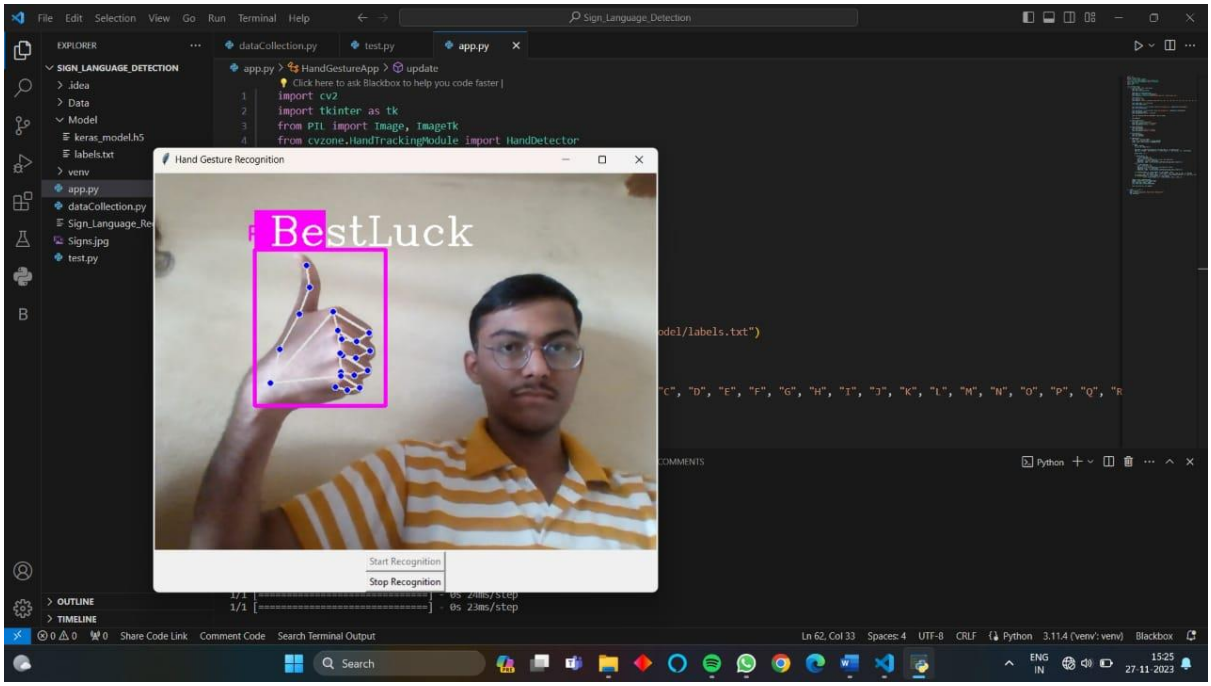
Applications of Sign Language Recognition System are Real- time interpretation of gestures, Over comes the barrier in communication, Sign Language Health Monitoring, Education and knowledge sharing, etc.

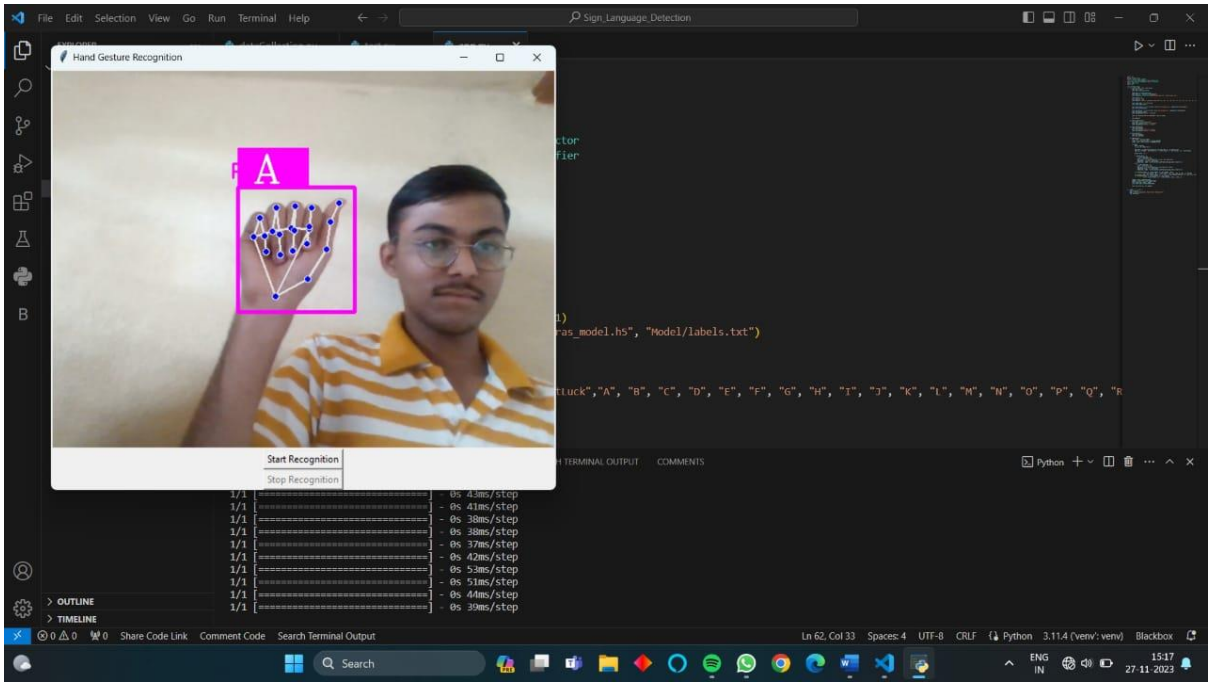
Advantages And Disadvantages:

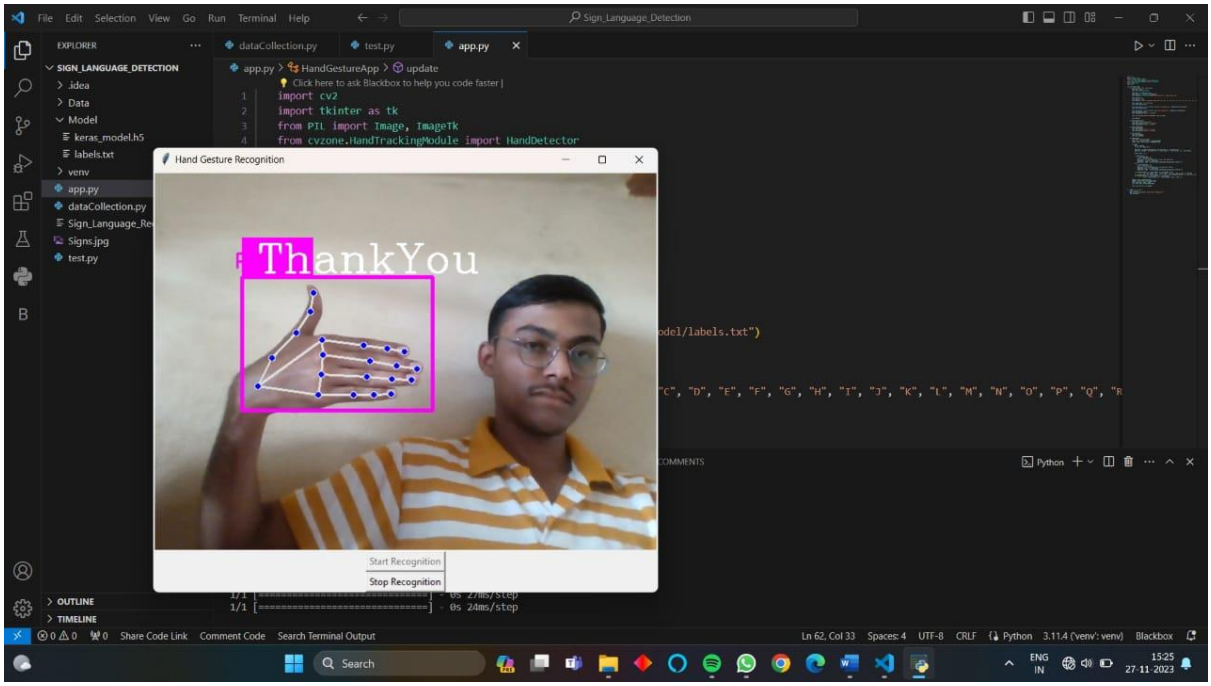
Advantages – Real time interpretation, Accessibility, On-device processing, Enhanced precision, Inclusive communication.

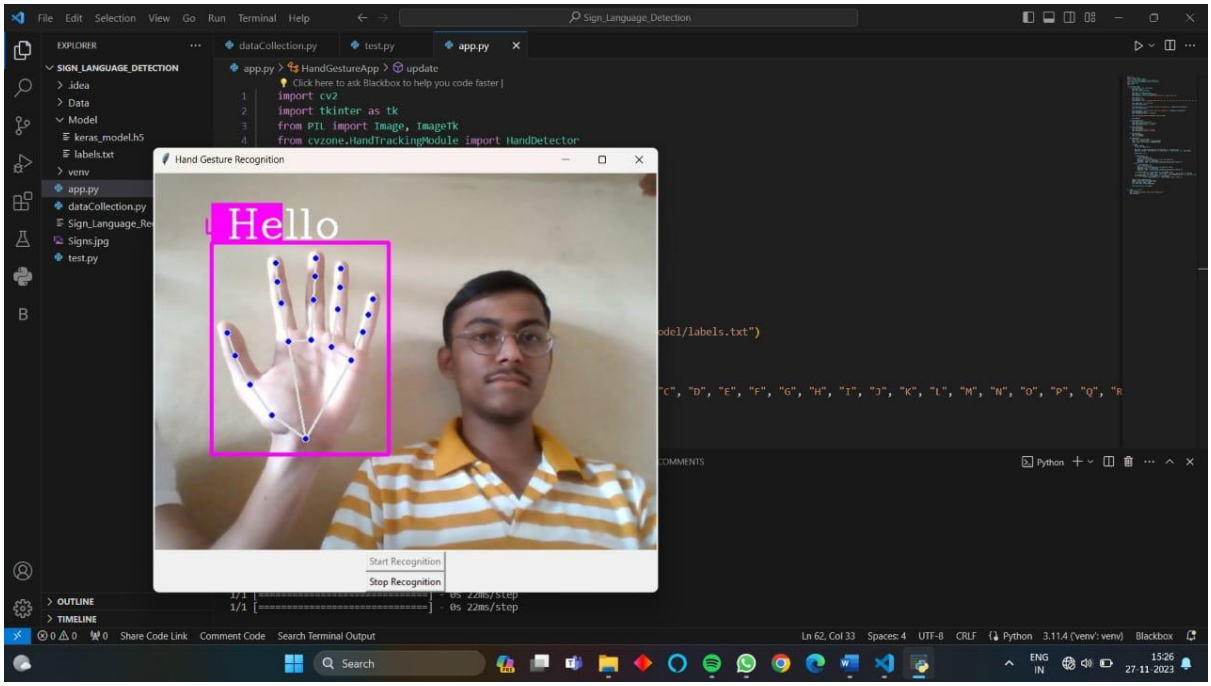
Disadvantages – and Quality dependency, Complex model training, Limited gesture coverage.

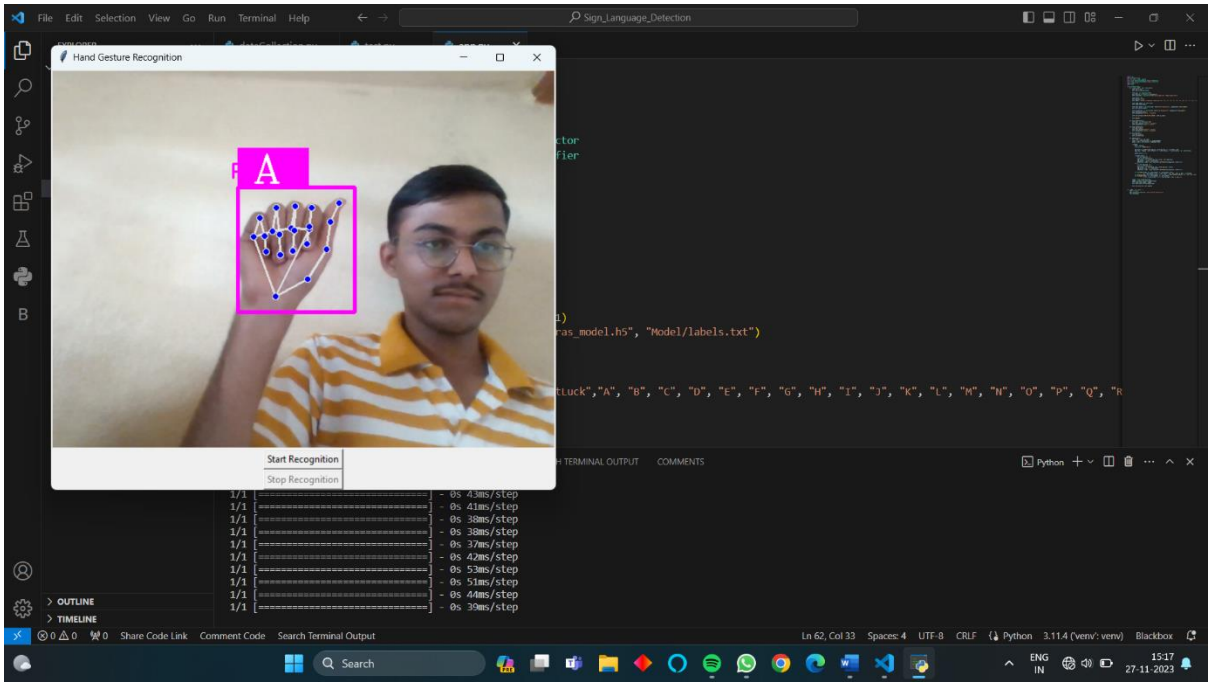
Screen Shots:


Hand Gesture Recognition
BestLuck
Start Recognition
Stop Recognition


Hand Gesture Recognition
A
Start Recognition
Stop Recognition


Hand Gesture Recognition
ThankYou
Start Recognition
Stop Recognition


Hand Gesture Recognition
Hello
Start Recognition
Stop Recognition



Further work and action plan:

Algorithm refining can improve machine learning algorithms used for hand gesture recognition.

Exploring to advanced deep learning techniques to enhance the accuracy and adaptability.

Expanded gesture dataset of hand gestures to enrich the model's training data and increases capabilities across broader spectrum.

User feedback mechanism to interact with user for any improvement or adding functionalities.

Developing mobile application and making it more accessible and portable for users.

Conduct usability studies and accessibility audits to ensure the system meets the diverse needs of users.

Conclusion:

This system introduces an innovative system set to revolutionize communication accessibility through seamless integration of computer vision, TensorFlow Lite, and neural networks for swift sign language interpretation. The user-friendly interface empowers individuals with hearing impairments, bridging communication gaps promptly. Leveraging offline capabilities ensures continuous learning, refining gesture recognition. Future efforts involve refining algorithms, expanding gesture models, incorporating user feedback for AI learning, and enhancing the system's educational interface. These advancements aim to firmly establish the system as an essential tool for communication accessibility and knowledge dissemination in diverse settings.

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