



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Smart Communication System For Deaf And Dumb

¹Rakshitha P, ²Sushmitha S, ³Rohith A V, ⁴S M Hemanth Kumar, ⁵Dr. Shamala N

¹Student, ²Student, ³Student ⁴Student ⁵Professor

¹Department of Electrical and Electronics Engineering

¹Vidya Vikas Institute of Engineering and Technology, Mysuru, India

Abstract: This paper presents a smart communication system designed to assist individuals who are deaf and/or dumb by enabling two-way interaction through computer vision, speech processing, and machine learning. The system combines object detection using YOLO/TensorFlow, image-to-voice conversion via OCR, text-to-speech using gTTS, voice-to-text with SpeechRecognition, and one-hand sign language recognition using MediaPipe and a Kaggle dataset. The hardware includes a webcam with a built-in microphone, a speaker, and a display, all controlled remotely via VNC Viewer. This integrated and cost-effective solution enhances accessibility and communication for individuals with speech and hearing impairments.

Index Terms - Smart Communication, Deaf and Dumb, Assistive Technology, Object Detection, YOLO, Optical Character Recognition (OCR), Text-to-Speech (TTS), Google Text-to-Speech (gTTS), Voice-to-Text, Speech Recognition, Sign Language Recognition, MediaPipe, Kaggle Dataset, Machine Learning, Accessibility.

I. INTRODUCTION

Communication remains a significant barrier for individuals who are deaf and/or dumb, especially in environments where interpreters or assistive technologies are not readily available. These individuals often struggle to express themselves or understand others, which limits their participation in social, educational, and professional settings. With the rapid advancements in artificial intelligence, computer vision, and speech processing, there is a growing opportunity to design affordable, real-time assistive tools that can bridge this communication gap. Our project aims to develop a smart, low-cost, and accessible communication system that facilitates two-way interaction for people with speech and hearing impairments. The scope of the system includes translating between various input and output modes such as text, voice, sign language, and printed images. The proposed solution integrates five main features using a webcam with a built-in microphone, a speaker, and a display interface. These features include object detection using YOLO/TensorFlow, which announces detected objects through audio output; image-to-voice conversion using Optical Character Recognition (OCR); text-to-speech conversion using Google Text-to-Speech (gTTS); voice-to-text conversion using the SpeechRecognition library; and one-hand sign language recognition using MediaPipe and a Kaggle dataset. The system is controlled remotely via VNC Viewer and is designed to enhance accessibility, promote independence, and support seamless communication for individuals with speech and hearing disabilities.

II. Literature Review

Various assistive technologies have been proposed to support communication for deaf and dumb individuals. A few key systems are:

- Yash Jhunjhunwala et al. (2017): Glove-based interface for converting ASL into speech. Limited to alphabets and numbers and relies on wearable hardware.
- SVBiComm (2019): Desktop application for multi-disability communication. Struggles with diverse sign variations and background noise.
- B. Lakshmi et al. (2019): CNN-based static sign converter, limited to English alphabets.
- EYERIS (2020): Recognizes objects/people for visually impaired but lacks navigation and reading support.
- Samiya Majid Baba and Indu Bala (2022): Glove-based interface with button-triggered audio responses. Very limited user flexibility.
- Shaik Rasool et al. (2024): Raspberry Pi-based multimodal interface but supports only static signs and increases hardware cost.

Our proposed system eliminates gloves and additional hardware, offering dynamic, real-time interaction using affordable and adaptable software tools like YOLO, GTTS, MediaPipe, and OCR.

III. System Architecture and Methodology

A. Hardware Used

- Webcam with Microphone: Captures video/audio for object detection, sign recognition, and speech processing.
- Speaker: Outputs speech generated from OCR, TTS, and sign-to-text.
- Display (Laptop/LCD): Runs the application and displays output text and images.

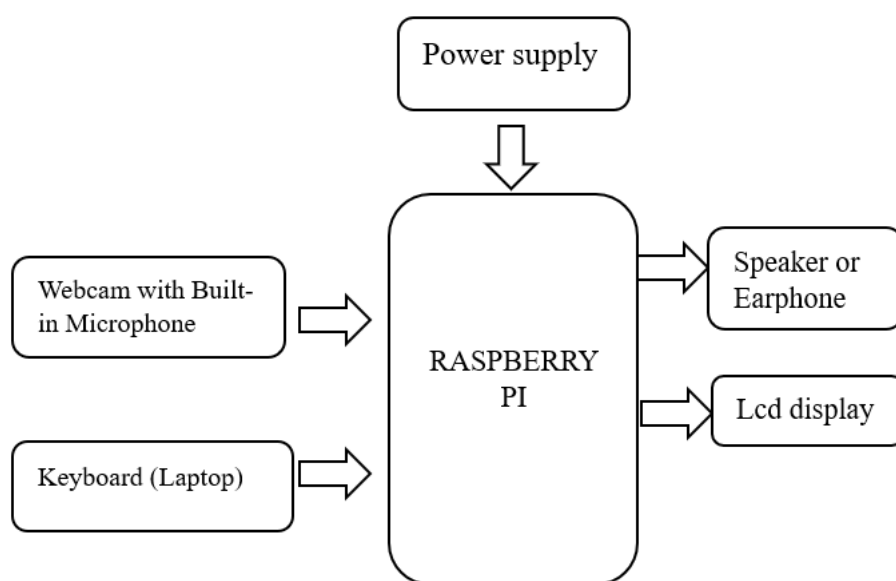


Fig 1.1 Proposed System Block Diagram

B. Software Tools and Techniques

- YOLO/TensorFlow: Real-time object detection
- OCR (Tesseract): Text extraction from images
- gTTS: Text-to-speech conversion
- SpeechRecognition: Converts audio to text
- MediaPipe + ML Model: Recognizes sign language gestures from video feed

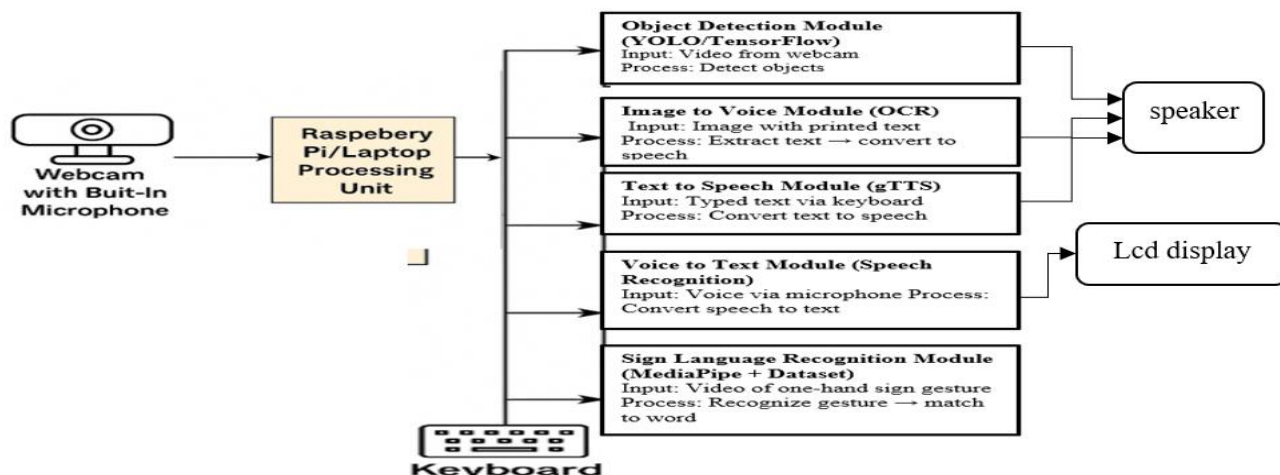


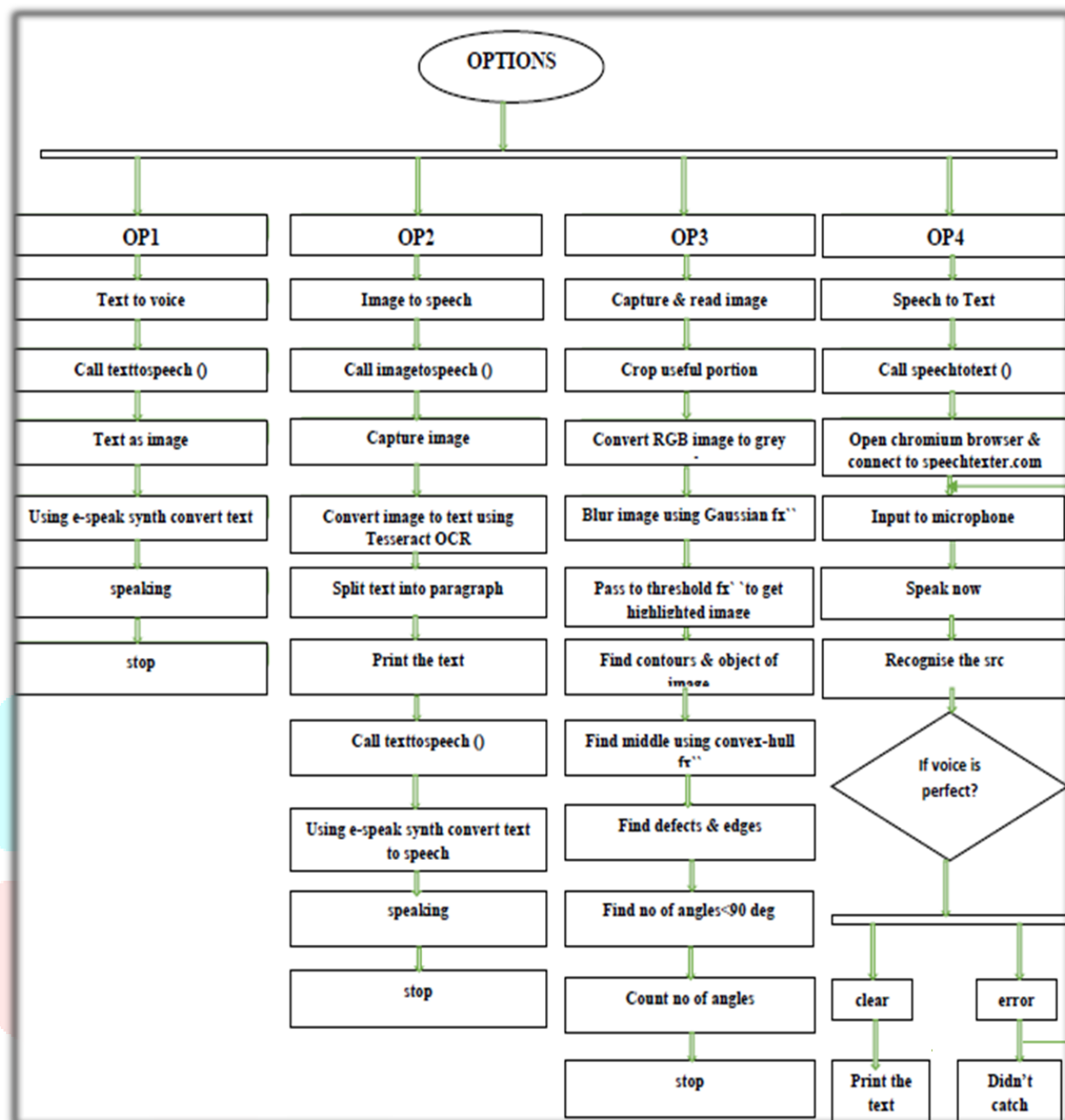
Fig 1.2 Data flow

IV. Implementation

Developed using Python, the application runs on a laptop with remote access via VNC Viewer.

- **Object Detection:** YOLOv5 with OpenCV identifies and labels objects from webcam feed. Labels are read aloud using gTTS.
- **Image-to-Voice:** OCR extracts text from images, which is spoken via gTTS.
- **Text-to-Speech:** Inputs via GUI/terminal are converted to audio using gTTS.
- **Voice-to-Text:** Real-time audio captured via mic is converted to text and displayed.

- **Sign Language:** Hand gestures detected via MediaPipe are classified and converted to audio/text.



V. Conclusion

This integrated system provides a real-time, affordable, and multi-modal communication platform for deaf and dumb individuals. By merging multiple assistive technologies into one solution, it offers robust functionality in real-world conditions and significantly enhances the independence and quality of life for individuals with speech and hearing impairments.

REFERENCES

- [1] Y. Jhunjhunwala et al., "Sign Language to Speech Conversion Using Arduino," ICICCS, 2017.
- [2] M. M. Reda et al., "SVBiComm...", IEEE ICCIS, 2019. DOI: 10.1109/ICCISci.2019.8716393.
- [3] B. Lakshmi et al., "Assistive Sign Language Converter...", IEEE ICSCAN, 2019. DOI: 10.1109/ICSCAN.2019.8878734.
- [4] J. A. Shah et al., "EYERIS...", IEEE ICCMC, 2020. DOI: 10.1109/ICCMC48092.2020.ICCMC-00074.

- [5] S. M. Baba and I. Bala, "Smart Communication Interpreter...", IEEE UPCON, 2022. DOI: 10.1109/UPCON55374.2022.00019.
- [6] S. Rasool et al., "An Assistive System for Deaf and Dumb...", IEEE ICSSIT, 2024.

