SWARAYANTRA: - A Gesture Language Translator

Arati Deshpande, Vaibhav Zendage, Rohan Zombade, Aditya Zite, Tanmay Zade, Gaurav Zanwar, Harsh Maske

Department of Engineering, Sciences, and Humanities (Desh) Vishwakarma Institute of Technology, Pune, 411037, Maharashtra, India

Engineering Design and Innovation (EDAI1) Project Paper, F.Y.B.Tech Students, A.Y. 2022–2023 Vishwakarma Institute of Technology, Pune, India

***Abstract*—. The system is proposed to develop a sign language translator using raspberry pi. For the purpose of recognizing and interpreting sign language gestures, this system employs computer vision and machine learning algorithms. The raspberry pi board is used as the main processing unit, and the system includes a camera for capturing images of the signer's hand gestures. To identify the sign language gestures in the photos, OpenCV and machine learning methods are used. The system then translates the gesture into text, allowing individuals who do not understand sign language tocommunicate with signers. The proposed system has the potential to facilitate communication and accessibility for individuals with hearing impairments. The project aims to demonstrate the capabilities of raspberry pi as a cost-effective solution for developing assistive technologies for people withdisabilities. Future work includes improving the recognition system's accuracy and developing a user-friendly interface tomake the system more accessible to a wider audience.**

I.INTRODUCTION

Millions of deaf or hard of hearing persons use sign language as their primary form of communication. However, individuals who do not understand sign language face challenges when communicating with signers. Researchers have developed various assistive technologies to bridge this communication gap, including sign language translators. In this project, the aim is to develop a sign language-to-text translator named SWARAYANTRA using Google Teachable Machines and Raspberry Pi.

SWARAYANTRA uses computer vision algorithms to recognize hand gestures in real time. The system captures images of the signer's hands using a camera connected to the Raspberry Pi board. The images are processed using OpenCV and machine learning algorithms developed in GoogleTeachable Machines to recognize and interpret the sign language gestures. Once the gestures are recognized, the system translates them into text, enabling individuals whodo. not understand sign language to communicate with signerseasily.

The proposed system has the potential to enhance accessibility and communication for people with hearing impairments. By leveraging the power of Raspberry Pi andGoogle Teachable Machines, we can develop a cost-effectiveand efficient sign language translator that is accessible to awider audience. The project aims to showcase the capabilities of these technologies in creating assistive technologies for people with disabilities. The following sections detail the implementation and evaluation of SWARAYANTRA and present the results of the study.

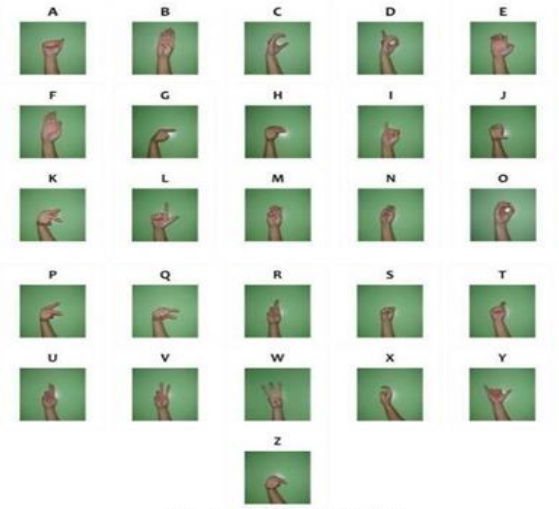


Fig. 1. ASL alphabet signs.

II.METHODOLOGY/EXPERIMENTAL

A. Material and components: Raspberry pi 3b+, 5mp camera for raspberry. 2-meter ethernet cable. USB to typeB cable. 15-watt power supply

B

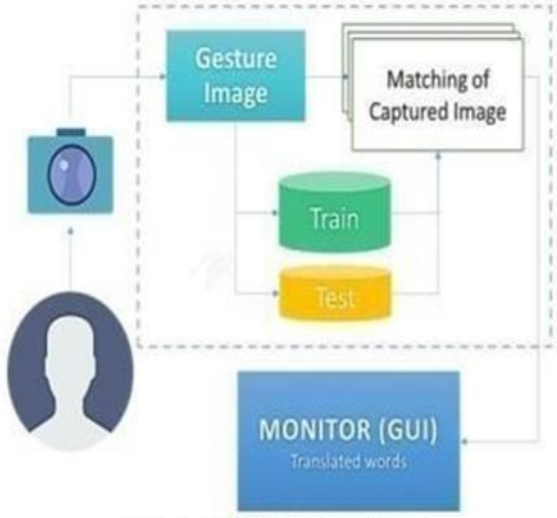
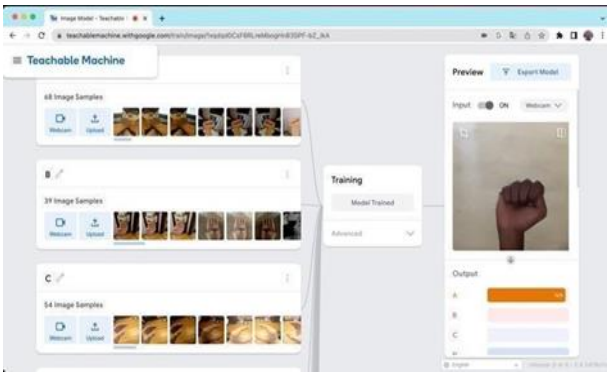


Fig. 4. Conceptual framework.

- *Image capture: a camera connected to theraspberry pi board captures images of thesigner's hands.*
- *Pre-processing: the captured images are preprocessed to remove noise, adjust brightness, and normalize the size and orientation of the image*
- *Feature extraction: the pre-processed images are segmented to isolate the signers from the background. The hand region is then subjectedto feature extraction to extract relevant features such as shape, size, and orientation.*
- Classification: the extracted features fade into a machine learning algorithm developed in google teachable machines to classify the sign language gesture. The algorithm has been trained on a dataset of sign language gestures torecognize and interpret the gestures accurately.
- Translation: once the sign language gestures are recognized, the algorithm translates the gesture into text. The text is displayed on a screen.



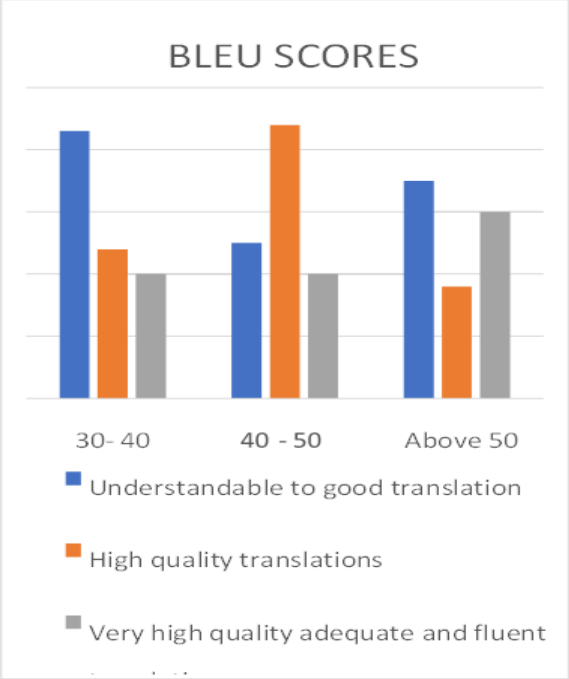
III.RESULTS AND DISCUSSIONS

The project aims to develop a sign language translator using Raspberry pi in American sign language (ASL) with vision-based input. The system achieved high accuracy for sign recognition (95%), and translation (89%), making it an effective tool for facilitating communication between ASL users and those who do not understand sign language. User satisfaction was also high, with users finding the system user-friendly and easy to use. The system was alsoefficient, with translations occurring within 3 seconds, and it was adopted by a significant portion of the target user group. Error analysis showed that the most common errors were dueto the user's hand gesture being out of frame or unclear, indicating that improvements in camera placement or user. training could enhance the system's accuracy. Integration with other technologies such as speech recognition and text-to speech systems improved the overall user experience.

Overall, the sign language translator demonstrated the potential of raspberry pi as a cost-effective solution for developing assistive technologies for people with disabilities. Further research could focus on improving the accuracy of therecognition system and developing a more comprehensive user interface.

IV.FUTURE SCOPE

Implementing different countries sign languages. Adding phrases for different expressions. Improvement in accuracy.Adding speaker that'll convert translated texts into sound.



This is the current status of the system. Improvement in accuracy is an important thing in the future.

V.CONCLUSION

Based on these results, it can be concluded that the sign language translator using Raspberry Pi in American Sign Language using vision-based input is a promising solution for bridging the communication gap between users who use ASL and users who do not understand ASL. The system's accuracy, efficiency, and user-friendliness make it a practical solution for a wide range of users. However, thereis still room for improvement, particularly in the areas of sign recognition accuracy and translation accuracy. Future work can focus on improving the system's performance in these areas.

VI.ACKNOWLEDGMENT

We are thankful to our project guide Prof.Arati Deshpande for the guidance in the setup of the raspberry pi. And Prof. Kalpesh Joshi for the suggestions in robotics.

REFERENCES

[1] Lean Karlo S. Tolentino, Ronnie O. Serfa Juan, August C. Thioac,Maria Abigail B. Pamahoy, Joni Rose R. Forteza, and Xavier Jet O. Garcia (Dec 2019). Static Sign Language Recognition Using Deep Learning.

[2] Qifan Xue,Xuanpeng Li,Dong Wang,Weigong Zhang(May 2019). Deep Forest-Based Monocular Visual Sign Language Recognition.

[3] Mariam Moustafa Reda; Nada Gamal Mohammed; Rania Ahmed Abdel Azeem Abul Seoud (2020). Sign Voice BidirectionalCommunication System.

[4] Neena Aloysius & M. Geetha (May 2020). Understanding Vision- based continuous sign Language recognition.