International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

A Review on Sign Language Automate

Prof. Mitali Ingle[1], Tejas Agrawal[2], Nandini Tumane[3], Bhaveshwar Wadbudhe[4], Prerna Tembhekar[5], Sanidhya Bokade[6], Om Muthal[7]

[1]Department Computer Science and Engineering Jhulelal Institute Of Technology Nagpur, India
m.ingle@jitnagpur.edu.in
[2]Department Computer Science and Engineering Jhulelal Institute Of Technology Nagpur, India
tejasagrawal36@gmail.com
[5]Department Computer Science and Engineering Jhulelal Institute Of Technology Nagpur, India
Prernatembhekar@gmail.com
[3]Department of Computer Science and Engineering Jhulelal Institute Of Technology Nagpur, India
nandinitumane42@gmail.com
[6] Department Computer Science and Engineering Jhulelal Institute Of Technology Nagpur, India
Sanidhyabokade08@gmail.com
[4]Department Computer Science and Engineering Jhulelal Institute Of Technology Nagpur, India
ashuw94@gmail.com
[7]Department Computer Science and Engineering Jhulelal Institute Of Technology Nagpur, India
ommuthal24@gmail.com

ABSTRACT:

The communication space between an aphonic and deaf individuals and the general population poses significant challenges. Sign Language (SL) is a visual method of communication that relies on hand gestures and patterns. However, understanding SL is limited among those unfamiliar with its signs. This project proposes the development of a smart system that translates sign language gestures into text and voice output on a mobile device, bridging the communication gap. Equipped with flex sensors and accelerometers, the glove captures hand movements and gestures, which are processed using machine learning algorithms for accurate gesture recognition. Unlike traditional camera-based systems that rely on image processing, this sensor-based system Is Portable and efficient in real-time translation. While camera-based methods, such as Discrete Wavelet Transform (DWT) for feature extraction and nearest neighbour classifiers, have shown high accuracy (up to 99.23%) in recognizing gestures, the sensor-based system offers practical advantages in portability and ease of use. This system addresses not only the needs of deaf individuals but also helps those with Autism Spectrum Disorder (ASD), enabling more effective communication. By combining robust sensor technology with machine learning, this smart serves as a powerful tool for enhancing communication accessibility.

INTRODUCTION:

Sign language is the primary form of communication for separate with speech and hearing impairments, allowing them to express thoughts through motion and body movements. Although, a significant communication barrier persists between these individuals and the general population, as most people are not similar with sign language. This limitation reduces social inclusion and restricts everyday interactions. Addressing this issue has become increasingly important, particularly as society moves toward greater inclusivity.

In response to this challenge, technology has emerged as a bridge, offering tools that translate sign language into text or speech. Such systems provide an accessible way for individuals with speech and hearing impairments to communicate more effectively with others. Over the years, various approaches to **Sign Language Recognition (SLR)** have been developed, particularly focusing on **Indian Sign Language Recognition (ISLR)**, which uses hand gestures as the primary mode of communication. Most of these systems rely on a combination of stages: **pre-processing**, **feature extraction**, and **classification**. Techniques like **Discrete Cosine Transform (DCT)** and **Discrete Wavelet Transform (DWT)** are used to extract gesture-related features from images or video, while classifiers such as **K- nearest neighbours (KNN)**, **neural networks**, and **fuzzy logic systems** are employed to recognize and translate the gestures into meaningful output.

While these image-based systems can achieve high accuracy, they also come with limitations. They require high-quality cameras, significant computational power, and are sensitive to environmental factors like lighting.

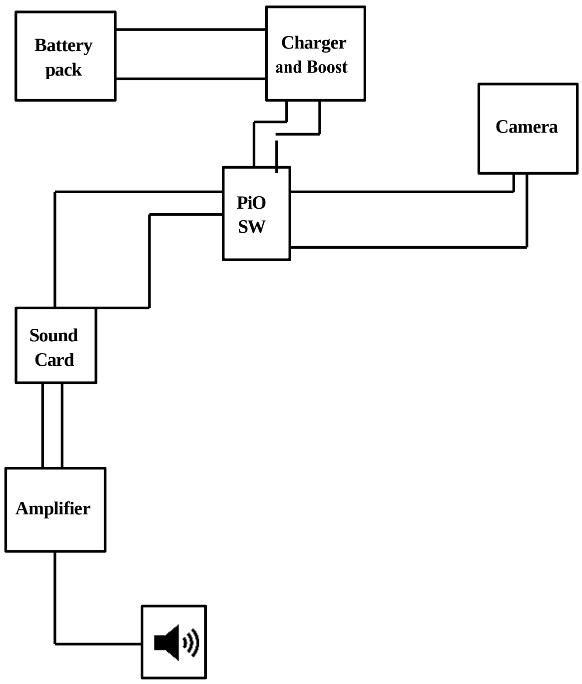
This complexity makes them less practical for everyday use, particularly in real-time applications. To address these limitations, this research proposes a **sensor-based smart system** that translates sign language into narrative and speech in actual-time. The smart is equipped with **flex sensors** and **accelerometers** that capture the movements and positions of the fingers and hands. This sensor data is processed using **machine learning algorithms** to interpret the gestures accurately. Unlike camera-based systems, the smart offers a more portable and user-friendly solution, allowing individuals with speech and hearing impairments to communicate effectively in a variety of settings.

The primary goal of this project is to create a **cost- effective, portable, and practical communication tool** that can enhance the daily interactions of mute individuals. The sensor-based approach not only provides real-time translation but also eliminates the need for complex image-processing algorithms, making it an efficient alternative. With the ability to function in different environments, the smart offers a solution that is both accessible and easy to use.

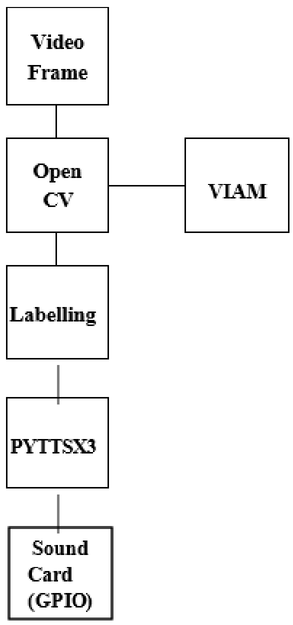
In the future, this system could be expanded to include more complex gestures and dynamic, multi-handed sign language recognition. As machine learning models evolve, the smart could become an even more versatile tool, supporting various sign languages and improving communication for a wider range of users.

Proposed System:

Hardware



software



LITERATURE SURVEY:

1. **Introduction to Sign Language Recognition:** Language recognition has been an area of an interest for many years to facilitate communication between the speech and hearing impaired and the public. Two main methods have been investigated: imaging/video processing and sensor-based authentication.

2. **Image-based Approaches:** There are many methods based on image processing techniques. For example, the Discrete Cosine Transform (DCT) and Discrete Wavelet Transform (DWT) have been used to extract features of hand gestures. These features are classified using Nearest Neighbour Network (KNN), Eigen map or fuzzy inference techniques. Although these methods can provide accuracy, they require a good camera that is expensive and usually sensitive tolighting conditions.

3. **Sensor-based Approaches:** In contrast, electronic devices such as adaptive sensors and accelerometers hold promise for go language recognition. For example, smarts equipped with sensors can detect hand and finger movements and send this information to machine learning models to translate text or speech. Compared to street cameras, these systems are more portable and suitable for immediate use
4. **Machine Learning Techniques:** Recently, machine learning has revolutionized language learning. Algorithms such as Support Vector Machines (SVM), Adaptive Neuro-fuzzy Inference Systems (ANFIS), and deep learning models have been used to improve the accuracy of action recognition. For example, the system uses DWT to extract videos and achieves more than 99% nearest neighbor accuracy
5. **Challenges:** Despite this progress, many challenges remain. Dynamic movements, environmental conditions, and on-the-fly processing are still obstacles for vision-based systems. Also, most solutions are not portable, which limits their use. Sensor-based systems, while promising, need further improvements to handle more complex definitions.

Methodology:

System Overview

The system uses **camera-based image processing** to recognize sign language gestures. The gestures are captured, pre-processed, and analysed using **edge detection** and **template matching** algorithms to convert them into recognizable text. This system is intended for real-time communication, especially for individuals with speech and hearing impairments, including those with **Autism Spectrum Disorder (ASD)**.

Image Processing and Pre-Processing

- **Image Capture**: A camera captures the hand gesture.
- **Pre-Processing**: The captured image undergoes **brightness** and **contrast adjustment** to enhance visibility.
- **RGB to Grayscale Conversion**: The colour image is converted into grayscale to simplify the processing.

Feature Extraction

- **Edge Detection**: An **edge detection algorithm** (such as Canny or Sobel) is used to extract important boundaries and features from the image.
- **Template Matching**: Each extracted edge is compared with a predefined set of templates stored in the system's database.

Classification and Recognition

- **Matching and Classification**: The system uses **template matching** to compare the input gesture with stored templates. Once a match is found, the gesture is classified as a corresponding sign or letter.
- **Text Output**: The recognized gesture is displayed as text, providing the user with the meaning of the sign language gesture.

System Implementation

- **Hardware**: A camera captures the real-time hand gestures, and a **processing unit** (computer or embedded system) performs the image processing tasks.
- **Software**: The image processing algorithms and template matching logic are implemented using Python and libraries like Open CV.

1. Testing and Evaluation

The system is evaluated for accuracy and performance in different environments, ensuring that the gestures are recognized correctly under varying lighting conditions and angles.

Conclusions:

In conclusion, the **camera-based sign language recognition system** developed in this project provides an effective tool for bridging the communication gap for individuals with speech and hearing impairments, including those with **Autism Spectrum Disorder (ASD)**. By leveraging **image pre-processing**, **edge detection**, and **template matching algorithms**,
However, the system's performance is influenced by environmental factors, such as radiance conditions, background voise, and the angle of hand gestures. While these factors may introduce some variability in the accuracy of recognition, the system achieves good results in controlled conditions. Further improvements can focus on increasing robustness by enhancing the flexibility of gesture recognition under different conditions and expanding the sign language vocabulary supported by the system.

Additionally, future developments may include incorporating **machine learning models** to improve dynamic gesture recognition and generalizing the system to support a wider range of sign languages beyond the current dataset. With these enhancements, the system has the potential to become a highly efficient and reliable tool for improving communication between seperate who use sign language and those who do not understand it.

REFERENCES

1. M.S. Anand, S. Mathavan, K. Kannan, and R. Balamurugan, "An Efficient Framework for Indian Sign Language Recognition Using Wavelet Transform," *Journal of Image Processing & Pattern Recognition Progress*, vol. 3, no. 4, pp. 182-188, 2016. Available at: ResearchGate. the system is capable of accurately translating hand gestures into text in real-time.

2. your project's smart system and sensor- based approach are grounded in recent developments in the field of sign language recognition, which includes works like the above, that leverage both image processing and machine learning for accurate translation.

3. "Sign Language Recognition Using Image Processing for Autism Spectrum Disorder and Deaf Individuals," *International Journal of Health Sciences*, 2023. Available at: Science Scholar.