SILENT COMMUNICATION GLOVE FOR DISABLED

Prof. Shilpa D. Chindamwar[1], Khushi H. Jais[2], Riya H. Jais[3], Vaidehi V. Bhimte[4], Anjali S. Bhil[5], Kunika D. Karemore[6]

1Assistant Professor, Department Of Information Technology , Govindrao Wanjari College of Engineering & Technology, Nagpur, Maharashtra, India
shilpachindamwar1@gmail.com
2 Student, Department Of Information Technology, Govindrao Wanjari College of Engineering & Technology, Nagpur, Maharashtra, India
jais.khushi13102gmail.com
3 Student, Department Of Information Technology, Govindrao Wanjari College of Engineering & Technology, Nagpur, Maharashtra, India
jais.riya1310@gmail.com
4 Student, Department Of Information Technology, Govindrao Wanjari College of Engineering & Technology, Nagpur, Maharashtra, India
vaidehibhimte2022@gmail.com
5 Student, Department Of Information Technology, Govindrao Wanjari College of Engineering & Technology, Nagpur, Maharashtra, India
anjalibhil2701@gmail.com
6 Student, Department Of Information Technology, Govindrao Wanjari College of Engineering & Technology, Nagpur, Maharashtra, India
kunikakaremore@gmail.com

Abstract
Many people with a speech hearing impairments face problems in daily communication , which affects their independence and social life . A silent communication Gloves assistive technology that converts hand gesture into understandable output using embedded sensing components and intelligent processing .This review discusses system that use flex sensors , accelerometers , motion detection modules , and micro controller based frameworks or gesture recognition . It also examines text generation , audio synthesis , and wireless transmission to smart devices to improve efficiency, accuracy, portability, and affordability . This people highlight challenges like gesture recognition complexity, energy consumption, comfort and multilingual adaptability . It also explore Machine Learning and Internet of things to enhance real life performance.
Keywords: *Assistive Technology, Gesture Recognition, Wearable Device, Sensor Glove, Speech Impairment, Iot Communication.*

I . INTRODUCTION

This work studies introduces a sign language recognition system that uses flex sensors to capture finger bending movements. The system translates these gestures into meaningful output to support communication for deaf and mute individuals. The focus is on developing a simple and effective assistive solution.[1]

It presents a gesture-to-voice glove designed to convert hand signs into spoken words in real time. The system uses sensors and a microcontroller to process gestures and generate audio output. It aims to improve interaction between disabled users and the general public.[2]

The authors explore wearable gloves integrated with Artificial Neural Network (ANN) for recognizing sign language gesture. Their work highlights improved accuracy in gesture detection and its usefulness in assisted learning applications. The system supports training and communication purposes.[3]

This research focuses on recognizing isolated static postures in American Sign Language using a data glove. A neural network model is applied to identify hand gestures accurately. The study emphasizes improving recognition performance for structured sign inputs. [4]

It has processes of a wearable smart glove designed specifically for speech and hearing impaired individuals. The device converts hand gestures into text or speech output. The authors focus on building a cost- effective and user-friendly communication aid.[5]

This systematic review analyzes various sensor-based gloves used for sign language pattern recognition. It compares technologies such as flex sensors and motion sensors used in previous systems. It also discusses limitations and areas needing further improvement.[6]

The authors developed a wearable device that interprets sign language into understandable output for deaf and mute users. Their system integrates sensing technology with processing modules for real-time communication. The design emphasizes flexibility and ease of use.[7]

This work introduces a smart glove designed for haptic interaction and communication applications. The system is suitable for areas like robotics , healthcare , and virtual environments. It focuses on flexible materials and advanced sensing capabilities.[8]
This research presents a sign language recognition system aimed at improving communication for deaf individuals. The system detects hand gestures and converts them into understandable signals. It highlights real-time gesture identification techniques.[9]
It describes a smart glove that uses flex sensors and an accelerometer for hand gesture recognition. The system provides fast and accurate detection of movements. It demonstrates the potential of combining multiple sensors for reliable gesture interpretation.[10]

1. LITERATURE REVIEW

Sr. no	Paper	Methodology used	Key Finding/Future Scope
1.	[1] **Ann Mmesoma , Chikwado eze ,** "Implementing Sign Language Recognition System Using Flex Sensors", 2024	Used flex sensors fixed on fingers, Sensors detect finger bending, Microcontroller processes signals, Converts gestures into text/voice.	The gloves uses Flex sensors on the fingers to sense how each finger is bent when making a gesture, Processing unit ,Voice Output.
2.	[2] Shwet Kamal Sudha bhuvanagiri,"Development Of gesture- to -voice gloves for disabled ." ,2024	Built a gesture-to-voice glove ,Used flex sensors to capture hand movement	The microcontroller roller reads the sensor data and send it to a system that turns the gesture into spoken voice in real time, Server Integration.
3.	[3] Hyeon-Jun kim, Soo-Whang baek ,"Applications of wearable gloves for assisted learning of sign language using ANN",2023	Collected gesture data ,Applied Artificial Neural Network(ANN), ANN recognizes and classifies signs.	Test show that the system sign recognition accuracy was about 85%, Useful for sign training.
4.	[4] **Muhammad Saad Amin , Syed Tahir Hussain Rizvi, Alezandro Mazzei , Luka Anselma**,"Assistive data gloves for isolated static postures recognition in American Sign language" , 2023	Machine Learning algorithm identifies postures.	A neural network identifies the sign, Neural network recognition.
5.	[5] **Ajinkya Mhatre,Sarang Joshi, Hrushikesh Kulkarni, Pradnesh Hagvane ,Pradnya Shinde, Sachin Patil,** "Wearable Smart glove for speech and hearing impaired people" ,2023	Portable wearable glove system.	Design for Indian users, simple and low cost design.
6.	[6] **Zinah Raad , Saeed B.B. Zaidan , A.H.Alamoodi ,**"A systematic review on system based sensory gloves for sign language pattern recognition" 2022	Conducted systematic review study, Analyzed previous smart glove systems , Compared sensors, algorithm , and accuracy.	Most Studies focus on static hand gesture rather than full sentences. Most gloves use flex sensors.
7.	[7] **Adil Rehman ,Abdul Hadi Shoufan**, " A Linguistic Communication Interpretation Wearable Device for Deaf and Mute User",2022	Developed wearable interpretation device , System translates into text/voice .	The design and fabric of the gloves is completed by any gloves that can fit perfectly onto the user hand. The system can also be made smaller and more flexible.
8.	[8**] Oliver Ozioko , Ravindra Dahiya** ,"Smart Gloves for Haptic interaction and communication" ,2021	Designed smart glove with haptic feedback, used flexible sensors, Enables communication through touch + gesture.	Useful in AR/VR, Robotics, healthcare. Flexible and light wait materials.

9.	[9] **Reddy Gari Sandhya Rani , R Rumana , R.Prema ,** " Sign language recognition for deaf and dumb people.", 2021	Software converts gestures into readable output	Helps deaf people to communicate easily. Real time hand detection
10.	[10] **M Kumar , S Jain , A Verma ,**"Smart glove for hand gesture recognition using flex sensors and accelerometer" ,2020	Used flex sensors + accelerometer ,Microcontroller processes motion data ,Recognizes hand gestures accurately.	Gives accurate and fast gesture recognition. Real time gestures detection.

Table 1:- Literature Review

2. Methodology

Methodology — Silent Communication Glove for Disabled Individuals (Point-Wise)

1. Problem Identification

Identify the communication difficulties face by deaf and mute people in daily life.

2. System Design

Design a wearable glove system that can convert hand gestures (sign language) into text to voice output.

3. Selection of Components

- Flex sensors (to detect finger bending)
- Microcontroller (such as Arduino Uno)
- Bluetooth module (for wireless communication)
- Speaker or mobile phone (for voice output)
- Power supply (battery)

4. Sensor Placement

Fix flex sensors on each finger of the glove to measure finger movements and bending angles.

5. Data Collection

When the user makes a hand gestures , the flex sensors detect the bending and send analog signals to the microcontroller.

6. Signal Processing

The microcontroller reads the sensor values, processes them, and compares them with pre-stored gesture patterns.

7. Signal Processing

The microcontroller reads the sensor values, processes them, and compares them with pre-stored gestures patterns.

Gesture Recognition

The system identifies the gesture based on programmed conditions in the microcontroller.

8. Output Generation

- The recognized gesture is converted into text on a display.
- Or converted into speech using a mobile application.

9. Wireless Communication

Bluetooth module sends the recognized message to a smartphone for voice output.

10. Testing and Calibration

Test the glove with different users and adjust sensor sensitivity for accurate results.

11. Final Implementation

The developed glove is used as a real-time communication device for disabled persons.

This structured approach helps in developing an effective, affordable, and practical communication system for individuals with speech or hearing disabilities.

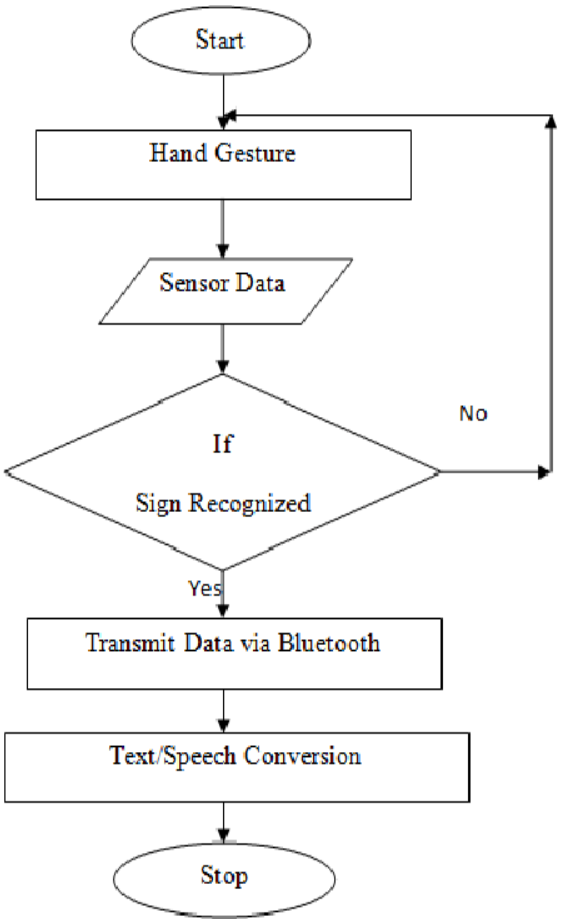

Figure 1: Block Diagram of Silent Communication Glove for Disabled

3. Application

The silent communication glove is designed to bridge the communication gap for individuals who face difficulty in speaking or hearing. Its use can be seen in multiple real-life situations where effective communication is essential.

1. Support for Speech and Hearing Impaired Individuals .The glove enables users to express their thoughts through hand gestures, which are then converted into understandable text or voice. This makes daily communication smoother with people who are not familiar with sign language.
2. Use in Medical Environment .Patients who temporarily or permanently lose their ability to speak can use the glove to communicate their needs clearly to healthcare professionals, improving the quality of care and response time.
3. Educational Assistance .In classrooms for specially-abled students, this device helps teachers understand student responses more easily, creating a more inclusive and engaging learning environment.
4. Emergency Communication Tool .During emergencies, when speaking may not be possible, the glove can help convey urgent messages quickly, which can be crucial for safety and timely assistance.
5. Public Interaction .It can be used in everyday public interactions such as shopping, traveling, or visiting offices, where communication barriers often create challenges for disabled individuals.
6. Household Communication Within families, the glove simplifies interaction and reduces misunderstandings, allowing better emotional connection and independence for the user.
7. Technological Integration. The glove can be linked with smartphones or computers, enabling real-time conversion of gestures into digital output, making communication faster and more efficient.

4. Limitations

Although the silent communication glove is a useful assistive device, it still has several limitations that affect its performance and widespread adoption.

1. Limited Gesture Recognition .The glove can recognize only a fixed set of predefined gestures. Any variation in hand movement or new signs may not be correctly interpreted.

2. Accuracy Issues. Small errors in sensor readings or improper hand positioning can lead to incorrect output, which may cause misunderstanding during communication.
3. Dependency on Technology .The device relies heavily on sensors, microcontrollers, and software. Any technical fault, battery issue, or system failure can stop it from functioning.
4. Learning Requirement Users need proper training to perform gestures in a way that the glove can recognize, which may be difficult for some individuals, especially beginners.
5. Cost Factor Advanced versions of the glove with better accuracy and features can be expensive, making them less accessible to economically weaker users.
6. Limited Language Output Many systems are designed for specific languages, which restricts communication in multilingual environments.
7. Maintenance and Durability Since the glove includes electronic components, it requires careful handling. Regular wear and tear or damage to sensors can reduce its lifespan.
8. Comfort and Usability Issues Wearing the glove for a long time may feel uncomfortable, especially if the design is bulky or not properly fitted.

II. Conclusion

Silent communication gloves are a helpful technology for people who cannot speak or hear properly. These gloves use sensors to detect finger and hand movements. When a person makes a sign, the glove understands the gesture and changes it into text or voice. This helps disabled people communicate easily with others who do not know sign language.

The system is simple, portable, and easy to use. It reduces communication barriers and increases confidence and independence for users. Many projects use flex sensors, accelerometer, and small controllers to make the glove accurate and fast.

In conclusion, silent communication gloves are a smart and affordable solution that improves daily communication for speech and hearing impaired people. With further improvements, this tehnology can become more accurate, comfortable, and widely available in the future.

References

1. Ann Mmesoma, Chikwado Eze, “Implementing Sing Language Recognition using flex sensors” International Journal of Research And Innovation in Applied Science ,2024
2. Shwet Kamal , Sudha Bhuvanagiri , “Development of Gesture to Voice gloves for disabled”, Bangalore Institute of Technology ,Dec-2024 ISSN No-2456-2165
3. Hyeon-Jun kim , Soo-Whang baek , “Applications of Wearable Gloves for Assisted sign language using ANN” ,Sangyung University ,April-2023.
4. Muhammad Saad Amin ,Syed Tahir Hussain Rizvi , Alezandro Mazzei ,Luka Anselma , “ Assistive Data Glove for Isolated Static Postures Recognition in American Sign Language” University of Stavanger , April 2023.
5. Ajinkya Mhatre ,Sarang Joshi ,Hrushikesh Kulkarni ,Pradnesh Hagvane ,Pradnya Shinde**,** Sachin Patil, “Wearable Smart glove for speech and hearing impaired people” International Journal of Engineering Research and Technology ,ISSN No -22780181 ,March -2023.
6. Zinah Raad , Saeed B.B. Zaidan ,A.H.Alamoodi “ A Systematic Review on System Based sensory Gloves for sign language pattern recognition . April -2022.
7. Adil Rehman ,Abdul Hadi Shoufan , “A Linguistic communication Interpretation Wearable Device for deaf And Mute User” International Journal Of Advance Science Computing and Engineering ,April 2022.
8. Oliver Ozioko ,Ravindra Dahiya , “ Smart Glove for Haptic Interaction and Communication” ,Sep-2021.
9. Reddy Gari Sandhya Rani , R Rumana , R.Prema , “ Sign language recognition for deaf and dumb people”,Oct-2021.
10. M Kumar , S Jain , A Varma , “ Smart Glove for Hand gesture recognition using flex sensor and acelerometer” International Journal of Engineering And Advance Technology ,Feb 2020