Smart Glove for the Hearing and Speech Impaired

A gesture-to-text system using Arduino and ADXL sensors

# Abstract

This project aims to provide a wearable and economical solution for individuals who are hearing and speech impaired by enabling gesture-based communication. The Smart Glove uses an ADXL335 accelerometer to detect hand movements corresponding to sign language. These inputs are processed by an Arduino microcontroller, and the corresponding message is displayed on an LED screen, acting as an assistive interface between the user and others.

# Introduction

Sign language is one of the most common ways hearing and speech impaired individuals communicate. However, not everyone understands it, which creates a communication barrier. This project proposes a glove-based device that recognizes basic hand gestures and translates them into readable text, enabling more inclusive communication.

# Objectives

• Design and develop a glove that detects predefined hand gestures.  
• Convert these gestures into digital signals using sensors.  
• Display the interpreted gesture message on an LED screen.  
• Ensure the system is compact, cost-effective, and easy to use.

# Components Used

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| --- | --- |
| Component | Description |
| Arduino Uno/Nano | Microcontroller for processing sensor data |
| ADXL 335 | Accelerometer for detecting movement |
| LED Display | Display the recognized gesture in text form |
| Switches | Additional input mechanism |
| Power Supply | Battery/Power bank for portability |
| Glove | Base material to mount the components |

# Working Principle

• Each finger movement creates a unique pattern detected by the ADXL335 accelerometer.  
• These analog signals are sent to the Arduino.  
• The Arduino uses conditional logic to map each signal pattern to a corresponding gesture.  
• The gesture is displayed on the LED display in real-time.

# Implementation

• Setup of sensors and components on the glove.  
• Arduino sketch written in Embedded C to process gesture data.  
• Calibration of gestures to ensure accuracy and responsiveness.  
• Testing and validation with different users.

# Advantages

• Economical and easy to assemble.  
• Lightweight and wearable.  
• Supports basic gesture recognition.  
• Portable and can be powered by a small battery.

# Limitations

• Can only recognize a limited set of predefined gestures.  
• Not waterproof or dust-resistant.  
• Sensitive to harsh mechanical stress.

# Future Scope

• Integration of voice output for enhanced communication.  
• Expandable to include more complex gestures using flex or gyroscope sensors.  
• Real-time translation and speech synthesis.  
• Enhanced durability for outdoor and long-term use.

# Conclusion

The Smart Glove bridges a vital gap in communication by translating sign language into readable text. It provides a simple yet powerful tool for improving the lives of hearing and speech impaired individuals. With further enhancements, this system has the potential to revolutionize assistive communication technology.

# References

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