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# SMART GLOVE FOR SIGN LANGUAGE TRANSLATION USING IOT

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**Abstract:** The design of a smart glove for deaf and dumb individuals using IoT technology aims to facilitate seamless communication by converting hand gestures into text and speech. This project integrates advanced sensors such as flex sensors to detect finger movements and accelerometers and gyroscopes to track hand orientation. The glove communicates wirelessly with paired devices using WI-FI modules, transmitting processed data to a mobile application. This app displays the translated text and provides text-to-speech functionality. Its ergonomic design ensures comfort and durability, with adjustable features to fit various hand sizes. Usability testing with real users ensures the glove meets user needs and incorporates feedback for continuous improvement. This innovative IoT-enabled smart glove enhances communication for deaf and dumb individuals.

**Keywords:** IoT, Smart Glove, Sign Language, Arduino, Flex Sensor, Accelerometer, Wireless Communication

## I. INTRODUCTION

The number of speech-impaired and hearing-impaired individuals is steadily growing, with approximately 70 million people globally affected. These individuals typically communicate using sign language, but this often creates challenges when interacting with people unfamiliar with it. To address this communication gap, gesture recognition systems have been developed. This technology helps bridge the gap between speech- and hearing- impaired individuals and those without impairments, enabling easier interaction. Gesture recognition systems are generally categorized into two types: image-processing- based and sensor-based. Image-processing techniques use visual inputs like cameras to recognize gestures but come with drawbacks such as complex algorithms for data processing and challenges in varying lighting conditions, backgrounds, and field-of-view constraints. Sensor- based gesture recognition, in contrast, offers greater mobility and eliminates many of the complexities associated with image processing.

The Smart Glove project is a sensor-based system aimed at translating sign language into text and voice. It provides a more accessible and cost-effective solution for communication between speech-impaired individuals and others. The project aims to create a wearable device that helps speech-impaired people communicate more easily, potentially improving their employability and reducing the daily challenges they face. The system uses a combination of sensors, microcontrollers, and wireless technology to convert hand gestures into digital signals that can be translated into text and speech.

Monitoring by being able to carry out a numbe activities remotely and autonomously. Automation has emerged as a critical component of contemporary care systems, helping to alleviate the strain on medical personnel and improve patient well-being as the world's population ages and the need for healthcare assistance increases.The advanced robotic care system proposed in this research may perform a variety of tasks that enhance patient safety, aid, and monitoring. Wireless charging, voice control, remote control, line-following capabilities, obstacle detection, smoke detection, and alcohol sensor monitoring are just a few of the essential characteristics that the robot incorporates. It also has an IoT-based smart accident detection system, which guarantees that any accidents or emergencies are reported in real time. The creation of such systems aims to increase overall operational efficiency in healthcare settings in addition to enhancing caregiving services, and multi-tasking duties, freeing up healthcare workers to concentrate on vital medical procedures that call for human involvement. Furthermore, seamless connectivity is made possible by the incorporation of cutting-edge technology like the Internet of Things (IoT) into healthcare robots. This permits real-time data exchange and communication between the robot, medical personnel, and family members. By giving continuous information on patient status, ambient variables, and possible threats, this connectedness improves decision-making processes.

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## II. LITERATURE SURVEY

A TOOL TO ASSIST INDIVIDUALS WITH HEARING DIFFICULTIES. [2023], Sanjay S, Tippannavar, Shivprasad N, Yashwanth S D. IEEE

- SMART GLOVE – VOICE OF DUMB. [2019], Adarsh Ghimire, Bhupendra Kadayat, Aakriti Basnet and Anushma Shrestha, office of KEC Research and Publication
- SMART GLOVES FOR HAND GESTURE RECOGNITION USING SIGN LANGUAGE TO SPEECH

CONVERSION SYSTEM. [2018], Albert Mayan J, Dr. B. Bharathi, Challapalli Vishal, International journal of pure and applied mathematics.

- DESIGN AND IMPLEMENTATION OF THE SMART GLOVE TO AID THE

VISUALLY IMPAIRED. [2019], Sambhav Jain, Sushanth D Varsha, Vijetha N Bhat, J V Alamelu, ICCSP.

- SMART HAND GLOWS USING FLEX SENSOR. [2024], Dhanya Shetty, Pooja Motirave, Prof. S.B. Kamble, IJCRT.
- IoT-BASED SMART GLOVES AND GOOGLE ASSISTANCE CONTROL FOR DISABLED PEOPLE

USING DESIGN THINKING APPROACH. [2023], Ms. Deepti S, Ms. Latchya Shree G, Mr. kirubakaran V, Mr. Dharanidharan S, JETIR.

- SMART GLOVE FOR HEARING-IMPAIRED. [2019], Abhilasha C Chougule, Sanjeev S Sannakki, Vijay S Rajpurohit, IJITEE

**PROBLEM FORMATION-** We gone through many research papers during Literature Survey, we gone through a discussion among us with the project guide. In this process we found a research paper on smart glove which help the deaf people, it seems interested to us hence decided to implement the Smart glove for sign language translation using IoT.

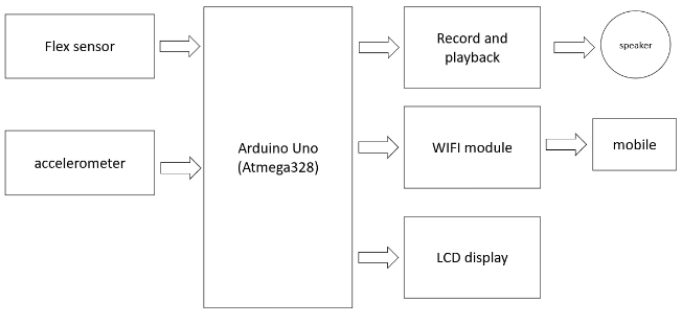
**OBJECTIVES-**

- Design a user-friendly glove that is easy to wear and operate.
- Providing a flex sensor and accelerometer to recognize the hand gesture.
- Develop code for Arduino that translate gestures into text.
- Integrate the glove with smartphones or tablets for enhanced functionality.

## III. METHODOLOGY

Technology has always been of great help to the disabled and given them a helping hand to allow them to live a normal and healthy life like others. Embedded systems are designed to do some specific tasks, rather than be a general-purpose computer for multiple tasks. “Embedded” reflects the fact that they are an integral part of the system. Some also have real time performance constraints that must be met, for reason such as safety and usability; others may have low or no performance requirements, allowing the system hardware to be simplified to reduce costs. An embedded system is not always a separate block- very often it is physically built-in to the device it is controlling.

**BLOCK DIAGRAM-**




Accelerometer sensor measures the linear movements of hand in X-axis, Y-axis, Z-axis and outputs different values of X, Y, Z corresponding to the movement in X-axis, Y-axis, Z-axis.

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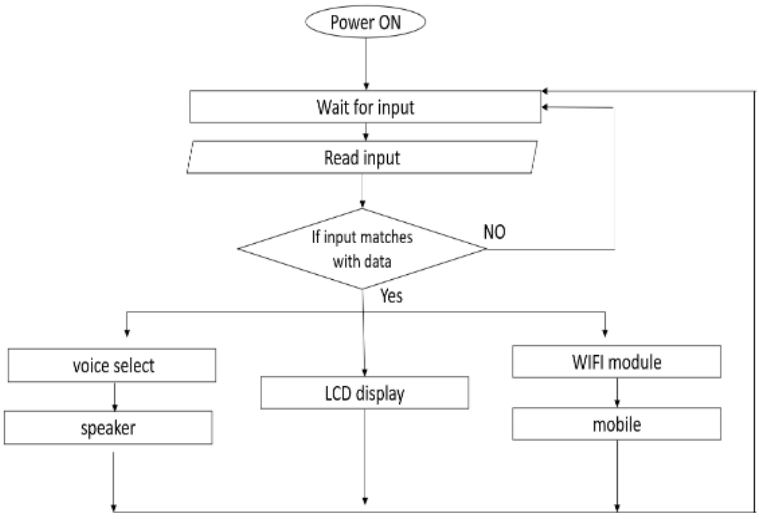
After sensing the gesture using accelerometers all the data from sensors are then processed on Arduino.

For this, appropriate ranges are set for each alphabet and the words that can be recognized with single hand based on the measured data obtained from repeated measurements.

A WI-FI module is connected to Arduino UNO which displays the result on android phone via Wi-Fi module

**FLOW CHART-**




The accelerometer sensors sense the bending of fingers and for sensing the direction of the hand. The gestures are sensed by these sensors and a battery should be connected to the glove.

Recognition of gesture:

The analog signals are converted into digitals signals and based on the signals of the sensors the resultant is compared with the code which is fed in the Arduino UNO, If there exists a match in the code the output is generated else the device waits until it gets the Correct input. Transmission of Output:

The output thus obtained is transmitted to the android application as a text via the WI-FI (which is the means for wireless communication) which is connected to android mobile and the Glove.

- The smart glove is turned on then the gesture is read by the sensors i.e., accelerometers, flex sensor attached on the four fingers of glove, touch. When the user puts the gesture in a particular angle according to the predefined values then it verifies whether the gesture is matched with predefined code in MCU. If its not matched it waits for correct data else it sends the output to the WI-FI module. If the WI-FI module is connected to the receiver it transmits the data otherwise it waits until the WI-FI module gets connected to the WI-FI receiver.
- The android application is started. The application turns on the WI-FI in the android device and then connect the smart glove to the WI-FI module connected to the glove. After connection is done it waits for the data from the module, if data is received it converts into text and then translates to voice using the Speaker on glove. The result obtained here is in the form of text and voice.

**RESULT-** The Develop code for Arduino that translate gestures into text or speech is tested in real-time. The implementation includes the flex sensor, accelerometer, Arduino LCD display, common board, connecting wires.

- The Arduino code captures hand gestures using flex sensors and an accelerometer sensor, detecting signal interruptions caused by movement.
- Arduino processes the accelerometer sensor data and maps specific patterns to predefined text messages.
- The predefined text messages are displayed on an LCD screen using the Liquid Crystal library.
- The voice output through a speaker embedded in the glove.
- Hand recognition is achieved through threshold conditions, ensuring accurate detection and interpretation of hand movements.

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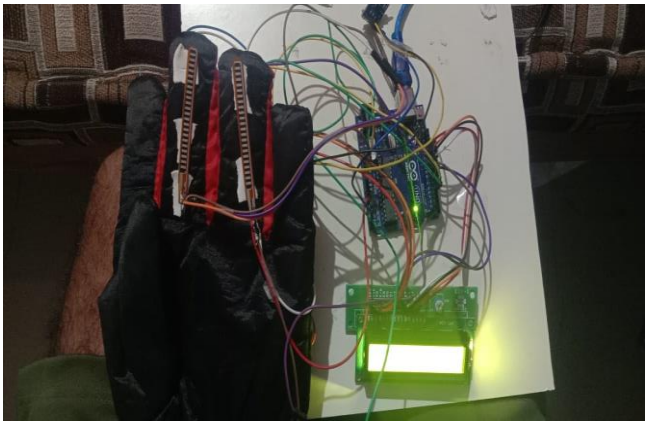
- The system translates gestures into text in real-time, making it interactive and user-friendly.



## IV. CONCLUSION

The Smart Glove for Sign Language Translation using IoT represents a meaningful step toward enabling inclusive communication between speech- and hearing-impaired individuals and the general public. Through the integration of flex sensors, an ADXL335 accelerometer, an Arduino Uno microcontroller, a Wi-Fi module (ESP8266), and a voice output system, the glove is capable of detecting complex hand gestures and converting them into real-time text and speech outputs. This combination of hardware and software has been successfully implemented and tested to demonstrate accurate gesture recognition and translation, with data transmitted wirelessly to an Android device for display and audio output. All the major objectives outlined in the project — including the development of a wearable, comfortable glove, the integration of gesture recognition sensors, effective Arduino programming, and smartphone compatibility — have been accomplished with promising results. The glove's ergonomic and lightweight design ensures long-term usability, while the wireless connectivity offers convenience and portability, making it ideal for daily communication needs.

Additionally, the system's modular nature allows for future expansion, including the support for more complex gestures, multilingual output, and cloud integration for data storage or remote usage. The glove also shows potential for application in other domains such as rehabilitation, virtual gaming, robotics, and military communication, thereby extending its usability beyond assistive communication alone.

## ACKNOWLEDGEMENT

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