International Journal of
Computational Learning & Intelligence
Vol. 02, Issue 04 (October) 2023

RESEARCH ARTICLE OPEN ACCESS

IoT Based Model Bridge Between Deaf and Mute Community with Normal People

Maharshi Vivekanand . Shrinivas R G . Piyush Kumar . Rahul C G . Naveen Chandra Gowda

School of Computer Science and Engineering,
REVA University, Bengaluru, India

DOI: **10.5281/zenodo.10254235**
Received: 21 October 2023 / Revised: 12 November 2023 / Accepted: 02 December 2023

Abstract – This paper delves into the analysis of fundamental components of sign language using embedded systems, a crucial exploration aimed at facilitating the development of an extensive vocabulary encompassing the factorial of 10. The primary emphasis is on shedding light on an unaddressed issue within the realm of sign language communication. By leveraging embedded systems, we seek to provide an innovative solution that not only enhances the understanding of basic sign language elements but also enables the creation of an expansive vocabulary. The research underscores the significance of addressing this unexplored challenge, emphasizing the potential impact on effective communication for the deaf and mute community. Through a meticulous examination of sign language components and the utilization of embedded systems, this paper contributes to bridging gaps in communication accessibility, paving the way for a more inclusive and comprehensive linguistic framework.

Index Terms – Embedded system, flex sensor, sign language, Bluetooth Module.

I. INTRODUCTION

Communication is a fundamental aspect of human interaction, yet for the deaf and mute community in India, the shortage of certified Indian Sign Language (ISL) interpreters has posed a significant barrier to effective engagement in various settings. With less than 300 certified ISL interpreters available, the need for innovative solutions to enhance communication opportunities for this community is more pressing than ever. This technical paper introduces a pioneering approach to address this critical concern: the development of a Smart Glove designed to empower deaf and mute individuals by enabling real-time communication with the hearing and speaking world. The proposed

solution incorporates cutting-edge technology, merging hardware and software components to create a seamless communication experience. The hardware component of the Smart Glove includes a sensor array embedded in the gloves, featuring flex sensors to detect hand movements and gestures. To capture more nuanced gestures and hand positions, additional sensors such as accelerometers and gyroscopes are integrated. This sophisticated sensor array forms the foundation for the gesture recognition software, which utilizes machine learning algorithms to interpret real-time sensor data.

The gesture recognition software is trained to recognize a diverse range of gestures and associate them with corresponding words or phrases. This breakthrough technology not only facilitates natural conversations but also reduces reliance on traditional communication aids like pen and paper or sign language interpreters. The integration of hardware and software components ensures a seamless user interface, allowing deaf and mute individuals to communicate effectively in various social, educational, and professional settings. The Smart Glove goes beyond mere communication by connecting the gesture recognition software to a speech synthesis system. This innovative feature converts recognized gestures into spoken words, simultaneously displaying the converted text on a screen or transmitting it to connected devices for text-based communication. By providing real-time communication capabilities, the Smart Glove not only enhances inclusivity but also opens doors to education and employment opportunities for the deaf and mute community. This paper delves into the technical intricacies of the Smart Glove, outlining its potential to revolutionize communication and empower individuals to participate fully in the broader societal landscape.

- **Problem Statement**

Deaf and mute individuals in India face a critical shortage of ISL interpreters. To address this, a Smart Glove with flex sensors and gesture recognition software is proposed. This technology aims to enable real-time communication, fostering inclusivity and unlocking educational and employment opportunities for the deaf and mute community.

- **Our Contributions**

Major contributions of the paper are as followed:

1. Our Smart Glove integrates cutting-edge flex sensors and gesture recognition software, allowing deaf and mute individuals to communicate seamlessly in real-time, reducing reliance on traditional aids.
2. By bridging communication gaps, the Smart Glove promotes inclusivity, enabling participation in various social, educational, and professional settings for the deaf and mute community.
3. The technology opens doors to previously limited educational and employment opportunities by providing effective communication tools for the deaf and mute, fostering their integration into broader societal spheres.

The rest of the paper is organized as section 2 gives an overview of the literature carried out in the field of smart gloves. Section 3 gives a proposed methodology and then section 4 gives the implementation, section 5 Components, section 6 concludes the paper.

II. LITERATURE SURVEY

Effective communication is a cornerstone of human interaction, enabling understanding and connection. However, for the deaf and mute community in India, a scarcity of certified Indian Sign Language (ISL) interpreters has posed a significant challenge. With less than 300 interpreters available, there's a pressing need for innovative solutions to enhance communication opportunities. This literature survey explores the development of Smart Gloves as a pioneering solution to address this critical concern. The scarcity of certified ISL interpreters in India has been widely acknowledged as a major obstacle for effective communication among the deaf and mute population. Existing literature emphasizes the challenges faced in educational, professional, and social settings due to the shortage of interpreters. The limited availability of interpreters restricts the access of deaf and mute individuals to essential information and hinders their active participation in various spheres of life.

Recent literature highlights the emergence of technological solutions to address the communication gap faced by the deaf and mute community. Among these innovations, Smart Gloves have gained attention as a potential game-changer. These gloves are equipped with a sensor array, including flex sensors, accelerometers, and gyroscopes, to detect hand movements and gestures. The incorporation of these technologies aims to provide a more nuanced and comprehensive means of communication. The integration of gesture recognition software into Smart Gloves is a crucial aspect explored in the literature. Machine learning algorithms play a central role in training the software to recognize a diverse range of gestures and associate them with corresponding words or phrases. This technological advancement is seen as a key driver in facilitating natural, real-time communication between deaf and mute individuals and the hearing and speaking world.

Literature emphasizes the significance of seamlessly integrating hardware and software components in Smart Gloves. The successful fusion of the sensor array's data with gesture recognition software ensures a user-friendly interface. This integration is vital to providing a smooth and efficient communication experience, ultimately enhancing the usability and effectiveness of Smart Gloves for the deaf and mute community. The real-time communication capabilities offered by Smart Gloves are highlighted as a major breakthrough in the literature. By converting recognized gestures into spoken words through speech synthesis systems, the gloves aim to reduce reliance on traditional communication aids such as pen and paper or sign language interpreters. This shift is seen as a significant step toward enabling more spontaneous and natural interactions for deaf and mute individuals.

The literature consistently emphasizes the potential of Smart Gloves to promote inclusivity in diverse settings. These gloves empower deaf and mute individuals to participate actively in social, educational, and professional environments where effective communication is paramount. By breaking down communication barriers, Smart Gloves contribute to creating a more inclusive society. One of the critical contributions highlighted in the literature is the potential of Smart Gloves to open doors to education and employment opportunities for the deaf and mute community. By providing effective communication tools, these gloves aim to empower individuals to access educational resources and pursue employment opportunities that may have been previously limited by communication challenges.

III. PROPOSED WORK

To create the Smart Glove for effective communication, we follow a step-by-step methodology. First, we embed a sensor array, including flex sensors, accelerometers, and gyroscopes, onto the gloves to capture hand movements and gestures. Next, we develop gesture recognition software using machine learning, training it to understand a wide range of gestures and associate them with words or phrases in real-time. Afterwards, we focus on integration, ensuring that the hardware (sensors) and software (gesture recognition) work smoothly with the user interface. This step is crucial to guarantee a seamless user experience.

The final phase involves connecting the gesture recognition software to a speech synthesis system. This allows recognized gestures to be converted into spoken words, simultaneously displaying the converted text on a screen or transmitting it to connected devices for text-based communication. This methodology ensures a comprehensive approach to developing the Smart Glove, making communication more accessible for the deaf and mute community. The overall system design is shown in Figure 1, with the architecture of the encapsulated application. The data from the picture dataset that was supplied for data preprocessing is subsequently used to train the model.

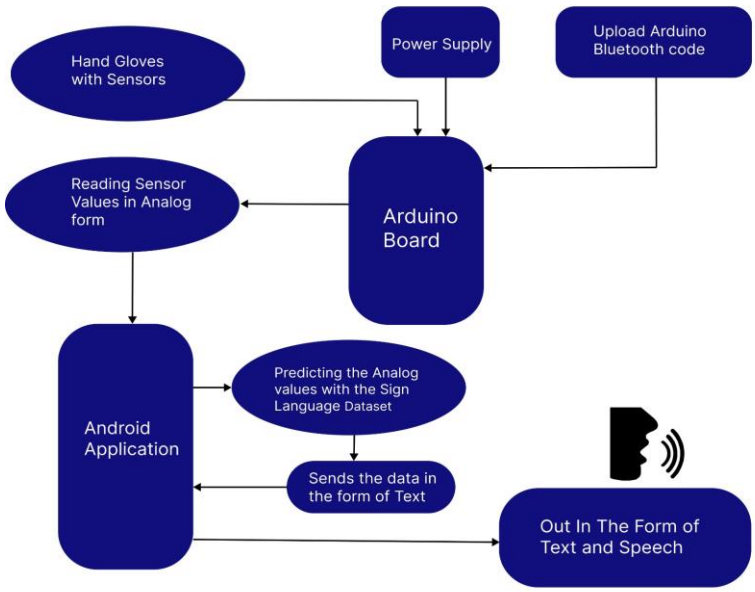

Fig. 1: Proposed architecture design

IV. IMPLEMENTATION AND RESULTS

The implementation of the Smart Glove involves several key steps to make communication easier for deaf and mute individuals. Firstly, we design and place a special array of sensors, including flex sensors, accelerometers, and gyroscopes, on the gloves. These sensors can detect how the hands move and the gestures made.

Next, we create advanced gesture recognition software using smart algorithms, like those in machine learning. This software is trained to understand a wide variety of gestures, connecting them to

specific words or phrases in real-time. This is important for making communication natural and quick. The hardware (sensors) and software (gesture recognition) components are then integrated, ensuring they work well together. This step is crucial to make sure the Smart Glove is user-friendly and effective in various situations.

The final part involves connecting the gesture recognition software to a speech synthesis system. This system changes the recognized gestures into spoken words. Simultaneously, the converted text is displayed on a screen or sent to connected devices for text-based communication. This step allows for real-time communication, helping deaf and mute individuals to interact more easily with the hearing world. By following this implementation process, we aim to create a Smart Glove that seamlessly combines advanced technology and user-friendly design, providing a valuable tool for inclusive communication and improving access to education and employment opportunities for the deaf and mute community.

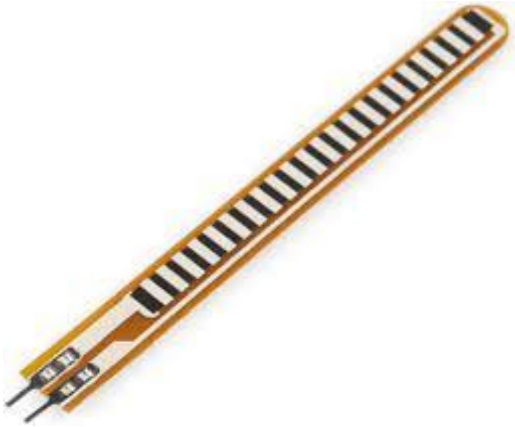

Fig. 2: Flex sensor

- **Flex Sensors**

A flex sensor is also called the bend sensor. It measures the amount of deflection or the bending caused to the sensor. The resistance of the sensor is directly proportional to the amount of bending moment. It is often called the flexible potentiometer. Flex sensors are widely used in areas of research from computer interfaces, rehabilitation, security systems and even music interfaces.

Fig. 3: Arduino Uno

- **Arduino Uno**

The Arduino Uno is a popular open-source microcontroller board, widely used in electronics projects. Featuring an ATmega328P microcontroller, it offers a user-friendly platform for beginners and enthusiasts to develop and experiment with various electronic projects.

Fig. 4. Prototype design and hardware proof of concept (PoC)

V. CONCLUSION

The Smart Glove is a remarkable solution that addresses the communication challenges faced by deaf and mute individuals. By combining advanced sensor technology and gesture recognition software, this special glove allows for easy and quick conversations, enabling participation in various settings like school and work. While it may not be perfect, the Smart Glove significantly improves the ability of deaf and mute individuals to engage with the hearing world, breaking down communication barriers. The addition of this innovative technology opens up new opportunities for learning and employment that were previously difficult to access. Despite its imperfections, the Smart Glove serves as a valuable tool, enhancing the quality of life for those who, before its introduction, faced limitations in communication and opportunities. This groundbreaking technology signifies a positive step toward inclusivity, making meaningful connections and enriching the lives of individuals who were once excluded from certain aspects of society.

REFERENCES

1. Axisa, F., Gehin, C., Delhomme, G., Collet, C., Robin, O., & Dittmar, A. (2004, September). Wrist ambulatory monitoring system and smart glove for real time emotional, sensorial and physiological analysis. In *The 26th annual international conference of the IEEE engineering in medicine and biology society* (Vol. 1, pp. 2161-2164). IEEE.

2. Chouhan, T., Panse, A., Voona, A. K., & Sameer, S. M. (2014, September). Smart glove with gesture recognition ability for the hearing and speech impaired. In *2014 IEEE Global Humanitarian Technology Conference-South Asia Satellite (GHTC-SAS)* (pp. 105-110). IEEE.
3. Patel, N., Jethwa, N., Mali, C., & Deone, J. (2022). Deepfake Video Detection using Neural Networks. In *ITM Web of Conferences* (Vol. 44, p. 03024). EDP Sciences.
4. Dipietro, L., Sabatini, A. M., & Dario, P. (2008). A survey of glove-based systems and their applications. *Ieee transactions on systems, man, and cybernetics, part c (applications and reviews)*, *38*(4), 461-482.
5. Ahmed, S. S. T., Thanuja, K., Guptha, N. S., & Narasimha, S. (2016, January). Telemedicine approach for remote patient monitoring system using smart phones with an economical hardware kit. In *2016 international conference on computing technologies and intelligent data engineering (ICCTIDE'16)* (pp. 1-4). IEEE.
6. Al-Shammari, N. K., Syed, T. H., & Syed, M. B. (2021). An Edge–IoT framework and prototype based on blockchain for smart healthcare applications. *Engineering, Technology & Applied Science Research*, *11*(4), 7326-7331.