UNIVERSITI TEKNOLOGI MARA

JIIICaS 2024
JOHOR INTERNATIONAL INNOVATION, INVENTION COMPETITION AND SYMPOSIUM

PROCEEDINGS OF JOHOR INTERNATIONAL INNOVATION INVENTION COMPETITION AND SYMPOSIUM 2024 (JIIICaS 2024)

"Flourish and Nurturing Sustainable Innovation for a Prosperous Nation"

JIICOS 2024
JOHOR INTERNATIONAL INNOVATION, INVENTION COMPETITION AND SYMPOSIUM

Editorial Board

e ISBN: 978-967-0033-25-9

Published in Malaysia by
Universiti Teknologi MARA Cawangan Johor
Kampus Pasir Gudang
81750 Masai

Preface

In the name of Allah, the Almighty who gives us the enlightenment, the truth, the knowledge and with regards to Prophet Muhammad (peace be upon him) for guiding us to the straight path. We thank to Allah for giving us guidance and strength to write this e-book.

This e-book compiles the extended abstracts that submitted to Johor International Innovation Invention Competition and Symposium 2024 (JIIICaS2024), where JIIICaS2024 is a virtual platform for all creative minds to share and present their invention and innovation. Each abstract gives a brief background on the innovation or project.

We hope that this e-book will help the readers to get to know the innovation done by the students and get some ideas to develop future innovation products.

Foreword Rector

Assalamualaikum warahmatullahi Wabarakatuh, Salam Sejahtera, Salam Malaysia MADANI and Salam UiTM Dihatiku.

In the name of Allah, the Most Gracious, the Most Merciful.

It is a great honor to welcome you to the Johor International Innovation, Invention, Competition, and Symposium 2024 (JIIICaS 2024). This event connects various disciplines, focusing on education and engaging educators, students, researchers, and innovators from all walks of life.

Innovation is not just about ideas; it demands perseverance, creativity, and determination to turn those ideas into reality. The remarkable projects showcased today highlight the dedication and spirit of all participants. Initiatives like this not only explore new technologies but also cultivate skills and leadership among our youth. At Universiti Teknologi MARA (UiTM) Johor Branch, we are fully committed to fostering a dynamic culture of innovation, promoting the commercialization of new products, and encouraging meaningful collaborations with industry and society.

As we celebrate this event, I would like to extend my heartfelt gratitude to all sponsors, judges, the College of Computing, Informatics and Mathematics, UiTM Pasir Gudang Campus as the event organizer, as well as to the researchers and participants for their hard work in making this event a success. Let us continue striving for innovation and excellence. May the ideas presented today inspire us and lay the groundwork for future achievements.

Thank you.

Associate Professor Dr. Saunah Zainon
Rector
Universiti Teknologi MARA (UiTM)
Johor Branch

(A-ST165) SIGN GLOVE WITH IOT SYSTEM

Farah Hanim Binti Mohd Fauzi[1], Nur Alya Sakinah Binti Mohd Khairusaleh [1], Mohd Shariman Bin A Aziz[2],

[1]Politeknik Ungku Omar, Ipoh, Perak
[2]Fine Matrix Projects Sdn. Bhd.

Corresponding author: farahhanim@puo.edu.my (Farah Hanim Binti Mohd Fauzi)

ABSTRACT

This paper details the development of an IoT-enabled sign glove designed to facilitate communication for individuals utilizing sign language. The glove incorporates an array of sensors, including flex sensors, gyroscopes, and accelerometers, to accurately capture and quantify hand gestures. These gestures are subsequently translated into text or speech in real-time, leveraging IoT technologies such as Wi-Fi and Bluetooth for wireless communication with external devices including smartphones, tablets, and computers. The principal aim of this work is to design, engineer, and validate the sign glove as an effective assistive communication tool for the deaf and hard-of-hearing community. The glove's capability to bridge communication barriers across diverse environments—ranging from educational and healthcare settings to routine social interactions—underscores its potential to enhance accessibility and inclusivity, thereby promoting greater autonomy and participation for its users.

Keywords: IoT Systems, sensors, and sign gloves.

1.0 INTRODUCTION

The "Sign Glove with IoT" project aims to develop an innovative wearable device that can translate sign language gestures into text or speech, facilitating communication for individuals who are deaf or hard of hearing. Utilizing advanced sensors like flex, gyroscope, and accelerometer, the glove captures the precise movements of the user's hands. These movements are then processed and translated into recognizable language, bridging the communication gap between sign language users and non-users. The integration of IoT technology ensures seamless connectivity with devices such as smartphones and tablets, making the glove a versatile tool in various settings, including educational institutions, healthcare, and daily interactions.

The exploration of communication technologies for individuals with disabilities has highlighted significant challenges and gaps in existing solutions. While various approaches have been developed, including wearable sensor gloves and innovative sign language recognition systems, many devices still struggle with accuracy, universality, and practical usability (Sharma et al., 2013; Bhatnagar et al., 2015; Tanyawiwat & Thiemjarus, 2012). The research reviewed demonstrates the ongoing evolution of assistive technologies, with advancements in sensor integration, gesture recognition, and signal processing playing crucial roles in improving communication for deaf, mute, and other non-verbal individuals (Sharma et al., 2013; Vutinuntakasame et al., 2011; Akkineni et al., 2024).

Innovations such as the wearable sensor gloves for British, Indian, and American Sign Language, as well as systems incorporating statistical template matching,

electromyography, and deep learning models, represent promising strides toward more effective and accessible communication tools (Bhatnagar et al., 2015; Al-Ahdal & Nooritawati, 2012; Mohammad et al., 2023). However, these advancements also underscore the complexity of creating universally applicable solutions that can address the diverse needs of the disabled community (Sharma et al., 2013; Luqman & Mahmoud, 2017).

Moving forward, the continuous refinement of these technologies, particularly in enhancing accuracy and expanding their applicability across different sign languages and contexts, will be vital. The reviewed literature, supported by recent developments in progression learning and sensor fusion, points to the necessity of further research and development to bridge the communication gap fully and provide more inclusive and reliable tools for individuals with disabilities (Al-Ahdal & Nooritawati, 2012; Luqman & Mahmoud, 2017; Mohammad et al., 2023; Akkineni et al., 2024).

2.0 OBJECTIVE

1. To design a Sign Glove with IoT capabilities.
2. To develop a functional prototype of the Sign Glove.
3. To validate the effectiveness of the Sign Glove in translating sign language gestures into text or speech.

3.0 METHODOLOGY

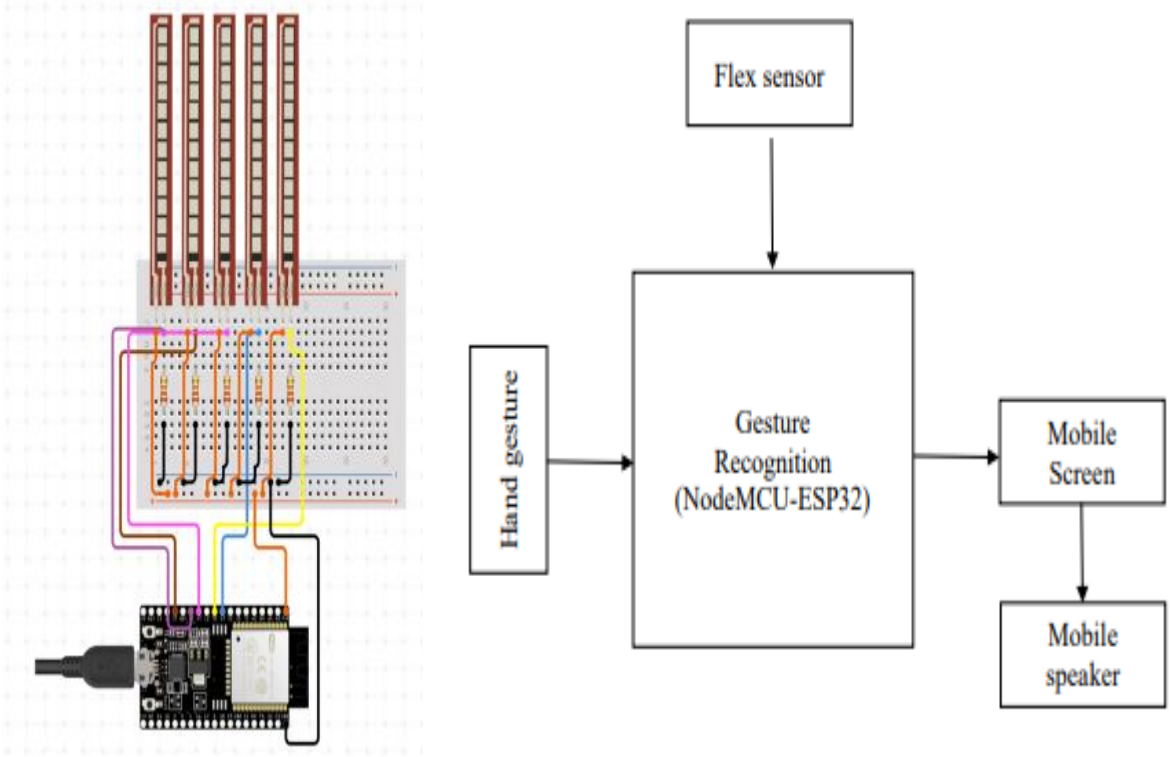

Figure 1: Circuit and Block Diagram Sign Glove with IoT

Figure 1 illustrates the role of the ESP32 microcontroller as the central processing unit, facilitating the interface between input and output devices. The input devices, as depicted, include flex sensors and hand gestures, while the output devices consist of

the mobile screen and speaker. This phase entails the collection of hand gesture data through sensors, primarily utilizing flex sensors for precise motion detection. The acquired data is processed through a gesture recognition algorithm, which systematically analyzes the extracted features to accurately identify distinct gestures or gesture sequences. Upon successful recognition of a gesture, the system triggers the corresponding output, which includes displaying text on the mobile screen and generating audio feedback through the mobile speaker.

4.0 RESULTS

The Sign Glove prototype successfully demonstrated its ability to accurately translate sign language gestures into text and speech in real-time. The integration of IoT technology enabled seamless connectivity with mobile devices, allowing for effective communication across different platforms. The testing phase showed a high level of accuracy in gesture recognition, with users reporting significant improvements in communication efficiency. The glove's ability to cater to various sign languages and its application in multiple settings, including education and healthcare, highlights its potential as a valuable tool for the deaf and hard-of-hearing community.

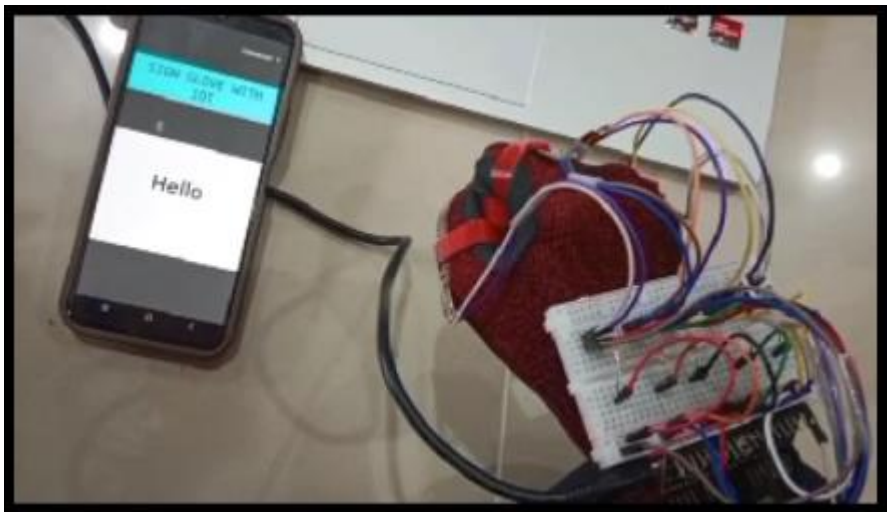

Figure 2: The prototype model of Sign Glove with IoT

5.0 CONCLUSION

The Sign Glove with IoT represents a significant advancement in assistive technology, offering a practical solution to the communication barriers faced by individuals who are deaf or hard of hearing. By converting sign language gestures into text or speech, the glove enhances inclusivity and fosters better communication in various social, educational, and professional settings. The success of this project opens the door for further development, with possibilities for expanding its capabilities and improving its design. Future iterations of the glove could incorporate additional features, such as support for more sign languages and improved portability, to further enhance its usability and impact.

6.0 REFERENCES

- Sharma, V., Kumar, V., Masaguppi, S. C., Suma, M., & Ambika, D. (2013). Virtual Talk for Deaf, Mute, Blind and Normal Humans. In *Proceedings of the 2013 Texas Instruments India Educators' Conference (TIIEC)* (pp. 316–320). Bangalore, India.
- Bhatnagar, V. S., Magon, R., Srivastava, R., & Thakur, M. K. (2015). A cost-effective Sign Language to voice emulation system. In *Proceedings of the 2015 Eighth International Conference on Contemporary Computing (IC3)* (pp. 521–525). Noida, India.
- Tanyawiwat, N., & Thiemjarus, S. (2012). Design of an assistive communication glove using combined sensory channels. In *Proceedings of the 2012 Ninth International Conference on Wearable and Implantable Body Sensor Networks (BSN)* (pp. 34–39). London, UK.
- Vutinuntakasame, S., Jaijongrak, V. R., & Thiemjarus, S. (2011). An assistive body sensor network glove for speech-and hearing-impaired disabilities. In *Proceedings of the 2011 International Conference on Body Sensor Networks (BSN)* (pp. 7–12). Dallas, TX, USA.
- Al-Ahdal, M. E., & Nooritawati, M. T. (2012). Review in sign language recognition systems. In *Proceedings of the 2012 IEEE Symposium on Computers & Informatics (ISCI)* (pp. 52–57). Penang, Malaysia.
- Luqman, H., & Mahmoud, S. A. (2017). Transform-based Arabic sign language recognition. *Procedia Computer Science, 117*, 2–9.
- Mohammad, M. H., Hashim, S. Z. M., & Rahman, N. A. (2023). Progression learning convolution neural model-based sign language recognition using wearable glove devices. *Advanced Research in Artificial Intelligence and Machine Learning*, 11(2), 80–87. https://doi.org/10.37934/aram.112.1.8087
- Akkineni, K., Mounika, T., Pooja, M., Reddy, T. B. P., Reddy, K. S., Ramesh, G., & Gupta, G. (2023). Smart glove for sign language and AI-driven wheelchair navigation. *MATEC Web of Conferences, 392*, 01061. https://doi.org/10.1051/matecconf/202439201061