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"Flourish and Nurturing Sustainable Innovation for a Prosperous Nation"

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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)
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(A-ST175) SIGN LANGUAGE TRANSLATION SYSTEM

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ABSTRACT

A sign language translation system is a mobile application designed to identify hand gestures in real-time using computer vision and machine learning techniques. It translates sign language gestures into text, facilitating communication for individuals who are speech and hearing impaired. Unlike existing systems that require specialized hardware or are limited to specific environments, this mobile-based solution leverages the smartphone camera and integrates TensorFlow Lite for efficient on-device processing. The application consists of three modules: a real-time translation module, a learning module for teaching the ABCs of sign language, and an interactive quiz module. The project employs a waterfall approach, ensuring organized development and consistent goals. Usability testing indicated positive feedback, confirming the system's effectiveness. Further testing and validation will enhance its utility for diverse user groups.

Keywords: Sign Language Translation, Computer Vision, Machine Learning, Real-Time Translation, Social Integration.

INTRODUCTION

A sign language translation system is a mobile application designed to identify hand gestures in real-time using computer vision and machine learning techniques. This system translates images of sign language into the corresponding meaning behind the gestures, facilitating communication for individuals who are speech and hearing impaired.

The purpose of this project is to develop a comprehensive sign language translator application. The application leverages the mobile camera, capturing hand movements and detecting gestures through image detection technology. This real-time translation module enables users to communicate effectively by translating sign language into text.

In addition to the sign language translation system, the application includes two other valuable modules: a learning module and a quiz module. The learning module is designed to teach the ABCs of sign language, making it accessible for individuals without hearing impairments to learn and understand the basics of sign language. The quiz module provides interactive quizzes to test users' knowledge of sign language, reinforcing their learning and providing a fun way to practice.

This application aims to bridge the communication gap between sign language users and those who do not know sign language. It can be utilized in various settings such

as schools, workplaces, and healthcare facilities, making it a versatile tool for enhancing interactions in the deaf and hard-of-hearing community. By enabling easier and more effective communication, this sign language translation system has the potential to revolutionize the way the deaf and hard-of-hearing community interacts with the world around them.

Communication can be challenging for the deaf and hard-of-hearing, who commonly use sign language. The World Health Organization reports that around 1.5 billion people experience hearing loss, with 430 million having hearing disabilities. By 2050, over 700 million people may have disabling hearing loss. This can lead to fewer educational and career opportunities, social withdrawal, and emotional issues due to impaired communication. [1]

Gesture recognition technologies can convert hand gestures into text, enhancing communication and facilitating the learning of sign language. This is particularly helpful as most deaf children are born to hearing parents. The Sign Language Translation System aims to assist both beginners and those with deaf family or friends in learning sign language using machine learning.

Sign language detection can be challenging due to variations in age, size, and gender. However, machine learning algorithms, especially neural networks, have proven effective in pattern recognition and classification. Training on datasets, such as those from Kaggle, improves the system's accuracy in recognizing gestures.

This project aims to develop an efficient system for translating sign languages so that non-signers and sign language users can communicate more efficiently. Through the use of machine learning algorithms and computer vision techniques, the system will recognize and interpret the movements and gestures of users of sign language.

In the development process, choosing the appropriate system development methodology is essential since it affects the project's organization and rationality. This project is best suited to a waterfall approach because the goal remains constant throughout. As long as the project aim is taken into account, it is simple to implement the waterfall model SDLC.

The project focuses on developing a sign language translation system using a dataset that includes the signs for "hello," "yes," and "I love you." The software tools employed for this project include Android Studio, Kaggle, OpenCV, TensorFlow Lite, and Java. The system will leverage deep learning and machine learning techniques to achieve accurate translations. The target audience for this application is non-signers who wish to easily understand sign language. The application's camera will be directed towards the person signing to capture and translate real-time gestures effectively.

The objectives of the project are to identify the requirements for a Sign Language Translation System, to design and develop the system, and to validate its effectiveness in translating sign language.

METHODS

The Waterfall methodology is a traditional project management approach often used

in software development and other engineering disciplines. It is a linear and sequential model that consists of distinct phases. Each phase must be completed before the next one begins, and there is usually no going back to a previous phase once it is finished. The key phases of the Waterfall methodology would be Requirements Analysis, this is the initial phase where the project's requirements are gathered and documented. The second one would be System Design. In this phase, the requirements from the first phase are used to design the system architecture. Next is Implementation, this phase involves the actual development of the software or system. Developers write code according to the specifications created in the design phase. Then Integration and Testing, once the system is implemented, it needs to be tested as a whole. Deployment, after testing is complete and the system is considered stable, it is deployed to the production environment. Lastly, maintenance, for the final phase involves maintaining and supporting the system post-deployment.

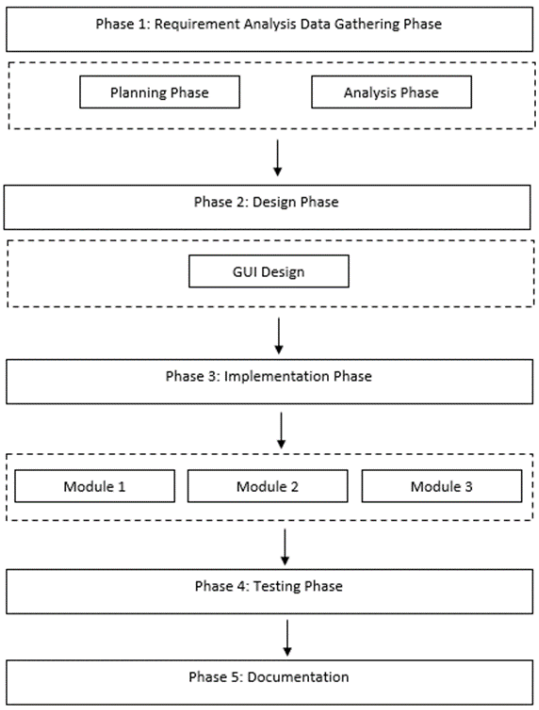

Figure 1: Waterfall Modelling for Sign Language Translation System

RESULTS AND DISCUSSION

The usability testing of the sign language translation system, conducted with 29 special needs students, 7 teachers, and 2 parents from SK Taman Universiti 1, yielded overwhelmingly positive results. Participants expressed satisfaction with the application's ease of use, user-friendliness, and overall effectiveness in translating sign language into text.

Figure.2: Result of user testing

Pre-testing Familiarity: Before using the application, the majority of participants (90%) had no familiarity with sign language, though they were generally comfortable with mobile apps (60%) and recognized the importance of such a tool for effective communication (100%).

Post-testing Feedback: After testing, 60% of users found the system easy to understand, and 50% rated their overall satisfaction at the highest level. The system was considered user-friendly and effective for learning and communication, with 80% rating its effectiveness at the highest level. Although most users had no suggestions for improvement, a few recommended enhancements like adding more child-friendly features and expanding the vocabulary.

Before Using Sign Language Translation System Questionnaire

Table 1: Before using sign language translation system questionnaire

Item	Question
1.	How familiar are you with using mobile apps for communication?
2.	How familiar are you with sign language (any sign language system)?
3.	How important do you think a sign language translation app is for effective communication?
4.	How comfortable are you with using technology to assist with language translation?
5.	How effective do you expect a sign language translation app to be in translating sign language accurately?
6.	How likely are you to use a sign language translation app in your daily life?

After Using Sign Language Translation System Questionnaire

Table 2: After using sign language translation system questionnaire

Item	Question
1.	How easy was it to understand how to use the sign language translation system?
2.	The sign language translation system interface is user-friendly

3.	The sign language translation system kept me engaged while using it.
4.	I found the sign language translation system to be an effective tool for learning or communicating.
5.	Overall, I am satisfied with my experience using the sign language translation system.
6.	I would recommend the sign language translation system to others.
7.	What you would suggest for improvement?

CONCLUSIONS

The Sign Language Translation System project successfully demonstrated that real-time translation of sign language into text can be effectively achieved using TensorFlow Lite and OpenCV, making communication between signers and non-signers more accessible. The system's success underscores key principles, such as the importance of integrating advanced gesture recognition algorithms and the utility of user-centric design in creating intuitive and efficient communication tools.

Generalizations and Principles: The project highlights that with the right technological approach, it is possible to create applications that bridge communication gaps between different language users, particularly in special needs education.

Exceptions and Challenges: However, the system's accuracy and effectiveness depend heavily on the quality of the datasets and the algorithms used, which may not yet handle more complex or nuanced sign language variations. Additionally, the initial version supports a limited range of sign languages, which constrains its broader applicability.

Theoretical and Practical Implications: Theoretically, this work contributes to the field of assistive technology by demonstrating that AI and machine learning can be effectively applied to enhance accessibility. Practically, it offers a tangible solution to communication barriers faced by the deaf and hard-of-hearing community, with potential for integration into educational and communication platforms.

Recommendations and Future Directions: To further advance the system, future work should focus on expanding language support, refining the gesture recognition algorithms, and incorporating voice output for a more comprehensive communication tool. Additionally, implementing user customization options and optimizing performance will enhance the system's usability and accessibility. Integrating a feedback loop and enabling dynamic content in educational modules are also recommended to ensure continuous improvement and engagement.

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