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



*“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 (JIICaS 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-ST083) BRAILLEEASE: SIMPLIFYING BRAILLE LITERACY WITH LOW-TECH ASSISTIVE TECHNOLOGY

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ABSTRACT

The BrailleEase: Simplifying Braille Literacy with Low-Tech Assistive Technology project introduces an innovative redesign of the traditional braille slate and stylus to enhance braille literacy for visually impaired individuals. This low-tech assistive technology initiative addresses the significant challenges posed by the conventional design, which requires users to write in reverse. This method often leads to errors and presents a steep learning curve, hindering effective braille literacy. Recognizing the need for a more user-friendly and efficient solution, BrailleEase aims to simplify the braille writing process through a mirrored-orientation usage. The project employs a user-centered design methodology, incorporating iterative testing and feedback from visually impaired users to ensure the new design meets their needs effectively. The project has successfully developed a fully functional prototype using 3D printing. Future production will involve injection molding through a supplier to ensure scalability and consistency. This innovation not only improves the user experience but also fosters inclusivity and accessibility, making braille literacy more attainable for the visually impaired community.

Keywords: braille literacy, low-tech assistive technology, user-centered design, accessibility, inclusive education,

1.0 INTRODUCTION

The BrailleEase project introduces an innovation aimed at simplifying braille literacy for visually impaired individuals. Traditional braille slates and styluses require users to write in reverse, a method that often results in errors and presents a significant learning curve as shown in Figure 1. This complexity can deter individuals from effectively learning and using braille, limiting their ability to read and write independently.

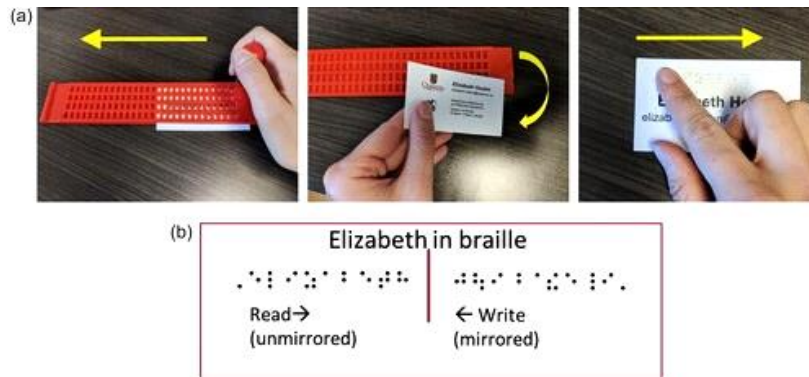


Figure 1: Traditional Braille slate and stylus usage: (a) using the slate and stylus to write in Braille; (b) the difference in Braille character orientation for reading (unmirrored) and writing (mirrored) (Hoskin et al., 2023).

Motivated by the need to make braille literacy more accessible and user-friendly, the BrailleEase project focuses on redesigning the braille slate and stylus to allow for mirrored-orientation usage. This low-tech assistive technology innovation simplifies the writing process, reducing the potential for errors and making it easier for users to learn and practice braille. By adopting a user-centered design approach, the project ensures that the needs and feedback of visually impaired individuals are at the forefront of the development process.

The BrailleEase project has successfully developed a fully functional prototype using 3D printing, demonstrating its usability and effectiveness. Future production plans include transitioning to more advanced manufacturing methods, ensuring consistent quality and scalability. This innovation not only addresses the technical challenges of the current design but also contributes to fostering a more inclusive society by empowering visually impaired individuals with better tools for reading and writing.

2.0 OBJECTIVE

The following are the objectives of this innovation

- i) Redesign the traditional braille slate and stylus for mirrored-orientation usage to enhance user experience and accessibility for visually impaired individuals.
- ii) Incorporate user feedback through a user-centered design methodology to ensure the product meets the specific needs and preferences of users.
- iii) Develop a cost-effective and sustainable low-tech assistive technology to promote inclusivity and independent braille literacy.

3.0 METHODOLOGY

3.1 User-Centered Design and Feedback

The methodology for the BrailleEase project began with a comprehensive analysis of customer needs and the identification of the core problems with existing Braille writing tools as listed in Table 1 below.

Table 1: Summary of methods of analyzing customer needs and identifying problems

Method	Description	Key Findings
Interviews and Surveys:	Conducting interviews and surveys with visually impaired individuals and sighted participants of Braille courses to gather firsthand insights into their experiences with traditional Braille slate and stylus.	<ul style="list-style-type: none"> — Difficulty of mirrored writing (slate) — Ergonomic discomfort of existing tools (stylus)
Benchmarking:	Analyzing comparable products available on the market through online platforms like Shopee and existing patents to identify their strengths and weaknesses.	<ul style="list-style-type: none"> — Highlighted necessary improvements for creating a more user-friendly Braille slate and stylus.
Problem Definition:	Synthesizing data from user feedback and benchmarking to clearly define the problem. The primary issue was the complexity and error potential of the traditional slate and stylus system, requiring users to write Braille characters in mirrored orientation.	<ul style="list-style-type: none"> — Complexity complicates the learning process for both sighted individuals learning to write Braille and visually impaired individuals — Increases the likelihood of errors

3.2 Conceptual Design

Various conceptual designs of the slate and stylus were proposed, as illustrated in Figure 2. A Pugh chart was then used to evaluate and compare these different concept designs for the Braille slate and stylus. By assessing each design against a set of predefined criteria, the chart helps identify the most promising design that best meets the project's objectives, as shown in Figure 3.

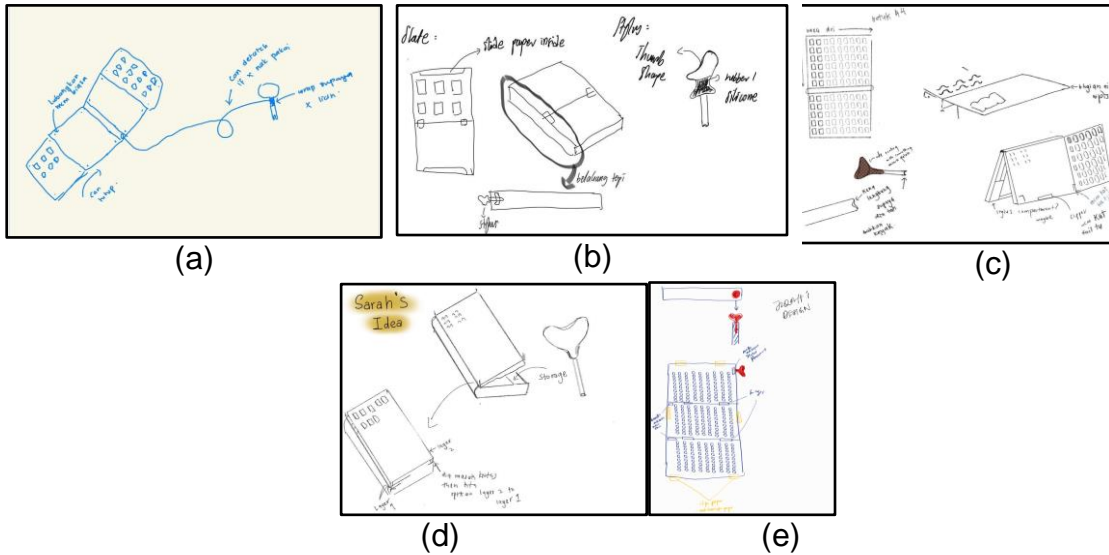


Figure 2: Initial concept designs of Braille slate and stylus by team members

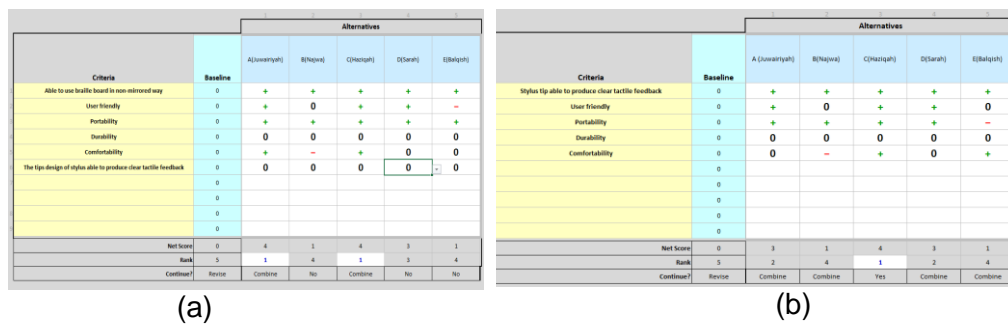


Figure 3: Pugh charts evaluating all the concept designs: (a) Braille slate, and (b) stylus.

Based on the evaluation in the Pugh Chart above, the embodiment design for the BrailleEase project was finalized by combining the most promising concepts. The final design incorporates elements from multiple initial concepts to create an optimal solution, as detailed in Table 2. The drawings of the finalized designs are shown in Figure 4.

Table 2: Finalised design elements for improved BrailleEase

Component	Finalised Design
Slate (Figure 4)	<ul style="list-style-type: none"> — The final slate design is a combination of concepts illustrated in Figure 2(a) and Figure 2(c). — This combination leverages the strengths of both designs to enhance usability, ergonomics, and functionality.
Stylus	<ul style="list-style-type: none"> — The final stylus design is based on the concept illustrated in Figure 2(c). — It was selected for its superior ergonomics and ease of use that complement the slate design.

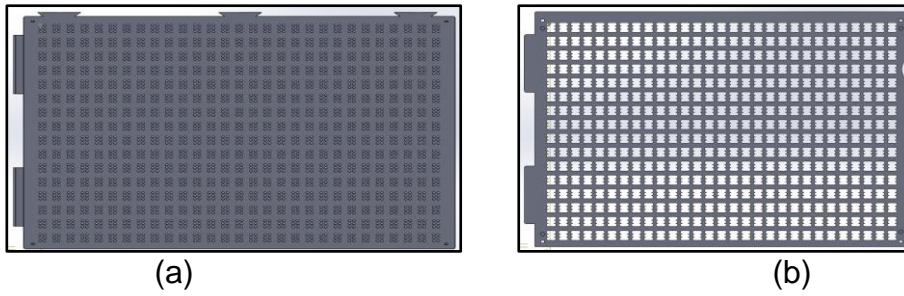


Figure 4: The finalised design of the Braille slate; a) lower slate, and b) slate cover

3.3 Prototype Development

The development of the BrailleEase prototype was guided by a user-centered design methodology. This approach involved engaging with visually impaired users throughout the design process to gather continuous feedback and ensure the product met their specific needs and preferences, as shown in Figure 5. Iterative testing and refinement phases were conducted to incorporate user feedback into the design. Prototypes were developed using 3D printing technology, which made it easy to quickly make and improve the designs based on user feedback.

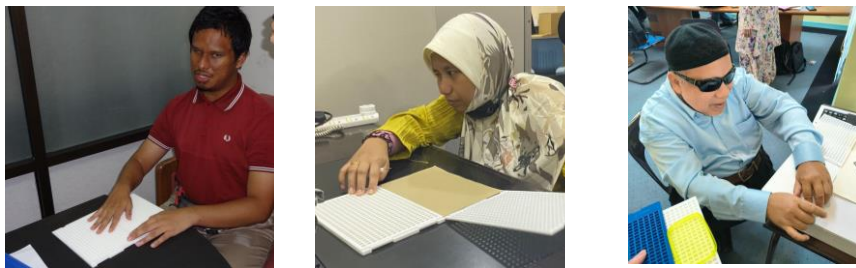


Figure 5: User testing sessions

4.0 RESULT

The redesigned Braille slate and stylus addressed the primary issues of traditional systems through a user-centered design approach, as shown in Figure 6. Users could write Braille characters in their natural orientation, significantly reducing complexity and errors. The ergonomic design and improved functionality received positive feedback, highlighting the project's success in making Braille writing more accessible and user-friendly for both visually impaired and sighted users.

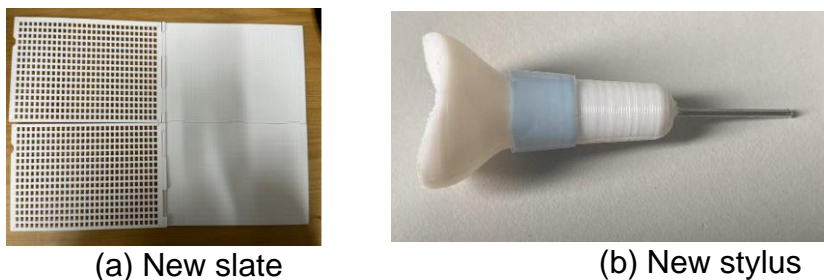


Figure 6: New improved braille slate and stylus- BrailleEase

5.0 CONCLUSION

The BrailleEase project successfully developed a redesigned Braille slate and stylus that address the primary issues of traditional systems. Through a user-centered design approach, the project incorporated continuous feedback from visually impaired and sighted users, resulting in a product that allows for writing Braille characters in their natural orientation. This significantly reduces complexity and errors, making Braille writing more accessible and user-friendly. The ergonomic design and improved functionality received positive feedback, highlighting the effectiveness of the new design in meeting the needs of users. The BrailleEase project demonstrates the importance of involving end-users in the design process to create effective and inclusive assistive technologies.

ACKNOWLEDGEMENT

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