International Journal of Applied Sciences and Smart Technologies

Volume 5, Issue 1, pages 17–26

p-ISSN 2655-8564, e-ISSN 2685-9432

Rfid Application For Designing Lowcost Learning Device For Play And Learning To Read Early Braille For Blind Children

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(Received 15-12-2022; Revised 21-12-2022; Accepted 24-12-2022)

Abstract

It is very important for children who have low vision or visual impairment to be able to recognize braille letters and recognize words. This ability will help them to be able to read and write Braille. Braille recognition learning methods currently use technology as a learning aid or assistive device. However, assistive devices with this technology are still rare and unaffordable for some schools and students in Indonesia. The design of this braille learning aid applies RFID as a low-cost solution for learning braille reading aids. This tool integrates several braille learning methods that have been carried out by teachers when teaching braille recognition in schools. The integrated methods are the Mangold method, the Fernald method, the Flashcards method and the scrabble method. This tool helps children recognize braille letters, arrange them as words and is confirmed directly by the tool through sound if the letters arranged as a word are right or wrong. With this integration method, children are expected to be able to learn to read braille while playing, and learn independently.

Keywords: learning aids, learning and playing tools, RFID applications, reading braille, low-cost braille

1 Introduction

Braille learning aids for children are needed to help children learn to read beginning braille. This reading learning aid [1] is intended for children who are learning to recognize letters and arrange them as words. In addition to learning, this tool is an interactive play facility that is expected to motivate children to learn to read in a fun way. A fun way to learn is to learn to use games or playing media [2]. Learning with the learning while

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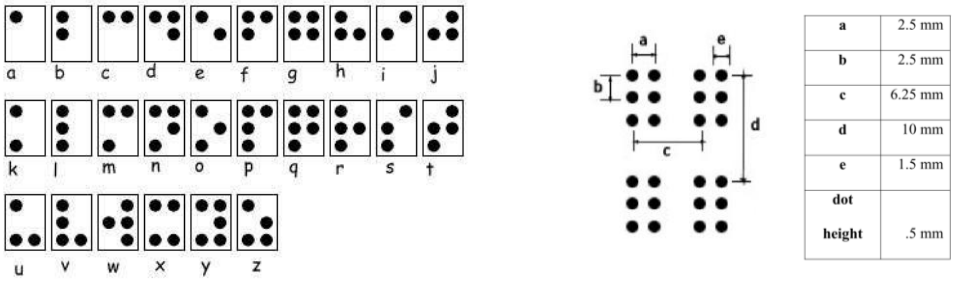
p-ISSN 2655-8564, e-ISSN 2685-9432

playing method is proven to improve children's ability to learn to read braille, scramble method as one example used for this process.

The learning method using this tool is conceptualized using a random letter and letter arrangement method which is known as the scrabble method. Research by Adhitya, [3] which concludes that the scrabble method can improve abilities, namely increasing the score obtained by students until they reach a predetermined success indicator of 70. However, this method can only be successful if it is given to children who are already able to read Braille. Braille letters will be pasted on the letter cards. This letter card method is referred to as the flash card method. Apsari [4] states that Braille flashcard media can facilitate children's memory in understanding letters and can improve children's tactile or sense of touch. This designed braille card still requires the interaction of the child to feel it using their fingers to recognize letters. The method used in this touch uses the mangold method or fingering with both hands [5] in addition, according to Khairani [6] the fingering method using two hands can improve the ability to recognize and read braille letters [7].

Braille The Indonesian Braille System for the Indonesian Language Section states that "Braille letters are letters that are arranged based on a combination of a six-dot pattern arranged as follows with the rules for the distance between points and the height of the peak of the braille code:



a	2.5 mm
b	2.5 mm
c	6.25 mm
d	10 mm
e	1.5 mm
dot height	.5 mm

Figure 1. Braille letters and standard sizes

Braille letters have standard rules related to the distance between dots and the height of embossed letters for braille letters printed using a braille typewriter [8].

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Learning Method Application The scramble method [3] is a form of game to form vocabulary from the letters available and have been scrambled to find answers accompanied by available alternative answers that can increase students' concentration and speed of thinking.

Ritawati (1996: 51) in [9] states that there are 5 steps in initial reading, namely recognizing sentence elements, recognizing word elements, recognizing letter elements, arranging letters into syllables and assembling syllables into words. Early reading teaching is more emphasized on the development of basic reading skills. Meanwhile, in reading Braille, the initial steps are: mastery of direction, tactile sensitivity, letter identification techniques and line tracing abilities. This ability cannot be easily mastered, [6] for that we need learning media to help teachers generate enthusiasm for students in recognizing letters and words needed to provoke a good response in reading by increasing vocabulary. Learning with interactive methods is able to make students have a better interest in learning to read [10].

While in the Fernald Method; using reading material from the words spoken by the child and each word being taught in its entirety. This method relies on reading braille and speaking aloud. When students say the word, then students will remember words that have similarities to the words they have learned [11].

The Manggold method is a way of reading braille by touching it with both hands. Touching using both hands reduces errors in crossing braille letters that are close together, reducing rubbing and back and forth [5]. Reading using the mangold method is an effective method in learning the beginning of reading braille [12] .

The flashcard method refers to the use of cards that have pictures and words as a medium for learning words for children. Then the child will memorize based on the pictures and words in the flashcard [4], [6] .

In the design of learning aids to read Braille, it is necessary to pay attention to matters related to the use of electrical, mechanical and control. These three things are elements of robotics, so the rules regarding the design of tools for children have special guidelines related to the safety of electricity and the use of resources and the wiring network [13].

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The category of reading learning aids needed by blind students is easy access, portable which includes battery life, light weight, and not thick. In addition, the tool is durable, technically non-malfunctioning, sturdy, easy to use, is an effective learning tool, attracts interest, can be used for various functions and provides direct feedback in the form of audio [14],[15].

2 RFID Application Methods in Designing Braille Reading Learning Aids

Braille learning reading aid products that already exist are still unaffordable tools due to the high technology used in these aids. The means that can be used to improve the experience of knowledge in visually impaired children are assistive technology. Assistive technology is a tool that leads to items, products, items that are modified to be able to provide accommodation for children with special needs, including visual impairments according to Bryant, (2012) in Handoyo [16] Therefore, the design of this tool applies RFID technology which is relatively affordable in terms of cost (low cost) as an assistive technology for the blind. The application of an RFID reader is used as a concept for a braille card reader that has an RFID tag that has been inputted as data in the microcontroller program library.

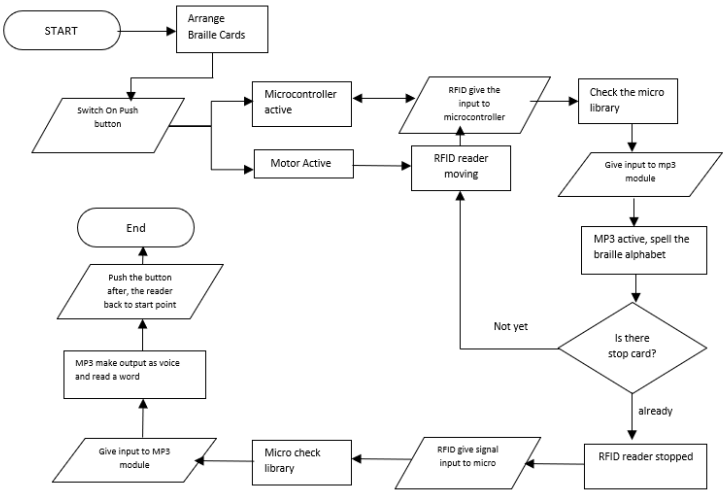

Figure 2. Braille reading aids schematic

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The RFID tag used is a Mifare type card that is used as a flash card by attaching a braille symbol to the back of the casing. Semi-conductor system Mifare cards, cards and readers for this card use a frequency of 13.56 MHz This card is suitable to be applied to this braille card because the system is capable of recording data [17].

Circuit System The card case is designed to cover the RFID card with braille. The tool case is designed to protect the equipment circuit and controls. These RFID cards are then treated as letter cards that are scrambled and then touched and then arranged as a word. The arrangement of the RFID card is then read by the RFID reader. The microcontroller used is Arduino Uno R3 microcontroller. Circuit uses an Arduino Uno R3 component as a microcontroller, an RFID reader Mifare to read RFID tag cards, an I2C LCD to display words composed of braille letters, an MP3 module which contains a voice recording to confirm the arrangement of letters and speakers to amplify the sound from the MP3 module. Programming using Arduino IDEE software.

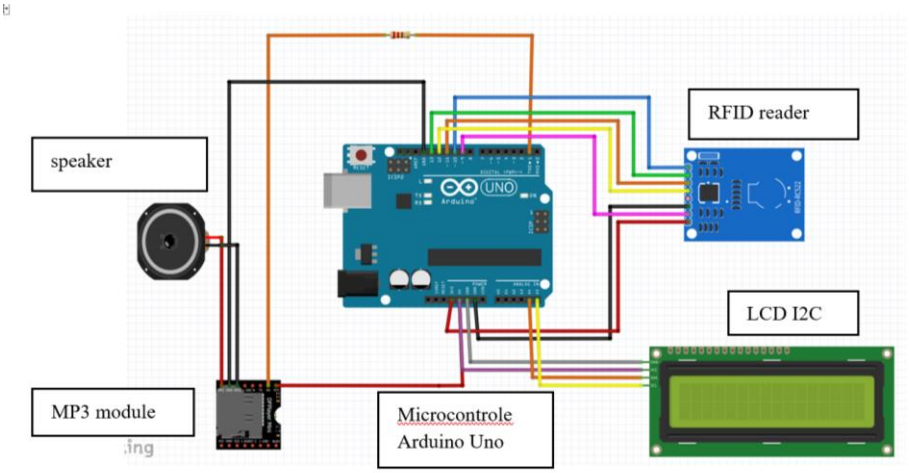

Figure 3. The main electrical circuit of the prototype

The RFID tag reader is driven by a DC motor which is controlled by an RFID input that is read by programming settings. The actuator to activate the function of the tool uses 2 (two) rechargeable 18650 Lithium batteries.

Prototype Design Concept. The design concept integrates the Fernald method, the mangold method, and the flashcard method with a playing system and learning to read

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braille using the sramble method. The Fernald method applied is the teacher writes a word using Braille and students feel it to read. Then students say the word they read. Direct word confirmation is done when students say the words they read. Word recognition by voice and confirmation of truth and error by voice. The mangold method here uses the tactile method of braille letters found on braille cards. The application of an RFID card as a braille flashcard equipped with a casing with a braille symbol is a flashcard method. This flashcard method does not use one card as one word, but one card as one braille letter. The cards are then shuffled, and students arrange the cards as a word, as a way of playing braille reading. This method is a scramble method.

The application of RFID is in the use of rfid cards and RFID readers. Cards with braille letters are arranged on a card tray totaling 6 places. In the design of this prototype, the arrangement of letters is limited to 5 letters. The 6th placeholder is where the card stops, as a marker for the rfid reader to finish reading the card. The RFID reader will provide input information to the microcontroller which will confirm the word read is true or false. The confirmation is voiced through the MP3 module which is activated by the microcontroller.

Determination of matters related to security and success of the function is carried out by several series and program trials. Once the circuit is working, then design a case for both the card with braille and the case for the whole device. The RFID reader is driven by a control on the motor driver which is located separately from the casing and protected by the motor casing. Cables that stick out are wrapped in a safety cover. The push button is placed in the place closest to the front of the tool and has a diameter of 1.5 cm so that it is easily palpable by the child's hand.

Braille reading aids as a starting Braille reading aid, there are 6 card slots. The card slot for letter card placement is limited to 5 letters and the last slot is as a stop card to command the MP3 module to confirm by voice.

3 Results and Analysis

The reading function by the RFID reader is already functioning properly. The reading distance with the card position can still be read at a distance of 15 cm. The use of

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p-ISSN 2655-8564, e-ISSN 2685-9432

acrylic as a prototype material is still not optimal because it still feels heavy, and the cutting angle is still a bit sharp. Acrylic material is less flexible.

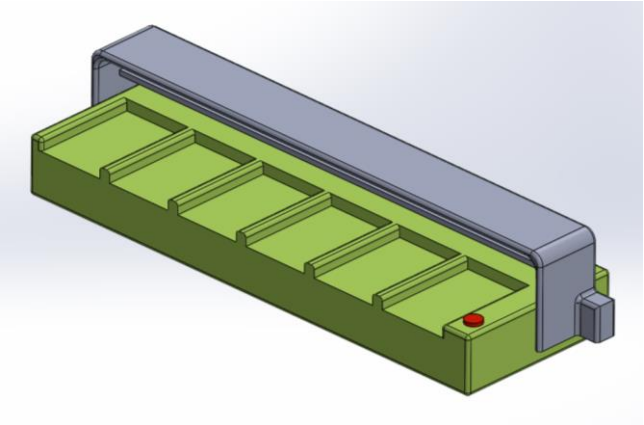

Figure 4. Drawing of braille reading aid design

Figure 5. The RFID cards of braille for Braille learning reading aid

The results of the new prototype voiced confirmation of true false, not yet voiced the reading by letter. In the next prototype improvement, it is planned to confirm by voice by letter. Card design will be modified so that the companion or teacher can also visually see the card directly even though it has been visualized through the LCD screen. The trials are conducted internally, to test the functionality of the tool.

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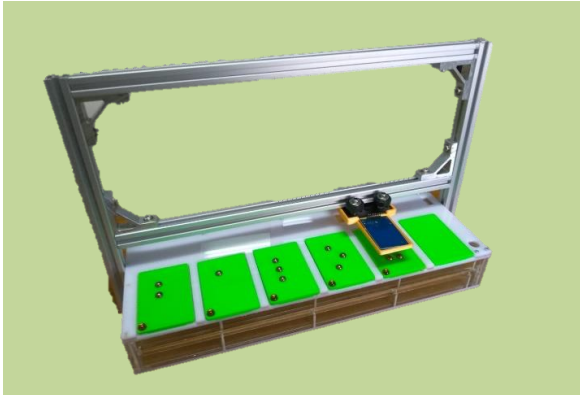

Figure 6. The RFID Braille learning reading aid prototype

4 Conclusion

Prototype This braille reading aid is functionally able to accommodate children learning to understand braille. The RFID card which is equipped with embossed braille is easy to feel well, equipped with a marker so that the card is not placed upside down. The RFID reader runs smoothly in the direction of reading from left to right at a program-controlled speed. Confirmation of letters and words by voice will add value to the success of this tool. With the improvement of the program, this tool is ready to be tested on students who have low vision or are blind.

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