INNOVATION DESIGN THE TEXT TO BRAILLE BASED TECHNOLOGY IN COMPUTER VISION

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Abstract. This paper discusses the design of assistive technological innovations for writing text on books onto braille boards and computer vision-based sound. So far, programs for converting writing into braille are still very difficult to find, changing from written form to sound. The design for the development of assistive technology that will be produced refers to an analysis of the current needs for blind students, where these students can only read Braille, not Latin. Broadly speaking, this research is image processing of Latin letters with board braille output and sound using a camera scanner with an algorithm processing on the Raspberry Pi system, so that scripts with Latin characters can be enjoyed by the blind. The result of the testing method in this program is to use a trial and errors system method with debugging that focuses on image processing, one of the reasons for this focus is because the image source has a big influence on the physical environment around the image source area.

Keywords : Blind Student, Braille, Raspberry Pi, Computer Vision, Image Processing

1. INTRODUCTION

Having a physical condition with a disability is not what every individual wants because they have to live life with physical limitations, so that it can hinder some of the activities that must be carried out like individuals in normal conditions. According to Law no. 4/1997 concerning Persons with Disabilities, Article 1 states that persons with disabilities are any person who has physical and/or mental disabilities, which may interfere with or constitute an obstacle for him to carry out activities properly, consisting of persons with physical disabilities, persons with mental disabilities, and persons with disabilities. physical and mental disabilities [1],[2],[3]. The types of disabilities can be divided into seven types, namely blind, deaf, speech impaired, physically impaired, moderately impaired, mentally impaired, and double impaired. [4]. Persons with physical disabilities, one of which is the blind, blindness is a person's loss of sight or the function of his sight that disappears even though he is still able to see light rays or unable to see completely [5],[6],[7]. According to the Indonesian Association of the Blind (IAB) / PATUNI in Indonesian language, the blind are those who are unable to see completely until those who are able to see the rest of their sight, but they are unable to use that vision to read writing with a size of 12 points with normal light even though they have been assisted by using glasses. [8],[9].

Blind people are individuals who do not function perfectly in their sense of sight (both) as channels for receiving information in daily activities, just like sighted people [10]. Even so, the blind only experience visual impairment. The intelligence of blind children is not disturbed. Blind people are just like any other normal child. It's just that they experience differences in receiving information and in their perception that there are special schools, especially schools for blind children, in lower grades they will be given material to recognize the Braille alphabet. Braille letters, embossed letters created by Louis Braille [11]. Braille letters are formed from a combination of six dots that form alert letter symbols so that they can be read by the blind [12]. Braille letters

consist of two rows of three dots, Louis [13]. So that the braille letters are arranged based on six raised dots with dot positions 1, 2, 3 (vertical), 1, 4 (horizontally), 4, 5, 6 (vertical). So that the pattern forms like a domino and the dots are named 1, 2, 3, 4, 5, and 6. In mastering braille, there are several things that must be considered, including: Understanding the location of the dots, Sensitivity to touch, understanding the position of the lines.

This ability is difficult to know. For this reason, special media are needed for learning so that they can meet the needs of teaching and learning in schools. Writing and printing system (based on the Latin alphabet) for the blind in the form of a code consisting of six dots of various combinations highlighted on paper so that they can be touched, Tumirah [14]. In mastering braille, there are several things that must be considered, including: understanding the position of the point, tactile sensitivity, understanding of 2 line positions. This ability is difficult to know. For this reason, special media are needed for learning so that they can meet the needs of teaching and learning in schools [15]. From observations that have been made in special schools and on campuses that have blind students, currently the technology for converting Latin writing from books to braille is not much of a technology that underlies it, that's why we want students with special needs, especially blind people, to be able to read all of the writing the one in the Latin book that will be converted to a braille board, the board will display up and down the braille code according to what is in the book using the camera and converted to raspberry pi with image recognition. It is hoped that with this technology blind students will have no more obstacles to reading Latin textbooks.

2. METHODS

The method applied in this study is the process design of the application of assistive text to braille technology with image processing input on the camera, the camera results are processed into braille and sound with a Raspberry Pi to send data up and down braille using a push pull solenoid. Computer Vision processes data in the form of text fed back to the domain via the internet network to correct words that are inappropriate or illegible on the camera.
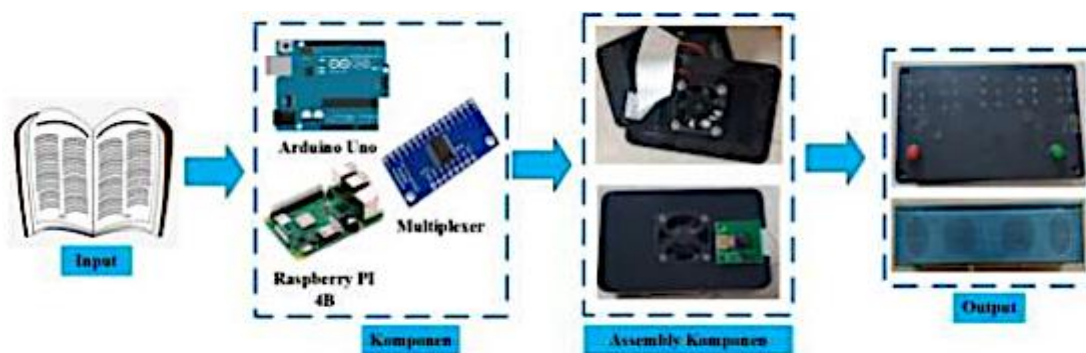

Figure 1. Process Design for Implementing Text to Braille

2.1 Development Plan of the Text to Braille Technology

The text to braille development plan that will be produced refers to the analysis of current needs for blind students, where these students can only read braille but not Latin writing, therefore this research designed an application system for identifying Latin letters using computer vision. The Latin letter conversion system uses the Artificial Neural Network (ANN) method. Broadly speaking, this research is image processing of Latin letters with board braille output and sound using a camera scanner processed on the Raspberry Pi system, so that scripts with Latin character characters can be enjoyed by the blind.

This system was built using an 8MP (Megapixel) resolution camera as a source for capturing text images on objects with the Raspberry Pi Microcomputer as an image processor, image processing on this tool was built using the OpenCv open source library and several other open source libraries as support. The conversion from image to text which is still in the form of const char* data is then fed to Arduino Uno using USART (Universal Synchronous Asynchronous Receiver Transmitter) communication which is then converted into a binary value which is used to drive the selenoid actuator according to the received binary value.

3. RESULTS AND DISCUSSION
3.1 Figure And Desain
Images and designs of text to braille can be seen as follows.
1. The name of Technology Innovation
The product name of the assistive device for students with special needs with visual impairments is image processing-based text to braille assistive technology for the blind.

Figure 2. Display Braille Design

2. Text to Braille Product Specifications
It has a camera with 8MP Raspberry Pi resolution which allows it to be used to read text on paper very quickly. The braille field is built using a mini selenoid which allows the system to switch from 1 braille text to another braille text quickly. For processing the system uses the Raspberry Pi 4B, which is a very fast processing system.

Figure 3. Text To Braille Component

Raspberry Pi 4b Rear View

Raspberry Pi 4b Front View
And 8MP Camera

Figure 4. Assembly Text to Braille

3. Program Flow

In this program, a text to braille assistive technology system for students with special needs based on image processing was built using the Open Cv open source library and several other open source libraries for modeling and implementing analog image processing algorithms into digital form. The source of image capture in this program uses an OV model camera with a 5MP resolution. Arduino Uno acts as a receiver of const char* data from the Raspberry Pi microcomputer and converts text data into binary form using USART (Universal Synchronous Asynchronous Receiver Transmitter) communication to trigger the work of the selenoid actuator drive found on the braille board assisted by a digital multiplexer with 16-bit resolution.

In general, the hardware design and system flowchart can be seen in the following figure:
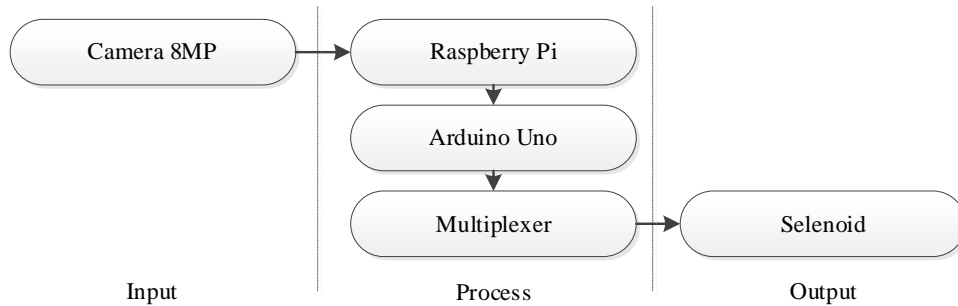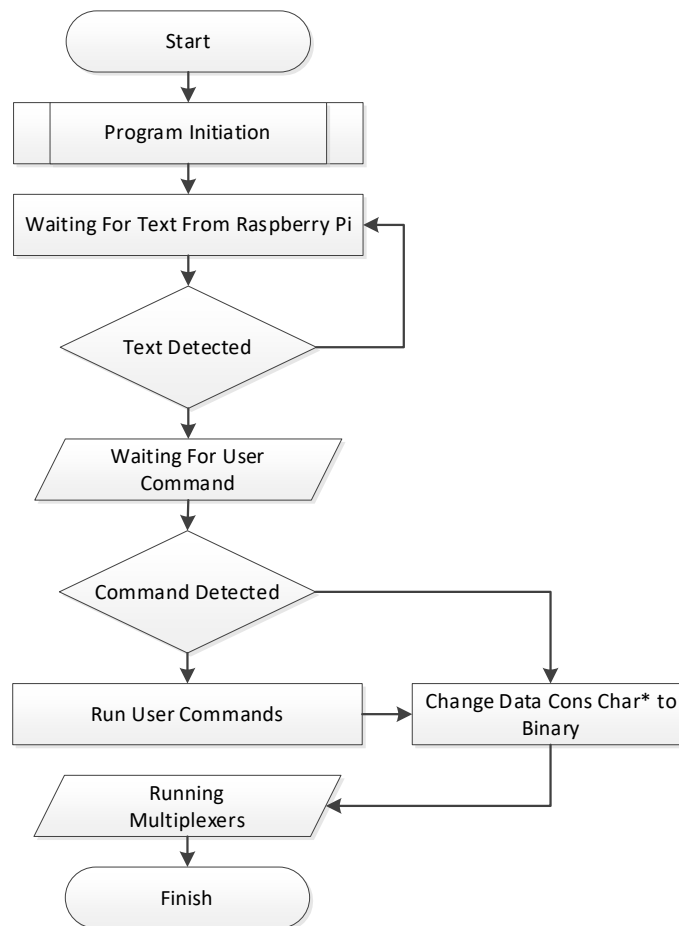
Figure 5. Hardware Block Diagram

Figure 6. Flowchart *Raspberry Pi*

3.2. Results of Application of Assistive Technology Innovations

For the results of the application of text to braille assistive technology innovation for the blind, it has been tested and is running well and is able to convert text to braille, although there are still problems that not all text can be read, some tests still have to change the position of the textbook that will be converted to the blackboard. braille.

Figure 7. Created Products

4. CONCLUSION

The result of the testing method in this program is to use a trial and errors system method with debugging that focuses on image processing, one of the reasons for this focus is because the image source has a big influence on the physical environment around the image source area. The system testing process in this program uses an analog source in the form of text printed on paper in a horizontal position using external lighting from the camera and shows an error rate of 70%. The results of the design of a prototype tool for reading text books onto a braille board can provide opportunities for the blind to actualize their potential according to the abilities and differences that exist in each person.

5. ACKNOWLEDGEMENT

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