Text to Braille Conversion System

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***Abstract*— Braille is a vital means of communication; it is a system for blind persons, one of touch reading and writing in which raised dots are impressions which represent the letters of the alphabet. It is a combination of six impressions that each represent a type of alphabet and it also contains equivalent representation combinations for punctuation marks. Braille is typically read by using the sense of touch, by running fingers across, from the left to the right along each of the lines. Braille is an extremely important tool for blind people to educate themselves and it is a critical component that supports not only educational advancement, but sub consequently also increases employment prospects. It is just like sign language, it is universally accepted but mostly, only the visually impaired people learn braille, unlike sign language which at least the family members of the deaf or hard of hearing individuals learn to be able to communicate with them. The blind should be taught braille to be able to become literate, which is a necessity in today's world. Braille is a much harder language than sign as there exists a lot of combinations of the impressions of the six raised dots that are not easy to memorize. Text to braille Conversion system acts as a means of communication between those who do not know braille and the blind who do understand how to read braille. One would no longer require knowing braille himself to be able to communicate with someone who is visually impaired. He could just simply type in normal text and those texts would get translated to Braille characters in real time.**

Keywords—Text to Braille Conversion, Braille, Braille Converter

I. INTRODUCTION

The World Health Organization (WHO) did a survey in 2020 the results of which were that about 76 million people out of the 7.8 billion in the world are visually impaired. Being blind in an environment designed for the sighted means it is expected that a lot of typical mishaps happen. Dealing with sight loss is already a challenge, on top of that, the societal stigma attached to the blind and the lack of employment opportunities make life even more difficult, these are all factors frequently leading blind or low vision individuals in isolation. This stigma makes it difficult to adapt, leading to a loss of social and self-acceptance. Society has a big role to play in the betterment of the lives of the disabled, blind, or not. Besides treating them as equals and not considering them any less there is also a need to minimize the communication gap that lies in between. The Text to Braille Conversion system that is discussed in this paper is one such attempt at inclusivity. This project aims at bridging the communication gap that prevents the society from being at ease with the blind. One would no longer require knowing braille himself to be able to communicate with someone who is visually impaired.

II. LITERATURE REVIEW

Technology has made human life addicted to comfort, but there are still a group of disadvantaged groups who are struggling to find an innovative way to facilitate the communication process. According to the World Health Organization, about 285 million people are blind, 300 million are deaf, and 1 million are deaf. [1] Communication plays an extremely important role in everyday life. But it is difficult for ordinary people to communicate with deaf-mute people, and vice versa. It is the only means through which we may share our thoughts or transmit a message, yet a person with a handicap finds it difficult to communicate with those who are not disabled. Those with disabilities will almost certainly experience some form of social isolation. [2] There are over 1.3 billion people over the globe who suffer from vision problems. Unfortunately, the developing countries are where about 80% of the total blind people live, with restricted facilities for them.[3] They are typically required to read printed information in Braille and when that does not happen, it adds to a lot of difficulty, to add to that these persons have limited access. Although there is a lot of electronic technology that can help them read, the costs are prohibitive.

The visually impaired person uses the Braille system for reading or writing. The Braille system essentially creates a basic cell which consists of six raised dots or impressions that are embossed outwards and aligned in a domino pattern, and each braille, or alphabet letter, is built up of combinations of dots from this basic cell. According to a study, the average reading rate of youngsters who read in Braille is just about half that of print readers who read with their eyes open. This is because human eyes have the potential to read multiple words at once, while fingers can only read Braille one word at a time.[4] One of the most essential ways for visually impaired persons to acquire information is through the braille system. According to National Braille Press (2011) (NBP), blind persons have a tough time obtaining work (costing the US $8.0 billion per year in lost production), although the majority of those employed are braille readers.[5] The inability to interpret visual text has a significant influence on the quality of life of visually impaired persons.[6] Many speech synthesis

based technological equipment have been developed as well to combat this problem and even though braille competes with speech synthesis, it provides the same natural reading experience as sighted persons but does not help the deaf. On asking participants in our experiments about the effectiveness of voice synthesis interfaces versus tactile ones, they expressed a strong preference for the latter, owing to their superior control over information flow. Nonetheless, numerous potentially valuable prototype devices have been built and are about to be examined in this country, at least one of which is from another country. However, if these gadgets are ever to be used by the blind, methods for evaluation, field trials, manufacturing, and deployment must be established. The field of sensory-aids research initiatives that are currently active is examined. Several efforts are aimed at making braille more convenient and accessible through the use of computer technology. Nonetheless, despite the undeniable significance of these advancements, braille's utility is restricted by its size, cost, and transcribing time. Several technologies are being developed to allow direct access to printed materials. These devices convert optical pictures from a printed page into aural or tactile displays, but they require motivation and training to use well. These machines are known as "direct-translation" units, and they are made to be simple and inexpensive. Other systems use print recognition algorithms to construct a reading machine that can output braille or voice. These machines have the ability to read at a faster rate than direct-translation machines, and their use should be easier to pick up than direct-translation machines, but at the cost of complexity and high cost. [7] Even though braille is much harder to grasp, it provides the user with the necessary chance to interact with the source of information and allows them to have an active role in retrieving the information they seek. In contrast, with voice synthesis, the user takes on a more passive role, which has the disadvantage of taking more effort to focus attention as needed and remember the useful portion of the information flow.[5] Given the importance of such emerging technology in the education of young blind children, creating a low-cost device for converting the Braille code to the alphabet would enable schools to address the communication difficulty not only from an educational but also from a financial standpoint.[8] The tactile channel is the primary means of communication for those with hearing disabilities and those who are visually impaired. As a result, technical assistive devices for the hard of hearing and visually challenged should turn internal stimuli into helpful tactile sensations in some way. Many issues are impeding the development of such assistive gadgets, such as the small population of deaf-blind people. This indicates a constrained market with constrained costs.[9] Another system-prototype based on a Raspberry Pi module was created with a similar goal in mind: to convert optical text to braille in order to help visually impaired people read printed publications. This is a remedy to the delays, if not outright failures, in translating or printing braille versions of common reading materials. In this particular system, a photo of the text that needed to be converted or translated into braille was recorded by the system's optical character recognition engine. The digital texts are then sent to a braille haptic device through the internet. This gadget is a piezoelectric-based haptic system that is made up of many haptic pins that are configured to look like the braille writing system. To determine the system's performance, several trials were carried out. Overall, 95.68 percent of the system was found to be reliable. [10]

This research paper also proposes the implementation of a prototype device that enables one-way communication using a microcontroller-based technology which is between persons who are differently abled (deaf, dumb, and blind) and those who are not. This will be a text to braille conversion system that will make use of Portable Technology and Arduino Circuit Boards to provide the required means of communication. The code for the conversion to braille from text is written for the Arduino microcontroller that is used. The text is taken from a keyboard in real time and then the rotation of the motors creates the required braille impression which can then be sensed by the user.

III. METHODOLOGY

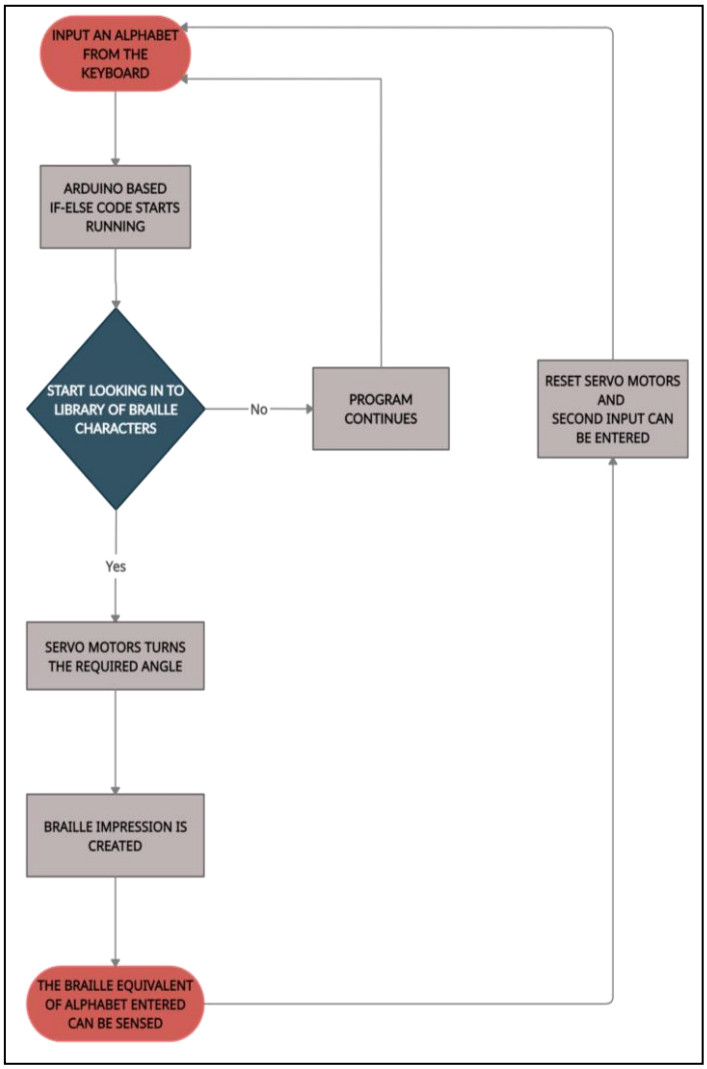

Fig. 1. Block Diagram of Text to Braille Conversion system

To convert text to braille , input is being taken from the keyboard of a laptop , one letter at a time. The user types the letter in the serial monitor window of Arduino. After receiving the letter, Arduino processes it according to the source code.

Fig. 1 shows the block diagram for this working. In order to simulate braille letters there will be 6 servo motors connected to the Arduino and the swing arms of these motors are connected to 6 metal rods. When the servo motors rotate by a small angle the connected rods correspondingly move backwards or forward depending upon the direction of rotation. This back-and-forth motion of the rods will result in a depression or elevation on the surface of the device. With 6 rods arranged in 3 rows and 2 columns we can create all braille letters. The source code of the device is a simple if else construct , all alphabets will be saved and their braille equivalents will be the overall output of the system, this will be in terms of servo rotations by a small positive angle for elevation and a small negative angle for depression that will raise the metal road and result in the kind of impressions that someone who understands braille can use to read what someone needs to convey. It is extremely hard for some individuals to acquire fundamental and vital data required for their living. They are at a danger of being socially avoided because of this. A text to braille converter hence is an attempt at bridging the communication gap that is caused.

IV. PROBLEM STATEMENT

To take text from a keyboard and convert them into equivalent braille letters so that someone who has no knowledge of braille can communicate with a visually impaired person. This is an attempt to serve as a bridge between communication gap that may arise for a variety of reasons.

V. COMPONENTS REQUIRED

TABLE I. Components required for Text to Braille Conversion system

S.No.	Part	Manufacturer and Part Number	Qty	Description
1.	Micro-controller	Arduino MBAR	1	9V-42mA (ATmega328)
2.	Servo motor	ADRAxX SG90	6	(5-6)V-1A
3.	Jumper wires	TECHLEADS TL-26105	1 set	Male-Male, Male-Female, Female-Female
4.	Header pins	Scriptronics SRG0091/92	5 set	Male & Female Pin Headers
5.	Data cable	TECHTONICS TECH1735-00	1	Type-A to Type-B USB Cable
6.	Copper clad board	TechDelivers TD-CLAD12GE	1	[30cm * 30cm] board
7.	LCD alphanumeric display	Silicon TechnoLabs (16x2)	1	16x2 data LCD display board

Table I. lists a table of components required for the Text to Braille Conversion System and some important details about it including the quantity of these components needed and a short description about each of those.

VI. SCHEMATIC DIAGRAM AND PCB LAYOUT

A schematic which is often known as a schematic diagram, is a representation of the elements of a system that uses abstract, graphic symbols rather than realistic photographs to represent the elements.

The schematic shown in Fig. 2 was made on EasyEDA and also further used for making the PCB layout.

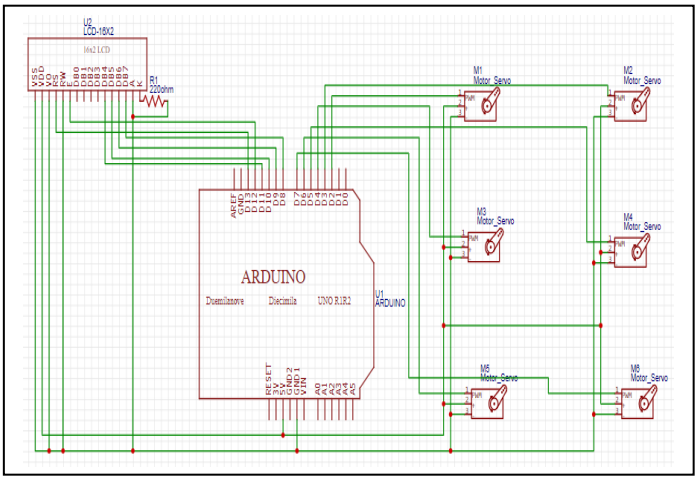

Fig. 2. Schematic Diagram (EasyEDA) for Text to Braille Conversion system

Fig 3. shows the two-dimensional PCB layout of the Text to Braille Conversion System as made in EasyEDA with the help of the schematic from the same software.

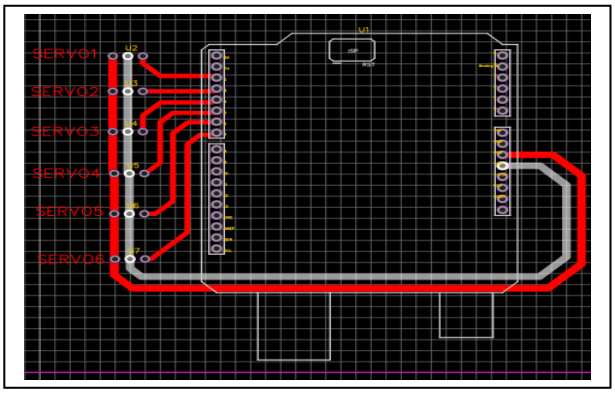

Fig. 3 . 2-D PCB Layout for Text to Braille Conversion system

VII. ENCLOSURE

Fig. 4 shows the Enclosure of the Text to Braille Conversion system as made on Fusion 360.

Fig. 4. Enclosure for Text to Braille Conversion system

VIII. CONCLUSION

The Text to Braille Conversion System is an extremely relevant tool in today's time. The main idea behind the making of this Conversion system is that it is a translator or a converter that takes alphabets from a keyboard or a keypad and then converts the letters into braille language one by one with the help of servo motors that have metallic rods that rotate at certain angles when a particular alphabet is sent into the conversion system. This product is an attempt at bridging the communication gap between those who are visually impaired and those with vision.

Using this, someone can communicate with the blind people without requiring knowledge of braille scripture themselves. With the help of this project, it is possible to employ someone who is visually impaired to do basic tasks by giving instructions through the Text to Braille Conversion system which can then be read by someone who knows the braille language. This product uses basic electronic components, simple microcontroller technology and knowledge of C programming to solve a socially relevant problem.

This Text to Braille Conversion System can be used by people and serves the possibility of increasing and improving employment as well as higher education prospects.

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