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A Tool for Converting Text to Braille Script to Empower Readability for Blind People

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Abstract: ***The utilization of Braille patterns has long been instrumental in facilitating literacy among visually impaired individuals, enabling them to decipher alphabets and numerals through tactile means. In this project, an innovative integration of Braille and servo motor technology is employed to render electronic text accessible to individuals with visual impairments. Each character within an electronic file is systematically translated into its corresponding Braille representation, with servo motors dynamically facilitating the tactile presentation of these patterns. Upon receiving input, the system activates the necessary servo motors, causing them to rotate 90 degrees above the surface, thereby bringing the Braille representations into physical contact with the user. To read the content, individuals simply touch these servo motors, allowing them to sense and interpret the encoded alphabetic or numeric information. This approach not only enhances accessibility but also promotes independent literacy among visually impaired individuals. By combining Braille with servo motor technology, this project offers a promising solution for overcoming barriers to information access, fostering inclusivity, and empowering individuals with visual impairments to engage with electronic text effectively.***

Keywords: Arduino Uno, Servo Motor, Arduino IDE, Processing IDE.

1. INTRODUCTION

As the world is moving towards digital technology and the way it results into development of technologies such as replacement of books into websites and applications in the education domain, our desire to work for the society especially for the impaired persons' in order to connect them with the world has motivated us to this work for the visually impaired person's

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by helping them to learn Braille script (LIPI) using electrical components as hardware and programming these components using software.
The electrical component Arduino UNO has a wide range of applications. It can be interfaced with other electrical boards and components such as sensors, motors, LEDs, etc. The Braille Script (LIPI) uses six dots to represent an Alphabet or Character. In this project, six motors are used for the six dots where each motor can rotate 0 to 90 degrees and produce the character or alphabet as output for the provided input.

2. RELATED WORK

Blind and visually impaired individuals heavily rely on sound and touch to communicate and navigate their surroundings. One primary tool they use for accessing information is Braille, a universally recognized reading and writing system. Braille utilizes embossed dots arranged in cells, typically comprising six dots in a 3x2 matrix format. With 64 possible combinations of dots, Braille characters represent letters, numbers, and symbols. Notably, the same Braille cell can convey different meanings across languages, making it adaptable to various linguistic requirements. For English, each character corresponds to a unique Braille pattern, facilitating seamless communication and literacy for blind individuals.
Several devices incorporating speech recognition/synthesis and mechanical Braille displays for tactile input/output have been developed for PCs. Additionally, there's the Textbook, a portable e-book reader equipped with a Braille translator, piezoelectric actuator, electronic drive, and tactile display. Despite the range of options available for learning Braille, their limited production volume results in high costs due to a small market size. Furthermore, many affordable devices are basic mechanical machines lacking intelligence and information capacity, hindering self-learning. Consequently, students often rely heavily on teachers to learn Braille symbols for different languages, posing a significant barrier to their Braille education.

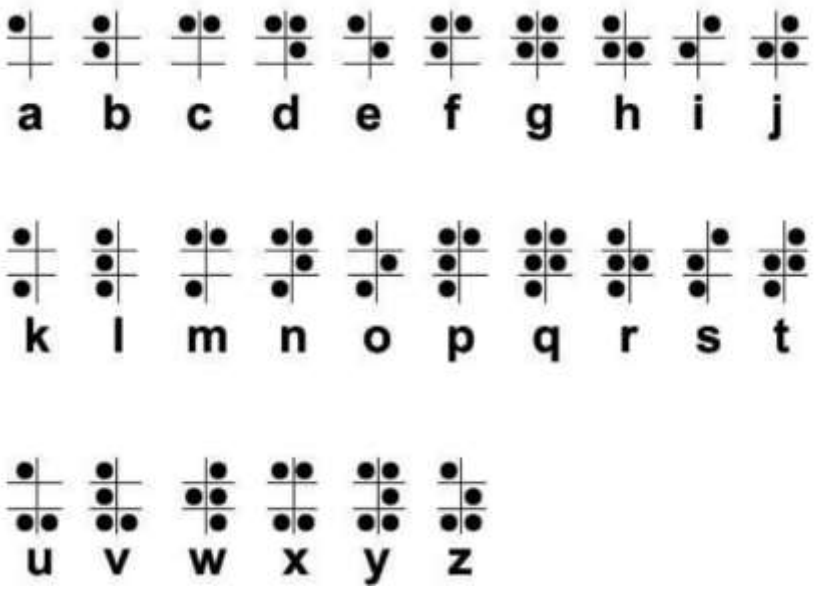

Fig: 1

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3. METHODOLOGY

The refreshable braille display model developed in figure uses Arduino UNO and Servo Motors. The Braille cell consists of six dots. Six Servo motors are used to provide the six dots. The Arduino UNO is a programmable device. The input is provided in a text file with alphabets separated with comma. The processing IDE takes input and transfers it to the Arduino UNO which in turn changes the position of Servo motors from 0 to 90 degrees according to the input provided and produces output. The produced output by the device is the same as the Braille shown in figure 6.

Circuit Diagram

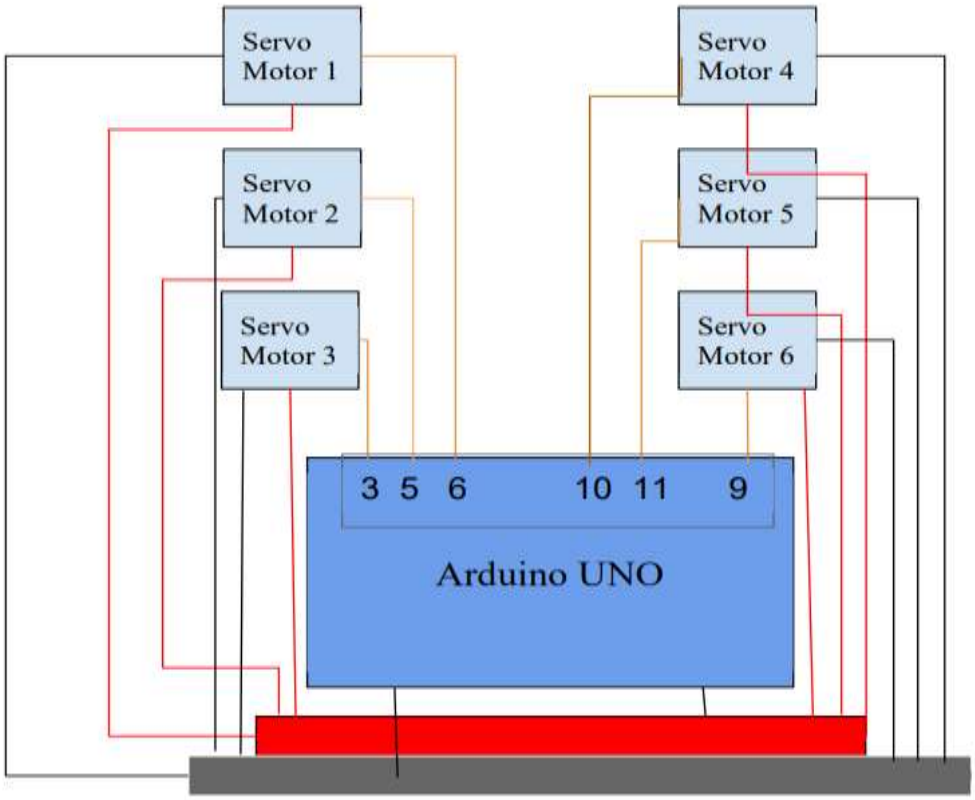

Fig: 2

Arduino UNO Board

The Arduino UNO stands as a cornerstone in the realm of electronics prototyping and experimentation. It embodies simplicity and versatility, offering both beginners and seasoned enthusiasts a platform to unleash their creativity. Powered by an Atmega328P microcontroller, the UNO features an array of digital and analog input/output pins, enabling seamless interaction with sensors, actuators, and other electronic components. With its user-friendly interface and open-source nature, the Arduino UNO has become a catalyst for innovation in fields ranging from hobbyist projects to industrial automation and IoT applications.

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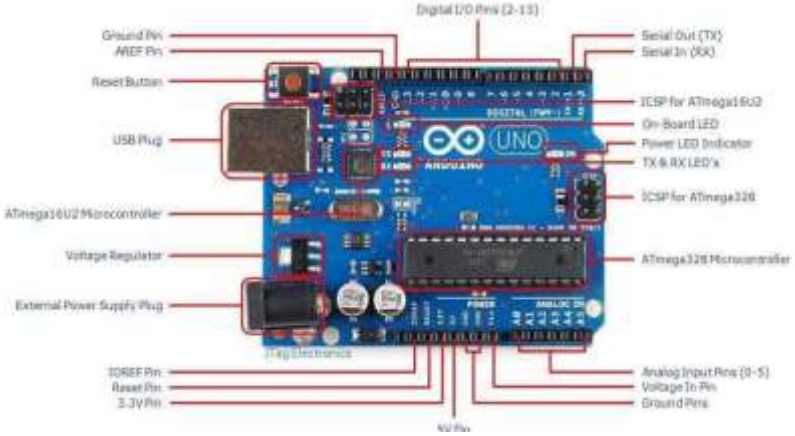

Fig: 3

Servo Motors (Six in No.)

In the realm of motion control, the servo motor reigns supreme as a precision-driven rotary actuator. Characterized by its ability to precisely control angular position, the servo motor finds applications in robotics, automation, and beyond. Comprising a motor paired with a feedback mechanism, typically a potentiometer, it delivers accurate and predictable motion. Servo motors operate on pulse-width modulation (PWM) signals, translating variations in pulse width into precise movements. From robotic arms to remote-controlled vehicles, servo motors play a vital role in bringing motion to life with unparalleled accuracy and reliability.

Fig: 4

Jumper Wires

Jumper wires are flexible wires with connectors at both ends, commonly used to make temporary electrical connections on breadboards, prototyping boards, or between electronic components. They come in various lengths, colors, and connector types, such as male-to-male, male-to-female, and female-to-female. Jumper wires are essential tools in electronics

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prototyping and experimentation, allowing for quick and easy circuit modifications without soldering. They facilitate the connection of components like microcontrollers, sensors, LEDs, and other electronic modules in prototyping and educational projects.

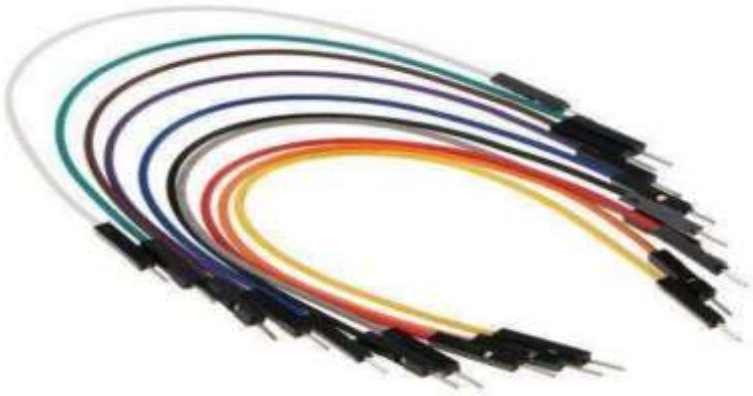

Fig: 5

Implementation

The detailed implementation of this research can be explained in the following steps.

1. The text file with data is to be provided to the processing IDE. The processing IDE will convert the given text file into a file where each character will be separated by comma. This comma separated file is now read by the processing IDE Code.
2. The data read by Processing IDE is sent to the Arduino UNO.
3. The Arduino UNO is dumped with each character's code programmed in Arduino IDE.
4. The Arduino UNO reads the data and changes the position of Six Servo Motors.
5. The Six Servo Motors change their position from 0 degrees to 90 degrees based on the character read by Arduino.
6. The output produced by the servo motors can be touched/ sensed using fingers and the character can be identified.

4. RESULT & DISSCUSSION

Result

The proposed system is a blend of hardware and software components designed to offer compactness and ease of use for individuals familiar with Braille reading. By enabling Braille text to be read with a single finger, it maintains the comfort and efficiency of traditional reading methods. Automatic conversion from text to Braille enhances convenience while remaining cost-effective, ensuring accessibility for individuals of varying means. Portability and reliability are key features, allowing for easy handling and convenience in movement. This system facilitates the conversion of electronic data into mechanically produced Braille for tactile reading. With its single-cell design and automatic conversion process, it ensures seamless reading without the need for constant finger movement. Moreover, by saving books as digital documents on memory cards, it transforms into a digital library, enabling blind individuals to access a vast array of literature effortlessly.

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Discussion

The proposed research integrates both hardware and software components to offer a more compact and user-friendly solution for reading Braille text. Users can easily read Braille with a single finger, maintaining their familiar reading method. Automatic conversion from text to Braille enhances convenience, making it cost-effective and accessible to individuals of varying financial means. Its portability and reliability ensure easy handling and convenient mobility. The system efficiently converts electronic data into tactile Braille, allowing seamless reading without the need for finger movement. With the capability to store entire books as digital documents on memory cards, the system transforms into a digital library for the blind, enabling access to a wide range of literature.

Fig: 6

5. CONCLUSION

This refresh-able Braille device is designed to cater to the needs of blind and visually impaired individuals by offering an automated text-to-Braille conversion system with swift processing capabilities. Developed as an affordable solution, it addresses the financial constraints often faced by this demographic. By incorporating an adjustable conversion speed feature, the device ensures adaptability to the reading pace of individual users. Its primary objective is to facilitate computer interaction for the blind, both in professional settings and within the comfort of their homes. While existing devices serve similar purposes, their high costs pose a significant barrier to accessibility. The lack of affordable technological support hinders blind individuals' access to computer education, exacerbating the digital divide. To overcome these challenges, we utilized an ATmega328 micro-controller on an Arduino board as the core component of the system. Additionally, the device employs six vibration DC motors to simulate the Braille cell, enabling tactile reading. Despite the availability of reading facilities in specialized centers, economic constraints and practical difficulties persist, underscoring the importance of cost-effective solutions like ours in empowering blind individuals with access to information and education.

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