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DESIGN AND DEVELOPMENT OF ELECTRONIC BRAILLE READER

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***Abstract*— The visually challenged are the people with permanent or temporary loss of vision. Such people cannot read as normal human beings. Our project looks into a new design which may help the visually impaired individuals to read the Braille text electronically. The software and hardware design parts of the project work are described. The software design which uses Arduino (AT mega) to read each character of a text from the SD card and covert them to Braille pattern. The hardware design uses a linear actuator which actuates the Braille pattern onto an array of dots. Now days there are many devices that can help them to read however the main problem is that they are expensive and bulky. The aim of this project is to design a portable, Braille device with high accuracy, less labor intensive and affordable cost.**

Keywords*— *Braille, Arduino, linear actuator.

I. INTRODUCTION

Braille is a tactile reading and writing system used by visually challenged people who cannot access print materials. It uses raised dots to represent the letters of the print alphabet. It also includes symbols to represent punctuation, mathematics and scientific characters, music, computer notation and foreign languages. A Braille is typically attachable to a computer keyboard, that allows a visually challenged person to read the contents of a display one text line at a time in the form of a line of Braille characters. Each Braille character consists of six or eight movable pins in a rectangular array. Braille is not a language but a code by which all languages may be written and read.[1]

Electronic braille displays are paperless, soft or refreshable braille displays which works with a screen reader in the device and placed underneath a computer keyboard and enables the user to read what is on the computer screen by touch in braille. They vary in size from 12 to 80 braille cells. Each cell has 6 or 8 pins made of metal or nylon, which are electronically controlled to move up and down, to display a braille version of characters that appear on the computer screen. The seventh and eighth dots can show additional information like formatting.

The developed Braille display enables the user to read the braille text which is stored in the SD card. The Arduino software reads the text from the SD card converts it into Braille characters and sends it to the array of actuators to simulate braille pattern. All over the world, visually challenged people have used Braille as the primary learning device for accessing information. This paper aims to develop a low cost and assistive device simulating braille pattern to enhance learning skill for the visually challenged people.

II. LITERATURE REVIEW

Several Braille systems are developed to help the visually challenged individuals. Blazie Engineering (England) developed a braille device named braille lite which has the

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ability to represent up to 18 characters. It is refreshable and help visually challenged individuals to read a document. However, its cost made it difficult for all the visually challenged individuals to get it.[2]

In order to provide visually challenged, the ability to read easily, Telesensory (Singapore) developed a braille device named Optacon which prints the regular shape of the letters and so the visually challenged can feel the letters while reading. The technique used here is, vibrating metal rods moved over the printed page, and converting the image of the letter into a tactile form. The major drawback of Optacon is that it would take a visually challenged a very long time to read a text document.[3]

Scott Stoffel developed a braille device called palm braille which connects to the computer and reads the characters from a file. The visually challenged can sense the six pins on the device and identify the letter they are reading. The main drawback of palm braille is that it read only one character at a time.[4]

Jun Su Lee and Stephan Lucyszyn proposed Micro machined Refreshable Braille Cell which uses an electro thermally controlled micro actuator to produce the braille output for visually challenged. In this technique, a Braille cell having six dots was fabricated using bulk micromachining and novel bonding techniques with silicon and glass wafers, respectively. Thus ultrathin micro machined refreshable Braille cells are actuated using hydraulic pressures from the volumetric expansion of paraffin wax, to raise the six dots as braille output. The main problem with this braille cell is the production cost of the bulk micromachining of silicon wafers.[5]

Michel J. Owayjan proposed a Multi-Lingual Braille System Output Device with Audio Enhancement which enable the visually challenged to access and read texts from a computer. The device acquires texts and displays using controlled piezoelectric Braille cells. It also has the ability to produce a sound that matches the displayed characters. The control of the cells is made by Programmable Interface Controller (PIC) microcontroller. The device and the computer is connected through universal serial bus (USB). C language is used for programming to get the connection between the device and the computer. The main drawback is that inclusion of computers makes it difficult for the visually challenged to use this device.[6]

D.Sreenivasan, and Dr. S. Poonguzhali proposed an electronic aid for visually challenged in Reading Printed Text which captures the printed text as the image. The characters in the captured text are recognized using the OCR system. The OCR system then sends the ASCII representation of the character to the ARDUINO UNO board which correspondingly actuates the braille display such that the visually challenged could understand the printed text. The major drawback in this aid is that the user find it difficult to properly position the camera to capture the printed text.[7]

In order to overcome the drawbacks of all the above braille system a new design is proposed in this paper which includes SD card, Arduino mega, linear actuator. The developed system is quite inexpensive and easy to operate.

III. METHODOLOGY

The project work is divided into software and hardware section. The software section works to read each character stored in the SD card and convert them to braille pattern. The hardware section works to actuates Braille patterns onto an array of dots. The Fig-1 depicted below represents the methodology of the electronic Braille system.

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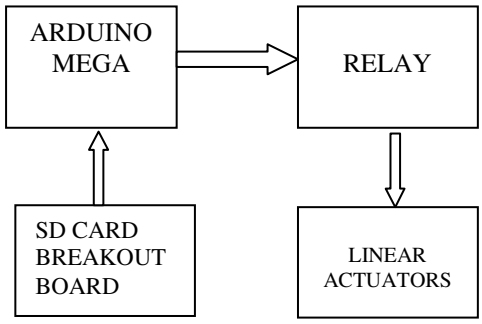


Fig-1 *Block diagram of Electronic Braille Reader*

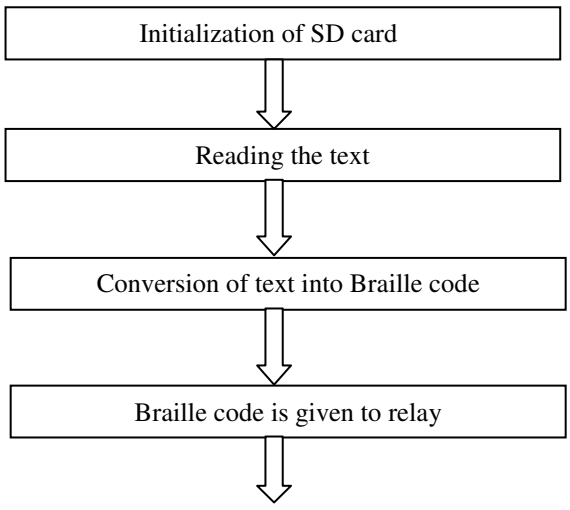
3.1.SOFTWARE

3.1.1.SD card breakout board

The adafruit SD card breakout board holds the SD card which contains the text to be read by the visually challenged individual. The breakout board requires 3V-6V power supply to operate and may read and write up to 2Gb of storage. This micro SD breakout board has special features to be use with the Arduino microcontroller.

3.1.2Arduino

An Arduino Mega 2560 microcontroller was chosen because it provides the required I/O and ability to extend with extra shields if required. Fig-2 shows the flow chart for Arduino program.



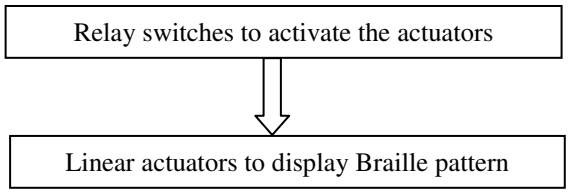


Fig-2 *Flow chart.*

The Arduino was coded in such a way that the actuators which are arranged as six dots of array will raise and fall with respect to the characters stored in the SD card.

The EBR requires text in Braille format to be actuated on a finger. The Braille pattern received from the Arduino is in the form of six pins at a state high or low, each pin representing a dot. Each actuator is connected to the outputs of the Arduino.

3.2.HARDWARE

3.2.1.Relay

A Relay is a switch operated by small electric current that can turn on or off a much larger electric current. The proposed design has used the relay to actuate each braille dot. Totally eight relays were used which are of SRD-05VDC-SLC type relay. These relays are subminiature type and have an advantage of low dissipation. This relay has an additional advantage that it glows LED for corresponding braille output.

3.2.2. Linear actuator

The linear actuator creates motion in a straight line as contrasted with circular motion of a conventional electric motor. The actuators for the Braille dots are the most important part of the electronic braille reader. The Arduino has been coded in binary format so that the linear actuators raises and falls according to the braille alphabet.. The Fig-3 shown below is the typical Braille pattern.

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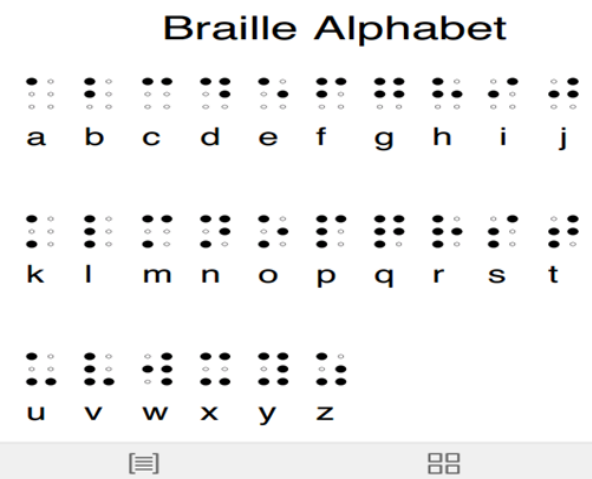

Fig-3 *Braille Alphabet.*

The electronic Braille reader has the ability to simulate those Braille pattern , shown in Fig-3 as an actuated output.

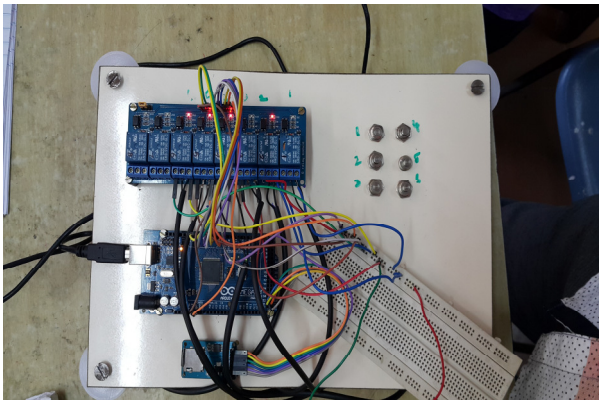

Fig-4 *EBR with six braille dots*

The Fig-4 shows the final output of the electronic braille reader which consists of six actuators which are arranged as Braille dots of array. The Fig-5 shows the actuated Braille Pattern output for the letter 'm'.

Fig 5- *Actuated Braille Pattern for the letter'm'.*

IV. RESULTS AND DISCUSSION

The Electronic Braille Reader has been designed which is capable of reading the text from the SD card and convert them into Braille pattern. The time of translation of text into Braille pattern is approximately measured as 1 second and the delay between the projections of each character is estimated as 2 seconds. The device is compact and portable. The characters that are projected on the linear actuators are accurate and the projections are perfect without any errors. The present system is only for English alphabets and numbers along with special character. The limitation of this system is that it could read the file only in the .txt format and not in any other formats. In future, this system could be developed for reading all text formats and projecting tables, other special characters and languages.

V. CONCLUSION AND FUTURE WORK

The proposed Electronic Braille Reader is a portable, low cost and efficient device which could make the visually challenged people understands the text easily with high speed of actuation of Braille pattern. In future, the system can be enhanced with audio in phase with actuated Braille pattern so that the visually challenged people find it easy to understand and apprehend the text.

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