# Braille Learning System for Blind People

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**Abstract-- Braille literacy is crucial for blind individuals, as it enables life-long learning and is key to employment and independency. One way to promote Braille literacy is to make existing Braille reading devices more accessible, affordable, and user friendly. Commercially available Braille reading devices in this regard need various improvements. Most of these devices cost thousands of dollars, mainly because they rely on multiple piezoelectric actuators in order to create the Braille letters. Other issues include high voltage actuation and reduced portability. In order to solve these issues and improve existing Braille displays, various actuation methods have been widely investigated. This project helps in simplifying the process of learning of braille instructions. The integration of physical activity and hearing can facilitate easy learning of Braille Script. In this project we develop a kit which helps the blind and visually impaired people to learn braille even in the absence of teachers.**

*Keywords—Braille, solenoid actuator, Raspberry pi, Learning aid Teacher independent.*

## I. MOTIVATION

Self-respect is a word that gives a value to any person by generating self-esteem in her/him. It is important for physically challenged to be self-reliant. The physically challenged people must lead a peaceful life with self-respect. Now-a-days technology had been developed to an unimaginable level. With this development in the technology one must help the physically challenged to lead a quality life. To lead a quality life, they must get the quality education. Being engineering students, we have thought, it would be better to do the project which has humanitarian approach and help physically challenged people to lead a happy and peaceful life with self-respect. Among physically challenged people, visually impaired are the most vulnerable, because they cannot differentiate the colours and see dimensions of any object. Moreover, there are many opportunities for educated visually impaired people in government sectors. So we have decided to provide them with the learning kit and full-fledged device which can reduce their labour and infuses excitation to learn basic letters in Braille to fully fledged use for visually impaired.

## II. INTRODUCTION

In the era of Digital India, the generation become more modern and internet surrounds people. But the blind children in remote and rural areas are left unseen by the society. For many children in India, due to lack of education, these children stand behind the society and they overcome many obstacles to meet their daily needs in their life. It is the immense response to the engineer community to prolong their ideas and concepts behind Assistive Technologies is appreciated. In the

developed world, facilities are prolonged to care the disabled people to come out of their circle, work in buildings independently without depending on people around them. Almost in all the Technical advances, there is a wide scope for the disabled people especially in the fields of precision manufacture and electronics have resulted in products which helps the disabled cope with their specific disabilities.

The situation observed in India is said to be different for two basic reasons.

1. Technology is not affordable by majority of the citizens specifically those who live in rural/ remote areas.

2. Lack of knowledge or little familiarity of Braille Script for English or any other languages, which is required to be in pace with ever running technologies.

We have to build a strong basement in order to create solutions for the visually impaired people to learn their education at their early stages. Teaching the Braille script at their initial stages of schooling makes them easier. Braille Learning Kit would be fully-fledged device which will facilitate the learning of Braille and meets the objective in a cost effective manner.

## III. BRAILLE SCRIPT

Braille is a system that enables blind and visually impaired people to read and write through touch. It was devised by Louis Braille in 1821 and consists of raised dots arranged in "cells". A full Braille cell consists of six raised dots arranged in two parallel vertical columns of three dots (like the number 6 on a dice). The dot positions are identified by numbers one through to six. 63 combinations are possible using one or more of these six dots. Each cell represents a letter, a word, a combination of letters, a numeral or a punctuation mark.
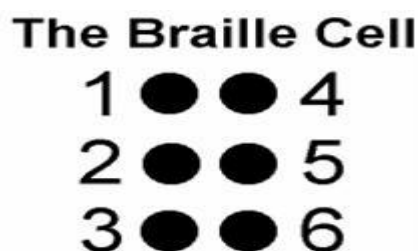


Fig 1. Arrangement of Braille cell

## IV. IMPOTANCE OF BRAILLE

The ability to learn, to read and to write is no different for a sighted or blind person; it is fundamental skill that everyone should develop in order to excel in their life. There is no substitute for the ability to read. For blind people, braille is an essential tool that helps in the process of becoming literate. Tape recorders and synthesized speech are useful tools, but they are inadequate substitutes for reading and writing. Braille plays an important role in education of blind and visually impaired people. Several studies show that braille literacy is directly related with academic achievement and employment among the blind and visually impaired. There are many government job available for blind and visually impaired people. They must be educated to get job from the government organisation. For that they must learn braille which is an important thing. When blind children learn Braille, they learn alphabets, numbers, grammar, spelling, punctuation and sentence structure skills that they do not learn using text-to-speech technology. Braille also lets blind people read charts and graphs that are almost impossible to convey using text-to-speech. Even if they also use low-vision aids or text-to-speech technology, Braille lets them label items clearly, read public signs at airports or bathrooms.
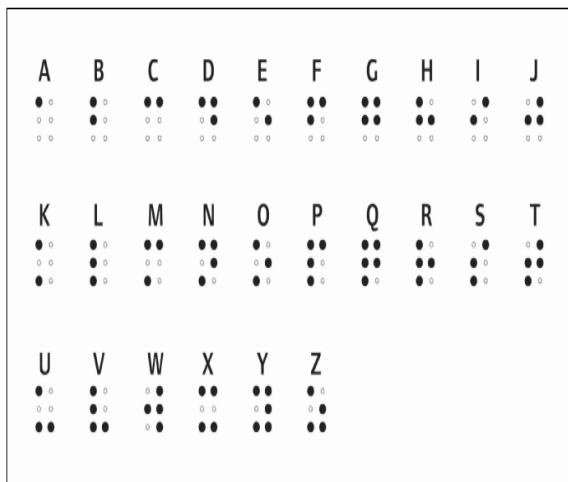
## V. BRAILLE SYMBOLS
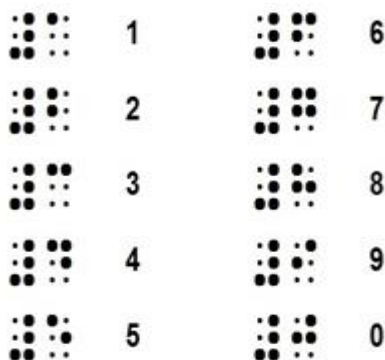


Fig 2.  Braille alphabets



Fig 3. Braille numbers

## VI. LITERATURE REVIEW AND INDIAN SECENRIO

There are different gadgets available in the market for visually impaired people to help them in educational activities and to bridge the communication gap between visually impaired people and people with sight. The popular devices for visually impaired people are Speech Assisted Learning which costs around $4,600, Book Sense Reader which costs around $499, Eye-Pal Reader which costs around $1,995, Eye-Pal ROL which costs around $2,195, Electronic Braille pad, Automated electronic pen, Automatic visual to tactile translation, Interactive 3D Sound Hyper stories for Blind Children, A PC- based Braille library system for the sightless, FPGA Based Braille to Text and Speech for Blind Persons. There are also some web browsers specially designed for visually impaired people to help them in internet surfing. The popular web browsers for visually impaired people are Audio-haptic internet browser and associated tools for blinds and visually impaired computer users, The Auditory browser for blind and visually impaired users. According to the statistics provided by the World Health Organization (WHO), about 90% of world's visually impaired live in developing countries and majority of the people are living on less than $1.25 per day so they can't afford the devices available in the market for visually impaired individuals. Most of the devices available in the market are either Braille writing tutors, or Braille scanners, yet a low-cost Braille system is not available in the market for visually impaired individuals belonging to developing countries which can teach the Braille combinations to visually impaired people without the need of a Braille teacher.

## VII. MATERIALS SOLENOID ACTUATOR

Solenoid actuator is an electro-magnet. It consists of a coil surrounded by an insulation, a small iron rod and a spring. When an electric current passes through the coil, it produces magnetic flux which in turn attracts the iron rod. When the electric current is disconnected, the magnetic flux is cut off and the iron rod goes to its original position using spring action. These solenoid actuators are used to make the braille combinations.



Fig 4. Solenoid Actuator

## VII.   RASPBERRY PI 3 MODEL B

Raspberry pi is a SBC, with great computational power. Raspberry Pi is a credit card sized single board computer designed by Raspberry Pi Foundation, which can be plugged into a monitor or TV. It was primarily designed for teaching coding to kids of elementary school, but overtime pi has built its reputation as a Multitasking Board which is widely used by various hobbyists and makers for their projects. The

board is capable of functioning as a full desktop and is capable of processing high quality video. It even has the ability to interact with the outside world and control the music systems, Television etc. Here we are using Raspberry Pi 3 Model B, which is having 1.2 GHz 64/32-bit quad-core ARM Cortex-A53. The device works on a 5 V power supply. We have worked on Raspbian OS, which is based on debian Linux. This OS is specifically designed for raspberry pi and is most widely used on this board. This OS comes with python pre-installed. The whole system runs on the micro SD card, which has the OS and files in it.

## VIII. BRAILLE SYSTEM DESIGN AND IMPLEMENTATION METHODOLOGY
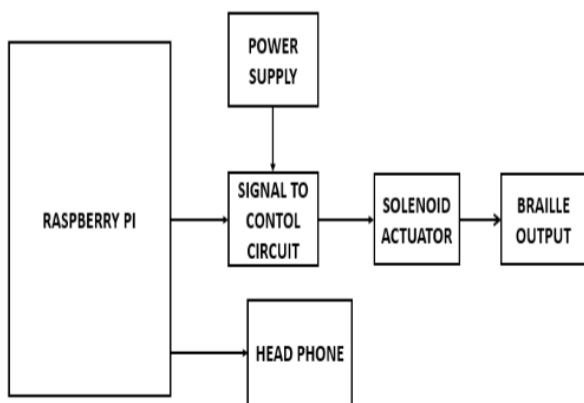


Fig 5. Block Diagram

The main components used for making this low cost braille learning system are raspberry pi, solenoid actuators, headphone and some electronic devices for the control circuit and for the power supply. The raspberry pi is coded in python. The six pins in the raspberry pi is connected to the six solenoid actuator, one pin for each solenoid actuator. The pins of the raspberry pi are connected to the solenoid actuator through a solid state switch. Since solenoid actuator cannot work with the power supplied from the raspberry pi, it is connected to the external power supply. When the pins of the raspberry pi goes high the switch is closed and the solenoid actuator draws power from the external power supply and it actuates. When the raspberry pi goes low the switch is opened and the power supply is disconnected and solenoid actuator goes to its original position through its spring action. So by using this the required braille combination are produced. For example, we can take alphabet A, to produce the braille combinations for alphabet A, the solenoid no 1 is alone energized and the remaining solenoid are de-energized. These are setup for making braille combinations. The next is voice, when the braille combinations are produced in the solenoid actuator, the corresponding voice is heard to the user through the headphone. The flite libraries are installed in the raspberry pi for taking the voice output. For example, we can take the alphabet A, when the braille combinations appear for the alphabet A in the solenoid actuator, correspondingly the voice 'A' is heard in the head phone. So that the user can identify that this braille combination is for the alphabet A.

## IX. TECHNICAL CHANLLENGES ENCOUNTERED DURING THE BRAILLE SYSTEM DESIGN POWER SUPPLY DESIGN

Since the solenoid actuator draws more power it will not energize with the power supplied by the raspberry pi. The power requirement for the solenoid actuator was high and hence designing the external power supply for the solenoid actuator was difficult.

*A. Braille Character Size*

Distance between dots
- Horizontal or vertical distance from centre to centre of adjacent dots in the same cell = 2.3 mm – 2.5 mm.
- Horizontal distance from centre to centre of corresponding dots in adjacent cells = 6.0 mm – 7.0 mm.
- Vertical line spacing from centre to centre of nearest corresponding dots in adjacent lines = 10.0 mm – 11.0 mm.

B. Dot size

- dot base diameter = 1.5 mm – 1.6 mm.
- dot height = 0.6 mm – 0.9 mm.
- spherical radius = 0.76 mm – 0.81mm.

These are the braille character size but here the braille display is solenoid actuator which is much bigger than the actual braille size. This may affect the users because they learn the braille combinations in bigger size and actual braille books have braille combinations in smaller size. To overcome this problem, an arrangement was made. Hence to reduce the size of the braille combinations to the actual size what blind people are using, we are here attaching a small thin iron rod with the solenoid actuator.
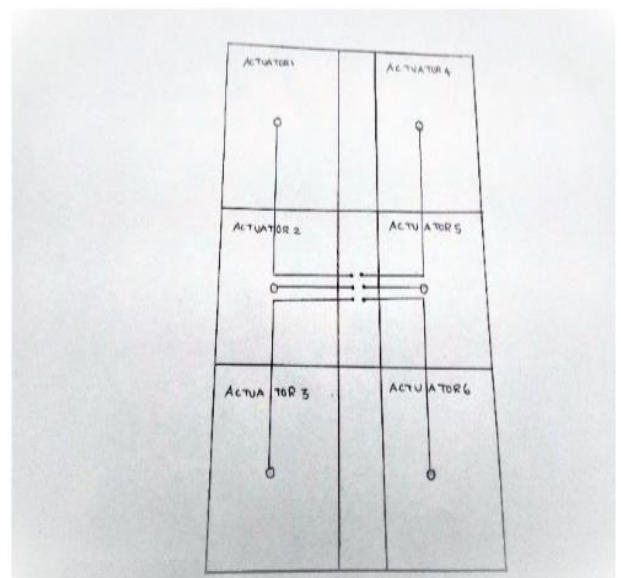


Fig 6. Arrangement of braille cell for smaller size

## X. ADVANTAGES OF BRAILLE KIT

Self-learning kit, Low cost, can learn braille faster, can be used in schools to teach braille for blind and visually impaired people, The easy learning of Braille with audio output and instructions.

## XI. CONCLUSION AND RESULT

Braille teaching kit is low in cost and is affordable for all class of people. This kit will help the blind and visually impaired to learn braille by their own in an efficient manner. This kit can be used numerous number of times and hence the user can learn braille in their own phase, they need not to worry about the time limit. This can be used in braille teaching schools which will be best replacement for lack of good skilled teachers.

## XII. FUTURE SCOPE

The product can be enhanced with addition of extra features like automatic search mode where the blind people can search a letter by giving the voice input, that is they can give input of any of the alphabets and numbers and the corresponding braille output is produced and in the testing mode the braille combination will be produced in the braille kit, the user had to touch and feel the braille combinations and say the which alphabet or number the combination belong to, this will enhance the remembrance level of the blind and visually impaired people.

### Reference

[1]. https://en.wikipedia.org/wiki/Braille
[2]. Saurabh Bisht, Sandeep Reddy Goluguri , Rajat Maheshwari, Akhilesh Kumar and P.Sathya "Refreshable Braille Display using Raspberry Pi and Arduino", International Journal of Current Engineering and Technology.
[3]. Prachi Rajarapollu, Stavan Kodolikar, Dhananjay Laghate, Amarsinh Khavale , "FPGA Based Braille to Text &amp; Speech For Blind Persons", International Journal of Scientific &amp; Engineering Research, Volume 4, Issue 4, April-2013 348 ISSN 2229- 5518
[4]. Supriya S. and Senthilkumar A., "Electronic Braille pad", INCACEC 2009, International Conference on Control, Automation, Communication, and Energy conversation, p1-5, June 2009.
[5]. Joshi A. V. K., Madhan T. P., and Mohan S. R., "Automated Electronic pen aiding visually impaired in reading, visualizing, and understanding textual contents", IEEEICEIT 2011, IEEE International Conference on Electro Information Technology, p1-6, May 2011.
[6]. www.anugrahadrishtidaan.org/Blindne ss-Global-&amp;-Indian- Scenario.htm
[7]. https://www.electronics- tutorials.ws/io/io_6.html
[8]. World Health Organization, "Fact sheet 282: Visual impairment and blindness, World Health Organization, May 2009.
[9]. https://www.raspberrypi.org/
[10]. Aisha Mousa, Hazeem Hiary, Alomari, and Loai Alnemer "Firstland Experience with balanced Approach"2009 International Conference on, no., pp.201-211,17- 19 April 2009.
[11]. Vineeth Kartha; Dheeraj S. Nair; S. Sreekant; P. Pranoy; P. Jayaprakash (2012) "DRISHTI – A gesture controlled text to braille converter", India Conference(INDICON),2012 Annual IEEE, pp. 335-339.