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A Electro-Micromechanically Actuated Text To Braille Converted Refreshable Display With The Mono Cell

Vrushabh S. Dharme[1], S. P. Karmore[2]

[1, 2]Department of Computer Science and Engineering, GHRCE, Nagpur, India

Abstract: ***Blind people are the integral part of our society. However their disabilities have made them to have less access to computers, digital data and high quality educational software than the people with clear eye sight and because of this they would not have been able to improve their own knowledge. The impact of this is on their economic as well as educational growth in the society. They have to face two major problems: first, they must learn the skills and techniques which will enable them to carry on as a normal, efficient citizen in the community and second they must become aware of and learn to cope with public attitudes and misconception about blindness and misconception which goes to very roots of our culture and permeate every aspects of social behaviour and thinking. We can solve the first problem with the help of proper training and facility. One way to minimize this vast gap and to impart a invert part of this trend is to develop a system within their economic reach, which will strengthen their knowledge. The great problem faced by the blind are how to read digital data with their Braille language. As in Braille language the manner of six dots arrangement in 3x2 matrix manner and it can only be sense by tactile means. The blind person could not read it without touching to the arrangement of the dots for the text. This paper introduces a new text to Braille converged electro-mechanically actuated Braille display with low cost, easy to use and portable with compactness by which the blind can read Braille alphabet on a single finger in familiar reading manner.***

Keywords: English digital text, Automated comparison algorithm, MCU, keys, electro-micromechanical mechanism, Braille board.

1. Introduction

Commencing in the early times, the blind were not considered as a being of much importance to the societies in which they lived. In the times of problems, it was also considered that they could not find or hunt a food or fish for their survival. By the later time, civilized societies starts to operate in the belief that it was a duty of the society itself to care for the handicapped including blind. Blind people plays a vital role in the development of the society and without consideration of the blind gross improvement of the community is not possible. In 1784, the first "school for the blind" was established in France. The Louis Braille, founder of the tactile writing and reading was born in France in 1809. He invented his tactile writing and reading system by 1820, but was not embraced soon as a writing as well as reading medium of visually handicapped. In 1918, Braille was accepted as a standardized tactile writing for the blind. The international standard cell has one to six dots and these dots are planned in two parallel columns of three dots in each. The alphabet is composed of all 63 possible Braille dot patterns that can be created from the different arrangements of one to six filled positions [3].

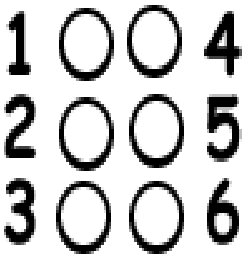


Figure 1: The six dots Braille cell

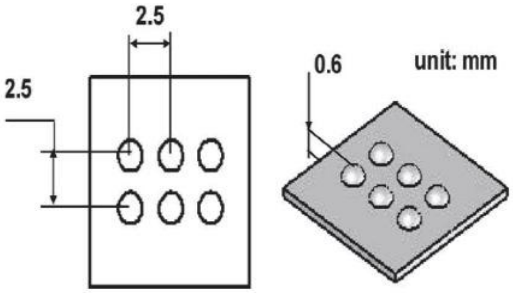


Figure 2: International building standard of a Braille cell

The figure one shows the six dots Braille cell arrangement for Braille alphabet. For the corresponding Braille alphabet, the specific predefined dot(s) raised than others and then it is read by the blind with the sense of touching to the Braille cell The figure two evince the international standard of Braille cell arrangement which is with the two similitude columns of the three dots scheme in each.

In the English language Braille, mainly there are two grades of representation that is the grade1 and the grade2. In grade1, the single cell represents the single alphabet and it is the one to one conversion same like as English alphabet. In the grade2, which was made as a saving of space option to grade1 Braille. Grade-2 Braille system was proposed and introduced as a space-saving alternative to supplant the grade-1 Braille. In this system, a single cell is able to represent a brief form of a word. There are many combinations of cells dots introduced to represent general and common words. This made the Grade-2 popular than the Grade-1. The Grade-3 Braille system is mainly a system of Braille shorthand but due to non standardized it is not used in publications. However , it is used by individuals for their personal assistance. It has a around 300 word contractions

[4].

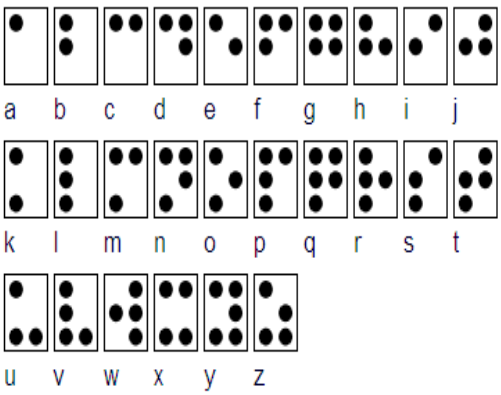


Figure 3: English Braille alphabet

The Braille is not with another alphabet of capital text as in print. The dot number 6 is used to show the Braille alphabet. For single dot number 6, the word is with first letter capital and if there are two consecutive dot number 6 then it shows the whole capitalization of word. The dots which represent the English Braille alphabet 'a-i', shows the same combination of dots for the numbers '1-9' and 'j' for '0' but for displaying of the numbers, the dots 3,4,5,6 raised than the remaining dots and then reading of the number starts by the blind as shown in figure four.

The punctuations, which are used in print have also the Braille representation as shown in figure four. For the differentiation of the two words from each other then only the dot number 2 raised than others which also shows the punctuation of 'comma'.

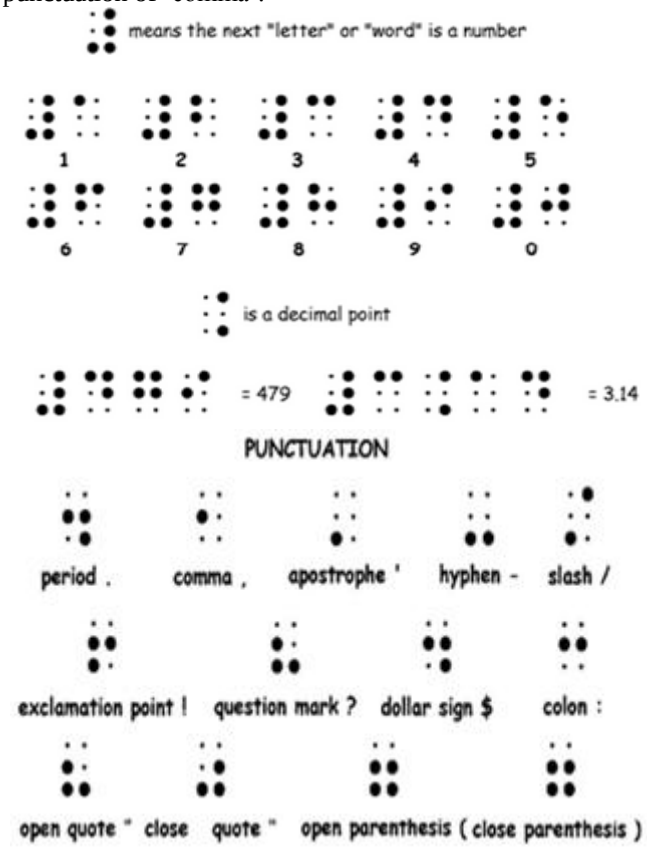


Figure 4: Numbers and punctuations in Braille

The related work about the previous research is explained in section II. Section III described details of proposed methodology for text to Braille conversion and steps in automated comparison algorithm. Section IV describes system architecture for text to Braille conversion of the proposed model. Section V describes the results obtained by showing the snapshot of hardware. Section VI describes the conclusion

2. Related Work

Individualize researches have been carried out on the conversion of text to Braille using the different methodologies.

In the paper [1], the researched on the conversion of text from Braille into the normal text which is done with the help of image capture and extraction method. In this research work, image capture and extraction method is used, for the

conversion of text from the Braille into the normal text. The first part contains capturing of image of Braille text and another contains its processing. For the conversion from text to the Braille the system is not efficient because of the error occurred in the conversion of captured image into Braille. Another drawback is that, the implemented system consumes time and required help of intermediate for capturing the image which causes dependency of work.

The paper[2], suggested use of SMS for text input called as 'Body-Braille'. In the first step text is inputted through the SMS and then processing is performed on it. In this methodology, six micro vibration motor were placed on different parts of the body like the six dots of Braille cell and then according to the Braille text inputted to the system, the specific motor vibrated and text will be converted into visualistic Braille by the blind with the help of Micro vibration motor on his body. In this the conversion into Braille is performed, but it is all based on visualization and the memorization by the blind in which error rate would be high. If blind's brain diverted from the motor vibrations of his body, then error might be occured in the memorization by blind.

The paper [3], researched for a device which was a Unit-celled refreshable Braille display that would convert digital text into Braille output. In this, at the input stage, the text data was sent from the mobile device by the Bluetooth Transmitter and at the output part the data received by Bluetooth Receiver. Later on, with the Arduino kit the text data was converted into output in the unit-cell Braille board. The Braille board was formed by Brushed Coin Vibration Motor. In this methodology, Braille language output formed but the conversion is not according to the need of blind people as every person having different reading speed. Also the Braille board is formed by the Brushed Coin Vibration Motor in which error would be occurred to sense the vibration by the blind person. The other drawback is the compactness of area for Braille output board which subsequently not follows the International building standard for a Braille cell. In this, the Braille outputted text read by

the two fingers which is not familiar reading to the blind person.

In the paper[4], the work is done with mobile phones by the modified Braille display concept and simulation shown in LabVIEW. The methodology used Braille display consists of five Virtual LEDs which were with the five pins of modified Braille display. Mobile phones with modified Braille display concept had been programmed here, using graphical nodes in it. This methodology is used for the calling by the blind, but for the reading of inputted number the Braille display could cause an error as the Braille display have the simple motors for the reading.

While performing the literature survey it is observed that, these systems are not suitable for blind to contend with the sighted one and could not solve the problem of them. The existing modules are far away from the fundamental problems of blind and the blind could not acquire self dependence in the field of reading informatory knowledge available in the form of digital data. Hence, to overcome the problem of visually handicapped the system is proposed.

To achieve high accuracy in a proposed system, a automated comparison algorithm based on comparison of the alphabet is designed. By employing this algorithm, a fast text to Braille converged output is formed by the system which will be more compact and produce accurate results.

3. Methodology for Text to Braille Conversion

In this paper, a technique is being described which having the low error rate, ease of reading of Braille, compactness with fast conversion that is with the automated comparison algorithm. As the previously designed text to Braille conversion system for the visually handicapped person has with the drawback for reading, comfort and compactness. So, using proposed technique, the proposed design will be effective for the blind person to read the English text into the Braille text with the hardware implementation of the work. The proposed work will also be beneficial for the blind person as a digital library and with the help of this work, the blind person can read the electronic text as well whole of book or any novel within a single cell without the movement of the fingertip. Also, the proposed system is cope up with reading speed of blind, as every person has a different reading speed, so for such a type of person the proposed system could do conversion according to need of reader.

The flowchart shown below, extracted the proposed working methodology for the proposed system. Also the automated comparison algorithm for text to Braille conversion output the Braille pattern on the Braille board with the steps performed by the proposed algorithm. The Braille pattern generation is totally based on the text matched up and comparison of the text and finally the text pattern generated on the Braille board according to the standard Braille text for the blind people

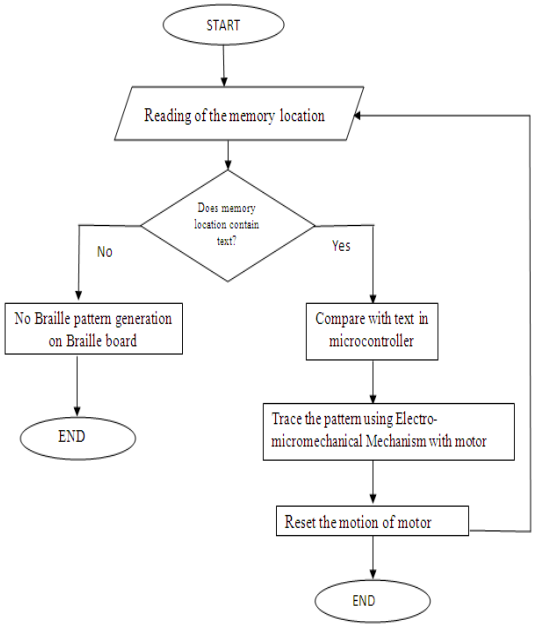


Figure 5: Flowchart

The figure five shows below the flowchart of the proposed way for conversion from text to Braille. At first, the location of the memory will be read from its respective location by the Micro-controller unit and if the location of the memory is with the text then the memory location text is compared with the programmed text or number. After this decision, the text is trace on the Braille board using the Electro-micromechanical mechanism with motion of the motor. Then, after generating the text pattern on Braille board, the trace pattern of Braille will remain on same position to some delay time for reading of the text by blind as same as a embossed paper. Then, motion of the motor will be reset to the its original position automatically after the displaying of the text on proposed Braille board. If the memory location does not contain the text then, directly the end of program would be there and no Braille pattern generation on the Braille board.

4. System Architecture

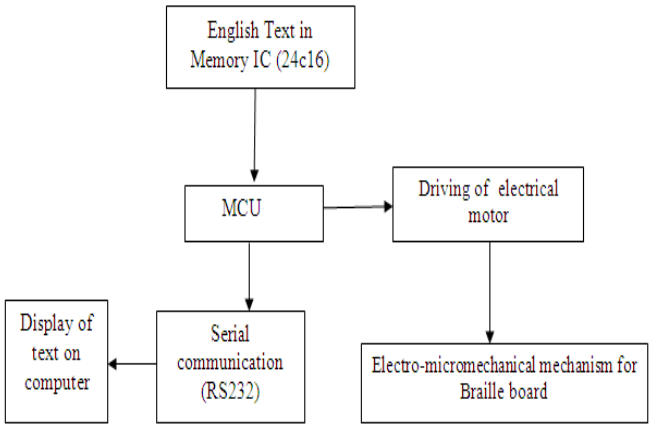


Figure 6: System architecture

The figure six shows the System architecture of proposed system.

In the first phase, the texts which are programmed in a memory IC (24c16), read from the its memory location and the text will be fed to microcontroller.

In the phase two, the text which will be inputted from a memory IC to microcontroller unit (AVR atmega16), compare with the programmed text or number in microcontroller. In this each text is compared to its equivalent English alphabet or number in a ATMEGA16 microcontroller IC. The comparison of English text from 'A-Z' or the number from '0-9' will be fast, as a microcontroller which used is having a 1 MHz frequency with good throughput.

In the phase three, driving of electrical DC motor by the microcontroller to operate the mechanism for Braille board will be carried out. Also, the micro-controller section is having the communication to the computer via serial to com port.

In the phase four, the electro-micromechanical mechanism is used which available with six motors and the interfacing with the controlling by microcontroller. In this, respective motor will be worked according to the corresponding text to generate the English Braille alphabet. At the same, the alphabet generated on Braille board will be shown on computer for normal use.
With the help of this work, a blind person can read the tremendous knowledge available in the form of digital thing and also electronic text in their Braille language. It will work as blind welfare project and can improve the electronic reading of the visually handicapped.

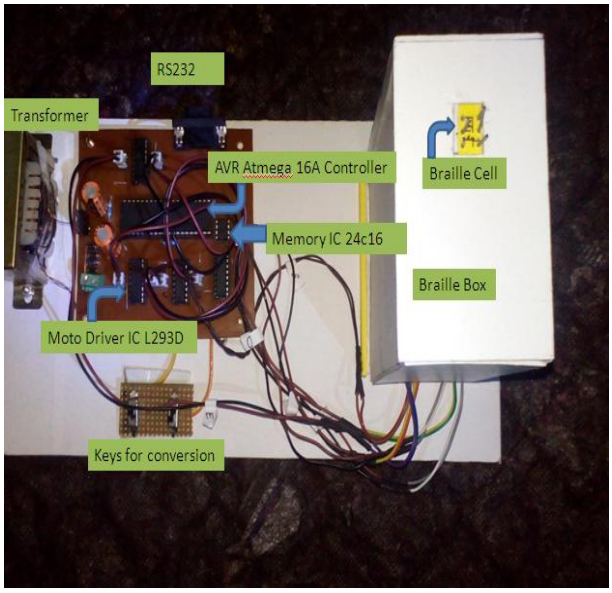
The software part of proposed system composed of CodeVision AVR C Compiler which is used for programming part and flash magic used for showing the outputted text of Braille board on computer system via RS232.

5. Results

The proposed system is implemented by the both hardware and software. The Hardware part composed of memory IC 24c16, micro-controller AVR Atmega16, RS232 for serial communication, six simple electrical DC motors with pin arrangement for Braille cell and computer system for showing the inputted text from memory IC to Braille board. The software part consist of Proteus 7 Professional_PORTABLE ISIS for simulation, CodeVisionAVR C Compiler for programming and flash magic for displaying the outputted text of Braille board on computer system via RS232.

Table 1: Result table

Compactness	The Braille text can be read by single finger in their familiar reading manner.
Comfort	Automatic conversion from text to Braille with the soft foam sheet.
Power consumption	The mechanism can be operated at 12v and circuit at 9v.
Cost affectivity	Very low cost and can be easily afford by normal individual
Portability	The system is easy to handle and can move conveniently.
Reliability	The system will automatically convert the text from English to Braille according to programming
Automatic	The system based on automatic conversion without movement of the finger i.e. system is with a single cell.
Tactile conversion	Electronic data is converted into mechanically worked Braille for tactile reading.
Reading of the electronic book	The whole book can be read by blind according to programming in memory IC and system will worked as digital library for a blind.



Snapshot 1: Hardware implementation

Snapshot 2: Displaying of outputted text on computer system

6. Results Analysis

Parameter

Table 2: Comparative analysis 1

Parameter	Fingers sensing the Braille Display[3	Proposed Method
Tactile Compactness	Tactile sense by two fingers	Tactile sense by single finger(familiar manner)

Motors	Brushed Coin Vibration Motor(vibration sense cause an error)	Gear motor(forward & backward motion of motor provide perfect standard reading)

Table 3: Comparative analysis 2

Micro-controller	*PIC 16F877A[4]*	*AVR Atmega 16A (Proposed Method)*
Instruction set/architecture	No add/subtract with carry, small stack	Add with carry, and compare with carry simplify multiple precision arithmetic
Power consumption	More power consumption	Brownout detector on recent parts has much lower consumption than the PIC one
UART	TX and RX can not be enabled individually	TX and RX can be enabled seperately
Interrupts	Interrupts are not so efficient	Vectored interrupts are more efficient where there are multiple interrupt sources

7. Conclusion

A system with automated comparison algorithm for text to Braille conversion is having the fast conversion from programmed text into the tactile Braille. For analyzing the system, some issues are considered and according to that the system is being designed. The simulation results of the proposed system are shown in Proteus 7 Professional_PORTABLE ISIS software. Also, the proposed system is having the key for speeding up or slowing down the speed of conversion according to the need of blind reader.

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Author Profile

Vrushabh S. Dharme received B.E. degree in Electronics & Communication Engineering from R.T.M. Nagpur University in 2012 and currently pursuing M.E. in Embedded System & Computing from G.H. Raisoni College of Engineering Nagpur.