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Microcontroller Based Smart Touch Gadget Assistant for Visually Impaired

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ABSTRACT— *All over the world, persons who are not able to visualize (blind) have used Braille as the primary means of accessing information. Almost all countries have adapted the system 'Braille' as a universal approach that works to get the information for visually impaired. This paper describes the hardware implementation of a text to English Braille translator using Arduino UNO.*

Visually impaired people report numerous difficulties with accessing printed text using existing technology, including problems with alignment, focus, accuracy, mobility and efficiency. We present a device that assists the visually impaired with effectively and efficiently reading paper-printed text. We introduce a novel, local sequential manner for scanning text which enables reading single lines, blocks of text. The design is motivated by preliminary studies with visually impaired people, and it is small-scale and has mobility.

KEYWORDS— *Braille Translation, Arduino UNO, Memory module, Relay Drive, Algorithms, Visually impaired.*

I. BLINDNESS AND VISUAL IMPAIRMENT KEY FACTS

- An estimated 253 million people live with vision impairment: 36 million are blind and 217 million have moderate to severe vision impairment (1).
- 81% of people who are blind or have moderate or severe vision impairment are aged 50 years and above (1).
- Globally, chronic eye diseases are the main cause of vision loss. Uncorrected refractive errors and then un-operated cataract are the top two causes of vision impairment. Un-operated cataract remains the leading cause of blindness in low- and middle-income countries.
- The prevalence of infectious eye diseases, such as trachoma and onchocerciasis, have reduced significantly over the last 25 years.
- Over 80% of all vision impairment can be prevented or cured.

Definitions : Vision function is classified in 4 broad categories, according to the International Classification of Diseases -10 (Update and Revision 2006):

- normal vision
- moderate vision impairment
- severe vision impairment
- blindness.

Moderate vision impairment combined with severe vision impairment are grouped under the term "low vision": low vision taken together with blindness represents all vision impairment.

The major causes of blindness are:

- un-operated cataract 35 %
- uncorrected refractive error 21 %
- glaucoma 8 %.

People aged 50 and over :

81% of all people who are blind or have moderate to severe vision impairment are aged 50 years and above. With an increasing population of older people, more people will be at risk of vision impairment due to chronic eye diseases.

Children below age 15:

An estimated 19 million children are vision impaired. Of these, 12 million children have a vision impairment due to refractive error. Around 1.4 million have irreversible blindness, requiring access to vision rehabilitation services to optimize functioning and reduce disability (2).

Changes over the last twenty years

Overall, the prevalence of vision impairment worldwide has decreased since early estimates in the 1990s. This decrease is associated with:

- overall socioeconomic development;
- concerted public health action;
- increased availability of eye care services;
- awareness of the general population about solutions to the problems related to vision impairment (surgery, refraction devices, etc.).

However it is estimated that the number of people with vision impairment could triple due to population growth and ageing. For example, by 2050 there could be 115 million people who are blind, up from 38.5 million in 2020 *(3).*

The global response to prevent blindness

Globally, more than 80% of all vision impairment can be prevented or cured. Areas of progress over the last 25 years include:

- governments established national programmes and regulations to prevent and control vision impairment;
- eye care services increasingly available and progressively integrated into primary and secondary health care systems, with a focus on the provision of services that are high quality, available and affordable;
- campaigns to educate about vision function importance and raise awareness, including school-based education; and
- stronger government leadership on international partnerships, with increasing engagement of the private sector.

II. INTRODUCTION

According to the World Health organization (WHO), 285 million people are estimated to be visually impaired worldwide among which 90% live in developing countries [1]. Despite the fact that education plays a crucial role in everyone's life and there is a significant relationship between Braille literacy and academic success, higher income, and employment, the rate of Braille literacy in developing countries is alarming low [2]. Today in developing countries less than 3% of visually impaired children are learning to read Braille in school [3].

Blind people are an integral part of the society. However, their disabilities have made them to have less access to computers, the Internet, the e-papers & e-books also the high quality educational software, than the people with clear vision. Consequently they have not been able to improve on their own knowledge, and have significant influence and impact on the economic, commercial & educational ventures in the society. One way to narrow this widening gap it is necessary for them to develop a system, within their economic reach and which will empower them to communicate freely and widely using the softcopy of books or any other information infrastructure.

Braille a linguistic model, was invented in the year 1829 by a blind Frenchmen, Louis Braille. Braille comprises of a rectangular in shape with six-dot cell on it. Using one or more of the six dots it can have up to 64 possible combinations ($2^6 = 64$). Braille is embossed by hand or with a machine onto thick paper, and read by the blind people with the fingers moving across on top of the dots. Each letter in Braille script comprises of six dots arranged in three rows and two columns. This six dots arrangement is termed as a "cell" [1]. An example of a Braille letter cell has been shown in Fig.1.1. The main advantage of Braille is that it encourages the visually impaired to be independent in all walks of life, get the information of the world around.

Basically there are two types of blindness can be seen in visually impaired. The two forms are- "congenital and acquired (contracted)". In first case- (congenital blindness) loss of sight is observed from birth. People suffering from the congenital blindness are taught Braille during their determining years itself. This in turn makes them independent and well educated. These people get the education as normal student (visually blessed) in the school.

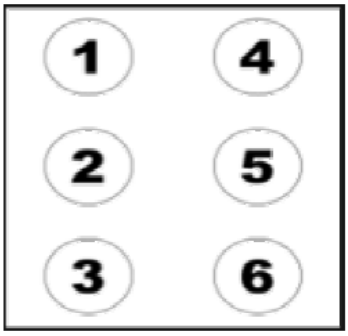

Figure 1.1: Braille Cell

Where as in second case- (contracted blindness) people loss their sight due to disease or due to accident at a later stage in their life. This will be a mental breakdown for them. In such cases, it becomes difficult for such people to learn Braille by themselves and to teach such an individual the Braille script, can be a challenge.

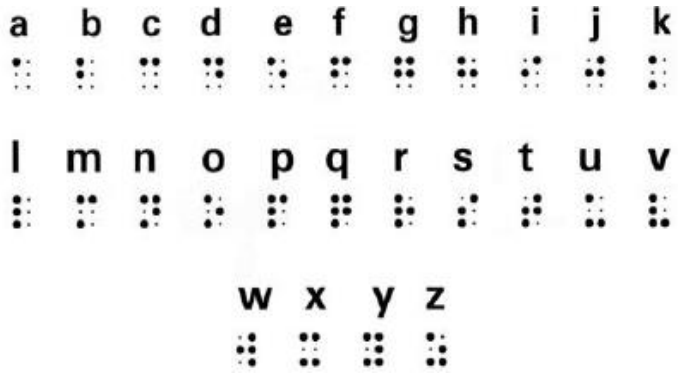

Figure 1.2: Braille Alphabet

Since Braille become one of the most important ways for the blind to learn and obtain information, translating normal text into Braille became a necessity in today's life. Today, most Braille translators are computer based and use the American Standard Code for Information Interchange (ASCII). Paul Blenkhon's proposed a system to convert text

into Standard English Braille [1]. Apart from the English alphabets there are various symbols we can use while writing a text and same can be translated in Braille.

III. OBJECTIVE OF STUDY

The objective of this project is to convert the English text into the Braille English alphabets. Since, Braille became one of the important ways to learn and obtain information for blind people, so translating normal text into Braille became a necessity. The output is a Braille cell (connected with 6 vibration motors). The visually impaired will be able to read the Braille English, alphabet by alphabet with the delay of 5sec and a complete word with the delay of 10sec. When any text file can be saved in the memory it will interact with Arduino UNO and the data (alphabets/ word) will be displayed on the LCD and the Braille Cell which is mounted on the relay drive mechanism.

Figure 1.3: Braille Sheet

IV. BLOCK DIAGRAM & WORKING

The block diagram given below shows the basic blocks required to execute the result in Braille language. The Memory (SD card) is the input and the Braille cell which is connected or mounted on the relay mechanism is the output. The basic and most important block of this section is Arduino UNO which is the heart of this project which will convert the ASCII data to binary. We need to interface the memory of the SD card module and LCD (16x2) with Arduino UNO. So when any text file can be saved in the memory it will interact with Arduino UNO and the data (alphabets/ word) will be displayed on the LCD. For this we need to go through with the codes for interfacing and most importantly the conversion of ASCII to binary.

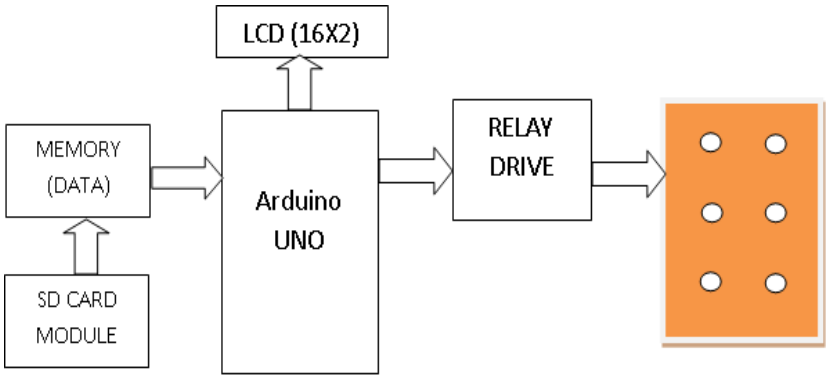

Figure 1.4: Block diagram of microcontroller based Braille translator for visually impaired

V. PROPOSED SYSTEM

Braille is a method of representing characters through a pattern of raised dots so that the blind can read by the sensation of touching. Written communication between two people is an easy task provided that they can both read and write the same language. So this project explains "To design a translator for converting English text to Braille code and this Braille code into vibration signal through vibration motors & can be read on a Braille cell membrane". The vibration produces more sensitivity in fingers.

Braille Software Algorithm- When English text is translated to Braille code, the steps are as follows:

a) Read the input character from the text file stored in SD card.
b) Separate the words on the basis of blank space.
c) Break the word into single character.
d) Access the Braille database.
e) Display the character on LCD screen along with the Braille cell as output.

The detail procedure will be explained in the next section. The system has been implemented in an Arduino UNO ATmega 328 evaluation board.

VI. HARDWARE IMPLEMENTATION

Figure 1.4 shows the block diagram of the module for reading text of the system. In this module the e-books and e- documents, blogs etc. is sent to the Graphical User Interface (GUI) on the define code running in the PC. The American Standard Code for Information Interchange (ASCII) value of the character sent from the Braille database is converted to the corresponding Braille code using a conversion algorithm. This conversion program is written in Arduino 1.0 programming language. The microcontroller board used here is the Arduino UNO ATmega328 development board by Open Source Electronics. The output of the microcontroller Arduino UNO board is taken from the general purpose input/output pins of the development board in the form of voltages that is either 0 Volts or 5 Volts.

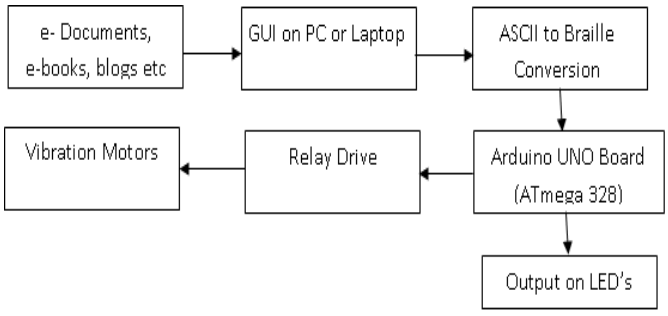

Figure 1.5: Block diagram of the module of reading text

Since we have used six vibration motors and the Braille cell contains only six dots, only six of the Input/output pins of the development board are used. A six bit number in binary/hexadecimal form is obtained from the output of the microcontroller corresponding to the Braille code of the character. The output from the six Input/output pins is further given to the vibration motor through relay circuit. This driver circuit is used for voltage conversion which will be suitable for the safe operation of the vibration motor. Any visually impaired person can read through touch sensation and understand the English characters through the vibration of the motors. Similarly the whole word or sentence is converted into Braille vibration codes.

VII.SOFTWARE IMPLEMENTATION

The Arduino runs a simplified version of the C programming language, with some extensions for accessing the hardware. It is not the complete version of C & Java thus called "hardwire". All Arduino instructions are one line. The board can hold a program hundreds of lines long and has space for about 1,000 two-byte variables. The Arduino executes programs at about 300,000 source code lines per sec. The following flowcharts in Figure 1.5 and 1.6 explains the execution.

The code written in Ardunio 1.0 software is generalized code and all the characters are stored in Braille database. The flowchart in Figure 1.6 gives the complete overview of the code.

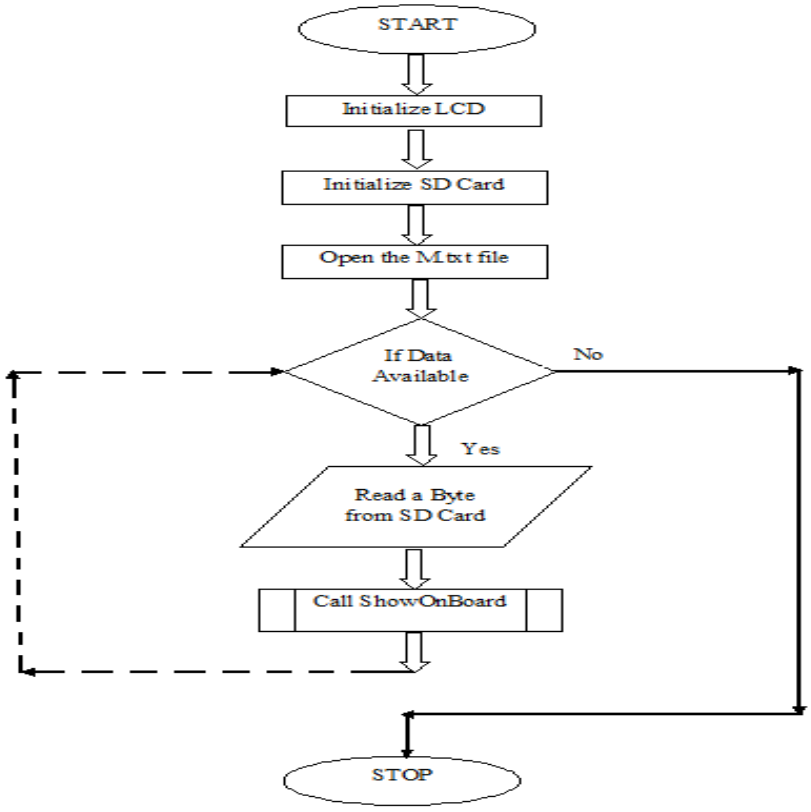

Figure 1.6: Flowchart for code execution

The next flowchart Figure 1.7 explains the function 'ShowOnBoard'. This function checks for the character and activates the respective motors depending on the Braille code. The ShowOnBoard function checks the character alphabet by alphabet and make the respective pins low or high and generates the output on LED's and the motors.

At last compile the code and dump or upload the code on hardware. The steps are:

a) Upload or Dump the code.
b) Connect the USB cable to the Arduino UNO board.
c) Go on Tools menu select the Serial Port, Board- Arduino Uno.
d) Check the output on the hardware.

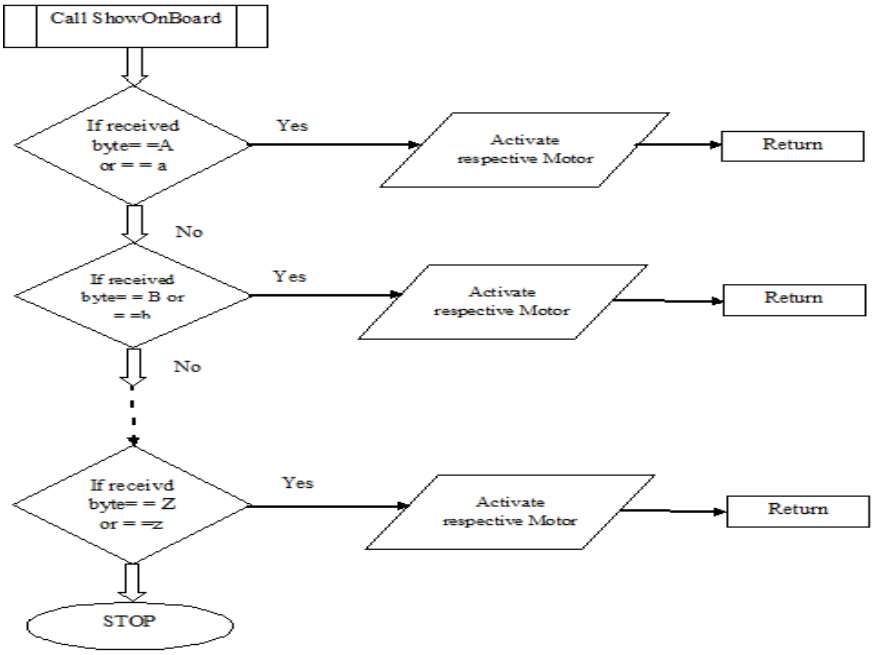

Figure 1.7: Flowchart to read character & run the respective motors

VIII. RESULT

For the use of visually impaired people, the feel of vibration will be considered as a dot and Braille language of the respective alphabet of the word can be read. Implemented Circuit for the Design System, the hardware setup is shown along with the vibrating motors and LEDs which will show the Braille equivalent of text read from the memory module. The figure 1.8 shows the hardware setup when power supply is provided to the Aurdino board. The LCD module connected shows a message "Braille Project".

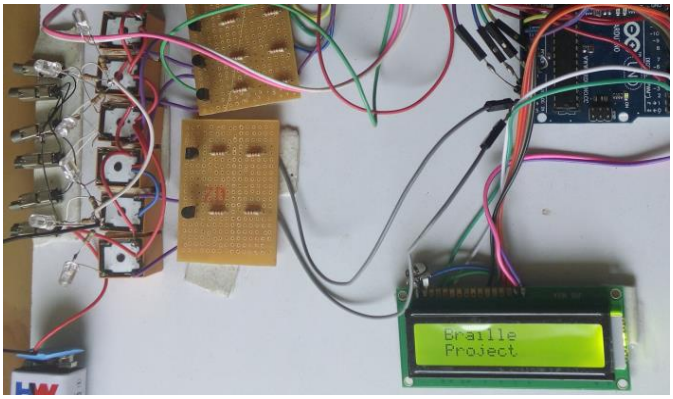

Figure 1.8: LCD Screen displaying 'Braille Project' at start-up

Figure 1.9: Social Application of Braille in Electronic Gadgets

IX. CONCLUSION

There are several improvements which will be incorporated in future versions of the hardware translator. For example, the current system is a stand-alone component. Its structure has to be changed for every individual application. The design and implementation of an Arduino UNO microcontroller based, text-to-Braille translator has been presented. In its current version, the system can be used in embedded and high-performance applications.

X. FUTURE SCOPE

For further future scope the texts to be translated but the translated Braille English text to be stored in a PC as a file format so that it can be connected to Braille printer and the user can get the hard copy of it. Braille printers are easily available in market but with the high cost. Also for further improvement, a multi-language-Braille translator will be considered. Look-up tables for different languages could be stored in flash memory so that when translation of text in a particular language is required, the microcontroller loads the corresponding look-up table. Thus, we hope that the future hi-tech improvement will enlighten their life.

REFERENCES

[1] Automated Braille Production from Word-Processed Documents by Paul Blenkhorn & Gareth Evans, IEEE Transactions on Neural Systems & Rehabilitation Engineering, vol. 9, No.1, March 2001.

[2] FingerReader: A Wearable Device to Support Text Reading on the Go Roy Shilkrot, Pattie Maes, Jochen Huber, Suranga C. Nanayakkara, Connie K. Liu MIT Media Lab 75 Amherst street Cambridge, MA 02139 USA, Singapore University of Technology and Design 20 Dover Drive Singapore, Singapore.

[3] Low Cost Real-Time Communication Braille Hand-Glove for Visually Impaired Using Slot Sensors and Vibration Motors by Mukul Bandodkar & Virat Chourasia, World Academy of Science, Engg & Technology, International Journal of Electrical vol. 8 No.6, 2014

[4] Blenkhorn, P. & Evans, G. (2001) "Automated Braille Production from Word-Processed Documents", IEEE Transactions on Rehabilitation Engineering Vol. 9, No 1, pp 81 – 85 March 2001.

[5] A Multimodal Interaction Scheme Between a Blind User and the Tyflos Assistive Prototype 2008 20th IEEE International Conference on Tools with Artificial IntelligenceNikolaos Bourbakis1,3, Robert Keefer1, Dimitrios Dakopoulos1 and Anna Esposito1,2 1Wright State University, ATRC, Dayton.

[6] A Platform Independent Braille Translator by Alasdair King, Gareth Evans & Paul Blenkhorn, Department of Computation, UMIST, Manchester.

[7] Reconfigurable PDA for Visually Impaired Using FPGAs, Xuan Zhang & Cesar-Sanchez & Iain Murray, Curtin University of Technology, Perth, Western Australia, International Conference on Reconfigurable Computing & FPGAs, 978-0-7695-3474-9/08, 2008 IEEE

[8] Pazio, M., Niedzwiecki, M., Kowalik, R., and Lebiedz, J. Text detection system for the blind. In EUSIPCO (2007), 272–276

[9] Kane, S. K., Frey, B., and Wobbrock, J. O. Access lens: a gesture-based screen reader for real-world documents. In Proc. of CHI, ACM (2013), 347–350

[10] Electronic Travel Aids for Blind Guidance An Industry Landscape Study IND ENG 290 Project Report, Fall 2015

[11] BlindAid: An Electronic Travel Aid for the Blind Sandra Mau, Nik A. Melchior, Maxim Makatchev, Aaron Steinfeld The Robotics Institute Carnegie Mellon University Pittsburgh, Pennsylvania 15213, May 2008