Cell Phone Technology for Visually Impaired: A Vibration Based Braille Perception

[1]Vijaykumar T.Korishetti, [2]Asit.R.Kittur, [3]Sachin Gurav, [4]Veeresh P.M.
[1,2,3,4]Dept. of Electronics, Bharati Vidyapeeth's College of Engineering, Kolhapur, Maharashtra, India

Abstract
Cell phones based on GSM technology for Visually Impaired People [VIP] are available in market in the recent past. GSM phones has Braille keypad with large keys that helps visually impaired people to understand the digits and the presence of voice response for key press helps the VIP's to understand the numbers. Current Technology has enabled the blind to use cell phones more easily for voice calling as well as messaging. The current practice of creating information for the visually impaired in the form of Braille, generally involve manufacturing of molds, which is further used to create shaping material per Braille dots. However, the major disadvantage in producing mold is lower accuracy and are not economical. This paper presents a novel design for low cost manufacturing of cell phone display using small size DC motors, which enables the blind user to read incoming text messages.

Keywords
Visually Impaired Person, Braille, GSM, DC Motor Array

I. Introduction

As per the statistics provided by World Health Organization [3], 285 million people are estimated to be visually impaired worldwide. Among these 39 million are totally blind and 246 million are suffering from low vision. For the assistance of Visually Impaired Persons(VIP) in a society many technologies have been developed to provide them access to reading, writing, voice calling and also messaging [1]. These technologies generally include conversion of information into Braille symbols and also auditory translations enabling the VIP to exchange information with others.
But people suffering from deaf-blind impairment would find such systems difficult to use as audio translations cannot be heard by them. Hence our objective is to provide this community an additional alternative based on Braille which uses touch and vibration feature to sense and interpret information to themselves.

II. Related Work

In a paper based on V-Braille[4], Chandrika Jayant, Christine Acuario, William A. Johnson, Janet Hollier, Richard E. Ladner have used the concept of haptic Braille perception using a touch screen and a novel software that enables the blind to use the mobile phone to read text. The Nokia Braille Reader uses the vibrating touch-screen on Nokia phones to convey Braille[5]. In one of the interview with the Times of India, Sumit Dagar describes about his novel phone for Visually impaired which uses Shape memory alloy technology [6].

III. Proposed Work

Braille is a method that is widely used by blind and deaf-blind people to read and write. A Braille character is made up of six dots, placed in two columns of three dots each. This paper proposes a design of special kind of display that has arrangement of Braille dots in the form of matrix of small pin sized dc motors covered with rubber caps. Whenever a incoming message arrives it is converted into the Braille language i.e. dot language and then it would be given as a input to drive the dc motor matrix and accordingly particular motors would be put in motion and the rest would remain stationary. By sensing these motors the sightless person would easily understand the message. In this project six characters can be simultaneously read in parallel. A snapshot of fabricated DC motor array is displayed in fig. 1

Fig. 1: DC Motor Matrix as Braille Dots

IV. Implementation

The set up consists of Microcontroller AT89V51 unit, GSM board, DC motor arrays mounted on acrylic slab and a reset circuit for controlling GSM messages. The GSM receiver is connected to the microcontroller to a port pin, which receives a message from a GSM phone. The received message is the input to a decoder latch which maintains a database of ASCII value to corresponding data that run motors. The block diagram of mobile technology for VIP is shown in the fig. 2.

V. Experimentation and Acceptance Testing

We conducted a live test at one of the Blind School in the city. Initially VIP's were made familiar with the device and the Braille dots to motors. Next task performed was making them read characters and later gradually sentences were provided for reading based on the received message from a GSM phone. The blind student was able to recognize characters easily as vibrations helped them identify the dots. This test was repeated for five such students and also a blind teacher. We asked them share their experience regarding the test. These blind students felt really interesting and were able to recognize strings not taking time more than 4 seconds per letter. The experimental set up for test is displayed in fig. 3.

VI. Results and Observations

The five voluntary students took more time to decode the first message. Furtherance to this as they got familiar with the set up the time consumed for recognizing the strings was reduced. The data collected regarding this is presented in Table 1.

Table 1: Time Taken for Decoding GSM Messages

Serial number	GSM Message	Recognized message	Time Taken in Seconds
1	ABC	ABC	20
2	HEY	HEY	15
3	NAMASKAR	NAMASKAR	25
4	THANK YOU	THANK YOU	26

Fig. 3: Blind User Examining Braille Pattern

VII. Future Scope

The demonstration of our cell phone technology helped us identify several future research area which include designing of micro motor strips for display devices for blind. Another area of enhancement include enabling this project to interpret graphical data in future scope.

VIII. Conclusion

These devices truly become low cost alternative to other cell phone technology's discussed in this paper, as our design results in a device with low cost, low power consuming and also smaller in size.

IX. Acknowledgements

We thank Bharati Vidyapeeth's College of Engineering for supporting this work. We thank Principal Dr. Mrs. S.R Chougule for providing infrastructure support. Thanks for the great interest and encouraging input from our voluntary participants. We are grateful to all the staff and students of Gyan Prabhandini Blind School Kolhapur for the tremendous support they have provided.

References

[1] [Online] Available: http://www.fonearena.com/blog/35760/intex-vision-phone-for-visually-impaired.html

[2] Hampshire, B.,"The design and production of tactile graphic material for the visually impaired", Applied Ergonomics, 10 (2). pp. 87-97.

[3] [Online] Available: http://www.who.int/mediacentre/factsheets/fs282/en/

[4] Chandrika Jayant, Christine Acuario, William A. Johnson, Janet Hollier, Richard E. Ladner,"VBraille: Haptic Braille Perception using a Touch-screen and Vibration on Mobile Phones", ASSETS'10, October 25-27, 2010, Orlando, Florida, USA. ACM 978-1-60558-881-0/10/10

[5] Nokia Braille Reader. 2009, [Online] Available: http://betalabs.nokia.com/apps/nokia-braille-reader

[6] [Online] Available: http://www.mashable.com/2013/04/24/braille-smartphone/

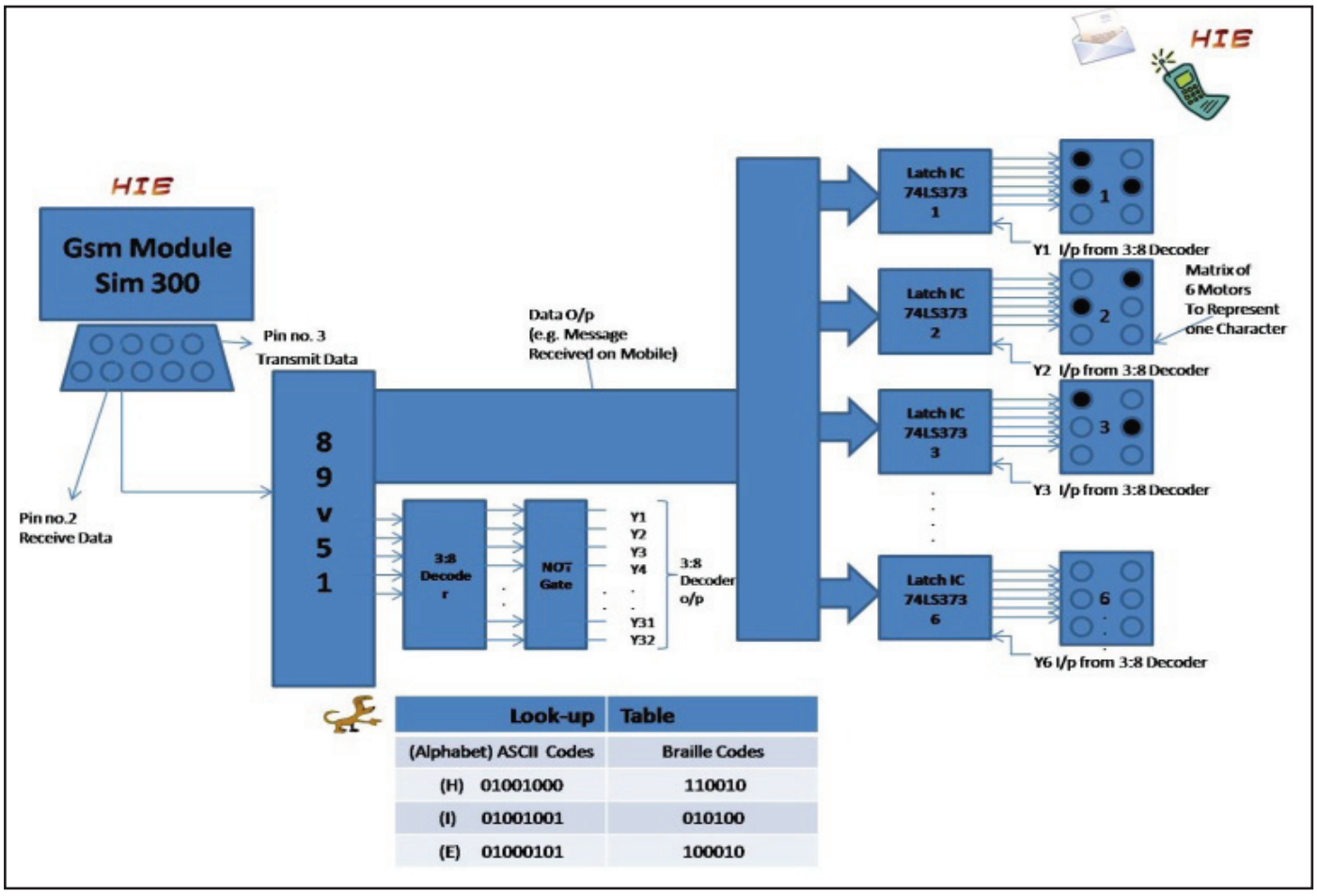

Fig. 2: Cell phone Technology for VIP