Mobile SMS to Braille Transcription: A New Era of Mobile for the Blinds

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ABSTRACT
In this paper, we describe an application that converts Mobile SMSs into Braille script with special emphasis on special symbols so that visually impaired people will also be able to read mobile messages. This application filters mobile message's text from their special format and than converts this message text into Braille script and send it to the parallel port so that it can be embossed on paper by Braille Embosser or can be read by electronic Braille reader attached to the parallel port. This application increases the availability of information and use of technology for handicapped –visually impaired individuals.

Categories and Subject Descriptors
J.5 **[Computer Applications]:** Arts and Humanities- *Language translation*

General Terms
Design, Human Factors, Verification, Performance, Experimentation

Keywords
Mobile SMS, Braille, ASCII-Braille Encoding, Braille Transcription.

1. INTRODUCTION
At the end of the march 2006 there were people in UK who were registered as severely sight impaired (blind) in the department of health. A large group of people have also significant sight loss that does not fall in this narrow category. At 31 March 2008, 153,000 people were on the register of blind people, a slight increase of around 500 (0.3%) from March 2006[14]. In India, 10,634,000 people are blinds in which 5,732,000 are male and 4,902,000 are female. So According to this scenario there is strong need of technological development in this field. Mobile SMS that is Short text Messaging Service is becoming very popular now-a-days since it provides a cheap means of communication. Today an average of 60% of mobile communication is done by means of SMSs. But how a blind person is going to use this service. So to resolve this problem we have implemented mobile SMS to Braille transcription software that filters out mobile message into text format from their special format and than transcribe this text message into Braille. After that this message in Braille format is displayed on the screen from where it can be sent to the parallel port. We have also implemented hardware by means of it we can verify our Braille output on the parallel port with the help of glowing LEDS that represent Braille notations. Practically message in Braille format is sent on parallel port to which a Braille reader or Braille embosser device is connected. So Braille message can be read by a blind person. Of course there may be some speech to text converter software available for mobiles but our software is advantageous in many means. Like due to limited memory factor in mobiles only few messages can be stored at a time and for getting new messages we have to delete old messages in that case speech to text converter fails but by SMS to Braille transcription software user can emboss important messages on paper and can read them whenever required. This software also proves very useful when a person has both visible and listening disability.

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2. BACKGROUND

2.1 A Brief Introduction of Braille
Braille is a system of encodings of print in embossed dot patterns used for reading and writing by the blind [10]. Each Braille character occupies a cell of fixed size. It consists of two columns of dots, numbered 1, 2, 3 and 4, 5, 6 from top to bottom. (There are also Braille codes using two columns with four dots [8][15].)

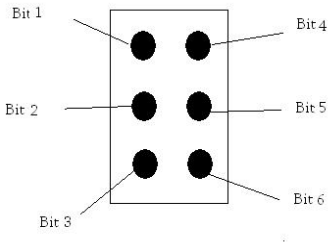

Figure 1. Braille Cell Representation

In this paper, Braille characters are represented by dot images; as examples we list the Braille representations of the first ten characters of the alphabet which, when preceded by the indicator for numbers, also denote the ten digits.

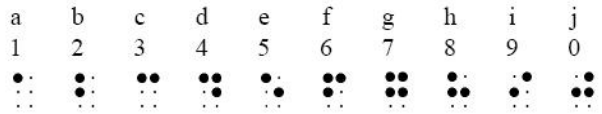

Figure 2. Some Braille Characters[4]

There are 26 = 64 Braille characters altogether with used as the space character. The dimensions of the Braille cell, according to the Library of Congress standards, are given in [1].Certain Braille printers also permit a graphics mode. However, in this paper we do not consider Braille graphics at all. Given the fact that only 64 Braille characters are available, it is clear that special encoding rules had to be developed for different applications [12]. Different languages use different encodings (see [5][6], for instance). In this paper, we restrict our attention to the message text to Braille conversion. In addition to the variation according to language, there exist different "grades" for the encoding: Grade I Braille, for instance, renders text with all details concerning punctuation, capitalization, spelling, and numerals, whereas grade II Braille employs a system of contractions and abbreviations [6][7]. Typically, a grade II Braille text is 30% shorter than its grade I counterpart. We have employed an encoding technique that transcript messages into grade I Braille so as to cover a wide range of symbols in Braille.

2.2 A Brief Survey of Braille Transcription

Before the introduction of computers into the Braille production process, Braille transcription worked essentially as follows: a person who had been trained in the relevant Braille codes would have a printed copy of the text in question and produce a Braille copy using a Braille writing machine. Typically, such a Braille writing machine has six keys for embossing a Braille character, one for each of the dots of the Braille cell, and a few more keys for operations like 'space', 'backspace', etc. In the case of single copy, the Braille is produced directly onto heavy stock paper. For large scale production, the Braille is embossed onto zinc plates which are then applied under pressure to the heavy stock paper [9]. The Braille version would have to be proofread and corrected; corrections could require that complete pages be re-done. Braille transcription is difficult, time intensive and costly. The training time for a transcriber is given as between 6 months and a year[9]; even longer periods are required for training in complicated codes like Nemeth Braille. A page of Braille takes about 30 minutes to produce on the average. This includes proofreading and corrections. Typically, a page of print results in about two pages of Braille. Given these conditions, it is clear that only a very small part of the printed publications can actually be transcribed. Moreover, access to less frequently demanded documents is very slow. Given the traditional set-up, browsing through scholarly journals or recent technical reports is something a blind reader can only dream of. With the introduction of computers into the transcription process certain simplifications became feasible. In the first step, the text is put into machine readable form. The task of translating the input into Braille is then left to a computer program. Several programs exist that afford the conversion from ASCII Braille to (literary) grade II Braille (see [2][3][4], for example). Some successful attempts at computer-aided transcription of mathematics have also been made . However, to our knowledge, the automatic transcription into the Braille code for mobile SMSs is not offered by any software package up to now which I think a essential thing today and must be available for the blinds.

3. SYSTEM DESCRIPTION

Mobile SMSs to Braille Transcription is an application that produces Braille for mobile messages. It filters Text message from their special file format like .VMG. This text message is then converted into Braille format and displayed on the screen along with text message. Only by hitting the Enter key on the keyboard this message in Braille format can be send to the parallel port. Mostly Braille output devices like Braille embosser, Refreshable Braille display and many more, can be connected to the computer system through parallel port. So data from the parallel port can be utilized by Braille output device connected to the parallel port. We have developed this software by using Visual Basic 6.0 Enterprise Edition, C language, MS Access 2003, Some DOS Shell Commands and some dynamic link libraries to interact with parallel port.

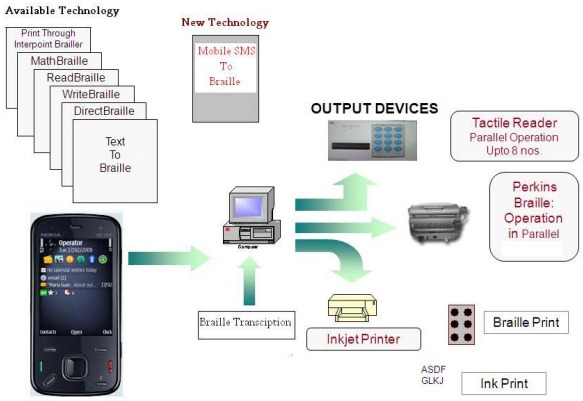

Figure 3. Complete System Interfacing

There are basically three major modules of this software application-

3.1 Message File to Text Filtration

To use this application first of all we have to transfer message files from mobile to the computer system. This can be done with the help of mobile's supporting software like PC Suite, and connecting mobile to the PC via data cable or Bluetooth. These message files are in their special format like Nokia mobiles have message files in .VMG format which can not directly be converted into Braille because it can not be read by Visual Basic. These message files also have many unwanted information along with message text. This unwanted information needs to be filtered. So for this purpose we have implemented a program in C language which takes the message file name as CLA (Command Line Argument), reads message file and filter the unwanted information from this file. It stores the useful message text in a Text file. Now this text file contains only useful message text which can be further processed and converted into the Braille.

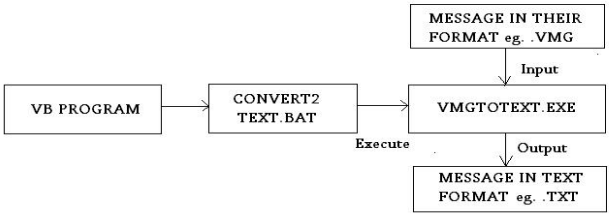

Figure 4. Flow of control for Message filtration Module

Above figure shows the flow of execution in which first VB program takes message file name as input and write a DOS command in convert2text.bat file for executing VMGTOTEXT.EXE. This program takes message file in their format as input and writes message text in a text file as output.

3.2 ASCII to Braille Conversion

To convert ASCII characters into the Braille characters we have used an encoding schema, known as ASCII-Braille encoding that encodes Braille. According to this encoding schema six dots of a Braille character are considered as six bits of Braille character. Raised dots are considered as bit '1' or 'high' and lowered dots are considered as bit '0' or 'low' as shown in following figure.

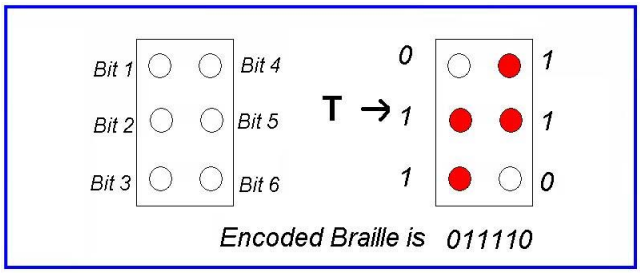

Figure 5. Showing Braille encoding of character T

As shown Figure , In Braille representation of character 'T', dot number 2,3,4,5 are raised and considered as bit '1' and dot number 1,6 are lowered and considered as bit '0'. So In ASCII 'T' is represented as 01110100 and its corresponding Braille Value is XX011110 in which two MSBs are "don't care" and only six LSBs are significant. Using this encoding we have created a look up table in MS Access 2003. VB program reads the text message one by one character and corresponding Braille notation is fetched from the look up table and then this message is displayed on the screen in Braille format.

TABLE 1. ASCII-Braille encoding for some character

Input	Input Binary	Output Binary
R	01110010	XX010111
S	01110011	XX001110
T	01110100	XX011110
U	01110101	XX100101
V	01110110	XX100111
W	01110111	XX111010
X	01111000	XX101101
Y	01111001	XX111010
Z	01111010	XX110101
1	00110001	XX000010
2	00110010	XX000110
3	00110011	XX010010
4	00110100	XX110010
5	00110101	XX100010
6	00110110	XX010110
7	00110111	XX110110
8	00111000	XX100110
9	00111001	XX010100
0	00110000	XX110100

TABLE 2. ASCII-Braille encoding of some special symbols

Input (Sp. Symbols)	Input Binary	Output Binary
Semicolon	00111011	XX000110
Colon	00111010	XX010010
Exclamation	00100001	XX010110
Open Bracket	00101000	XX110110
Close Bracket	00101001	XX110110
Open Quotation	00100010	XX100110
Close Quotation	00100010	XX110100
Single Quotation	00100111	XX000010
Full Stop	00101110	XX110010
Hyphen	00101101	XX100100
Question Mark	00111111	XX100110

3.3 Sending Data on the Parallel Port

Braille Output devices can be connected to the computer system through one of these three types of Port 1- Parallel Port 2- RS232 3- USB Port. We assume here interfacing of Braille output devices through 25 pins D-type parallel port. We have implemented a module to send message in Braille to the parallel port so that this message can be embossed on paper by Braille embossers or can be Read by Refreshable Braille Display connected to the parallel port. We have used inpout32.dll file for sending data on the parallel port and hwinterface.dll for determining address of parallel port from BIOS of system.

3.4 Testing Hardware

We have designed a testing hardware so as to verify that we are receiving correct Braille on the port. This hardware represents single Braille character cell in which dots are represented by means of six LEDs. When there is 1 on data line LED glows and when 0 it doesn't glow. The Braille output devices also work on the same principle. The aim of this hardware is only to verify Braille at output.

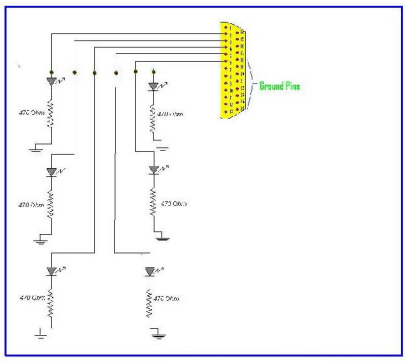

Figure 6. Circuit Design of Testing Hardware

3.5 Screen Shots of Software

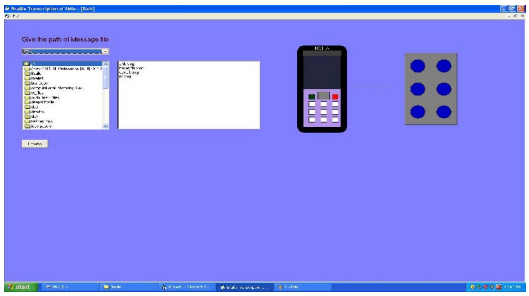

Figure 7. Path of Message File

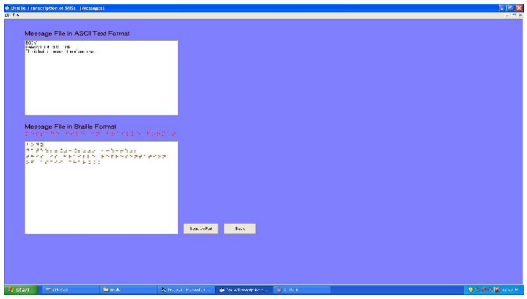

Figure 8. Message in Text and Braille Format

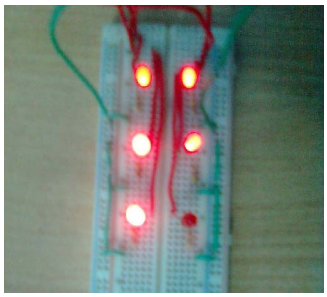

Figure 9. Hardware representing a single Braille Cell at output

4. PRACTICAL APPLICATIONS

The practical applications of this software include reading and writing of SMSs for the Blinds through devices for the blind persons. The device used by the blinds for reading purpose is known as refreshable Braille display and the device used for writing Braille codes or to print out the Braille coded characters is known as Braille Embossers. A Braille display is a device that allows a blind 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. The pins can rise and fall depending on the electrical signals they receive. This simulates the effect of the raised dots of Braille impressed on paper. There are usually 40, 65, or 80 arrays (characters) per line of text, depending on the device[4]. When currents or voltages are applied to points in each six-pin array, various combinations of elevated and retracted pins produce the effect of raised dots or dot-absences in paper Braille. In the piezoelectric display, each pin is mounted above a piezoelectric crystal with metal attached to one side. If a sufficient voltage is applied to the crystal, it becomes slightly shorter. This causes the metal to bow upwards, raising the pin. Thus when there is no voltage, the pin is retracted, corresponding to the absence of a dot in Braille; when there is voltage across the crystal, the pin is elevated, corresponding to a dot.

Figure 10. Refreshable Braille Display

Braille Embosser is a printer which is used for printing Braille. It embosses Braille Character on the sheet of paper with relative ease. Some Braille Embossers are Romeo Attaché, Tiger Braille Embosser, Juliet Classic Braille and Braille Express 150 and many more.

Figure 11. Braille Embosser

5. RESULT AND CONCLUSION

We are here converting text SMS to Braille and simulating Braille output devices through attached hardware. We have tested results for over hundred SMSs of various types.

Table 3. Testing Results

Types of SMS	Number of SMS	Expected Result
Simple text	30	100%
Text with special symbols	30	97%
Text with picture	30	75%
MMS	30	Fails

As shown in table for text messages results is 100% correct but since we are not considering graphics at all so result for text message with picture depends on ratio of text and picture part in the message if text part is more than picture part then accuracy will be high, our tested aggregate result in such case is 75 % and in case of MMS this software fails. There are some Braille transcription software available that read word documents, text files, HTML pages and e-mails. As per the referred articles there is no Braille transcription software for Mobile SMSs. So we have here introduced the Braille transcription of Mobile SMSs with relatively easy and fast conversion method. We have tried to greater extent to produce a perfect Braille through this software. This is fully practical based application which will help the blinds for the usage of technology (SMSs). This application increases the availability of information for blinds. It also provides reliability since some mobile speech software available but what about when these messages are deleted. So Using "Mobile SMS to Braille Transcription" we can make records of messages and can use them whenever required. We hope that this software will be very helpful for the blinds.

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