E-mail Client having Articulation and Braille Transcription of E-mails for the Blinds

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Abstract

In this paper, We describe an email client application that sends and receives emails, and converts them to speech and also transcripts them into Braille script with special emphasis on special symbols so that visually impaired people will also be able to read emails. This application filters unwanted message like advertisement, spam and more text from mail and converts this message text into speech or Braille script. Then this Braille script is sent 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 that is for visually impaired individuals.

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]. India is becoming home to the world's largest number of blind people. The 37 million people across the globe, are blind and from which over 10 million are Indians. In 10,634,000 people are blinds in which 5,732,000 are male and 4,902,000 are female .This makes us leading countries as the home of blind people and inspire us to make technological development for blind. In this era of communication and information technology, E-mail has replaced telephone as the most frequently used business communication tool, according to a new study sponsored by Oracle Corp. and conducted by KRC research. The study also indicates that this shift has challenged employees to maintain high levels of productivity, inside and outside of the office. In steed of as a business tool, Email is also widely used by students, research scholar and academicians. So this reveals the strong need of development of this technology for visually impaired persons. So we have developed E-mail client software that can read mail from any mail server by configuring it. And then it filters mails from unwanted messages like advertisement, spam and more. In this software, we have provided to ways for blinds to read mails. The first is articulation which means speak out that is, mails will be converted in to voice output by electronic speakers and this also makes it general e-mail client with special articulation utility that can be used by any person ,not only blinds. The second is Braille transcription of mails, in which mail's text part will be converted into Braille which is a script used by blinds to read. By this utility mails in Braille format will be displayed on the screen and just only hitting a single enter key, the entire mail in Braille format will be sent on the parallel port and can be displayed on electronic Braille reader or embossed on paper by the Braille embosser attached to that parallel port.

2. Background

2.1. A brief Introduction of articulation

Articulation means to speak out. It basically describes how the tongue, lips, jaw, and other speech organs are involved in making a sound make contact. We have used the term articulation to produce voice for written text.

2.2. 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].)

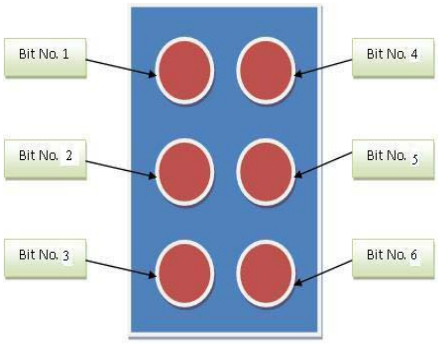

Figure 1. Braille cell representation

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.

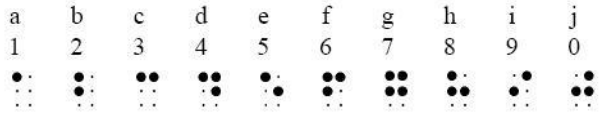

Figure 2. Some Braille characters [5]

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. 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 E-mail 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 E-mail into grade I Braille so as to cover a wide range of symbols in Braille.

2.3. A view 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. 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 [11]. 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. 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 to (literary) grade II Braille (see [12, 13, 14], for example). Some successful attempts at computer-aided transcription of mathematics have also been made [8]. 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 an essential thing today and must be available for the blinds.

3. System Description

Email articulator is a lightweight & portable e-mail client which is able to read the mails to its user and to transcript mails into Braille for blind persons. It works as a client application for listening, reading and sending email using POP3 and SMTP protocol respectively. Email articulator connects to a pop3 enabled e-mail servers and check for new mail, when it arrive e-mail articulator read it. E-mail articulator can read the date of its arrival, the email address of the man who sends it, the subject and the body of the message and all these information can be converted in

Braille and sent on the parallel port so that can be embossed on paper or read via refreshable electronic Braille reader.

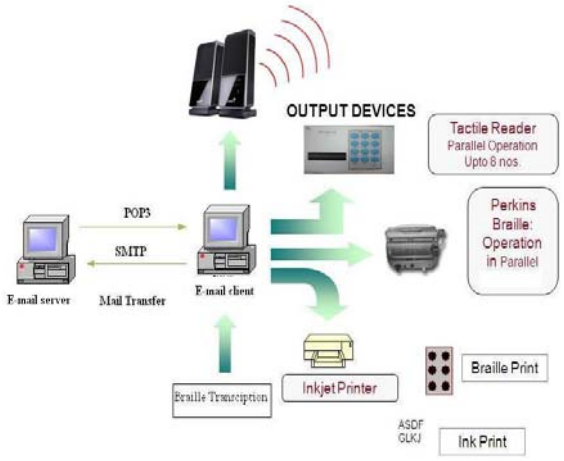

Figure 3. Complete system interfacing

Major modules of this software are-

3.1. Configuration of linux based intranet email server

To configure linux system into a mail server it should have sendmail and sendmail-cf rpm packages installed. When mail passes through a sendmail server, the mail routing information in its header is analyzed, and sometimes modified, according to the requirement of the systems administrator. Using a series of highly complicated regular expressions listed in the /etc/mail/sendmail.cf file, sendmail inspects this header and then acts accordingly. We have done editing of sendmail.mc using vim editor and then converted it into sendmail.cf by using m4 compiler. The Mail Delivery Agent accepts email from MTA and places it into user's mailbox. The mail exchanger, MX, in the context of the Domain Name System formally refers to an IP address assigned to a device hosting a mail server, and by extension also indicates the server itself. To retrieve the mail from user's account using a mail client, dovecot.conf file needs to be present on system. We have done this by installing corresponding rpm package i.e. dovecot-1.0.5-1.fc8.i386.rpm. By default dovecot will act as a server for IMAP, secure IMAP (IMAPS), POP and secure POP (POPS).

3.2. Text to speech conversion

We have used SAPI (speech API) which is already featured to convert text to speech. There are various features provided by SAPI such it expands emoticons into words, decides whether capitalized words should be read as words like LOS ANGELES, UNESCO or as sequences of letters, expands non-conventional words such as WinNT into appropriate rendering and many more.

3.3. Text to Braille conversion

To convert ASCII characters into the Braille characters we have used an encoding schema, known as ASCII-Braille encoding [1] that encodes text into 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'.

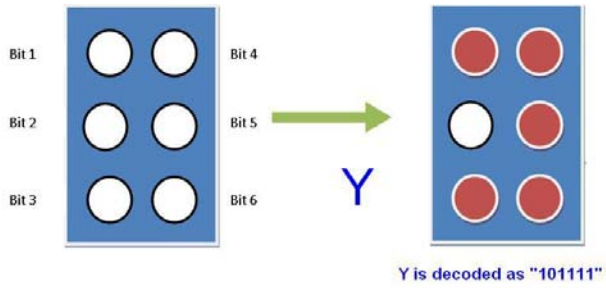

Figure 4. Braille encoding of character Y

As shown in figure 5 , 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 'Y' is represented as 01111001 and its corresponding Braille value is XX110101 in which two MSBs are "don't care" and only six LSBs are significant. Using this encoding we have created a look up table. Our software 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
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

Table 2. ASCII-Braille encoding of some special symbols

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

3.4. Sending data on then parallel port

Braille Output devices can be connected to the computer system through one of these three types of ports 1- Parallel Port 2- RS232 3- USB Port. We have assumed here interfacing of Braille output devices through D-type, 25 pins parallel port. We have implemented a module to send a message in Braille to the parallel port. We have used inpout32.dll file for sending data to the parallel port and hwinterface.dll for determining address of parallel port from BIOS of system.

3.5. Testing hardware

We have designed a testing hardware so as to verify that we are receiving correct Braille output at 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 output.

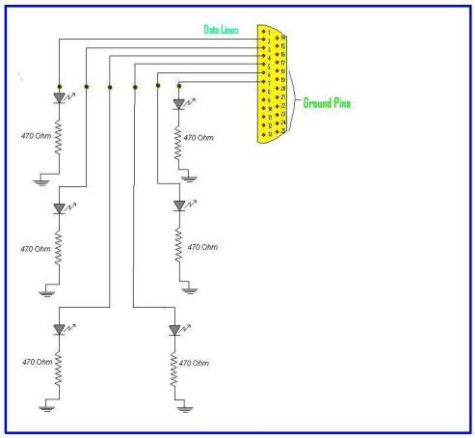

Figure 5. Circuit design of testing hardware

3.6. Screen Shots of Software

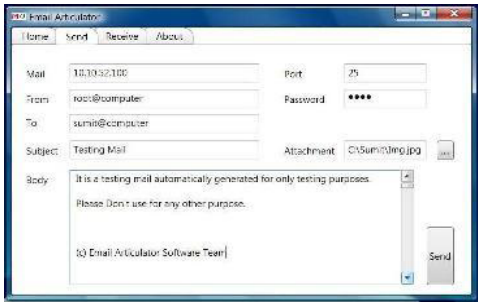

Figure 6. Sending mail

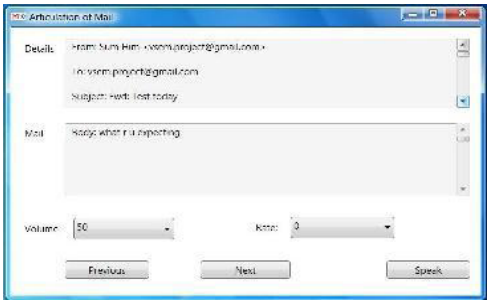

Figure 7. Articulation screen

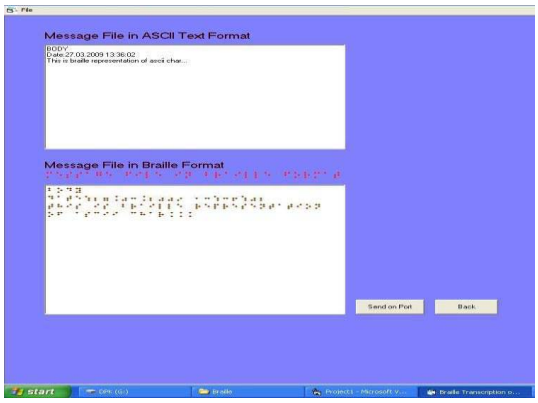

Figure 8. Message in Text and Braille format

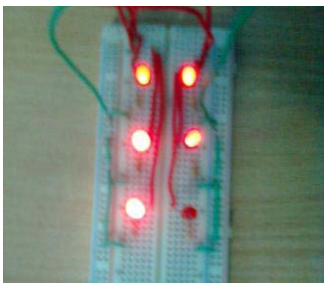

Figure 9. Hardware representing a single Braille Cell at output

4. Practical Applications

The practical applications of this software include reading mails for the Blinds through devices for the blind persons or listening mails via speakers. 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.

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 performing text to speech and Braille conversion, and simulating Braille output devices through attached hardware. We have tested results for over hundred mails of various types.

Table 3. Testing Results

Types of mails	Number of mails	Expected Result
Simple text	30	100%
Text with special symbols	30	98%
Text with picture	30	60%

As shown in table for text messages result 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 message if text part is more than picture part then accuracy will be high, our aggregate result in such case is about 60 %. As per the referred articles there is no Braille transcription software for Mobile SMSs. This software increases the availability of information for blinds. Using this e-mail client we can also make record of messages on Braille papers and can use them whenever required. We hope that this software will be very helpful for the blinds.

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