CHAPTER 3

METHODOLOGY

Generally, people with disabilities belonging to lower income group are the most suffers. The awareness and attention of the society towards the usage of computer technology to help the blind people is not satisfactory. Even though, some governments are supportive in terms of providing information technology for the blind people, the technology has not reached visually challenged people to large extend.

It is sad that visually impaired are not exposed or aware of the current technology and are not, up to the mark with current trends. Some of the visually challenged do not prefer such education. Hence, one of the results of the availability of computer technology today for disabled people is that people who formerly could not work. For that reason, it is essential to conduct a research to understand the computer technologies available for such visually impaired people and the characteristics of computer equipments available. Adaptive computing technology also helps in improving physical or mental functioning. It can overcome a disorder or impairment by providing easy assistance. It can also help us to prevent the worsening of a condition and subsequently strengthen a physical or mental weakness. Thus it helps to improve a person's capacity to learn, or even getting all the advantages of a normal person. It promotes greater independence for people with disabilities by enabling them to perform tasks that they were formerly unable to accomplish, or had great difficulty in accomplishing, by providing enhancements to changed methods of interacting with the technology needed to accomplish such tasks.

3.1 Objectives of the Problem

This research focus is to design and implement a novel technology using computer to help visually challenged person to communicate with the outside world in ease. The technology will certainly help the visually challenged to communicate with others through this newly invented vibration glove in a computer environment. The research focuses on:
1. Design and develop a Braille hand glove that produces vibration which helps the blind to communicate.

2. Identify the factors that influence visually impaired people to use computer technology.

3. Encourage the visually impaired to have acceptance towards new teaching method using computer technology.

4. Conversion of English letters, digits and symbols to Braille code in a single step

5. Designing the Braille hand glove at its lowest cost.

6. Design hardware and software for Braille conversion which to be platform independent and to support all types of ports of the computer.

7. Minimum usage of energy with help of 12 volt power supply to control Braille glove as a power source and to the use of context matching rules which is much more straight forward and easier to understand. The same voltage is used with the Coin type vibration motor which is perfectly fixed inside the hand glove.

8. Vibration method is new non verbal communication for deaf blind people. So vibration in six different positions of right hand is easily recognized by blind people.

9. Support diabetic blind persons with help of tactile sensation vibration as their finger tips are insensitive

10. Vibration Communication method is the solution for swelling in ankles of continues Braille readers.
3.2 Statement of the Problem

The main aim of the research is to develop a novel methodology which helps visually impaired person to automatically read and communicate with others with the aid of software, technology and to overcome the issues faced by most of the existing Braille system.

The fully automated Braille Code Vibration Translation System (BCVTS) is a novel methodology that converts the English text to Braille code and this Braille code into vibration signal. The vibration activates the relevant positions in the glove worn by the visually impaired person. The BCVTS system is constructed using Braille software and Braille hardware algorithm.

The proposed Braille Code Vibration Translation System (BCVTS) is to research a novel approach to computerize the conversion of English text to Braille Code and on to vibration. This has been developed for the benefit of deaf and blind people, who prefer to work in computer environment. Also this research covers all Braille symbols to equivalent vibrations. This produces a new communication media between a visual person and a blind person. The BCVTS system is constructed using Braille software and Braille hardware algorithm and it is matched with Braille symbols. The software algorithm is implemented in Visual Basic as a screen editor; it accepts the user typed information as input and converts input English text to Braille code using Braille database. The converted Braille code is received by hardware algorithm and is written in HIGH-TECH C language. The micro controlling programs controls the vibrations of six Coin type motors and time delay inside the hand glove. The position of vibration generated inside the Braille hand glove helps the blind persons to recognize the equivalent to Braille code. The Entire process is based on two steps.

Step 1. Conversion of English Text to Braille Code

Step 2. Braille code to Braille Vibration

The above two steps are diagrammatically represented as shown in the figure 3.1.
3.3 Software Design of BCVT System

There are several open source software for Text to Braille Translation, but is not suitable to implement with 89C51 micro processor which controls the Braille hand glove. Also these tools do not have a proof for algorithms in Braille code conversion. The English text to Braille code software tool has been developed by comparing several algorithms of Braille hardware devices like Braille Printer, Braille keyboard and chording gloves. This gives the idea of translation algorithms and functions of converting English to Braille symbols.

Braille hardware devices are constructed using a language rules table which consists of a set of translation rules and a decision table. During translation the software works along the input text, character by character. It attempts to match a window of input text starting with the current character with one of the translation rules in the language rules table. The translation rule then provides the translation for that window of input text, which is appended to the growing output text and this conversion, moves along the input text to the next unmatched character. Based on the idea BCVTS screen design is constructed.
3.3.1 Braille Code Translation Algorithm

The steps to convert English text to Braille code are as follows:

1. **Read the input value up to the enter key.**
2. **Separate the words on the basis of blank space.**
3. **Break the word into single letter.**
4. **Access the Braille database based on the following major condition:**
   
   a. If the input value is between ‘a’ to ‘z’, then it prints the corresponding small letter Braille Symbol from the Braille Database.
   
   b. If the input value is between ‘A’ to ‘Z’ then it prints the corresponding Capital letter Braille symbol from the Braille Database. (Capital letters are indicated by placing a dot in the 6th position of the Braille cell followed by lowercase Braille symbol of the same letter).
   
   c. If the input value is between ‘0’ to ‘9’ then it prints the Braille Numbers from the Braille Database. (Braille numbers are constructed using the first ten letters of the alphabet “a” through “j” and a special number sign(#) i.e. dots 3, 4, 5 and 6 in front of each value).
   
   d. If the input value is in special symbol list (! @#$ %^&*()_+":;’<>? []; /,. Etc) then it prints the corresponding Braille symbol from the Braille Database.
   
   e. Repeat the step 4 until all the characters of the input values are matched with database.
   
   f. If a character does not match in Braille Database then appropriate error message is generated.

By the above mentioned steps, the English letters could be converted to Braille code. This conversion is totally based on one to one matching. Before translation starts, the input is checked, ensuring that any character in the text is appropriate for that language. This may be upper and lower case, for instance. It can simplify translation and can also allow more flexibility if required. If the user types wrong input characters or non special character or any non available character in the Braille list then it generates appropriate error message.
3.3.2 Activity Diagram

Figure 3.2: Flow Chart for Conversion Methodology
The activity diagram in Figure 3.2 shows the conversion of English text to Braille code. This diagram shows the outer loop repeating until all input text has been translated. It terminates the loop only of the input value is Null. It can be seen that if any field does not match, the next rule in the list is considered. If no more rule exists then the first character of the input is removed, the message “error” is appended to the output and the state is reset.

Based on new proposed algorithm, this software tool of BCVTS is constructed using Visual Basic 6.0 and MS Access 2002; it will convert all English Text documents into Braille code format one at a time as follows:

**Braille code conversion system**

In standard Braille, all sixty four cells will correspond to a letter of the English alphabet. When we convert English text to Braille code, the database plays an important role. It is used to store all the Braille cell formats. (Braille cell alphabets are either downloaded from internet as Braille fonts or drawing from several tools). Braille code conversion is coded in the Visual Basic 6.0 language. It is designed to be compiled and run on one of the Microsoft Windows 32-bit operating systems (Windows ’95/98/ME or Windows NT/XP). When compiled to an executable program, in native code, it resides on a machine as a Windows Dynamic Linked Library (DLL). This is a binary executable that supplies a public interface to the Windows operating system and can thus be utilized by other Windows applications with comparative ease.

Figure 3.3: Use Case Diagram for Text to Braille Code Conversion
All Braille cells are stored in MS Access 2002 database. So this concept looks like client/server Architecture. Here Braille database stored in MS Access 2002 acts as a backend tool. Input text box, output text box, format designs, hardware link, help facility are designed in Visual Basic 6.0. It acts as a front end tool and it is connected through ODBC connectivity to Braille database.

The user typed information is stored in the input box of the software tool. During conversion time the software algorithm is applied to the input value, which converts to equivalent Braille code that resides in the Database and stored in the output box of the software tool.

The screen layout of Braille conversion is as follows. It contains major components like:

1. Input Box for English letters.
2. Output Box for Braille code.
3. Control Button for English to Braille code Conversion.
4. Control Button for sending all Braille codes to Hand Glove.
5. Online help facility for Braille and its functions.
8. Clear Button for clear the input screen
9. Size Adjustment button for Braille output
10. Radio Button Hand Glove for timing adjustment
Figure 3.4 Screen Layout of Software Tool in BCVTS System

The following VB code is used to connect Braille hand glove to the computer and output box sends all characters to the output port of the computer one character at a time.

Private Sub cmd_parallel_Click()  ' activate parallel mode in Braille hand glove
    nt = nor_text.Text  ' Store the input values
    For i = 1 To Len (nt)  ' find the length of the input value
        MSComm1.Output = mid (nt, i, 1)  ' send one character at a time
        Sleep (6000)  ' set time delay as 6000 micro second
    Next i
End Sub

The following VB code is used to set initial values when Braille Glove is connected in the screen editor and serial port of the Computer

Private Sub Form_Load()

With MSComm1
    .CommPort = "1"
    .Handshaking = comNone
    .SThreshold = 8
    .RThreshold = 1
    .InputMode = comInputModeText
    .InputLen = 1
    .Settings = "9600, n, 8, 1"
    .PortOpen = True
    'MsgBox "Connected"
End With
End Sub
The following code is used to change the font size of Braille code which is displayed in output box. This different display gives a clear idea about Braille symbols for the beginners.

Private Sub Picture4_Click ()
bra_text.FontSize = 30
End Sub

Private Sub Picture5_Click ()
bra_text.FontSize = 40
End Sub

Private Sub Picture6_Click ()
bra_text.FontSize = 50
End Sub

Private Sub Picture7_Click ()
bra_text.FontName = "Braille"
End Sub

The following code is used to trigger the help menu in the editor. It displays the conversion algorithm, Braille alphabets, Numbers, symbols and Braille history.

Private Sub cmd_help_Click()

Dim a, b as String

Dim c as Double

a = Chr(34) + ("c:\Program Files\Microsoft Office\OFFICE12\winword.exe") + Chr(34)
b = Chr(34) + (App.Path & "\" & "Help.doc") + Chr(34)
Shell a + "" + b, vbNormalFocus

End Sub
3.4. BCVTS Software Implementation-Examples

Example 1:

For example when the input value is “rajasenathipathi”, after clicking the translate button, the corresponding Braille code is displayed in the output box. This is achieved by breaking the sentence into words and then to characters; then total number of input characters is found out with the software tool. The input characters are moved to Braille conversion software engine from the first letter to NULL value. The software will check all 64 combinations of Braille matching value for all the input character values. If a character match occurs, and then it will send the matched input value to the database and produces the corresponding Braille code as output. If no match occurs then the appropriate error message is generated in error box window. Also the maximum number of input characters is restricted to 1000 due to Braille Design format and font style is fixed as Times New Roman.

Figure 3.5 Screen Layout for Braille Code
Example 2:

Here the input value is “I am From Pollachi !!”. So the corresponding Braille code is displayed in the output box. Here style and size control is applied to the output to produce a small size appearance. The serial or parallel button in the Braille conversion tool is used to send the input value to activate the Braille hand glove which is worn by the blind person. The serial button is used to vibrate the motor in Braille hand glove in one by one manner. The parallel button is used to vibrate the motor in Braille hand glove simultaneously which is used to speed up the action. After activating either serial or parallel button the software will check the connectivity of Braille hand glove. Suppose the glove is not connected with any port of the computer then it produce a message, “Hand glove is not connected “.

Figure 3.6: Screen Layout for Braille Code Style