DRISHTI – A Cost Effective Braille Printer

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***Abstract*: Braille Printer proves to be of a very great help for visually challenged people. They are specialized printer or embossers that are used for printing in Braille Format. Unlike a normal printer they use a special type of paper for the purpose. They are noisy and very costly. The main problem in a developing economy like India is that the institutes working for visually challenged people cannot afford these printers which cost in lacs. Project DRISHTI is an attempt to allow a visually challenged person to use the very basic facilities provided by a computer hence allowing them to take advantage of the existing computer technology.**

***Keywords*:-Braille code, Braille script, fontographer**

I. INTRODUCTION

One of the major inventions of the last century is the invention of computers. Computer is predominantly influencing each and every aspect of our life today. Today, the usage of computer is in every field starting from education to entertainment. This very invention is useless for the visually challenged due to their inability to see. Today's computer with multimedia and images are beyond the reach of a visually challenged person to use without an assistance of someone else. Even publishing text books for visually challenged people is a costly affair. This system has a huge scope in a country like India with 40% of world blind population. Being a cost effective solution, it has an added advantage. This system can be used by publication houses which publish books for blind people. It can be used by educational institutes working for blind students. Its low cost makes it feasible for individuals too to buy this printer for his/her personal use. This Paper organized as follows: Section II Relevant theory, section III system design and section IV conclusion.

II. RELEVANT THEORY

2.1 The Braille Script

Braille is a writing system which enables blind and partially sighted people to read and write through touch. It was invented by Louis Braille (1809-1852), a French teacher of the blind. It consists of patterns of raised dots arranged in cells of up to six dots in a 3 x 2 configuration. Each cell represents a letter, numeral or punctuation mark. Some frequently used words and letter combinations also have their own single cell patterns.
There are a number of different versions of Braille:

• Grade 1, which consists of the 26 standard letters of the alphabet and punctuation. It is only used by people who are first starting to read Braille.

• Grade 2, which consist of the 26 standard letters of the alphabet, punctuation and contractions. The contractions are employed to save space because a Braille page cannot fit as much text as a standard printed page. Books, signs in public places, menus, and most other Braille materials are written in Grade 2 Braille.

• Grade 3, which are used only in personal letters, diaries, and notes. It is a kind of shorthand, with entire words shortened to a few letters.

2.2 Braille Codes

Braille scripting requires the text to be printed on a thick sheet of paper using special symbols representing the letters of the alphabets. The symbols are made up of six dots forming a rectangular array of two horizontal dots and three vertical dots. The rectangular array is referred to as a cell and in each cell one or more dots will be printed so as to project slightly from the surface of the paper. A visually challenged person is taught to feel the projections using the fingers and thereby recognizing each letter. The six dots can be arranged in a total of sixty three different combinations. Also the dots are given reference numeral like dot one, dot two etc or simply one, two, three etc. In the rectangular arrangement, the dots are numbered serially from top to bottom with the dots on the left side of the array numbered from one to three and on the right side it's four to six. A sheet of Braille has been standardized to a square size of 11 inches consisting forty cells on each line and twenty five lines on a single page. Bharati Braille is the adaptation of six dot system that can be used to represent languages from India.

2.3 Support for Braille

Visually challenged people write Braille with the help Braille slate and stylus. By placing a sheet of Braille paper in the slate and punching the Braille dots with the stylus thus in the process creating the risings that represents the individual characters in Braille format. This device is very small in size and can easily be fitted in a pocket or purse. Since dots are punched through the paper, so the paper must be turned over in order to read the risings. Braille writer is another instrument that is used by the blind people to make notes in the Braille script [2]. It's very much similar to a common typewriter. It has 6 keys which are used to put holes corresponding to the Braille character on paper. To write Braille using a Braille writer, the user presses the key combination to make the Braille symbols on the paper.

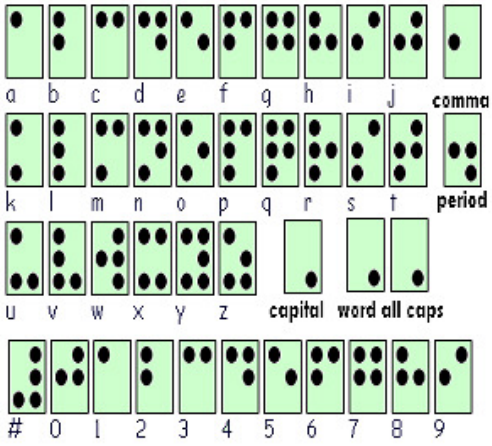

Fig. 1 Snapshot of BRAILLE script

Another very useful gadget is a Braille Note Taker. They are notebooks with the Braille keyboard similar to that of a Braille writer. The written text is stored in memory and then an in-build speech synthesizer can be used to speak those notes. These note takers can be used along with computers to upload and download files, which can be used for some useful purposes. Finally the main device Braille Printer, which proves to be of a very great help for visually challenged people. They are specialized printer or embossers that are used for printing, i.e. by puncturing a paper, the documents in Braille Format. Unlike a normal printer they use a special type of paper for the purpose. They are noisy and very costly.

2.4 Basic Blocks in the system

This system aims at printing any normal text document in the Braille script on an emboss paper. The idea to be implemented is to replace the current vacuum suction principle used in the current Braille printer heads with electromechanical clutching principle [5] used in the electrical door bells. Construction of the printer head is to be accomplished with the help of 6 bell armatures. These will emboss the print paper. Controlling of head is to be done with the help of an interface circuitry consisting of transistors and relays as switches. Software module will take care of conversion of plain English text to Braille text.

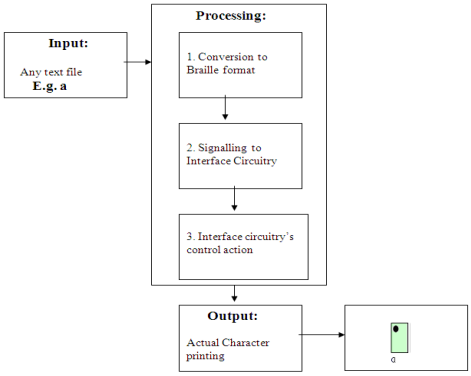

Fig.2 System Overview

III. SYSTEM DESIGN

3.1 Converter and Controller

It will consist of a front end GUI. The input to this module will be any text document in English. This module will be responsible for the conversion of plain English text to Braille script. Once converted, second part is to control the head mechanism with the help of interface circuitry. Control signals to the printer head will be sent from software modules via interface circuitry. The details of each sub modules are given below:

3.2 GUI:

This module provides an interface to user by which a user can interact with the system.GUI will provide user the features to open a particular file and issue print command for that file. It will also provide user options like enabling text to speech feature, explicit conversion of English to Braille script, etc.

3.3 English to Braille converter

As the name suggests, this module will convert English statements into its equivalent Braille format. A standard and easier way to do so is by creating a user defined font. Various tools are available for creation of fonts. One such tool that we are going to use for this system is fontographer [4]. Anyone who works with fonts such as a web designer, digital artist, graphic designer or computer crafter knows how important the font or typeface is to the success of their artwork, website or craft project. With Macromedia's Fontographer, there are just three basic steps to creating a font.

Step1: The first step is to design the individual font characters. You can start from a scanned image or you can draw your font characters by hand or you can transform an existing font character. The digital artist would probably want to start from scratch by using Fontographer's drawing tools to freehand draw each font character.

Step2: Once you have your font characters, you are ready for the next step. You will need to tweak the alignment and spacing for the individual characters. These "metric" adjustments will ensure that the font works correctly with any combination of characters that make up a word. Fontographer's auto spacing and auto kerning features make this step easy or you can make these adjustments manually if you prefer.
Step3: The last step is to convert your font characters into a font file format that can be used on your computer. Fontographer can create Type1, Type3, and TrueType fonts. Once you have your font file, you can use it as you would any other font installed on your computer.

3.4 Interface Circuitry

This module acts as a connecting link between the first module and head mechanism. This module will receive the control signals through LPT port. These signals will drive the semiconductor components present on the interface circuit. It will be mainly consisting of transistors and relays. Both of these components will be acting as switch. The sole purpose of interface circuitry is to drive the print head mechanism. The interface circuitry can also be called as "Electronic Clutch Driver Assembly". It is further divided into two parts viz. Power Supply and Switching circuit.

3.5 Switching circuit

Two semiconductor components viz. transistors and relays are to be used as switches. Their basic configuration as switches and a combined one is as shown in figures below.

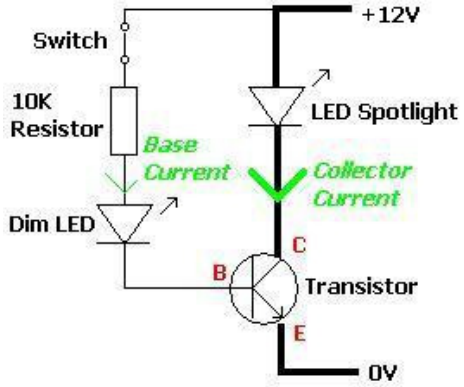

Fig. 3 Basic configuration of transistor as a switch

Sub Part of interface circuitry diagram is as shown in fig. 5 above. Actual interface circuitry will consist of integration of such 6 sub-parts. Whenever the data pin of parallel port outputs logic HIGH, the signal is send to the base of NPN transistor [1].

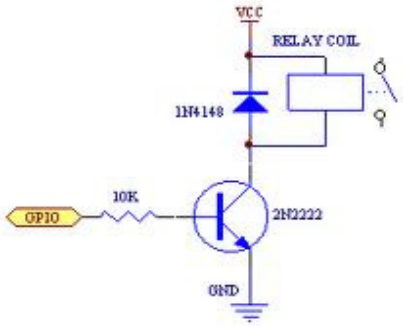

Fig. 4 Basic configuration of relay as a switch

This supply will then magnetise the coil which will result in closing of switch. This will then trigger that corresponding relay. The triggered relay will pass the actual AC supply to the respective bobbin.

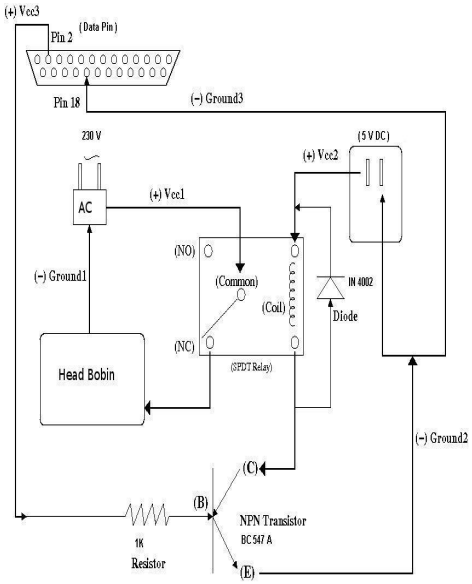

Fig.5 Switching circuit subpart

The transistor becomes forward bias. The required power to drive the relay is given by the 5V power supply.

3.6 Head Mechanism

The heart of the system is the print head mechanism for which the entire software and interface circuitry is to be built. The idea to be implemented is to replace the current vacuum suction principle used in the current Braille printer heads with electromechanical clutching principle used in the electrical door bells. We are using 6 armatures of electrical bell. These will be arranged in a 3x2 matrix format in a single assembly. The movement of the armatures will help in embossing the Braille characters on the print paper. The fig.6 below shows the up and down movement of the T when the current is passed through the solenoid wound around the T.

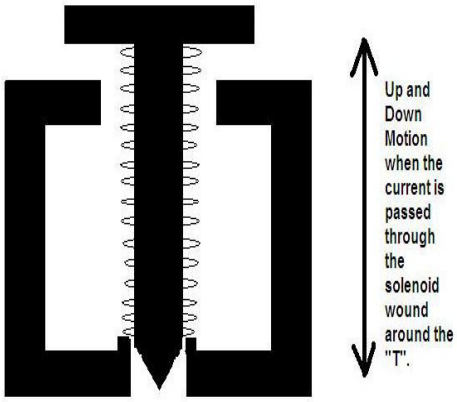

Fig.6 Sample Punching Mechanism

The entire head assembly will consist of six such punching rods arranged in the manner as shown in fig.7. The bobbins of electrical bells are given an external power supply of 230V.

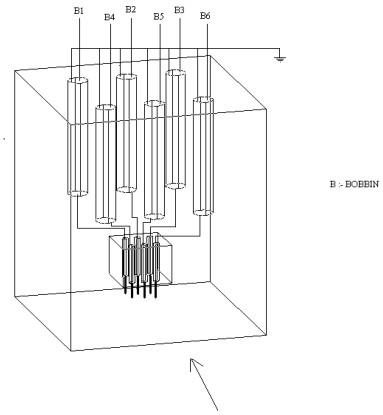

Fig.7 Entire Head Assembly

To the end of each bobbins are attached needles which will help in piercing the emboss paper, thus resulting in embossing of character. The bobbins and needles are placed in a box made up of galvanized sheets.

CONCLUSION

We have proposed a new and cost effective way of developing Braille printers. The new design makes use of electronic clutching principle. The traditional Braille printers make use of vacuum suction principle for embossing the characters on the paper. The system that

has been proposed here eliminates the use of vacuum suction principle and hence reduces the cost of printer to a great extent. To support this new design, we have also given details of interface circuitry and software system that controls this head. Another advantage of this system would be that it will provide a text to speech interface for the blind person so that he can hear what is being printed.

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