Advanced Research in Electrical and Electronic Engineering
p-ISSN: 2349-5804; e-ISSN: 2349-5812 Volume 3, Issue 1 January-March, 2016, pp. 23-26

http://www.krishisanskriti.org/Publication.html

Braille to English Text Interface System with Microcontroller

Dibyendu Sur[1], Biswarup Mukherjee[2] and Vaibhav Gupta[3]

[1]Narula Institute of Technology 81,Nilgunj Road, Agarpara, Kolkata 700109, West Bengal
[2,3]Guru Nanak Institute of Technology, 157/F, Nilgunj Road, Panihati, Sodepur, Kolkata 700114, West Bengal
E-mail: [1]dibyendumalay@gmail.com, [2]bmukherjee.gnit@gmail.com, [3]vaibhav_gnit@yahoo.co.in

Abstract—*The Braille interface method has been traditionally used by the visually challenged persons to read books etc. The designed system has implemented a method to interface the Braille characters and English text characters. The system will help to communicate the Braille message from one visually challenged person to another as well as help us to convert the Braille language to English text through a microcontroller and a PC in order to communicate with the visually challenged persons.*

1. INTRODUCTION

Braille mechanism was invented by Louis Braille in 1821. Braille symbols can be interpreted to finger combination to 6-bit binary numbers conversion. In the method discussed in this paper, person wears a glove through which, switches are connected to each finger. When a particular switch to a specific finger is pressed, binary '1' will be transmitted. If the corresponding switch has been remained not pressed, it can be assumed binary logic '0'. Braille characters can be assumed as a combination of 6 bit binary number with 2 columns each having 3 binary numbers shown in Fig. 1. It can be assumed as the first binary codification system of English messages. The presence and absence of switch at the corresponding digits (at a, b, c, d, e, f) provides '1's and '0's as the binary combination [5].

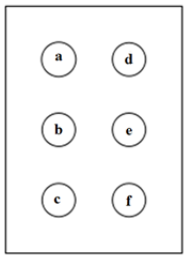

Fig. 1: Positions of binary dots in Braille system

The designed circuit has main objective to recognize Braille character inputs from a visually challenged user and transmit them to another similar Braille device. This system has been embedded onto a glove that can be worn by the blind person. The first four fingers of the glove, starting from the thumb will be fitted with tactile micro switches and a vibration motor. This circuit is then connected with a microcontroller and PC via RS232C cable to interface the Braille words with the PC based text language. The switch pressed by any person will create a Braille code that should be converted to ASCII form by ASCII conversion program for microcontroller and these letters will be seen in PC screen. This is used in order to make the characters USART compatible. Similarly, a PC text word will be reverse programmed into Braille code in order to produce vibration to respective fingers of visually challenged persons in order to make them understand the words. The PC interfacing procedure is shown in Fig. 2.

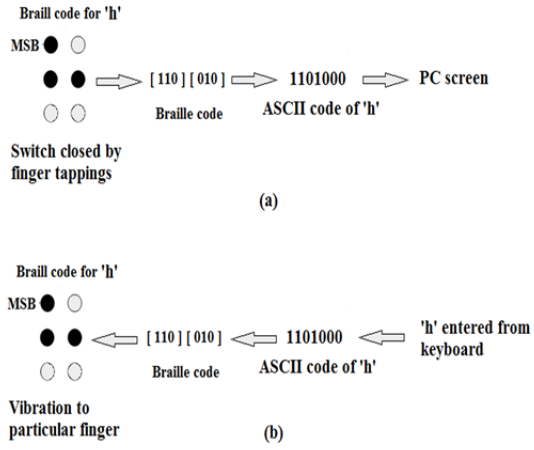

Fig. 2(a). Braille to PC communication (b) PC to Braille communication

2. COMMUNICATION MODE OF OPERATION

The designed system can work in communication mode (data to be communicated from one Braille system to another or communication between Braille and PC), store mode, record

mode, read back mode and erase mode. The communication mode is most important and it combines the communication between two gloves and Braille to PC communication. For PC connections, DB-9 connector from gloves should be connected with DB-9 male pot of computer. If it is connected to another glove, two DB-9 female connectors must be connected via gender changer. A hyper terminal window opens up while connecting to a PC. The necessary information like bits per second, parity bit, data bits, stop bits have to be specified. Thumb finger is used for column separator. The switch information goes to Atmel Corporation's AVR ATmega16 microcontroller with proper ASCII mapping and then it is fetched to PC for display in hyper terminal.

From PC, the data can be transmitted to another computer or can be stored in server. The configuration is shown in Fig. 3.

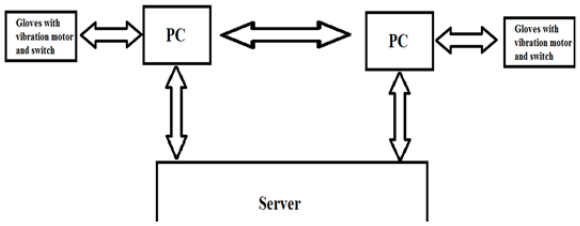

Fig. 3: Communication of Braille words

For near communication, Bluetooth, IR or ZIGBEE are normally used. In case of far remote data transfer, the data sent from Braille are stored in a file and are sent by internet with messenger protocols such as MSNP10 (MSN Messenger Protocol 10) or YMSG protocol (Yahoo Messenger protocol) [2, 4]. It has been assumed that the total number of sender and receiver is one. A text file is auto generated in order to serve the logging of the conversation. The text file may be sent by peer-to-peer data transmission mode.

3. MICROCONTROLLER CONNECTIONS

The AVR ATmega16 microcontroller has the following features.

RISC Architecture:

1. 131 instruction set
2. Single clock Cycle Execution
3. 16 MIPS Throughput at frequency of 16 MHz
4. On-chip 2-cycle Multiplier
5. 32 × 8 bit General Purpose Registers
6. Non-volatile Memory
7. 16K Bytes on-chip programmable Flash memory
8. 512 Bytes EEPROM and 1K Byte Internal SRAM
9. Data retention: 20 years at 85°C/100 years at 25°C
10. 10,000 Flash/100,000 EEPROM write cycle
11. User programmable USART support
12. 4 PWM channels

The necessary circuit diagram from Braille based vibration motor and switch to microcontroller has been shown in Fig. 4.

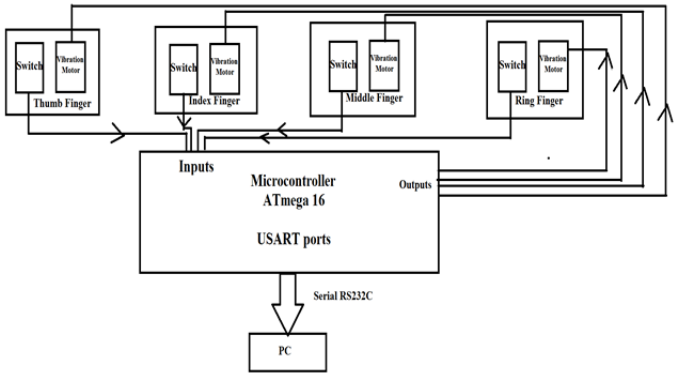

Fig. 4: Finger connection with microcontroller and PC

For capital letters, special combination is provided in Braille language so user can distinguish any font change.

The input to the microcontroller is given via switch which is connected in fingers. The switch must be pressed for at least some predetermined time interval in order to assume the number as binary '1'. The following combination is then programmed to ASCII number and it is sent to PC. A level converter program has also to be written in order to make the data RS232C compatible.

The Serial In-System Programming (ISP) feature in AVR ATmega16 enables us to program the microcontroller even if on runtime, it is connected to its necessary circuit. The serial programmer connection should be connected to the serial port of the computer using the DB-9 connector. The necessary hex code is downloaded in flash memory of microcontroller through the pins named MOSI and MISO. AVR Studio software is used to convert the embedded C program to hex AVR code and transfer it to the microcontroller.

4. SERIAL COMMUNICATION WITH PC

RS 232C cable is used for serial communication between microcontroller and PC. For proper USART connection, Rx and Tx wires along with ground cables are used for this communication. Tx is used to transmit the data whereas Rx is used for receiving the data. The necessary bits per second, number of parity bita, stop bits, frame and frequency has been decided and programmed. Correct selection of Baud rate is crucial for serial communication through RS 232C port. An internal RC oscillator with frequency of 8MHz is used as the clock circuit for our microcontroller. Baud rate is chosen of 38400 bps for having error percentage around 0.2%. UBRR

value or USART Baud Rate Register is assigned to 12 for this decided setting.

MAX 232C IC from Maxim Corporation is used for conversion from TTL logic to RS 232C compatible logic and vice versa. It is used as line driver/ receiver.

5. VIBRATION MOTOR INTERFACING CIRCUIT

The vibration motors used in this work is manufactured by LG. 12pi Coin or Flat Type Vibration Motors are used in this purpose. The snapshots are shown in Fig. 5.

Fig. 5: Snapshot of a vibration motor

Vibration motors are connected to the individual fingers through gloves. The A Tmega ports Port4 to Port7 are used for vibration purpose for different fingers. Thumb is connected to Port4 and the ring finger is connected to Port7 pin. The operating voltage is around 2.5 Volt. Maximum allowable current is 80mA. The transistor BC 548 is used to provide the sufficient current to drive the motors which are connected to the collector. A current limiting resistance of value 47Ω was used. The Back emf is controlled by the diode which is connected with reverse order along vibration motors. The necessary circuit diagram is shown at Fig. 6.

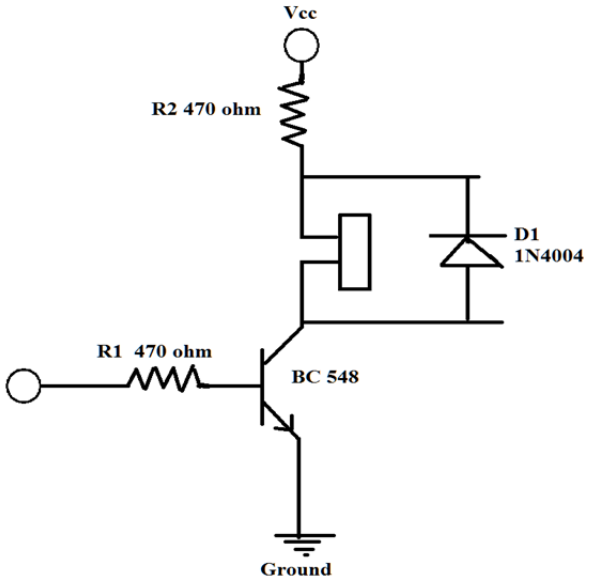

Fig. 6: Vibration motor interfacing circuit

6. FUTURE SCOPES

The following features are needed to be upgraded in future.

1. Wireless data transmission method establishment.

2. As the recent PCs do not support DB9 connectivity, the communication may be established by USB device.

3. LAN/ Internet connection can be established.

7. ADVANTAGES AND APPLICATIONS

The domain of applications of the designed system have been summarized below

1. This system can provide direct communication between two visually challenged persons.

2. This system will enable us to communicate with the visually challenged persons via PC. The text they want to tell can be displayed to us by PC screen. Again if one normal person enters some words to PC, then these data can be communicated to them via vibration motors in specified fingers.

3. This system practically gives a chance o visually challenged persons to use the computer directly by their own.

4. If upgraded in future, the remote internet communication technique can be used by visually challenged persons to send their email via internet.

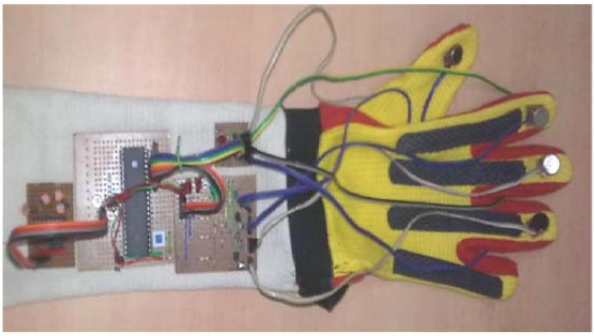

Fig. 7: Snapshot of the work with the vibration motor circuit at gloves

REFERENCES

List and number all bibliographical references in 9- point Times, single-spaced, at the end of your paper. When referenced in the text, enclose the citation number in square brackets, for example [2-4], [2, 5], and [1].

[1] Rex, E. J., Koenig, A. J., D. P. Wormsley, D. P., Baker , R. L., "Foundations of Braille literacy" , *1st Ed., AFB Press, New York,* 1994

[2] Yahoo messenger protocol, Yahoo! Coder's Cookbook Available http://ycoderscookbook.com

[3] Mintz, M., Sayers, A., MSN Messenger Protocol, Available: http://www.hypothetic.org/docs/msn/index.php

[4] Yahoo! Messenger Plug-in SDK documentation, Available: http://developer.yahoo.com/messengerBriand, L. C., Daly, J., and Wüst, J., "A unified framework for coupling measurement in objectoriented systems", *IEEE Transactions on Software Engineering*, 25, 1, January 1999, pp. 91-121.

[5] Mukherjee B., Chakraborty B., Gupta V., Choudhury A., Ghosal S., Mandal Kr. P., Sur D., "A Braille based Human-computer Interface and Trainer", *Proc. of ICTTAP 2010, at SPS University, Udaipur,* 2010.

[6] Barnett, R., O'Cull, L., Cox, S., "Embedded C Programming and the Atmel AVR", *Delmar CengageLeraning, New Delhi, , 1st Ed,* 2007.

[7] Eady, F., "Networking and internetworking with microcontrollers", *Elsevier, Oxford, 2004, 1st Ed.octoral Thesis,* 2003.