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Braille to Text Conversion using Slot Sensorized Hand Glove

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Abstract - *Visually impaired people find it extremely difficult to acquire basic and vital information necessary for their living. Therefore, they are at a very high risk of being socially excluded as a result of poor access to information. In recent years, several attempts have been made in improving the communication methods for them. But there are some problems which arise in such methods such as lack of privacy and lack of compatibility to computer environment. All over the world, persons who are blind have used Braille as the primary means of accessing information. Almost all countries have adapted the system "Braille" as a universal approach that works to get the information for visually impaired. This paper describes a low cost Braille hand glove for blind people using slot sensors with the help of which they can read and write emails. This glove allows the person to type characters based on different Braille combination using six slot sensors. The implementation of real-time two-way translation between English and Braille, and communication of the wearable device opens up new opportunities of information exchange between blind individuals.*

Key Words— Braille, Braille Hand-Glove, Slot sensors, Visually impaired,

1.INTRODUCTION

Blind people are integral part of society. However, their disabilities have made them to have less access to computers, the Internet, the e-papers & e-books also the high quality educational software, than the people with clear vision. Due to this, they have not able to improves their own knowledge & have significance effect on economic, commercial sectors in society. To acquire information necessary to carry out normal day to-day activities, this low cost real-time communication Braille Glove can immensely benefit the visually impaired people, who work in the computer environment. This concept will go a long way in helping them learn on an equal footing with their sighted counterparts. The innovative idea in this design is the reverse engineering process for the above problem i.e. it has a unique feature of typing messages through hand gestures of all the Braille codes. This is accomplished by using slot sensors on the five fingers of the glove and one on the wrist. Hence different hand gestures correspond to different Braille codes. These Braille codes are sent wirelessly to the PC where they are converted to display the corresponding alphabets, words and sentences. If a person wants to read a character from the PC, then the character corresponds to a Braille code which is matched to algorithm and the character is read efficiently by the reader. This acts as an effective two-way communication tool in online chatting and new effective teaching methodology for visually impaired people.

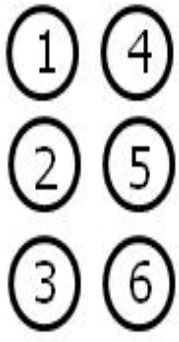

Fig1.(a) Braille Cell

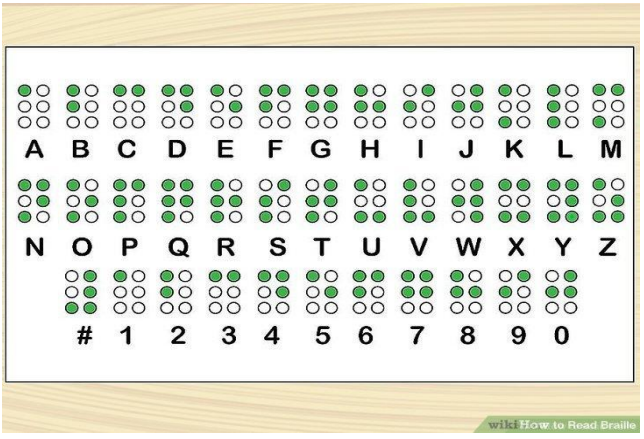

Fig1.(b) Braille chart

Objectives of developed work are,

1. To improve the impaired to normal person communication methods.
2. To allow the impaired person to type and read characters based on different Braille combination.
3. Low cost.
4. Comfortable to use.

2. PRACTICAL IMPLEMENTION

2.1 BLOCK DIAGRAM:

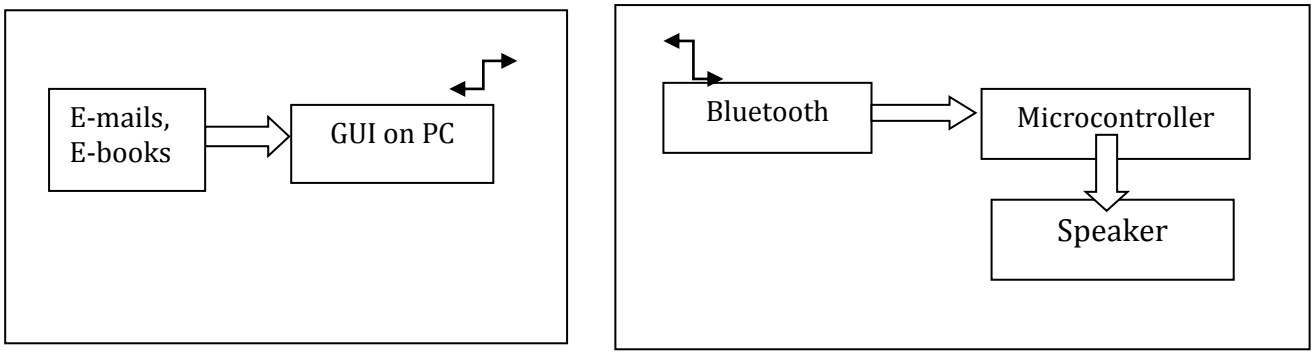

Fig.2(a)Block diagram of the module for reading text

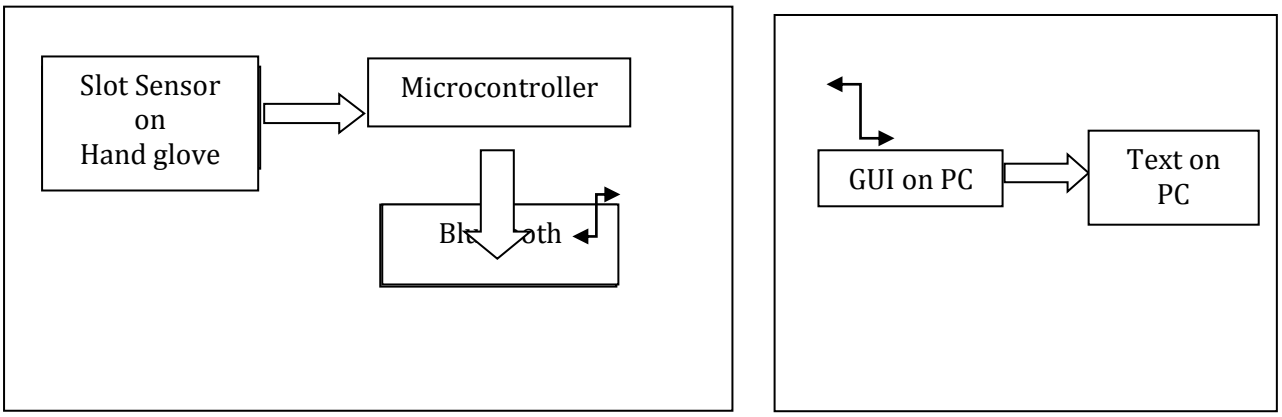

Fig 2(b) Block diagram of the module for typing text

3.Working Component

The sensor is electronic equipment employed to identify and react to the natural phenomena and takes it as their input. The input such as moisture, pressure, temperature, heat and light. The signals are generated as the output of the signal which is in the form of human-readable format to the specified location is transmitted through a network for further analysis or processing. In this paper the two sensors are used majorly for sensing which are listed below.

A. TCST2103 Sensor

The slot sensor used in our project is TCST2103 . A slot sensor is an Opto-isolator module, with an Infrared (IR) transmitter & a photodiode mounted on it. It performs Non-Contact Object Sensing. This is normally used as a position sensor switch (limit switch) or as Position Encoder sensors used to find the position of the wheel. It consists of Infrared (IR) LED and Photodiode mounted facing each other, enclosed in plastic body as shown in fig.3(a).

B. Bluetooth module

Bluetooth module can easily achieve serial wireless data transmission. Its operating frequency is among the most popular 2.4GHz

ISM frequency band (i.e. Industrial, scientific and medical). It adopts Bluetooth 2.0+EDR standard. In Bluetooth 2.0, signal transmit time of different device stands at a 0.5 seconds interval so that the workload of Bluetooth chip can be reduced substantially and more sleeping time can be saved for Bluetooth. This module is set with serial interface, which is easy to use & simplifies the overall design/development cycle. It has 4 pin in which 2 for transmission and reception i.e. TXD & RXD also VCC & GND for power supply.

C. Ardiuno UNO

Microcontroller is the processing unit of proposed design. All the conversion algorithms are to be stored in the memory of microcontroller. Ardiuno UNO is the development board having the ATmega328. It consists of 14 digital i/o pins & 6 analog i/o pins to connects different peripheral devices, 16 MHz crystal oscillator for a clock, a USB (mini) connection, a power jack, a reset button.

Figure 3.(a) TCST2103 Sensor

Figure 3.(b) Bluetooth module

Figure 3.(c) Ardiuno UNO

MATCHING BRAILLE CODE & HAND GLOVE

A braille cell is a rectangular cell consisting of six dots arranged in the form of a 3x2 matrix. These six dots allow sixty four different patterns of dot arrangement. Therefore, these dots arrangements can be used to represent sixty four different characters. The hand glove comprises of six slot sensors, five which are placed on the fingers and one placed on the wrist and six vibration motors, five of which are placed on the fingers and one is placed on the palm. Fig. 1 shows the one to one correspondence between the Braille cell and the hand glove. Say for example, If the user wants to type a letter 'e', this is represented by the first and the fifth dot on the Braille cell. So the user will bend only his/her thumb and the last finger to type the letter 'e' successfully. Therefore the user does not require any special training for the hand gestures.

METHODOLOGY

The proposed system can be divided into two modules. The first module is for receiving or reading online text from the PC which is done using the speaker of PC. The second module is for writing online text messages and emails which are accomplished by different hand gestures corresponding to the Braille code of the particular character to be typed using lower cost and effective slot sensors. Fig.2(a) shows the block diagram of the first module of the system. In this module the e-mails and online text is sent to the Graphical User Interface (GUI) on the PC. The American Standard Code for Information Interchange (ASCII) value of the character to be read is sent wirelessly from the PC to the Micro-controller using the wireless Bluetooth module. The American Standard Code for Information Interchange (ASCII) value of the character sent from the PC is converted to the corresponding Braille code using a conversion algorithm. This conversion program is written in an Embedded C language and it is recorded in microcontroller of the hand glove.

As shown in fig.2(b), according to the different braille hand gestures using slot sensors the corresponding alphabet is wirelessly transmitted to the PC. To type a character, particular hand gesture is made corresponding to the Braille code of that particular character. The slot sensors are placed on the five fingers and one on the wrist so a total of six slot sensors are used which represent the six dots of the Braille sheet. A mechanism is developed for the slot sensors such that when a finger is bent the slot sensor which is placed on the finger gets low. When the finger is in the relaxed state the sensor produces high output. This slot sensor is connected in a resistor circuit. If the user wants to type the letter 'a', which is represented only by the first dot on the Braille sheet, then the user will have to bend only his thumb to type the letter 'a'. Arduino is used for processing the sensed data from the sensor and Bluetooth is used for wireless transmission. the Graphical User Interface which is developed using MATLAB for reading as well as writing text. There are two modes of selection which are read and write. On pressing "*", read mode will be activated and on pressing "#", write mode will be activated by entering valid username and password, the user will be logged into his account. User has composed a mail which was sent successfully. The

mail was received in the inbox of the recipient. The graphical user interface is linked to internet so the user can comfortably type a text online.

RESULTS

Fig.4(a)Prototype of hand glove with slot sensors

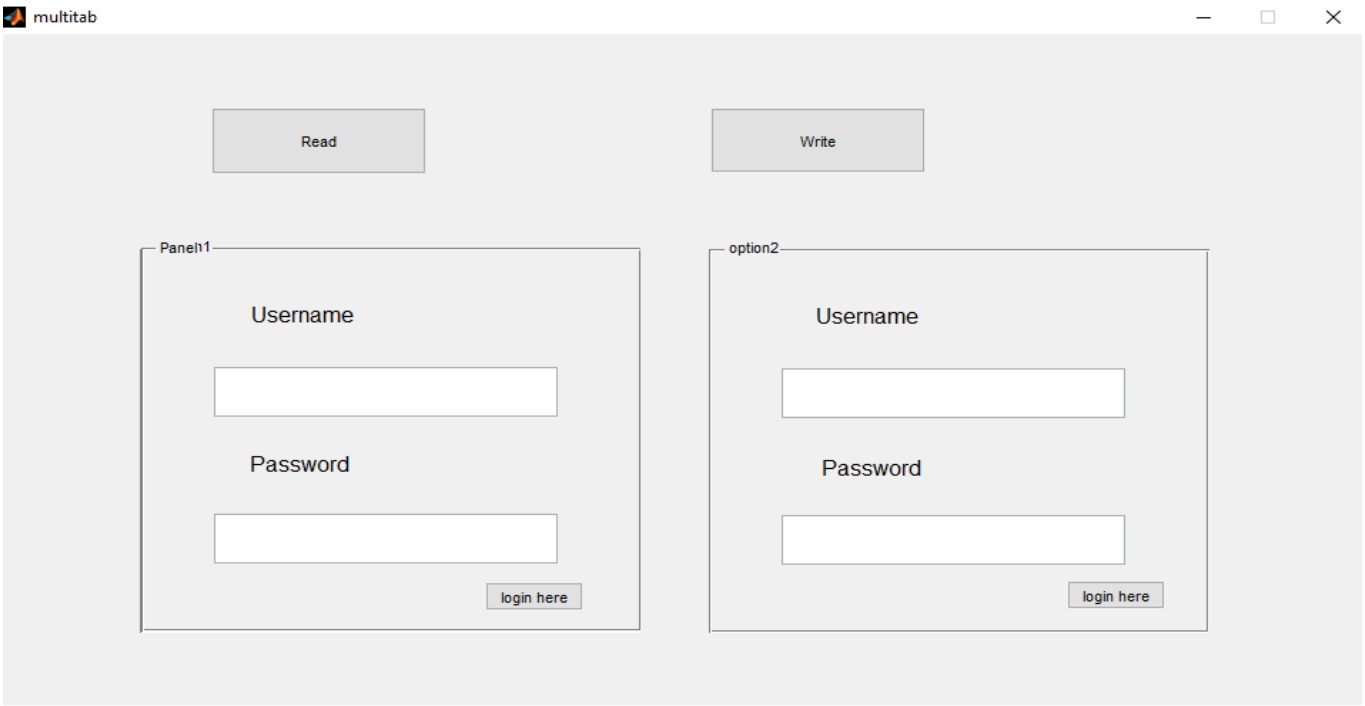

Fig.4(b) Matlab GUI

Fig.4(a) shows the different electronic components and modules which are used in the developed system. The microcontroller development board, wireless Trans-receiver module and various electronic components used is shown. Fig.4(b) shows the Graphical User Interface which is developed using MATLAB for reading as well as writing text online. This is linked to web pages and internet.

CONCLUSION

The main objective of this work is to develop an easy-to-use hand glove for the blind people in order to enlighten their dark lives. With the designed Braille Hand Glove, we are able to provide an efficient method of communication to the visually impaired people. By the proposed model, they are exposed to technology and have greater access to the digital media. The given design will also enable the blind people to stay in touch with the people at distant places. So apart from the delay caused during the procedure, the given model is win situation for the blind people when we talk about digital communication. The Braille Hand Glove can be successfully used to receive as well as transmit text data from the PC to the glove and vice versa based on the different standard Braille combination. This Braille Hand glove can also be used by blind people for other applications like opening web pages and reading E-books independently with the help of Graphical User Interface (GUI) from MATLAB.

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