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Flex Sensor Based Text Recognition System for Blind People Using Android Mobile.

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ABSTRACT

The ever-increasing popularity of mobile devices such as smart phones and tablets have made the communication more easier. And the mode of Human Computer Interface(HCI) originally designed for sighted people is highly inconvenient to use for disabled people. Everybody faces difficulties and hardships at one or another time. But for disabled people, barriers can be more frequent and have greater impact. In this work the designing of a smart glove for the differently disabled set of humans is discussed. The glove is linked with a GSM-GPS module to facilitate the data communication by using wireless technology. Here the user sends the SMS to the blind person's smart phone and it is connected to the microcontroller which is able to read the text message using an inbuilt AT commands and then converts each character of the message into Braille code with the help of lookup table present in its memory. Using 6 relays, PIC microcontroller vibrates the motors which are fixed on the glove acts as a basic technology on which the blind person can read the SMS.

Keywords: Flux sensor, Vibration motor, RS232, AT commands, GSM SIM A900, Braille Language

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INTRODUCTION

Smart phones are the important part of our modern life. It is always necessary for us to make a call or send a message at anytime from any part of the world. For visually impaired users voice based list of contact are provided with many cell phones, they can choose contacts through voice and make call whenever necessary. Irrespective of all these advancement in the telecommunication technology, the physically (visually) impaired people have limited access for these technologies. So to fill up the gap between the blind people and the technological advancement in the telecommunication field we have decided to design a Smart Glove system for them. For that impetus we are using Braille language as the backbone of the project. So the visually disabled people use the Braille language for reading and writing messages. Now our focus is limited towards short message system, it is text messaging service serves as component of mobile phone, by using standardized communications protocols that allow the exchange of short text messages between mobile phones. We are designing such type of a modular device which can be accessible by blind person. Till today Braille books are used conventionally. But it is not an economical way of communication now a day. It has limitation on the maximum number of words per page and pages per book. So we are interfacing Braille pad with the mobile phone so that visually impaired person can have the access to the SMS system.

EXISTING SYSTEM

E-Mail or messages received at computer's GUI is sent to the Radio Frequency transceiver module CC 2500 and then it is given to ASCII to Braille conversion algorithm which is present in microcontroller. This converted code in AVR microcontroller sends the signal to vibration motor in Braille Pad as shown in figure 1. The motor starts to vibrate according to the Braille dot matrix for each character.

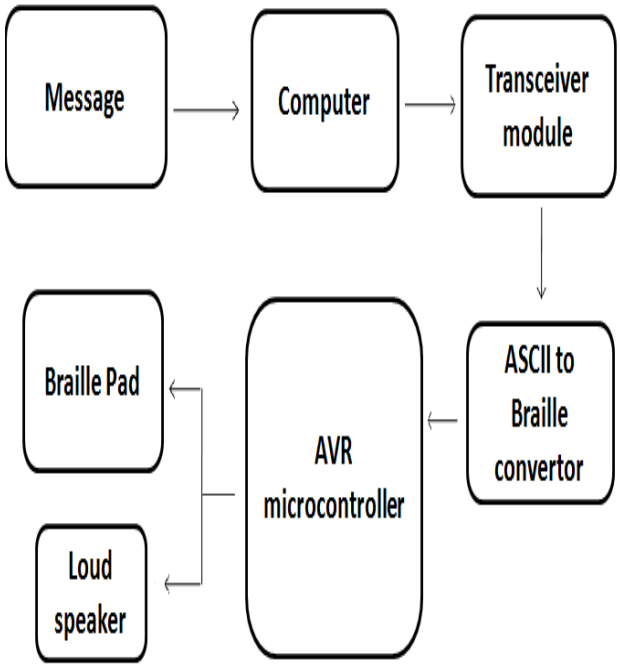

Figure 1: Existing System Block Diagram

DISADVANTAGES

- AVR gives jitter, consumes more power, highly non- orthogonal instruction set and many operations can only be done on certain registers.
- Tiny AVR has less memory, small size and it is suitable only for simpler application.
- Xmega AVR is used for complex applications which require large program memory and high speed.

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PROPOSED SYSTEM

The main objective of this project is to develop a low cost Braille smart glove using flux sensors and vibration motors to read and write text messages, e-mails and e-books. The vibration in six different positions of the glove which matches to the Braille code allows them to read the characters. This glove allows the person to respond for the message using the flux sensors. The hand glove is linked with a GSM-GPS module to facilitate the data communication by using wireless technology. Here the user sends the SMS to the blind person's mobile number which is connected to the microcontroller which is able to read the text message using inbuilt AT commands. Then converts the character of the message into the Braille language using the lookup table presents in its memory. Using 6 relays, PIC microcontroller vibrates the motors which are fixed on the glove acts as a basic technology on which the blind person can read the SMS as shown in figure 2.

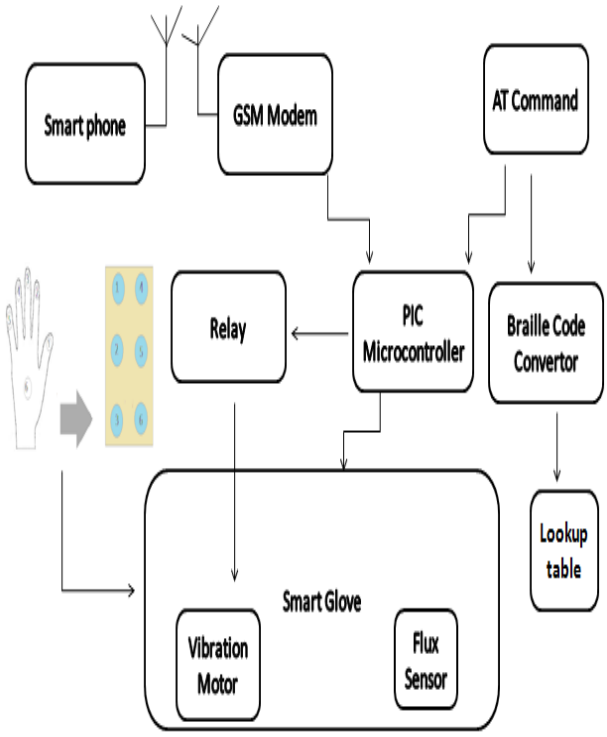

Figure 2: Proposed System Block Diagram

HARDWARE COMPONENTS AND DESCRIPTION

PIC 16F877:

The microcontroller that has been used for this project is from PIC series. PIC is the first RISC based microcontroller fabricated in complementary metal oxide semiconductor that uses separate bus for instruction and data allowing simultaneous access of program and data memory. The foremost advantage of CMOS and RISC combination is very small chip size resulting in low power consumption. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques represented in figure 3.

PERIPHERAL FEATURES :

- Timer0, Timer1 andTimer2 are 8 & 16 bit timer/counter with 8-bit period register, prescaler and postscaler
- Two Capture, Compare, PWM modules, Analog-to-Digital converter, Synchronous Serial Port with SPI and I2C
- Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with 9- bit address detection. Brown-out detection circuitry for Brown-out Reset (BOR)

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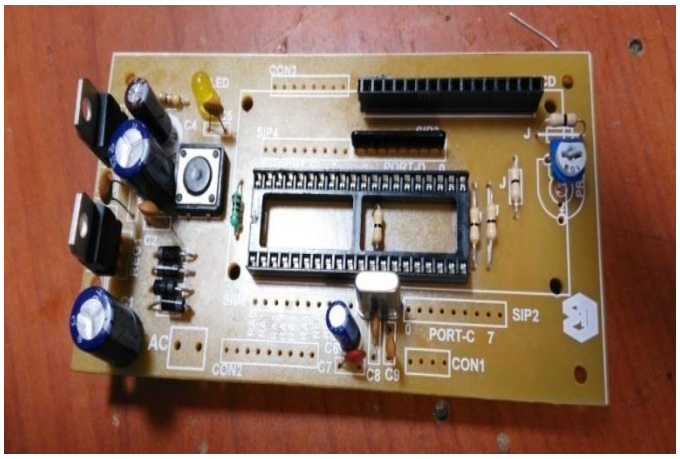

Figure 3: PIC Development Board

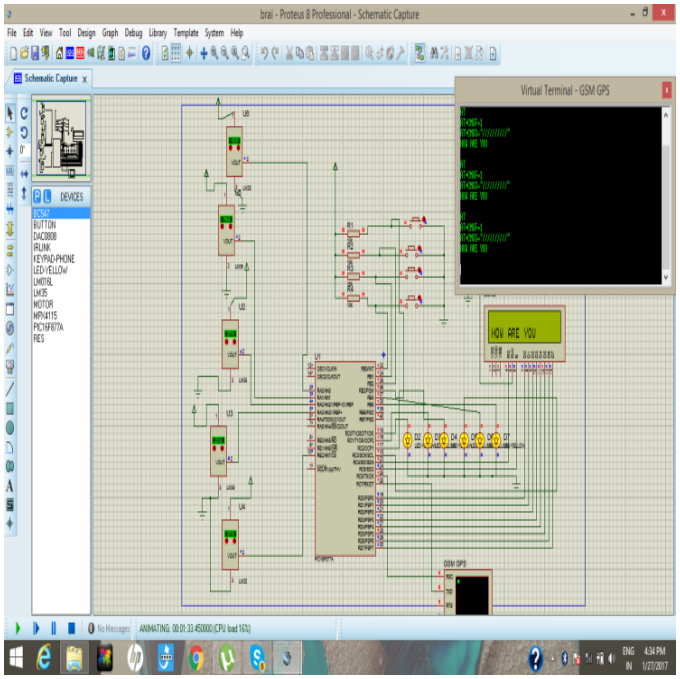

Figure 4: Output Through Virtual Terminal

FLEX SENSOR :

The flex sensor technology is based upon the resistive carbon elements. The flex sensor is a variable printed resistor which achieves great form factor on a thin flexible substrate when it is bent. The based upon the bend radius, sensor produces a resistance output. Smaller the radius higher the resistivity value. Spectra symbols has used this technology in supplying flex sensors for the Nintendo power Glove, the P5 gaming glove etc. To facilitate the response from blind person we have fixed this sensor in the smart glove. Each flex sensor is assigned with a particular message say for example, hi, How are you? Etc. When a particular finger is bent text which is assigned for that specific sensor will be sent.

VIBRATION MOTOR:

The basic functionality of the vibration motor is to alert the user to incoming calls. They are normally classified into cylinder type and button type. The Principle behind the cylinder type vibration motor is an offset counterweight is fitted to the end of the motor shaft. When the shaft turns, the imbalance in the

counterweight causes the handset to vibrate. One of the main components is the vibration motor placed on the glove which vibrates according to the message received at the blind persons mobile. The miniature vibrating motors are used in a wide range of products such as, scanners, medical instruments, GPS trackers, and control sticks. Vibrator motors are also the main actuators for tactual feedback which is a less expensive way to increase a product's value, and differentiate it from competition.

RELAY:

Relays have two circuits one is control circuit and the other is load circuit. The first circuit has a small control coil while the load circuit has a switch and the coil controls the operation of the switch. When a current flowing through the control circuit coil creates a small magnetic field which causes the switch to close . The switch which is a part of the load circuit and it is used to control an electrical circuit that may connect to it and the current starts to flow when the relay is energized. When current stops flowing through the control circuit the relay becomes de-energized. Without the magnetic field, the switch opens and current is presented from flowing. The relay is now OFF.

LCD DISPLAY:

Liquid crystal display is used to show the messages received and sent by blind person. They allow much thinner displays consumes low power coparing to Cathode Ray Tube, LED's and gas display. 16*2 LCD is interfacd with 40 pin PIC microcontroller. To initialize the display and to perform the functions like turning the display's back ground light, moving cursor to next position, sending command and data to LCD there are set of functions. To turn ON display and OFF the cursor we use lcdcmd(0x0c) and to clear the display lcdcmd(0x01) is used. For sending the command the Register select pin and Read Write pin should be low. If the data is sent then, only RS is set to 1 and RW to 0. Enable pin is always kept high.

GSM, RS232 & MAX232:

GSM stands for global system for mobile communication widely used in many parts of the world for digital telephony. SIM 900 is a compatible quad band moble phone normally functions at frequency of 850 to 1900 MHZ. RS-232 is a straight cable which is used to make connection between Data terminal equipment and data communication equipment. In this paper it connects the GSM SIM900 with PIC microcontroller. RS232 is used for exchanging the digital data between electronic devices. MAX232 IC is a dual driver/receiver converts the signals such as TX, RX, RTS and CTS from RS232 serial port in such way it is suitable for TTL digital logic circuit.

SOFTWARE IMPLEMENTATION:

PROTEUS:

Using Proteus Design Suite a schematic capture, simulation and PCB Layout modules can be developed.. this software helps to perform testing of any embedded application before hardware implementation. It consist of many similar and equivalent components as that of the real time hardware devices. Some of them are PIC, resistor, ground, power supply, LED, LCD display etc. And certain devices like GSM, flex sensors are not available so they are replaced by virtual terminal, LM35 etc. The micro-controller simulation in works by dumping either a hex file or a debug files to the microcontroller part on the schematic capture as per figure 5.

MICRO VISION KEIL:

MP Lab is a proprietary IDE (Integrated Development Environment) developed by microchip technology for the embedded systems application on PIC microcontroller. The coding is written in C language for the controlling operation of the smart glove. Whenever a message is received it should be converted into Braille language. The program is initialized by writing the header files which contains function declarations and macro definitions to share with other source files. The required variables and functions are declared in the program are called using the main function. The different functions created in this program are Keypad(), GSM_init(), enter(), send(), communication(), interrupt(), LCD_init(). Inside a main() function the ports should

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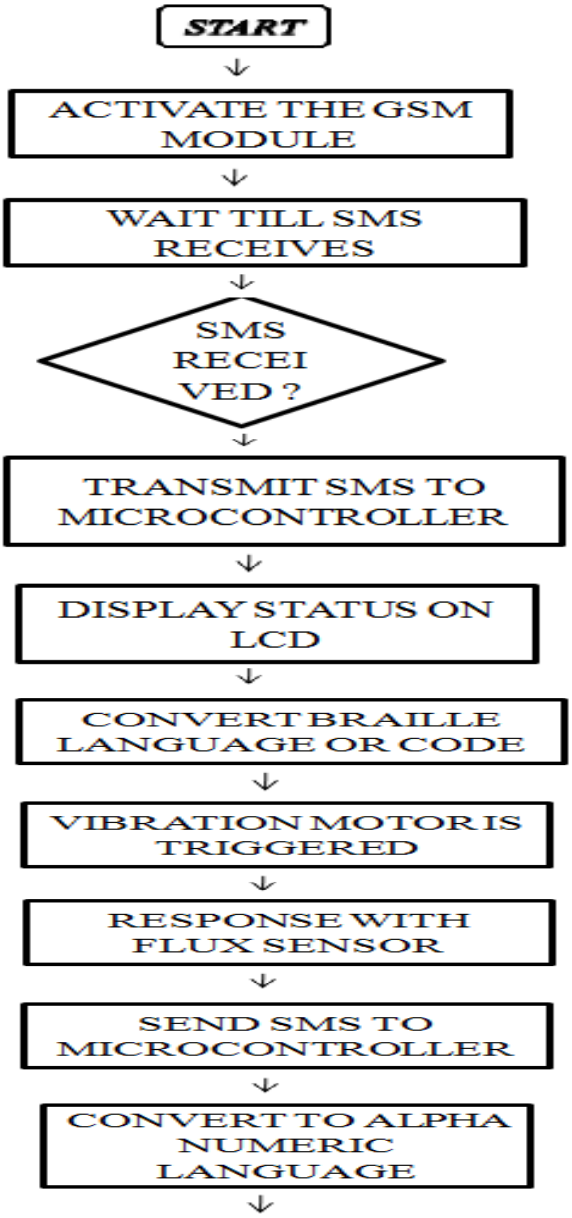
be assigned as input or output using TRIS register and all relays are set to 1. So that the LED's will be in ON state. Then a LCD_init() function is called which turns on LCD display and a cursor blinks. It displays "Braille comm" in first row and "with Braille pad" in second row. After a delay of few seconds the execution enters into a loop where the 10 digit mobile number will be stored in EEPROM. To enter the number we have 4 switches in which first switch is to enter the number, second switch increments & third switch decrements the number and the fourth switch will move the cursor to the next position. Next step is calling the GSM_init() function where "AT, AT + CMGF, AT + CNMI" commands are used to initialize the virtual terminal that is the hardware GSM modem and the messages will be displayed on it. The enter() function is used for conversion of normal alphabets to Braille code. After the conversion process the six LED's will glow according to the tiny palpable bumps called raised dots. Each dot and LED is given a number as L1, L2, L3, L4, L5 & L6. In which ever position the dots are raised the LED turns off indicating the Braille text. Then the LM35 resistivity value is varied, if they outpace the threshold value of each variable resistor the response messages whichever is assigned to it will be displayed in the virtual terminal.



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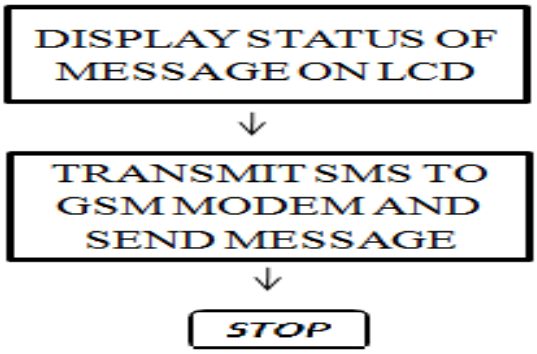

Figure 3: Testing of Prototype Using Proteus

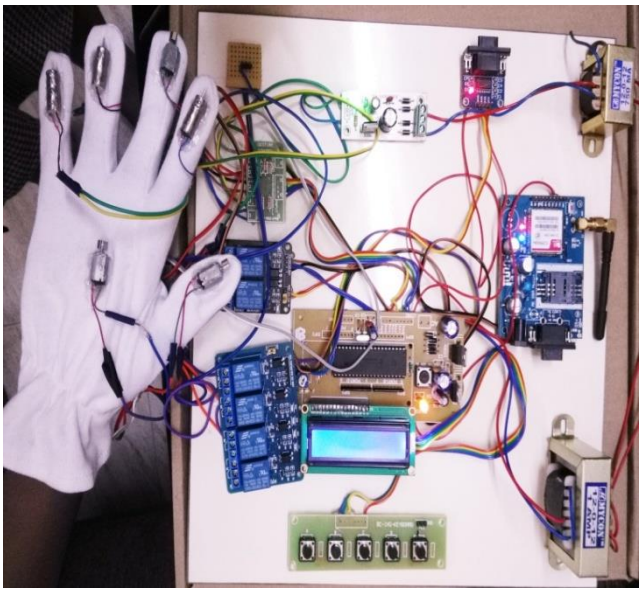

Figure 6: Hardware Implementation

Figure 4: Prototype of Smart Glove with Flex sensor & Vibration Motor

CONCLUSION

The smart glove developed using flex sensor and vibration motor can be used for transmission and reception of message from android phones. This smart glove can be used by deaf-blind people for opening web browsers, e-books, making phone calls etc using Graphical User Interface. When the prototype was tested the delay between characters made the understanding of transmitted text difficult. Once after increasing the delay it was felt comfortable and understandable. This flex sensor based text recognition system has been tested using deaf-blind student and they felt it very comfortable to use. It is depicted in figure 6 & 7.

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