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# Design and Implementation of Messaging System Using Braille Code for Virtually Impaired Persons

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**ABSTRACT**: The system is specially designed for the visually impaired community to connect, communicate and socialize without vision. Enabling those who are blind to accomplish important tasks with just their sound and touch via a comprehensive eye free. Now a day physically impaired people have no access of advanced communication technologies. To aware the blind peoples with the advance telecommunication system, our approach focused on design a Short Message Service (SMS) system for them, it interface Braille pad with the cell phone. For sending a SMS, the microcontroller IC AT89S52 is used which converts the typed Braille letter on Braille pad to the English alphabets using the Lookup table. The first blind person sends the message to the another blind person's mobile number which is connected via microcontroller which reads the message using GSM module which operates on AT commands and then converts the letters received in the message into the Braille language using the lookup table in its memory. With the help of 6 relays Microcontroller vibrates the Braille pad on which the blind person can read the message. LCD and Loud speaker are used for display and voice announcement it helps verification of the system response.

**KEYWORDS:** Microcontroller, Braille Pad, SMS, Message.

## I.INTRODUCTION

Now a day there are a huge range of mobile phones on the market, ranging from the most basic (all they do is make calls) to models more complex and powerful than a desktop computer. But the visually impaired people cannot able to use this facility[1]. Louis Braille was the father and inventor of Braille system. This is a worldwide universally accepted basic system that is being used by blind people for reading and writing purpose. Braille is read by passing the fingers over characters designed as an arrangement of one to six embossed points. Braille is not a language but it is the way of writing other languages. Louis Braille self-invented raised dot system getting inspired by the wooden dice given by his father; consisting of only six dots which corresponded to letters. The six-dot system helps to recognize alphabets or letters passing fingertip sensing all the dots at once. These systems are arranged in rectangular patterns of dots so that the system can easy to learn [2-5].

Today Braille became one of the most important ways for the blind to learn and share information; many kinds of Braille products are available in the market to help the blind peoples. Among these products, Braille note takers, slates, paper etc are widely used by blind people [6]. Especially in the educational context, a note taker is an essential device used by blind students to carry out assignments and take notes[7]. The Braille note takers utilizes microcontrollers with software running in them to perform multifunction's including not taking translation, real time speaking, etc. however, in order to build a universal Braille system on a chip, a Braille note taker is going to be used as a single component implemented in hardware, while a microcontroller is used for interface and control purposes.

But it is not an economical way of communicating now a day[8-13]. It has limitation on the maximum number of words per page and pages per book. It stops the growth of blind peoples; to increase their communication to explore their knowledge with other people they should have most efficient economical system. By keeping this view in mind our approach focused on the design a SMS system for them, that interface Braille pad with the cell phone.

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## II. FUNCTIONAL BLOCK DIAGRAM AND DESCRIPTION

The functional block diagram of the entire system is divided in to two parts named as transmitter and receiver shown in figure 1. All the major subsystem blocks are shown with their interconnections to each module. It consists of Braille Keypad, AT89S52 microcontroller, GSM MODEM (SIM300), relay, solenoid keypad and power supply.

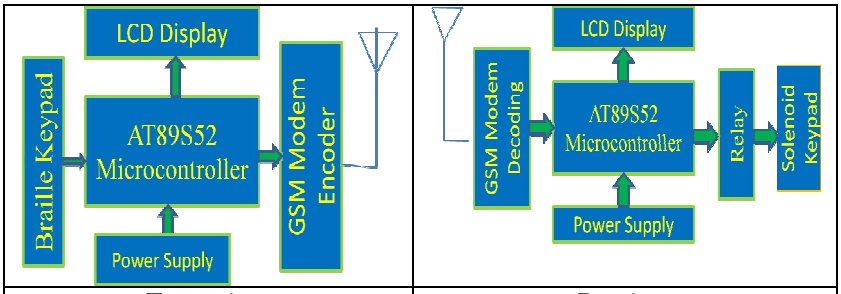


Figure 1. Functional Block Diagram of the system

## III. SYSTEM ELEMENTS

The implementation of all the features stated above we need to have a constant interaction between the hardware and Software like Braille Keypad, Microcontroller, GSM Module, Relay, Solenoid Keypad, Software.

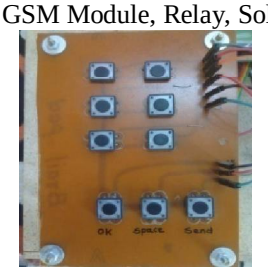

Figure 2. Braille Keypad

### A. Braille Keypad

Electronic Braille keypad is shown in figure 2 it is specially designed for the visually impaired or blind peoples. The concept of Braille keypad arises from the wooden dice. It is used to enter the text message in the form of characters, alphabets etc. only for the blind peoples having the specific standard pattern for each character or alphabet. Group of six raised dots or bumpy dots represent the particular letter. Braille keypad is consisting of 3x2 matrixes by which we can display 64 different characters as shown in figure 3a and 3b. All the six dots are arranged in the form of rectangular array design. Each character has standard symbolic pattern respective to its Braille keypad. This electronics Braille keypad has Ok, Send, and Space button. Ok button used to fix that particular character and ready to accept next character. Space button used to give space between the characters. Send button used to transmit typed text message.

In recent days the Electronic Braille note takers portable devices are available in the market places with Braille keyboards the Braille readers can use to enter information. The text stored in these devices can be read with a built-in Braille display or the device can read aloud with a synthesized voice. These devices are handy for taking notes in class, and often have built-in address books, calculators, and calendars, too.

### B. Microcontroller

The transmission and reception of the messages and the conversion of Braille letters in to valid message as well as received message into equivalent Braille code signals is done by Microcontroller AT89S52 shown in figure 4. The microcontroller is the heart of the system. It handles overall activity of the system. It has inbuilt on chip peripheral devices like RAM, Flash memory, ADC etc. The internal RAM is used to store data. The flash memory is used to hold embedded c program and code of Braille alphabets, word and their abbreviation. ADC is used to convert the analog

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signal into digital signal. The inbuilt embedded C program monitors and compare digital signal coming from Braille keypad. These digital signals are compared with specified level defined by the programmer to identify the key entered by the user. The execution speed of the microcontroller is 20MHz achieved using external crystal oscillator [14].

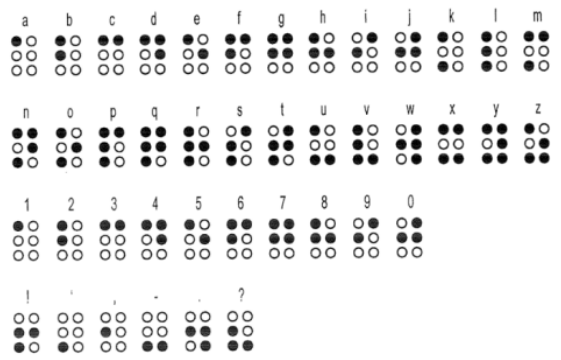


Figure 3a. Braille Alphabets

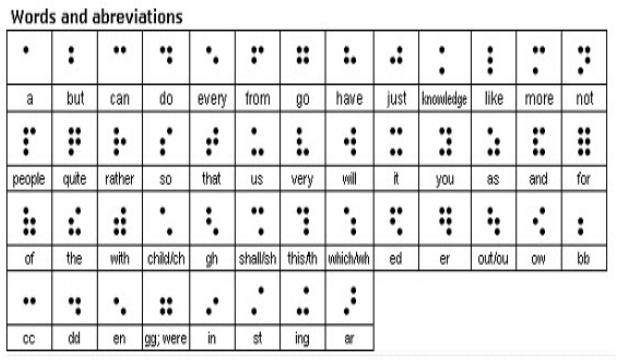


Figure 3b.Words and Abbreviations

Figure 4. Microcontroller AT89S52

**C. Global System for Mobile Communications (GSM) Module interface**

In recent years the most widely adopted cellular GSM module is shown in figure 5. GSM module is used to send and receive short text messages. The subscriber identification module (SIM) is interfaced with the module it permit the use of mobile service. This technology enables the system as a wireless system. This is a plug and play GSM Modem with a simple to implement RS232 and TTL serial interface. It is used to send and receive message, make and receive calls, allow internet services and do other GSM operations. AT commands shown in table 1 are executed on microcontroller to obtain the services. The GSM module receives the signal as AT commands executes and performs various operations. GSM Module is connected to the controller and transmits the incoming messages to the controller. It also receives the messages from controller.GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band, better signal quality, status lights indication.

**D. Relay**

A relay is usually an electromechanical device shown in figure 6 that is actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit. Relays are like remote control switches and are used in many applications because of their relative simplicity, long life, and proven high reliability. Relay contain a sensing unit, the electric coil, which is powered by AC or DC current. When the applied current or voltage exceeds a threshold value, the coil activates the armature, which operates either to close the open contacts or to open the closed contacts. When a power is supplied to the coil, it generates a magnetic force that actuates the switch mechanism. The magnetic force is, in effect, relaying the action from one circuit to another.

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The electromechanical action of relay requires current approximately 100mA, the current supplying capability of the microcontroller's port is less that this requirement. In such situation externally transistor amplifier or darlington pair circuit are used to raise the current carrying and delivering capacity of the port.

Figure 5. GSM Modem

Table 1. AT-Command set overview

| Command | Description |
|---|---|
| AT | Check if serial interface and GSM modem is working. |
| ATE0 | Turn echo off, less traffic on serial line. |
| AT+CNMI | Display of new incoming SMS. |
| AT+CPMS | Selection of SMS memory. |
| AT+CMGF | SMS string format, how they are compressed. |
| AT+CMGR | Read new message From a given memory location. |
| AT+CMGS | Send message to a given recipient. |
| AT+CMGD | Delete message. |

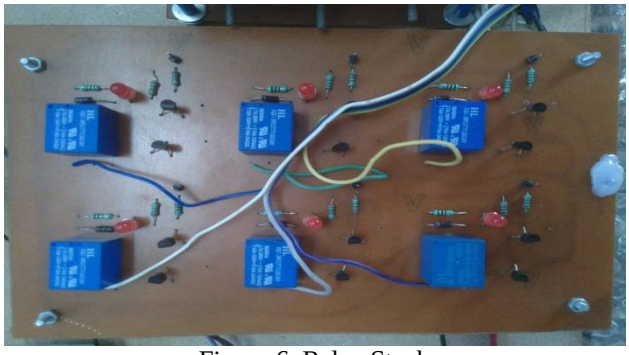

Figure 6. Relay Stack

**E. Solenoid Sensing Keypad**

Figure 7 shows solenoids are the most common actuator components. The basic principle of operation involves a moving ferrous core (a piston) that will move inside a wire coil as shown in figure 8. Normally the piston is held outside of the coil by a spring. When a voltage is applied to the coil and current flows, the coil builds up a magnetic field that attracts the piston and pulls it into the centre of the coil. The piston can be used to supply a linear force.

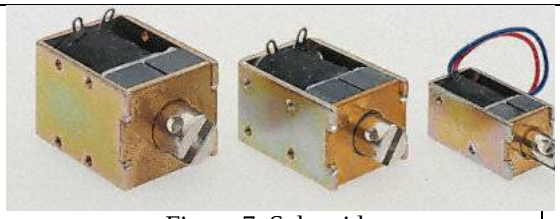

Figure 7. Solenoid

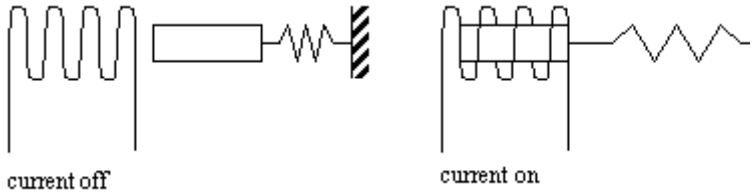


Figure 8. Solenoid operation

The force and speed of the piston movement depends on the strength of the magnetic field, it can be increased or decreased by either controlling the amount of current flowing through the coil or by changing the number of turns of the coil. The output signal of relay is fed to the solenoid for vibration.

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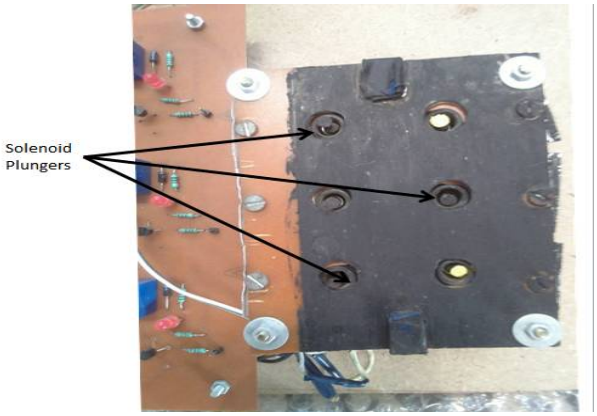


Figure 9. Solenoid Sensing Keypad

**F. Software**

This Proposed System uses Keil software to convert Embedded C programme to machine level. The Keil tool kit includes three main tools, assembler, compiler and linker. An assembler is used to assemble the Embedded C program. A compiler is used to compile the C source code into an object file. A linker is used to create an absolute object module suitable for our in-circuit emulator [14].

## IV. HARDWARE IMPLEMENTATION AND DESCRIPTION

The hardware implementation is shown in figure 10, it has two sections. The first section transmitter consists of Braille keypad interfaced with microcontroller. The purpose of microcontroller is to converts the Braille key signal into equivalent english code by using the lookup table. The lookup table is nothing but equivalent hexadecimal code of Braille alphabet or words; they are stored inside the microcontroller. The 8K Bytes of In-System Programmable (ISP)

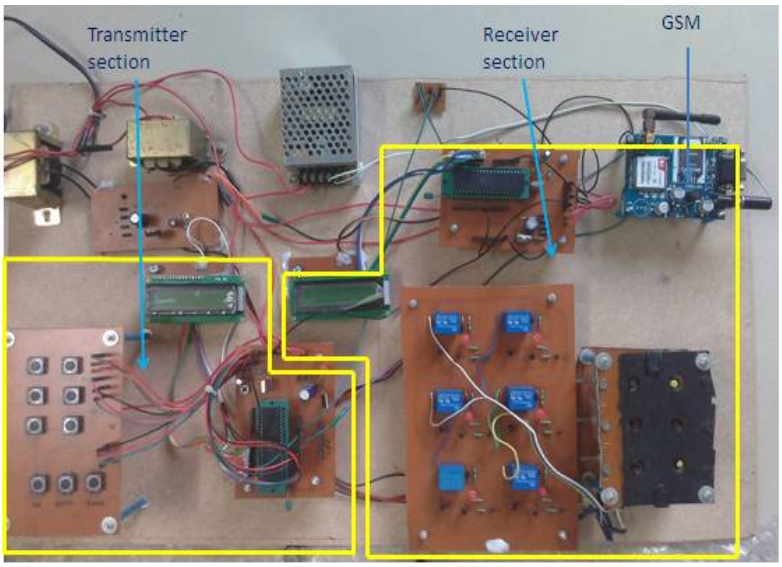


Figure 10. Hardware block diagram

Flash Memory is used to store the lookup table. As any person hits the Braille key the microcontroller receives the key code and matches with internal key code stored in lookup table. From figure 2 the OK button is used to enter the first character and allow concatenation of second character into one string. The SPACE button is necessary to enter a space

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in two strings. The internal registers of the microcontroller hold the message. The SEND button is used for passing the message hold by the register to the GSM modem. But the application software in the microcontroller first encloses the message into AT commands as listed in table 1. The AT commands initialize the GSM modem and activates the message services. Once these services are activated on GSM modem, the message is transmitted to the recipient mobile.

The second section is receiver, it is essential to receive a message. When a sender sends the message to the blind person then his mobile is interfaced with the microcontroller. The microcontroller receives the message through the AT commands and converts the letters of the message in to the equivalent electrical signals of Braille language by using the lookup table which are stored in the internal memory of microcontroller. These electrical signals are fed to activate the 6-relay stack with solenoid valve interfaced with microcontroller. To understand the received message the blind person has to place his hand over the stack of solenoid valve, the valves are arranged in such a way that the person can understand looks like Braille letters. An electrical signal energizes the relay and the respective solenoid valve does vibration and these vibrations are sensed by the blind person.

## V. RESULT AND DISCUSSION

The embedded C application will always be in running state at the background once it is started. Once application is downloaded on microcontroller, all message related activities are by default performed by application. With respect to user perspective, application working is divided in two ways – One application is used for sending messages and other when application is used to read received messages.

To send a message “abc” as shown in figure 11, the visual impaired person should have knowledge of Braille language. The Braille keypad is needed to pass the message

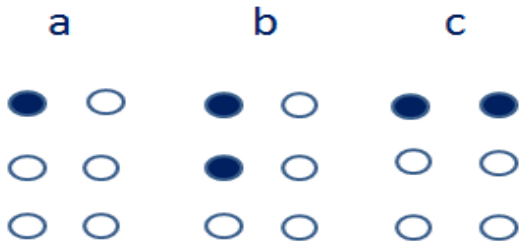


Figure 11 Send and receive message “abc”

1) Braille keypad has Ok, Send, and Space button.
   - Ok button used to fix that particular character and ready to accept next character means typed character get stored inside the database of microcontroller.
   - Space button used to give space between the characters.
   - Send button used to transmit typed text message.
2) Microcontroller accepts Braille code and store into its database and converts Braille to its respective English code with the help of standard Lookup table.
3) Confirmation of the entered message is done with LCD Display for visual people, figure 12 shows view1,2,3 represent the character message ‘a’,” ab”, “abc” respectively.
4) Finally converted message get transmitted to recipients by using controlled AT Commands through GSM module.

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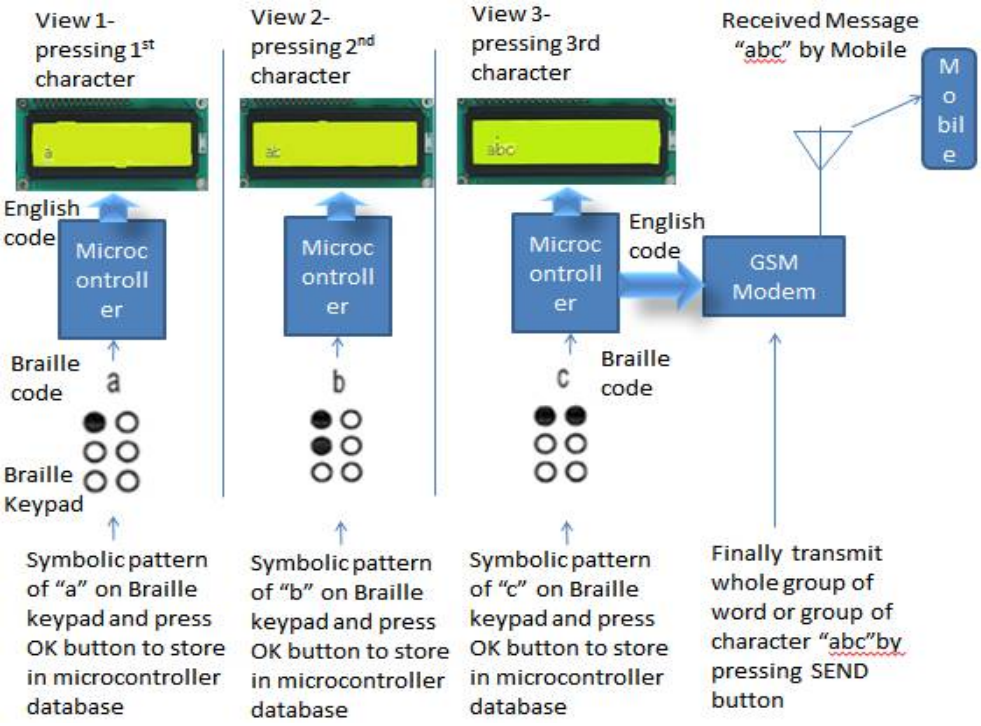


Figure12 Transmitter section concept

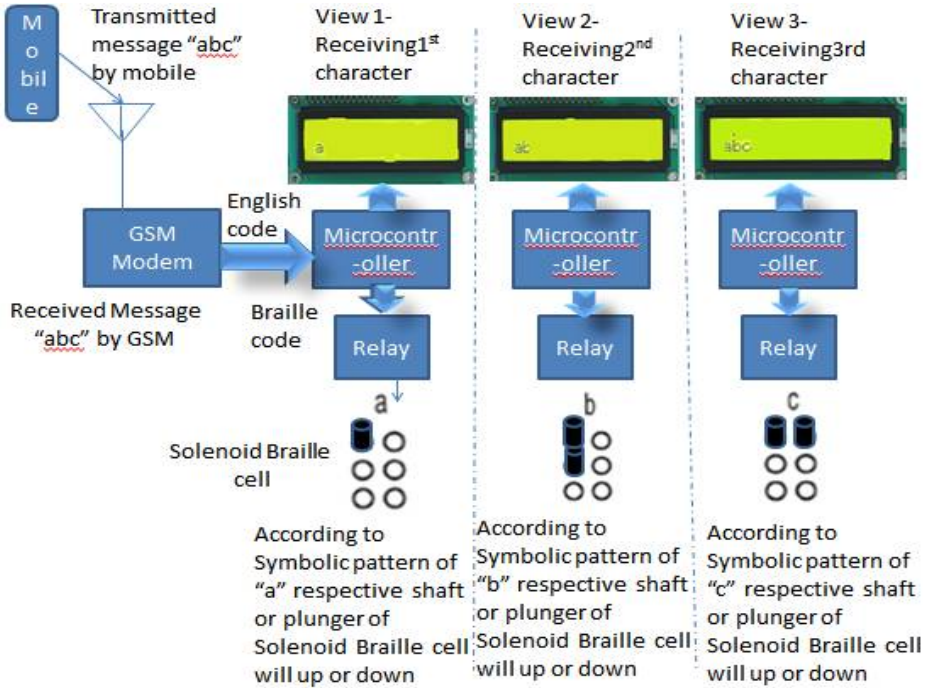


Figure13 Receiver section concept

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Reception of message:

1) Transmitted English message "abc" are received by using AT Command controlled through GSM module.
2) Microcontroller accepts English code and store into its database and converts English to its respective Braille code with the help of standard Lookup table.
3) Confirmation of the received message is done with LCD Display for visual people, figure 13 shows view1,2,3 represent the character message 'a'," ab", "abc" respectively.
4) Finally converted Braille code activates its respective solenoid Braille cell through its respective relay to raise solenoid shaft in upward direction.
5) Visually impaired people puts palm on solenoid Braille cells sensing keypad and understands the message through one by one character.

## VI. CONCLUSION

The advanced messaging system for blind people is based on the conversion of Braille key to text and Text to Braille key with the use of two microcontrollers. The system performance and various parameters are tested for proposed systems. The algorithm designed for conversion time, data transfer and receive rate execute in 0.1 microsecond. For multiple messages the blind person has a provision to change the operating speed of the microcontroller. By varying speed the blind person can read the letters of the message simultaneously. As far as the cost point of view the most expensive component of the system is the solenoid Braille cell to read the message. In future vibrating touch screen devices may replace these expensive components.

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